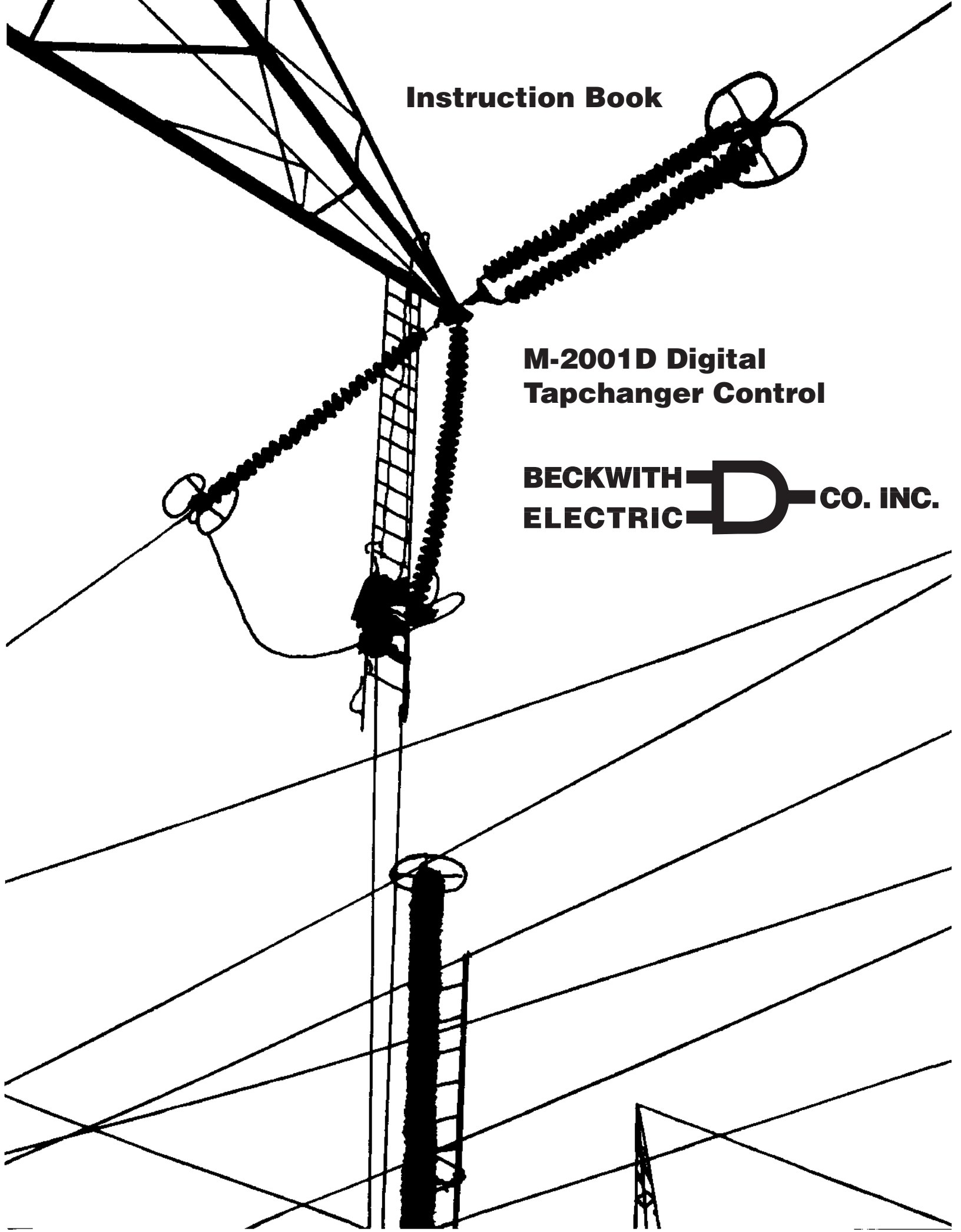
Instruction Book



M-2001D Digital Tapchanger Control

BECKWITH ELECTRIC CO. INC.

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CONTROLS

Digital Tapchanger Control M-2001D

Digital Tapchanger Control for Transformers and Regulators

- LTC transformer, substation regulator, and line regulator control provides reliable operation with expanded capabilities
- Adapter panels to retrofit popular industry tapchanger controls
- USB 1.1 Communications Port for quick field-updatable programming
- Smart Reverse Power detection/operation with VT configuration for source and load sides
- Demand metering/Data Logging with Date/Time Stamp (Single/Three-Phase)
- Harmonic Analysis
- LDC with R & X or Z-compensation
- SCAMP (SCADA Controllable Auto/Manual Pushbutton) Adapter Panel Auto/Manual Switch State can be changed by a SCADA command
- Sequence of Events Recording
- SCADA HeartBeat
- Smart Flash SD Card
- Source PT Voltage Input
- CBEMA Monitoring
- VAr Bias for downstream coordination with capacitor controls
- Tap position knowledge by four KeepTrack™ methods
- Transformer paralleling by circulating current, Master/Follower (peer to peer) circuitry, or ΔVAR® methods
- LCD display (rated –20 to +70 degrees Celsius) or Vacuum Fluorescent display optionally available (rated –40 to +80 degrees Celsius)
- Optional Control Power Backup Input for Fiber Optic communication loop-through
- DNP3.0, MODBUS® and IEC 61850 Communications Protocols available
- Optional Ethernet RJ45 or Fiber Optic Ethernet

Industry Leader Since 1969
Made in the USA

Features

The M-2001D includes the following features and can be used for LTCs or regulators where SCADA communications are desired.

- Adjustable Bandcenter
- Adjustable Bandwidth
- Adjustable VAr Bias
- Line Drop Compensation, R, X and Z Compensation with ±72 Volt range
- Time Delay, Definite and Inverse
- Intertap Time Delay
- Four Settings Profiles
- Selectable Outputs, Continuous or Pulsed
- Reverse Power Operation with eight control selections including a distributed generation mode and Smart Reverse Power Operation with two Auto Determination modes
- CT to VT Phasing Correction
- Real-Time Metering of measured and calculated parameters (Single/Three-Phase)
- Demand Metering with selectable time interval
- Drag Hands Operation
- Adjustable Line Overcurrent Tapchange Inhibit
- Voltage Limits
- Tap Position Limits
- Auto Runback (due to overvoltage)
- Auto Runup (due to undervoltage)
- Three independent Voltage Reduction Steps
- Smart Voltage Reduction
- Fast Voltage Recovery
- Sequential and Non-Sequential Operation
- VT Ratio Correction
- Self-Test Alarm Output Contacts
- User Programmable Alarm Contacts
- Tap Position Knowledge by:
  - Contact KeepTrack™
  - Shaft Coupled KeepTrack™
  - Resistor Divider KeepTrack™
  - Motor Direct Drive KeepTrack™
- Operations Counter
- Resettable Operations Counter
- Tap Position Record
- Auto/Off/Manual Switch Status via SCADA
- A or B Regulator Type Selection
- Control Voltage Input
- Motor Power Input
- Source Voltage Input
- Line Current Input
- Raise Output
- Lower Output
- Motor Current Profiling
- Up to 30 unique 15 character User Access Codes (Level 1 or Level 2)
- 20 Character by 2 Row LCD or optional Vacuum Fluorescent Display
- "Hot Buttons" provide quick access to setpoints, configuration and communications
- S-2001D TapTalk® Communications Software
- Adapter Panel Auto/Manual Switch Manual control outside of microprocessor
- Front USB 1.1 Communications Port
- External Inhibit of Auto Tapchange
- Circulating Current Input with Circulating Current, optional **ΔVAR®** Paralleling Methods, and optional Master/Follower (peer to peer) Paralleling (requires Ethernet and IEC 61850)
- Front Panel LEDs for Out-of-Band **Raise**, Out-of-Band **Lower**, Reverse Power Flow **Rev Pwr** Detected, **ALARM** in effect, Voltage Reduction **V/RED** in Effect, CPU **OK**, Auto Operation Block **MANUAL**, SCADA Control blocked **LOCAL** and Com1 **TX** and **RX**
- Front-Panel Voltage Reduction 1 & 2 Inputs as well as (Binary) inputs (3 Steps Total)
- Neutral Position Detect (Binary) and Counter
- Counter Input (Binary) for Regulator applications/Complete Sequence Input for Transformer applications
- Seal-in/Switch Status Input (Binary)
- Motor Seal-In Block/Alarm

Features (Cont.)

- Non-Sequential/SCADA Block Input (Binary)
- Seal-in Output (Cooper Applications)
- COM1 (top), RS-485 and Fiber Optic Port (ST and V-pin connectors available with 62.5 and 200 micro fiber supported)
- COM2 (top), RS-232 and optional Bluetooth® (user selectable if Bluetooth is installed)
- Communication Protocols include DNP3.0, MODBUS® and IEC 61850 (IEC 61850 only available with optional ethernet port)
- Smart Flash SD Card Slot supporting SD and SDHC SD cards
- Smart Flash SD Card can be linked to one or multiple controls providing a physical security "Key" which provides Level 2 User Access to the control when the SD Card is inserted for settings manipulation
- Supports Station and Feeder Level DNP addressing in addition to individual addressing for Smart Grid applications
- One pushbutton access to user configurable Wakeup screen for manual data recording with Smart Flash SD Card saving feature
- Power Quality which consists of:
  - Sequence of Events Recorder (132 events)
  - Data Logging
  - Harmonic Analysis
  - Oscillography
  - CBEMA monitoring to detect sags and swells and trigger data collection and alarming functions
- TapPlot® Oscillograph Data Analysis Software
- Individual Tap Wear Alarm
- Run Through Neutral, Automatic reversing switch swiping
- Remote Voltage Bias

Optional Features

- Ethernet Port COM3 (10/100 BaseT) is available through a RJ45 jack or ST Fiber on the top of the control. This port supports DNP over TCP/IP, MODBUS® over TCP/IP, and IEC 61850 over TCP/IP
- Local Wireless Bluetooth capability
- Vacuum Fluorescent Display (rated –40 to +80 degrees Celsius)
- Control Power Back-Up Input – input (+12 Vdc) for backup of Fiber Optic communication loop-through
- IEC 61850 Communications
- ΔVAR® Paralleling
- Master/Follower Paralleling (peer to peer)

Accessories

- M-2025B(D) Current Loop Interface Module – Current-To-Voltage analog converter for tap position sensors
- M-2026 AC-DC Control Power Backup Supply
- M-2027 Control Power Backup Supply–AC Only
- M-2948 Tap Position Sensor

Feature Information

Bandcenter: Adjustable from 100 V to 135 V in 0.1 V increments.

Bandwidth: Adjustable from 1 V to 10 V in 0.1 V increments.

Line Drop Compensation: R and X compensation. Adjustable from –72 V to +72 V in 1 V increments. Z compensation available with adjustment of voltage raise from 0 V to +72 V, in increments of 1 V.

Time Delay: Definite; adjustable from 1 second to 360 seconds, in 1 second increments. Inverse; adjustable from 1 second to 360 seconds, in 1 second increments.

InterTap Time Delay: Used to introduce time delay between tap operations when control is in sequential mode; adjustable from 0 to 60 seconds in 1.0 second increments. Counter input required.

Selectable Outputs: Continuous or pulsed. Normally, an output (raise or lower) signal is maintained when the voltage remains outside the band. A pulsed output length is programmable from 0.2 to 12 seconds, in increments of 0.1 second.

Reverse Power Operation:
If Motor Direct Drive KeepTrack™ is applicable, unit may be set to "Block", "Regulate Forward (Ignore)", "Regulate Reverse", "Return to Neutral", "Regulate Reverse (Measured)" or "Distributed Generation." The Regulate Reverse feature allows separate setpoints and regulation in the reverse direction without the installation of source-side VTs. Distributed Generation allows alternate LDC R and X values to be applied to the control when reverse power is detected. If Motor Direct Drive KeepTrack is disabled, then " Regulate Reverse (Measured)", "Ignore" and "Block" modes are available. Regulate Reverse (Measured) allows the control to switch it's voltage sensing input from a load side VT to a source side VT if one is available and operate in Reverse Power Mode using that input.

Smart Reverse Power (Auto Determination)
For reverse power conditions requiring more than one reverse power mode depending on the cause of the reverse power condition; either Distributed Generation mode or Regulate In Reverse/Regulate in Reverse Measured. The M-2001D provides two new reverse power modes, "Auto Determination" and "Auto Determination Measured" which allow the control to intelligently choose which reverse power mode applies at the time reverse power is sensed.

CT to VT Phasing Correction: Adjustable from 0° to +330° in 30° increments.

Load Overcurrent Tapchange Inhibit: Adjustable from 50 mA to 640 mA of line current for 200 mA CT or 0.2 A to 3.2 A for 1 A CT display and 1.2 A to 16.0 A for 5 A CT display. External auxiliary CT required for 1.0 A and 5 A CT inputs.

Voltage Limits, Tap Position Limits, Runback and Runup: Overvoltage and Undervoltage limits are independently adjustable from 95 V to 135 V in 0.1 V increments. Upper and lower tap position limits may be set by user, with tap position knowledge active. An adjustable Runback deadband (above the overvoltage limit) of 1 V to 4 V is available, which is used to set the runback limit. Additionally, an adjustable Runup deadband (below the undervoltage limit) of 1 V to 4 V is available, which is used to set the runup limit.

Voltage Reduction: Three independent steps, each adjustable from 0% to 10% in 0.1% increments of the bandcenter setpoint can be actuated from the dedicated front-panel pushbutton or through contact inputs. Voltage Reduction can be disabled locally and remotely if desired.

Normalizing Voltage: A Normalizing Voltage Multiplier with a range of 0.80 to 1.20 is available to be applied to Meter Out Voltage and displayed in real time as Normalizing Voltage. The purpose of the Normalizing Voltage is to allow the user to overcome differences in the ratio of the PT that the Load Voltage input is using versus the PT the end user or other metering methods are using.

Inhibit of Auto Tapchange: Blocks automatic tapchanger operation in response to external contact closure or software setting.

Non-Sequential/SCADA Block Operation: Non-sequential/SCADA Block blocks automatic tapchanger operation in response to external contact closure or software setting. Non-sequential/SCADA Block input also resets the time delay upon momentary external contact closure at the non-sequential input.

Paralleling Methods:

Circulating Current: The circulating current method is standard, and may be implemented using separate balancing equipment such as the Beckwith Electric M-0115A Parallel Balancing Module. Consult with factory for use with existing external master-follower circuitry.

ΔVAR® (optional): When selected, the ΔVAR1 method may be implemented by using separate balancing equipment such as the M-0115A Balancing Module. The ΔVAR2 method does not require the use of the M-0115A Balancing Module and is only applicable when paralleling two transformers.

For all methods of paralleling except ΔVAR2, overcurrent protection, such as that provided by the M-0127A Overcurrent Relay, is recommended.

Master/Follower(Optional): The optional Master/Follower feature employs the GOOSE messaging of the IEC 61850 protocol to provide peer to peer communications.

ΔVAR3 (future): Paralleling achieved through communication using IEC 61850 GOOSE messaging.

VT Ratio Correction: VT correction from –15 V to +15 V in 0.1 V increments.

Self-Test Alarm Output Contacts: Alerts operator to loss of power or malfunction of control. When the control is configured for SCAMP Pushbutton Auto/Manual Switch Type, this output is not available.

User-Programmable Alarm Contacts: Alerts operator to one or more of the following system conditions:

- Communication Block
- Voltage Reduction
- Tap Block Raise
- Abnormal Tap
- Tap Changer Failure
- Block Raise Limit
- Reverse Power Flow
- Tap Block Lower
- VAr Bias Lag
- Block Lower Limit
- Line Current Limit
- LDC/LDZ
- VAr Bias Lead
- Backup Fail (if purchased)
- Individual Tap Wear
- Op Count Signal
- RTN Fail to Operate

Tap Position Knowledge

Current Loop Method: The optional M-2025D Current Loop Interface Module receives a signal from a position transducer and provides an input to the M-2001D through a six pin port.

Single-Phase Regulators: In most applications, tap position information can be maintained by means of Motor Direct Drive KeepTrack™ logic.

Transformers: The control includes two additional methods of Tap Position Knowledge, Contact KeepTrack™ "1R1L" and "1N". These methods utilize re-assigned voltage reduction VR1 and VR2 inputs as Raise and Lower contact inputs respectively. These inputs cause the controls "KeepTrack™" tap position status to increment.

Operation Counter: A software counter increments by one count per either an open/close/open contact operation (X1) or an open/close or close/open contact operation (X2), and is preset by the user. A Count Window mode registers any activity as a valid input within the count window time setting. When a Cam Follower contact input is wired into the Counter contact input of the M-2001D, the operation counter will increment when the counter input sees the cam follower open and then close.

Resettable Operation Counter: A second software counter, similar to the Operation Counter, which may be reset by the user.

Tap Position Record: Provides a record of the number of times each tap position has been passed through. The tap position record can be reset by the user.

Tap Wear Settings: Provides the capability to determine tap wear in a regulator's tap change mechanism.

Auto/Manual Switch Status: Provides the user with the Auto/Manual switch position status through the Comm ports. When the M-2001D is configured for a switch status input, the switch status is read using the seal-in input on the control. When configured for Seal-in input, the switch status is read using the counter input.

A or B Regulator Type: Allows the user to select the type of regulator being used to provide a more accurate source voltage calculation.

SCADA HeartBeat: The purpose of the SCADA HeartBeat feature is to have two sets of settings for the control and switch between these two setting sets based on the presence or absence of SCADA communications (utilizing the DNP or optional IEC 61850 protocol) to the control. The SCADA HeartBeat feature can be enabled from TapTalk® Communications Software. There are four different types of SCADA HeartBeat modes that can be selected:

- SCADA HeartBeat for transformer control applications (LTC)
- SCADA HeartBeat for regulator control applications (Regulator)
- Profile Switching – This mode allows the user to specify a different settings profile to operate by while communication is active
- Profile Switching (GOOSE) – with the optional IEC 61850 protocol

SCADA Remote Manual Mode: The purpose of the SCADA HeartBeat Remote Manual Mode is to provide a means for a SCADA system to place the unit in Remote Manual and perform Raise and Lower operations. As long as a Remote Manual Timer setting in the control is refreshed by the SCADA system before it times out, the control will stay in Remote Manual. If the timer times out, the control reverts to normal Automatic operation.

VAr Bias: This feature is intended but not restricted for use with distribution feeders which have switched capacitor banks controlled by M-2501 series Autodaptive® Capacitor Controls. Use of VAr Bias allows the M-2001D to coordinate it's operation with the M-2501 series Autodaptive Control devices on the distribution system in order to minimize losses, smooth the voltage profile and optimize VAr flow.

Optional Bluetooth: The optional Bluetooth® (V2.0 +EDR Class 1 Type) provides wireless access to the M-2001D. With Bluetooth the user is able to configure the control, read status and metering values as well as change setpoints. This option can be field installed. There are two modes of operation for the Bluetooth:

Mode 0 – The device is discoverable and connectable to any client station.

Mode 1 – The device is non-discoverable but it is connectable to any client station who knows the control Bluetooth device address indicated under "**Control BT Device**" in the HMI.

Mode 1 – Has been added to meet CIP requirement. (CIP-0007-4 System Security Management) (R2.3)

Source Side PT Input: The Source Side PT Input feature provides for Reverse Power regulation with measured source side voltage. This mode consists of energizing a contact relay when reverse power is sensed which will switch the analog voltage input from the load side to the source side. Voltage regulation will then operate on the new measured source side voltage instead of the traditional source side voltage.

SCAMP: (SCADA Controllable Auto/Manual Pushbutton) switch allows the Auto/Manual state on an adapter panel to be changed by a SCADA command.

Monitoring/Metering

Real-Time Metering: The following single/three-phase measured and calculated values are available in real-time:

- Primary Voltage
- Tap Position
- Drag Hands
- Raise/Lower Timer
- Intertap Timer
- Operation Counter
- Resettable Counter
- Neutral Counter
- Meter Out Voltage
- Primary Source Voltage
- Primary Current
- Primary Watts
- Primary VAr
- Primary VA
- Load Voltage
- Source Voltage
- Compensating Voltage
- Normalizing Voltage
- Load Current
- Power Factor
- Frequency
- Circulating/ΔVAr Current

Present Demand: The Present Demand feature captures the maximum values during the specified time interval. Time interval can be selected as 5, 10, 15, 30, or 60 minutes.

- Demand Load Voltage
- Primary Watts
- Primary VA
- Demand Primary Current
- Primary VArs

Demand History (Drag Hands Operation):

The following "drag-hand" values are stored with date and time stamping and are averaged over 32 seconds:

- Min Load Voltage
- Max Load Voltage

The following "drag-hand" values are stored with date and time stamping and are calculated over the demand time interval (5, 10, 15, 30, or 60 minutes) as selected by the user:

- Max Primary Current (Amps)
- Max Primary Watts (kW, or MW)
- Power Factor @ Max VA
- Max Primary VArs (kVAr or MVAr)
- Max Primary VA (kVA or MVA)

Energy Metering:

The following measured values are retained in non-volatile memory. A real time clock is utilized to record a date/time stamp for each quantity to indicate when the period of measurement was initiated.

- Watt Hours Forward (kWh)
- Watt Hours Reverse (kWh)
- Lagging VAr Hours (kVArh)
- Leading VAr Hours (kVArh)

Power Quality

Sequence of Events: The Sequence of Events recorder provides comprehensive data recording (of voltage, current, frequency etc.) Sequence of Events data can be downloaded using the communications ports to a PC running TapTalk® Communications Software. The unit can store up to 132 events in a first in/first out memory scheme.

The Sequence of Events can be triggered by the status change of any of the following signals:

- Raise Contact
- Lower Contact
- Voltage Reduction 1
- Voltage Reduction 2
- Force Lower
- Raise Tap Limit
- Lower Tap Limit
- Low Band
- High Band
- Low Voltage Limit
- High Voltage Limit
- Auto Inhibit
- Non-sequential
- Reverse Power
- Peak Motor Current
- Avg. Motor Current
- Motor Current Duration
- Voltage Harmonics
- Current Harmonics
- CBEMA Event 1
- CBEMA Event 2
- CBEMA Event 3
- CBEMA Event 4
- VAr Bias Active
- Sealin Fail Alarm Active
- Sealin Fail Low Blk Act
- Sealin Fail Raise Blk Act
- Low Current Blk Active
- Motor Seal-in Input
- Neutral Input
- Counter Input
- Op Count Signal
- HMI Active
- Individual Tap Wear Alarm

Oscillograph Recorder: The Oscillograph Recorder provides comprehensive data recording (voltage, current, and status input/output signals) for all monitored waveforms (at 16, 32 or 64 samples per cycle). Oscillograph data can be downloaded using the communications ports to any personal computer running TapTalk Communications Software. Once downloaded, the waveform data can be examined and printed using the TapPlot® Oscillograph Data Analysis Software.

Harmonic Analysis: Provides the total harmonic distortion and the harmonic content of the load voltage and current up to the 31st harmonic.

Data Logging: A built-in data logging recorder that continually records data in non-volatile memory. Data Logging will continue indefinitely as long as the data interval is set to a non-zero value.

- Load Voltage
- Compensated Voltage
- Primary Watts
- Primary VA
- Primary VAr
- Load Current
- Power Factor
- Line Frequency
- Tap Position
- Source Voltage
- Primary Current
- Operation Counter
- Circulating/ΔVAr Current
- Meter Out Voltage

CBEMA: Monitoring to detect sags and swells, trigger data collection and alarming functions.

Inputs

Control Voltage Input: Nominal 120 Vac, 60 Hz (50 Hz optional); operates properly from 90 Vac to 140 Vac. If set at 60 Hz, the operating system frequency is from 55 to 65 Hz; if set at 50 Hz, the operating system frequency is from 45 to 55 Hz. The burden imposed on the input is 8 VA or less. The unit should be powered from a voltage transformer connected at the controlled voltage bus. The unit will withstand twice the voltage input for one second and four times the voltage input for one cycle.

Motor Power Input: Nominal 120 Vac to 240 Vac, at up to 6 A as required by the load, with no wiring changes required.

Line Current Input: Line drop compensation is provided by a current transformer input with a 0.2 A full scale rating. A Beckwith Electric model M-0121 (5 A to 0.2 A) or M-0169A (5 A or 8.66 A to 0.2 A) Auxiliary Current Transformer is available when required. The burden imposed on the current source is 0.03 VA or less at 200 mA. The input will withstand 400 mA for two hours and 4 A for 1 second.

Circulating Current Input: Parallel operation of regulators or transformers is accommodated by a current transformer input with a 0.2 A full scale rating. The burden imposed on the current source is 0.03 VA or less at 200 mA. The input will withstand 400 mA for two hours and 4 A for 1 second.

Optional Control Power Backup Input: (Two pin Molex connector on the top of control): The optional Control Power Backup Input feature sustains operation of the control in the event of a loss of AC input power to the control. Raise and Lower commands are possible if the control's motor power remains energized. See M-2026/M-2027 Companion Control Power Backup Supplies later in the specification.

Source Side PT Input: Nominal 120 Vac, 60 Hz (50 Hz optional). If set at 60 Hz, the operating system frequency is from 55 to 65 Hz; if set at 50 Hz, the operating system frequency is from 45 to 55 Hz. The burden imposed on the input is 8 VA or less. The unit should be powered from a voltage transformer connected at the controlled voltage bus. The unit will withstand twice the voltage input for one second and four times the voltage input for one cycle.

Binary Inputs

Voltage Reduction 1 & 2 Inputs: These inputs provide three levels of programmable voltage reduction which can be manually invoked. The Voltage Reduction 2 Input can also be programmed as an auxiliary input with a DNP status point affiliated with it.

Neutral Position Detect: The Neutral Position Detect Input detects the neutral tap position, which assists the Motor Direct Drive KeepTrack™ tap position function. This Neutral Position Detect Input also facilitates disabling the paralleling mode ΔVAR®2 (KeepTrack™).

Counter Input/Switch Status Input: When Input Selection 1 configuration is set to Switch Status, the Counter Input detects tap position changes and updates two counters, one pre-settable and one re-settable. Also, when the Contact KeepTrack™ "1R1L" method is selected the Counter Input functions as a 1L tap connection input. When Input Selection 1 configuration is set to Seal-In, the counter input is used as the Switch Status Input and the Seal-In input will cause the counter to increment.

Seal-in/Switch Status Input: When the Input Selection 1 configuration is set to "seal-in input", this input provides for detection of the seal-in state to operate the seal-in output and will also increment the counters. When "Input Selection 1" is set to Switch Status Input, this input provides the means to read the Auto/Manual switch position status using SCADA.

Non-Sequential/SCADA Block Input: When the Input Selection 2 configuration is set to "Nonseq Input", this input provides the means to perform non-sequential operations. When Input Selection 2 is set to "SCADA Block Input", this input provides a means to block all write operations to the control from SCADA.

Outputs

Raise Output: Capable of switching 6 A at 120 Vac to 240 Vac motor power.

Lower Output: Capable of switching 6 A at 120 Vac to 240 Vac motor power.

Seal-In Output: Connects to the B-0553 motor seal-in printed circuit board subassembly.

Deadman Alarm Output: Capable of switching 6 A at 120 Vac or 100 mA at 120 Vdc.

Programmable Alarm Output: Capable of switching 6 A at 120 Vac or 100 mA at 120 Vdc.

Run Through Neutral

The control includes a Run Through Neutral feature that when enabled counts tapchanger operations and when user settable settings are met, drives the tapchanger through the neutral position to swipe the reversing switch to prevent contact buildup and coking.

Remote Voltage Bias

The Remote Voltage Bias feature is similar to Load Drop Compensation (LDC) in that it uses a remotely monitored voltage obtained by the control (through either DNP 3.0, MODBUS, or IEC 61850 protocol) to bias the Bandcenter of the control. A Remote Voltage Heartbeat Timer is utilized to initiate the Bandcenter Bias and when it expires the control reverts back to the existing settings.

Front Panel Controls

Menu-driven access to all functions by way of seven navigational pushbuttons and a two-line alphanumeric display. There are two programmable passwords available to provide various levels of access to the control functions.

The M-2001D offers a 2-line by 20 character LCD display for enhanced viewing in direct sunlight. It also offers a low-level LED backlight for reading in darker environments.

Smart Flash SD Card Slot

Allows the user to perform the following functions:

- Load Setpoints
- Save Setpoints
- Save Data Log
- Save Sequence of Events
- Save Oscillograph Records
- Clone Save
- Clone Load
- Load DNP Config
- Save DNP Config
- Firmware Update
- Save Metering Data
- Save/Load IEC 61850 CID Files
- User Access Key Code
- Save Wakeup Screen Parameters
- Quick Capture

LED Indicators

Front panel LED indicators show the following control conditions: Out-of-Band **RAISE**, Out-of-Band **LOWER**, Reverse Power Flow **REV PWR** detected, CPU **OK**, **ALARM** in effect, Voltage Reduction **V/RED** in effect, Communications or Front Panel Auto Operation Block **MANUAL**, SCADA control blocked **LOCAL** and COM1 **TX and RX**.

Output Contacts

Alarm Contact Outputs (2): One normally open programmable alarm contact capable of switching 6 A at 120 Vac and one normally closed self-test alarm contact; capable of switching 6 A at 120 Vac.

Voltage Measurement Accuracy

Control accuracy is ±0.3 % when tested in accordance with the IEEE C57.15.9-2009 standard over a temperature range of –40° C to +85° C.

Communications

The communication ports provide access to all features, including metering, software updates, and programming of all functions. This is accomplished using a modem or direct serial connection from any Windows™ based computer running TapTalk® S-2001D Communications Software or SCADA communications software. COM1 (top) is available with RS-485 or ST or V Pin Fiber Optics. COM2 is available with RS-232 standard or optional Bluetooth®. COM3 is an optional RJ45 or Fiber Optic Ethernet Port. A USB front port is standard for local communications with TapTalk and for software updates.

Protocols: The following standard protocols are included in COM1/COM2/COM3: DNP3.0, MODBUS®, and IEC 61850 (when used with the optional ethernet port). The USB port uses MODBUS for local communications.

Communications Via Direct Connection: TapTalk supports direct communication (MODBUS protocol) with a M-2001D using the applicable connector (USB cable) for the PC, or Fiber Optic communication using ST standard or V-pin, or two-wire RS-485.

Optional Ethernet Port: An optional Ethernet 10/100 Mpbs Port (COM3) is available through an RJ45 or Fiber Optic Ethernet Port on the top of the control. This port supports DNP over TCP/IP, MODBUS over TCP/IP, and IEC 61850 over TCP/IP. Also, SNTP (Simple Network Time Protocol) Protocol is available to synchronize the control's RTC clock with the network server.

Optional Bluetooth: The optional Bluetooth provides wireless access to the M-2001D. With Bluetooth the user is able to configure the control, read status and metering values as well as change setpoints using TapTalk Communication Software.

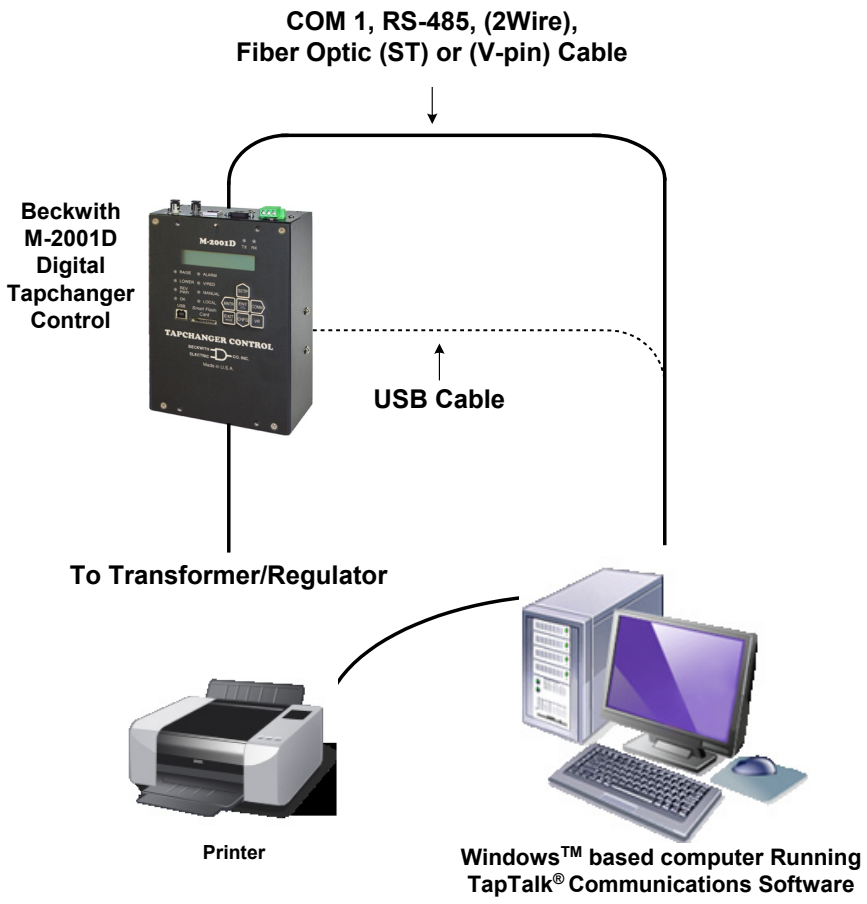

Figure 1 Direct Connection

Communications Using Networking: The addressing capability of the M-2001D allows networking of multiple Beckwith Electric Digital Tapchanger Controls. Each tapchanger control can be assigned a Communications Address, Feeder Address or Substation Address ranging from 1 to 65519. Selected commands may be broadcast to all controls on the network. Figures 2, 3 and 4 illustrate typical network configurations. Addresses 1 to 247 can be assigned to MODBUS® and 1 to 65519 for DNP3.0.

Application: Using a Windows™ based computer or wireless modem, the operator has real-time, remote access to all functions of the Digital Tapchanger Control. The control can act as the monitoring point for all voltage, current, and related power quantities, thereby simplifying operation while avoiding transducers and multiple Remote Terminal Unit (RTU) analog inputs. The protocols implement half-duplex, two-way communications. This allows all functions, which would otherwise require the presence of an operator at the control, to be performed remotely. Communication capabilities include:

- Interrogation and modification of setpoints
- Broadcast of commands, such as tapchange inhibit and voltage reduction (up to three steps) to networked controls
- Recognition of alarm conditions, such as voltage extremes and excessive load
- Selective control of raise and lower tapchange operations
- Re-configuration of the control, such as a change to the demand integration time period or a selection of different alarm parameters
- Unsolicited exception reporting multicast capability using UDP and TCP
- DNP file transfer of Data Logging, Oscillography and Sequence of Events records

Unit Identifier: A 2-row by 20-character alphanumeric sequence, set by the user, can be used for unit identification.

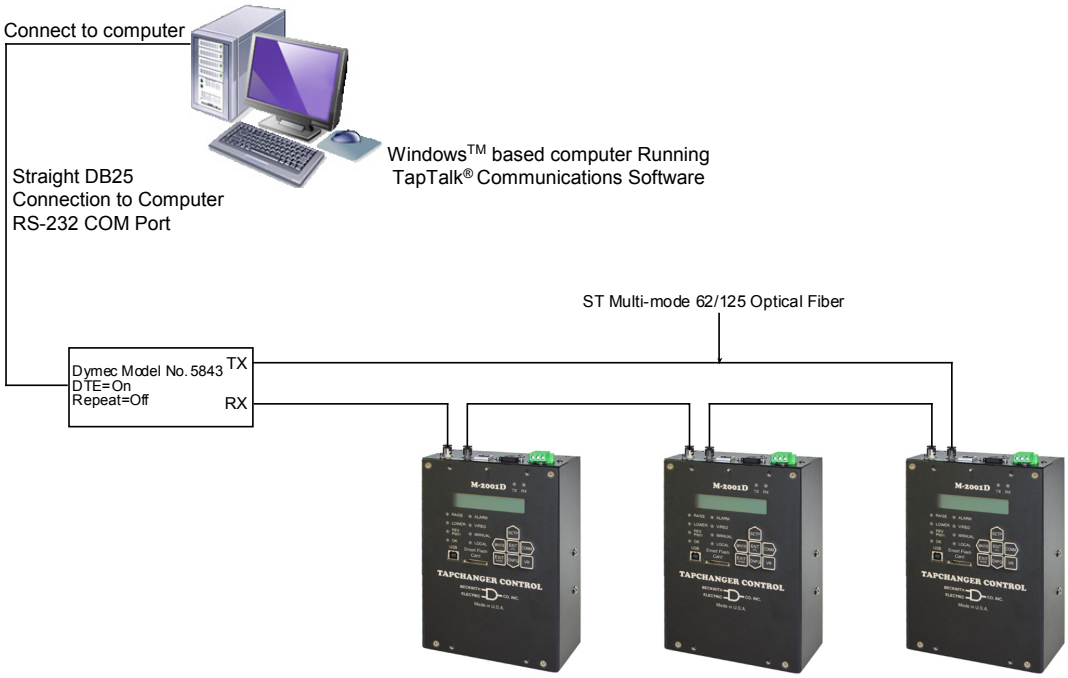

Figure 2 Fiber Optic Connection Loop (optional V-pin connection available)

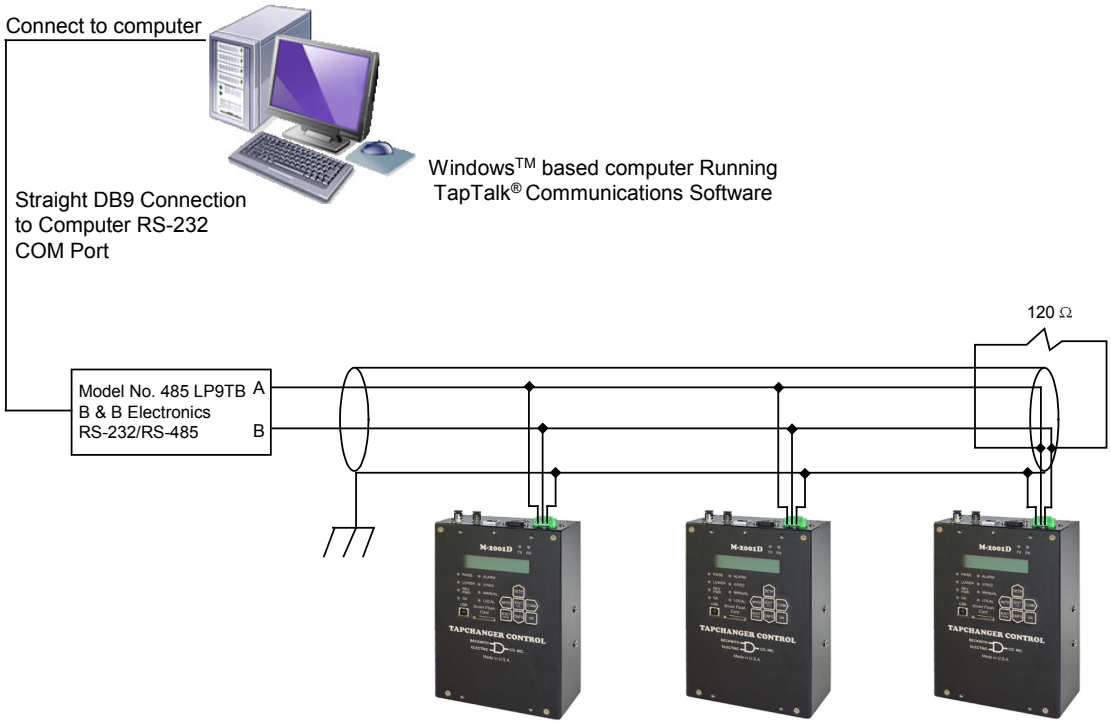

Figure 3 RS-485 Network Connection

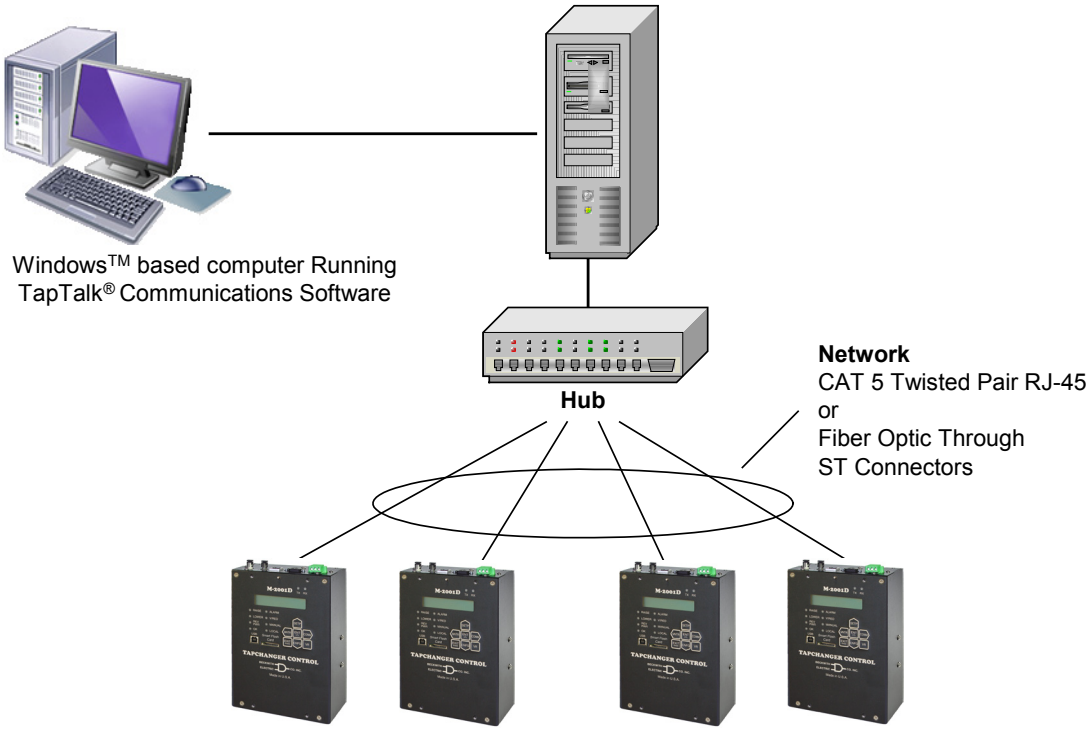

Figure 4 Ethernet Network Connection

Tests and Standards

M-2001D Digital Tapchanger Control complies with the following type tests and standards:

Voltage Withstand

Dielectric Withstand

IEC® 60255-5	1,500 Vac for 1 minute applied to each independent circuit to earth 1,500 Vac for 1 minute applied between each independent circuit

Impulse Voltage

IEC 60255-5	5,000 V pk, +/- polarity applied to each independent circuit to earth 5,000 V pk, +/- polarity applied between each independent circuit 1.2 by 50 µs, 500 ohms impedance, three surges at 1 every 5 seconds
IEC 60255-5	> 100 Megaohms

Electrical Environment

Electrostatic Discharge Test

IEC 60255-22-2	Class 4 (±8 kV)—point contact discharge
IEC 60255-22-2	Class 4 (±15kV)–air discharge

Fast Transient Disturbance Test

IEC 60255-22-4	Class A (±4 kV, 2.5 kHz, 5 kHz)

Surge Withstand Capability

ANSI/IEEE C37.90.1-1989	2,500 V pk oscillatory applied to each independent circuit to earth 2,500 V pk oscillatory applied between each independent circuit 5,000 V pk Fast Transient applied to each independent circuit to earth 5,000 V pk Fast Transient applied between each independent circuit
IEEE C37.90.1-2002	2,500 V oscillatory applied to each independent circuit to earth 2,500 V oscillatory applied between each independent circuit 4,000 V pk Fast Transient burst applied to each independent circuit to earth 4,000 V pk Fast Transient burst applied between each independent circuit

■**NOTE**: The signal is applied to the digital data circuits (RS-232, RS-485, Ethernet communication port coupling port) through capacitive coupling clamp.

Surge Immunity

IEC 60255-22-5	±2,000 V pk

Radiated Field Immunity

IEEE C37.90.2	80 MHz - 1000 MHz @ 35 V/M
IEC 60255-22-3	80 MHz - 2700 MHz @ 10 V/M

Conducted Field Immunity

IEC 60255-22-6	150 kHz - 80 MHz @ 10 V emf

Atmospheric Environment

Temperature: *Control operates from –40° C to +85° C with either the LCD or optional Vacuum Fluorescent Display*

■ **NOTE**: The LCD display's functional temperature range is –20° C to +70° C. The optional vacuum fluorescent display's functional temperature range is –40° C to +80° C.

IEC 60068-2-1	Cold, –40° C
IEC 60068-2-2	Dry Heat, +85° C
IEC 60068-2-78	Damp Heat, +40° C @ 95% RH
IEC 60068-2-30	Damp Heat Condensation Cycle, 25° C, +55° C @ 95% RH

Mechanical Environment

Vibration

IEC 60255-21-1 Vibration response Class 1, 0.5 g
Vibration endurance Class 1, 1.0 g

Compliance

cULus-Listed per 508 – Industrial Control Equipment

– Industrial Control Equipment Certified for Canada CAN/CSA C22.2 No. 14-M91

cULus-Listed Component per 508A Table SA1.1 Industrial Control Panels

Recommended Storage Parameters

Temperature: 5° C to 40° C

Humidity: Maximum relative humidity 80% for temperatures up to 31° C, decreasing to 31° C linearly to 50% relative humidity at 40° C.

Environment: Storage area to be free of dust, corrosive gases, flammable materials, dew, percolating water, rain and solar radiation.

Periodic Surveillance During Storage: The M-2001D contains electrolytic capacitors. It is recommended that power be applied to the control every three to five years for a period not less than one hour to help prevent the electrolytic capacitors from drying out.

Physical

Size: 5 13/16" wide x 8 1/2" high x 3 1/8" deep (10.81 cm x 21.6 cm x 7.94 cm)

Mounting: Unit mounts directly to adapter or conversion front panels sized to replace popular industry tapchanger controls.

Approximate Weight: 3 lbs, 11 oz (1.67 kg)

Approximate Shipping Weight: 6 lbs, 11 oz (3.03 kg)

Patent & Warranty

The M-2001D Tapchanger Control is covered by U.S. Patent 5,581,173.

The M-2001D Tapchanger Control, M-2026 AC-DC Control Power Backup Supply and M-2027 Control Power Backup Supply-AC Only, M-2948 Tap Position Sensor, and M-2025B(D) Current Loop Interface Modules are covered by a ten-year warranty from date of shipment.

Specification subject to change without notice.

M-2025B(D) Current Loop Interface Modules and M-2948 Tap Position Sensor

The M-2025B(D) Current Loop Interface Modules are current-to-voltage analog converters that can accept inputs from M-2948 Beckwith Electric Tap Position Sensors (Table 1) or Incon 1250B Rotary Position Sensor.

Sensor	Rotation Range	Degrees/Tap	Taps	Neutrals	Rotation/Slope
M-2948-91N	0 – 297°	9°	±16	1	Negative
M-2948-91P	0 – 297°	9°	±16	1	Positive
M-2948-92N	0 – 306°	9°	±16	2	Negative
M-2948-92P	0 – 306°	9°	±16	2	Positive
M-2948-93N	0 – 315°	9°	±16	3	Negative
M-2948-93P	0 – 315°	9°	±16	3	Positive
M-2948-11N	0 – 330°	10°	±16	1	Negative
M-2948-11P	0 – 330°	10°	±16	1	Positive
M-2948-12N	0 – 340°	10°	±16	2	Negative
M-2948-12P	0 – 340°	10°	±16	2	Positive
M-2948-13N	0 – 350°	10°	±16	3	Negative
M-2948-13P	0 – 350°	10°	±16	3	Positive

■ **NOTE**: Tap Position Sensors are available with either a positive "P" or negative "N" slope. Negative slope (clockwise rotation) causes a decrease in Tap Position. Positive slope (clockwise rotation) causes an increase in Tap Position.

Table 1 M-2948 Model Application Information

The tap position sensors are rotary shaft encoders with built-in microprocessors that provide stepped output signals in 9 or 10 degree increments. They have rotations of 297, 306, 315, 330, 340 and 350 degrees respectively for 32 taps and up to three neutral positions. The electrical output of these sensors is a 4-20 mA current loop that converts easily to a voltage signal at the input of the M-2025B(D) with the addition of a proper value shunt resistor. For a 4-20 MA Current Loop, 150 ohms is required on the input of the M-2025B(D).

Configurations

Most LTC tapchangers have an output shaft on the tapchanger mechanism whose angular position is a mechanical analog of the tapchanger tap position. In many cases, the total range of tap positions is represented by less than one complete rotation of this position output shaft. The typical values of shaft movement on 32 tap mechanisms are 9° or 10° of mechanical rotation per tap position.

Other angular rotation values are likely to be encountered. Contact Beckwith Electric for information on sensor availability for specific requirements.

Application Notes

- The M-2948 Tap Position Sensor directly mounts in place of the Incon Tap Sensor Model 1292.
- The M-2948 Tap Position Sensor directly mechanically replaces the Selsyn-Type Position Sensor.
- The M-2948-91N Tap Position Sensor is for use with a Qualitrol Position Indicator, Model 081-002-01 or equivalent.

Incon Tap Position Monitor connected to an Incon 1250 Series Rotary Position Sensor

Both types of devices provide a 4-20 mA dc current loop output. The current loop develops a voltage across a properly sized resistor on the input to the M-2025B(D). The resultant voltage signal is conditioned in the M-2025B(D) and routed to the M-2001 series Tapchanger Control where the voltage is converted to a corresponding tap position number.

The tap position sensors are rotary shaft encoders with built-in microprocessors that provide stepped output signals in 9 or 10 degree increments. They have rotations of 288 and 320 degrees respectively for 32 taps and one neutral position. The electrical output of these sensors is a 4-20 mA current loop that converts easily to a voltage signal at the input of the M-2025B(D) with the addition of a proper value shunt resistor. For a 4-20 MA Current Loop, 150 ohms is required on the input of the M-2025B(D).

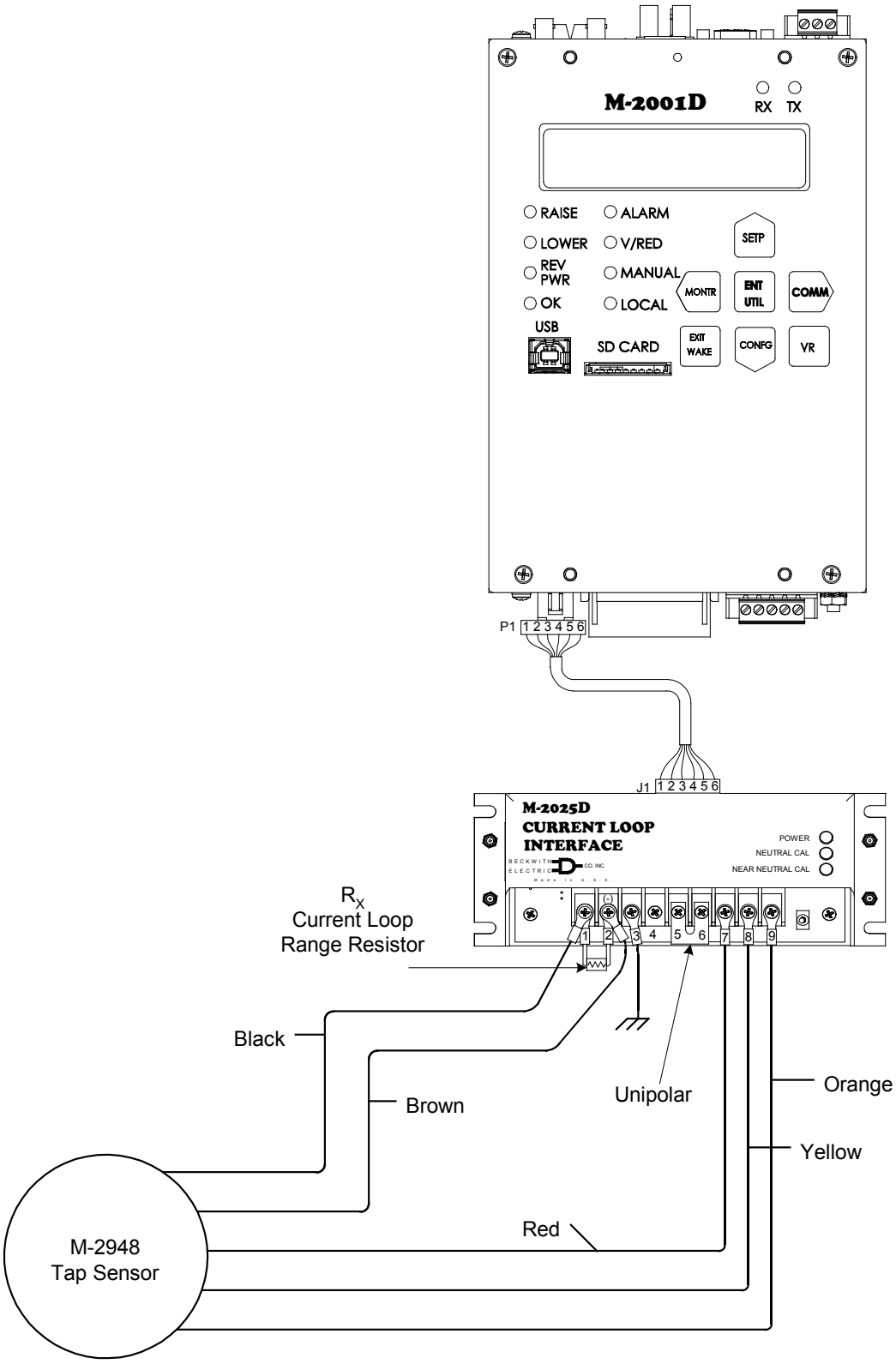

Figure 5 Typical M-2025B(D) External Tap Position Interface with M-2948 Tap Position Sensor

M-2026/M-2027 Control Power Backup Supplies

If the optional Control Power Backup Input is purchased, the following accessories are available:

M-2026 AC-DC Control Power Backup Supply

The M-2026 Control Power Backup Supply will accept either an AC or DC input over the following ranges:

- 21 to 32 V
- 42 to 60 V
- 105 to 145 V

■**NOTE**: It must be ordered in the input range needed.

The M-2026 will output a regulated +12 Vdc (±0.5 V) output voltage. The unit incorporates a fused input, surge protection, and reverse polarity protection. The M-2026 is capable of up to a 1.5 Ampere output.

M-2027 Control Power Backup Supply-AC Only

The M-2027 will accept an AC (105 to 140 Vac, 50/60 Hz) input and output +12 Vdc (Nominal). The M-2027 is capable of loads up to 1.0 Ampere. The unit incorporates a fused input and surge protection.

The M-2026 and M-2027 units are housed in a non-weathertight enclosure and equipped with screw terminal blocks for input and output connections.

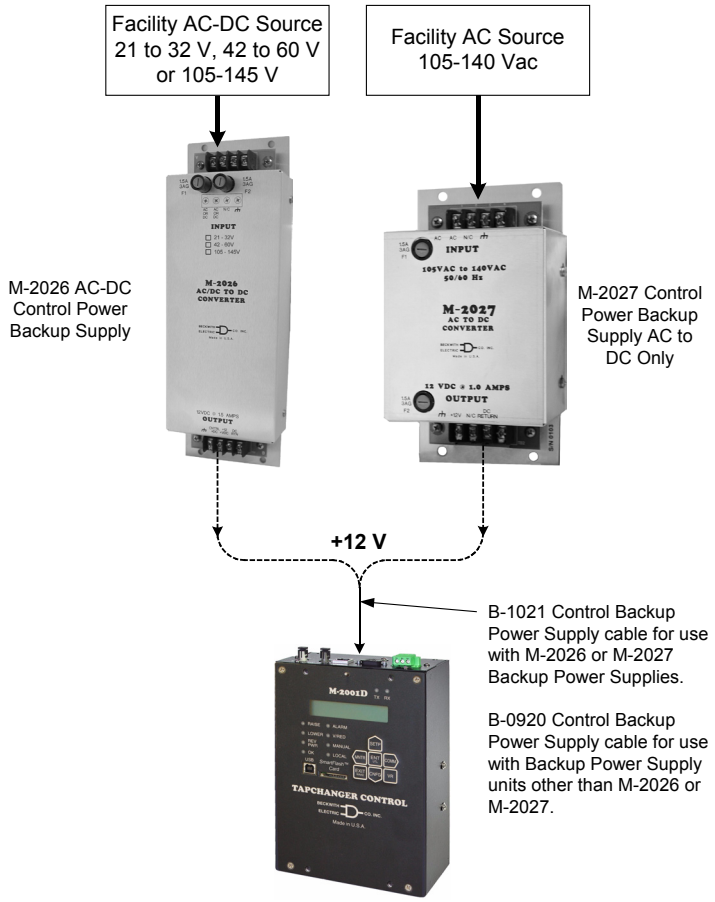

Figure 6 Typical M-2026/M-2027 Control Power Backup Supply Application

M-2001D Style Selection Chart

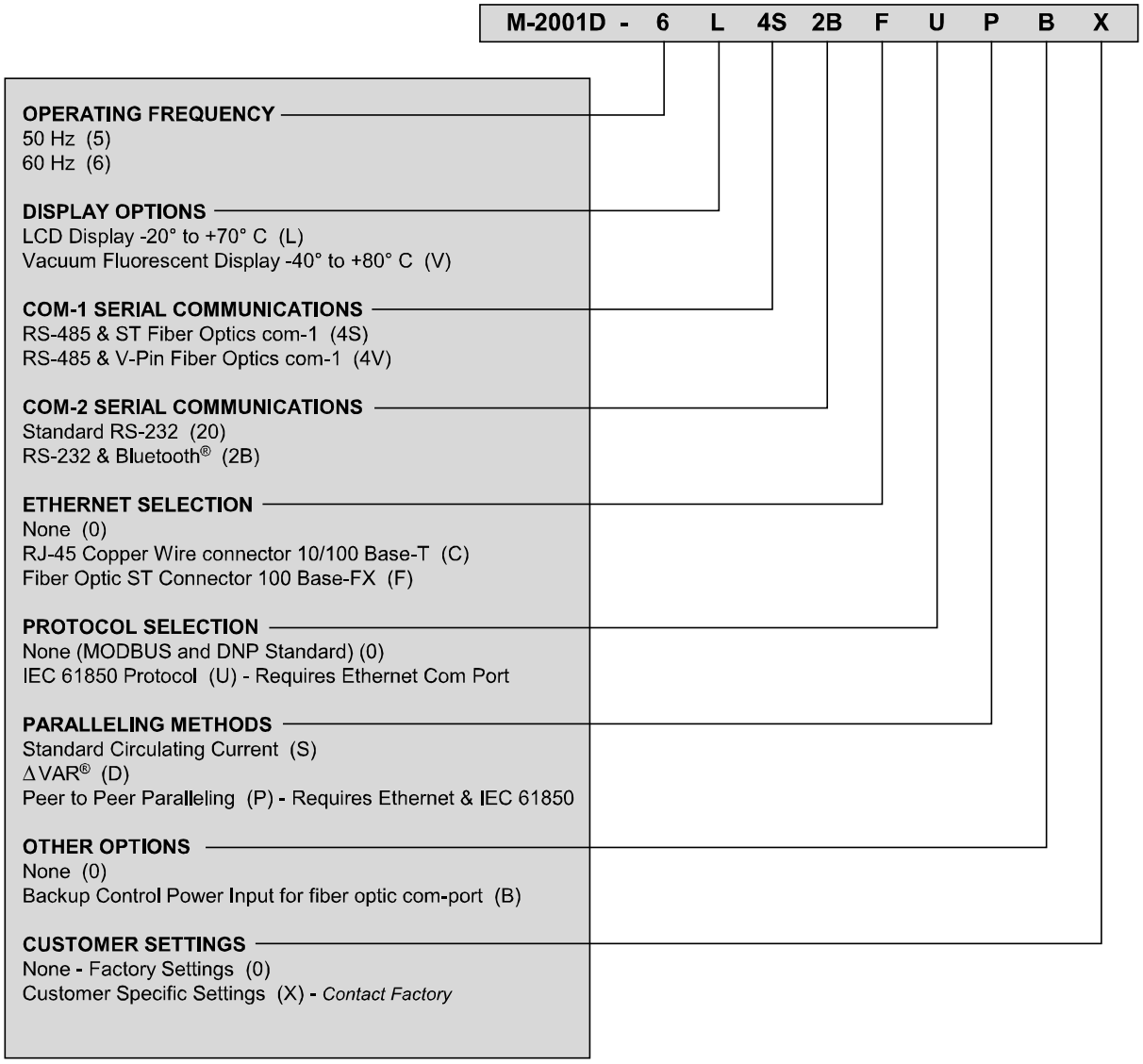

Figure 7 M-2001D Style Selection Chart

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TapPlot is the Registered Trademark of Beckwith Electric Co., Inc.

TapTalk is the Registered Trademark of Beckwith Electric Co., Inc.

ΔVAR is the Registered Trademark of Beckwith Electric Co., Inc.

MODBUS is the Registered Trademark of Gould, Inc.

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ISO 9001:2008

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800-2001D-SP-05 10/13

WARNING

DANGEROUS VOLTAGES, capable of causing death or serious injury, are present on the external terminals and inside the equipment. Use extreme caution and follow all safety rules when handling, testing or adjusting the equipment. However, these internal voltage levels are no greater than the voltages applied to the external terminals.

DANGER! HIGH VOLTAGE

– This sign warns that the area is connected to a dangerous high voltage, and you must never touch it.

PERSONNEL SAFETY PRECAUTIONS

The following general rules and other specific warnings throughout the manual must be followed during application, test or repair of this equipment. Failure to do so will violate standards for safety in the design, manufacture, and intended use of the product. Qualified personnel should be the only ones who operate and maintain this equipment. Beckwith Electric Co., Inc. assumes no liability for the customer's failure to comply with these requirements.

– This sign means that you should refer to the corresponding section of the operation manual for important information before proceeding.

Always Ground the Equipment

To avoid possible shock hazard, the chassis must be connected to an electrical ground. When servicing equipment in a test area, the Protective Earth Terminal must be attached to a separate ground securely by use of a tool, since it is not grounded by external connectors.

Do NOT operate in an explosive environment

Do not operate this equipment in the presence of flammable or explosive gases or fumes. To do so would risk a possible fire or explosion.

Keep away from live circuits

Operating personnel must not remove the cover or expose the printed circuit board while power is applied. In no case may components be replaced with power applied. In some instances, dangerous voltages may exist even when power is disconnected. To avoid electrical shock, always disconnect power and discharge circuits before working on the unit.

Exercise care during installation, operation, & maintenance procedures

The equipment described in this manual contains voltages high enough to cause serious injury or death. Only qualified personnel should install, operate, test, and maintain this equipment. Be sure that all personnel safety procedures are carefully followed. Exercise due care when operating or servicing alone.

Do not modify equipment

Do not perform any unauthorized modifications on this instrument. Return of the unit to a Beckwith Electric repair facility is preferred. If authorized modifications are to be attempted, be sure to follow replacement procedures carefully to assure that safety features are maintained.

PRODUCT CAUTIONS

Before attempting any test, calibration, or maintenance procedure, personnel must be completely familiar with the particular circuitry of this unit, and have an adequate understanding of field effect devices. If a component is found to be defective, always follow replacement procedures carefully to that assure safety features are maintained. Always replace components with those of equal or better quality as shown in the Parts List of the Instruction Book.

Avoid static charge

This unit contains MOS circuitry, which can be damaged by improper test or rework procedures. Care should be taken to avoid static charge on work surfaces and service personnel.

Use caution when measuring resistances

Any attempt to measure resistances between points on the printed circuit board, unless otherwise noted in the Instruction Book, is likely to cause damage to the unit.

WARNING

This equipment contains a certified transmitter found to comply with FCC Part 15.247 rules regarding frequency hopping spread spectrum intentional radiators. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Only the antenna provided is authorized for use with the M-2001D. If the antenna is lost or damaged, please contact Beckwith Electric Co., Inc. to secure a replacement antenna.

This product generates, uses, and can radiate radio frequency (RF). If it is not installed and used in accordance with the operating instructions, it can cause harmful interference to communications. If this equipment causes harmful interference to radio or television reception, the user should try and correct the interference by:

- Reorienting or relocating the receiving/transmitting antenna
- Increasing the separation between the equipment and the M-2001D
- Connecting the equipment into an outlet on a different circuit from the M-2001D

If these do not correct the interference, consult an experienced radio/television technician for assistance. Correcting such interference is the responsibility of the user, not the manufacturer.

Changes or modifications not expressly approved by Beckwith Electric Co., Inc. may void the user's authority to operate the equipment.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for uncontrolled equipment. This equipment should be installed and operated with a minimum distance of at least 20 cm between the radiator and person's body (excluding extremities) and must not be located or operated with any other antenna or transmitter.

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Chapter 8 Testing

Appendix A HMI

Appendix B Record Forms

Appendix C DNP Configuration Editor

Appendix D IEC 61850 Configuration Editor

Appendix E Self-Test Error Codes

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1 Introduction

1.1 Instruction Book Contents

This instruction book includes eight Chapters and six Appendices.

Chapter 1: Introduction

Chapter One introduces the instruction book contents, provides an overview of M-2001D Tapchanger Control and describes the available accessories.

Chapter 2: Operation

Chapter Two provides the necessary instructions regarding operation of the M-2001D. Operation of the M-2001D is accomplished by utilizing either the unit's front panel controls or through the TapTalk® S-2001D Communications Software.

Chapter 3: TapTalk

Chapter Three provides a description of each element of the TapTalk S-2001D Communications Software. The TapTalk menu structure and commands are described for each feature and function.

Chapter 4: System Setup

Chapter Four is designed for the person(s) responsible for the system setup of the control. It describes the procedures for entering system setup information into the M-2001D. It also illustrates the definition of system quantities and equipment characteristics required by the M-2001D, and describes the individual control settings.

Chapter 5: Configuration

Chapter Five is designed for the person or group responsible for the configuration of the M-2001D Digital Tapchanger Control. Chapter Five provides definitions of system quantities and equipment characteristics required by the control.

Chapter 6: Setpoints

Chapter Six is designed for the person or group responsible for the Setpoints of the M-2001D.

Chapter 7: Installation

The person or group responsible for the installation of the M-2001D will find herein all mechanical information required for physical installation, equipment ratings, and all external connections in this chapter.

Chapter 8: Testing

This chapter provides step-by-step test procedures for Bench Testing, Check-out, Operational, and In-Service tests.

Appendix A: Human Machine Interface (HMI)

This Appendix provides a graphical representation of the Human Machine Interface (HMI) menu structure. It also includes descriptions of each menu element.

Appendix B: Setpoint Configuration and Communication Record Forms

This Appendix provides a set of forms to record and document the settings required for the proper operation of the M-2001D. Also included are the default values for each setting, where applicable.

Appendix C: DNP Configuration Editor

This Appendix includes the DNP Configuration Editor features and functions.

Appendix D: IEC 61850 Configuration Editor

This Appendix includes the IEC 61850 Configuration Editor features and functions.

Appendix E: Self-Test Error Codes

This Appendix lists all error codes and their definitions.

Appendix F: Index

This Appendix includes the index for the M-2001D Instruction Book.

1.2 Adapter Panel/ Surface Mounting Kit

An adapter panel *or* an M-2050 or M-2054 Surface Mounting Kit *must* be used with the M-2001D Tapchanger Control. Each panel adapts the M-2001D as a transformer and regulator control replacement and provides the external connections necessary for operation via terminal blocks on the rear of the adapter panel. Contact Beckwith Electric for a list of adapter panels that are currently available. Refer to the Application Guides of the specific adapter panel for the mounting details. See Figure 1-2 for a typical adapter panel mounting.

The M-2050 is an adapter kit which permits surface mounting of the control using two right angle mounting brackets, four screws and a 24-pin connector with six-foot pigtails on each pin. The M-2050 does *not* include features available on adapter panels. These features include mechanical configurations and wiring connections for direct replacement, CT shorting or front panel switches, fuses or test points. Refer to the Instruction Manual of the M-2050 for the mounting details.

The M-2054 is an adapter kit which permits surface mounting of the control using two right angle mounting brackets, four screws and a 24-pin connector with six-foot pigtails on each pin. Refer to the Instruction Manual of the M-2054 for the mounting details and additional information.

1.3 General Overview of M-2001D Tapchanger Control

The M-2001D Digital Tapchanger Control is a microprocessor-based transformer and step-voltage regulator load tapchanger control.

The control is designed for initial OEM installation on new tapchangers or to replace a particular manufacturer's tapchanger control. Figure 1-1 provides an overview of the functional elements of the control. The M-2001D is designed to mechanically and electrically replace an old control, with mounting hardware to facilitate the replacement. See **Chapter 7**, **Installation** for detailed information.

Interrogation of the control and setting changes are made using either the front panel Human Machine Interface (HMI), or through the communications ports (MODBUS® or DNP3.0 protocol) utilizing TapTalk® S-2001D Communications Software. The HMI consists of a 20-character by 2-line display and seven pushbuttons. Two Access Codes are available to the user from the pushbuttons. All setpoints are stored in nonvolatile memory which is unaffected by control voltage disturbances.

Three Tapchanger operation counters are provided:

Presettable Operations Counter

Resettable Operations Counter

Presettable Neutral Counter

Ten LEDs are used to indicate Tapchanger Band Status, timing for **RAISE** and **LOWER, REV PWR** Reverse Power detection, CPU **OK**, **ALARM**, **V/RED** Voltage Reduction in Effect, **MANUAL**, **LOCAL**, and **TX**/**RX**.

The alphanumeric display and six pushbutton interface provides complete front panel access to the scrolling menu program shown in Appendix A, Figures A-1 through A-5. The control applies to tapchangers with ±16 taps and one neutral position.

A Voltage Reduction pushbutton allows the user to locally apply up to three levels of Voltage Reduction from the control front panel.

1.4 Accessories

TapTalk® S-2001D Communications Software

TapTalk is a Windows-based communications software program available for remote control and metering of the M-2001D Tapchanger Control. It is designed to interface with the microprocessor of the control through the standard USB Port (MODBUS®) and all installed communication ports. The TapTalk software displays all pertinent operating information. All operations that can be performed from the front panel user interface of the control can be duplicated remotely, through TapTalk. These operations include:

- Changing setpoint values. This includes those values for normal tapchanger control operation, as well as custom configuration to the site.
- Monitoring values. This includes measured and calculated values of real-time operating parameters.
- Data logging. The control can internally store various parameters at selected intervals. The TapTalk program can download this data into a spreadsheet and display. Alternatively, the PC can be programmed to poll the control and obtain a pre-selected list of parameters at selected intervals.

  Also, TapTalk includes a utility to convert the downloaded Datalog files from the Smart Flash SD Card into a spreadsheet readable format.
- Remote Control. The Remote Control feature allows the user to remotely raise or lower one tap position as well as apply voltage reduction to the target control.

Optional Communication Ports

The M-2001D Digital Tapchanger Control can be equipped with optional Bluetooth® capability (COM2). COM2 is located on the top rear of the unit. COM2 utilizes the DNP 3.0 and MODBUS protocols.

The M-2001D can also be equipped with an optional Ethernet Port through a RJ-45 Jack (10/100 Base-T) or Fiber Optic through ST connectors (100 Base-Fx). These ports support DNP over TCP/IP and MODBUS over TCP/IP.

M-2025B(D) Current Loop Interface Modules

The M-2025B(D) are external self-contained interfaces designed to operate with the tapchanger control for tap position by positive knowledge, for LTC transformer applications. The modules connect to the current loop output of a tap position monitor such as the 1250-series INCON Programmable Position Monitors. The tap position monitor includes current loop outputs whose level corresponds linearly to any of a pre-programmed number of tap positions depending on the tapchanger mechanism being monitored. The modules accept current loop ranges of:

- 0 to 1 mA dc
- 0 to 2 mA dc
- -1 to +1 mA dc
- 4 to 20 mA dc

The **Tap Information** screen is provided in the tapchanger's Tap Settings Menu to select whether the control uses the current loop method or the Motor Direct Drive KeepTrack™ method for tap position knowledge. The M-2025B(D) Current Loop Interface module is not used with the "KeepTrack™" method. The Motor Direct Drive KeepTrack method is used with single-phase line regulators having a counter contact and a neutral contact. The M-2025B(D) module easily connects to the tapchanger control through a six-pin connector located on the bottom of the control. For more information, refer to the **Tap Information** section of **Chapter 5, Configuration**.

For parallel operation using the circulating current method, the following accessories are needed: the M-0115A Parallel Balancing Module, the M-0127A AC Current Relay and the M-0169A Auxiliary Current Transformer. For more information, refer to the **Parallel Operation** section of **Chapter 5, Configuration**.

Backup Relay

The M-0329B Backup Relay or the M-5329 Multi phase Backup Relay are available to provide protection against failure of the primary control.

M-2026 AC-DC Control Power Backup Supply

The M-2026 accepts either AC or DC input over a range of 21 to 32, 42 to 60 and 105 to 145 V. The unit will supply a regulated +12 Vdc at up to a 1.5 A output. The unit includes a fused input, surge protection, and reverse polarity protection.

M-2027 Control Power Backup Supply - AC Only

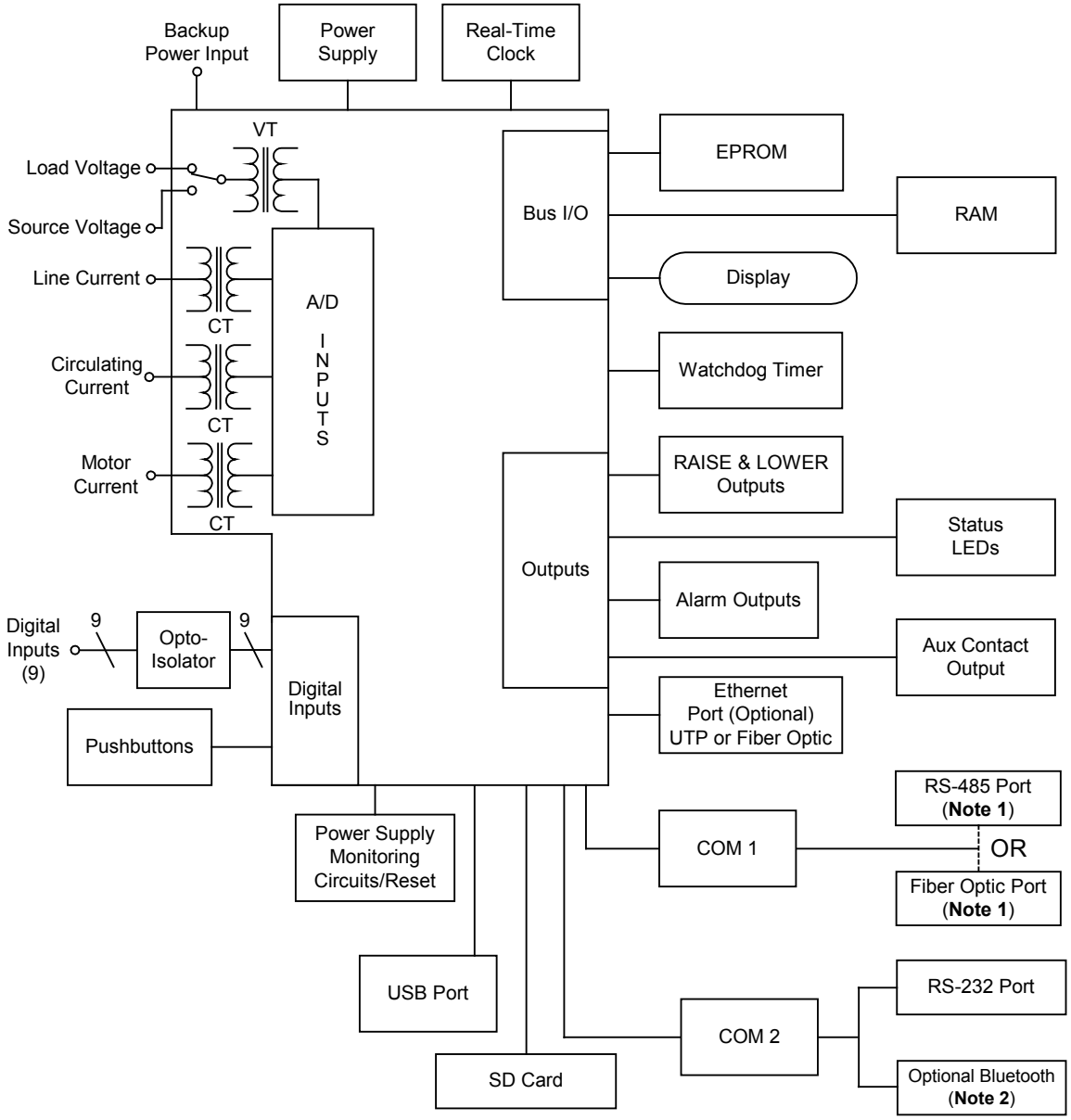
The M-2027 will accept an AC input over a range of 105 to 140 Vac at 50/60 Hz. The unit will supply a +12 Vdc at up to 1.0 A output.

B-0920 Control Power Backup Harness

The B-0920 Control Power Backup Harness provides fused (3 A) power to the M-2001D when a M-2026 or M-2027 Control Power Backup Supply is not used.

M-2948 Tap Position Sensor

The M-2948 tap position sensor is a rotary shaft encoder that includes a built-in microprocessor that provides stepped output signals in 9 or 10 degree increments. The M-2948 is available with 0 to 297°, 306°, 315°, 330°, 340° and 350° rotation for ±16 taps and 1, 2 or 3 neutral positions. The electrical output of the sensor is a 4-20 mA current loop that converts easily to a voltage signal at the input of the M-2025B(D) with the addition of a proper value shunt resistor. For a 4-20 mA Current Loop, 150 ohms is required on the input of the M-2025B(D). The signal from the M-2025B(D) is then conditioned and sent to the M-2001D as an analog signal. The M-2948 Tap Position Sensor is available with either a positive or negative slope. Negative slope (clockwise rotation) causes a decrease in Tap Position. Positive slope (clockwise rotation) causes an increase in Tap Position. M-2948 Tap Position Sensor directly mechanically replaces the Selsyn-Type Tap Position Sensor.



■**NOTES**:

1. The RS-485 and Fiber Optic ports are standard on COM 1. However, only one can be active at a time.
2. COM 2 is limited to either the standard RS-232 Port or the optional Bluetooth® capability. Only one option can be active on COM 2 at a time.

Figure 1-1 Functional Diagram

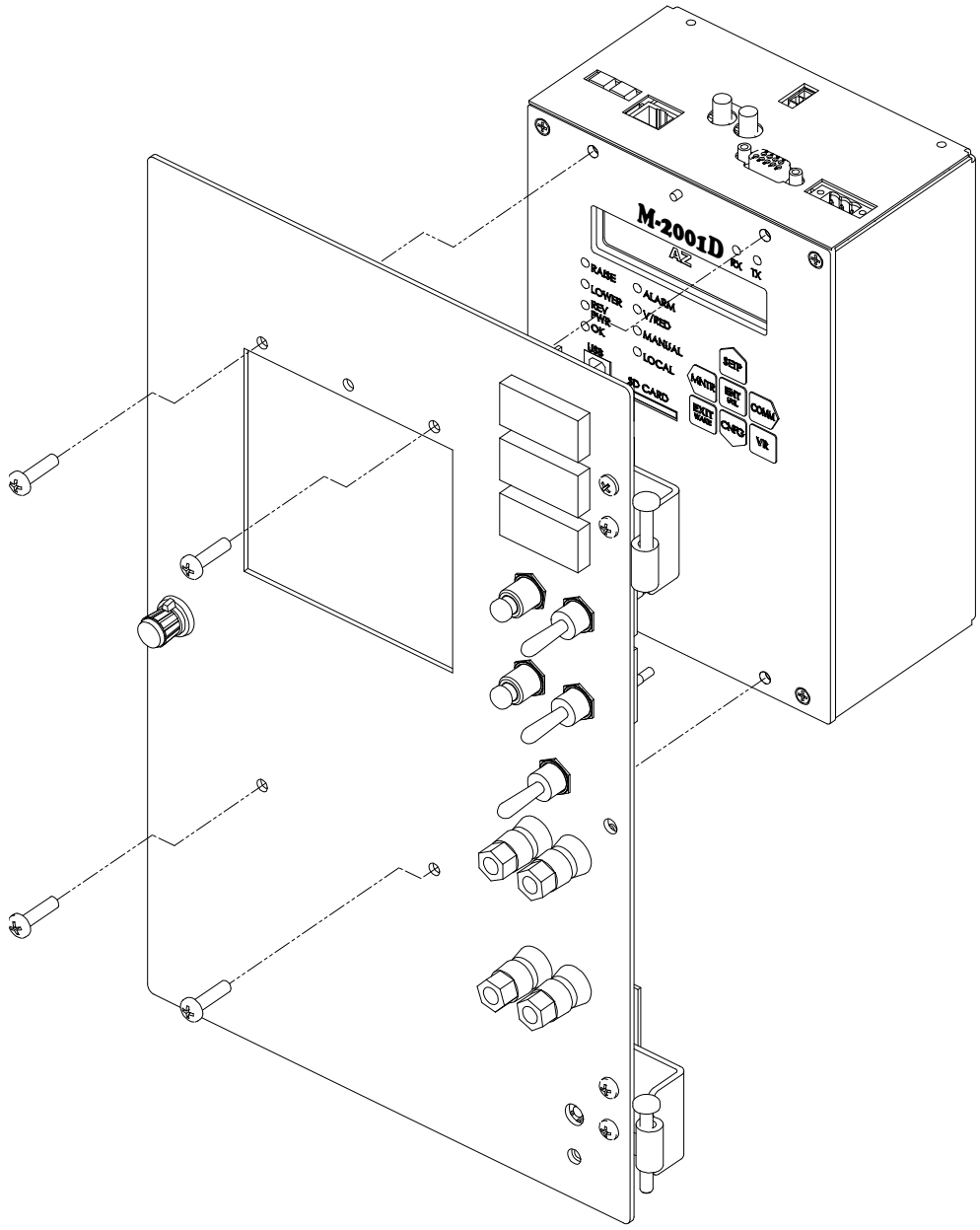


Figure 1-2 Typical Adapter Panel Mounting

2 Operation

2.0 Overview and Quick Index

The purpose of this chapter is to describe the steps that are necessary to interrogate the M-2001D utilizing either the front panel HMI or a PC running TapTalk® S-2001D Communications Software through any of the available communications ports. These instructions assume that the following conditions exist:

- The unit is energized from an appropriate power supply (Green OK status light is illuminated).

  See **Chapter 7**, **Installation**, Section 7.1, External Connections, for power supply connection details.
- For PC communications, TapTalk is installed on the host PC.

  See **Chapter 7**, **Installation**, Section 7.10, TapTalk S-2001D Communications Software Installation, if TapTalk is not installed.
- For PC communication, initial PC communication has been established with the unit.

If this is the first attempt to establish communications with the unit, then see **Chapter 7**, **Installation**, Section 7.11, Activating Initial Local Communications.

Message Screens and Access Codes

See **Chapter 6**, **Setpoints** for Setpoint information. M-2001D operation from either TapTalk or HMI is described herein.

2.1 Front Panel Controls and Indicators Overview

Display and Pushbuttons

The front-panel user interface consists of a Liquid Crystal Display (LCD) or Vacuum Fluorescent (VFD) Display, directional (Hot Buttons), **EXIT**, **ENT**, and **VR** pushbuttons, and the status indicators as shown in Figure 2-1, M-2001D Front Panel.

The display normally displays the user lines and remains so until the ⬆, ⬇, ➡, ⬅ or **ENT** pushbutton is depressed. Pressing any pushbutton will display the heading corresponding to the "Hot Button" label above the pushbutton (Figure 2-1). The "Hot Buttons" directly access the menu headers and can only be selected from either the user lines or the cycling display.

⬆, ⬇, ⬅ and ➡ Pushbuttons

The directional pushbuttons have three functions.

- They are used to change screens and scroll through selections.
- They are used to enter new values by incrementing or decrementing the displayed value. The new value is not stored until the **ENT** pushbutton is pressed a second time.
- Activate the "Hot Button" feature for the corresponding labels above each pushbutton to jump to that screen.

HMI Menu Structure

The HMI menu structure (Appendix A) consists of three levels: Header, Sub-Header and Data/Data Entry. From the header level (Figure 2-2) the user can navigate to the adjacent headers with the LEFT and RIGHT pushbuttons, go to the sub-header level by pressing ENT or DOWN pushbutton, or clear the screen by pressing the EXIT pushbutton.

From the sub-header level, the user can navigate to the adjacent sub-headers with the LEFT and RIGHT pushbuttons, return to the header level by pressing the EXIT or UP pushbuttons, or enter the data/data entry level by pressing ENT or DOWN. Once in the data/data entry screens, the user can navigate through the list with the UP and DOWN pushbuttons. In this level the list wraps around. To exit the level, the user can press EXIT to return to the corresponding sub-header, or use the LEFT and RIGHT pushbuttons to go to the adjacent sub-header level. To enter data, reset parameters or access data screens, press ENT.

ENT Pushbutton

The **ENT** pushbutton is a hot button for the "Utility Menu". It is also used to perform the following functions:

- Enter the "edit" mode of a screen
- Store a setpoint or condition in memory
- Enter the sub-header or data level
- Reset certain monitoring screens

EXIT Pushbutton

The **EXIT** pushbutton is a hot button for a unit "wakeup", which starts cycling through a series of user selectable metering and tap information screens. The user can move up and down the automatic cycling using the UP and DOWN pushbuttons. Pressing EXIT will stop the cycling on the displayed parameter. The screens for the wakeup sequence can be enabled or disabled from the TapTalk® Communications Software (See **Section 4.1, System Setup**).

The **EXIT** pushbutton is also used to perform the following functions:

- Exit a level to the next higher level
- Cancel data entry
- Clear the screen when at the header level

Data Entry Screens

Data entry screens are of three types:

- Alphanumeric
- List
- Bit Mask

For Alphanumeric Data, the LEFT and RIGHT pushbuttons advance the cursor to the digit to be edited and the UP and DOWN pushbuttons change the value. For List Data, the UP and DOWN pushbuttons change the data. For Bit Mask (i.e. Prog Alarm Function) the LEFT and RIGHT pushbuttons move the cursor to the bit and the UP and DOWN pushbuttons change the value. For all screens the ENT pushbutton saves the value and EXIT pushbutton cancels the operation. A "C" indicates the user is in the edit mode.

Power Up Screens

Each time the control is powered up, it will briefly display a series of screens that include:

- User Lines
- Control Firmware Number
- Serial Number
- Date
- Time of Day

Screen Blanking

The display automatically displays the user lines after exiting from any menu, or from any screen after 15 minutes of unattended operation.

LCD Screen Contrast

The LCD screen contrast can be set/reset from the control front panel through the HMI menu item or at any time. Pressing the Right and Left arrow pushbuttons at the same time displays the LCD Contrast screen which cycles from dim to bright. Selecting ENT during the cycle sets the displayed contrast to the value at the time ENT was pressed. The LCD Screen Contrast adjustment menu item is located in the Communication/HMI menu.

"C" CHANGE Prompt

This prompt, in the bottom right corner of a screen, is enabled by initially pressing **Utility/ENT**. This prompt indicates that the user can change a setting using the ⬆ or ⬇ pushbuttons to increment or decrement the settings. Values have factory preset increments, such as 0.1 volt or 1 second. Press **ENT** the second time to execute the setting change.

"ENT" Prompt

When the **"E"** prompt appears in the top right corner of the display window it indicates that the value of the display will reset if the **ENT** pushbutton is pressed.

⬅ and ➡ Prompt

Some setpoints screens include the Left and Right Arrows but do not move to the adjacent sub-header, but instead go to a configuration screen.

Volt Red Pushbutton (Voltage Reduction)

The **VR** pushbutton acts as a "hot" key to allow the user to change the Voltage Reduction status from the front panel. It can only be accessed when the screen displays the user lines, or a cycling message is being displayed on the front panel. The Voltage Reduction pushbutton allows the user to apply 3 Steps of Voltage Reduction.

Status Indicators

RAISE LED

The Raise LED (yellow) illuminates when the voltage is below the lower band edge and the timer has started timing for a tapchanger Raise operation.

LOWER LED

The Lower LED (yellow) illuminates that the voltage is above the upper band edge and the timer has started timing for a tapchanger Lower operation.

REV PWR LED

The Reverse Power LED (red) will illuminate to indicate when the unit detects reverse power flow.

OK LED

The OK LED (green) will remain illuminated whenever power is applied to the unit and the control is functioning properly. The OK LED will also extinguish when a Motor Seal-in Failure Block is in effect.

ALARM LED

The Alarm LED (red) will illuminate when any of the Programmable Alarm Functions set the output relay to true.

V/RED LED

The Voltage Reduction LED (yellow) will flash corresponding to the level of Voltage Reduction that has been invoked. This is true for any Voltage Reduction process whether it came from an external contact, any Comm input or HMI.

- 1 Flash for Level 1 Voltage Reduction
- 2 Flashes for Level 2
- 3 Flashes for Level 3

Figure 2-1 M-2001D Front Panel

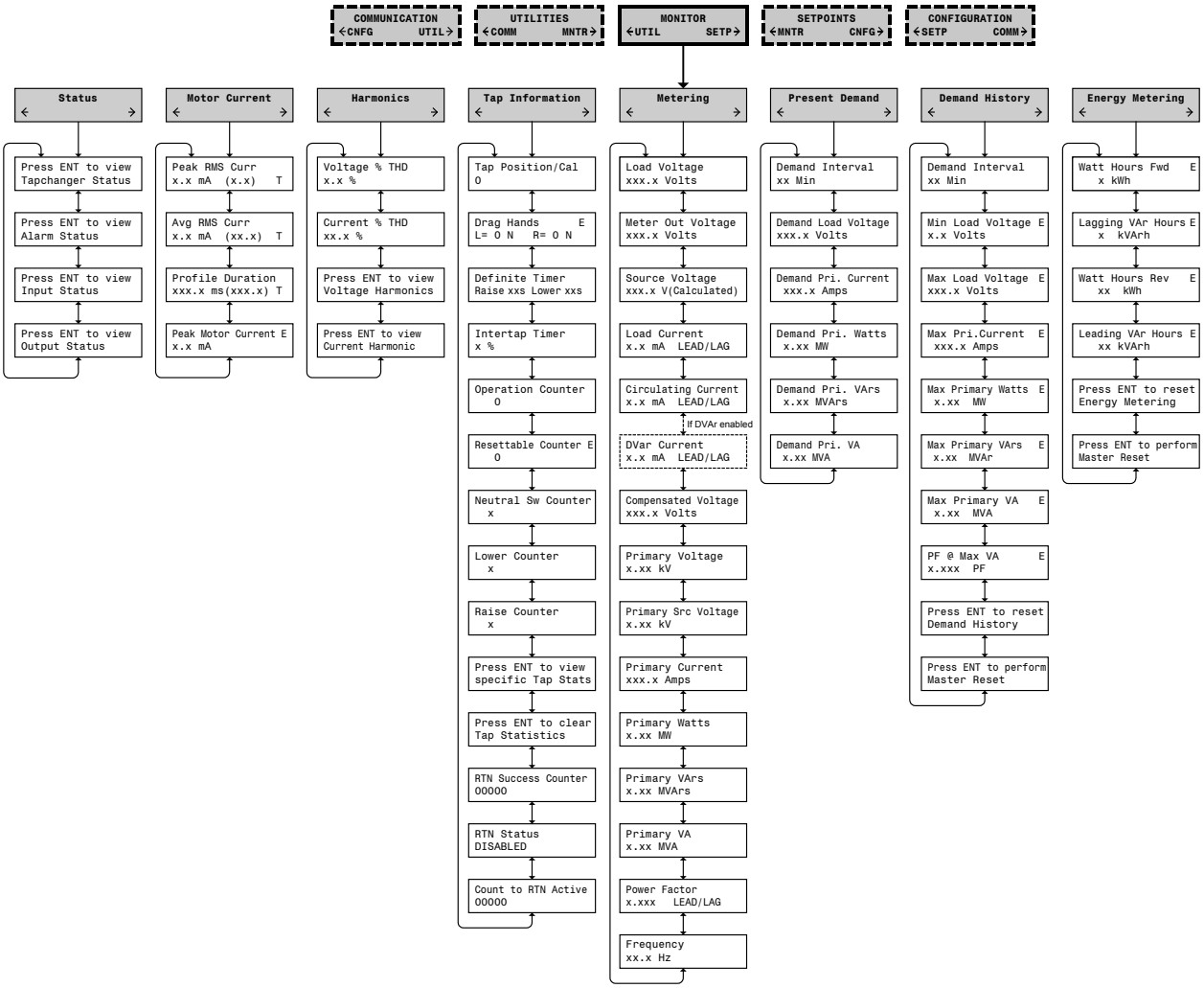


Figure 2-2 Example of HMI Menu Structure, Header, Sub-Header and Data/Data Entry Menus

MANUAL LED

The Manual LED (red) will illuminate when Auto operation of the control has been blocked from any Com port. It will also illuminate when Manual Mode has been selected using the Adapter Panel Auto/ Manual Pushbutton or Toggle switch.

LOCAL LED

The Local LED (yellow) will illuminate when all SCADA write capability to the control is blocked.

COM1 TX/RX LEDS

The Transmit TX (red) and Receive RX LEDs (green) indicate that the control is transmitting and/ or receiving through COM1. Also, during the boot-up sequence the TX and RX LEDs will cycle indicating that the memory test is in progress. If the memory test is successful, then the TX and RX LEDs will be extinguished. If the memory test fails then both TX and RX LEDs will illuminate.

Smart Flash SD Card Slot

The Smart Flash SD Card Slot allows the user to:

- Quick Capture
- Load and Save Setpoints
- Save Datalog files (in COMTRADE format)
- Save Sequence of Events files
- Save Oscillograph records (in COMTRADE format)
- Clone Save and Load
- Load and Save DNP files
- Update Firmware
- Save Wakeup Screen parameters
- Save All Metering parameters
- Utilize the SD Card as an Access Code Key
- Save/Load IEC 61850 CID Files (when IEC 61850 is purchased)

The steps necessary to perform these actions are described later in this chapter.

2.2 Operation (HMI/TapTalk®)

MESSAGE SCREENS

Default Message Screen

When the M-2001D is energized and unattended, the User Logo lines are displayed.

Local Voltage Reduction Screen

If Local Voltage Reduction is active, the display will cycle the appropriate Voltage Reduction Screen. When Local Voltage Reduction is terminated, then the display will return to the User Lines.

Op Count Signal Alarm Screen

The Op Count Signal Alarm will initiate a cycling display as long as the alarm is active.

Oscillograph Record Triggered Screen

If the "ENABLE OSC Message" feature is enabled (default setting is Enabled) and the Oscillograph has been triggered, a cycling display indicating that there is an oscillograph record available for download will be displayed. The screen will be displayed until the oscillograph record is cleared or the "ENABLE OSC Message" is disabled. However, if the Oscillograph file is not cleared, re-enabling this feature will restart the cycling.

The "Oscillograph Record Triggered" cycling display can be enabled from the TapTalk Communications Software by navigating to the "ENABLE Oscillograph Message" (Setup/Oscillograph/ENABLE Message) dialog screen (Figure 2-3) and selecting "Enable". It can also be enabled from the HMI by navigating to the "Communication HMI" menu.

Figure 2-3 Oscillograph Message Dialog Screen

Wakeup Message Screens

If the "Wake/EXIT" pushbutton is selected, then control will respond as follows:

- Pressing "WAKE/EXIT" when User Lines are being displayed will initiate a stepped display of the selected Wakeup parameters for a period of 15 minutes and then return to the User Lines display.
- If no Wakeup screens are selected, then no parameters will be displayed and the User Lines will blink for a moment.

■ **NOTE:** The Adapter Panel Drag Hand Reset only resets the Tap position Drag Hands.

- While the stepped parameter display is in effect, when ENT is pressed on any demand metering value, all demand metering Drag Hand parameters will be reset. This is also true for all metering Drag Hand values when ENT is pressed on an energy metering menu.
- The Wakeup stepped display can be stopped on the displayed parameter by selecting EXIT. Select EXIT again to terminate the stepped parameter display and return to the User Lines.

  The Wakeup screen values can be browsed by utilizing the Up and Down arrow pushbuttons. In this mode, if the ENT pushbutton is pressed while on a demand or energy metering value, it will only reset that individual Drag Hand value.
- When a Smart Flash SD Card present in the control while in the Wakeup screen menu, an additional Smart Flash SD Card menu item will be present. All Wakeup screen parameters can be saved to the Smart Flash SD Card in *.csv format by pressing ENT which initiates the following sequence of screens.

To save Wakeup screen parameters to a Smart Flash SD Card proceed as follows:

1. Verify that a (FAT) formatted Smart Flash SD Card is inserted into the Smart Flash SD Card slot.
2. Press "WAKE/EXIT" to initiate the Wakeup screen cycling display.
3. When the "Save Wake Data to SD Press ENT to begin" screen is displayed, press the ENT pushbutton. The control will display the following:

```
Enter file name
M2001DMT
```

4. Utilizing the Up/Down and Left/Right arrow pushbuttons enter the desired "File Name".
5. Press the ENT pushbutton, the control will display the following sequence of screens.

```
Saving CSV...
"File Name"
```

```
Save Wake Data to SD
Press ENT to begin
```

Alarms

If enabled the following alarms will be displayed on the HMI when the alarm condition is active and set in the Programmable Alarm Relay:

- Communication Block
- Block Raise (Tap)
- Block Lower (Tap)
- Block Raise (Voltage)
- Block Lower (Voltage)
- Voltage Reduction
- Max VAr Bias Duration–Lag
- Max VAr Bias Duration–Lead
- Individual Tap Wear
- LDC/LDZ
- Line Current Limit
- Reverse Power Flow
- Abnormal Tap Position
- Backup Fail (If Backup Power purchased)
- Op Count Signal
- Tap Changer Failure

The Alarm Activity feature can be accessed from the Utility/Calibration/Test HMI menu to display all currently active alarms.

The following alarms will also be displayed on the HMI when their features are enabled:

- Motor Seal-in Failure
- ΔVAR®2 Over Current Limit
- Low Current Block
- Master/Follower Lockout

Access Codes

To prevent unauthorized access to the control functions, there are provisions in the software for assigning a Level 1 and/or Level 2 Access Code (up to six characters). A fixed factory assigned Level 3 Access Code is required for changing calibration factors. When Level 1 or Level 2 Access Codes are active, then an additional 30 Level Access Codes (up to 15 characters) can be enabled as either Level 1 or Level 2. The Access Codes can be set in the Communication/HMI Menu or from TapTalk®.

Level Access protection will be automatically reinstated when either of the following conditions are met:

- No HMI menu activity for a period of 15 minutes
- The user exits to the top of the HMI menu for a period of greater than 10 seconds

Access Levels

General access to read setpoints, to monitor status, to reset draghand parameters and the resettable operations counter do not require an Access Code.

The **Level 1** Access Code, if set, is required to make setpoint changes. If the Level 1 Access Code is set to all zeros, this request for an Access Code will not be seen and changes can be made without an Access Code. The default Level 1 Access Code is 000000.

The **Level 2** Access Code, if set, is required to make changes to the configuration, communication, and utilities. If the Level 2 Access Code is set to all zeros, this request for an Access Code will not be seen and changes can be made without an Access Code. The default Level 2 Access Code is 222222.

The **Level 3** Access Code is required to make changes to calibration settings on the control. Contact Beckwith Electric Customer Service for M-2001D Level 3 Access Codes.

OSCILLOGRAPH RECORDER

Trigger Oscillograph Recorder

The Oscillograph Recorder can be manually triggered by the user from TapTalk.

To manually trigger the Oscillograph recorder, perform the following:

1. Start TapTalk, then establish communications with the target control.
2. Select **Setup/Oscillograph/Trigger** from the TapTalk toolbar. TapTalk will display an Oscillograph Trigger confirmation dialog screen (Figure 2-4).

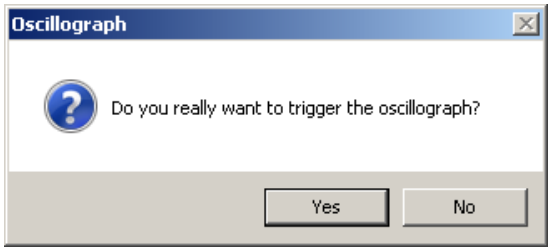


Figure 2-4 Manual Oscillograph Trigger Confirmation Dialog Screen

3. Select **Yes**. TapTalk will display an "Oscillograph was triggered successfully" confirmation screen (Figure 2-5).

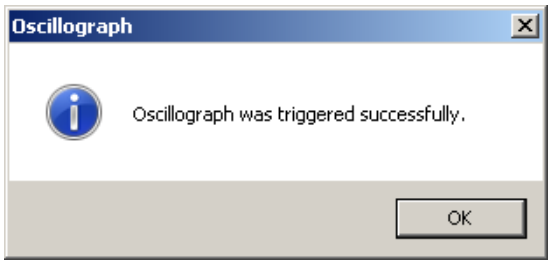


Figure 2-5 Oscillograph Recorder Successfully Triggered Confirmation Dialog Screen

The control will display an "Oscillograph Record Triggered" cycling message indicating that an oscillograph record is available for download. This screen message will continue until the oscillograph record is cleared.

4. Select **OK**. TapTalk will return to the Main screen.

Retrieve Oscillograph Record (TapTalk)

Oscillograph data must be retrieved from the control in a Comtrade file (*.cfg) in order to be viewed. S-2001D TapPlot® can be utilized to view the file contents.

To retrieve Oscillograph data, perform the following:

1. Start TapTalk®, then establish communications with the target control.
2. Select **Setup/Oscillograph/Retrieve** from the TapTalk toolbar. TapTalk will display a "Retrieve Oscillograph Record" dialog screen (Figure 2-6).

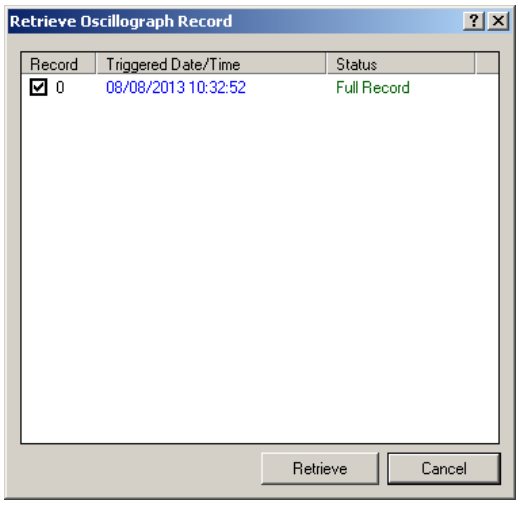


Figure 2-6 Retrieve Oscillograph Record Dialog Screen

3. Select the desire oscillograph record, then select Retrieve. TapTalk will display a Retrieve Oscillograph Record "Save As" dialog screen (Figure 2-7).

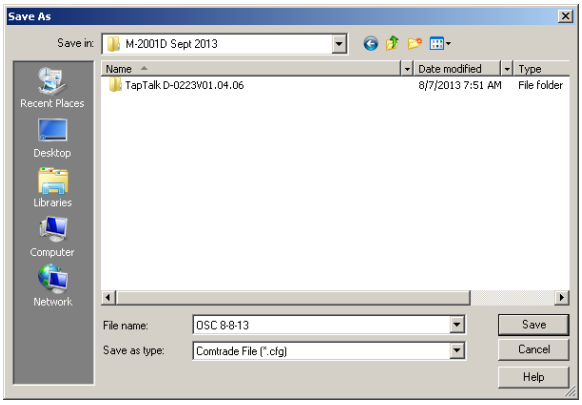


Figure 2-7 Retrieve Oscillograph Record (Save As) Dialog Screen

4. Select a folder to save the file to and the desired file name, then select **Save**, TapTalk will momentarily display an Initialization status screen (Figure 2-8), then a Retrieving Oscillograph Record status screen (Figure 2-9).

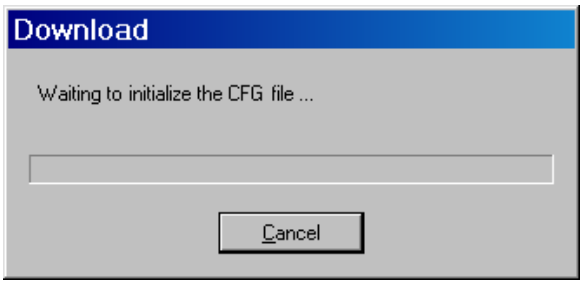


Figure 2-8 Initialize Oscillograph Record Download Screen

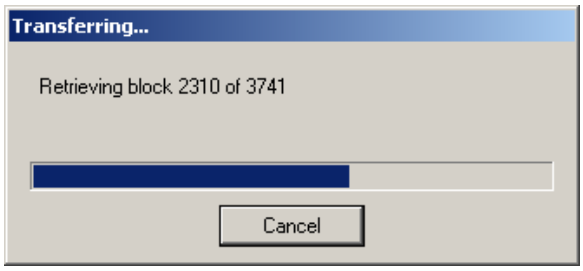


Figure 2-9 Retrieving Oscillograph Record Status Screen

When the oscillograph record has been downloaded, TapTalk will display the following confirmation screen. Also, the cycling display on the control will not stop until the oscillograph records are cleared.

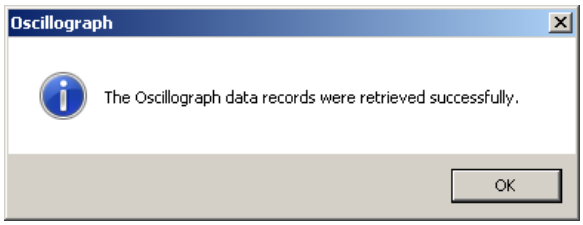


Figure 2-10 Oscillograph Data Records Were Retrieved Confirmation Screen

5. Select **OK**. TapTalk will return to the Main screen.

Clear Oscillograph Records (TapTalk)

To Clear all Oscillograph records in the control, perform the following:

1. Start TapTalk®, then establish communications with the target control.
2. Select **Setup/Oscillograph/Clear** from the TapTalk toolbar. TapTalk will display a Clear Oscillograph Record confirmation screen (Figure 2-11).

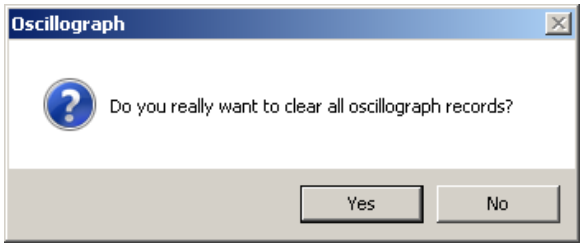


Figure 2-11 Clear Oscillograph Record Confirmation Screen

3. Select **Yes**. TapTalk will display a confirmation dialog screen (Figure 2-12).

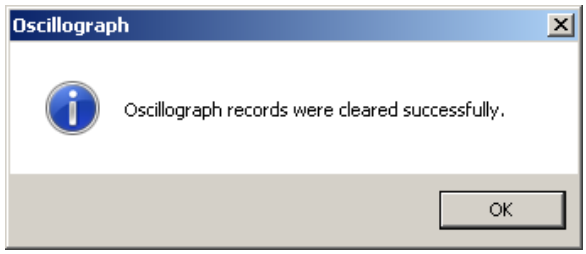


Figure 2-12 Clear Oscillograph Record Confirmation Screen

4. Select **OK**. TapTalk will return to the Main screen. The cycling display will be stopped.

Clear Oscillograph Records From The HMI

To clear Oscillograph Records from the HMI perform the following:

1. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                    UTIL→
```

OR

```
        Memory Card
←                        →
```

2. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                        →
```

3. From either the "Comm Settings" or "Memory Card" menu, press the Right or Left Arrow pushbutton as necessary until "HMI" is displayed.

```
            HMI
←                        →
```

4. Press the Down Arrow as necessary until the following is displayed.

```
Clear OSC Records
Ready Press ENTER
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, then the following will be displayed. Go to Step 8.

```
Confirm press ENTER
Cancel press EXIT.
```

6. If Level 2 Access is active, then the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, then the display will briefly flash a confirmation screen and then display the following:

```
Confirm press ENTER
Cancel press EXIT
```

   If not, re-enter a valid code.

8. Press the ENT pushbutton. The following will be displayed:

```
Records Cleared!
Any key to continue
```

SEQUENCE OF EVENTS RECORDER

Trigger Sequence of Events Recorder (TapTalk)

The Sequence of Events Recorder can be manually triggered by the user from TapTalk®.

To manually trigger the Sequence of Events recorder, perform the following:

1. Start TapTalk, then establish communications with the target control.
2. Select **Setup/Sequence of Events/ Trigger** from the TapTalk toolbar. TapTalk will display a Sequence of Events Trigger confirmation dialog screen (Figure 2-13).

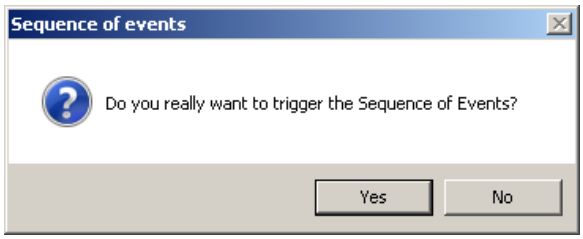


Figure 2-13 Sequence of Events Trigger Confirmation Dialog Screen

3. Select **Yes**. TapTalk will display a "Sequence of Events was triggered successfully" confirmation screen (Figure 2-14).

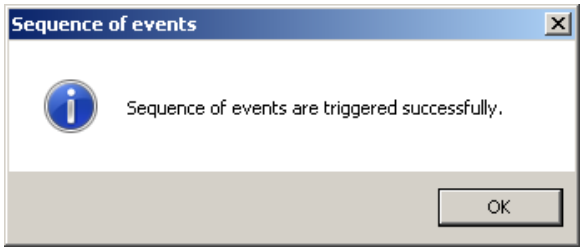


Figure 2-14 Sequence of Events Recorder Successfully Triggered Confirmation Dialog Screen

4. Select **OK**. TapTalk will return to the Main screen.

Retrieve Sequence of Events Record (TapTalk)

S-2001D TapPlot can be utilized to view the file contents.

To retrieve Sequence of Events data, perform the following:

1. Start TapTalk®, then establish communications with the target control.
2. Select **Setup/Sequence of Events/ Retrieve** from the TapTalk toolbar. TapTalk will display a Retrieve Sequence of Events Record "Save As" dialog screen (Figure 2-15).

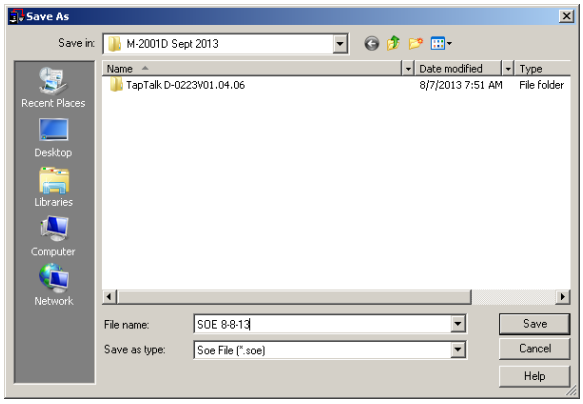


Figure 2-15 Retrieve Sequence of Events Record (Save As) Dialog Screen

3. Select a folder to save the file to and the desired file name, then select **Save**. TapTalk will momentarily display an Initialization status screen (Figure 2-16), then a "Retrieving Sequence of Events Record" status screen (Figure 2-17).

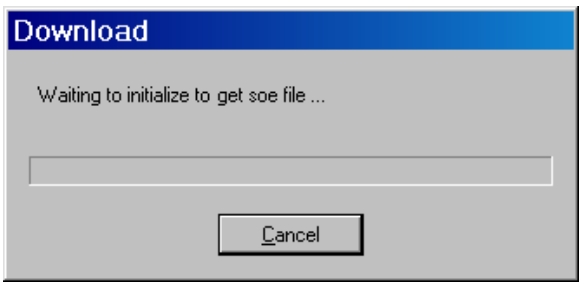


Figure 2-16 Initialize Sequence of Events Record Download Screen

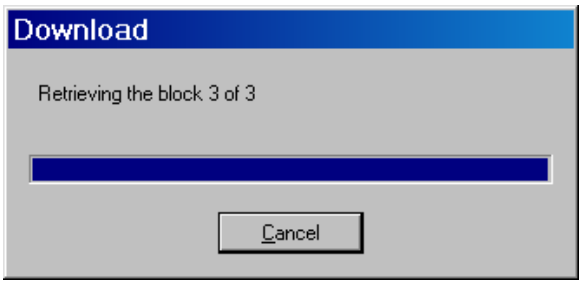


Figure 2-17 Retrieving Sequence of Events Record Status Screen

When the Sequence of Events record has been downloaded TapTalk will display the following confirmation screen.

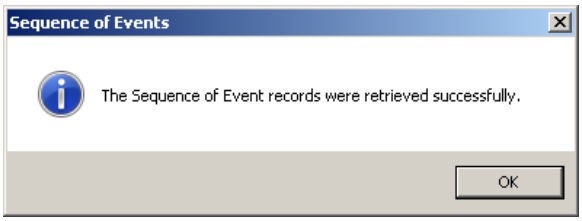


Figure 2-18 Sequence of Events Records Retrieved Successfully Confirmation Screen

4. Select **OK**. TapTalk will display Figure 2-19, "View Sequence of Events Record" dialog screen.

View Sequence of Events From TapTalk

To view Sequence of Events records, perform the following:

1. Start TapTalk®, then establish communications with the target control.
2. Select **Setup/Sequence of Events/ View** from the TapTalk toolbar. TapTalk will display a "View Sequence of Events Record" dialog screen (Figure 2-19).
3. Select the desired Sequence of Events record to display the captured parameters.

Trigger Status – The "Trigger Status" section of the View Sequence of Events Dialog Screen displays the current trigger status at the instant the Sequence of Events Recorder was triggered. Sequence of Events is monitored at a fixed period of 1 cycle.

Pickup/Dropout – The "Pickup and Dropout" sections of the View Sequence of Events Dialog Screen indicate which signal caused the Sequence of Events recorder to trigger. These sections also include all the signals that changed at the instant that the Sequence of Events Recorder triggered.

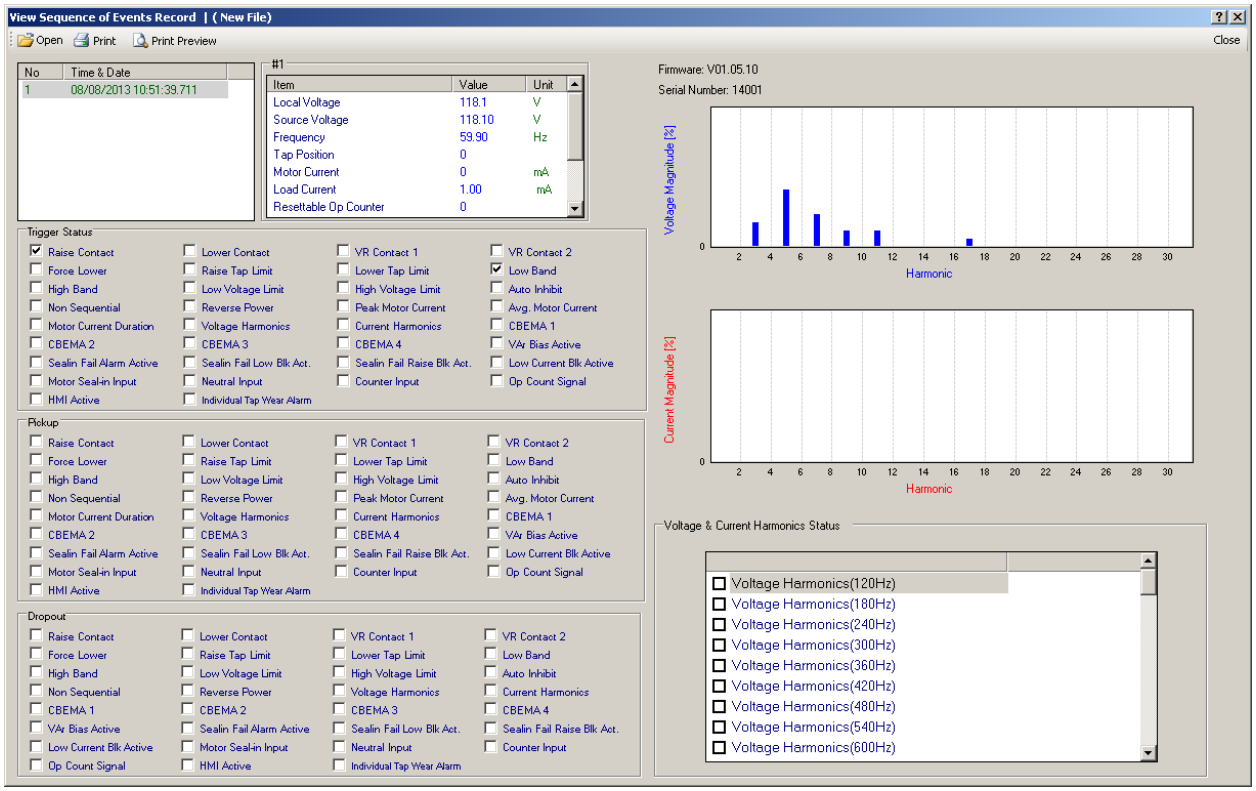


Figure 2-19 View Sequence of Events Dialog Screen

Clear Sequence of Events Records (TapTalk)

To Clear Sequence of Events records from the control perform the following:

1. Start TapTalk®, then establish communications with the target control.
2. Select **Setup/Sequence of Events/ Clear** from the TapTalk toolbar. TapTalk will display a Clear Sequence of Events Record confirmation screen (Figure 2-20).

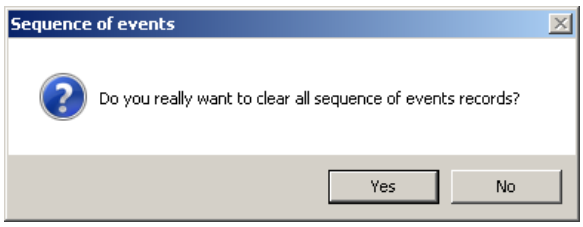


Figure 2-20 Clear Sequence of Events Record Confirmation Screen

3. Select **Yes**. TapTalk will display a "Clear" status screen (Figure 2-21), then a Sequence of Events records cleared successfully confirmation screen (Figure 2-22).

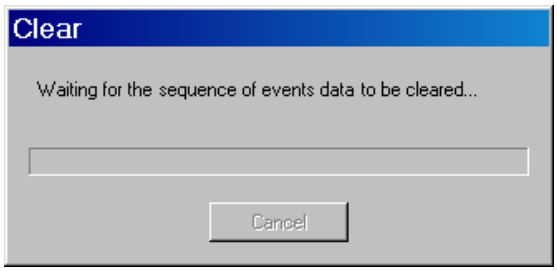


Figure 2-21 Clear Status Screen

Figure 2-22 Sequence of Events Records Cleared Successfully Confirmation Screen

4. Select **OK**. TapTalk will return to the Main screen.

DATA LOGGING

Retrieve Data Logging Data

■ **NOTE:** When Load Voltage, Compensated Voltage, Source Voltage and Load Current are selected, the data to be retrieved will consist of the average, minimum and maximum values over the sampling period.

To retrieve Data Logging data perform the following:

1. Start TapTalk, then establish communications with the target control.
2. Select **Setup/Data Logging/Retrieve** from the TapTalk toolbar. TapTalk will display a Data Log Download dialog screen (Figure 2-23).

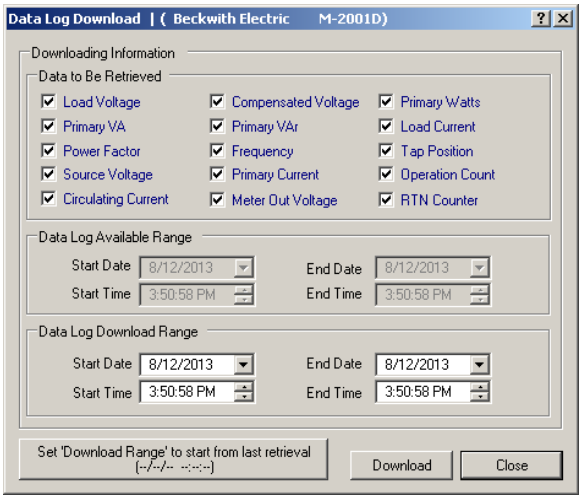


Figure 2-23 Data Log Download Dialog Screen

■ **NOTE**: Load Voltage, Compensated Voltage, Load Current and Source Voltage are the average value during the data logging interval.

3. From the "Data to be retrieved" section of the Data Log Download screen select the desired parameters to be retrieved.
4. From the "Data Log Download Range" section of the Data Log Download screen select the "Start Date", "Start Time", "End Date" and "End Time" or select "Set 'Download Range' to start from last retrieval".

5. Select "Download". TapTalk® will display a "Setpoints Successfully written to the control" confirmation screen (Figure 2-24) and then display a "Save As" dialog screen (Figure 2-25).

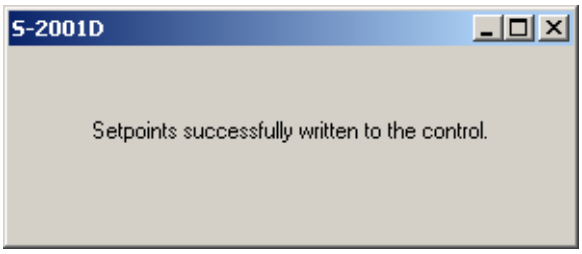


Figure 2-24 Setpoints Successfully Written To Control Confirmation Screen

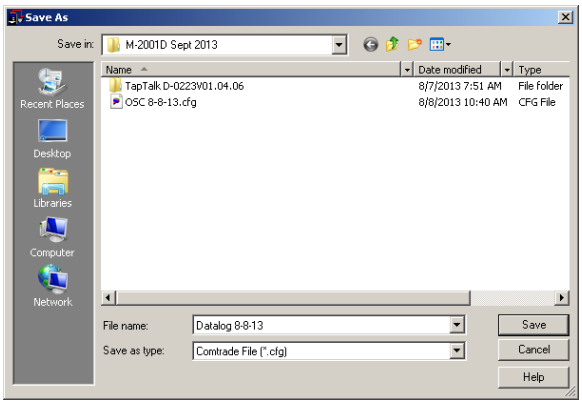


Figure 2-25 Data Log Download (Save As) Dialog Screen

6. Select a folder to save the file to and the desired file name, then select **Save**. TapTalk will display a Transferring Data Log status screen (Figure 2-26).

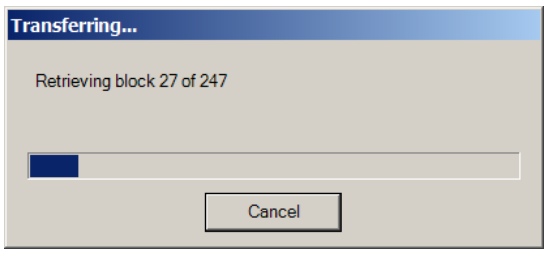


Figure 2-26 Transferring Data Log Status Screen

When the Data Log download is complete TapTalk will display the following confirmation screen.

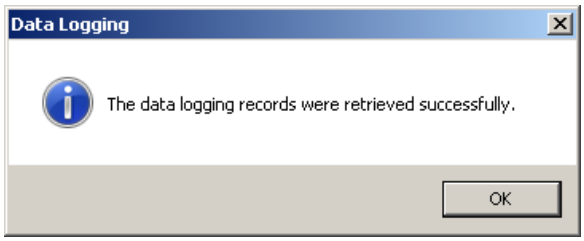


Figure 2-27 Data Log Records Retrieved Successfully Confirmation Screen

7. Select **OK**. TapTalk will return to the Main screen.

Clear Data Log Records From TapTalk

To Clear all Data Log records in the control perform the following:

1. Start TapTalk®, then establish communications with the target control.
2. Select **Setup/Data Log/Clear** from the TapTalk toolbar. TapTalk will display a Clear Data Log Record confirmation screen (Figure 2-28).

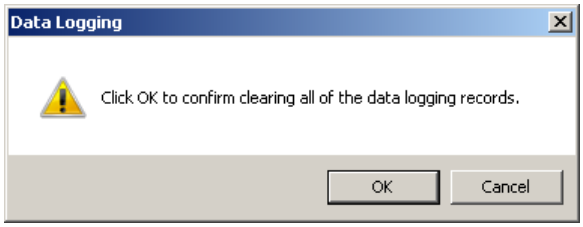


Figure 2-28 Clear Data Log Record Confirmation Screen

3. Select **OK**. TapTalk will display a "Clear" status screen (Figure 2-29) and then a "All of the data logging records were cleared" confirmation screen (Figure 2-30).

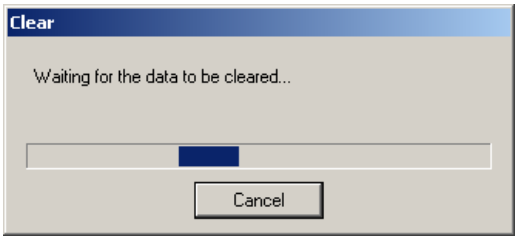


Figure 2-29 Clear Data Log Record Status Screen

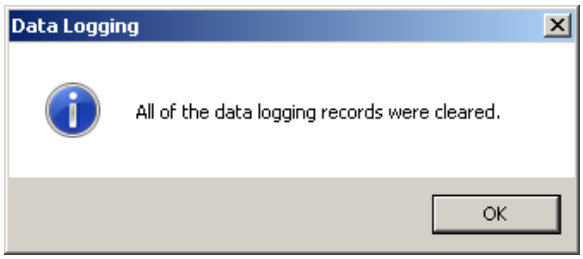


Figure 2-30 Data Log Records Cleared Successfully Confirmation Screen

4. Select **OK**. TapTalk will return to the Main screen.

Clear Data Log Records From The HMI

To clear Data Log Records from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                 COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                     →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Data Logging" menu.

```
        Data Logging
←                     →
```

4. Press the Down arrow pushbutton, as necessary, until the "Press ENT to clear Data Log Records" screen is displayed.

```
Press ENT to clear
Data Log Records
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Press ENT to confirm
clearing Data Log
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Press ENT to confirm
clearing Data Log
```

   If not, re-enter a valid code.

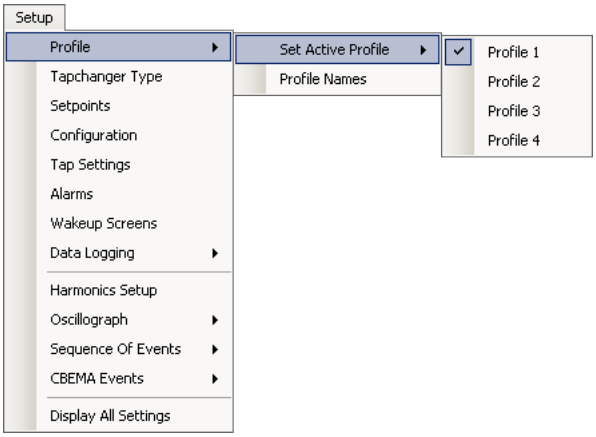
8. Press the ENT pushbutton, the following sequence of screens will be displayed.

```
Erasing Data Log
records...
```

```
Data Log records
have been cleared.
```

ACTIVE SETPOINT PROFILE

Set Active Setpoint Profile (TapTalk)



To set the Active Setpoint Profile perform the following:

1. Start TapTalk®, then establish communications with the target control.
2. Select **Setup/Profile/Set Active Profile** from the TapTalk toolbar.

▲ **CAUTION**: The control will immediately respond to the new Active Setpoint Profile settings.

3. Select the desired profile to activate. The Active Profile will be indicated in the menu dropdown and the TapTalk Lower Information Bar (Figure 2-31).

The Active Profile can also be selected from the Lower Information Bar as well. See **Chapter 6, Setpoints** for instructions for selecting the Active Profile and selecting a "Profile for editing".

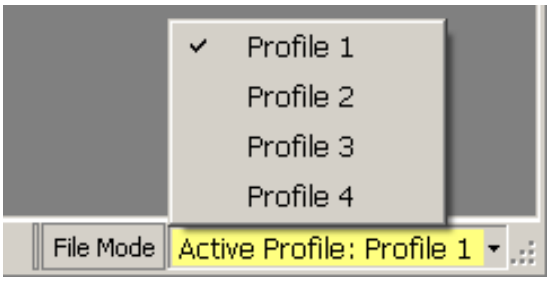


Figure 2-31 Set Active Profile from TapTalk Information Bar

METERING AND STATUS

Metering

The control has the capability of displaying measured and calculated secondary quantities and calculated primary quantities. Refer to Figures 2-33 and 2-34.

Secondary

The display will show local voltage, source voltage, compensated voltage, line frequency, and load current in secondary quantities along with load power factor. The voltage is displayed on a 120 V base and the current is displayed on a 200 mA base.

■ **NOTE:** The local voltage displayed will not match the voltage measured at the test terminals on the adapter panel if a sensing VT ratio correction other than 0.0 V has been entered.

Primary

In order to use the calculated primary quantities feature, the user must enter the following data in the Configuration Menu:

- Select line-to-line or line-to-ground VT configuration.
- Select single-phase quantities based on measured inputs, or three-phase quantities based on measured inputs and assume a balanced system.
- Select primary voltage and current multipliers needed to calculate primary quantities.

Present Demand

The Present Demand metering capability provided in the control follows the concept of a lagged demand meter. The demand time interval is selected by the user as 15, 30 or 60 minutes. This is the time it takes for a thermal meter to indicate 90% of a change in load.

Energy Metering

The Energy Metering function of the control displays the following measured values:

- Total Lagging VAr Hours (KVArh, MVArh or GVArh)
- Total Leading VAr Hours (KVArh, MVArh or GVArh)
- Total Reverse Watt Hours (KWh, MWh or GWh)
- Total Forward Watt Hours (KWh, MWh or GWh)

The measured values are retained in non-volatile memory. A real time clock is utilized to record a date/time stamp for each quantity to indicate when the period of measurement was initiated.

When a Energy Metering screen is selected, the screen cycles continuously to indicate the total value, date and time the measurement was initiated. The **E** indicates that the measured value can be reset by pushing **ENT**.

Demand History

Demand History quantities are the maximum and minimum values for the period since the last reset command. These are retained in non-volatile memory. A real-time clock allows the recording of a date/time stamp with each Demand History quantity. The following are available for drag-hand use:

- Min/Max tap position (when Tap Position is enabled)
- Min Load voltage (120 V base)
- Max Load voltage (120 V base)
- Max Primary current
- Max Primary watts, kW or MW
- Max Primary VAr, kVAr or MVAr
- Max Primary VA, kVA or MVA
- Power Factor at max VA

Where primary quantities are used, values displayed are single-phase or three-phase as defined in the Pri Pwr Display Screen of the Configuration Menu.

▲ **CAUTION:** When the M-2001D Tapchanger Control is used with a Beckwith Electric adapter panel, the panel's drag hands reset button only resets the mechanical drag hands of the regulator or LTC transformer. The button does **not** reset the tap draghands information stored in the control. The maximum and minimum tap position of the control should always be reset when the mechanical drag hands are reset.

The values retained in memory are time-tagged quantities that are calculated using the demand period selected (5, 10, 15, 30 or 60 minutes). For voltage, values are the average of samples taken over a period of 32 seconds which avoids undue retention of momentary voltage transients. The load power factor retained is the value at the time of max VA.

When selected, three screens for each parameter cycle continuously and indicate the value, date and time of each parameter. The **E** indicates that the drag-hand can be reset by pushing **ENT**.

The control is equipped with a real-time, 24-hour clock which is used with the drag-hand feature to record date/time stamp information on quantities saved in memory. The power source for the clock is maintained for at least 24 hours during a system power outage by a charged capacitor (no battery). If the power outage lasts longer than 24 hours, check the clock and reset if necessary.

Frequency

The control provides for real-time metering of the line frequency. If the control is a 60 Hz model, the operating frequency is 55 to 65 Hz; if the control is a 50 Hz model, the operating frequency is 45 to 55 Hz.

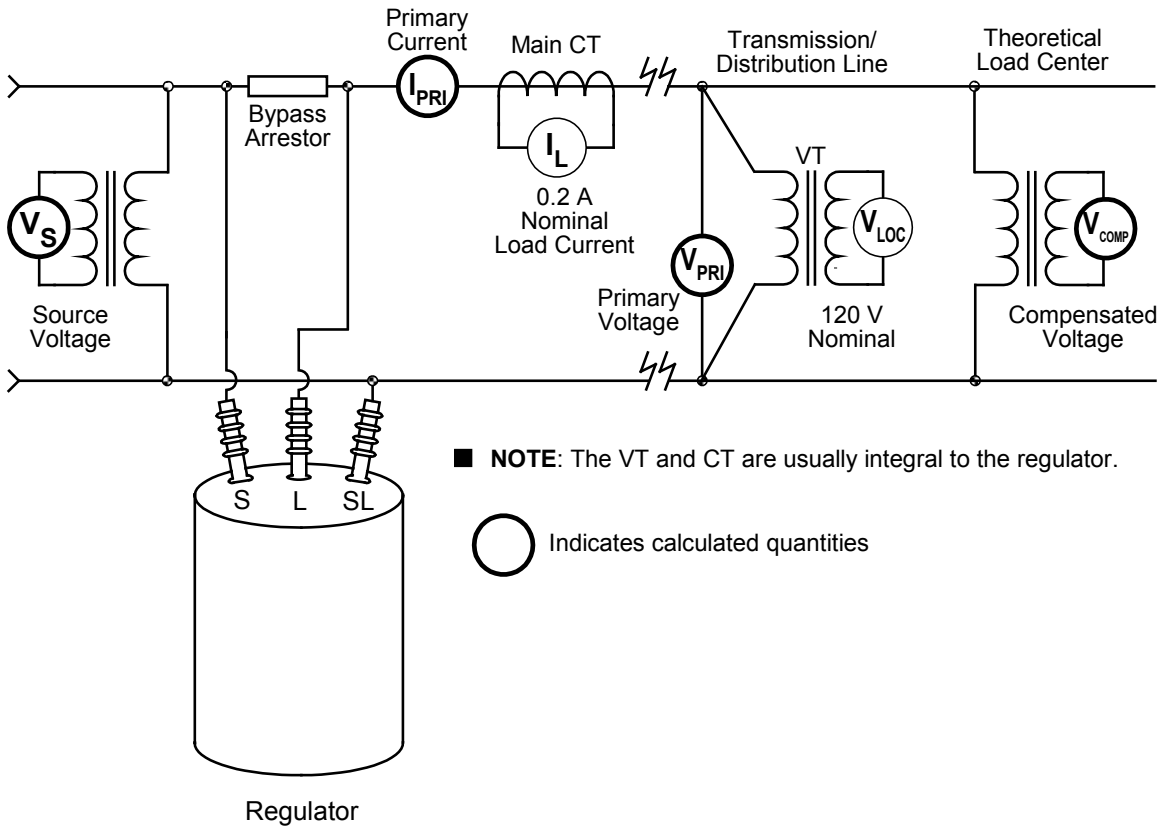


Figure 2-32 Secondary Quantity Metering and Primary Quantity Calculations for Regulator Applications

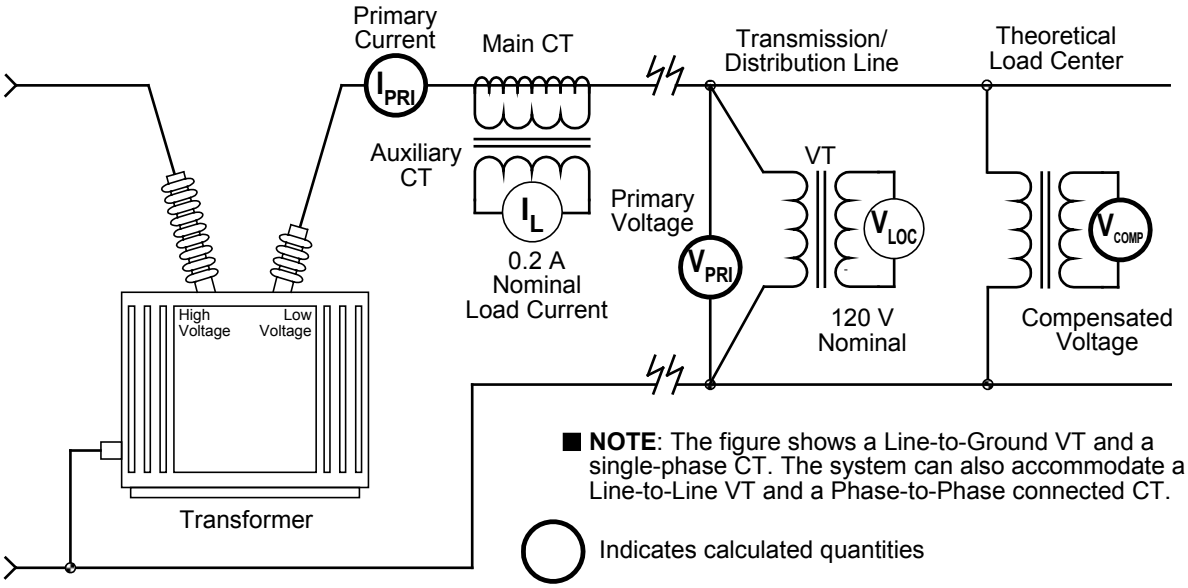


Figure 2-33 Secondary Quantity Metering and Primary Quantity Calculations for Transformer Applications

Accessing Monitoring Screens (HMI)

The Monitor menu provides the user with the capability to view the Metering, Status, Tap Information, Present Demand, Demand History, Energy Metering, Harmonics and Motor Current elements of the monitoring screens (Single or Three Phase). The steps necessary to access, view, and where applicable, perform parameter specific operations for each monitoring category are described herein.

Monitor (From Control Front Panel)

The HMI categories/parameters for Monitoring are:

- **Metering**
  Load Voltage
  Meter Out Voltage
  Source Voltage
  Load Current
  Circulating/DVAr Current
  Compensated Voltage
  Primary Voltage
  Primary Src Voltage
  Primary Current
  Primary Watts
  Primary VArs
  Primary VA
  Power Factor
  Frequency
- **Status**
  Tapchanger Status
  Alarm Status
  Input Status
  Output Status
- **Tap Information**
  (E) Indicates Tap Information parameters that can be reset to zero or set to a value.
  Tap Position/Cal
  Drag Hands (E)
  Definite Timer
  Intertap Timer
  Operation Counter
  Resettable Counter (E)
  Neutral Sw Counter
  Lower Counter
  Raise Counter
  Specific Tap Statistics
  Clear Tap Statistics
  RTN Counter
  RTN Status
  Count to RTN Active
- **Present Demand**
  Demand Interval
  Demand Load Voltage
  Demand Primary Current
  Demand Primary Watts
  Demand Primary VArs
  Demand Primary VA
- **Demand History**
  (E) Indicates Demand History parameters that can be reset to zero.
  Demand Interval
  Min Load Voltage (E)
  Max Load Voltage (E)
  Max Primary Current (E)
  Max Primary Watts (E)
  Max Primary VArs (E)
  Max Primary VA (E)
  PF @ Max VA (E)
- **Energy Metering**
  (E) Indicates Energy Metering parameters that can be reset to zero.
  Forward Watt Hours (E)
  Lagging VAr Hours (E)
  Reverse Watt Hours (E)
  Leading VAr Hours (E)
- **Harmonics**
  Voltage % THD
  Current % THD
  View Voltage Harmonics
  View Current Harmonics
- **Motor Current**
  (E) Indicates Motor Current parameters that can be reset to zero.
  Peak RMS Curr
  Avg RMS Curr
  Profile Duration
  Peak Motor Current (E)

Accessing The Metering Screens (HMI)

To access the Metering screens from the control front panel proceed as follows:

1. Press the Left Arrow (MNTR Hot Button) pushbutton to awaken the unit. The menu will advance to "MONITOR".

```
              MONITOR
  ←UTIL                    SETP→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
              Metering
  ←                            →
```

Pressing the Down arrow pushbutton will display the first metering parameter (**Load Voltage**). Pressing the Down arrow pushbutton will advance to the following Metering parameters:

Load Voltage

Meter Out Voltage

Source Voltage

Load Current

Circulating Current or DVAr Current

Compensated Voltage

Primary Voltage

Primary Source Voltage

Primary Current

Primary Watts

Primary VArs

Primary VA

Power Factor

Frequency

Accessing The Status Screens (HMI)

To access the Status screens from the control front panel proceed as follows:

1. Press the Left Arrow (MNTR Hot Button) pushbutton to awaken the unit. The menu will advance to "MONITOR".

```
              MONITOR
  ←UTIL                    SETP→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
              Metering
  ←                            →
```

3. Press the Right or Left arrow pushbutton as necessary to navigate to the "Status" screen.

```
               Status
  ←                            →
```

4. Press the Down arrow pushbutton once. The menu will advance to the first status element (**Tapchanger Status**) of the Status groups.

The status groups can be accessed by continuing to press the Down pushbutton within the Status menu and then pressing ENT to view.

The Status screens consist of four individual status groups that include:

Tapchanger Status

Alarm Status

Input Status

Output Status

Details regarding each individual group follow in this chapter.

Accessing The Tapchanger Status Screens (HMI)

To access the Tapchanger Status screens from the control front panel proceed as follows:

1. Navigate to the "Tapchanger Status" screen.

```
Press ENT to view
Tapchanger Status
```

2. Press the ENT pushbutton. The control will display a summary of the Tapchanger Status parameters, similar to the following.

```
TAP   BDS   PWR   BLK   VRD
 0    lo    fwd   ---   off
```

TAP = Tap Position

BDS = Band Status

PWR = Power Direction

BLK = Blocks In Effect

VRD = Voltage Reduction

To cycle through each element of the "Tapchanger Status" display press the Down arrow pushbutton.

```
Tap Position
0
```

The range of displayed values for Tap Position (TAP) are 16L–0–16R.

```
Band Status
Low
```

The range of displayed values for Band Status (BDS) are HIGH, LOW and In Band.

```
Power Direction
Forward
```

The range of displayed values for Power Direction (PWR) are Forward and Reverse.

```
Blocks in Effect
-- -- -- -- -- -- --
```

The range of displayed values for Blocks in Effect (BLK) from left to right are:

Position 1
LL – Block Line Limit
DL – Delta VAr Overcurrent Limit Block

Position 2
FL – Force Lower Block
BR – Volt Block Raise
BL – Volt Block Lower

Position 3
TR – Tap Raise Block
TL – Tap Lower Block

Position 4
NS – Non Sequential Block
SR – Seal-in Failure Raise Block
SL – Seal-in Failure Lower Block
IB – Low Current Block

Position 5
CB – Comm Block

Position 6
RP – Reverse Power Block

Position 7
SC – SCADA Cutout Local

```
Voltage Reduction
off
```

The range of displayed values for Voltage reduction (VRD) are on and off. Press the Exit pushbutton to return to the "Tapchanger Status" screen.

Accessing The Alarm Status Screens (HMI)

To access the Alarm Status screens from the control front panel proceed as follows:

1. Navigate to the "Alarm Status" screen.

```
Press ENT to view
Alarm Status
```

2. Press the ENT pushbutton. The control will display a summary of the Alarm Status parameters, similar to the following.

```
A B C D E F G H I J K L M N O P Q R S T
- - 0 0 - - - - - - - - - - - - - - - - -
```

Alarm Status Display Key

– = Disabled/Condition Not Met

1 = ALARM, ENABLED/Condition Met

0 = ENABLED/Condition Not Met

X = Disabled/Condition Met

To cycle through each element of the Alarm Status display, press the Down arrow pushbutton. The control will display a detailed status screen similar to the example below for each parameter.

```
A: Block Raise Tap
disabled/not met
```

```
B: Block Lower Tap
disabled/not met
```

```
C: Block Raise Volt
ENABLED/not met
```

```
D: Block Lower Volt
ENABLED/not met
```

```
E: Voltage Reduction
disabled/not met
```

```
F: Power Direction
disabled/not met
```

```
G: Current Limit
disabled/not met
```

```
H: Comm Block
disabled/not met
```

```
I: LDC/LDZ
disabled/not met
```

```
J: Abnormal Tap
disabled/not met
```

```
K: VAr Bias Lag
disabled/not met
```

```
L: VAr Bias Lead
disabled/not met
```

```
M: Backup Fail
disabled/not met
```

```
*N: DVar2 Over Curr
disabled/not met
```

```
*O: Seal-in Failure
disabled/not met
```

```
*P: Low Current Blk
disabled/not met
```

```
*Q: RTN Fail
disabled/not met
```

```
*R: Ind Tap Wear
disabled/not met
```

```
*S: Op Count Signal
disabled/not met
```

```
*T: Tap Changer Fail
disabled/not met
```

*These parameters will decrement by 1 letter if Backup Power (M) is not purchased.

The range of displayed values for each Alarm element are, disabled/not met, ENABLED/not met, COND MET/ disabled and ALARM (Enabled/condition exists).

Press the Exit pushbutton to return to the "Alarm Status" screen.

Accessing The Input Status Screens (HMI)

To access the Input Status screens from the control front panel proceed as follows:

1. Navigate to the "Input Status" screen.

```
Press ENT to view
Input Status
```

2. Press the ENT pushbutton. The control will display a summary of the Input Status parameters, similar to the following.

```
C NS VR TC KT N MS
0 0  -- 0  RL 0  0
```

Input Status Parameter Key

C = Counter Contact

NS = Non-Sequential Input

VR = Voltage Reduction 1
Voltage Reduction 2

TC = Tap Connection

KT = Keeptrack Lower
Keeptrack Raise

N = Neutral Tap Position

MS = Motor Seal-In

Input Status Display Key

1 = On

0 = Off

For VR

-- = No Voltage Reduction Steps in effect

1 - = Voltage Reduction Step 1 in effect

- 2 = Voltage ReductionStep 2 in effect

1 2 = Voltage Reduction Step 3 in effect

For KT

-- = No Raise or Lower inputs active

R - = Raise Input detected

- L = Lower Input detected

RL = Motor power is not connected or circuit failure

To cycle through each element of the "Input Status" display press the Down arrow pushbutton. The control will display a detailed status screen similar to the example below for each parameter.

```
Counter Contact
off
```

Accessing The Output Status Screens (HMI)

To access the Output Status screens from the control front panel proceed as follows:

1. Navigate to the "Output Status" screen.

```
Press ENT to view
Output Status
```

2. Press the ENT pushbutton. The control will display a summary of the Output Status parameters, similar to the following.

```
RAISE LOWER ALARM
  1     1     0
```

Output Status Parameter Key

RAISE = Raise Output Contact

LOWER = Lower Output Contact

ALARM = Alarm Output Contact

Output Status Display Key

1 = On

0 = Off

To cycle through each element of the "Output Status" display press the Down arrow pushbutton. The control will display a detailed status screen similar to the example below for each parameter.

```
Raise Contact
        ON
```

Accessing the Metering & Status Screen (TapTalk)

The Metering & Status Screen, when connected to a control, displays parameter values consistent with the capabilities of the communication system.

To access the Metering and Status screen from the TapTalk® Main Menu, select Monitor/Metering & Status, or the menu bar Metering & Status hot button. TapTalk will display the Metering & Status screen (Figure 2-34).

The Metering Status display colors and text can be set in the Monitor/Set Metering Colors dialog screen (See **Chapter 3**, **TapTalk S-2001D** for details).

■**NOTE**: When changing Metering and Status screen colors you must exit the Metering and Status screen for the color change to take affect.

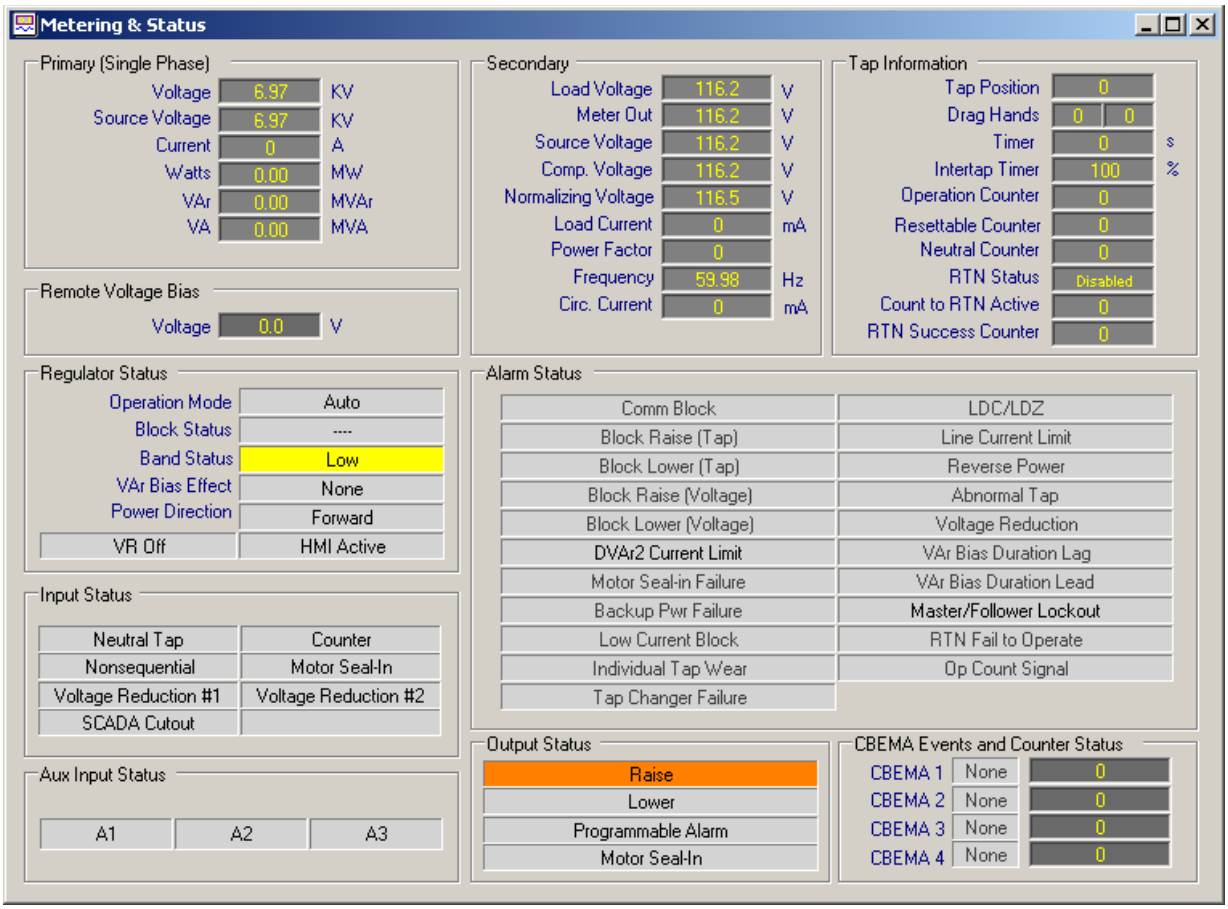


Figure 2-34 Metering & Status Screen

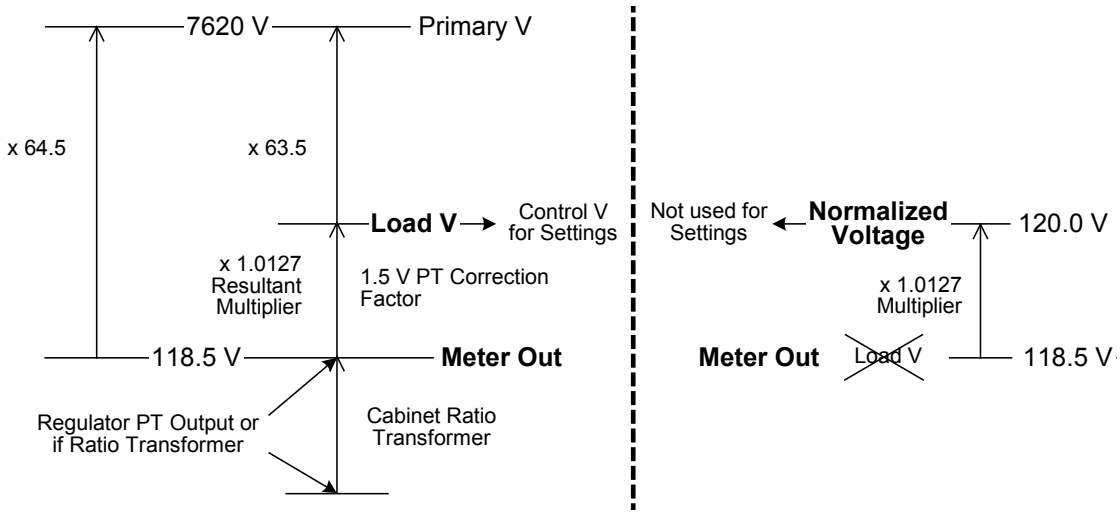


Figure 2-35 Meter Out Voltage Calculation

PRIMARY METERING (Single or Three Phase)

Voltage

Displays the calculated primary voltage based on the user-selected voltage multiplier, VT corrections, and measured secondary voltage.

Source Voltage

Displays the calculated primary source voltage based on the user selected source voltage multiplier, source VT corrections and source secondary voltage.

Current

Displays the calculated primary current based on the user-selected current multiplier, and measured secondary current.

Watts

Displays the calculated primary quantity based on the user-selected voltage and current multipliers; VT configuration (line-to-ground or line-to-line), single-phase or three-phase, and measured secondary voltage and current.

VAr

Displays the calculated primary quantity based on the user-selected voltage and current multipliers, VT configuration (line-to-ground or line-to-line), single-phase or three-phase, and measured secondary voltage and current.

VA

Displays the calculated primary quantity based on the user-selected voltage and current multipliers, VT configuration (line-to-ground or line-to-line), single-phase or three-phase, and measured secondary voltage and current.

REMOTE VOLTAGE BIAS

Voltage

Displays the Remote Voltage value provided to the control utilizing either DNP 3.0, MODBUS or IEC 61850 protocols. If a voltage value is present the control is utilizing the Remote Voltage Bias Voltage to control.

SECONDARY METERING STATUS

Load Voltage

Displays the real-time measured value of voltage at the Tapchanger and includes any corrections made using the user-selected VT correction voltage.

Meter Out Voltage

Displays the measured voltage at the terminals of the M-2001D without any software modifications. Used as the base for normalizing voltage.

Source Voltage

Displays the real-time calculated/measured source voltage and includes any corrections made using the user-selected VT correction voltage. See **Chapter 6, Setpoints** "Regulate REV and Regulate Reverse Measured" section to determine if the Source Voltage is Measured or Calculated.

Compensated Voltage

Displays the calculated voltage at the "load center".

Normalizing Voltage

Displays the result of the Normalizing Multiplier (0.80 to 1.20) times the Meter Out Voltage.

Load Current

Displays the real-time measured value of current.

Power Factor

Displays the real-time calculated value of power factor.

Frequency

Displays the real-time measured frequency value.

Circulating Current

Displays a representable value of circulating current, if the control is used with the Beckwith Electric M-0115A Parallel Balancing Module, or it's equivalent.

TAP INFORMATION

Tap Position

Displays the tap position of the tapchanger when any method of KeepTrack™ is used. Recognizes tapchanges commanded via manual, automatic or external (SCADA) means.

Drag Hands

Displays the tap position Drag Hands values for each direction.

Timer (Raise/Lower)

Displays the integrated out-of-band time for a voltage excursion outside the upper/lower band limit up to the value of the time delay setpoint.

Intertap Timer

In the sequential mode of operation, displays the integrated out-of-band time for a voltage excursion and the subsequent tapchange. Adjustable from 0 to 60 seconds, in 1 second increments, with a factory setting of 0 seconds.

Operation Counter

Records the number of raise and lower operations. The operation counter will increment based on the counter configuration, as set by the user. This counter is not resettable.

The counter accommodates 999,999 operation counts and the number of counts stored in memory is not affected by a loss of supply power. Total operation count is displayed in the Status Menu. This counter cannot be reset, but can be preset to any value up to 999,999 in the Configuration menu.

Resettable Operations Counter

The user resets this counter to zero by pressing ENT while viewing the resettable operation counter screen within the Status Menu. No password is required to reset the resettable operations counter.

■**NOTE**: The counter will only increment with a connection to the counter input.

Neutral Counter

Records the number of times the Neutral Input is energized.

The counter accommodates 999,999 operation counts and the number of counts stored in memory is not affected by a loss of supply power. Total operation count is displayed in the Status Menu. This counter cannot be reset, but can be preset to any value up to 999,999 in the Configuration menu.

RTN Status

Displays the "Run Through Neutral" feature status (Enabled or Disabled).

Count To RTN Active

Displays the number of counter operations since the operations between runs setting was set, or since the feature was enabled. The counter will reset to zero if the feature is enabled and successfully runs through neutral.

RTN Success Counter

The RTN Counter will increment after each successful operation of the Run Through Neutral feature.

TAPCHANGER STATUS

Operation Mode

Indicates the operational mode of the control (Auto, Manual or Off).

Block Status

Indicates blocks that are active. Blocks that can be active include:

- Selftest
- Comm Block
- Line Limit
- Reverse Power
- Over Voltage Runback
- Block Raise (Tap)
- Block Lower (Tap)
- Block Raise (Voltage)
- Block Lower (Voltage
- SCAMP Switch
- Front Panel Switch
- Non-Sequential Block
- Seal-in Failure Raise Block
- Seal-in Failure Lower Block
- Low Current

Band Status

Indicates one of three conditions: High, when voltage is out of band high, Low when voltage is out of band low, or OK when voltage is within band.

VAr Bias Effect

Indicates one of three conditions when enabled. If the control has determined that the absolute reactive power is >¾ of the Max Cap Bank Setting and the inverse timer has timed out, then the control will increase the effective bandcenter by 1 Volt depending on the direction of the reactive power and will either indicate "Bandcenter Raise" for negative reactive power or "Bandcenter Lower" for positive reactive power. If the absolute power is <¾ of the Max Cap Bank Setting then the display will indicate "None".

Power Direction

Indicates one of two power directions: Forward (forward power condition) or Reverse (reverse power condition).

Voltage Reduction

VR Off indicates voltage reduction is not active, blocked either by non-sequential input, reverse power condition, or by communicated command. VR Step 1, 2, and 3 indicate that voltage reduction is in effect for the stated step value. VR Step 1, 2, and 3 indicate that voltage reduction has been implemented from the control front panel for the stated step value.

HMI Active Mode

Indicates that HMI menu at the control is active. Turns off after 15 minutes of inactivity.

INPUT STATUS

Neutral Tap

Indicates neutral position contact input is closed.

Counter

Indicates operation counter contact input is closed.

Non-Sequential

Indicates Non-sequential contact input is closed. Tapchanger control blocks raise or lower operation on a sustained closed contact.

Motor Seal-In

Indicates when motor power is applied.

Voltage Reduction 1

Indicates Step 1 Voltage Reduction contact output is closed.

Voltage Reduction 2

Indicates Step 2 Voltage Reduction contact output is closed.

SCADA Cutout

Indicates SCADA (switch) input is closed. Tapchanger control blocks remote Raise or Lower operation.

AUX INPUT STATUS

Indicates (red) when the Auxiliary Input is active.

OUTPUT STATUS

Raise

Indicates when a Tap Raise output is active. Limited by tap Block Raise setpoint and tap position limit settings.

Lower

Indicates when a Tap Lower output is active. Limited by tap Block Lower setpoint and tap position limit settings.

Programmable Alarm

Indicates when a Programmable Alarm condition is true.

Motor Seal-In

Indicates when a Motor Seal-In Output is active.

ALARM STATUS

There are three available states designated by color for each of the Alarm Status elements:

- Gray with Dark Gray Text – Alarm disabled.
- Gray with Black Text – Alarm enable and condition not met
- RED – Alarm enabled and condition exists

Comm Block

The control has had its automatic operation blocked via communications and is now in manual operation mode and the alarm output is on due to this condition.

Block Raise (Tap)

The tap position equals or exceeds the block raise tap limit setting and the alarm output is on due to this condition.

Block Lower (Tap)

The tap position equals or exceeds the block lower tap limit setting and the alarm output is on due to this condition.

Block Raise (Voltage)

The tap position equals or exceeds the block raise voltage limit setting and the alarm output is on due to this condition.

Block Lower (Voltage)

The tap position equals or exceeds the block lower voltage limit setting and the alarm output is on due to this condition.

DVAr2 Load Current Limit

DVAr2 Load Current is exceeding the respective maximum current limit setting and the alarm output is on due to this condition.

Mtr. Seal-In Failure

Indicates that motor current has not been detected for a period 15 seconds after a Raise or Lower command has been executed. This event must occur two consecutive times for this alarm to occur.

Backup Pwr Failure

Indicates the absence of Backup Power circuiting when Backup Power option has been detected.

Low Current Block

When enabled the control determines if Load Current following a tapchange is less than 4 mA, coincident with Tap Delta Voltage being less than 4 VAC. When these conditions exist the control will initiate an alarm and block regulation.

Individual Tap Wear

The number of operations on any single tap exceeds the Individual Tap Wear Alarm setting.

Tap Changer Failure

When the Operation Counter Configuration is set to "Cam Follower" and this alarm has been enabled, indicates the counter contact input has detected a Tap Changer Failure condition.

A Cam Follower contact is a cam driven contact which is normally closed when the Tapchanger is at rest, and opens and closes once during each tap operation in either direction. If this contact does not open and close within 30 seconds after the control issues a Raise or Lower in either local automatic or remote manual operational modes, this alarm will activate. This alarm can be reset either by the Cam Follower contact operating correctly during a subsequent Raise or Lower operation, or if reset by the user.

LDC/LDZ

Any value other than zero has been set for LDC/LDZ.

Line Current Limit

The line current is exceeding the respective maximum current limit setting and the alarm output is on due to this condition.

Reverse Power

Reverse power is present at the control and the alarm output is on due to this condition.

Abnormal Tap Position

Abnormal Tap Position is indicated when the alarm is enabled, KeepTrack™ is enabled and the neutral input is detected but the present tap position at that instant is neither at minus one nor plus one. The Abnormal Tap Position Alarm will also be activated when the Motor Seal-in Failure detection feature has detected a Motor Seal-in Failure.

Voltage Reduction

Any level of voltage reduction is active.

VAr Bias Lead or Lag

Indicates when the VAr Bias effect (Lead or Lag) has exceeded the time limit imposed by the Max VAr Bias Duration Setting.

Master/Follower Lockout

There are two types of lockout conditions, Master lockout and Follower lockout. Any lockout of the paralleling mode will set the Master/Follower Lockout Alarm. When a lockout condition exists, the control issuing the lockout will stop any further GOOSE publishing and will stop load voltage regulation. Also, the alarm can be configured as a DNP event, or as a report in case of IEC 61850. The lockout state will be displayed on the control front panel display and in the Master/Follower Configuration Tool (Figure 3-87).

■ **NOTE**: Master/Follower Alarm messages can be observed for the connected control from the TapTalk® Monitor/Master/Follower Alarm messages menu item (Figure 3-34).

Master Lockout

- **Follower Detection Lockout -** When the control powers up in Master Mode, the control will wait for approximately 65 seconds to allow all the GOOSE messages from all the Followers in the network to reach the Master. Once all GOOSE messages have been received, the Master will start its normal algorithm. If within the initial 65 second period the Master does not receive all the GOOSE messages it expected, it will enter the Master lockout state.
- **Follower Timer Lockout -** The Tap Position Response Timer will start after the Master has published its new tap position message after it has performed a successful tap operation. If it doesn't receive the tap position messages from all the participating Followers in the network before the timer expires, then a Master Lockout is issued.
- **Tap Difference Lockout -** If the Tap position difference between any Follower and the Master is greater than or equal to the Tap Difference setting, the Master will enter the lockout state.
- **Follower Comm. Loss Lockout -** If any follower does not send a valid retransmitted GOOSE message within a 65 second internal keepalive time, then a lockout is issued, signaling a broken communication link.

Follower Lockout

- **Master Comm. Loss Lockout -** When the Follower does not receive a valid retransmitted GOOSE message from the Master, within a 65 second internal keepalive time, and if the previous Master GOOSE message indicates that the breaker statuses were closed, then a Follower Lockout is issued. This provides an indication that a broken communication occurred.
- **Follower Comm. Loss Lockout -** If any follower does not send a valid retransmitted GOOSE message within a 65 second internal keepalive time, then a lockout is issued, signaling a broken communication link.
- **Tap Difference Lockout -** If the Tap Position Difference between the Follower and the Master is greater than or equal to the Tap Difference setting, the Follower will enter the lockout state.

RTN Fail to Operate

The RTN Fail alarm will actuate when the "Maximum RTN operations before Alarms" setting has been exceeded.

Op Count Signal

The total number of operations has exceeded the Operations Counter Alarm Limit setting.

CBEMA EVENTS AND COUNTER STATUS

When the Load Voltage is sagging or swelling greater than the pickup setting, then a pickup status will be set after a minimum duration, in addition to incrementing a counter.

Up to 4 CBEMA events can be set and enabled allowing the control to trigger a Sequence of Events record when each event occurs. Also, the control will report both the time and duration of each event via DNP. These 4 settings allow the control to be set to record violations of the ITIC curves (formerly known as CBEMA curves).

DEMAND AND ENERGY METERING

Accessing the Present Demand Screens (HMI)

To access the Present Demand screens from the control front panel proceed as follows:

1. Press the Left Arrow (MNTR Hot Button) pushbutton to awaken the unit. The menu will advance to "MONITOR".

```
            MONITOR
←UTIL                    SETP→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
            Metering
←                         →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Present Demand" screen.

```
         Present Demand
←                         →
```

4. Pressing the Down arrow pushbutton once will advance the menu to the first element (**Demand Interval**) of the "Present Demand" screens.

```
Demand Interval
15 Min
```

5. Press the Down arrow pushbutton to access the remaining Present Demand parameter screens.

   Demand Load Voltage

   Demand Primary Current

   Demand Primary Watts

   Demand Primary VArs

   Demand Primary VA

Setting The Demand Interval (HMI)

■**NOTE**: The Demand Interval can be set from either the "Present Demand" menu or the "Demand History" menu.

To set the Demand Interval from the "Present Demand" menu or the "Demand History" menu perform the following:

1. Navigate to the desired "Demand Interval" screen (Present Demand or Demand History), then press the ENT pushbutton.

   If Level 2 Access is not active or has been previously input, then a "C" will be displayed. Go to Step 4.

```
Demand Interval
15 Min                      C
```

2. If Level 2 Access is active then the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

3. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, then the display will briefly flash a confirmation screen, then a "C". If not, re-enter a valid code.

4. Utilizing either the Up or Down arrow pushbuttons, select between 5, 10, 15, 30 or 60 minute interval settings, then press the ENT pushbutton.

   The display will return to the "Demand Interval" screen and display the new interval.

Accessing The Demand History Screens (HMI)

To access the Demand History screens from the control front panel proceed as follows:

1. Press the Left Arrow (MNTR Hot Button) pushbutton to awaken the unit. The menu will advance to "MONITOR".

```
              MONITOR
←UTIL                    SETP→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
            Metering
←                          →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Demand History" screen.

```
        Demand History
←                          →
```

4. Press the Down arrow pushbutton once. The menu will advance to the first element (**Demand Interval**) of the "Demand History" screens.

```
Demand Interval
15 Min
```

■**NOTE**: Demand Interval is also included in the "Present Demand" menu. The Demand Interval can be set from either menu. See **Setting the Demand Interval (HMI)** in the previous section for details regarding setting the Demand Interval value.

The remaining "Demand History" screens are accessed by navigating within the "Demand History" menu. When accessed the individual screen displays bottom line will cycle between the Demand History parameter value and the corresponding Date and Time Stamp for that value. "Demand History" screens that include an "E" on the right side of the top display line can be reset.

```
Max Load Voltage          E
XXX.X Volts
```

```
Max Load Voltage          E
01/01/090  6:30:48
```

Resetting Individual Demand History Values (HMI)

The presence of the "E" on the top line of the display indicates that the value can be reset from this menu item. The steps necessary to reset Demand History items are as follows:

1. Navigate to the desired Demand History parameter screen, then press the ENT pushbutton.

   The control will display a "confirmation" screen similar to the following.

```
Min Load Voltage          R
Press ENT to confirm
```

2. Press the ENT pushbutton. The control will reset the Demand History value.

```
Min Load Voltage          E
XXX.X       Volts
```

```
Min Load Voltage          E
01/01/0906:30:48
```

   The screen will return to the target "Demand History" screen and display the new value.

Resetting ALL Demand History Parameter Values (HMI)

All Demand History parameter menu items that include an "E" on the top line of the display can be reset from this menu item. The steps necessary to reset **ALL** Demand History parameter values are as follows:

1. Navigate to the "Reset Demand History" parameter values screen.

```
Press ENT to reset
Demand History
```

2. Press the ENT pushbutton. The control will display a "confirmation" screen similar to the following.

```
Press Ent to confirm
reset Demand History
```

3. Press the ENT pushbutton. The control will reset **ALL** the Demand History values.

   The control will then display the following sequence of screen displays.

```
Press Ent to confirm
reset Demand History
```

```
Demand History
has been reset.
```

4. Press the Exit pushbutton to return to the "Demand History" menu.

Performing a Master Reset of ALL Demand History and Energy Metering Parameter Values (HMI)

The "Demand History" menu includes the capability to initiate a Master Reset of both the Demand History and Energy Metering parameter values. This capability is also included in the "Energy Metering" menu. The steps necessary to reset **ALL** Demand History and Energy Metering parameter values are as follows:

1. Navigate to the "Master Reset" menu item within the "Demand History" or "Energy Metering" menus.

```
Press ENT to perform
Master Reset
```

2. Press the ENT pushbutton. The control will respond with a "confirmation" screen.

```
Press ENT to confirm
Press Exit to cancel
```

3. Press the ENT pushbutton. The control will then display the following sequence of screen displays.

```
Master Reset
is complete.
```

```
Press ENT to perform
Master Reset
```

4. Press the Exit pushbutton to return to the "Demand History" menu.

Accessing The Energy Metering Screens (HMI)

To access the Energy Metering screens from the control front panel proceed as follows:

1. Press the Left Arrow (MNTR Hot Button) pushbutton to awaken the unit. The menu will advance to "MONITOR".

```
            MONITOR
←UTIL                    SETP→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
            Metering
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to advance to "Energy Metering".

```
        Energy Metering
←                        →
```

4. Press the Down arrow pushbutton once. The menu will advance to the first element (**Watt Hours Fwd**) of the "Energy Metering" screens.

```
Watt Hours Fwd           E
X KWh
```

The remaining "Energy Metering" screens are accessed by navigating within the "Energy Metering" menu. When accessed, the individual screen displays bottom line will cycle between the Energy Metering parameter value and the corresponding Date and Time Stamp for that value. "Energy Metering" screens that include an "E" on the right side of the top display line can be reset individually or all at one time.

```
Lagging VAr Hours        E
x kVArh
```

```
Watts Hours Rev          E
x kWh
```

```
Leading VAr Hours        E
x kVArh
```

```
Press ENT to reset
Energy Metering
```

```
Press ENT to perform
Master Reset
```

Resetting Individual Energy Metering Values (HMI)

The presence of the "E" on the top line of the display indicates that the value can be reset from this menu item. The steps necessary to reset Energy Metering items are as follows:

1. Navigate to the desired Energy Metering parameter screen, then press the ENT pushbutton.

   The control will display a "confirmation" screen similar to the following.

```
Watt Hours Fwd              R
Press ENT to confirm
```

2. Press the ENT pushbutton. The control will reset the Energy Metering value.

```
Watt Hours Fwd              E
X kWh
```

```
Watt Hours Fwd              E
01/01/0906:30:48
```

   The screen will return to the target "Energy Metering" screen and display the new value.

Resetting ALL Energy Metering Parameter Values (HMI)

All Energy Metering parameter menu items that include an "E" on the top line of the display can be reset from this menu item. The steps necessary to reset **ALL** Energy Metering parameter values are as follows:

1. Navigate to the "Reset Energy Metering" parameter values screen.

```
Press ENT to reset
Energy Metering
```

2. Press the ENT pushbutton. The control will display a "confirmation" screen similar to the following.

```
Press Ent to confirm
reset Energy Metering
```

3. Press the ENT pushbutton. The control will reset **ALL** the Energy Metering values.

   The control will then display the following sequence of screen displays.

```
Press Ent to confirm
reset Energy Metering
```

```
Energy Metering
has been reset.
```

4. Press the Exit pushbutton to return to the "Energy Metering" menu.

Performing a Master Reset of ALL Energy Metering and Demand History Parameter Values (HMI)

The "Energy Metering" menu includes the capability to initiate a Master Reset of both the Energy Metering and Demand History parameter values. This capability is also included in the "Demand History" menu. The steps necessary to reset **ALL** Energy Metering and Demand History parameter values are described in the Demand History section of this chapter.

Accessing The Demand & Energy Metering Screen (TapTalk)

To access the Demand & Energy Metering screen from the TapTalk® Main Menu, select Monitor/ Demand & Energy Metering. TapTalk will display the Demand & Energy Metering screen (Figure 2-36).

The Demand & Energy Metering screen, when connected to a control, displays parameter values consistent with the capabilities of the communication system.

Each element of the Demand History and Energy Metering can be reset individually by selecting the desired parameter(s) and then selecting **Reset Selected Items.** When the **Reset** command is issued, the metered value is reset to zero and the time and date are updated.

Select All – Allows the user to select all parameters.

Clear All – Allows the user to reset all parameter values.

Reset Selected Items – Allows the user to reset only the selected parameter values.

Demand Interval – The Demand Interval applies to the Demand Present Primary Current (Amps) parameter and the Demand History parameters. The Demand Interval can be set to 15, 30, and 60 minutes.

The **Demand Present** Primary Current parameter value follows the concept of a lagged demand meter. The demand time interval is selected by the user as 15, 30 or 60 minutes. This is the time it takes for a thermal meter to indicate 90% of a change in load.

Load Voltage – Displays the real-time measured value of voltage at the Tapchanger or transformer and includes any corrections made using the user selected VT Correction Voltage.

Primary Current – Displays the calculated primary demand current based on the user-selected current multiplier and measured secondary current.

Primary Watts – Displays the real time demand value base on the user-selected voltage and current multipliers; VT configuration (line-to-ground or line-to-line), single-phase or three-phase, and measured secondary voltage and current.

Primary VAr – Displays the real time demand value based on the user-selected voltage and current multipliers, VT configuration (line-to-ground or line-to-line), single-phase or three-phase, and measured secondary voltage and current.

Primary VA – Displays the real time demand value based on the user-selected voltage and current multipliers, VT configuration (line-to-ground or line-to-line), single-phase or three-phase, and measured secondary voltage and current.

Demand History/Energy Metering

All demand history (single phase) and Energy Metering Values include the date and time at which each occurred. A drag hand value is the maximum or minimum value of a measured quantity recorded since the last reset.

Minimum Load Voltage – Displays minimum Load voltage at the Tapchanger or transformer. This value continuously averaged over consecutive 32-second intervals.

Maximum Load Voltage – Displays drag hand maximum Load voltage at the Tapchanger or transformer. This value continuously averaged over consecutive 32-second intervals.

Maximum Primary Current – Displays drag hand maximum primary current.

Maximum Primary Watts – Displays drag hand maximum primary watts.

Maximum Primary VAr – Displays drag hand maximum primary VArs.

Maximum Primary VA – Displays drag hand maximum primary VA. Resets automatically when Power Factor at (Max) VA value, below, is reset.

Power Factor @ Max VA – Displays drag hand power factor at time of maximum VA.

Forward Watt Hours – Displays drag hand forward Watt hours.

Reverse Watt Hours – Displays drag hand reverse Watt hours.

Lagging VAr Hours – Displays drag hand Lagging VAr hours.

Leading VAr Hours – Displays drag hand Leading VAr hours.

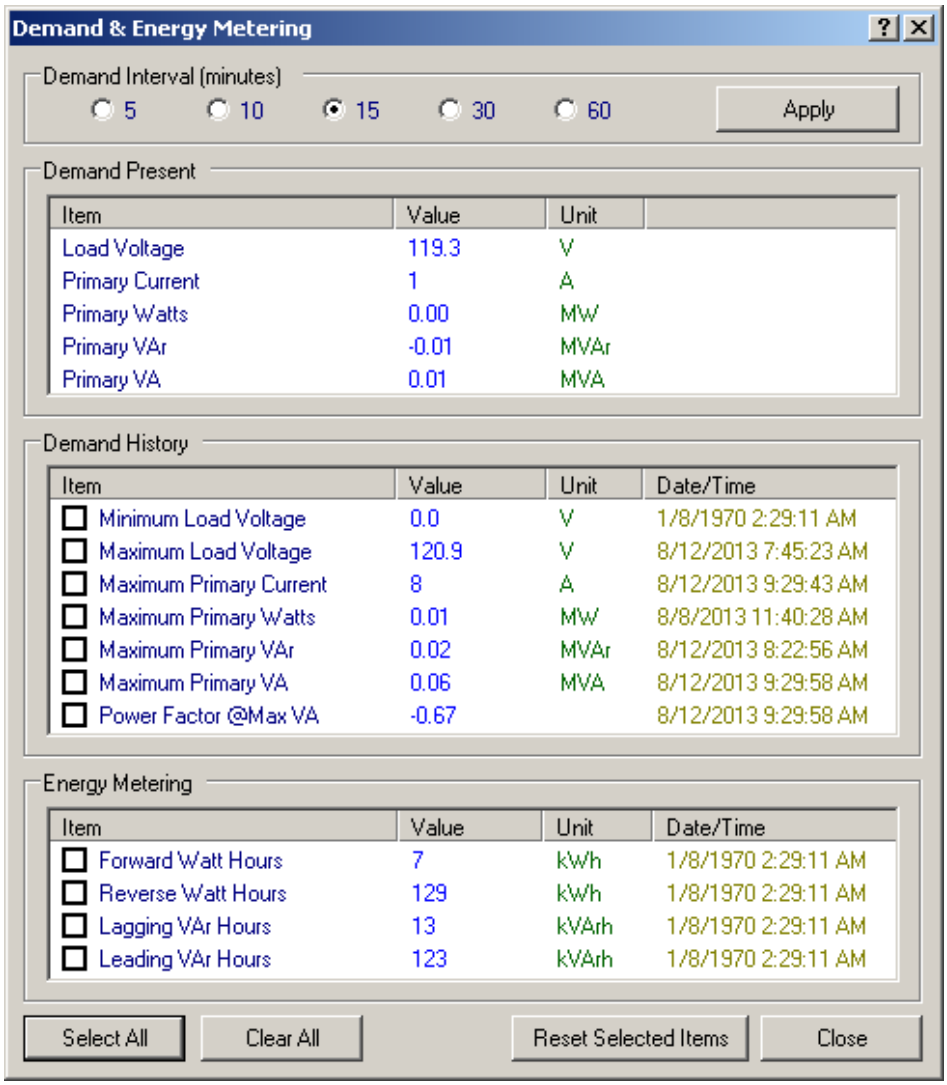


Figure 2-36 Demand & Energy Metering Screen

REAL TIME VOLTAGE PLOT

Real Time Voltage Plot (TapTalk)

The Real Time Voltage Plot feature allows the user to monitor in real time the last 60 seconds of the source voltage value and load voltage. The Voltage Chart freezes the last 30 seconds of the voltage profile and displays the current values.

To access the Real Time Voltage Plot screen from the TapTalk® Main Menu, select **Monitor/Real Time Voltage Plot**. TapTalk will display the Real Time Voltage Chart screen (Figure 2-37).

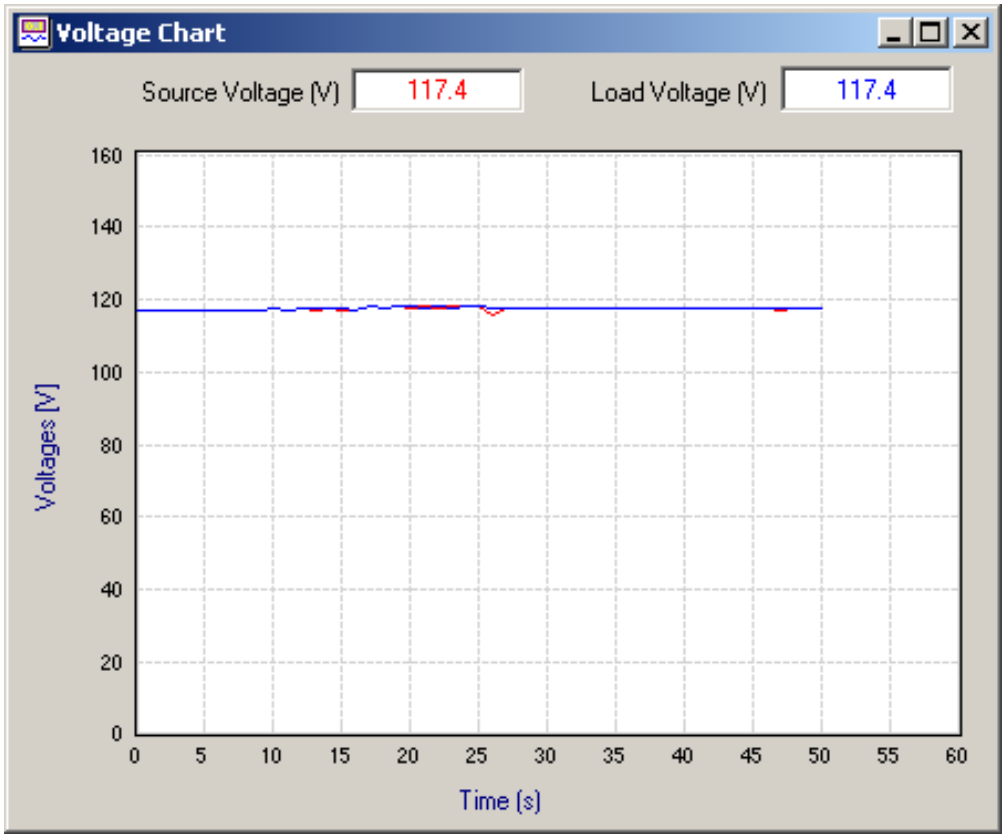


Figure 2-37 Real Time Voltage Chart

Display All Metering

The Display All Metering feature provides the user with a snapshot of all metering parameters. This feature also allows the Display All Metering screen (Figure 2-38) to be printed or saved to a *.HTM file.

All Metering

Print | Print Preview | Save | Refresh

M-2001D All Metering

Software Version: D-0223V01.03.01
Firmware version: D-0214V01.05.03

Beckwith Electric
M-2001D

Metering

Primary			
Voltage:	7.23 (KV)	Source Voltage:	7.23 (KV)
Current:	8 (A)	Watts:	-0.01 (MW)
VAr:	-0.06 (MVAr)	VA:	0.06 (MVA)
Secondary			
Load Voltage:	120.6 (V)	Meter Out Voltage:	120.6 (V)
Source Voltage:	120.7 (V)	Comp. Voltage:	120.6 (V)
Load Current:	1 (mA)	Circulating Current:	1 (mA) Lag
Power Factor:	0.117 (Lead)	Frequency:	60.00 (Hz)
Normalizing Voltage:	120.7 (V)		
Tap Information			
Tap Position:	0		
Drag Hands Lower:	0	Drag Hands Raise:	0
Timer:	0 (s)	Intertap Timer:	100 (%)
Operation Counter:	0	Resettable Counter:	0
Neutral Counter:	0		
STATUS			
Regulator			
Operation Mode:	Auto	Block Status:	--
Band Status:	Ok	VAr Bias Effect:	None
Power Direction:	Forward	Voltage Reduction:	--
HMI Active Status:	Not Active		
Alarm			
Comm Block:	--	LDC/LDZ:	--
Block Raise (Tap):	--	Line Current Limit:	--
Block Lower (Tap):	--	Reverse Power:	--
Block Raise (Volt):	--	Block Lower(Volt):	--
Voltage Reduction:	--	Abnormal Tap Position:	--
VAr Bias Duration Lag:	--	VAr Bias Duration Lead:	--
Backup Power Fail:	--	DVAr2 Current Limit:	--
Motor Seal-in Failure:	--	Master/Follower Lockout:	Inactive
Low Current Block:	--	Individual Tap Wear:	--
Op Count Signal:	--		
Input			
Neutral Tap:	--	Counter:	--
Nonsequential:	--	Motor Seal-In:	--
Voltage Reduction #1:	--	Voltage Reduction #2:	--
SCADA Cutout:	--	Aux Input 1:	0
Aux Input 2:	0	Aux Input 3:	0
Output			
Raise:	--	Lower:	--
Programmable Alarm:	--	Motor Seal-In:	--
CBEMA Events Status			
CBEMA 1:	None	CBEMA 1 Counter:	0
CBEMA 2:	None	CBEMA 2 Counter:	0
CBEMA 3:	None	CBEMA 3 Counter:	0
CBEMA 4:	None	CBEMA 4 Counter:	0

Demand

Demand Interval			
Interval:	15 minutes		
Present			
Load Voltage:	120.6 (V)	Primary Current:	1.0 (A)
Primary Watts:	0.00 (MW)	Primary VAr:	-0.01 (MVAr)
Primary VA:	0.01 (MVA)		
History			
Min Load Voltage:	0.0 (V)	1/1/1970 12:00:00 AM	
Max Load Voltage:	121.7 (V)	9/20/2012 7:53:04 AM	
Max Primary Current:	8 (A)	9/20/2012 12:11:01 PM	
Max Primary Watts:	0.02 (MW)	9/20/2012 9:59:52 AM	
Max Primary VAr:	0.00 (MVAr)	9/21/2012 9:56:47 AM	
Max Primary VA:	0.06 (MVA)	9/20/2012 12:23:37 PM	
Power Factor @ Max VA:	0.10 (Lead)	9/20/2012 12:23:37 PM	

Energy

Metering		
Forward Watt Hours:	44 (kWh)	1/1/1970 12:00:00 AM
Reverse Watt Hours:	198 (kWh)	1/1/1970 12:00:00 AM
Lagging VAr Hours:	1 (kVArh)	1/1/1970 12:00:00 AM
Leading VAr Hours:	318 (kVArh)	1/1/1970 12:00:00 AM

Motor Current Profile

Present Current Motor Profile			
Peak Rms Current:	0.0 (mA)	Average Rms Current:	0.0 (mA)
Average Duration:	0.0 (msec)		
Average Current Motor Profile			
Peak Rms Current:	0.0 (mA)	Rms Current:	0.0 (mA)
Duration:	316.7 (msec)	Training Mode:	In Training Mode
Peak Motor Current:	0.0 (mA)		

Figure 2-38 Display All Metering Screen

MOTOR CURRENT PROFILE

Accessing The Motor Current Screens (HMI)

To access the Motor Current screens from the control front panel proceed as follows:

1. Press the Left Arrow (MNTR Hot Button) pushbutton to awaken the unit. The menu will advance to "MONITOR".

```
            MONITOR
←UTIL                    SETP→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
            Metering
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to advance to the "Motor Current" screen.

```
         Motor Current
←                        →
```

4. Pressing the Down arrow pushbutton will advance the menu to the first element (**Peak RMS Curr**) of the "Motor Current" screens.

```
Peak RMS Curr
0.0  mA  (0.0)  T
```

5. Press the Down arrow to access the following "Motor Current" parameter screens.

   Avg RMS Curr

   Profile Duration

The remaining Motor Current screens are accessed by navigating within the "Motor Current" menu. When accessed, the individual screen displays bottom line will display current values for each parameter. For Peak Motor Current, Peak RMS Current, Average RMS Current and Duration the bottom display line may also include a "T" that indicates the Motor Current Monitoring is in the "Training" mode.

The "Training" mode is used during commissioning of the Tapchanger control. Several tapchange operations are manually performed, then the profile is stored in the EEPROM. The profile is compared during normal tapchange operation to initiate alarms.

```
Avg RMS Curr
0.0  mA  (0.0)  T
```

```
Profile Duration
xxxxx.xms  (xxxx.x)  T
```

Initializing Motor Current Values (HMI)

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton as necessary until "Mtr Current Profile" is displayed.

```
      Mtr Current Profile
←                        →
```

4. Press the Down arrow pushbutton, as necessary, to navigate to the "Init. Motor Current" screen.

```
Init. Motor Current
Press ENT to reset
```

5. Press the ENT pushbutton. The control will momentarily display the following.

```
Init. Motor Current
Initialization Done
```

```
Init. Motor Current
Press ENT to reset
```

Accessing Motor Current Profile Screen, Resetting Training Mode and Peak Motor Current From TapTalk

To access the TapTalk® Motor Current Profile screen perform the following:

1. Start TapTalk, then establish communications with the target control.
2. Select **Monitor/Motor Current Profile** from the TapTalk toolbar. TapTalk will display a "Motor Current Profile" dialog screen (Figure 2-39).

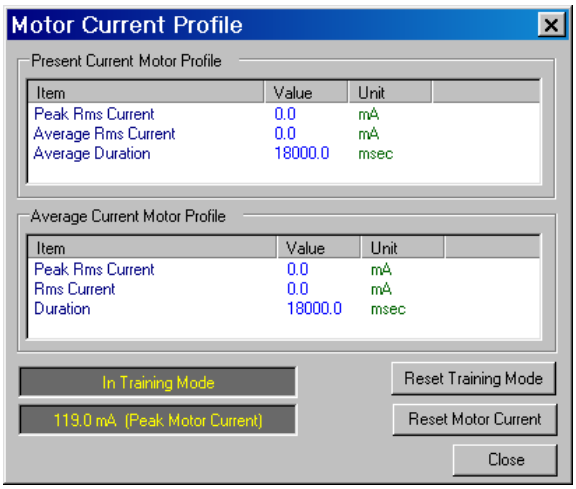


Figure 2-39 Motor Current Profile Dialog Screen

3. To reset the Motor Current Profile to the Training Mode select "Reset Training Mode". TapTalk will display a "Motor Current Profile Reset" confirmation screen (Figure 2-40).

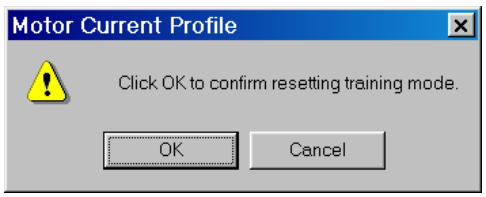


Figure 2-40 Motor Current Profile Training Mode Reset Confirmation Screen

4. Select **OK**. TapTalk® will display a Motor Current Profile Reset successfully sent confirmation screen (Figure 2-41).

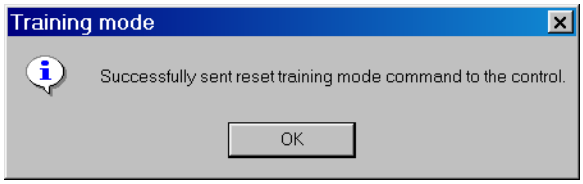


Figure 2-41 Motor Current Profile Reset Training Mode Successfully Sent Confirmation Screen

See **Chapter 5, Motor Current Detection and Monitoring** for details regarding this feature.

5. To reset the Peak Motor Current Value to zero select "Reset Motor Current". TapTalk will display a "Peak Motor Current" reset configuration screen (Figure 2-42).

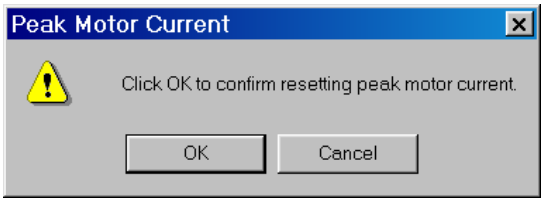


Figure 2-42 Peak Motor Current Profile Reset Confirmation Screen

6. Select **OK**. TapTalk will display a Peak Motor Current reset successfully sent confirmation screen (Figure 2-43).

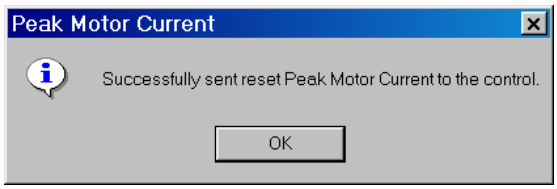


Figure 2-43 Peak Motor Current Profile Reset Successfully Sent Confirmation Screen

7. Select **OK**. TapTalk will return to the Motor Current Profile dialog screen (Figure 2-39).

HARMONIC ANALYSIS

Accessing The Harmonics Screens (HMI)

To access the Harmonics screens from the control front panel proceed as follows:

1. Press the Left Arrow (MNTR Hot Button) pushbutton to awaken the unit. The menu will advance to "MONITOR".

```
              MONITOR
←UTIL                          SETP→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
              Metering
←                                  →
```

3. Press the Right or Left arrow pushbutton, as necessary, to advance to the "Harmonics" screen.

```
              Harmonics
←                                  →
```

4. Pressing the Down arrow pushbutton will advance the menu to the first element (**Voltage % THD**) of the "Harmonics" screens.

```
Voltage % THD
X.X %
```

5. Press the Down arrow to access the remaining "Harmonics" parameter screens.

   Current % THD

   View Voltage Harmonics

   View Current Harmonics

The remaining "Harmonics" screens are accessed by navigating within the "Harmonics" menu.

Accessing Voltage/Current Harmonics Screens (HMI)

The steps necessary to view "Harmonics Voltage" or "Current Harmonics" screens are as follows:

1. Navigate to the "Voltage" or "Current Harmonics" screen.

```
Press ENT to view
Voltage Harmonics
```

2. Press the ENT pushbutton. The control will display the following screen.

```
Harmonic Magn Per
     2   0.0  0.0 %
```

or

```
Harmonic Mag Per
     2   0mA   0
```

Press the Up or Down arrow pushbutton as necessary to navigate to the desired Harmonic (2 – 31).

Accessing Harmonic Analysis Screen From TapTalk

To access the Harmonic Analysis screen perform the following:

1. Start TapTalk®, then establish communications with the target control.
2. Select **Monitor/Harmonic Analysis** from the TapTalk toolbar. TapTalk will display a "Harmonic Analysis" screen (Figure 2-44).

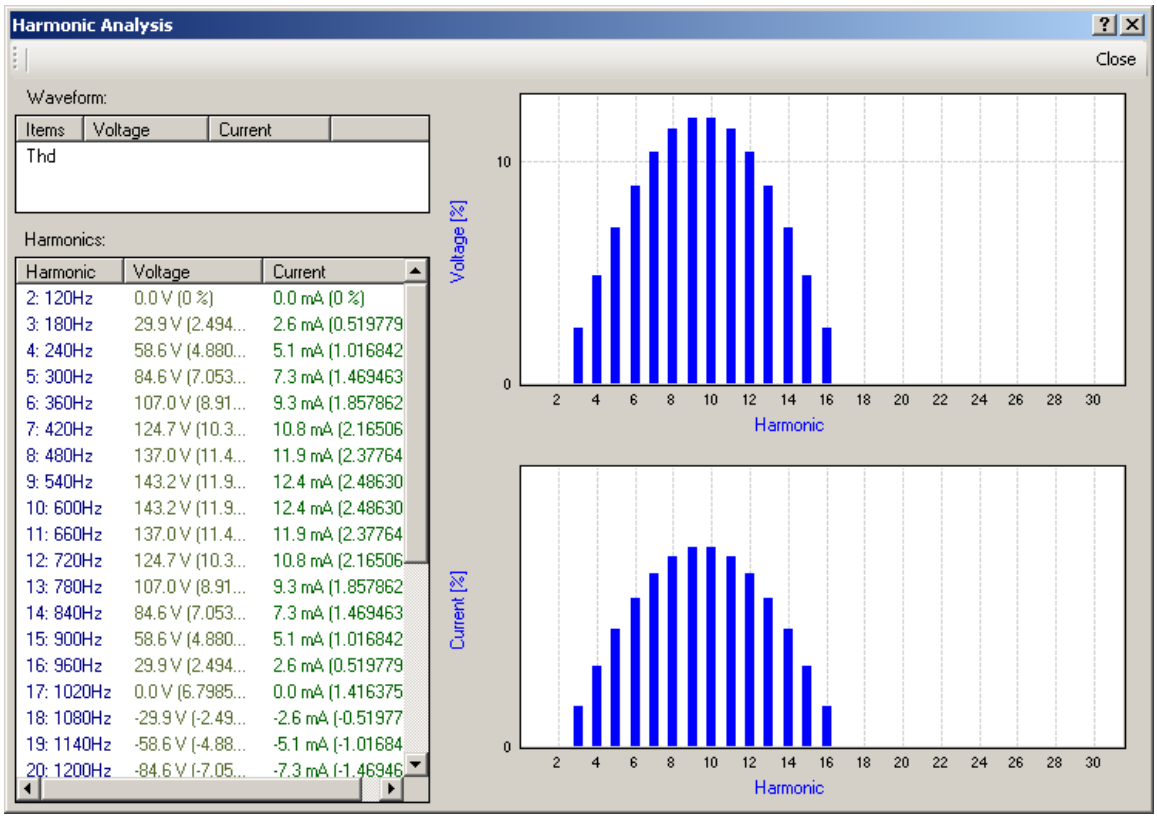


Figure 2-44 Harmonic Analysis Screen

TAP INFORMATION

Accessing The Tap Information Screens (HMI)

To access the Tap Information screens from the control front panel proceed as follows:

1. Press the Left Arrow (MNTR Hot Button) pushbutton to awaken the unit. The menu will advance to "MONITOR".

```
              MONITOR
←UTIL                          SETP→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
              Metering
←                                  →
```

3. Press the Left or Right arrow pushbutton, as necessary, to advance to "Tap Information".

```
          Tap Information
←                                  →
```

4. Press the Down arrow pushbutton once. The menu will advance to the first element (**Tap Position/Cal**) of the "Tap Information" screens.

```
Tap Position/Cal
     0
```

The remaining "Tap Information" screens are accessed by navigating within the "Tap Information" menu. "Tap Information" screens that include an "E" on the right side of the top display line can be reset from this menu item.

Tap Position/Cal

Drag Hands (Reset)

Definite Timer (Raise Sec. / Lower Sec.)

Intertap Timer (0-100%)

Operation Counter

Resettable (Operation) Counter (reset)

Neutral Switch Counter

Lower Counter

Raise Counter

View Specific Tap Statistics

Clear Specific Tap Statistics

RTN Success Counter

RTN Status (Enabled/Disabled)

Count to RTN Active

Calibrating Tap Position (HMI)

To Calibrate the Tap Position proceed as follows:

1. Navigate to the "Tap Position/Cal" screen in the Monitor/Tap Information menu.

```
Tap Position/Cal
  0
```

2. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, then a "C" will be displayed. Go to Step 5.

```
Tap Position/Cal
  0                          C
```

3. If Level 2 Access is active then the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

  _
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

4. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, then the display will briefly flash a confirmation screen, then a "C". If not, reenter a valid code.

5. At the cursor, input the desired Tap Position utilizing arrow pushbuttons, then press the ENT pushbutton. The display will return to the "Tap Position/Cal" screen.

DRAG HANDS

Reset Drag Hands Values (HMI)

To reset Drag Hands values proceed as follows:

1. Navigate to the "Drag Hands" screen in the Monitor/Tap Information menu.

```
Drag Hands                   E
L=ON      R=ON
```

   The presence of the "E" on the top line of the display indicates that the Drag Hands values can be reset from this menu item.

2. Press the ENT pushbutton. The displayed "E" will change to a "R".

3. Press the ENT pushbutton. The control will display the following.

```
Drag Hands                   R
Press ENT to confirm
```

4. Press the ENT pushbutton. The control will display the following.

```
Drag Hands
L=ON      R=ON
```

   The Drag Hands values are now reset to the current value.

Reset Drag Hands Values (TapTalk)

To reset Drag Hands values from TapTalk® perform the following:

1. Select **Setup/Tap Settings** from the TapTalk toolbar. TapTalk will display the Tap Settings dialog screen (Figure 3-45).

2. From the "Drag Hands" section of the Tap Settings dialog screen select "Reset".

3. Select **Save**. TapTalk will display a "Save to Device" confirmation screen.

4. Select **OK**. TapTalk will display a Setpoints "Successfully Written to Control" confirmation screen.

5. The Drag Hands values will be reset to the current value.

RESETTABLE OPERATION COUNTER

Reset Operation Counter (HMI)

To reset the Operation Counter proceed as follows:

1. Navigate to the "Resettable Counter" screen in the Monitor/Tap Information menu.

```
Resettable Counter          E
  X
```

2. Press the ENT pushbutton. The displayed "E" will change to a "R", then press ENT again.

```
Resettable Counter          R
Press ENT to confirm
```

3. Press the ENT pushbutton. The control will display the following.

```
Resettable Counter
0
```

The Operation Counter is now reset. Press the Exit pushbutton to return to the "Tap Information" screen.

Reset Operation Counter (TapTalk)

To reset the Operation Counter from TapTalk® perform the following:

1. Select **Setup/Tap Settings** from the TapTalk toolbar. TapTalk will display the Tap Settings dialog screen (Figure 3-45).
2. From the "Operation Counter" section of the Tap Settings dialog screen select the "Reset" for the "Resettable" parameter.
3. Select **Save**. TapTalk will display a "Save to Device" confirmation screen.
4. Select **OK**. TapTalk will display a Setpoints "Successfully Written to Control" confirmation screen.
5. The Operations Counter value will be reset to zero.

TAP STATISTICS

Viewing Specific Tap Statistics (HMI)

To view tap statistics proceed as follows:

1. Navigate to the View Specific Tap Statistics screen in the Monitor/Tap Information menu.

```
Press ENT to view
specific Tap Stats
```

2. Press the ENT pushbutton. The control will display the number of recorded tapchanges and the Accumulated Primary Current for each individual tap position on the Tapchanger control.

```
Tap       Tap Number
  0        0  0.0    A
```

The Up and Down arrow pushbuttons are utilized to scroll through the tap positions. Press the Exit pushbutton to exit Tap Stats.

Clearing Tap Statistics (HMI)

To clear Tap Statistics proceed as follows:

1. Navigate to the Clear Tap Statistics screen in the Monitor/Tap Information menu.

```
Press ENT to clear
Tap Statistics
```

2. Press the ENT pushbutton. The control will display "Clearing Tap Stats" confirmation display.

```
Press ENT to confirm
Clearing Tap Stats
```

3. Press the ENT pushbutton. The control will briefly display the "Tap Statistics have been cleared" confirmation and then return to the previous display.

```
Tap Statistics
have been cleared
```

Press the Exit pushbutton to exit Tap Stats.

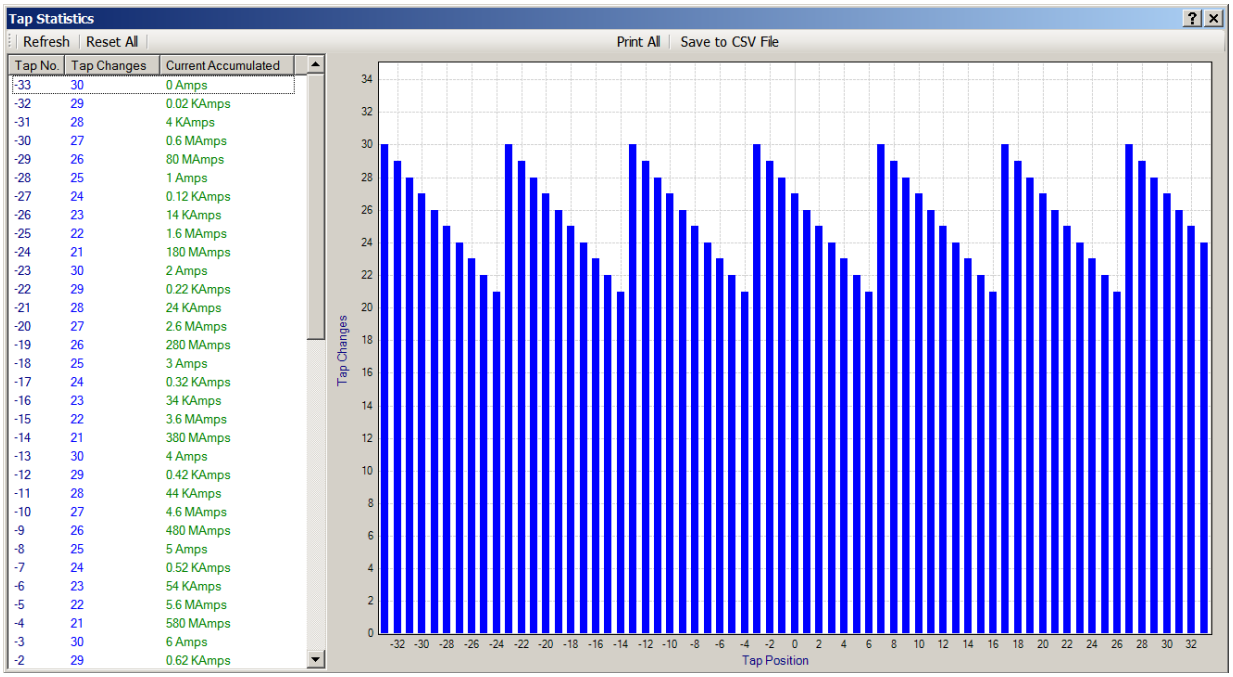
View Tap Statistics From TapTalk

To view Tap Statistics from TapTalk® perform the following:

1. Start TapTalk, then establish communications with the target control.
2. Select **Monitor/Tap Statistics** from the TapTalk toolbar. TapTalk will display a "Tap Statistics" screen (Figure 2-45).

   The "Tap Statistics" screen includes the capability to Refresh the screen display, Reset All displayed values, and save the data to a ".csv" file which can be read by a spreadsheet program.

   Selecting "Reset All" will clear the Individual Tap Wear Alarm in the Metering & Status screen.



Tap No.	Tap Changes	Current Accumulated
-33	30	0 Amps
-32	29	0.02 KAmps
-31	28	4 KAmps
-30	27	0.6 MAmps
-29	26	80 MAmps
-28	25	1 Amps
-27	24	0.12 KAmps
-26	23	14 KAmps
-25	22	1.6 MAmps
-24	21	180 MAmps
-23	30	2 Amps
-22	29	0.22 KAmps
-21	28	24 KAmps
-20	27	2.6 MAmps
-19	26	280 MAmps
-18	25	3 Amps
-17	24	0.32 KAmps
-16	23	34 KAmps
-15	22	3.6 MAmps
-14	21	380 MAmps
-13	30	4 Amps
-12	29	0.42 KAmps
-11	28	44 KAmps
-10	27	4.6 MAmps
-9	26	480 MAmps
-8	25	5 Amps
-7	24	0.52 KAmps
-6	23	54 KAmps
-5	22	5.6 MAmps
-4	21	580 MAmps
-3	30	6 Amps
-2	29	0.62 KAmps

■ **NOTE:** By pointing the mouse to any bar, the corresponding tap statistic will be highlighted as well as displayed in a tool tip.

Figure 2-45 Tap Statistics Screen

SMART FLASH SD CARD

Accessing The Smart Flash SD Card Screens (HMI)

To access the Smart Flash SD Card screens proceed as follows:

▲ **CAUTION**: The "Smart Flash SD Card" menu screens can only be accessed when a properly formatted Smart Flash SD Card or SDHC Card is inserted and seated in the Smart Flash SD Card slot.

1. Verify that a (FAT) formatted Smart Flash SD or SDHC Card is inserted into the Smart Flash SD Card slot.
2. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to "Memory Card".

```
            Memory Card
  ←                          →
```

The Memory Card can now be utilized to:

Quick Capture

Load Setpoints

Save Setpoints

Save Data Log

Save Sequence of Events

Save Oscillograph Records

Clone Save

Clone Load

Load DNP Config

Save DNP Config

Save Metering Data

Firmware Update

Save/Load IEC 61850 CID Files

User Access Code Key

Save Wakeup Screen Parameter data

■**NOTE**: If the Smart Flash SD Card has had a valid Access Level 1 or Access Level 2 code written to it, the control will accept the code and not prompt for an Access Code.

SD Card Quick Capture

The SD Card Quick Capture feature provides the means (in one step) to initiate a save of the following data files to the inserted SD Card (if they exist on the control):

- Control Clone
- Data Logging
- Oscillography
- Sequence of Events
- DNP Map
- Multi-user Access Code
- Multi-user Access Code Log

The SD Card Quick Capture feature requires a Level 2 Access Code to initiate. If any data file other than "Control Clone" does not exist on the control at the time the Quick Capture is initiated, the control will display a "XXX file doesn't exist" message for approximately three seconds before continuing with the Quick Capture process.

Quick Capture File Naming Convention

Since Data Logging and Oscillography files both utilize the same Comtrade format, the Quick Capture feature will name Data Logging files as DSXXXXXX.dat and DSXXXXXX.cfg. Oscillography files will be named as YYXXXXXX.dat and YYXXXXXX.cfg, with YY representing the "Partition" and XXXXXX representing the "Serial Number" of the control. For example, 16009999.dat would be an Oscillography file of the 16th Partition in control Serial Number 9999.

Initiating a Smart Flash SD Card Quick Capture

1. Insert the target Smart Flash SD Card into the control as previously described.
2. Press the Right Arrow (Comm Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
          Memory Card
←                          →
```

3. Press the Down Arrow pushbutton as necessary to navigate to the "SD Quick Capture" menu item.

```
SD Quick Capture
Press ENT to begin
```

4. Press the "ENT" pushbutton. If Level 2 Access is not active or has been previously input, then the following will be displayed. Go to Step 7.

```
Confirm press ENT
Cancel press EXIT.
```

5. If Level 2 Access is active, then the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE:** When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

6. Enter a valid Level 2 Access code, then press the "ENT" pushbutton.

   If a valid Level 2 Access code was entered, then the display will briefly flash a confirmation screen and then display the following:

```
Confirm press ENT
Cancel press EXIT
```

   If not, re-enter a valid code.

7. Press the "ENT" pushbutton. The control will cycle through the Quick Capture sequence of displays listed below:

■**NOTE:** If a file is not present (OSC for example) the control will display a "XXX file does not exist" message for approximately three seconds before continuing with the next save item in the Quick Capture sequence.

```
Confirm press ENT
Cancel press EXIT
```

```
Saving...
Clone File
```

```
Saving...
DNP CFG file
```

```
Saving...
SOE file
```

```
Saving...
Data Log file
```

```
Saving data file
......
```

```
Saving...
OSC file
```

```
Saving...
Multi-user Pass.log
```

```
Quick Cap Complete
Any key to continue
```

Loading Setpoints from a Smart Flash SD Card

1. Insert the target Smart Flash SD Card (that includes the setpoints file) into the control as previously described.
2. Press the Right Arrow (COMM Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
          Memory Card
←                          →
```

3. Press the Down pushbutton arrow as necessary to navigate to the "Load Setpoints" menu item.

```
Load Setpoints
Press ENT to begin
```

4. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, then the following will be displayed. Go to Step 7.

```
Confirm press ENT
Cancel press EXIT.
```

5. If Level 2 Access is active, then the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

6. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, then the display will briefly flash a confirmation screen and then display the following:

```
Confirm press ENT
Cancel press EXIT.
```

   If not, re-enter a valid code.

■**NOTE**: If an arrow is displayed on either end of the bottom display line, additional setpoint files are available for selection. Utilize the Right or Left arrow pushbuttons to select the desired file.

7. Press the ENT pushbutton. The control will prompt the user to select the file to be loaded.

```
File Name.tpt
MM/DD/YYYYY  hh:mm →
```

8. Utilize the Right or Left arrow pushbutton to select the desired setpoint file (*.tpt) .

▲ **CAUTION**: Setpoint changes are immediately acted upon by the control and may cause undesired control operation.

9. Select ENT. The control will briefly display a progress screen and then display the setpoints loaded screen.

```
Loading file.
Please wait........
```

```
Setpoints loaded.
Any key to continue
```

   The new setpoints are now available to the control.

Saving Setpoints to a Smart Flash SD Card

1. Insert the Smart Flash SD Card (that has adequate space available) into the control as previously described.
2. Press the Right Arrow (COMM Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
          Memory Card
←                          →
```

3. Press the Down pushbutton arrow as necessary to navigate to the "Save Setpoints" menu item.

```
Save Setpoints
Press ENT to begin
```

4. Press the ENT pushbutton. The control will respond with a "confirmation" message screen.

```
Confirm press ENT
Cancel press EXIT.
```

5. Press the ENT pushbutton. The control will prompt for a file name to be entered.

```
Enter file name
     M2001SP
```

6. Utilize the arrow pushbuttons to enter the desired file name.
7. Select ENT. The control will briefly display a progress screen and then display the setpoints loaded screen.

```
Saving setpoints
Please wait........
```

```
File saved!
Any key to continue
```

Saving Data Log to a Smart Flash SD Card

1. Insert the Smart Flash SD Card (that has adequate space available) into the control as previously described.
2. Press the Right Arrow (COMM Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
          Memory Card
←                          →
```

3. Press the Down pushbutton arrow as necessary to navigate to the "Save Data Log" menu item.

```
Save Datalog
Press ENT to begin
```

4. Press the ENT pushbutton. The control will respond with a "confirmation" message screen.

```
Press ENT to view
available data range
```

5. Press the ENT pushbutton. The control will display a range of data.

```
MM/DD/YY      HH:MM:SS
MM/DD/YY      HH:MM:SS
```

6. Press the ENT pushbutton to enter the desired data range. The control will display the following with the cursor located under the far left digit:

```
Enter start time
MM/DD/YY      HH:MM:SS      C
```

7. Utilizing the arrow pushbuttons enter the desired "start" date and time, then press **ENT**. The control will display the following:

```
Enter end time
MM/DD/YY      HH:MM:SS      C
```

8. Utilizing the arrow pushbuttons enter the desired "end" date and time, then press **ENT**. The control will display the following:

```
Enter file name
      M2001DLG
```

9. Utilizing the arrow pushbuttons enter the desired "file name", then press **ENT**. The control will briefly display a progress screen and then display the file saved screen.

```
Saving data file.
Please wait........
```

```
File saved!
Any key to continue
```

Saving Sequence of Events to a Smart Flash SD Card

1. Insert the Smart Flash SD Card (that has adequate space available) into the control as previously described.
2. Press the Right Arrow (COMM Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
          Memory Card
←                          →
```

3. Press the Down pushbutton arrow as necessary to navigate to the "Save seq. of events" menu item.

```
Save seq. of events
Press ENT to begin
```

4. Press the ENT pushbutton. The control will respond with a "enter file name" prompt screen with the cursor under the far left position.

```
Enter file name
      M2001D
```

5. Utilizing the arrow pushbuttons enter the desired file name, then press **ENT**. The control will display the following confirmation screen:

```
File Saved!
Any key to continue
```

6. Press any key. The display will return to the "Save seq. of events" screen.

Saving Oscillograph Record to a Smart Flash SD Card

1. Verify that the "Oscillograph Record Triggered" message cycling display is present on the control.
2. Insert the Smart Flash SD Card (that has adequate space available) into the control as previously described.
3. Press the Right Arrow (COMM Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
          Memory Card
←                          →
```

4. Press the Down pushbutton arrow as necessary to navigate to the "Save oscillograph" menu item.

```
Save oscillograph
Press ENT to begin
```

5. Press the ENT pushbutton. The control will respond with a "Select partition#" prompt screen.

```
Select partition:
1 MM/DD/YY    HH:MM:SS
```

6. Utilizing the Up/Down arrow pushbutton select the desired partition, then press **ENT**. The control will respond with a "Enter file name" prompt screen with the cursor under the far left position.

```
Enter file name
      M2001OSC
```

7. Utilizing the arrow pushbuttons enter the desired file name, then press **ENT**. The control will display the following:

```
Saving data file
.......00
```

8. When the file has been saved to the Smart Flash SD Card, then the control will display the following confirmation screen:

```
File Saved!
Any key to continue
```

9. Press any key, the display will return to the "Save oscillograph" screen.

Clone Save and Load

There are two types of "Clone Save" and "Clone Load" features included in the control. The two types are distinguished by the file name that is utilized when initiating a Clone Save or Clone Load.

Clone Save with "DNP Configuration" and "Multi-user Password" files

When the Clone Save feature is initiated, a default file name that includes the control Serial Number is displayed (SNxxxxxx). If the user utilizes the default file name, the control will write the control Settings File, DNP Configuration File and Multi-user Password File (if the DNP and Password files exist on the control) to the Smart Flash SD Card.

If the DNP and/or Password files do not exist on the cloned control, a message stating "DNP CFG file does not exist" or "Multi-user Password file doesn't exist" will be displayed during the Load sequence.

Clone Load with "DNP Configuration" and "Multi-user Password" files

When the Clone Load feature is initiated, the user must enter/select the clone file name that includes the control Serial Number (SNxxxxxx) that was saved with the associated DNP Configuration and Multi-user Password files. When the clone file name is entered, the control will check for DNP and Multi-user Password files named for the serial number of the clone file and will write the found files to the target control.

If the DNP and/or Password files do not exist on the cloned control, a message stating "DNP CFG file does not exist" or "Multi-user Password file doesn't exist" will be displayed during the Load sequence.

Clone Save Without "DNP Configuration" and "Multi-user Password" files

When the Clone Save feature is initiated, a default file name that includes the control Serial Number is displayed (SNxxxxxx). If the user enters a different file name the control will only write the control Settings File to the Smart Flash SD Card.

Clone Save to a Smart Flash SD Card

To save Clone files to the Smart Flash SD Card perform the following:

1. Insert the Smart Flash SD Card (that has adequate space available) into the control as previously described.
2. Press the Right Arrow (COMM Hot Button) pushbutton. The control will display the "Memory Card" menu.

```
          Memory Card
←                          →
```

3. Press the Down pushbutton arrow as necessary to navigate to the "Clone Save" menu item.

```
Clone save
Press ENT to begin
```

4. Press the ENT pushbutton. The control will respond with a "confirmation" screen.

```
Confirm press ENT
Cancel press EXIT.
```

5. Press **ENT**. The control will respond with a "Enter file name" prompt screen with the cursor under the far left position.

```
Enter file name
    SN1
```

6. Determine if any found DNP Configuration and Multi-user Password files are to be included in the Clone Save and proceed as follows:
   a. If found DNP Configuration and Multi-user Password files are to be included in the Clone Save go to Step 10.
   b. If found DNP Configuration and Multi-user Password files are not to be included in the Clone Save go to Step 7.
7. Utilizing the arrow pushbuttons enter the desired file name, then press **ENT**. The control will display the following:

```
Saving data
    SN1
```

8. When the file has been saved to the Smart Flash SD Card, then the control will display the following "confirmation" screen:

```
File Saved!
Any key to continue
```

9. Press any key. The display will return to the "Clone Save" screen. No further action is required.

10. To include found DNP Configuration and/or Multi-user Password files in the Clone Save, **Do Not** change the default file name displayed by the control.

11. Press "ENT". The control will display the following sequence of screens:

```
Saving data
   XXXXXXXXX
```

```
Saving...
DNP CFG File
```

If DNP Configuration file does not exist on the control the following will be displayed:

```
DNP CFG
File doesn't exist!
```

```
Saving...
Multi-user Password
```

If Multi-user Password File file does not exist on the control the following will be displayed:

```
Multi-user Pass File
File doesn't exist!
```

```
File Saved!
Any key to continue
```

12. Press any key, the display will return to the "Clone Save" screen. No further action is required.

Clone Load from a Smart Flash SD Card

To load Clone files to another control which may or may not include DNP Configuration and/or Multi-user Password files proceed as follows.

1. Insert the Smart Flash SD Card (that includes the Clone file) into the control as previously described.

2. Press the Right Arrow (COMM Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
          Memory Card
←                          →
```

3. Press the Down pushbutton arrow as necessary to navigate to the "Clone Load" menu item.

```
Clone load
Press ENT to begin
```

4. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, then the following will be displayed. Go to Step 7.

```
Confirm press ENT
Cancel press EXIT.
```

5. If Level 2 Access is active, then the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

6. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, then the display will briefly flash a confirmation screen and then display the following:

```
Confirm press ENT
Cancel press EXIT.
```

   If not, re-enter a valid code.

7. Press **ENT**. The control will display the following:

```
 SN000001.cln
MM/DD/YYYY   HH:MM  →
```

8. Utilizing the arrow pushbuttons select the desired Clone File name, then press **ENT**. The control will display the following:

```
Loading file
Please wait ....
```

```
Loading...
DNP CFG File
```

If DNP Configuration file does not exist on the control the following will be displayed:

```
DNP CFG
File doesn't exist!
```

```
Loading...
Multi-user Password
```

If Multi-user Password File file does not exist on the control the following will be displayed:

```
Multi-user Pass Log
File doesn't exist!
```

9. When the clone file has been loaded the control will display the following "confirmation" screen:

```
Clone loaded
Any key to continue
```

10. Press any key. The display will return to the "Clone load" screen.

Loading DNP Configuration from a Smart Flash SD Card

1. Insert the Smart Flash SD Card (that includes the DNP config file) into the control as previously described.
2. Press the Right Arrow (COMM Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
        Memory Card
←                          →
```

3. Press the Down pushbutton arrow as necessary to navigate to the "Load DNP Config" menu item.

```
Load DNP config
Press ENT to begin
```

4. Press the ENT pushbutton. The control will display the following.

```
 M2001DNP.xml
MM/DD/YYYY  HH:MM   →
```

5. Select the desired file name, then press the ENT pushbutton. The control will display the following:

```
File loaded!
Any key to continue
```

The new DNP configuration is now available to the control.

Saving DNP Configuration to a Smart Flash SD Card

1. Insert the Smart Flash SD Card (that has adequate space available) into the control as previously described.
2. Press the Right Arrow (COMM Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
          Memory Card
 ←                          →
```

3. Press the Down pushbutton arrow as necessary to navigate to the "Save DNP Config" menu item.

```
Save DNP config
Press ENT to begin
```

4. Press the ENT pushbutton. The control will display the following:

```
Enter file name
   M2001DNP
```

5. Utilizing the arrow pushbuttons enter the desired file name, then press the ENT pushbutton. The control will save the DNP config file and respond with a "confirmation message" screen.

```
File saved!
Any key to continue
```

Saving Metering Data to a Smart Flash SD Card

1. Insert the Smart Flash SD Card (that has adequate space available) into the control as previously described.
2. Press the Right Arrow (COMM Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
          Memory Card
 ←                          →
```

3. Press the Down pushbutton arrow as necessary to navigate to the "Save Metering Data" menu item.

```
Save Metering Data
Press ENT to begin
```

4. Press the ENT pushbutton. The control will display the following:

```
   Enter file name
      M2001MT
```

5. Utilizing the arrow pushbuttons enter the desired file name, then press the ENT pushbutton. The control will save the Metering Data in a *.csv file and respond with the following sequence of screens:

```
Saving CSV...
    M2001MT
```

```
Saving Done...
    M2001MT
```

```
Save Metering Data
Press ENT to begin
```

Firmware Update from Smart Flash SD Card

1. Insert the Smart Flash SD Card (that contains the firmware update file) into the control as previously described.
2. Press the Right Arrow (COMM Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
          Memory Card
←                          →
```

3. Press the Down pushbutton arrow as necessary to navigate to the "Firmware Update" menu item.

```
Firmware Update
Press ENT to begin
```

4. Press the ENT pushbutton. The Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

5. Enter a valid Level 2 Access code, then press the ENT pushbutton. The control will begin the firmware update.

```
Updating From SDCARD
...
```

6. When the firmware update is complete the control will display a "confirmation message" screen.

```
Update Complete
Rebooting...
```

After the setpoints and configuration have been successfully restored after rebooting, the control will display the following:

```
Update Successful
Any Key to continue
```

At this point the control is fully operational by pressing any key.

7. Press any key. The control will display the following sequence of screens:

```
User Line 1
User Line 2
```

```
D-0214VXX.XX.XX
Serial Number XXXX
```

```
Date & Time
XX/XX/XX    XX:XX:XX
```

```
Factory Options
XXXXX   XXXXX
```

```
User Line 1
User Line 2
```

If restoring of setpoints and configuration fail, then the control will display the following:

```
Failed to restore!
Any key to continue
```

At this point the control will be operating with default initialized setpoints and configuration data.

If this condition exists, the user should reload the correct file settings and contact Beckwith Electric Customer Service.

Smart Flash SD Card User Access Code

A user Access Code Level 1 or 2 can be written to a Smart Flash SD Card. The user Access Code will be read by the control when the SD Card is inserted into the Smart Flash Card slot on the front of the control. As long as the SD Card is inserted, the control will not prompt for the Level Access Code contained on the SD Card.

Writing a user Access Code to a Smart Flash SD Card.

1. Start the TapTalk® Communications Software on the PC.
2. Open a TapTalk "File" or connect to M-2001D control.
3. Verify that the target Smart Flash Card is inserted in the PC.
4. Select **Utility/SD Card Access Code**. TapTalk will display the SD Card dialog screen (Figure 2-46).

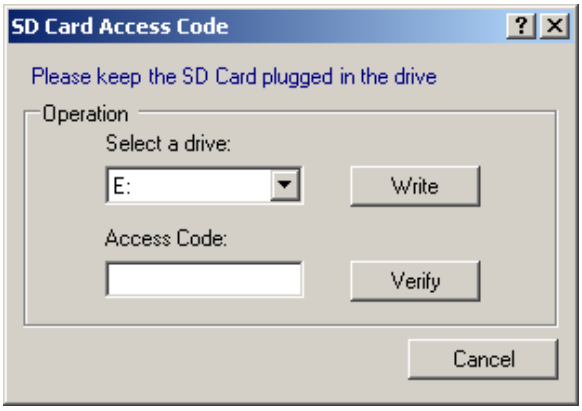


Figure 2-46 SD Card Dialog Screen

5. From the Operation section of the dialog screen select the drive that the SD Card represents in the drop down menu.
6. Enter the desired User Access Code, then select "Write". TapTalk will display a "Write Successfully" confirmation screen (Figure 2-47).

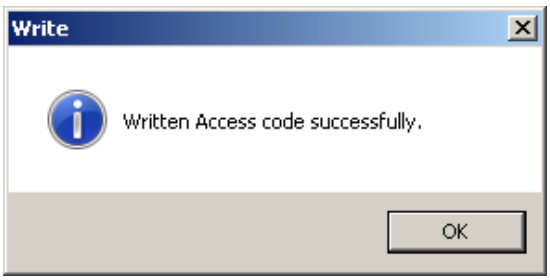


Figure 2-47 SD Card Access Code Written Successfully Confirmation Screen

7. Select "**OK**", then select "Verify". TapTalk will display the user Access Code that was written to the SD Card (Figure 2-48).

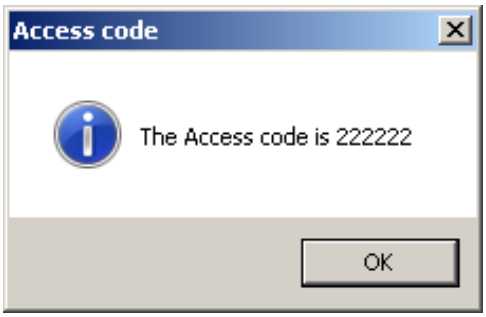


Figure 2-48 SD Card User Access Code Verification Screen

8. Select OK. The SD Card now contains the user Access Code and will be read each time the SD Card is inserted into the control.

Load IEC 61850 Configuration from a Smart Flash SD Card

1. Insert the Smart Flash SD Card (that contains the IEC 61850 Configuration file) into the control as previously described.
2. Press the Right Arrow (COMM Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
          Memory Card
←                          →
```

4. Press the Down pushbutton arrow as necessary to navigate to the "Load IEC Config" menu item.

```
Load IEC config
Press ENT to begin
```

5. Press the ENT pushbutton. The control will display the following:

```
file name.cid
xx/xx/xxxx   xx:xx
```

6. Utilizing the arrow pushbuttons select the desired file name, then press the ENT pushbutton. The control will load the IEC config file and respond with a "confirmation message" screen.

```
Loaded Successfully
Any key to continue
```

Save IEC 61850 Configuration to a Smart Flash SD Card

1. Insert the Smart Flash SD Card (that has adequate space available) into the control as previously described.
2. Press the Right Arrow (COMM Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
          Memory Card
←                          →
```

4. Press the Down pushbutton arrow as necessary to navigate to the "Save IEC Config" menu item.

```
Save IEC Config
Press ENT to begin
```

5. Press the ENT pushbutton. The control will display the following:

```
Enter file name
   M2001
```

6. Utilizing the arrow pushbuttons enter the desired file name, then press the ENT pushbutton. The control will save the IEC Configuration in a *.cid file and respond with the following sequence of screens:

```
Saving IEC Config
Please wait...
```

```
File Saved
Any key to continue
```

Wakeup Screen Parameter Save to a Smart Flash SD Card

The Wakeup Screen Parameter Save feature provides the user with the capability to save all Wakeup Screen Parameters to the Smart Flash SD Card.

1. Insert the Smart Flash SD Card (that has adequate space available) into the control as previously described.
2. Press the Exit (Wake Hot Button) pushbutton to awaken the unit. The menu will advance to "Save Wake Data to SD".

```
SAVE WAKE DATA to SD
Press ENT to begin
```

3. Press **ENT**. The control will respond with a "Enter file name" prompt screen with the cursor under the far left position.

```
Enter file name
    SN1
```

4. Utilizing the arrow pushbuttons enter the desired file name, then press **ENT**. The control will display the following:

```
Saving data
SN1
```

5. When the file has been saved to the Smart Flash SD Card, the control will return to the Wakeup Screens.

UTILITY/CALIBRATION

Accessing Utility/Calibration Screens (HMI)

THE FOLLOWING INFORMATION REGARDING CHANGING CALIBRATION PARAMETERS IS INTENDED FOR AUTHORIZED PERSONNEL ONLY. CHANGES TO THESE PARAMETERS CAN RESULT IN PHYSICAL DAMAGE TO THE CONTROL AND THE SYSTEM/COMPONENT THAT IT IS APPLIED TO.

The Utility/Calibration HMI screens provide access to calibration parameters that can be reset by the user as necessary to restore calibration settings to those that were calculated at the factory. Also included are key parameters that are indication only.

The following calibration parameters can be accessed and set by the user:

- Voltage Offset
- Volt Cal Coefficient
- Volt RMS Coefficient
- Curr Cal Coefficient
- I Sin Coefficient
- I Cos Coefficient
- Mtr Cal. Coefficient
- Mtr Sin Coefficient
- Mtr Cos Coefficient
- Mtr RMS Coefficient
- Circ Cal Coefficient
- Circ Sin Coefficient
- Circ Cos Coefficient

Indication only parameters available from the Calibration/Test HMI menus:

- Load Voltage
- Control Load I
- Power Factor
- Motor Current
- X1 Duration

These instructions describe making a change to the "Volt Cal Coefficient" calibration parameter. The other calibration parameters are changed in the same manner.

▲ **CAUTION**: Incorrect calibration parameter settings can result in damage to the control.

1. Press the ENT (UTIL Hot Button) pushbutton to awaken the unit. The menu will advance to "UTILITIES".

```
          UTILITIES
←COMM                    MNTR→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Calibration/Test
←                        →
```

3. Press the Down arrow pushbutton as necessary to navigate to the "Volt Cal Coefficient" calibration parameter screen.

```
Volt Cal Coefficient
32767 X
```

4. Press the ENT pushbutton. The following will be displayed.

```
ENTER LEVEL 3 ACCESS
_
```

■**NOTE**: When entering the Level 3 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

5. Enter a valid Level 3 Access code, then press the ENT pushbutton.

   If a valid Level 3 Access code was entered, then the display will briefly flash a confirmation screen, then a "C". If not, reenter a valid code.

6. At the cursor, input the desired Voltage Calibration Coefficient value utilizing the arrow pushbuttons, then press the ENT pushbutton. The display will return to the "Voltage Calibration Coefficient" screen.

```
Volt Cal Coefficient
32767 X
```

7. Remove power to the control, then reapply power to the control.

SOURCE VOLTAGE

Changing Source Voltage Input

This feature allows the user to manually switch the sensing voltage source for diagnostic procedures.

To manually switch the Source Voltage input proceed as follows:

1. Press the ENT (UTIL Hot Button) pushbutton to awaken the unit. The menu will advance to "UTILITIES".

```
          UTILITIES
←COMM                    MNTR→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Calibration/Test
←                        →
```

3. Press the Down arrow pushbutton as necessary to navigate to the "Change Src Input" screen.

```
Change Src Input
Press ENTER.
```

4. To toggle between voltage source inputs press the ENT pushbutton. The following will be displayed depending on the source that is selected:

```
Change Src Input
Calculated  XXX.X  V
```

```
Change Src Input
Measured  XXX.X  V
```

WATCHDOG AND POWER RESETS

Watchdog Resets and Power Resets

This feature provides the user with the ability to determine the number of processor resets that have occurred and also the number of power cycles the control has experienced. Both counters can be reset by the user.

In the event that a "checksum error" occurs this menu will change to "Init Setpoints".

To clear the Watchdog reset and Power Cycle counters proceed as follows:

1. Press the ENT (UTIL Hot Button) pushbutton to awaken the unit. The menu will advance to "UTILITIES".

```
          UTILITIES
←COMM                    MNTR→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
       Calibration/Test
←                        →
```

3. Press the Down arrow pushbutton as necessary to navigate to the "Clear reset counters" screen.

```
Clear reset counters
Press ENT to begin
```

4. Press the ENT pushbutton. The following will be displayed:

```
Confirm press ENTER
Cancel press EXIT.
```

5. Press ENT. The control will display a "Counters Reset" screen,

```
Counters Reset
```

then return to the following:

```
Clear reset counters
Press ENT to begin
```

CHECKSUM ERROR

■**NOTE**: When a Checksum ERROR occurs the voltage control element of the control is NOT available.

In the event a "checksum error" occurs, then the control will initiate a cycling "Checksum Error" display. In this case the "Clear reset counters" menu item in the Utilities/Configuration/Test menu display will change to "Init setpoints" function. To reinitialize the control setpoints perform the following:

1. Press the ENT (UTIL Hot Button) pushbutton to awaken the unit. The menu will advance to "UTILITIES".

```
          UTILITIES
←COMM                    MNTR→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
       Calibration/Test
←                        →
```

3. Press the Down arrow pushbutton as necessary to navigate to the "Init setpoints" screen.

```
Init setpoints
Press ENT to begin
```

4. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, then the following will be displayed. Go to Step 7.

```
Init setpoints
Press ENT to begin
```

5. If Level 2 Access is active, then the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
  _
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

6. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, then the display will briefly flash a confirmation screen and then display the following:

```
Init setpoints
Press ENT to begin
```

   If not, re-enter a valid code.

7. Press the ENT pushbutton. The following will be displayed:

```
Confirm press ENT
Cancel press EXIT.
```

8. Press ENT. The control will display the following sequence of screen displays:

```
Initializing....
```

```
Initialization Done
```

```
Init Setpoints
Press ENT to begin
```

DATALOG FILES

Converting Datalog Files to "*.CSV" Format

This utility converts "*.CFG" datalog files to "*.CSV" files for viewing in Excel. Selecting this utility from the TapTalk® utility drop down menu opens an "Open" file dialog screen. Selecting the target CFG file and then selecting "Open" converts the file and saves the resulting CSV file in the target file directory.

ABOUT SCREENS

Accessing The About Screens (HMI)

The About screens provide the user with unit serial number and firmware version. To access the About screens from the control front panel proceed as follows:

1. Press the ENT (UTIL Hot Button) pushbutton to awaken the unit. The menu will advance to "UTILITIES".

```
        UTILITIES
←COMM                 MNTR→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Calibration/Test
←                       →
```

3. Press the Right or Left arrow pushbutton. The menu will advance to About.

```
            About
←                       →
```

4. Press the Down arrow pushbutton as necessary to navigate to the desired screen.

REMOTE CONTROL (TapTalk)

▲ **CAUTION:** This feature should be used with extreme caution.

The **Remote Control** menu item located in the Utility drop down menu displays the applicable **Remote Control** screen (Figure 2-49 or 2-50). Remote Control allows the user to:

- Remotely raise or lower one tap position.
- Apply Voltage Reduction Step 1 or 2 or 3.
- When the Auto/Manual Switch Type is set to either "Toggle" or "NONE" the Block Auto Control via Communication (Comm Block) setting is available.
- When the Auto/Manual Switch Type is set to "SCAMP" the SCAMP Auto/Manual Control setting is available.

Remote Tap Control

■ **NOTE:** If the unit is supplied with DC Power Backup, then all automatic Raise or Lower operations are blocked when the input voltage decreases to less than 85.0 Vdc. Remote initiated Raise or Lower operations will still be initiated if Motor Power is available.

▲ **CAUTION**: The control will not accept a new command unless the previous command is completed.

Lower 1 Tap – Initiates remote Lower in 1 tap increments. Limited by tap Block Lower setpoint and tap position limit settings.

▲ **CAUTION**: If an appropriate pulse width setting is not input, then a misoperation of the tapchanger may occur when a SCADA Manual Raise or Lower is initiated.

Raise 1 Tap – Initiates remote Raise in 1 tap increments. Limited by tap Block Raise setpoint and tap position limit settings.

Remote Voltage Reduction

Off – No Voltage Reduction command is sent when **Apply** is selected.

Step #1 – Initiates first step voltage reduction command for addressed control.

Step #2 – Initiates second step voltage reduction command for addressed control.

Step #3 – Initiates third step voltage reduction command for addressed control.

Block Auto Control via Communication

Block – Blocks automatic operation of the addressed control.

Unblock – Initiates automatic operation of the addressed control.

SCAMP Control

The SCAMP Control feature (Figure 2-50) allows the user to remotely observe the status of the Adapter Panel SCAMP pushbutton (when equipped). This feature also allows the user to change the state of the Local SCAMP pushbutton on the Adapter Panel/Control.

Remote Control/Miscellaneous

Close – Returns to the TapTalk® main screen.

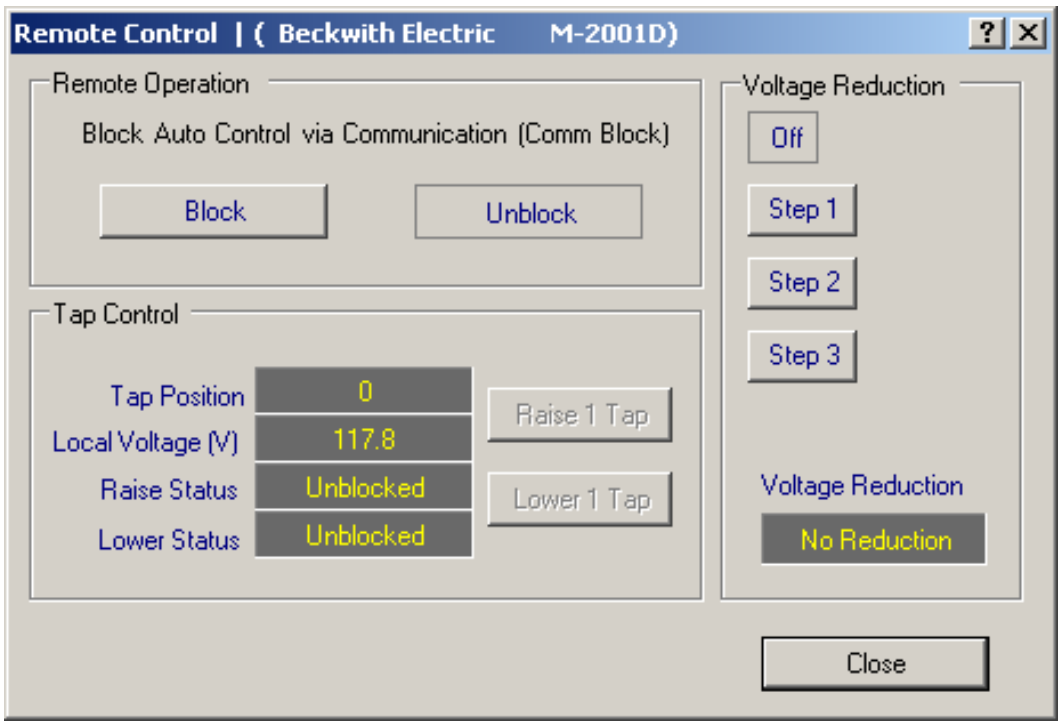


Figure 2-49 Remote Control Screen for Toggle or None Auto/Manual Switch Type

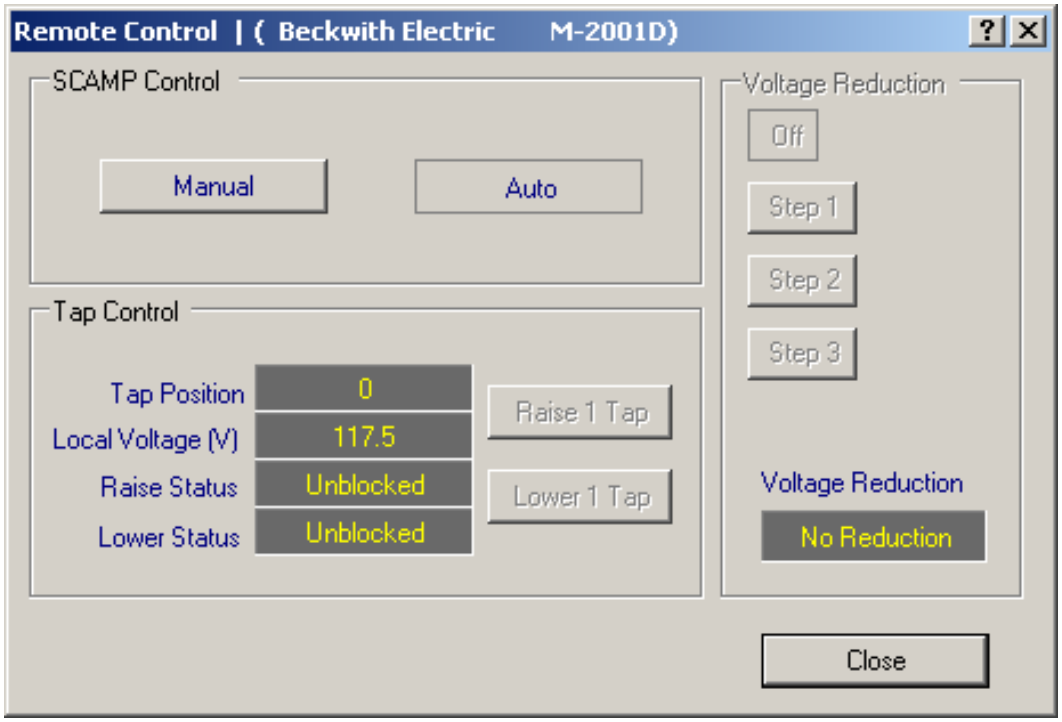


Figure 2-50 Remote Control Screen for SCAMP Auto/Manual Switch Type

Low Current Alarm/Block

Clearing Low Current Alarm/Block From The HMI

To clear the Low Current Alarm/Block from the HMI, perform the following:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, until "Programmable Alarm" is displayed.

```
        Programmable Alarm
←                        →
```

4. Press the Down arrow, as necessary, until the following will be displayed.

```
Clr Low Current Blk
Ready Press ENTER
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Confirm press ENTER
Cancel press EXIT.
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
  _
```

■**NOTE**: When entering the Level 2 Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Confirm press ENTER
Cancel press EXIT.
```

   If not, re-enter a valid code.

8. Press the ENT pushbutton. The following sequence of screens will be displayed:

```
Confirm press ENTER
Cleared
```

```
Clr Low Current Blk
Ready Press ENTER
```

Clearing Low Current Alarm/Block From TapTalk

To clear the Low Current Alarm/Block from TapTalk®, perform the following:

1. Select **Setup/Alarms** from the TapTalk toolbar. TapTalk will display the Programmable Alarm dialog screen (Figure 2-51).
2. From the Low Current Block Reset section of the dialog screen select Reset.

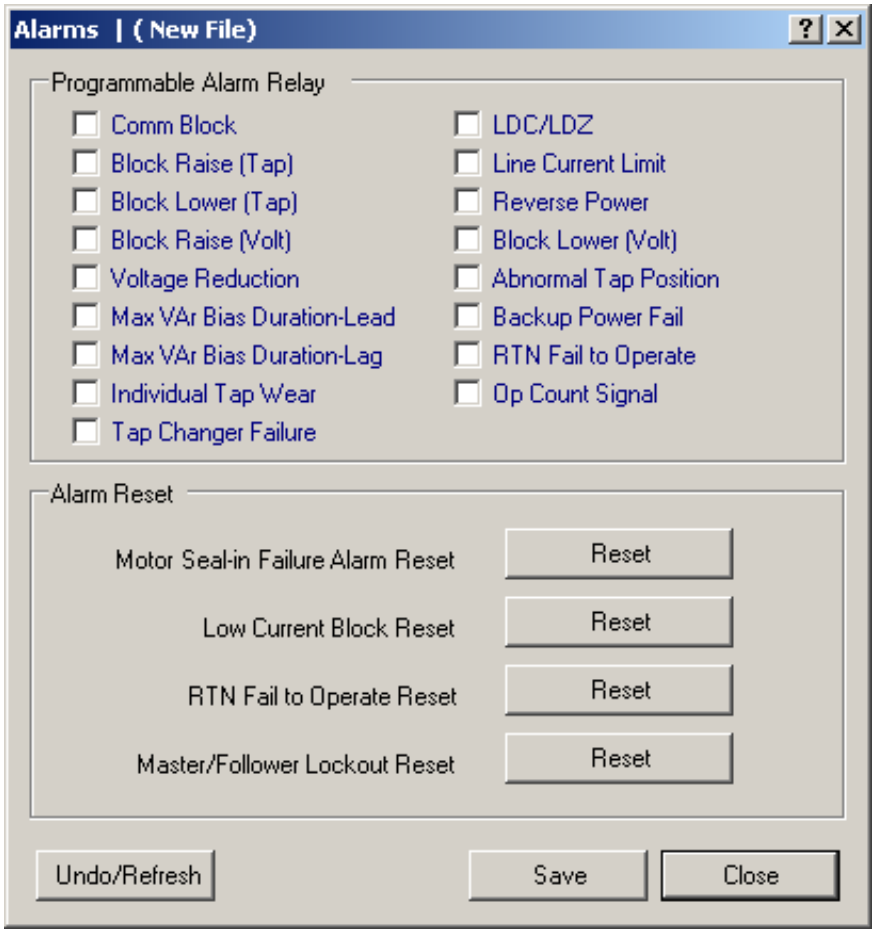


Figure 2-51 Programmable Alarms Dialog Screen

Motor Seal-in Failure Alarm/Block

When Motor Seal-in is selected in the control the Motor Seal-in Failure Alarm/Block feature and the input to the Abnormal Tap Position alarm are enabled by default. The user may choose to disable the Motor Seal-in Block feature. However, the input to the Abnormal Tap Position alarm and the Motor Seal-in Failure Alarm is always enabled when Motor Seal-in is selected. The feature includes the following:

Abnormal Tap Position Alarm Input - The Motor Seal-in Failure Block feature provides an input to the "Abnormal Tap Position" alarm. This input is actuated on the first occurrence of a tapchange coincident with no motor seal-in current detected for 15 seconds.

Motor Seal-in Failure Alarm - The Motor Seal-in Failure Alarm is actuated on the second occurrence (either direction) of a tapchange coincident with no motor seal-in current detected for 15 seconds. This alarm can be reset by the user from the Human Machine Interface (HMI), from the TapTalk® "Alarms" dialog screen or via SCADA. The alarm is also reset when a successful tapchange operation occurs (motor seal-in current detected) in either direction.

```
Alarm Active
MTR SEAL-IN FAILURE
```

Motor Seal-in Failure Block - The Motor Seal-in Failure Block is actuated on the second occurrence of a tapchange coincident with no motor seal-in current detected for 15 seconds in either direction. The block will be in effect in the direction that produced the second Motor Seal-in Failure occurrence. If a Motor Seal-in Failure is detected in the opposite direction, then operation will be blocked in that direction also.

This Block can be reset by the user from the HMI, from the TapTalk "Alarms" dialog screen or via SCADA. The block is also reset when a successful tapchange operation occurs (motor seal-in current is detected) in the opposite direction.

The internal accumulator that counts the occurrences of failed tapchanges is stored in volatile memory and is set to zero when a loss of power occurs and the unit is not equipped with a backup power supply. This is considered normal operation of the feature.

Resetting Motor Seal-in Failure Alarm/Block From The HMI

To reset the Motor Seal-in Failure Alarm from the HMI, perform the following:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                          →
```

3. Press the Right or Left arrow pushbutton, as necessary, until "Programmable Alarm" is displayed.

```
     Programmable Alarm
←                          →
```

4. Press the Down arrow, as necessary, until the following will be displayed.

```
Clear Seal in Alarm
Ready Press ENTER
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Confirm press ENTER
Cancel press EXIT.
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■ **NOTE**: When entering the Level 2 Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Confirm press ENTER
Cancel press EXIT.
```

   If not, re-enter a valid code.

8. Press the ENT pushbutton. The following sequence of screens will be displayed:

```
Confirm press ENTER
Cleared
```

```
Clear Seal in Alarm
Ready Press ENTER
```

Resetting Motor Seal-in Failure Alarm/Block From TapTalk

To reset the Motor Seal-in Failure Alarm from TapTalk®, perform the following:

1. Select **Setup/Alarms** from the TapTalk toolbar. TapTalk will display the Programmable Alarm dialog screen (Figure 2-51).
2. From the Motor Seal-in Failure Alarm reset section of the dialog screen select Reset.

Master/Follower Lockout Alarm

Clearing Master/Follower Lockout Alarm From The HMI

To clear the Master/Follower Lockout Alarm from the HMI, perform the following:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                 COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
       Tapchanger Type
←                         →
```

3. Press the Right or Left arrow pushbutton, as necessary, until "Paralleling" is displayed.

```
         Paralleling
←                         →
```

4. Press the Down arrow, as necessary, until the following will be displayed.

```
Clear Lockout Alarm
Ready Press ENTER
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Confirm press ENTER
Cancel press EXIT.
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Confirm press ENTER
Cancel press EXIT.
```

   If not, re-enter a valid code.

8. Press the ENT pushbutton. The following sequence of screens will be displayed:

```
Confirm press ENTER
Cleared
```

```
Clear Lockout Alarm
Ready press ENTER
```

Clearing Master/Follower Lockout Alarm From TapTalk

To clear the Master/Follower Lockout Alarm from TapTalk®, perform the following:

1. Select **Utility/Master/Follower Configuration** from the TapTalk toolbar. TapTalk will display the Access Level Code dialog screen (Figure 2-52).

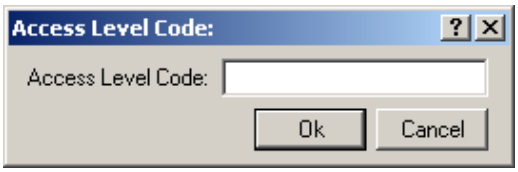


Figure 2-52 Access Level Code Dialog Screen

2. Enter a valid Level 2 Access Code, then select OK. TapTalk will display the Access Granted Successfully confirmation screen (Figure 2-53).

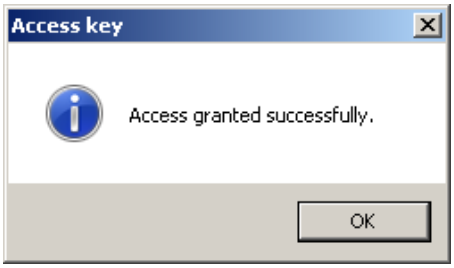


Figure 2-53 Access Granted Successfully Confirmation Screen

3. Select OK. TapTalk will display the Master/Follower Configuration Tool dialog screen.
4. Select the desired control to be reset, then select "Alarm Reset" to reset the Master/Follower Lockout Alarm.

■ **NOTE:** The Master/Follower Lockout Alarm can also be reset from the Programmable Alarm dialog screen.

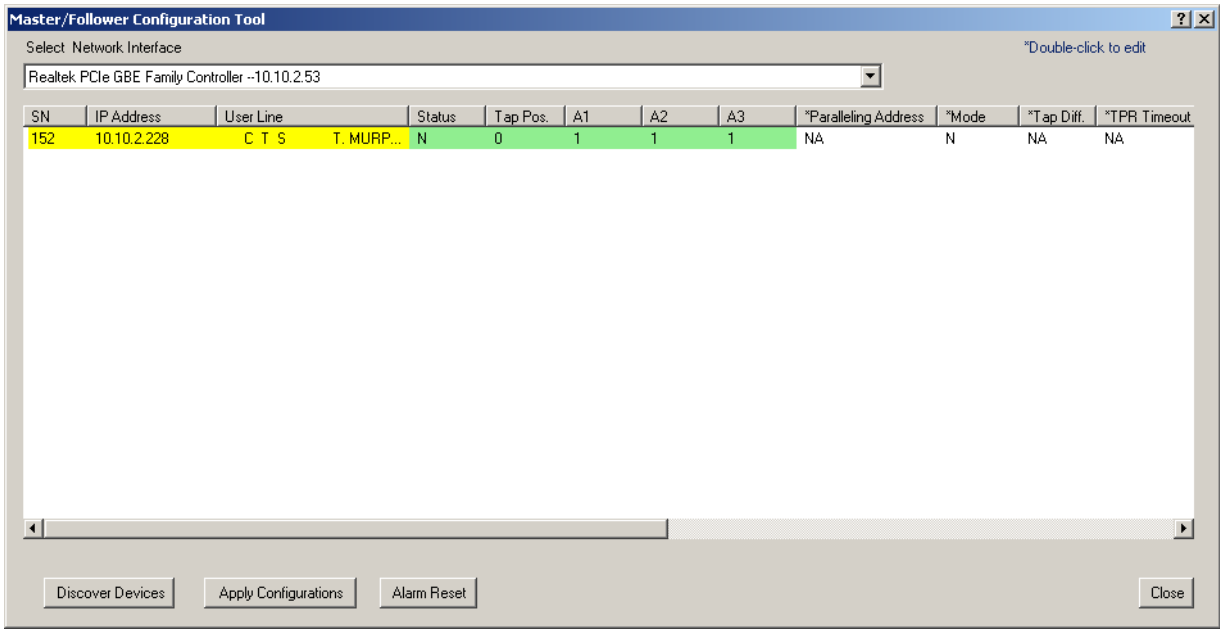


Figure 2-54 Master/Follower Configuration Tool Dialog Screen

Send/Receive IEC 61850 Configuration File

To Send a Configuration file proceed as follows:

1. Start the TapTalk® Communications Software on the PC.
2. Connect to the M-2001D control.
3. Select **Utility/IEC61850/Configuration File/Send**. TapTalk will display the "Authentication Key Generated Successfully" confirmation screen (Figure 3-79).
4. Select **OK**. TapTalk will display the "Open" dialog screen with a default file extension of "*.cid".
5. Select the desired Configuration file, then select "Open". TapTalk will display the "Send" status screen (Figure 3-81) while the Configuration file is sent.
6. When the file has been successfully sent to the control, TapTalk will display the File Uploaded Successfully confirmation screen (Figure 2-55).

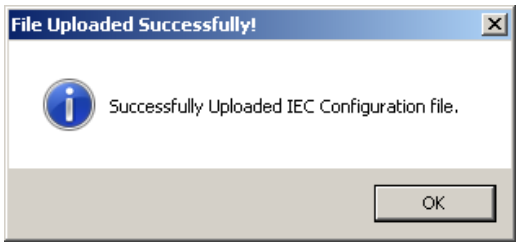


Figure 2-55 IEC Configuration File Uploaded Successfully Confirmation Screen

To Receive a Configuration file proceed as follows:

1. Start the TapTalk Communications Software on the PC.
2. Connect to the M-2001D control.
3. Select **Utility/IEC61850/Configuration File/Receive**. TapTalk will display the "Save As" dialog screen with a default file extension of "*.cid".
4. Name the Configuration file, then select "Save". TapTalk will display the "Transferring" status screen (Figure 2-56) while the Configuration file is transferred.

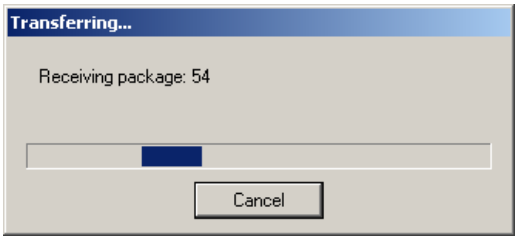


Figure 2-56 IEC Configuration File Transferring Status Screen

5. When the file has been successfully downloaded from the control, TapTalk will display the File Downloaded Successfully confirmation screen (Figure 2-57).

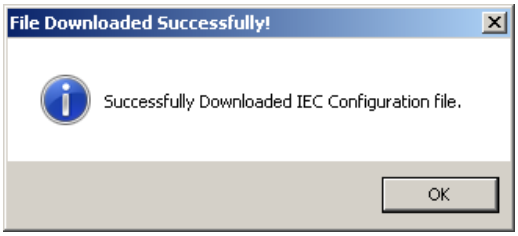


Figure 2-57 IEC Configuration File Downloaded Successfully Confirmation Screen

3 TapTalk® S-2001D Communications Software

This chapter describes the TapTalk S-2001D Communications Software which provides the user with the capability to interrogate Beckwith Electric Digital Tapchanger Controls using a Windows™ based personal computer. Firmware version is displayed when power is applied to the control or through the display panel. While the software has been carefully designed for easy use and installation, we suggest that first-time users acquaint themselves with its operation prior to use by carefully reading this chapter.

3.0 Availability

TapTalk® S-2001D Communications Software is available on CD-ROM or from www.beckwithelectric.com. Also included on the CD-ROM is the companion Instruction Book in *.pdf format.

3.1 Hardware Requirements

TapTalk will run on any PC that provides at least the following:

- Windows 2000®, Windows XP®, Windows Vista® or Windows 7®
- One CD-ROM drive
- One USB (serial) port

Hardware Required for Direct USB (Serial) Communication

To use TapTalk to communicate with a Beckwith Electric Digital Tapchanger Control using a direct USB (serial) connection, a USB cable is required.

The M-2001D Digital Tapchanger Control includes a fiber optic port and RS-485 port. See **Section 7.1, External Connections**, for detailed information regarding the use of these connections.

3.2 Installing TapTalk

The TapTalk S-2001D installation program has been written to overwrite previous versions of TapTalk. However, considering variations in installed software, hardware and operating systems, if you are upgrading from a previous version of TapTalk, it is recommended that any older versions of the TapTalk program be removed before installing the new TapTalk.

TapTalk runs with the Windows 2000, Windows XP, Windows Vista or Windows 7 operating system. Familiarity with Windows is important in using TapTalk, as the conventions defined in the Windows documentation are strictly followed.

TapTalk will be installed on the host PC's hard disk. While it does not require special installation procedures, an installation utility has been provided to make the process easier.

To install TapTalk:

▲**CAUTION:** The USB cable must be disconnected from the M-2001D control before installing TapTalk.

1. Insert the TapTalk software into your CD-ROM drive.
2. Select **Run** from the **Start Menu**.
3. In the **Run** dialog box, initiate software installation by typing **D:\Setup.exe** (or other drive designator:\Setup.exe, depending on the letter designation for the CD-ROM drive).
4. The Installation Wizard will prompt the user through the installation process. After installation, the TapTalk program icon (located in the Becoware folder) can be placed on the desktop (Figure 3-1).

Starting TapTalk

1. Select the TapTalk program-item icon from the Becoware group in the Program Manager, or select TapTalk from the program list using the **Start** Menu. The TapTalk Main Screen will be displayed.

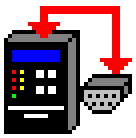


Figure 3-1 TapTalk S-2001D Program-Item Icon

3.3 Communications Using Direct USB Connection

To use TapTalk® to interrogate, set, or monitor the M-2001D Digital Tapchanger Control using a direct USB connection, the appropriate driver must be loaded. The driver that is required to be resident in the "windows\inf" folder on the host PC is "beco_usb.inf." This driver is automatically loaded by the TapTalk installation software.

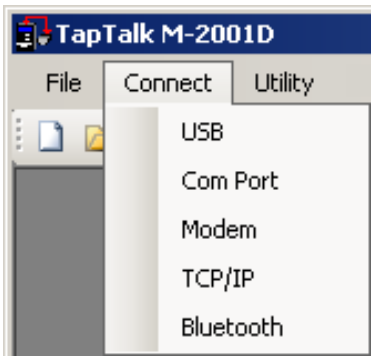
When the control is connected to the PC utilizing a USB cable, Windows will enumerate the control as a serial com device and will assign an unused COM Port to the control.

Direct Communication Using USB (Serial) Connection

1. Ensure the following conditions exist:
   - TapTalk is installed on the host computer
   - The control is energized
2. Plug the USB cable into the host PC USB port.
3. Plug the USB cable into the USB port on the control. The host PC will:
   a. Interrogate the control to determine the type of hardware device it is.

■**NOTE:** If the host PC cannot identify the proper driver for the M-2001D, the driver can be found on the TapTalk software installation disk.

   b. Load any required drivers.
   c. Assign the next available COM port to the USB connection.
4. Start the TapTalk program. TapTalk will display the TapTalk **Main** dialog screen.
5. Select **Connect/USB** from the **Connect** drop-down menu.



TapTalk will display the USB Port dialog screen (Figure 3-2).

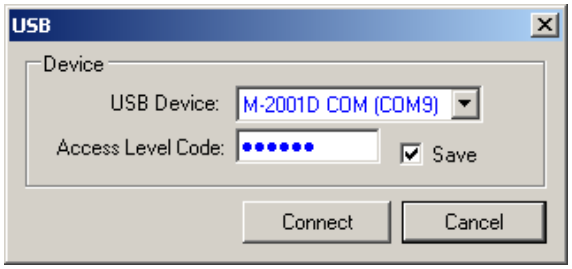


Figure 3-2 USB Port Connection Dialog Screen

6. Ensure that the correct COM port is displayed for the selected USB device.

■**NOTE:** TapTalk will automatically choose the port for the control you just connected to.

7. Enter "Access Level Code" and check "Save" if desired.

   Default Values:

   Level 1 000000 (Disabled)

   Level 2 222222

8. Select **Connect**. TapTalk will attempt to connect to the target control.

9. If TapTalk® returns a Failed to Connect Error screen (Figure 3-3), then repeat Steps 6,7 and 8.

Figure 3-3 Failed to Connect Error Screen

10. If Level 1 Access is not active or the proper Level 1 or Level 2 access code was entered, then TapTalk will briefly display a "Successfully Connected Level 1/Level 2" confirmation screen, then display the connected version of the TapTalk Main Screen (Figure 3-13) with the appropriate Access Level.

11. If Level 1 Access is active and an invalid access code was entered, then TapTalk will display a "Failed to complete Access Code Verification" error message (Figure 3-4).

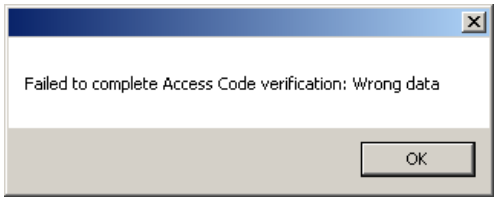


Figure 3-4 Failed to complete Access Code Verification Error Screen

12. Select **OK**. TapTalk will briefly display the "Successfully Connected Read-Only Access" screen (Figure 3-5) and then display the connected version of the TapTalk Main Screen (Figure 3-13) with Read-Only permission.

Figure 3-5 Successfully Connected Read Only Access Screen

3.4 RS-485 Communications

To use TapTalk to interrogate, set, or monitor the M-2001D Digital Tapchanger Control using a RS-485 connection the following conditions must be met:

- The control is physically connected to a RS-485 network consistent with the hardware and connection requirements of **Section 7.1, External Connections**.
- TapTalk software communication parameters and device parameters must match the control's default RS-485 settings and the selected/default device parameters.

Elements of the control's RS-485 Port communication parameters include the following (default settings):

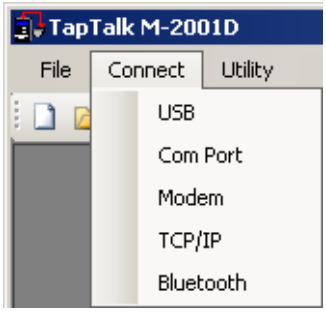
- Baud Rate (9600 bps)
- Sync Time (2 ms)
- Parity (None)
- Stop Bits (1)

Default device parameters that are at the default settings or have been configured locally at the control include (default settings):

- Device (Comm) Address (1)
- Protocol (DNP)
- Echo Cancel (fiber optic) (None)

Communication Using RS-485 Connection

1. Ensure the following conditions exist:
   - The control is physically connected to the RS-485 network
   - TapTalk® is installed on the host computer
   - The control is energized
2. Start the TapTalk program. TapTalk will display the TapTalk **Main** dialog screen.
3. Select **Connect/Com Port** from the **Connect** drop-down menu.



   TapTalk will display the Serial Port dialog screen (Figure 3-14).
4. Ensure that the correct COM port is displayed.
5. Ensure that both the Device and Comm settings are consistent with the control's default values.
6. Select **Connect**. TapTalk will attempt to connect to the target control.
7. If TapTalk returns a Failed to Connect Error screen (Figure 3-3), then repeat Steps 4, 5 and 6.
8. If Level 1 Access is not active or the proper Level 1 or Level 2 access code was entered, then TapTalk will briefly display a "Successfully Connected Level 1/Level 2" confirmation screen, then display the connected version of the TapTalk Main Screen (Figure 3-13) with the appropriate Access Level.
9. If Level 1 Access is active and an invalid access code was entered, then TapTalk will display a "Failed to complete Access Code Verification" error message (Figure 3-4). Select **OK**. TapTalk will briefly display the "Successfully Connected Read-Only Access" screen (Figure 3-5) and then display the connected version of the TapTalk Main Screen (Figure 3-13) with Read-Only permission.

3.5 Fiber Optic Communications

The fiber optic interface is connected to the rear COM Port of the device. It can be enabled through the front panel under the Comm setting menu. When fiber optic is selected, the RS-485 is disabled. The fiber optic baud rate is selectable from 300 to 115200 bps.

The echoing of the received data is supported by the hardware. Switch (located on the side of the control to the right of the TX fiber transmitter connection as viewed from the rear of the control) opened, will disable the echoing feature (echo off). Echo ON is primarily used if the control is in a daisy chain network. Disabling the echo transmission is usually done when there is peer to peer communication. If the client software supports echo canceling, as is the case for TapTalk, then there is no need to disable echo transmission. In this case echo cancel should be enabled on the client software. Physical specification:

- Fiber type: Multi mode
- Tested with fiber size 62.5/125 or 200 HCS™
- 820 nm nominal wavelength

To use TapTalk to interrogate, set, or monitor the M-2001D Digital Tapchanger Control using a Fiber Optic connection the following conditions must be met:

- The control is physically connected to a Fiber Optic network consistent with the hardware and connection requirements of **Section 7.1, External Connections**.
- TapTalk software communication parameters and device parameters must match the control's default Fiber Optic settings and the selected/default device parameters.

Elements of the control's Fiber Optic Port communication parameters include the following (default settings):

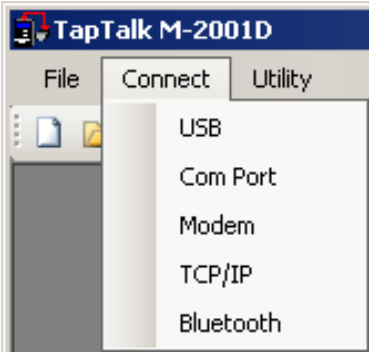
- Baud Rate (115200 bps)
- Sync Time (2 ms)
- Parity (None)
- Stop Bits (1)

Default device parameters that are at the default settings or have been configured locally at the control include (default settings):

- Device (Comm) Address (1)
- Protocol (MODBUS®)
- Echo Cancel (fiber optic) (None)

Communication Using Fiber Optic Connection

1. Ensure the following conditions exist:
   - The control is physically connected to the Fiber Optic network
   - TapTalk® is installed on the host computer
   - The control is energized
2. Start the TapTalk program. TapTalk will display the TapTalk **Main** dialog screen.
3. Select **Connect/Com Port** from the **Connect** drop-down menu.



   TapTalk will display the Serial Port dialog screen (Figure 3-14).
4. Ensure that the correct COM port is displayed.
5. Ensure that both the Device and Comm settings are consistent with the control's default values.
6. Select **Connect**. TapTalk will attempt to connect to the target control.
7. If TapTalk returns a Failed to Connect Error screen (Figure 3-3), then repeat Steps 4, 5 and 6.
8. If Level 1 Access is not active or the proper Level 1 or Level 2 access code was entered, then TapTalk will briefly display a "Successfully Connected Level 1/Level 2" confirmation screen, then display the connected version of the TapTalk Main Screen (Figure 3-13) with the appropriate Access Level.
9. If Level 1 Access is active and an invalid access code was entered, then TapTalk will display a "Failed to complete Access Code Verification" error message (Figure 3-4). Select **OK**. TapTalk will briefly display the "Successfully Connected Read-Only Access" screen (Figure 3-5) and then display the connected version of the TapTalk Main Screen (Figure 3-13) with Read-Only permission.

3.6 Ethernet Communications

The optional Ethernet Port can be purchased as either a RJ-45 (10/100 Base-T) interface or Fiber Optic through ST or SC connectors (100 Base-Fx) for Ethernet communication to the M-2001D. The port supports up to 17 concurrent connections. The maximum number of allowed DNP connections is five. The maximum number of MODBUS® connections is eight. When IEC 61850 is purchased, the maximum number of IEC 61850 connections is four. The port supports DHCP protocol and also allows manual configuration of the Ethernet port. MODBUS protocol "Port Number" and DNP Protocol "Port Number" are required for manual configuration.

■**NOTE:** TapTalk can be used through the Ethernet port and may be considered a MODBUS connection for the purpose of determining how many concurrent connections are allowed.

■**NOTE:** Using Fiber Ethernet requires the Auto Negotiate setting in the control be set to Disable to operate correctly.

Ethernet Fiber Optic Physical Specification:

- Fiber type: Multi mode
- Tested with Fiber size 62.5/125 or 200 HCS™
- 1300 nm nominal wavelength

Communication Using Ethernet Connection

1. Ensure the following conditions exist:
   - The control is physically connected to the Ethernet network
   - TapTalk is installed on the host computer
   - The control is energized
2. Start the TapTalk program. TapTalk will display the TapTalk **Main** dialog screen.
3. Select **Connect/ TCP/IP** from the **Connect** drop-down menu. TapTalk will display the TCP/IP Connection Dialog Screen (Figure 3-16).
4. Enter the Device and TCP/IP parameters for the target control or select from the Address Book.
5. Select **Connect**. TapTalk will attempt to connect to the target control.

6. If TapTalk returns a Failed to Connect Error screen (Figure 3-3), then repeat Steps 4 and 5.
7. If Level 1 Access is not active or the proper Level 1 or Level 2 access code was entered, then TapTalk will briefly display a "Successfully Connected Level 1/Level 2" confirmation screen, then display the connected version of the TapTalk Main Screen (Figure 3-13) with the appropriate Access Level.
8. If Level 1 Access is active and an invalid access code was entered, then TapTalk will display a "Failed to complete Access Code Verification" error message (Figure 3-4). Select **OK**. TapTalk will briefly display the "Successfully Connected Read-Only Access" screen (Figure 3-5) and then display the connected version of the TapTalk Main Screen (Figure 3-13) with Read-Only permission.

If the control is to be connected to a network that does not support DHCP protocol, then the following information must be obtained from the Network Administrator, to be entered locally at the control or remotely utilizing TapTalk:

- IP Address
- Net Mask
- Gateway (may be necessary)

Also, if the network MODBUS® Port address is not "502" or the DNP Port address is not "20000", then the MODBUS and DNP Port settings must be set.

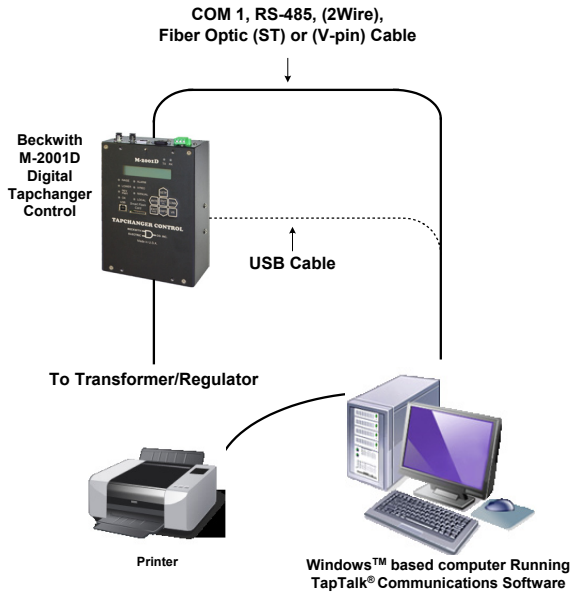


Figure 3-6 Direct Connection

3.7 Bluetooth Communications

Optional Bluetooth

The Bluetooth® option enables wireless access to the M-2001D. Utilizing the Bluetooth wireless feature the user is able to configure the control, read status and metering values, as well as change setpoints.

The Beckwith factory default values for device information are:

- Friendly Name – M2001D-Serial Number
- Mode of Device – Mode0 (discoverable)
- Internal operation status – Standby
- Authentication: None
- Encryption: None

Communication Using Bluetooth Connection

1. Ensure the following conditions exist:
   - The Bluetooth Factory Option is enabled on the control
   - The Bluetooth Status on the control is "Present" and "Connectable"
   - TapTalk is installed on the host computer
2. Start the TapTalk program. TapTalk will display the TapTalk **Main** dialog screen.
3. Select **Connect/Bluetooth** from the **Connect** drop-down menu. TapTalk will display the Bluetooth Connection Dialog Screen (Figure 3-17).
4. Enter the Bluetooth device parameters for the target control or select from the Address Book.
5. Select **Connect**. TapTalk will attempt to connect to the target control.

   The connection time to the control will depend on the distance between the control and the client device and also on the amount of RF interference present.
6. If TapTalk returns a Failed to Connect Error screen (Figure 3-3), then repeat Steps 4 and 5.
7. If Level 1 Access is not active or the proper Level 1 or Level 2 access code was entered, then TapTalk will briefly display a "Successfully Connected Level 1/Level 2" confirmation screen, then display the connected version of the TapTalk Main Screen (Figure 3-13) with the appropriate Access Level.

8. If Level 1 Access is active and an invalid access code was entered, then TapTalk will display a "Failed to complete Access Code Verification" error message (Figure 3-4). Select **OK**. TapTalk will briefly display the "Successfully Connected Read-Only Access" screen (Figure 3-5) and then display the connected version of the TapTalk Main Screen (Figure 3-13) with Read-Only permission.

3.8 Communications with Multiple Controls

▲ **CAUTION:** Each control connected to either a direct or modem connection configuration must have a unique communications address. If two or more controls share the same address, corrupted communication will result.

The remote addressing capability of TapTalk® and the M-2001D Digital Tapchanger Control allows multiple controls to share a direct or network connection. A fiber optic loop network (see Figure 3-7, Fiber Optic Connection Loop), RS-485 tree configuration (see Figure 3-8, RS-485 Connection Tree) or Ethernet Network (see Figure 3-9, Optional Ethernet Network Connection) may also be used.

A control address of zero is a "wild card" that will illicit a response from all controls on a shared connection and result in corrupted communication.

With these arrangements, any control can be selected from within TapTalk by specifying it's unique communications address, ranging from 1 to 200. The communications address must have previously been set from the control's front panel.

3.9 Cautions

Control and TapTalk Compatibility

Every attempt has been made to maintain compatibility with previous control software versions. In some cases (most notably, with older controls), compatibility cannot be maintained. However, TapTalk should work correctly with more than one version of the M-2001D Series Digital Tapchanger Controls on a single bus, provided that the controls are all set to use the same protocol. If there is any question about compatibility, contact the factory.

Control Priority

Control conflicts will not occur as local commands initiated from the front panel receive priority recognition.

Time and Date Stamping

Time and date stamping of events is only as useful as the validity of the control's internal clock. Under the **Configuration/System Clock** menu, the Set Control Date/Time command allows you to manually set the control's clock. For reference, the computer's clock is also displayed.

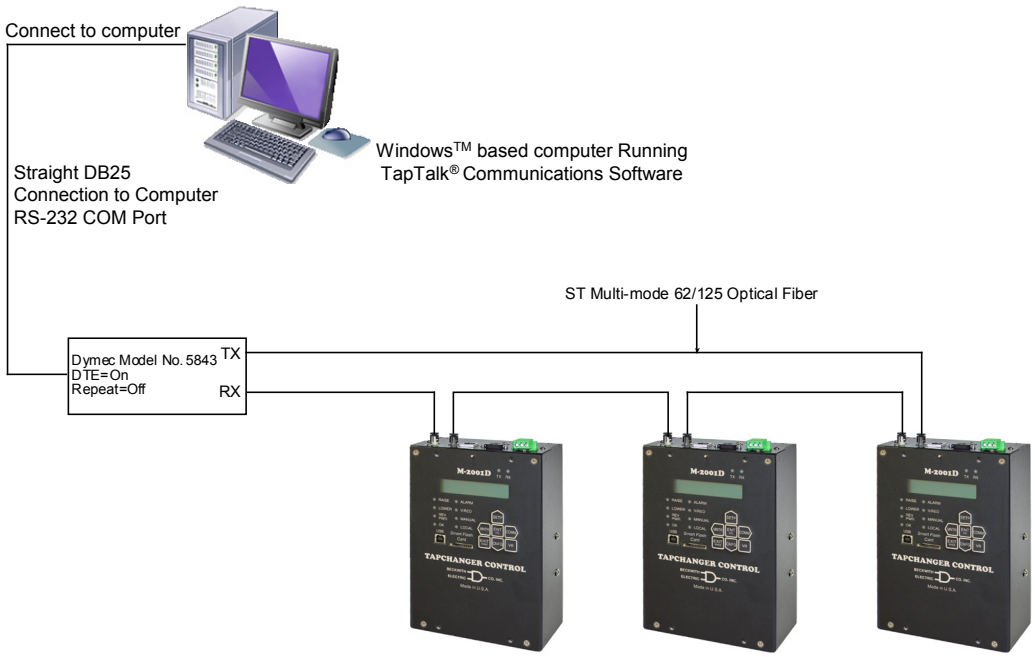


Figure 3-7 Fiber Optic Connection Loop

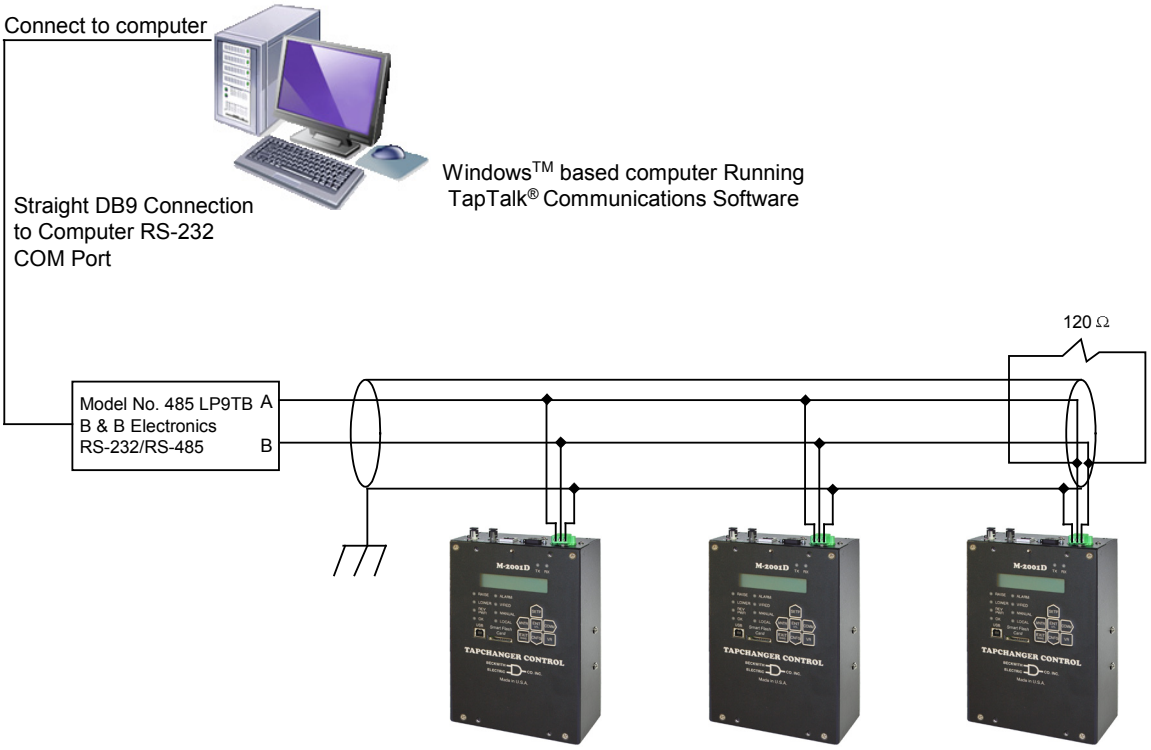


Figure 3-8 RS-485 Connection Tree

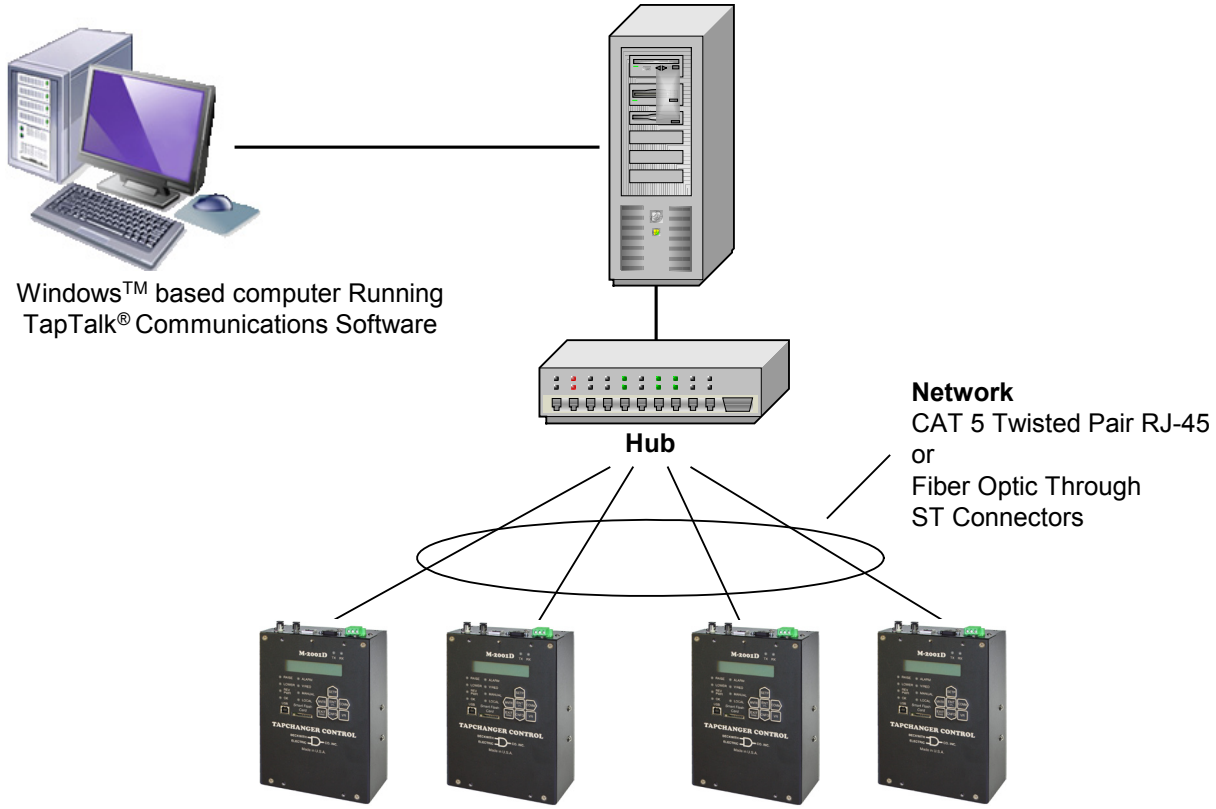


Figure 3-9 Optional Ethernet Network Connection

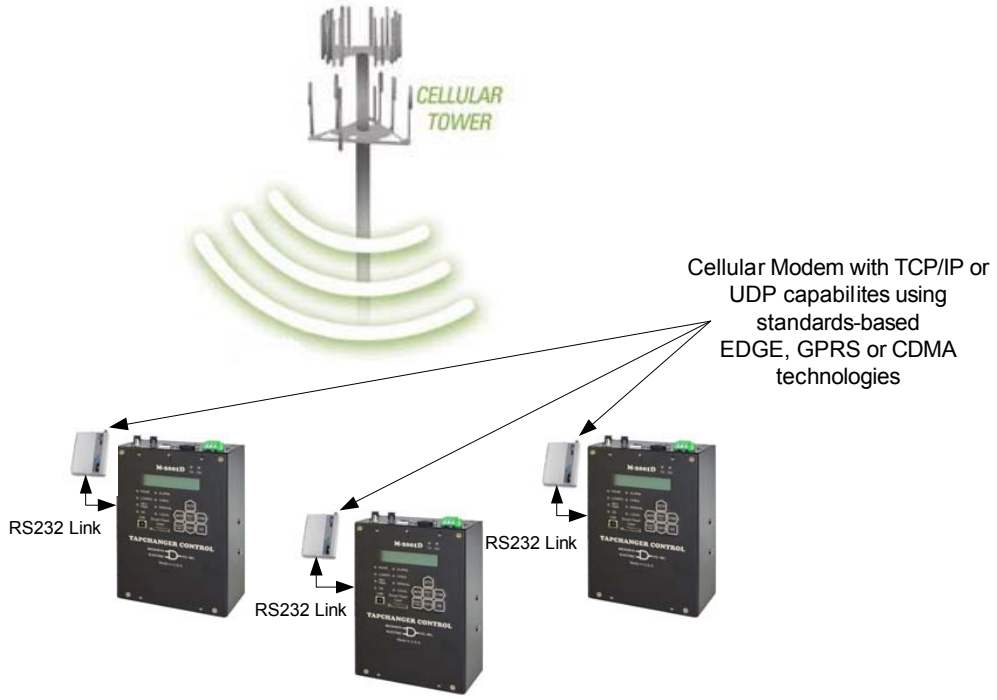


Figure 3-10 Cellular Modem Network

3.10 Overview of Operation

The TapTalk® S-2001D Communications Software can be used to successfully communicate settings and operational commands to the M-2001D as well as access the extensive monitoring and status reporting features. Figure 3-11 represents the TapTalk Main Screen menu structure. TapTalk Main Screen "File Mode" menu structure and TapTalk Main Screen "Connected" menu structure are presented in Figures 3-12 and 3-13 respectively.

This section provides a general description of each TapTalk menu selection and command in the same order as they are displayed in the software program. Those TapTalk features and functions that are covered in other sections of this Instruction Book will be noted and referenced.

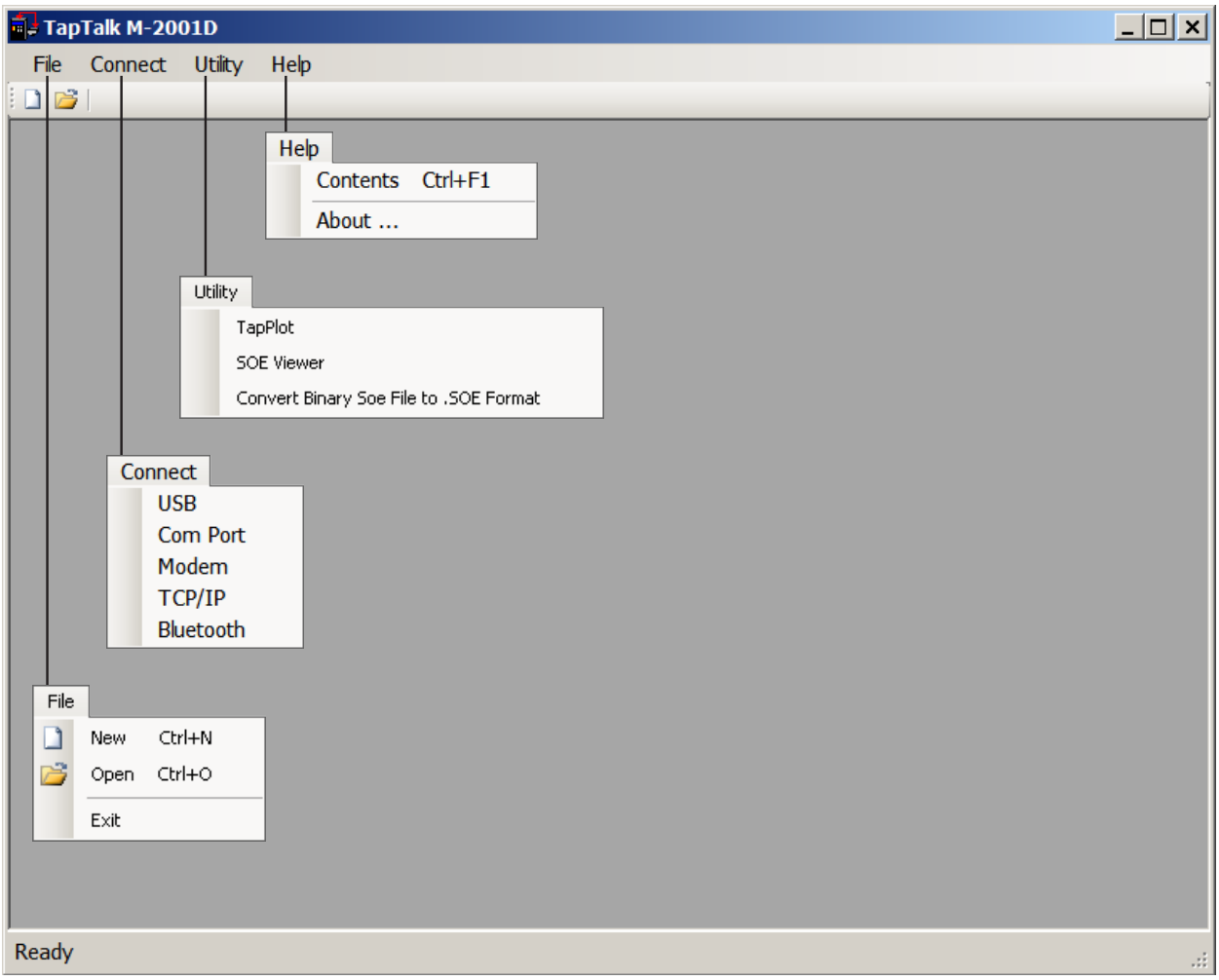


Figure 3-11 TapTalk Main Screen Menu Selections

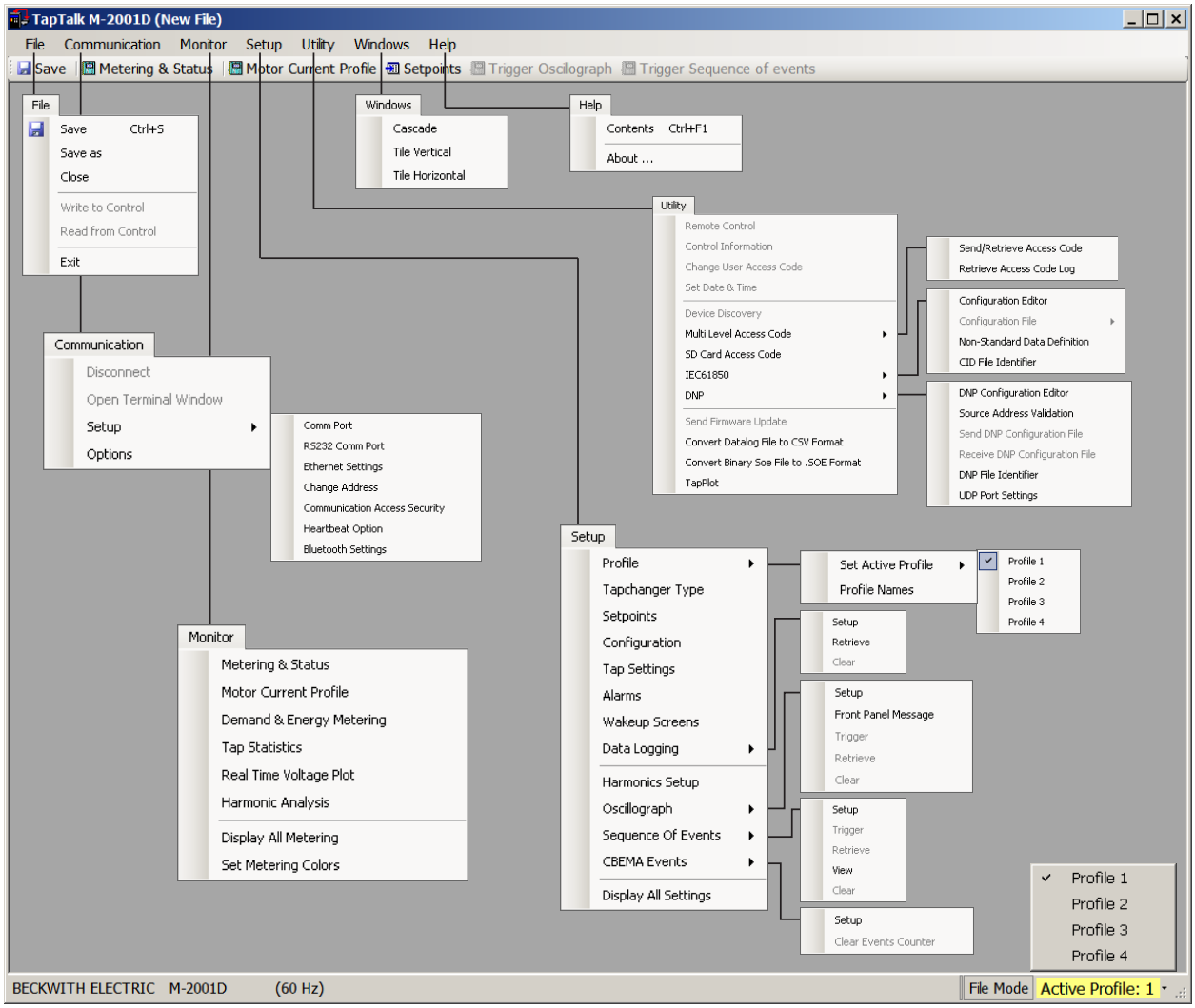


Figure 3-12 TapTalk Main Screen Menu Selections (File Mode)

The TapTalk® Main Screen "Connected" (Figure 3-13) also displays the type of connection that is in effect (top of menu bar), and on the bottom menu bar the Control Time, Firmware Version, Connection Status and Active Setpoint Profile. When in File Mode with a named file open the file name and path to the file are displayed in the top menu bar. Also displayed is the Active Profile in the bottom menu bar.

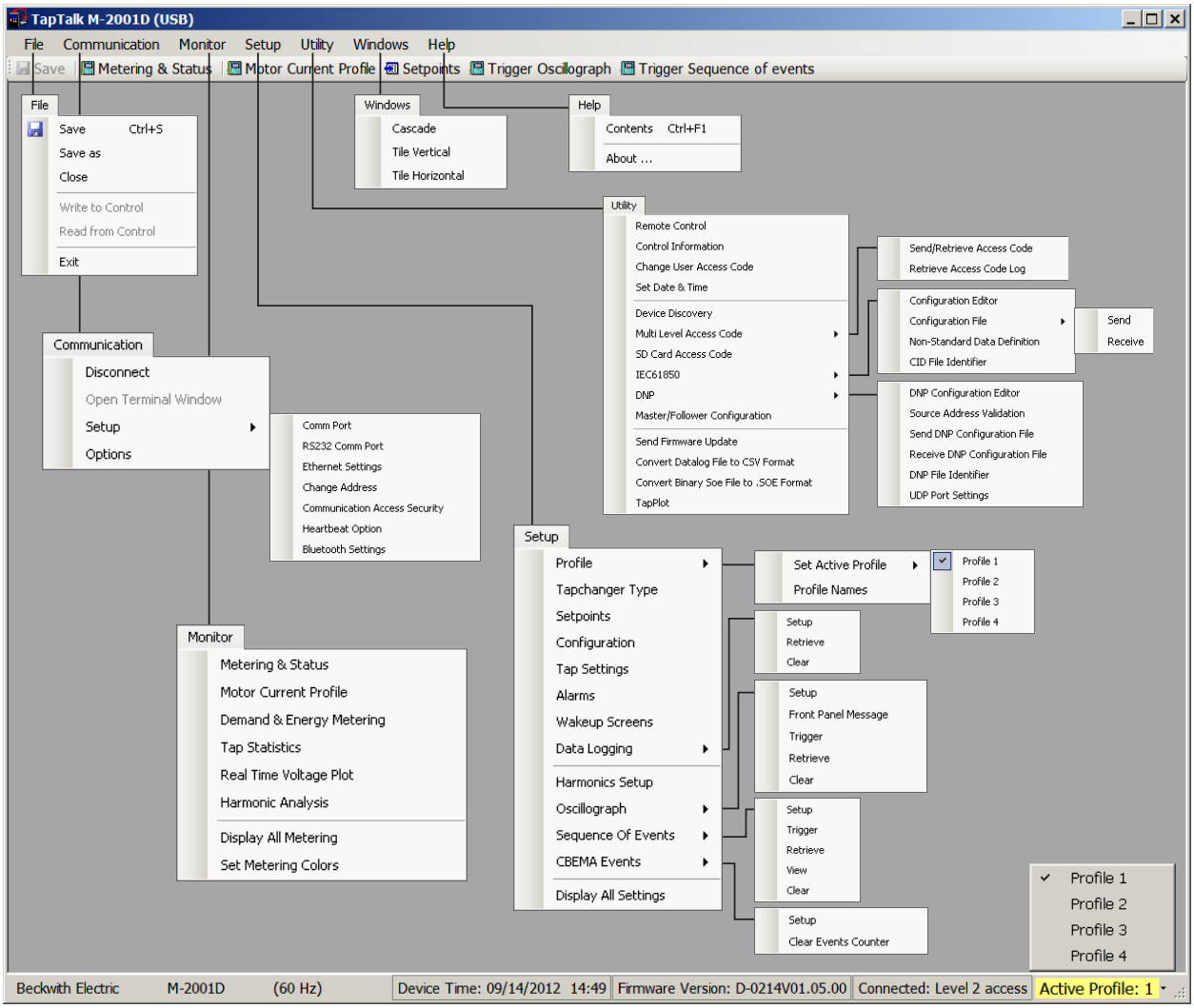


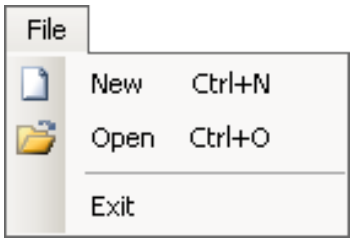
Figure 3-13 TapTalk Main Screen Menu Selections (Connected)

■ **NOTE**: If communication is not established to the unit and no file is open, items relating to settings, utilities, or monitoring are disabled. If not connected but a file is open, monitoring and utilities screens are displayed without data (Tap and Harmonics display simulated data.)

Once installed, the TapTalk® program-item icon is available from the Program Manager and TapTalk can be run like any other Windows™ program (The installation utility places TapTalk in a Program Manager group named Becoware).

File

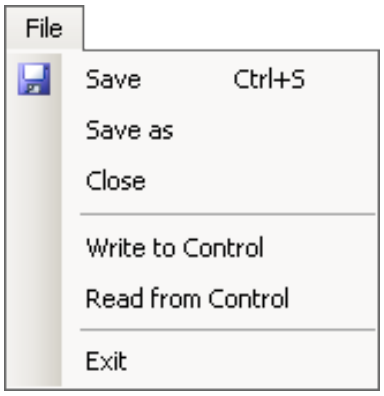
File Not Open or Not Connected Mode



The File drop down menu when TapTalk is not connected to a control or a file is not open provides the following features:

- **New** – Opens the File Information Box to allow the user to select the unit type and nominal frequency.
- **Open** – Opens the file browser window to allow the user to select an existing file. It will not allow the user to create a new file.
- **Exit** – Exits the TapTalk program.

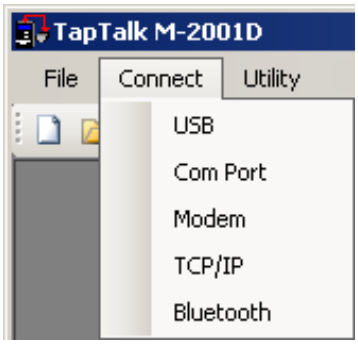
File Open or Connected Mode



The **File** toolbar item when TapTalk is connected to a control or a file is open provides the following features:

- **Save** – Saves the open file.
- **Save As** – Allows the user to save the open file with a different file name.
- **Close** – Closes the open file in the control window.
- **Write to Control** – When connected to a control and no file is previously open, this function allows the user to open a *.cfg file and send the setpoints and configuration to the control in one step.
- **Read from Control** – When connected to a control and no file is previously open, this function allows the user to recall the control profile and save the data to a *.cfg file.
- **Exit** – Exits the TapTalk program.

Connect and Communication



The **Connect** drop down menu is displayed when the unit is not connected to a control. This menu provides the user with access to the screens that are necessary to set TapTalk® communication parameters and connect to the target control. Menu selections include **USB**, **Com Port**, **Modem**, **TCP/IP** and **Bluetooth**.

USB

The USB menu selection initiates the USB dialog screen to connect to the M-2001D USB Port (Figure 3-2). The user is prompted to input the required Device and Access code. The USB/Comm Port selection identifies the PC Comm Port to be utilized for communication.

Com Port

The **Com Port** menu selection initiates the **Serial Port** dialog screen (Figure 3-14). The user is prompted to input the necessary communications information to open Serial communications through the selected Comm Port.

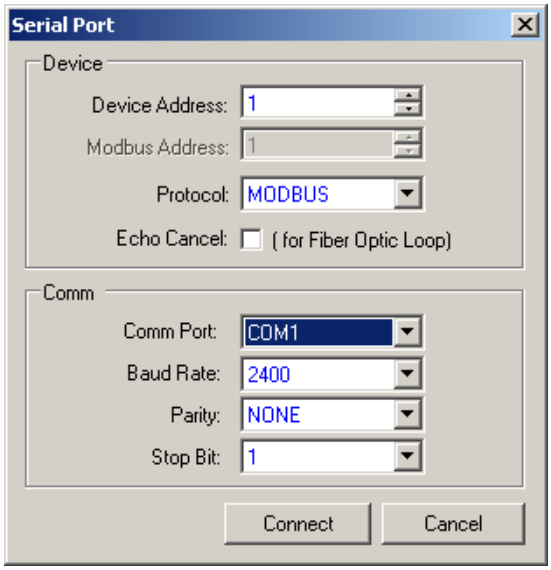


Figure 3-14 Serial Port Connection Dialog Screen

Modem

The Modem menu selection initiates the Modem communication dialog screen (Figure 3-15). This screen contains the Device, Phone, PC Comm Port and Modem parameters that are necessary to setup and communicate with a modem attached to the host PC and the target M-2001D. This screen also contains a phone book, selection of Comm Port or modem and a selection for bringing up a terminal window after dialing.

TCP/IP

The TCP/IP menu selection initiates the TCP/IP communication dialog screen (Figure 3-16). This screen contains the parameter settings for communicating with a M-2001D over a network.

Bluetooth

The Bluetooth menu selection initiates the Bluetooth communication dialog screen (Figure 3-17). This screen contains the parameter settings for communicating with a M-2001D using the optional Bluetooth feature.

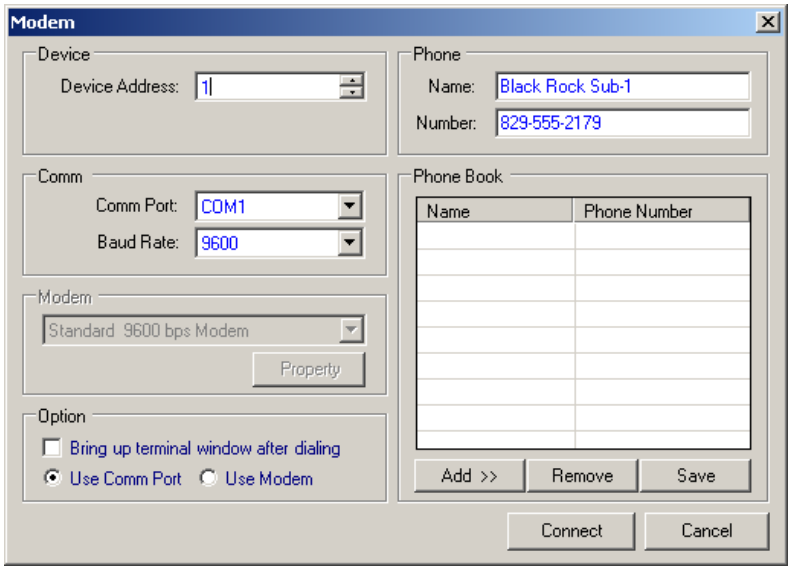


Figure 3-15 Modem Connection Dialog Screen

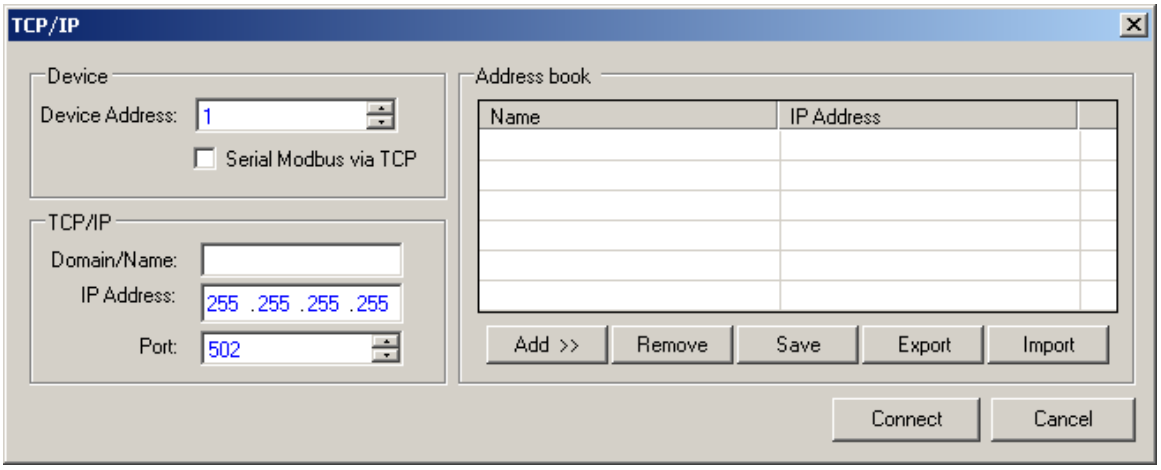


Figure 3-16 TCP/IP Connection Dialog Screen

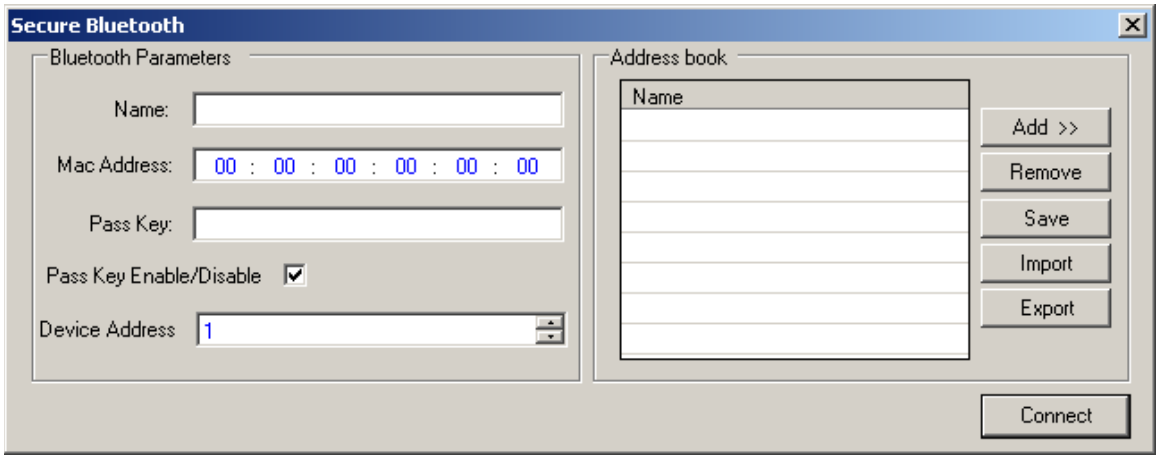
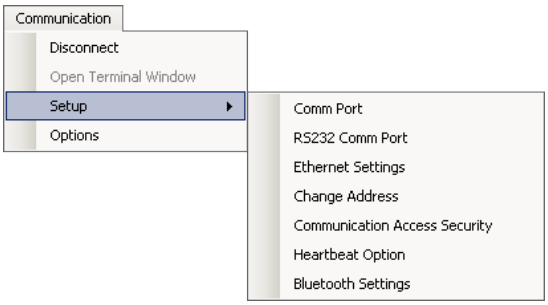


Figure 3-17 Bluetooth Connection Dialog Screen

Communication



The **Communication** drop down menu is displayed when TapTalk is connected to a control. This menu provides the user with access to the screens that are necessary to **Disconnect** from the target control, initiate the **Open Terminal Window** feature or access the **Setup** menu items.

Disconnect

The Disconnect menu item when selected prompts the user to confirm (Figure 3-18) the disconnect command.

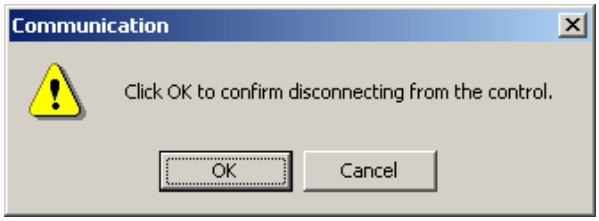


Figure 3-18 Disconnect Command Confirmation Screen

Open Terminal Window

Not Available at this time.

Communication/Setup

The **Setup** submenu provides the user with the capability to setup and configure the standard RS485 Fiber Optic Port. Also, the Setup submenu provides for the setup and configuration of the RS-232 port, optional Ethernet and Bluetooth® communication features.

The Communication/Setup submenu also provides the user with access to the Change Address, Communication Access Timeout and HeartBeat settings.

Communication/Setup/Comm Port

See Chapter 4, **Section 4.1 System Setup** for details regarding the selection of Comm Port settings (Figure 3-19) when the RS-485/Fiber Optic rear Comm Port is present.

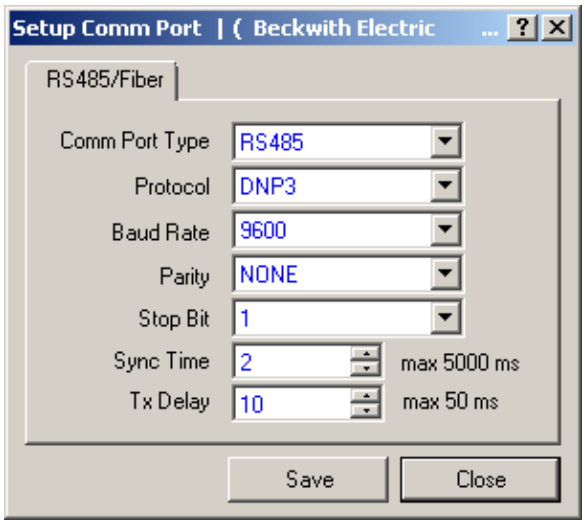


Figure 3-19 Setup Comm Port Dialog Screen

Communication/Setup/RS-232 Comm Port

See Chapter 4, **Section 4.1 System Setup** for details regarding the selection of RS-232 Comm Port Settings (Figure 3-20) when the RS-232 Comm Port is present.

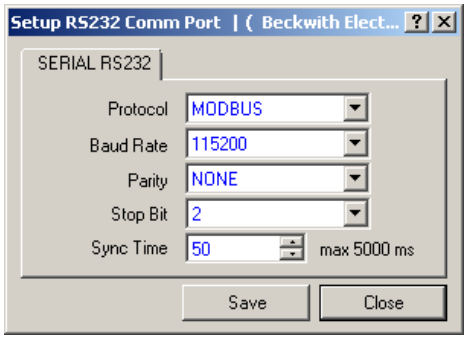


Figure 3-20 Setup RS-232 Comm Port Dialog Screen

Communication/Setup/Ethernet

See Chapter 4, **Section 4.1 System Setup** for detailed information regarding the selection of Ethernet Port Settings when the Ethernet Port is present.

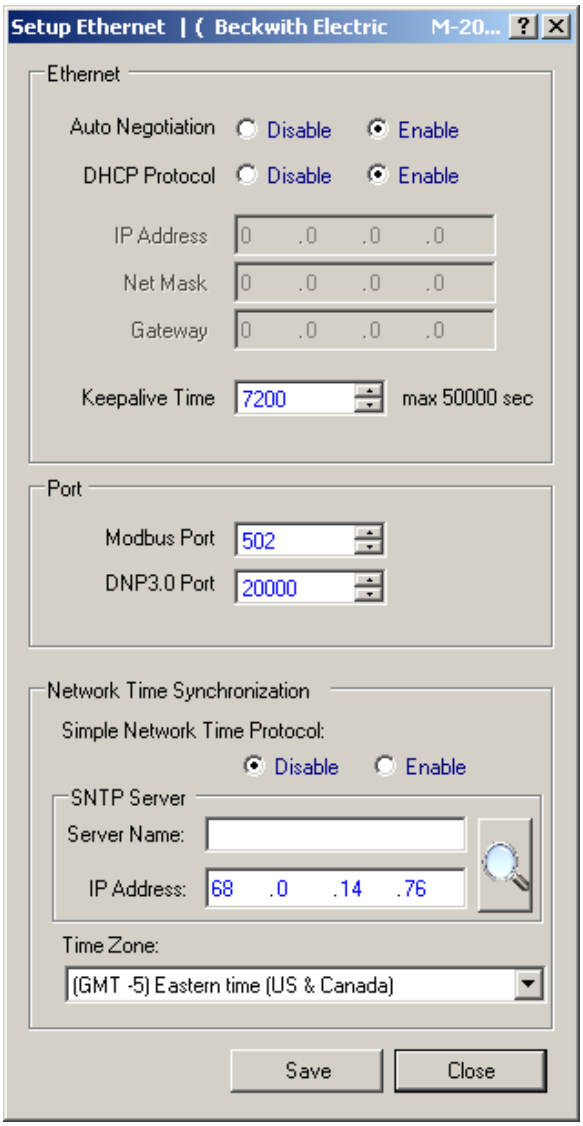


Figure 3-21 Ethernet Setup Dialog Screen

Communication/Setup/Change Address

Multiple Control Addressing

To modify the Control Communication Address, the user can do so from the Change Communication Address screen (Figure 3-22). The Communication Address is used for both MODBUS® and DNP protocols. Substation and Feeder Addresses apply only to DNP protocol (see Substation and Feeder Addresses definition in **Chapter 4, Feeder and/or Substation Addressing**).

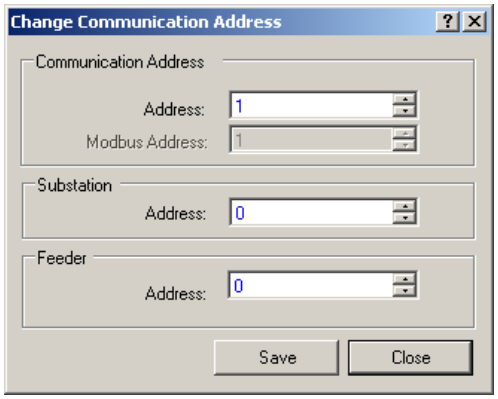


Figure 3-22 Change Communication Address Dialog Screen

When Change Address submenu item is selected, TapTalk® will respond with a confirming dialog screen (Figure 3-23), As long as communication to the remote location is maintained, the user can switch between controls.

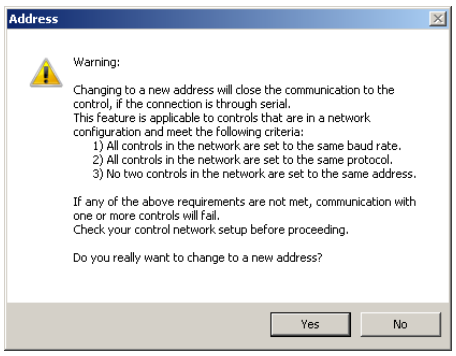


Figure 3-23 Change Address Warning Screen

Change Address/Miscellaneous

Save – The **Save** command saves the Address change to the control when TapTalk is connected to a control.

Close – The **Close** command cancels any Address changes before the changes have been sent to the control.

Communication/Setup/Communication Access Security

When Communication Access Security is enabled it applies only when MODBUS has been selected regardless of the physical interface. If enabled, the user Level Access Code must match either the Level 1 or Level 2 Access Codes in order to be granted the access to control settings ascribed to each Level. See **Section 4.1 System Setup** for detailed information. If an invalid Access Level Code is entered at the connection prompt, then read only access will be granted. TapTalk® must be closed for the timeout period specified (1 to 50,000 seconds) in order for any Access Code changes to take effect when this feature is enabled. The setting range is from 1 to 50,000 seconds. See **Section 4.1, System Setup** for details regarding selection of connection timeout features.

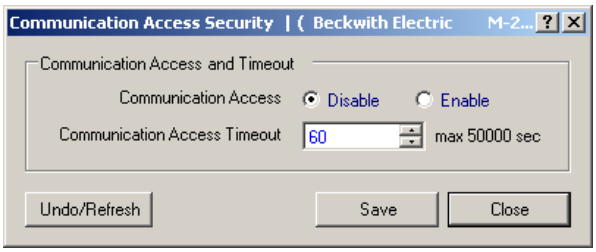


Figure 3-24 Communication Access Security Dialog Screen

Communication/Setup/HeartBeat Option

The purpose of the SCADA HeartBeat feature is to have two sets of settings for the control and switch between these two setting sets based on the presence or absence of SCADA communications (utilizing the DNP protocol) to the control. The SCADA HeartBeat feature can be enabled from TapTalk Communications software. There are four different types of SCADA HeartBeat modes that can be selected:

- SCADA HeartBeat for transformer control applications (LTC)
- SCADA HeartBeat for regulator control applications (Regulator)
- Profile Switching (DNP)
- Profile Switching (GOOSE)

See **Section 4.1 System Setup** for details regarding Enabling/Disabling and selecting control type.

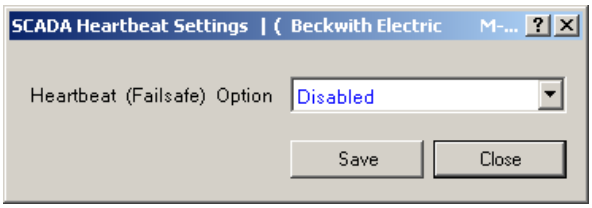


Figure 3-25 HeartBeat Option Screen

Communication/Setup/Bluetooth® Settings

The Bluetooth Information dialog screen provides the user with the capability to setup Bluetooth communication parameters and also initiate a "Reset" of the Bluetooth module. See Chapter 4, **Section 4.1 System Setup** for detailed information.

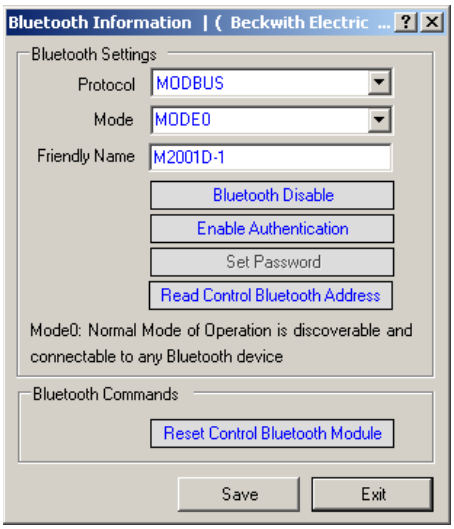


Figure 3-26 Bluetooth Information Dialog Screen

Communication/Options

This feature allows the user to enable RS-232 and the optional Bluetooth module if equipped.

TapTalk provides the means to enable or disable installed RS-232 and Bluetooth modules. This capability is provided by a communication options utility under the Communications menu. Prompts to enable communication hardware are also contained in the individual port setup menus.

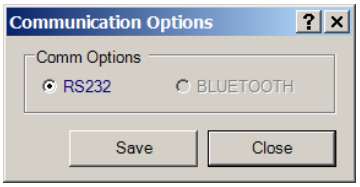
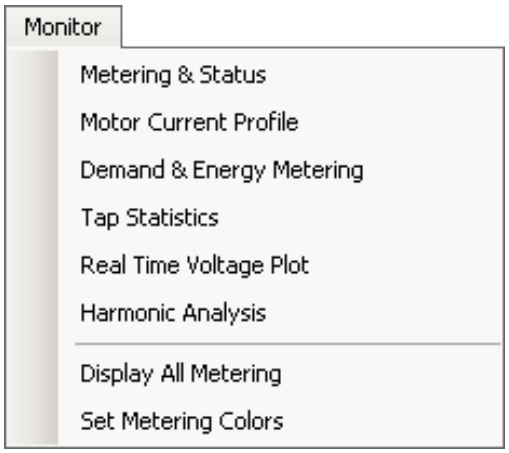


Figure 3-27 Communication Options Dialog Screen

MONITOR



The **Monitor** toolbar item provides the user with the means to display the control's **Metering & Status**, **Motor Current Profile, Demand & Energy Metering, Tap Statistics, Real Time Voltage Plot, Harmonic Analysis, Master/Follower Alarm Messages, Display All Metering** and **Set Metering Colors** screens. The data that is displayed is only available when communication is established between the control and the PC.

MONITOR/METERING & STATUS

The **Metering & Status** submenu item displays the **Metering & Status** Screen (Figure 3-28). Values displayed are updated depending on communication system capabilities.

PRIMARY STATUS (Single or Three-Phase)

Voltage – Displays the calculated primary voltage based on the user-selected voltage multiplier, VT corrections, and measured secondary voltage.

Source Voltage – Displays the calculated primary source voltage based on the user selected source voltage multiplier, source VT corrections and source secondary voltage.

Current – Displays the calculated primary current based on the user-selected current multiplier, and measured secondary current.

Watts – Displays the calculated primary quantity based on the user-selected voltage and current multipliers; VT configuration (line-to-line or line-to-ground), single-phase or three-phase, and measured secondary voltage and current.

VAr – Displays the calculated primary quantity based on the user-selected voltage and current multipliers, VT configuration (line-to-line or line-to-ground), single-phase or three-phase, and measured secondary voltage and current.

VA – Displays the calculated primary quantity based on the user-selected voltage and current multipliers, VT configuration (line-to-line or line-to-ground), single-phase or three-phase, and measured secondary voltage and current.

REMOTE VOLTAGE BIAS

Voltage

Displays the Remote Voltage value provided to the control utilizing either DNP 3.0, MODBUS or IEC 61850 protocols. If a voltage value is present the control is utilizing the Remote Voltage Bias Voltage to control.

SECONDARY STATUS

Load Voltage – Displays the real-time measured value of voltage at the regulator or transformer and includes any corrections made using the user-selected VT correction voltage.

Meter Out Voltage – Displays the measured voltage at the terminals of the M-2001D without any software modifications. Used as the base for normalizing voltage.

Source Voltage – Displays the calculated primary source voltage based on the user selected source voltage multiplier, source VT corrections and source secondary voltage.

Compensated Voltage – Displays the calculated voltage at the "load center".

Normalizing Voltage – A Normalizing Voltage Multiplier with a range of 0.80 to 1.20 is available to be applied to Meter Out Voltage and displayed in real time as Normalizing Voltage.

Load Current – Displays the real-time measured value of current.

Power Factor – Displays the real-time calculated value of power factor.

Frequency – Displays the real-time measured frequency value.

Circulating Current – Displays a representative value of circulating current, if the control is used with a Beckwith Electric M-0115A Parallel Balancing Module, or its equivalent.

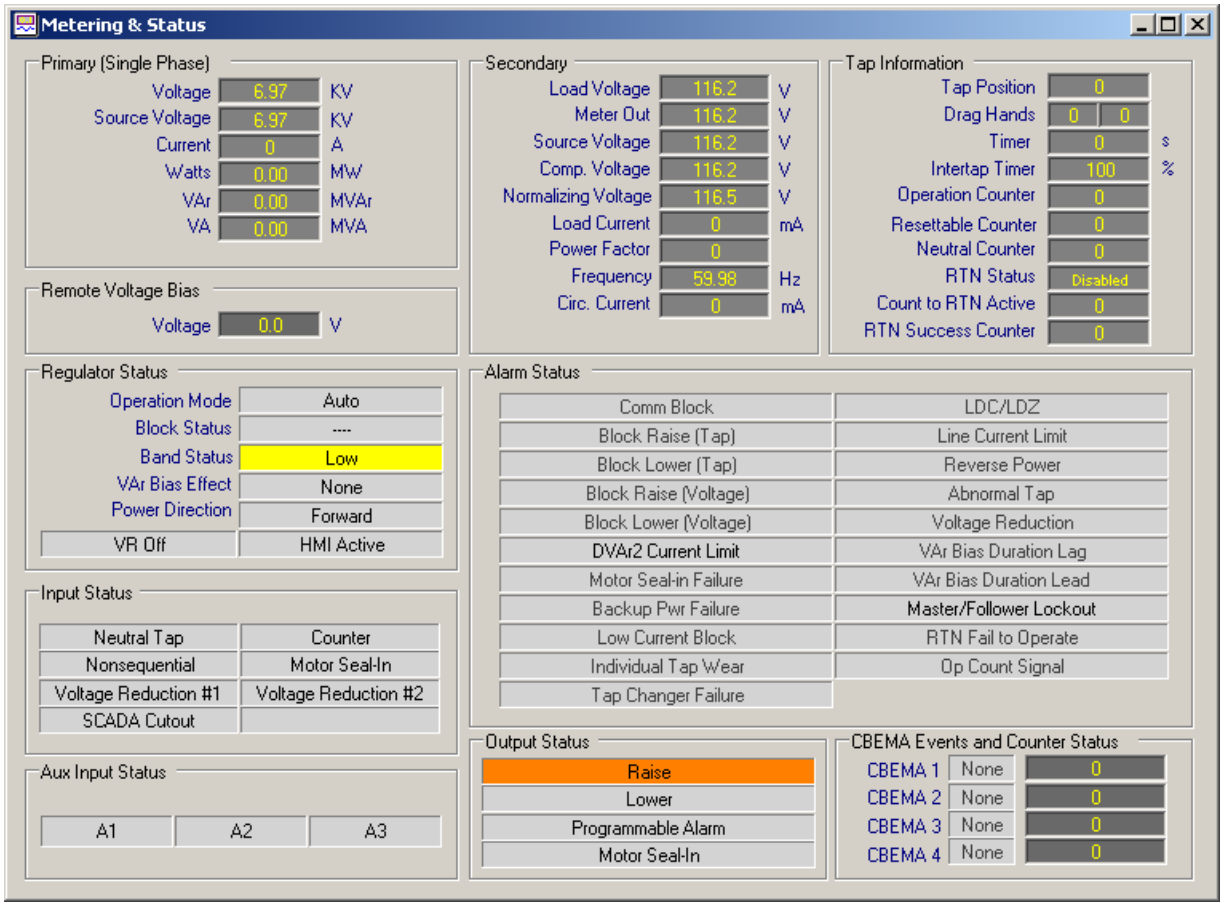


Figure 3-28 Metering and Status Screen

TAP INFORMATION

Tap Position – Displays the tap position of the tapchanger when any method of KeepTrack™ is used. Recognizes tapchanges commanded via manual, automatic or external (SCADA) means.

Drag Hands – Displays the tap position Drag Hands values for each direction.

Raise Timer – Displays the integrated out-of-band time for a voltage excursion greater than the upper band limit up to the value of the time delay setpoint.

Lower Timer – Displays the integrated out-of-band time for a voltage excursion less than the lower band limit up to the value of the time delay setpoint.

Intertap Timer – In the sequential mode of operation, displays the integrated out-of-band time for a voltage excursion and the subsequent tap-change. Adjustable from 0 to 60 seconds, in 1 second increments, with a factory setting of 0 seconds.

Operation Counter – Records the number of raise and lower operations. The operation counter will advance by one or two counts, as set by the user, for each open-close-open contact operation. This counter is not resettable.

The counter accommodates 999,999 operation counts and the number of counts stored in memory is not affected by a loss of supply power. Total operation count is displayed in the Status Menu. This counter cannot be reset, but can be preset to any value up to 999,999 in the Configuration menu.

Resettable Operations Counter

A second, resettable operations counter operates with the method selected by X1/X2/Count Window. The user resets this counter to zero by pressing ENT while viewing the resettable operation counter screen within the Status Menu. No password is required to reset the resettable operations counter.

■ **NOTE**: The counter will only increment with a connection to the counter input.

Neutral Switch Counter

The Neutral Switch Counter is updated each time the neutral input is detected. Neutral Switch Counter can also preset to any value. The Neutral Switch Counter is a software counter that is stored in non-volatile memory and has a maximum value of 1,000,000.

RTN Status

Displays the "Run Through Neutral" feature status (Enabled or Disabled).

Count Towards RTN

Displays the number of counter operations since the operations between runs setting was set, or since the feature was enabled. The counter will reset to zero if the feature is enabled and successfully runs through neutral.

RTN Counter

The RTN Counter will increment after each successful operation of the Run Through Neutral feature.

TAPCHANGER STATUS

Operation Mode (Auto)

Gray Background – Indicates that the control is in automatic mode of operation.

Yellow Background – Indicates Automatic but some Limits in effect.

Red Background – Indicates Auto Operation Blocked.

Block Status – Indicates blocks that are active.

Band Status – Indicates one of three conditions: **High**, when voltage is out of band high, **Low** when voltage is out of band low, and **OK** when voltage is within band.

VAr Bias Effect

Indicates one of three conditions when enabled. If the control has determined that the absolute reactive power is >¾ of the Max Cap Bank Setting and the inverse timer has timed out, then the control will increase the effective bandcenter by 1 Volt depending on the direction of the reactive power and will either indicate "Bandcenter Raise" for negative reactive power or "Bandcenter Lower" for positive reactive power. If the absolute power is <¾ of the Max Cap Bank Setting then the display will indicate "None".

Whenever VAr Bias is in effect, the control will display the "VAr Bias in effect" message on the display and the appropriate Raise/Lower LED will flash.

Power Direction – Indicates one of two power directions: **Forward** (forward power condition) and **Reverse** (reverse power condition).

Voltage Reduction VR Off – Indicates voltage reduction is not active, blocked either by non-sequential input, a reverse power condition, or by communicated command. Steps 1, 2, and 3 indicate that voltage reduction is in effect for the stated step value.

HMI Active Mode – Indicates (Yellow) that HMI menu at the control is active.

ALARM STATUS

There are three available states designated by color for each of the Alarm Status elements:

- Gray with Dark Gray Text – Alarm disabled.
- Gray with Black Text – Alarm enable and condition not met
- RED – Alarm enabled and condition exists

Comm Block

The control has had its automatic operation blocked via communications and is now in manual operation mode and the alarm output is on due to this condition.

Block Raise (Tap)

The tap position equals or exceeds the block raise tap limit setting and the alarm output is on due to this condition.

Block Lower (Tap)

The tap position equals or exceeds the block lower tap limit setting and the alarm output is on due to this condition.

Block Raise (Voltage)

The tap position equals or exceeds the block raise voltage limit setting and the alarm output is on due to this condition.

Block Lower (Voltage)

The tap position equals or exceeds the block lower voltage limit setting and the alarm output is on due to this condition.

DVar2 Load Current Limit – DVar2 Load Current is exceeding the respective maximum current limit setting and the alarm output is on due to this condition.

Motor Seal-In Failure – Indicates that motor current has not been detected for a period 15 seconds after a Raise or Lower command has been executed. This event must occur two consecutive times for this alarm to occur.

Backup Pwr Failure – Indicates the absence of Backup Power circuiting when Backup Power option has been detected.

Low Current Block – When enabled the control determines if Load Current following a tap change is less than 4 mA, coincident with Tap Delta Voltage being less than 4 VAC. When these conditions exist the control will initiate an alarm and block regulation.

Individual Tap Wear

The number of operations on any single tap exceeds the Individual Tap Wear Alarm setting.

Tap Changer Failure

When the Operation Counter Configuration is set to "Cam Follower" and this alarm has been enabled, indicates the counter contact input has detected a Tap Changer Failure condition.

A Cam Follower contact is a cam driven contact which is normally closed when the Tapchanger is at rest, and opens and closes once during each tap operation in either direction. If this contact does not open and close within 30 seconds after the control issues a Raise or Lower in either local automatic or remote manual operational modes, this alarm will activate. This alarm can be reset either by the Cam Follower contact operating correctly during a subsequent Raise or Lower operation, or if reset by the user.

LDC/LDZ

Any value other than zero has been set for LDC/LDZ.

Line Current Limit

The line current is exceeding the respective maximum current limit setting and the alarm output is on due to this condition.

Reverse Power

Reverse power is present at the control and the alarm output is on due to this condition.

Abnormal Tap Position

Abnormal Tap Position is indicated when the alarm is enabled, KeepTrack™ is enabled and the neutral input is detected but the present tap position at that instant is neither at minus one nor plus one. The Abnormal Tap Position Alarm will also be activated when the Motor Seal-in Failure detection feature has detected a Motor Seal-in Failure.

Voltage Reduction

Any level of voltage reduction is active.

VAr Bias Lead or Lag – Indicates when the VAr Bias effect (Lead or Lag) has exceeded the time limit imposed by the Max VAr Bias Duration Setting.

Master/Follower Lockout

There are two types of lockout conditions, Master lockout and Follower lockout. Any lockout of the paralleling mode will set the Master/Follower Lockout Alarm. When a lockout condition exists, the control issuing the lockout will stop any further GOOSE publishing and will stop load voltage regulation. Also, the alarm can be configured as a DNP event, or as a report in case of IEC 61850. The lockout state will be displayed on the control front panel display and in the Master/Follower Configuration Tool (Figure 3-87).

■ **NOTE**: Master/Follower Alarm messages can be observed for the connected control from the TapTalk® Monitor/Master/Follower Alarm messages menu item (Figure 3-34).

RTN Fail

The RTN Fail alarm will actuate when the "Maximum RTN operations before Alarms" setting has been exceeded.

Op Count Signal

The total number of operations has exceeded the Operations Counter Alarm Limit setting.

INPUT STATUS

Neutral Tap – Indicates (Green) neutral position contact input is closed.

Counter – Indicates (Green) operation counter contact input is closed.

Non-Sequential – Indicates (Green) Non-sequential contact input is closed. Tapchanger control blocks raise or lower operation on a sustained closed contact.

Motor Seal-in – Indicates (Green) when motor power is applied.

Volt Reduction 1 – Indicates (Green) Step 1 voltage reduction contact output is closed.

Volt Reduction 2 – Indicates (Green) Step 2 voltage reduction contact output is closed.

SCADA Cutout – Indicates (Green) SCADA (switch) input is closed. Tapchanger control blocks Raise or Lower operation.

OUTPUT STATUS

Raise – Indicates (Green) when a Tap Raise output is active. Limited by tap Block Raise setpoint and tap position limit settings.

Lower – Indicates (Green) when a Tap Lower output is active. Limited by tap Block Lower setpoint and tap position limit settings.

Programmable Alarm – Indicates (Green) when a Programmable Alarm condition is true.

Motor Seal-In – Indicates when a Motor Seal-In Output in active.

CBEMA EVENTS AND COUNTER STATUS

When the Load Voltage is sagging or swelling greater than the pickup setting, then a pickup status will be set after a minimum duration, in addition to incrementing a counter.

Up to 4 CBEMA events can be set and enabled allowing the control to trigger a Sequence of Events record when each event occurs. Also, the control will report both the time and duration of each event via DNP. These 4 settings allow the control to be set to record violations of the ITIC curves (formerly known as CBEMA curves).

AUX INPUT STATUS

Indicates (red) when the Auxiliary Input is active.

Monitor/Motor Current Profile

The M-2001D Tapchanger Control measures the motor current during tapchange operation. The motor current is sampled at 64 samples per cycle and the total RMS value of the current is computed every cycle (60 Hz or 50 Hz cycle). The dynamic range of the current measurement is from 0 to 10 A.

The tapchange start signal is generated when the motor current exceeds a threshold value (user programmable or fixed at a small value such as 0.1 A). The tapchange operation is considered complete when the counter contact input is generated. If the tapchanger is making multiple tapchanges where the current is not interrupted between tapchanges then the counter contact can be used to decide the completion of one tap before the start of the next tap.

The following parameters are logged for the motor current profile:

- Average RMS value of the motor current (once every cycle for the complete duration of the tapchange)
- Total duration of the tapchange in ms
- Peak RMS value of the motor current

The Sequence of Events Recorder will trigger when any of the following conditions occur:

■ **NOTE**: The average RMS current is the average of the RMS current for the tapchange duration.

- Peak RMS current exceeds a certain percent (programmable from 110% to 200%) of the stored peak current which was recorded during the training mode.
- Average RMS current exceeds a certain percent (programmable from 110% to 200%) of the stored average RMS current which was recorded during the training mode.
- Total duration of the tapchange exceeds a certain percent (programmable from 110% to 200%) of the stored value which was recorded during the training mode.

The training mode will be used during the commissioning of the Tapchanger Control. In this mode twenty tapchange operations will be manually conducted and the average profile stored in non-volatile memory. This profile will be compared with the profile during normal tapchange operation to trigger the Sequence of Events Recorder when the above conditions occur.

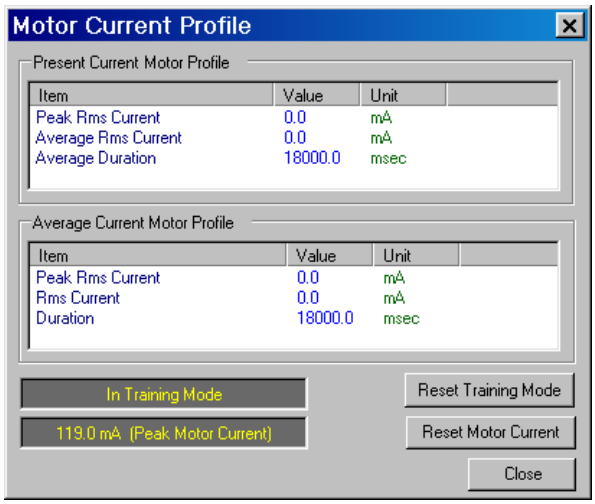


Figure 3-29 Motor Current Profile Dialog Screen

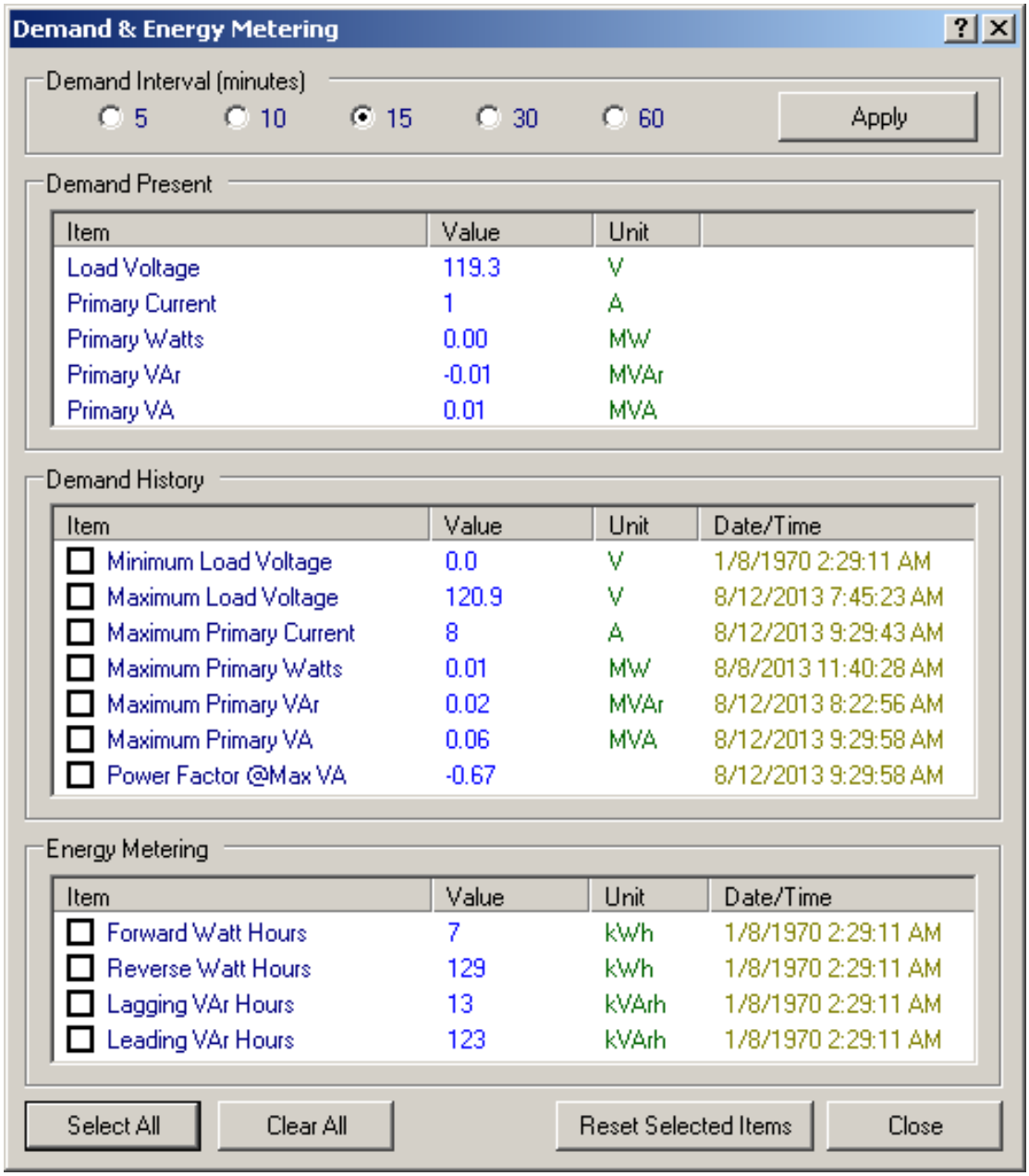


Figure 3-30 Demand & Energy Metering Dialog

Monitor/Demand & Energy Metering

The **Demand & Energy Metering** submenu item displays the **Demand & Energy Metering** screen (Figure 3-30). Real-time demand and metering information can be monitored from an addressed control.

Demand Interval

The Demand Interval applies to the Demand Present Primary Current (Amps) parameter and the Demand History parameters. The Demand Interval can be set to 5, 10, 15, 30, and 60 minutes.

Demand Present

The Demand Present Primary Current parameter value follows the concept of a lagged demand meter. The demand time interval is selected by the user as 15, 30 or 60 minutes. This is the time it takes for a thermal meter to indicate 90% of a change in load.

Load Voltage – Displays the real-time measured value of voltage at the regulator or transformer. This value continuously averaged over consecutive 32-second intervals.

Primary Current – Displays the calculated primary demand current based on the user-selected current multiplier and measured secondary current.

Primary Watts – Displays the real time demand value base on the user-selected voltage and current multipliers; VT configuration (line-to-ground or line-to-line), single-phase or three-phase, and measured secondary voltage and current.

Primary VAr – Displays the real time demand value based on the user-selected voltage and current multipliers, VT configuration (line-to-ground or line-to-line), single-phase or three-phase, and measured secondary voltage and current.

Primary VA – Displays the real time demand value based on the user-selected voltage and current multipliers, VT configuration (line-to-ground or line-to-line), single-phase or three-phase, and measured secondary voltage and current.

Demand History

All demand history values (single phase) include the date and time at which each occurred. A drag hand value is the maximum or minimum value of a measured quantity recorded since the last reset.

Minimum Load Voltage – Displays minimum local voltage at the regulator or transformer. This value continuously averaged over consecutive 32-second intervals.

Maximum Load Voltage – Displays drag hand maximum local voltage at the regulator or transformer. This value continuously averaged over consecutive 32-second intervals.

Maximum Primary Current – Displays drag hand maximum primary current.

Maximum Primary Watts – Displays drag hand maximum primary watts.

Maximum Primary VAr – Displays drag hand maximum primary VArs.

Maximum Primary VA – Displays drag hand maximum primary VA. Resets automatically when Power Factor at (Max) VA value, below, is reset.

Power Factor @ Max VA – Displays drag hand power factor at time of maximum VA.

Energy Metering

The **Energy Metering** section of the **Demand & Energy Metering** screen displays the **Energy Metering** parameters. This feature enables the user to review real-time and historical demand metering information (Single Phase). This section includes Forward and Reverse Watt Hours and Forward and Reverse VAr Hours.

Miscellaneous

Each element of the Demand History and Energy Metering can be reset individually by selecting the desired parameter(s) and then selecting **Reset Selected Items.** When the **Reset** command is issued, the metered value is reset to zero and the time and date are updated

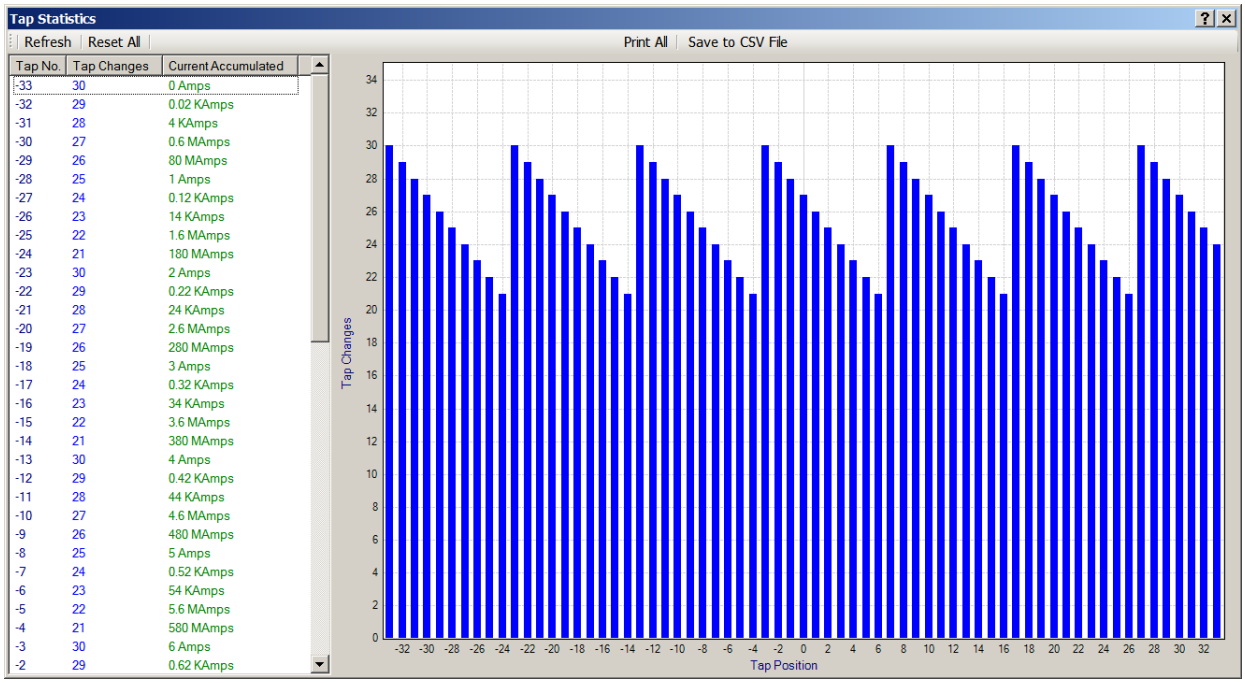
Select All – Allows the user to select all parameters.

Clear All – Allows the user to reset all parameter values.

Reset Selected Items – Allows the user to reset only the selected parameter values.

Monitor/Tap Statistics

The **Tap Statistics** submenu item displays a statistical representation of the Tapchanger operation (Figure 3-31). The cumulative (since last visit) number of tapchanges and the Accumulated Primary Current for each tap position is displayed both graphically and numerically. Selecting **Refresh** updates tap statistical data. Selecting **Reset All** resets all tap statistic counters to zero and clears the Individual Tap Wear Alarm in the Metering & Status screen. Selecting Save to CSV File allows the user to save the tap statistics as a ".csv" file which can be read by a spreadsheet program.



Tap No.	Tap Changes	Current Accumulated
-33	30	0 Amps
-32	29	0.02 KAmps
-31	28	4 KAmps
-30	27	0.6 MAmps
-29	26	80 MAmps
-28	25	1 Amps
-27	24	0.12 KAmps
-26	23	14 KAmps
-25	22	1.6 MAmps
-24	21	180 MAmps
-23	30	2 Amps
-22	29	0.22 KAmps
-21	28	24 KAmps
-20	27	2.6 MAmps
-19	26	280 MAmps
-18	25	3 Amps
-17	24	0.32 KAmps
-16	23	34 KAmps
-15	22	3.6 MAmps
-14	21	380 MAmps
-13	30	4 Amps
-12	29	0.42 KAmps
-11	28	44 KAmps
-10	27	4.6 MAmps
-9	26	480 MAmps
-8	25	5 Amps
-7	24	0.52 KAmps
-6	23	54 KAmps
-5	22	5.6 MAmps
-4	21	580 MAmps
-3	30	6 Amps
-2	29	0.62 KAmps

■ **NOTE:** By pointing the mouse to any bar, the corresponding tap statistic will be highlighted as well as displayed in a tool tip.

Figure 3-31 Tap Statistics Screen

Monitor/Real Time Voltage Chart

The Real Time Voltage Chart (Figure 3-32) feature allows the user to monitor in real time the last 60 seconds of the source voltage value and load voltage. The Voltage Chart freezes the last 30 seconds of the voltage profile and displays the current values.

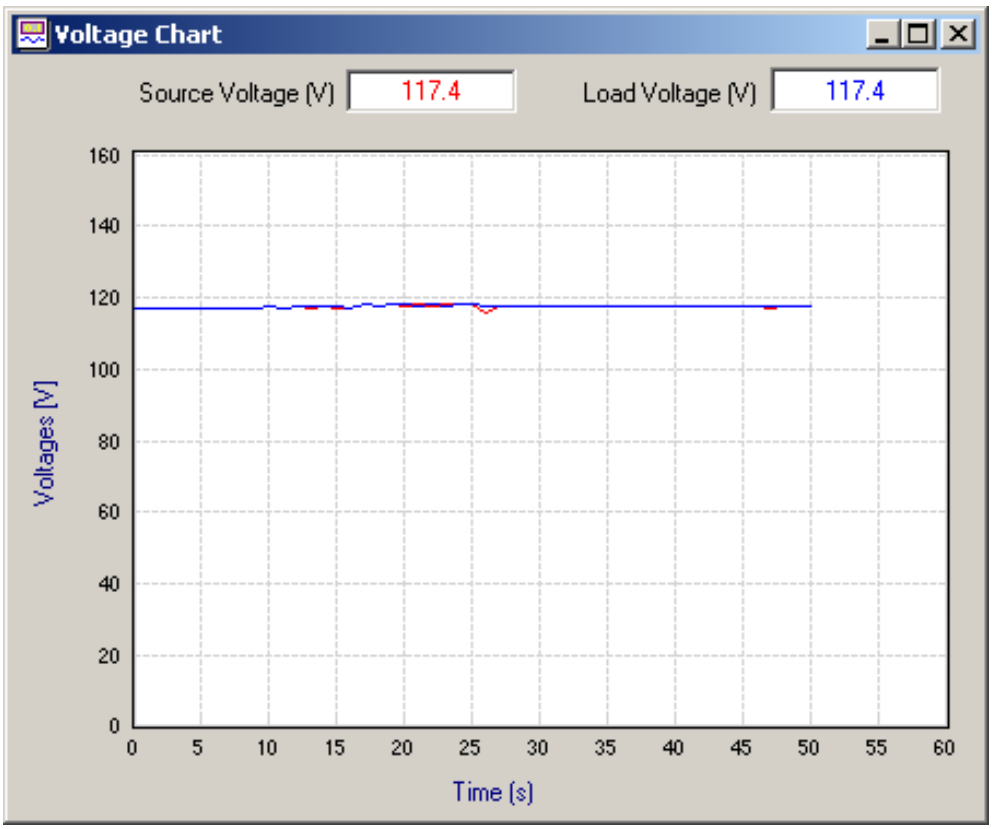


Figure 3-32 Real Time Voltage Chart

Monitor/Harmonic Analysis

The input signal is sampled at 64 samples per cycle, giving an overall sampling rate of 3840 samples per second for a 60 Hz system. This provides the ability to reproduce signals of up to 1920 Hz. Therefore, up to the 31st harmonic can be calculated using discrete Fourier transform with a fundamental frequency of 60 Hz. The fundamental for both the Voltage and Current channels is calculated every sample meaning, every 260.41 µs. These voltage and current magnitudes are used in a real-time decision making algorithm and real-time metering.

Total Harmonic Distortion (THD) for both voltage and current are calculated and displayed using the following equation:

$$\mathrm{THD} = \frac{\left[\sum_{k=2}^{31} A_k^2\right]}{A_0^2} \qquad k = 2,3....31$$

Where k is the Harmonic number

In addition to Harmonics and THD calculations the secondary task also triggers the Sequence of Event (SOE) recorder whenever any Harmonic selected by the user exceeds a preset threshold level.

The user is able to select which Harmonic(s) will trigger the SOE function and also set the threshold level, above which the SOE recorder will be initiated and below which the current will be ignored. The threshold level is set as a percentage of the magnitude of the fundamental. The user can also set the threshold level of either the Voltage or the Current Harmonic.

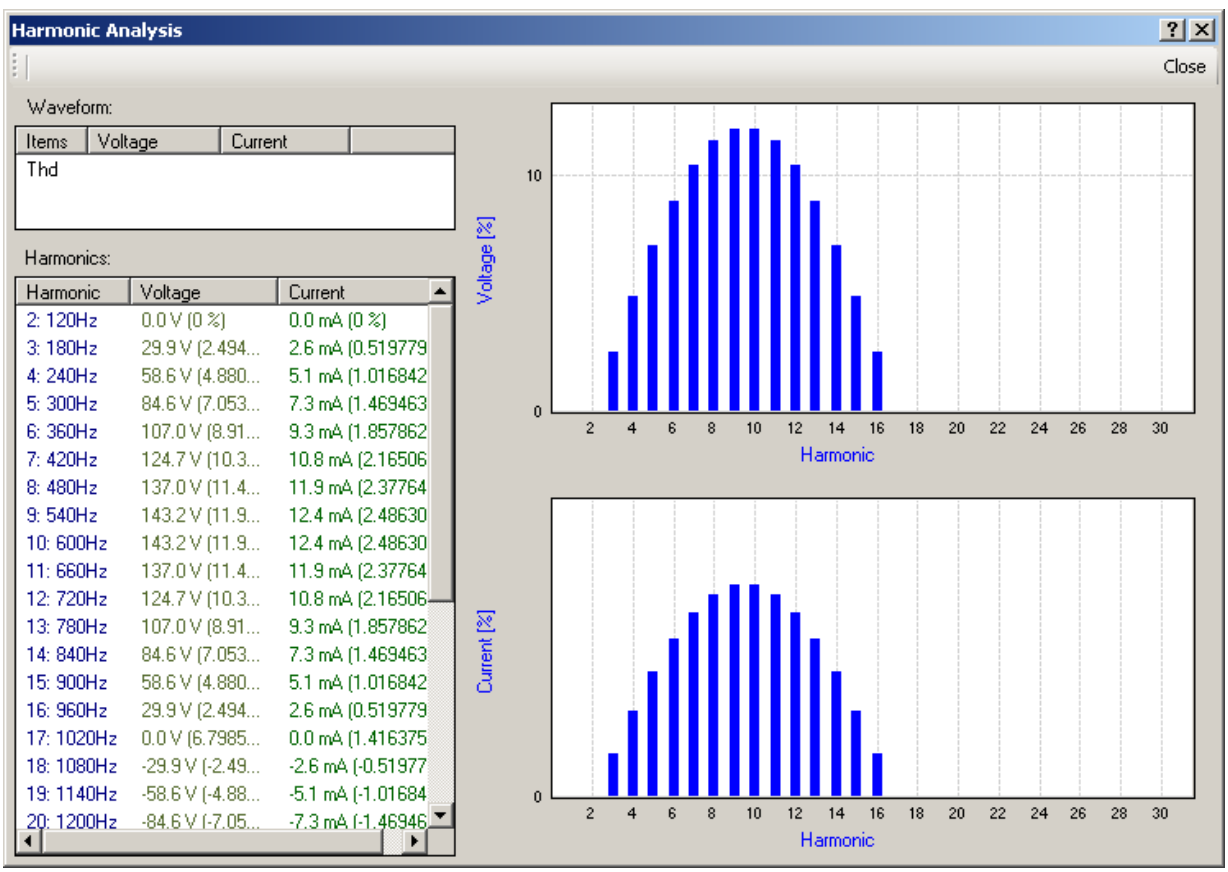


Figure 3-33 Harmonic Analysis Dialog Screen

Monitor/Master/Follower Alarm Messages

Master/Follower Alarm Messages for the control that TapTalk® is connected to can be observed from TapTalk by selecting Monitor/Master/Follower Alarm Messages. TapTalk will display Figure 3-34.

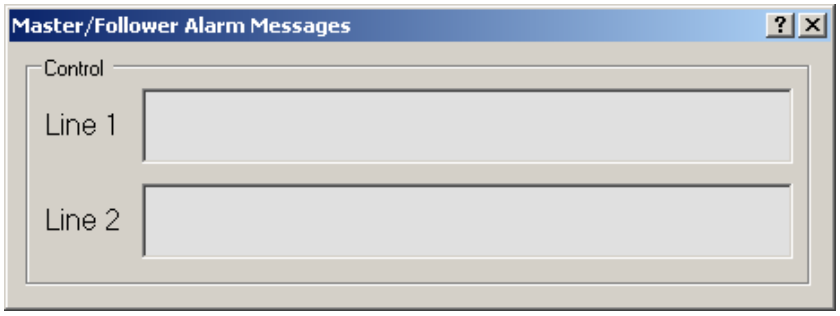


Figure 3-34 Master/Follower Alarm Messages Screen

Monitor/Display All Metering

The Display All Metering feature provides the user with a snapshot of all metering parameters. This feature also allows the Display All Metering screen to be printed or saved as a *.HTML file. The menu bar also includes a refresh feature to refresh parameters displayed on the screen.

All Metering

Print | Print Preview | Save | Refresh

M-2001D All Metering

Software Version: D-0223V01.03.01
Firmware version: D-0214V01.05.03

Beckwith Electric
M-2001D

Metering

Primary			
Voltage:	7.23 (KV)	Source Voltage:	7.23 (KV)
Current:	8 (A)	Watts:	-0.01 (MW)
VAr:	-0.06 (MVAr)	VA:	0.06 (MVA)
Secondary			
Load Voltage:	120.6 (V)	Meter Out Voltage:	120.6 (V)
Source Voltage:	120.7 (V)	Comp. Voltage:	120.6 (V)
Load Current:	1 (mA)	Circulating Current:	1 (mA) Lag
Power Factor:	0.117 (Lead)	Frequency:	60.00 (Hz)
Normalizing Voltage:	120.7 (V)		
Tap Information			
Tap Position:	0		
Drag Hands Lower:	0	Drag Hands Raise:	0
Timer:	0 (s)	Intertap Timer:	100 (%)
Operation Counter:	0	Resettable Counter:	0
Neutral Counter:	0		
STATUS			
Regulator			
Operation Mode:	Auto	Block Status:	--
Band Status:	Ok	VAr Bias Effect:	None
Power Direction:	Forward	Voltage Reduction:	--
HMI Active Status:	Not Active		
Alarm			
Comm Block:	--	LDC/LDZ:	--
Block Raise (Tap):	--	Line Current Limit:	--
Block Lower (Tap):	--	Reverse Power:	--
Block Raise (Volt):	--	Block Lower(Volt):	--
Voltage Reduction:	--	Abnormal Tap Position:	--
VAr Bias Duration Lag:	--	VAr Bias Duration Lead:	--
Backup Power Fail:	--	DVAr2 Current Limit:	--
Motor Seal-in Failure:	--	Master/Follower Lockout:	Inactive
Low Current Block:	--	Individual Tap Wear:	--
Op Count Signal:	--		
Input			
Neutral Tap:	--	Counter:	--
Nonsequential:	--	Motor Seal-In:	--
Voltage Reduction #1:	--	Voltage Reduction #2:	--
SCADA Cutout:	--	Aux Input 1:	0
Aux Input 2:	0	Aux Input 3:	0
Output			
Raise:	--	Lower:	--
Programmable Alarm:	--	Motor Seal-In:	--
CBEMA Events Status			
CBEMA 1:	None	CBEMA 1 Counter:	0
CBEMA 2:	None	CBEMA 2 Counter:	0
CBEMA 3:	None	CBEMA 3 Counter:	0
CBEMA 4:	None	CBEMA 4 Counter:	0

Demand

Demand Interval			
Interval:	15 minutes		
Present			
Load Voltage:	120.6 (V)	Primary Current:	1.0 (A)
Primary Watts:	0.00 (MW)	Primary VAr:	-0.01 (MVAr)
Primary VA:	0.01 (MVA)		
History			
Min Load Voltage:	0.0 (V)	1/1/1970 12:00:00 AM	
Max Load Voltage:	121.7 (V)	9/20/2012 7:53:04 AM	
Max Primary Current:	8 (A)	9/20/2012 12:11:01 PM	
Max Primary Watts:	0.02 (MW)	9/20/2012 9:59:52 AM	
Max Primary VAr:	0.00 (MVAr)	9/21/2012 9:56:47 AM	
Max Primary VA:	0.06 (MVA)	9/20/2012 12:23:37 PM	
Power Factor @ Max VA:	0.10 (Lead)	9/20/2012 12:23:37 PM	

Energy

Metering		
Forward Watt Hours:	44 (kWh)	1/1/1970 12:00:00 AM
Reverse Watt Hours:	198 (kWh)	1/1/1970 12:00:00 AM
Lagging VAr Hours:	1 (kVArh)	1/1/1970 12:00:00 AM
Leading VAr Hours:	318 (kVArh)	1/1/1970 12:00:00 AM

Motor Current Profile

Present Current Motor Profile			
Peak Rms Current:	0.0 (mA)	Average Rms Current:	0.0 (mA)
Average Duration:	0.0 (msec)		
Average Current Motor Profile			
Peak Rms Current:	0.0 (mA)	Rms Current:	0.0 (mA)
Duration:	316.7 (msec)	Training Mode:	In Training Mode
Peak Motor Current:	0.0 (mA)		

Figure 3-35 Display All Metering Screen

Monitor/Set Metering Colors

This feature allows the user to select individual display colors for the Metering and Status screen. The Alarm, Warning, Input, Output and Metering Background text and background colors can be set.

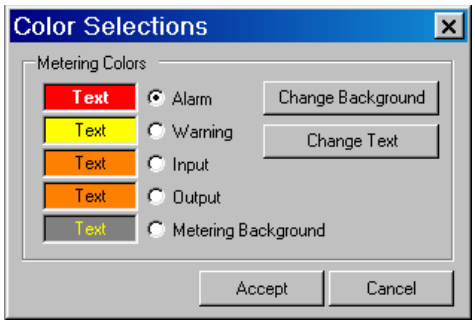


Figure 3-36 Set Metering Colors Screen

Toolbar Editor

The Toolbar Editor feature allows the user to create TapTalk® toolbar menu items that are available from the TapTalk main menu screen. By right clicking on the toolbar TapTalk will display the Toolbar Editor Mode selections "Start Edit Toolbar" and "End Edit Toolbar" (Figure 3-37). To add a Toolbar item simply select "Start Edit Toolbar" and then drag and drop the desired single menu item onto the main toolbar. To remove menu items drag and drop the item on the "Help" menu item. When the Toolbar Editor is active (as displayed in the TapTalk menu top line) no TapTalk functions can be initiated.

By right clicking and selecting "End Edit Toolbar" TapTalk features are accessible.

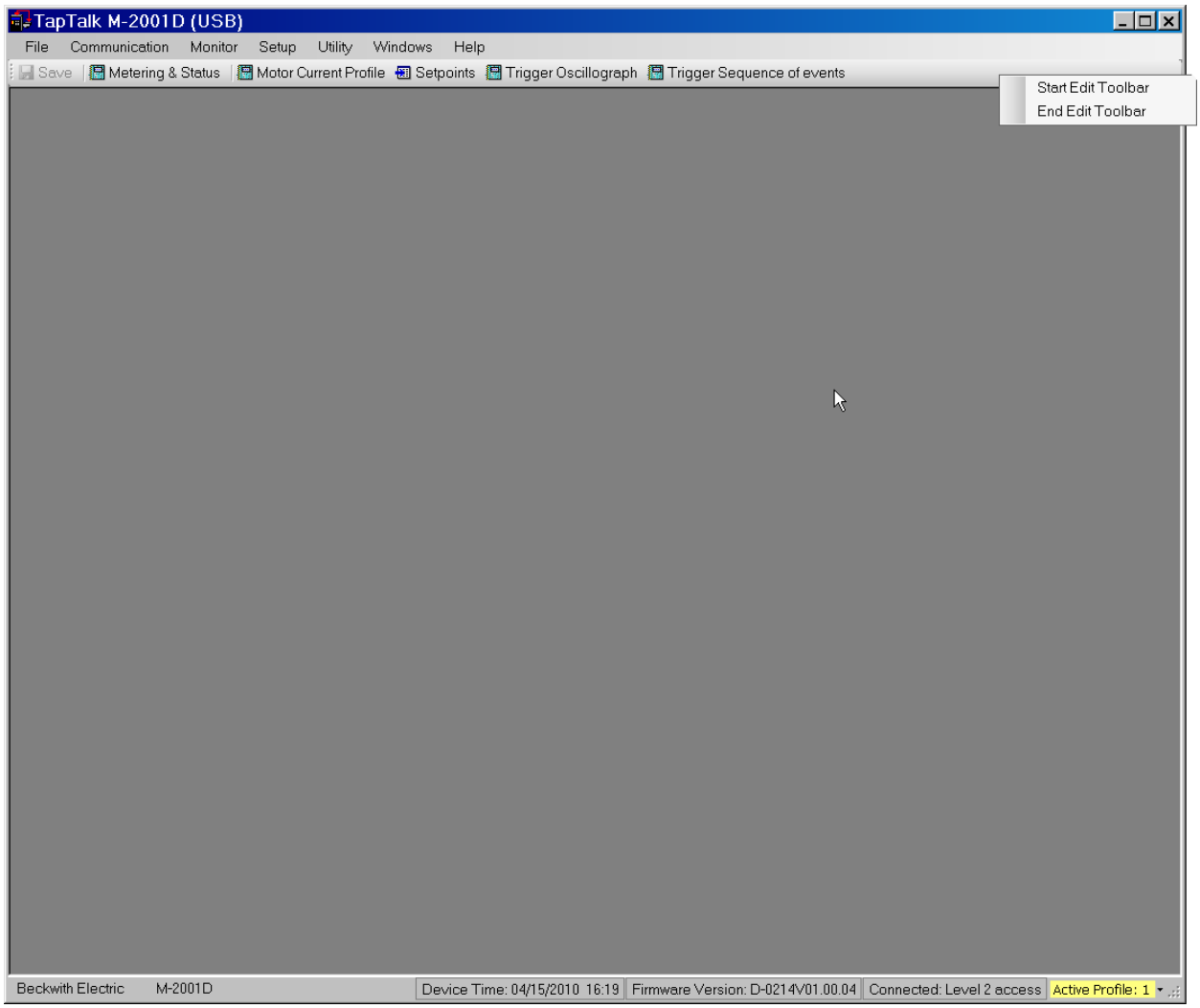
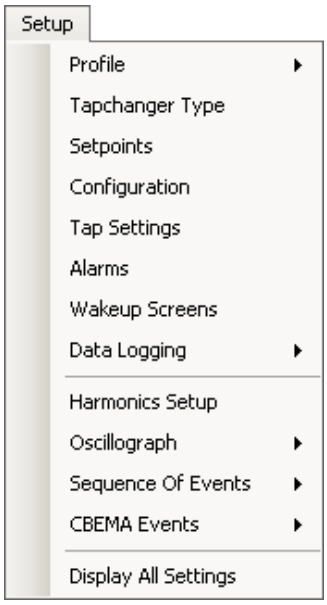


Figure 3-37 TapTalk Main Menu Screen with Toolbar Editor Active

Setup



The **Setup** menu item provides the user with access to the **Profile**, **Tapchanger Type, Setpoints**, **Configuration**, **Tap Settings**, **Alarms**, **Wakeup Screens**, **Data Logging**, **Harmonics Setup**, **Oscillograph**, **Sequence of Events** and **CBEMA Events** submenu items. The setpoint information displayed on these screens can be from either the control or from an open TapTalk® file.

Also included in the Setup submenu is the **Display All Settings** command which when invoked displays the M-2001D All Setpoints Dialog Screen (Figure 3-65).

Setup/Profile

The Profile menu item includes the "Set Active Profile" selection which allows the user to manually select the active Setpoint Profile. Also included is the "Profile Names" menu item which allows the user to Enter/Edit the 16 character Profile name for each file (Figure 3-38).

Setup/Tapchanger Type

The Tapchanger Type Selection feature (Figure 3-39) provides the user with the ability to set regulator vendor specific configuration settings in the control from TapTalk. See **Chapter 5 Section 5.2 Tap Changer Type Selection.**

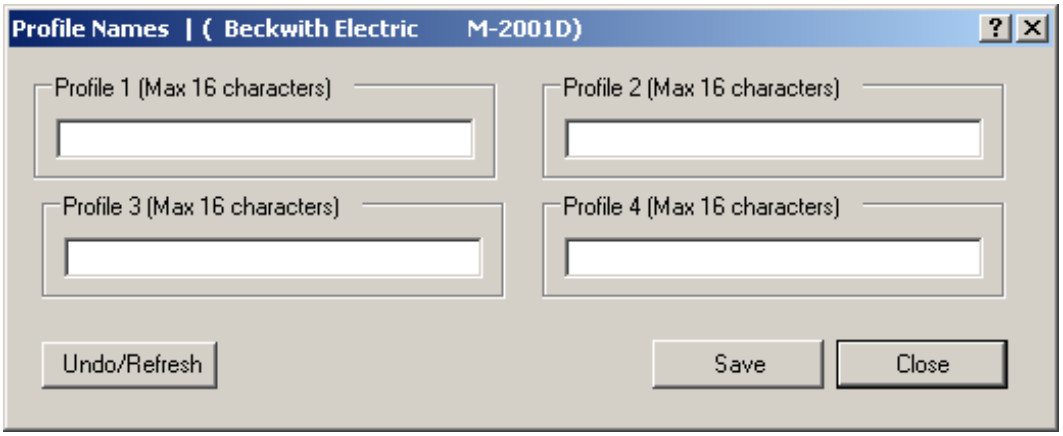


Figure 3-38 Profile Names Dialog Screen

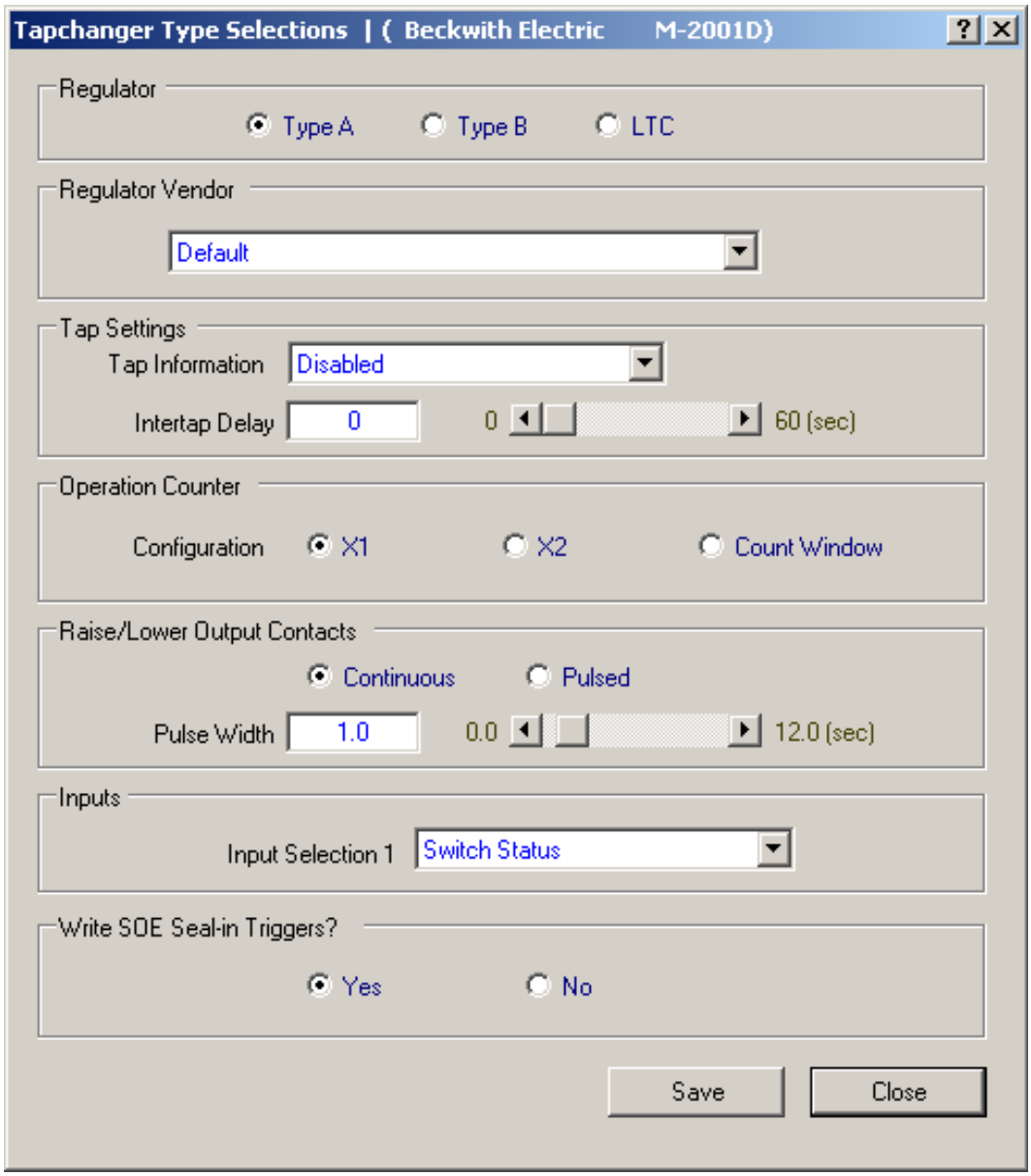


Figure 3-39 Tapchanger Type Dialog Screen

Setup/Setpoints

Setpoints/General

Line Drop Compensation – Toggles between two modes of operation: R, X (factory setting), and Z.

Timer Delay Selection – Toggle between two modes of operation: **Definite Time** (factory setting) and **Inverse Time**.

Basic Timer Type – Toggles between **Integrating** and **Instant Reset.**

Power Direction Bias – The Power Direction Bias setpoint feature includes three settings to determine how the control will switch between forward and reverse power operation. The three settings are **None**, **Forward**, and **Reverse**.

Setpoints/Voltage Reduction

Step 1 – First of three independent steps of voltage reduction adjustable from 0% to 10% in 0.1% increments of the bandcenter setpoint. Factory setting is 2.5%.

Step 2 – Second voltage reduction step, adjustable from 0% to 10% in 0.1% increments of the bandcenter setpoint. Factory setting is 5.0%.

Step 3 – Third voltage reduction step, adjustable from 0% to 10% in 0.1% increments of the bandcenter setpoint. Factory setting is 7.5%.

Setpoints/Limit and Runback

Block Raise – Over voltage limit is adjustable from 95.0 V to 135.0 V in 0.1 V increments with a factory setting of 128.0 V.

Runback Deadband – Adjustable from 1.0 V to 4.0 V in 0.1 V increments with a factory setting of 2.0 V.

Block Lower – Under voltage limit is adjustable from 95.0 V to 135.0 V in 0.1 V increments with a factory setting of 114.0 V.

Runup Deadband – Adjustable from 1.0 V to 4.0 V in 0.1 V increments with a factory setting of 2.0 V.

Runup – This feature may be Enabled/Disabled.

Current Limit – Adjustable from 50 mA to 640 mA, in increments of 1 mA. If the value of the current exceeds the current limit setpoint, the unit will not permit automatic control in either the raise or lower direction. Factory setting is 640 mA.

Setpoints/Forward Power

Band Center – Adjustable from 100.0 V to 135.0 V in 0.1 V increments with a factory setting of 120 V.

Band Width – Adjustable from 1.0 V to 10.0 V in 0.1 V increments with a factory setting of 2.0 V.

Definite/Inverse Time – Adjustable from 1 sec. to 360 sec. in 1 second increments with a factory setting of 30 seconds.

LDC-Z – Adjustable from 0 V to 72 V in 1 V increments with a factory setting 0 V.

LDC Resistance – Adjustable from –72 V to +72 V in 1 V increments with a factory setting of 0 V.

LDC Reactance – Adjustable from –72 V to +72 V in 1 V increments with a factory setting of 0 V.

Setpoints/Reverse Power

Operation – Toggles between eight modes of operation:

- **Block** – inhibits automatic tapchange operation.
- **Regulate Forward (Ignore)** – continues unit action as though forward power flow continued to exist.
- **Regulate Reverse** – (calculated voltage or measured voltage) detects a reverse power condition and regulates according to reverse power settings.
- **Return to Neutral** – detects a reverse power operation and drives tap position to neutral and then stops.
- **Regulate Reverse (Measured)** – allows the control to switch it's voltage sensing input from a load side VT to a source side VT if one is available and operate in Reverse Power Mode using that input.
- **Distributed Generation** – allows alternate LDC R and X values to be applied to the control when reverse power is detected.
- **Auto Determination** – allows the control to use the "Smart Reverse Power" feature to choose the applicable reverse power mode, either Distributed Generation or Regulate Reverse.
- **Auto Determination (Measured)** – allows the control to use the "Smart Reverse Power" feature to choose the applicable reverse power mode, either Distributed Generation or Regulate Reverse (Measured).

The Setpoints Reverse Power section also contains a link which displays the "Reverse Power Vendor Cross Reference" table showing Cooper/Siemens reverse power names and their Beckwith Electric equivalents (Figure 3-41).

Band Center – Adjustable from 100.0 V to 135.0 V in 0.1 V increments with a factory setting of 120 V.

Band Width – Adjustable from 1.0 V to 10.0 V in 0.1 V increments with a factory setting of 2.0 V.

Definite/Inverse Time – Adjustable from 1 sec. to 360 sec. in 1 second increments with a factory setting of 30 seconds

LDC-Z – Adjustable from 0 V to 72 V in 1 V increments with a factory setting 0 V.

LDC Resistance – Adjustable from –72 V to +72 V in 1 V increments with a factory setting of 0 V.

LDC Reactance – Adjustable from –72 V to +72 V in 1 V increments with a factory setting of 0 V.

Setpoints/Miscellaneous

Undo/Refresh – The **Undo** command allows the user to undo any setting changes in the Setpoints screen before the settings have been saved to either the Device or Open File. It also refreshes the screen with the data stored in the unit.

Save – The **Save** command saves the setting changes to either the Open File when in File mode or the Device when TapTalk® is connected to a device.

Close – The **Close** command cancels any setting changes before the settings changes have been sent to either the Device or Open File.

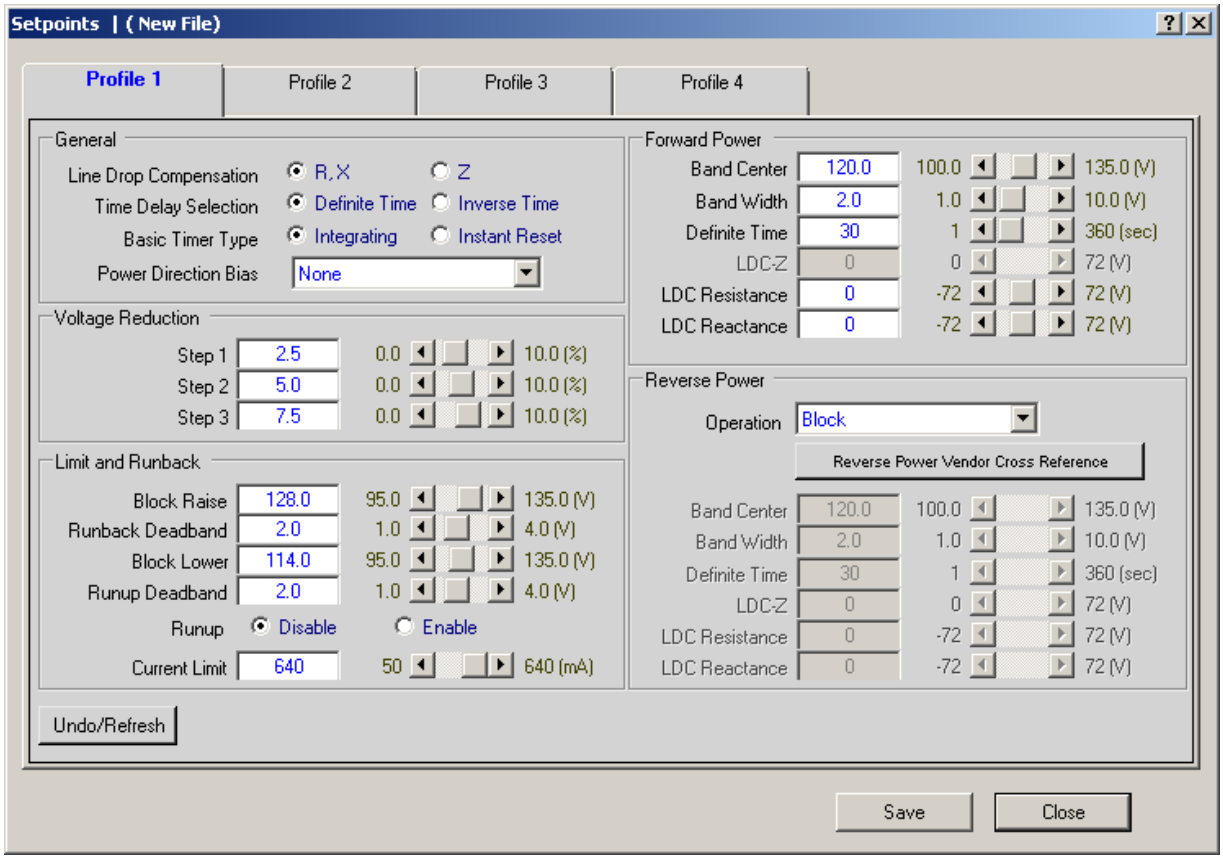


Figure 3-40 Setpoints Dialog Screen

Reverse Power Vendor Cross Reference

Beckwith Reverse Power Mode	Cooper/Siemens Reverse Power Mode
Block	Locked Forward Mode
Regulate Forward (Ignore) *	Reverse Idle Mode
Regulate Reverse	None
Return to Neutral *	Neutral Idle Mode
Regulate in Reverse (Measured) *	Bi-Directional Mode
Distributed Generation	Cogeneration Mode
Auto Determination	None
*Low Current block feature must also be enabled to be equivalent to this Cooper Reverse Power Mode.	

OK

Figure 3-41 Reverse Power Vendor Cross Reference Table

Setup/Configuration

Configuration/Primary

Voltage Multiplier – Adjustable from 0.1 to 3260.0 in 0.1 increments with a factory setting of 60.0. User selection must include knowledge of VT ratio and sensing VT-ratio correction.

Voltage Source Multiplier – Adjustable from 0.1 to 3260.0 in 0.1 increments with a factory setting of 60.0. User selection must include knowledge of source VT ratio and sensing source VT-ratio correction.

Current Multiplier – Adjustable from 1 to 32600 in 1 increments with a factory setting of 6000. User selection must include knowledge of CT ratio, from primary rating to 0.2 A rating of control.

Primary Power Display – Toggles between two modes of operation: Single-Phase – based on measured inputs, and Three-Phase – based on measured inputs and presumed balanced system. Factory setting is single-phase.

Configuration/VT/CT Load

Normalizing Voltage Multiplier – Displays the result of the Normalizing Multiplier (0.80 to 1.20) times the Meter Out Voltage.

VT Correction – Adjustable from –15.0 V to +15.0 V in 0.1 V increments with a factory setting of 0.0 V.

CT/VT Phasing – Adjustable from 0° to 330° in 30° increments with a factory setting of 0°.

Aux Current Transformer – Can be set to 200 mA, 1 A or 5 A. This choice fixes the scale of both the metering readout quantities and the settings and current values.

VT Configuration – Load VT configuration toggles between Line-to-Line and Line-to-Ground.

Configuration/VT/CT Source

VT Source Correction – Adjustable from –15.0 V to +15.0 V in 0.1 V increments with a factory setting of 0.0 V.

CT/VT Source Phasing – Adjustable from 0° to 330° in 30° increments with a factory setting of 0°.

Configuration | (Beckwith Electric M-2001D)

Primary
Voltage Multiplier 60.0 0.1 3260.0 (X)
Voltage Source Multiplier 60.0 0.1 3260.0 (X)
Current Multiplier 6000 1 32600 (X)
Primary Power Display Single Phase Three Phase

VT/CT Load
Normalizing Volt. Multiplier 1.00 0.80 1.20 (X)
VT Correction 0.0 -15.0 15.0 (V)
CT/VT Phasing 0 degree
Aux Current Transformer 200 mA
VT Configuration Line to Line Line to Ground

VT/CT Source
VT Source Correction 0.0 -15.0 15.0 (V)
CT/VT Source Phasing 0 degree

Raise/Lower Output Contacts
Continuous Pulsed
Pulse Width 1.5 0.2 12.0 (sec)

Motor Current Settings
Peak Rms Current 110 110 200 (%)
Average Rms Current 110 110 200 (%)
Average Duration 110 110 200 (%)

Program Alarm Relay Mode
Normal Deadman Out

Inputs and Switch
Input Selection 1 Switch Status
Input Selection 2 Non-sequential
Input Selection 3 VR2
Auto/Man Switch Type None

Regulator
Type A Type B

Paralleling
Paralleling Type Disable

Remote Voltage Bias
Disable Enable
RVB Scale Factor 1.0 0.1 100.0
RVB Heart Beat Timer 5 2 120 (sec)
Reverse RVB Scale Factor 1.0 0.1 100.0

Run Through Neutral
Disable Enable Counter Reset
Maximum Allowed Taps 4 3 7
Tap Operations Between Runs 1000 10 10000
Maximum Load Current 50 1 100 (mA)
Maximum RTN Standby Operations 20 1 10000

Low Current Block
Disable Enable

Save Comm Block at Power Off
Don't Save Save

Fast Voltage Recovery
Disable Enable
Fast Voltage Recovery 5.0 1.0 15.0 (V)

Voltage Reduction (VR)
Standard VR Disable Enable
Smart VR Disable Enable
Smart VR LDC Disable Enable
Smart VR LDC Settings
R 0 -72 72 (V)
X 0 -72 72 (V)
Z 0 0 72 (V)
Com VR Turnoff Timer 0 0 999 (Min)
Save VR at Power Off Don't Save Save

VAr Bias
Disable Enable
Max 3 Phase Cap Bank Size 12000 4 12000 (kvar)
Lead % Bank Size Pickup 75 10 100 (%)
Lag % Bank Size Pickup 75 10 100 (%)
VAr Bias Voltage Step 1.0 0.1 2.0 (V)
Max VAr Bias Duration 300 10 1440 (min)

Undo/Refresh Save Close

Figure 3-42 Configuration Dialog Screen

Configuration/Raise/Lower Output Contacts

Output Selection – Toggle between two modes of operation: **CONTINUOUS** (factory setting) and **PULSED**.

Pulse Width – Adjustable from 0.2 seconds to 12.0 seconds in 0.1 second increments with a factory setting of 1.5 second. When the output is set to pulse and the control is calling for Raise/Lower (and no non-sequential or counter input is applied), an output will turn on for the preprogrammed time, and then turn off for 0.5 seconds, plus the intertap time delay. A square wave is generated on the output.

Configuration/Motor Current Settings

Peak RMS Current – Adjustable from 110% to 200% in 1% increments.

Avg RMS Current – Adjustable from 110% to 200% in 1% increments.

Avg Duration – Adjustable from 110% to 200% in 1% increments.

Configuration/Program Alarm Relay Mode – When the Auto/Manual Switch Type configuration is set to "SCAMP", then the Programmable Alarm Function can be set to function as "Normal" or "As a Deadman Output". This option is available when SCAMP mode is used since the Deadman Output is not available.

Configuration/Inputs and Switch

Input Selection 1 – Allows the Operation Counter Input to be selected to either Seal-In Input or Switch Status. When a Cooper Regulator is used the "Seal-In Input" selection must be chosen.

Input Selection 2 – The Input Selection 2 can be configured to be either an input that initiates Non-Sequential control operation or a SCADA Cutout switch input. The default configuration setting is Non-Sequential.

Input Selection 3 – Can be configured to become an Auxiliary Input that can be read as a DNP point or Voltage Reduction 2.

Auto/Manual Switch Type – The Auto/Manual Switch Type setting allows the Auto/Man Switch type on the adapter panel to be set to "Toggle, SCAMP or None". None is used when no Auto/Manual Switch exists. The default configuration setting is None.

Configuration/Regulator

Regulator Type – Allows the Regulator type to be selected as Type A or B for correct source voltage calculation. Factory setting is Type **A**.

Configuration/Paralleling

Paralleling Type – Paralleling Type can be selected (when purchased) to Disable, Circulating Current, ΔVAR®1, ΔVAR2, ΔVAR2 (KeepTrack™), or Master/Follower.

Paralleling Options for ΔVAR2 and ΔVAR2 (KeepTrack)

Sensitivity – Adjustable from –4 to +4 in 0.1 increments with a factory setting of 0.0.

Circulating Current Limit (Reactive) – Adjustable from 5 mA to 200 mA in 1.0 mA increments with a factory setting of 200 mA.

Input Ratio (Load/Parallel) – Adjustable from 0.50 to 2.00 in 0.01 increments with a factory setting of 1.00.

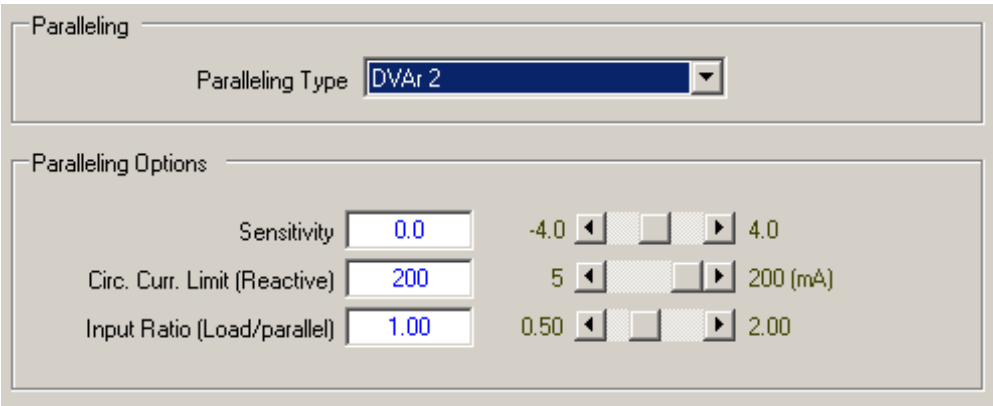


Figure 3-43 DVAR2 and DVAR2 (Keeptrack) Configuration Dialog Screen

Master/Follower Paralleling Configuration Settings

Paralleling Address – The unique address for each device (range 1-16).

Master/Follower Configuration – Sets the control configuration as None, a Follower or a Master.

Number of Devices – The total number of devices that are in the paralleling scheme (maximum of 16 inclusive of the master).

Tap Difference – The difference between Master and Follower tap positions that will result in a Lockout condition.

Tap Position Response Timeout – The time within which the Followers have to be at the same tap position as that of the Master (range 1,000 ms - 6,000 ms).

If the Master Timeout is greater than the intertap delay setting, then the Master Timeout is used as the Intertap delay, so that the Master waits for all the Followers to make a tapchange before the Master takes the next Tap.

Line Breaker, Right Tie Breaker, Left Tie Breaker – The Line Breaker, Right and Left Tie Breakers can be individually selected to be included or excluded from the algorithm. Furthermore, the polarity of the input detection can be either negative or positive.

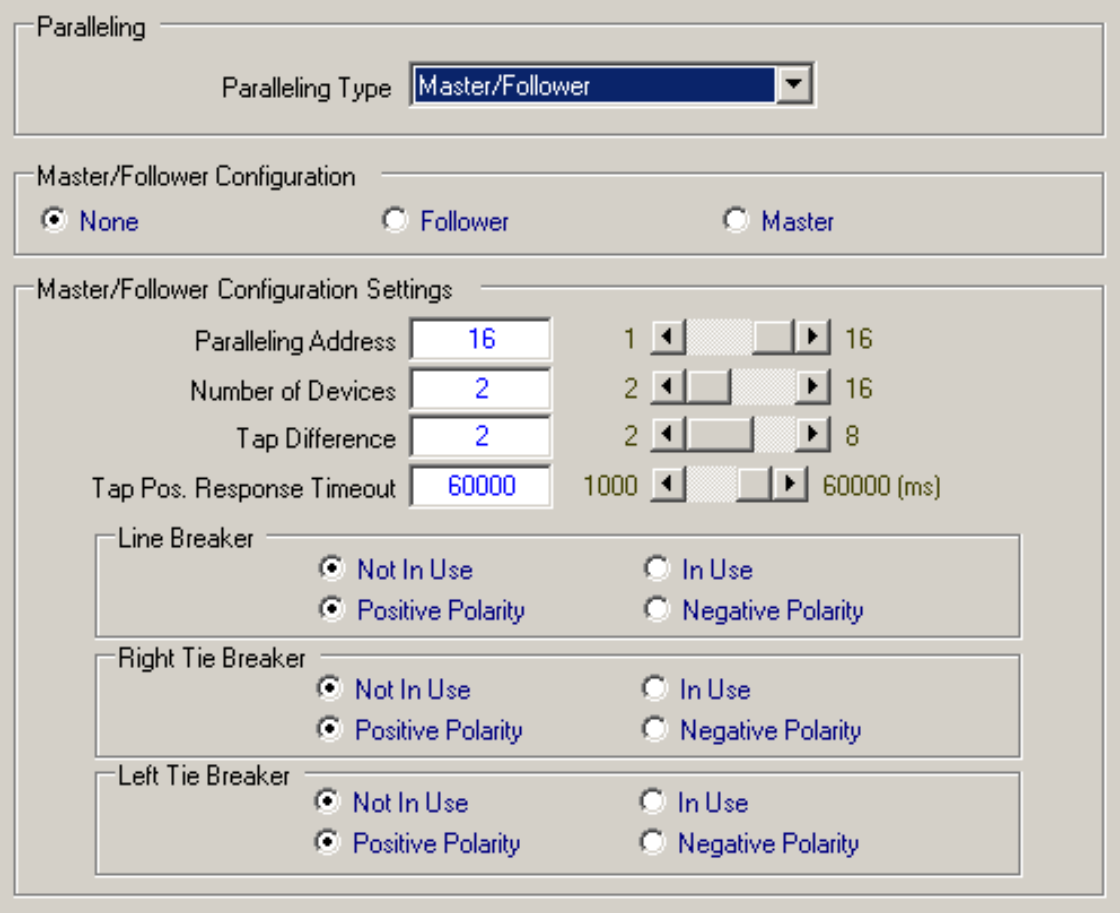


Figure 3-44 Master/Follower Configuration Dialog Screen

Configuration/Remote Voltage Bias

Enable/Disable – Allows Remote Voltage Bias to be Enabled or Disabled.

RVB Scale Factor

Allows a forward scale factor to be applied to the raw value being supplied to the control from SCADA.

RVB Heartbeat Timer

The Heartbeat Timer is the refresh value of the Internal Heartbeat. The remote voltage parameter must be written to the control within the period defined in the RVB Heartbeat Timer. If the timer times out, the control reverts back to the normal chosen regulating method using the bandcenter and LDC settings.

Reverse RVB Scale Factor

Allows a reverse scale factor to be applied to the raw value being supplied to the control from SCADA.

Configuration/Run Through Neutral

Enable/Disable – Allows the Run Through Neutral feature to be Enabled and Disabled.

Maximum Allowed Taps – The Maximum Allowed Tap setting provides a user selectable limit for the number of taps that are allowed to be taken to accomodate taking one tap through neutral.

Tap Operations Between Runs – This setting is the number of operations the control will count up to before allowing the Run Through Neutral feature to operate if all pre-conditions are met.

Maximum Load Current – The Run Through Neutral feature will not be allowed to operate when the Maximum Load Current setting is exceeded.

Maximum RTN Standby Operations – This setting provides the number of attempts to exceed the RTN feature before the "RTN Fail to Operate" Alarm is initiated.

Configuration/Low Current Block – When enabled the control determines if Load Current is less than 4 mA coincident with Tap Delta Voltage being less than .4 V AC. When these conditions exist the control will initiate an alarm and block regulation.

Save Comm Block at Power Off

When the Auto/Manual Switch Type is set to "None" or "Toggle", the following selections are available:

Don't Save – Allows the state of the "Block Auto Operation" communication command to NOT be saved when power has been lost.

Save – Allows the state of the "Block Auto Operation" communication command to be saved when power has been lost.

SCAMP Initialize on Power Up

When the Auto/Manual Switch Type is set to "SCAMP", the following selections are available:

When **Last Save** is selected, the SCAMP switch is configured in such a way that upon the control performing a cold power up, the state of the SCAMP switch is initialized to the last saved state of the SCAMP switch prior to the control powering off.

For example, if prior to powering off the control, the SCAMP switch was in Manual, then when the control is powered back on the control will initially go back to the Manual state and vise versa. Now when **Auto Mode** is selected, the control always initializes into the Auto Mode after powering up regardless of the saved state of the control prior to powering off.

Configuration/Fast Voltage Recovery

Enable/Disable – Allows Fast Voltage Recovery to be Enabled or Disabled.

Fast Voltage Recovery – Allows a setting from 1.0 to 15.0 V outside the normal band edges in 1.0 V increments. When voltage exceeds the Raise or Lower band edge plus the Fast Voltage Recovery setting, the normal definite or inverse time delay is replaced with instantaneous operation (<0.5 Sec).

Configuration/Voltage Reduction (VR)

Standard VR – Allows standard Voltage Reduction to be Enabled or Disabled.

Smart VR – Allows Smart Voltage Reduction to be Enabled or Disabled. This setting is only available when Standard VR is Disabled.

Smart VR LDC – Allows Smart Voltage Reduction LDC to be Enabled or Disabled. This setting is only available when Smart VR is Enabled.

Smart VR LDC Settings – When enabled, existing LDC settings are ignored and the Smart VR LDC settings will be used. The choice between R and X, or Z compensation is determined by the LDC setting in the Setpoints screen.

Com VR Turnoff Timer – Allows Voltage Reduction to be turned off after a prescribed time period from 1 to 999 minutes. A setting of zero disables this feature.

Save VR at Power Off – Save Voltage Reduction at Power Off allows the state of the "Voltage Reduction" communication command to be saved or not saved when power has been lost. The default setting is "Don't Save".

Configuration/VAr Bias

VAr Bias can be enabled or disabled. Use of VAr Bias allows coordination of the M-2001D with M-2501 series Capacitor Bank Controls. Maximum Capacitor Bank size is adjustable from 4 KVAr to 12000 KVAr.

Max 3 Phase Capacitor Bank Size – Maximum Capacitor Bank size is adjustable from 4 KVAr to 12000 KVAr.

Lead % Bank Size Pickup – Lower negative VAr limit in percentage of the Max Cap Bank size below which the control will increase the upper band edge by the amount defined by VAr Bias Voltage Step.

Lag % Band Size Pickup – Upper positive VAr limit in percentage of the Max Cap Bank size above which the control will decrease the lower band edge by the amount defined by VAr Bias Voltage Step.

VAr Bias Voltage Step – Amount by which the control will increase or decrease the Upper or Lower band edges when there is a VAr Bias out of band situation.

Max VAr Bias Duration – Maximum allowable time in minutes the control will bias the voltage edge.

Configuration/Miscellaneous

Undo/Refresh – The **Undo** command allows the user to undo any setting changes in the Configuration screen before the settings have been saved to either the Device or Open File. It also refreshes the screen with the data stored in the unit.

Save – The **Save** command saves the setting changes to either the Open File when in File mode or the Device when TapTalk® is connected to a device.

Close – The **Close** command cancels any hardware setting changes before the hardware settings changes have been sent to either the Device or Open File.

Setup/Tap Settings

Tap Settings/General

Tap Information – Tap information can be disabled or can be selected to one of the following tap position knowledge methods:

- Regulate Internal (KeepTrack™)
- Regulate External #1
- Regulate External #2
- Regulate External #3
- XFMR External #1
- XFMR External #2
- XFMR External #3
- Contact KeepTrack™ 1R1L
- Contact KeepTrack 1N

InterTap Delay – Adjustable from 0 to 60 seconds in 1 second increments with a factory setting of 0 seconds. This value must be set less than the count window setting for counter operation.

Tap Settings/Tap Limits

Enable/Disable – Allows Tap Limits to be enabled or disabled.

Block Raise/Block Lower – When enabled, Block Raise and Block Lower are adjustable from the Tap Maximum configuration point to the Tap Minimum value in 1 step increments (Tap Limit Block Raise cannot be lower than Tap Limit Block Lower +4. Tap Limit Block Lower cannot be higher than Tap Limit Block Raise –4).

Highest Tap/Lowest Tap

The M-2001D Digital Tapchanger Control tap position information applies to many different configurations of tapchangers, e.g., ±16 taps, 1 to 17 taps, ±10 taps, 1 to 33 taps, etc. Two configuration points, Lowest Tap and Highest Tap, are assigned to allow the user to select the range of a specific tapchanger. The Highest Tap range is 0 to 33 taps, and the Lowest Tap range is –33 to +29 taps.

Tap Setting/Operation Counter

Configuration – Selects the contact operation sequence that will cause the software counter to increment by one. Open/close/open (X1), open/close or close/open contact operation (X2). The count window mode registers any activity as a valid input within the count window time setting. Factory setting is X1.

The Cam Follower setting should be selected when a Cam Follower contact input is wired into the Counter contact input of the M-2001D. The operation counter and resettable operation counter will increment when the counter input sees the cam follower open and then close.

Count Window – Operation count will increment by only one count during a set time period or "Count Window". This is true no matter how many counter inputs occur during the count window time period. After a counter input is accepted, the count window timer begins and another count won't be accepted until the count window time period expires. The count window time period can be set from 0.5 to 60.5 seconds. The count window setting must be set greater than the InterTap Delay setting.

X Mode Delay

When the control is using X1 or X2 mode counter contact detection method, the X1/X2 mode delay setting in millisecond can be used to delay the detection of the **NEUTRAL** position switch. This is sometimes necessary if the regulator activates the counter contact switch before the neutral switch when moving to the neutral position. The default value is 10 ms.

Preset (Counter) – Displays the number of operations since the last reset.

Alarm Limit (Op Count Signal Alarm) – Displays the Op Count Signal Alarm limit value from 0 to 999,999. This value sets the trigger for the Programmable Alarm "Op Count Signal" if enabled.

Resettable (Operation Counter) – Displays the number of operations since the last reset. Selecting the **Reset** check box and then selecting **Save** sends a reset command to the control.

Neutral Counter – The Neutral Switch Counter is updated each time the neutral input is detected. Neutral Switch Counter can also preset to any value. The Neutral Switch Counter is a software counter that is stored in non-volatile memory and has a maximum value of 999,999.

Tap Settings/Motor Seal-in Failure Block

When Input Selection 1 is set to "Seal-In Input", the Motor Seal-in Failure Block feature and the input to the Abnormal Tap Position alarm are enabled by default. The user may choose to disable the Motor Seal-in Block feature. However, the input to the Abnormal Tap Position alarm is always enabled when Motor Seal-in is selected.

Tap Settings/Drag Hands

Drag Hands Lower – Displays the lowest tap since last reset. Selecting the **Reset** check box and then selecting **Save** sends a reset command to the control.

Drag Hands Raise – Displays the highest tap since last reset. Selecting the **Reset** check box and then selecting **Save** sends a reset command to the control.

Tap Settings/Tap Statistics

The Tap Statistics Tap Wear feature provides the user with the capability to determine tap wear in a regulator's tap change mechanism. The Tap Statistics Tap Wear feature records the accumulated primary current on each tap change using the measured Primary Current just prior to moving off a tap. Primary current is calculated from measured Secondary Load Current times the Primary Current Multiplier. The accumulated Primary Current for each tap position is displayed on the Tap Statistics dialog screen (Figure 3-31) which displays the number of times the regulator has been on each tap. The Tap Statistics are stored in non-volatile memory and will remain intact through power cycle and firmware update, as its value is in its long term indication of mechanism wear.

The Tap Statistics can be downloaded to a CSV file and printed. Tap Statistics can also be downloaded in CSV format to an SD card. The File name defaults to the serial number of the unit but allows for user modification.

The Tap Statistics Tap Wear feature also includes two settings that are located in the TapTalk, Tap Settings dialog screen (Figure 3-45) in the Tap Statistics section and in the HMI under the Configuration/Tap Settings menu. Both settings are considered to generate a Programmable Alarm output "Individual Tap Wear Alarm":

- Maximum Tap Wear setting – The Maximum Tap Wear setting can be set from 1–999,999.
- Individual Tap Wear Alarm setting – The Individual Tap Wear Alarm setting is a percentage setting with a range from 1–200% and a default of 100%. This setting is used in conjunction with the Maximum Tap Wear setting to determine when the "Individual Tap Wear Alarm" is triggered.

  The Individual Tap Wear alarm will trigger when the number of operations on any single tap exceeds the Individual Tap Wear Alarm setting. This alarm also triggers SOE and OSC.

Tap Settings/Tap Calibration

Tap Position – Value of actual tap position can be set from -16 to 16 including Neutral.

Tap Settings/Miscellaneous

Undo/Refresh – The **Undo** command allows the user to undo any setting changes in the Tap Settings screen before the settings have been saved to either the Device or Open File. It also refreshes the screen with the data stored in the unit.

Save – The **Save** command saves the Tap Settings changes to either the Open File when in File mode or the Device when TapTalk® is connected to a device.

Close – The **Close** command cancels any Tap Settings changes before the changes have been sent to either the Device or Open File.

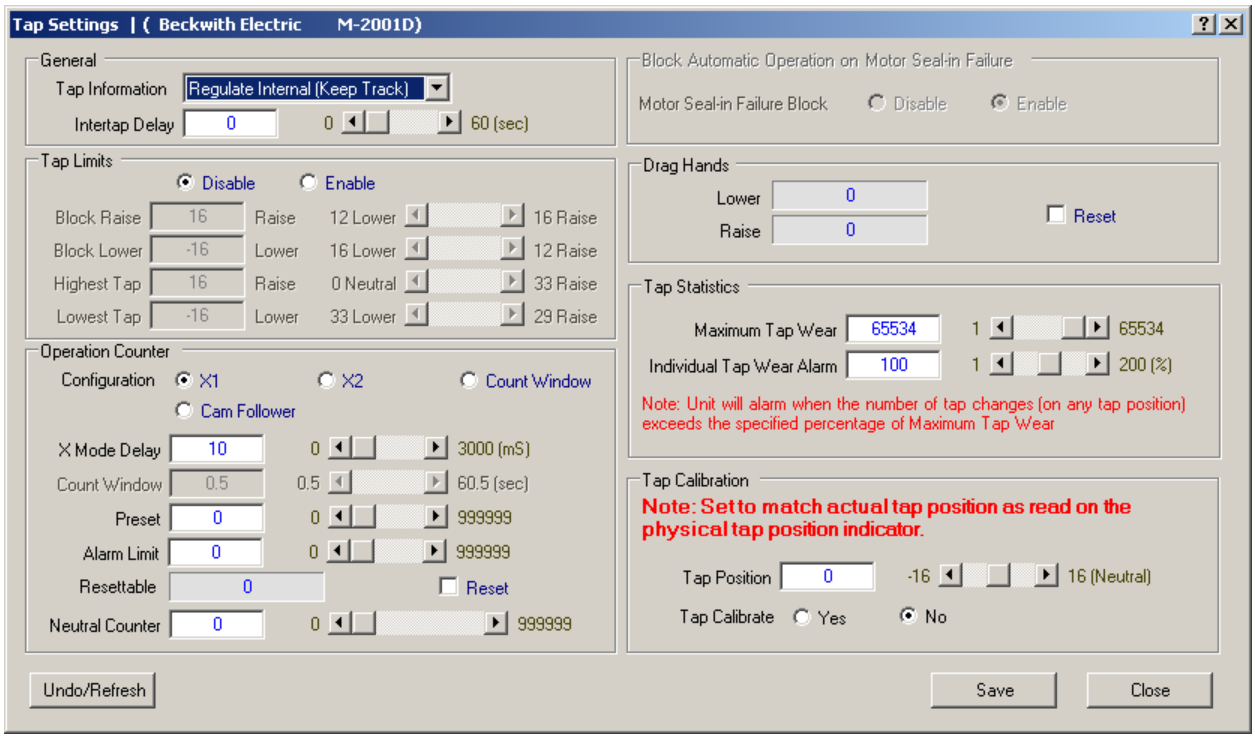


Figure 3-45 Setup Tap Settings Dialog Screen

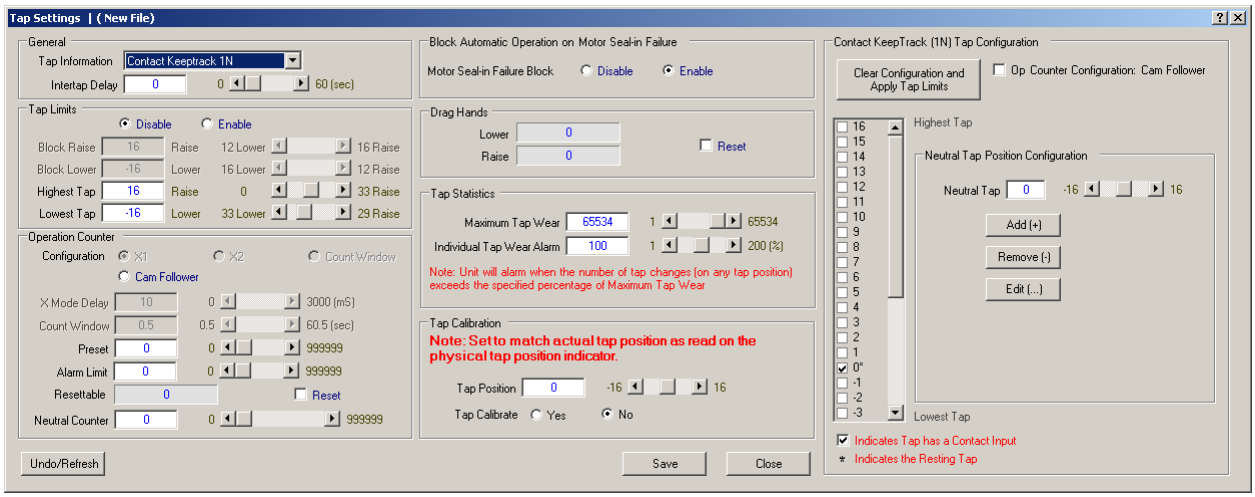


Figure 3-46 Tap Settings Dialog Screen – Contact KeepTrack™ 1N

Setup/Alarms

Programmable Alarm Relay

The programmable alarm function (Figure 3-47) provides alarm monitoring for one or more of the following conditions: Comm Block, Block Raise (Tap), Block Lower (Tap), Block Raise (Voltage), Voltage Reduction, Max VAr Bias Duration Lead/Lag, Individual Tap Wear, LDC/LDZ, Line Current Limit, Reverse Power, Block Lower (Voltage), Abnormal Tap Position, Backup Power Fail, Run Through Neutral Fail to Operate, and Operations Count Signal. Alarm conditions are continuously displayed in the **Metering & Status** screen (Figure 3-28).

The Tap Changer Failure Alarm is only functional when the Operation Counter configuration is set to Cam Follower.

The Alarms Dialog screen also provides the means to reset the Motor Seal-in Failure Alarm/Block, the Low Current Block, the Run Through Neutral Fail to Operate Alarm and the Master/Follower Lockout.

Alarms/Miscellaneous

Undo/Refresh – The **Undo** command allows the user to undo any setting changes in the Alarms screen before the settings have been saved to either the Device or Open File. It also refreshes the screen with the data stored in the unit.

Save – The **Save** command saves the Alarms settings changes to either the Open File when in File mode or the Device when TapTalk is connected to a device.

Close – The **Close** command cancels any Alarms setting changes before the changes have been sent to either the Device or Open File.

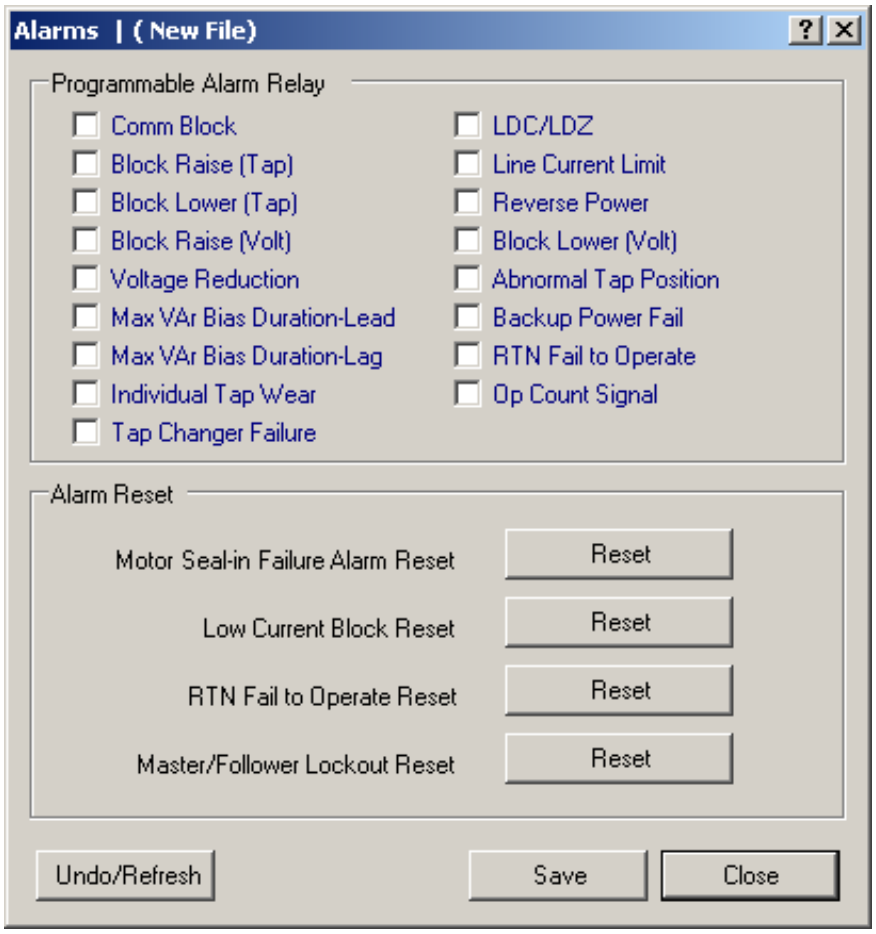


Figure 3-47 Programmable Alarms Dialog Screen

Setup/Wakeup Screens

The Wakeup Screens (Figure 3-48) feature allows the user to select specific control parameters that will be displayed when the control is awakened by depressing the **EXIT/WAKE** pushbutton. When the control is awakened the selected parameters are displayed in a cycling fashion. The display can also be directed to a specific parameter by utilizing the ⬆ or ⬇ pushbuttons. Pressing the **EXIT** pushbutton will stop the cycling display on the displayed parameter. Press **EXIT** again to return to the User Lines screen.

Wakeup Screens/Miscellaneous

Default – The **Default** command allows the user to reset the Wakeup Screens to the default settings.

Save – The **Save** command saves the Wakeup Screen changes to either the Open File when in File mode or the Device when TapTalk® is connected to a device.

Close – The **Close** command cancels any Wakeup Screen changes before the changes have been sent to either the Device or Open File.

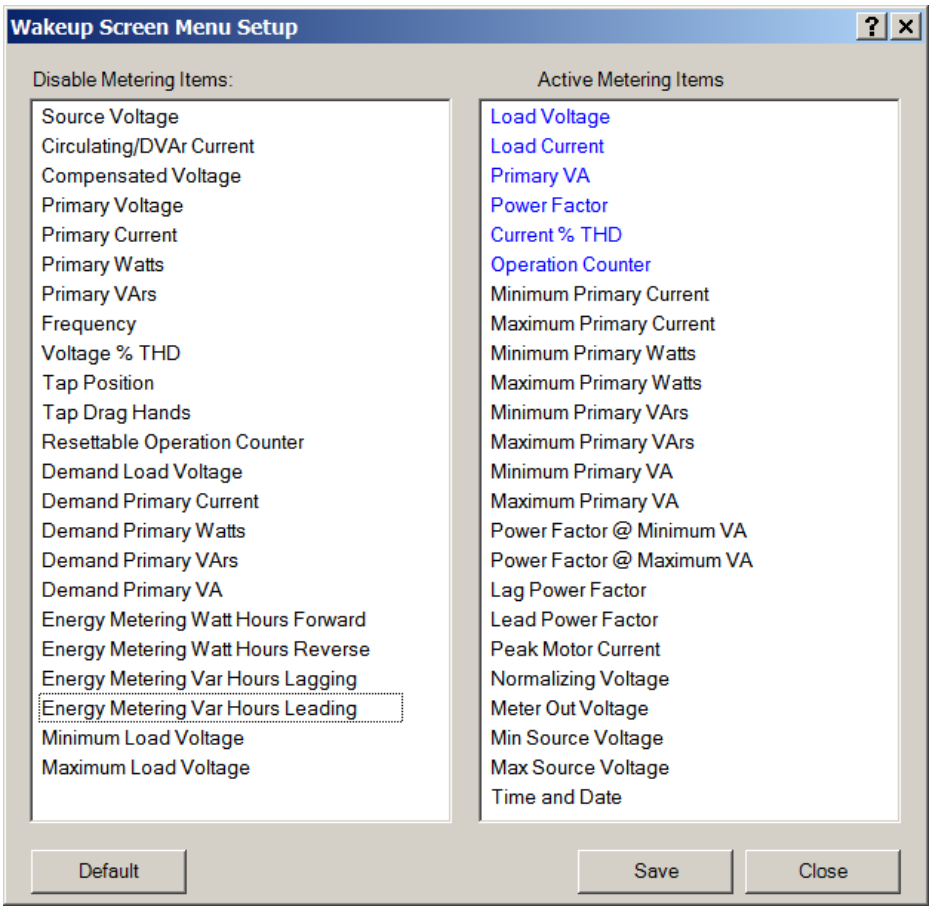


Figure 3-48 Setup Wakeup Screen Dialog Screen

Setup/Data Logging

Data is recorded internally into non volatile memory. The data log is transferred in the Comtrade format. The Comtrade format consist of two files, the configuration file (*.cfg) and the data file (*.dat).

Data logging will continue indefinitely as long as the data interval is set to a non-zero value. A zero value for the data interval will effectively disable data logging. The data log, can be downloaded using MODBUS® (see M-2001D protocol document) or DNP (using file transfer) protocol. The data can be viewed using any Comtrade compatible viewer. TapTalk provides such a tool.

Data logging interval ranges from 0 to 120 min with an increment of 1 minute. Once data logging is enabled, the control will store the data in records at the data interval rate. Each record has the following data:

- Load Voltage
- Primary VA
- Power Factor
- Source Voltage
- Compensated Voltage
- Primary VAr
- Frequency
- Primary Watts
- Load Current
- Tap Position
- Primary Current
- Operations Count
- Circulating/DVAr Current
- Meter Out Voltage
- RTN Counter

The checksum is used to ensure the integrity of the record stored. The average value is calculated over the data logging interval.

Due to the internal structure of the Comtrade format, time stamping is always performed. A total of 6 Mbytes (100,000 records) of data can be saved in non volatile memory.

When connected to a M-2001D Tapchanger Control the **Data Logging** feature provides the user with the ability to initiate data logging of all control parameters to the selected control for downloading at a later time.

This feature allows the user to configure the parameters that the control will use to log data, and to download the logged data to a Comtrade (*.cfg) file. This file format can be viewed by a third party Common Format for Transient Data Exchange (COMTRADE) format viewer software.

Setup/Data Logging/Setup

This submenu item displays the **Data Logging Setup** Dialog Screen (Figure 3-49).

In the **Logging Timer** section, the **Data Log Interval** allows the user to input the interval in minutes at which the data will be logged.

Save – The **Save** command saves the Data Logging Setup changes to either the Open File when in File mode or the Device when TapTalk® is connected to a device.

Close – The **Close** command cancels any Data Logging setup changes before the changes have been sent to either the Device or Open File.

■ **NOTE:** When Load Voltage, Compensated Voltage, Source Voltage and Load Current are selected, the data to be retrieved will consist of the average, minimum and maximum values over the sampling period.

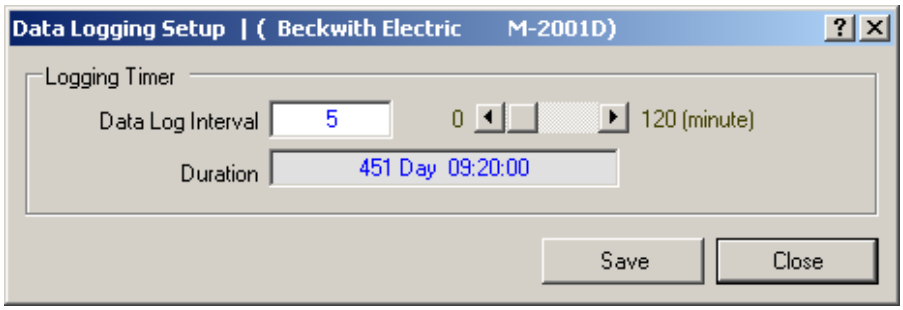


Figure 3-49 Data Logging Setup Dialog Screen

Setup/Data Logging/Retrieve

This submenu item when selected, displays the Data Log Download Screen (Figure 3-50) which allows selection of the parameters and date/time range to be retrieved. Selecting "Download" initiates the retrieval of the current data logging file from the control.

Setup/Data Logging/Clear

This submenu item when selected, clears the data logging information stored in the control.

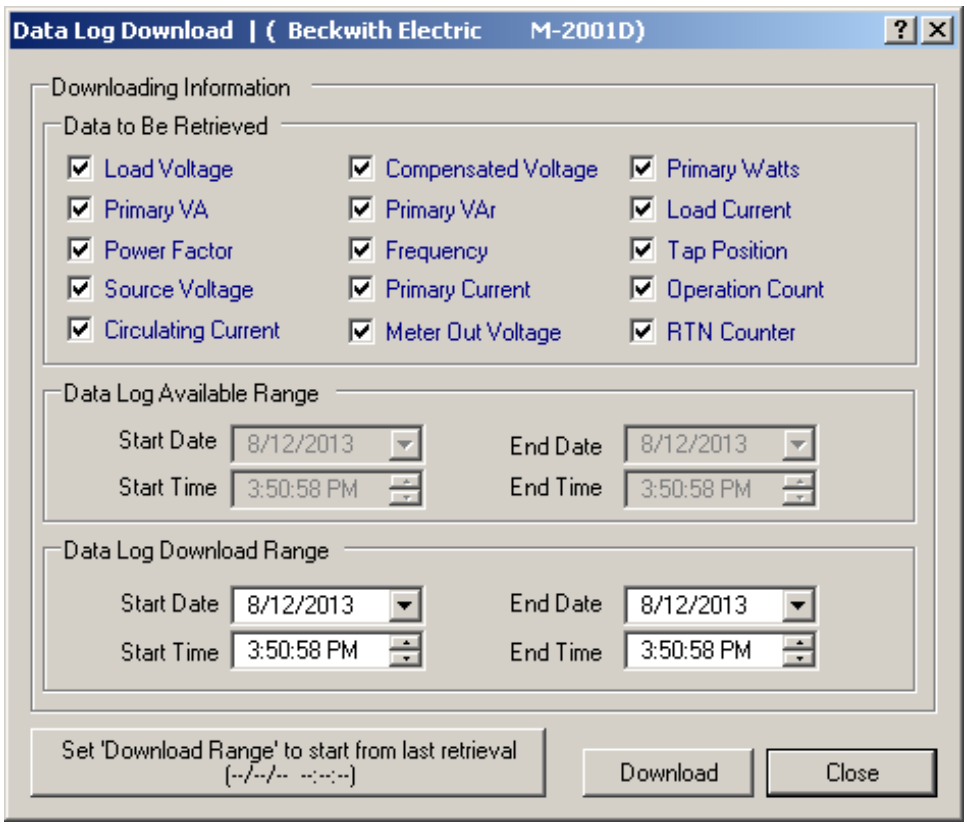


Figure 3-50 Data Log Download Dialog Screen

Setup/Harmonics Setup

The Harmonics Setup dialog screen provides the user with the ability to select Voltage and Current Harmonics for monitoring relative to a Voltage and Current threshold setting. Whenever any selected Voltage or Current Harmonic exceeds their respective threshold if selected in Sequence of Events setup will initiate Sequence of Events recording. The threshold level is set as a percentage of the fundamental.

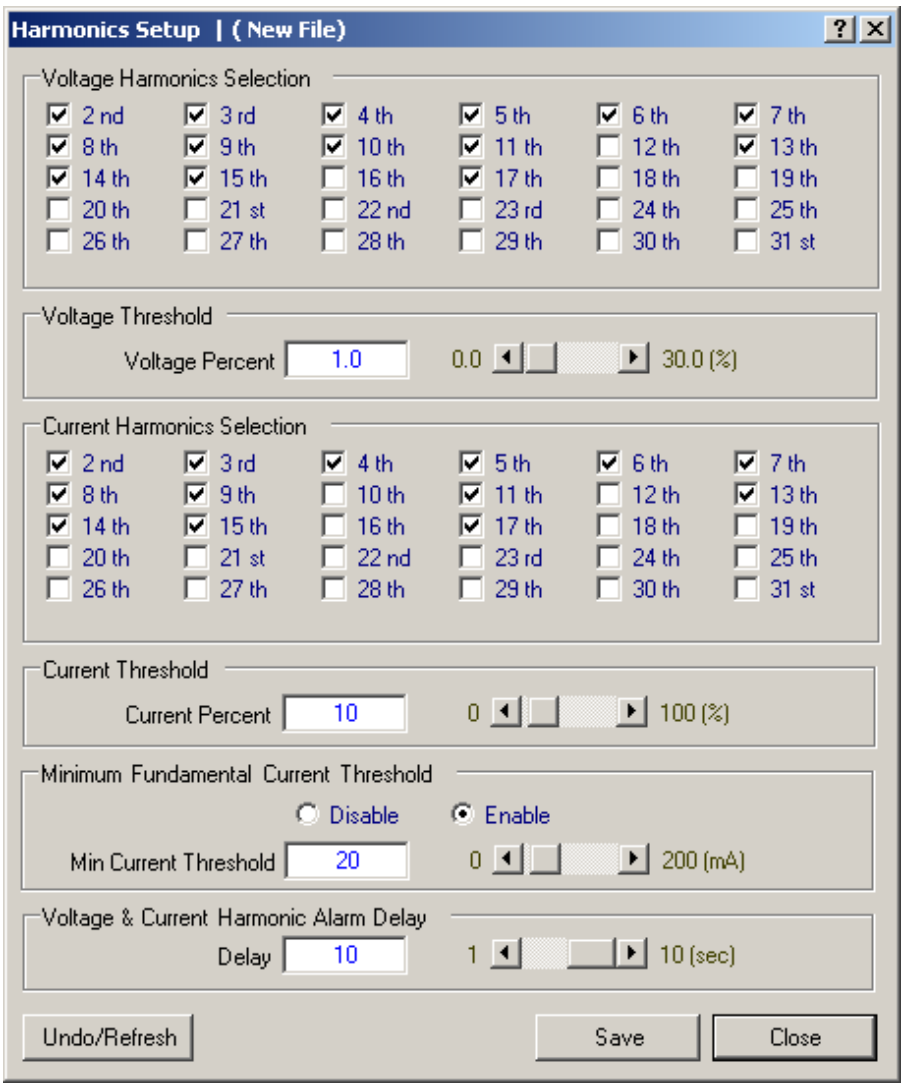


Figure 3-51 Harmonics Setup Dialog Screen

Setup/Oscillograph/Setup

The **Oscillograph Recorder** provides comprehensive data recording (voltage, current and status input/output signals) for all monitored waveforms (at 16 samples per cycle). Oscillograph data can be downloaded using the communications ports to any Windows™ personal computer running the S-2001D TapTalk® Communications Software. Once downloaded, the waveform data can be examined and printed using the TapPlot® Oscillograph Data Analysis Software.

The general information required to setup the Oscillograph Recorder (Figure 3-52) includes:

- **Number of Partitions** – When untriggered, the recorder continuously records waveform data, keeping the data in a buffer memory. The recorder's memory may be partitioned into 1 to 16 partitions (Table 3-1).

When triggered, the time stamp is recorded and the recorder continues recording for a user-defined period. The snapshot of the waveform is stored in memory for later retrieval using TapTalk S-2001D Communications Software.

- **Samples/Cycle** – The number of samples/cycle can be selected to either 16, 32 or 64 samples/cycle.

- **Post-Trigger Delay** – A post-trigger delay of 5% to 95% must be specified. After triggering, the recorder will continue to store data for the programmed portion of the total record before rearming for the next record. For example, a setting of 80% will result in a record with 20% pre-trigger data and 80% post-trigger data.

Number of Partitions	Cycles Per Partition
1	1365
2	910
3	682
4	546
5	455
6	390
7	341
8	303
9	273
10	248
11	227
12	210
13	195
14	182
15	170
16	160

Table 3-1 Oscillograph Recorder Partitions and Cycles for 16 Samples/Cycle

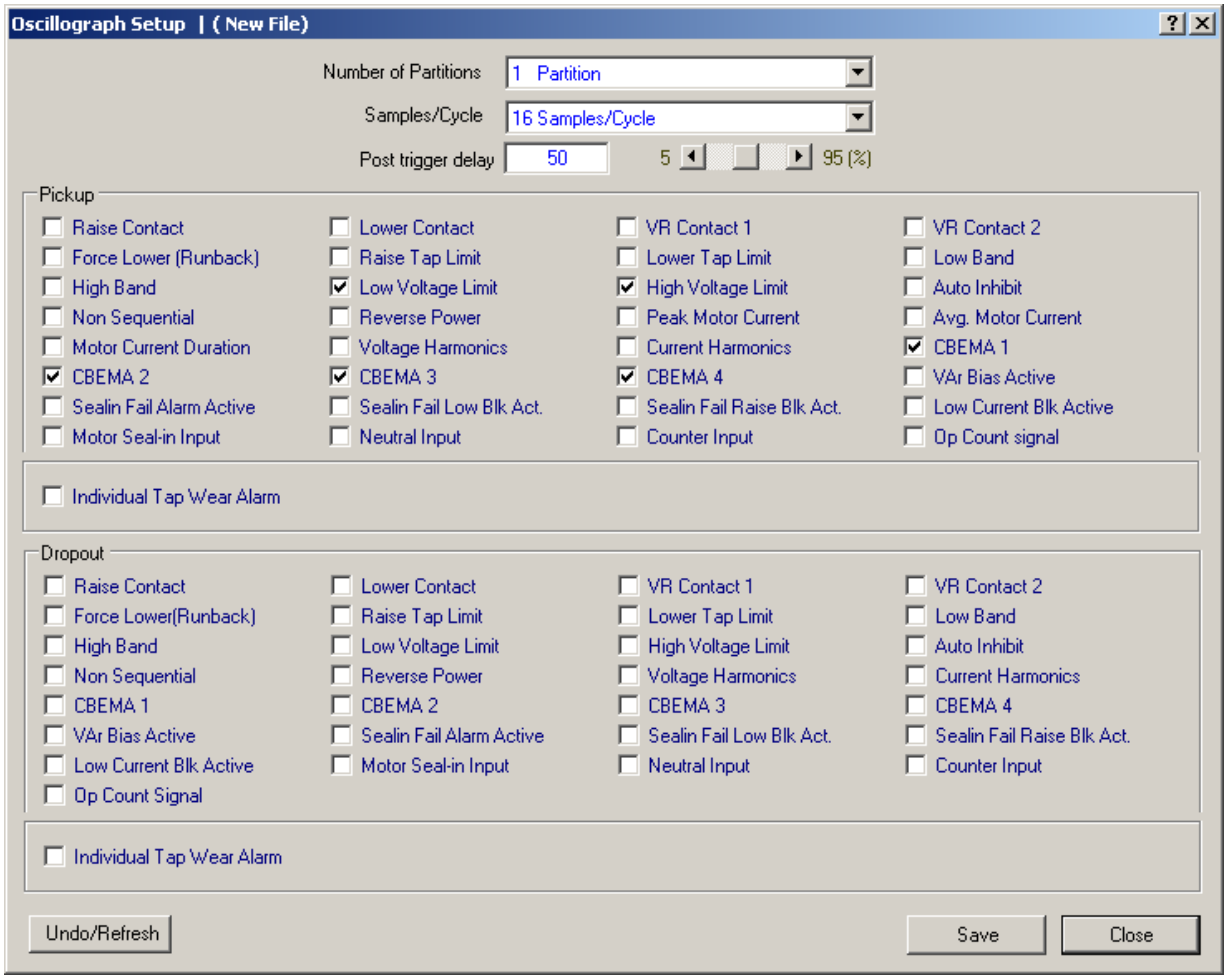


Figure 3-52 Oscillograph Setup Dialog Screen

Setup/Oscillograph/Front Panel Message

The "Oscillograph Record Triggered" cycling display can be enabled from the TapTalk® Communications Software by navigating to the "Oscillography Message" (Setup/Oscillograph/Front Panel Message) dialog screen (Figure 3-53) and selecting "Enable". It can also be enabled from the HMI by navigating to the "Communication HMI" menu.

Figure 3-53 Oscillograph Front Panel Message Dialog Screen

Setup/Oscillograph/Trigger

The **Oscillograph Recorder** can be manually triggered by the user. When trigger is selected a confirming dialog screen is displayed. Selecting **Yes** triggers the Oscillograph Recorder and TapTalk displays a confirming dialog screen.

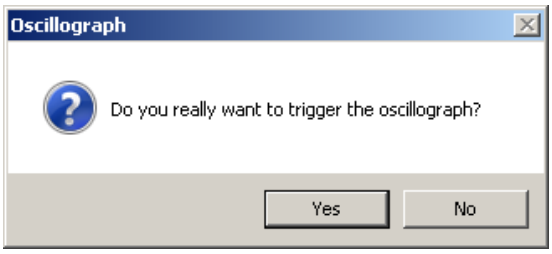


Figure 3-54 Oscillograph Trigger Dialog Screen

Setup/Oscillograph/Retrieve

The **Retrieve** command initiates a sequence of dialog screens (Figures 3-55 and 3-56) to download the Oscillograph data from the currently connected control. Oscillograph data must be retrieved from the control in a Comtrade file (*.cfg) in order to be viewed. TapPlot® can be utilized to view the file contents.

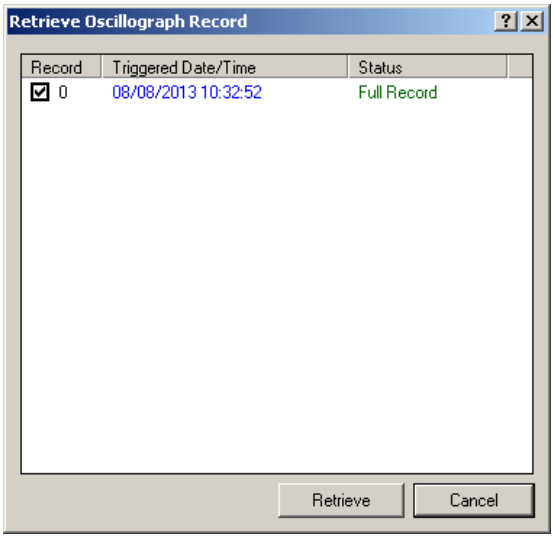


Figure 3-55 Retrieve Oscillograph Record Dialog Screen

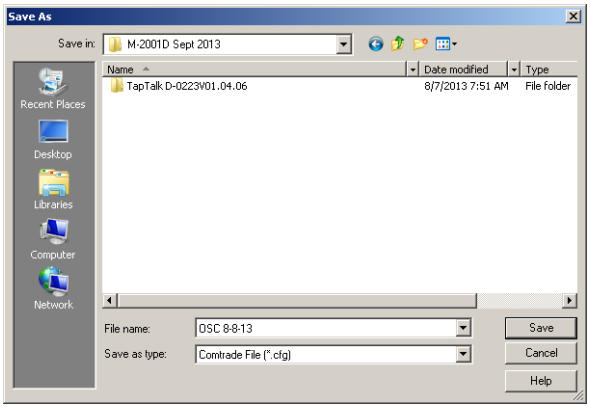


Figure 3-56 Retrieve Oscillograph Record (Save As) Dialog Screen

Setup/Oscillograph/Clear

The **Clear** command clears any Oscillograph records on the connected control.

Setup/Sequence of Events/Setup

The **Sequence of Events Setup** consists of selecting the initiating Pickup and Dropout elements of the control and also setting any logical conditions relative to the Pickup and Dropout sequence to trigger the Sequence of Events recorder.

Selecting the OR and AND Trigger elements is accomplished by selecting either OR or AND Gate boxes on Figure 3-57. TapTalk® will display the OR Gate or AND Gate Setup Dialog Screen. After selections are made in the OR Gate and AND Gate dialog screens the user must select either OR or AND logic to initiate the Sequence of Events recorder. Selecting SAVE then writes the settings to the control.

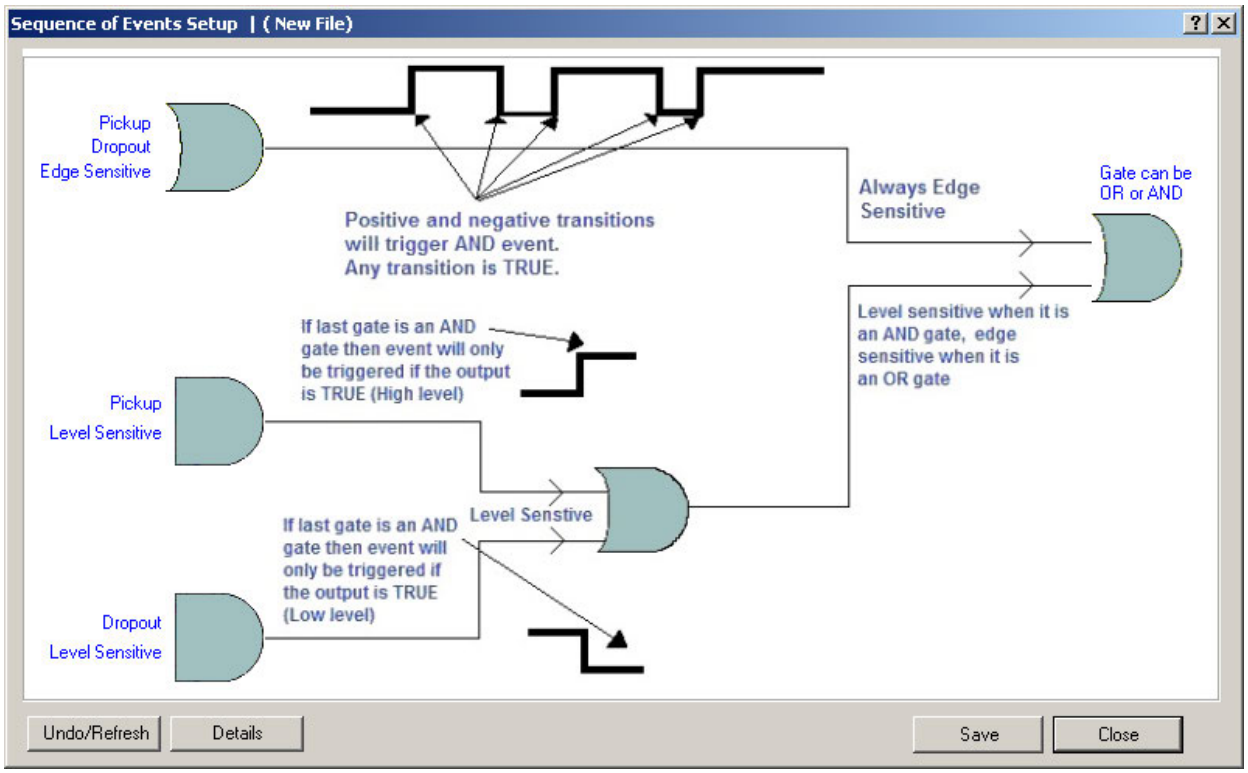


Figure 3-57 Sequence of Events Trigger Logic and Element Selection Dialog Screen

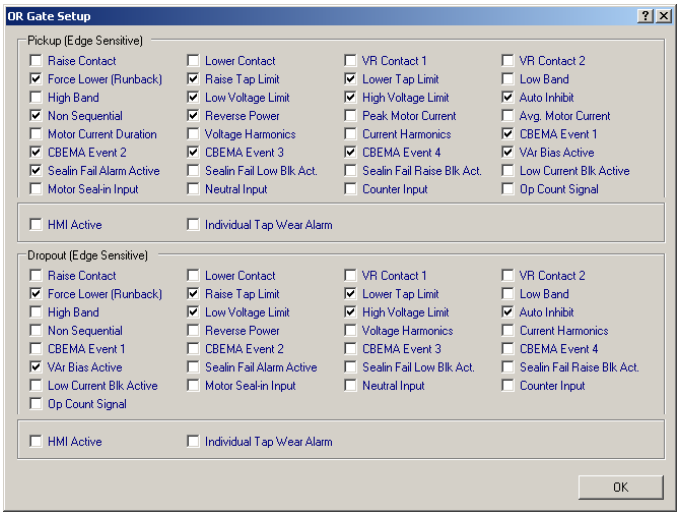


Figure 3-58 Sequence of Events Pickup/Dropout Edge Sensitive OR Gate Setup Dialog Screen

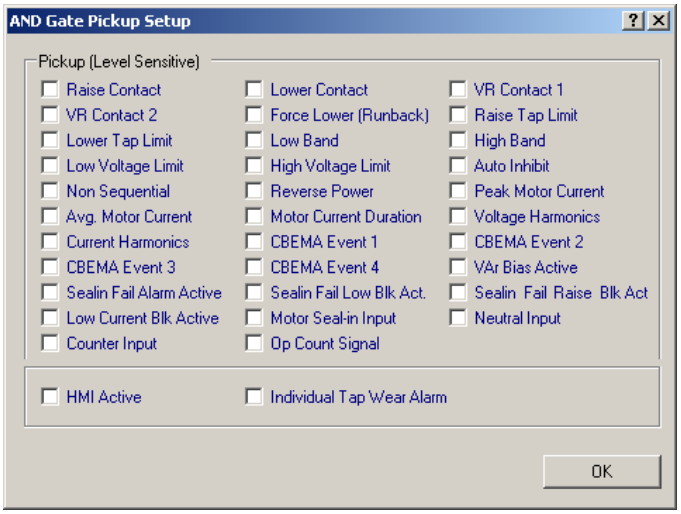


Figure 3-59 Sequence of Events Pickup Level Sensitive AND Gate Setup Dialog Screen

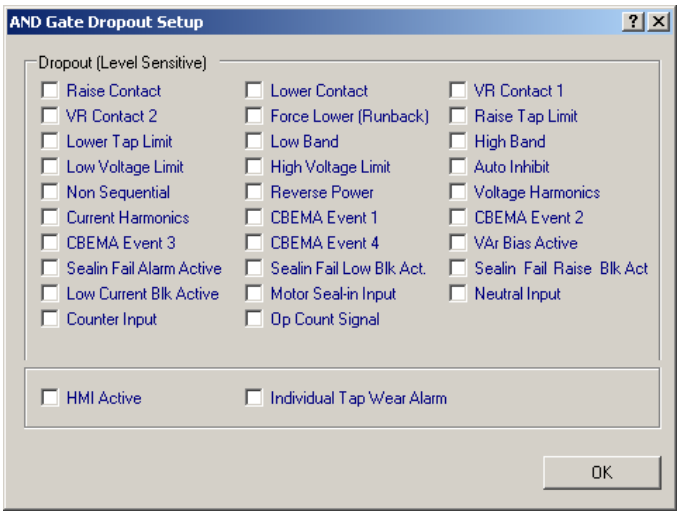


Figure 3-60 Sequence of Events Dropout Level Sensitive AND Gate Setup Dialog Screen

Setup/Sequence of Events/Retrieve

The **Retrieve** command downloads the events from the currently connected control. Events must be retrieved from the control and stored in a file in order to be viewed.

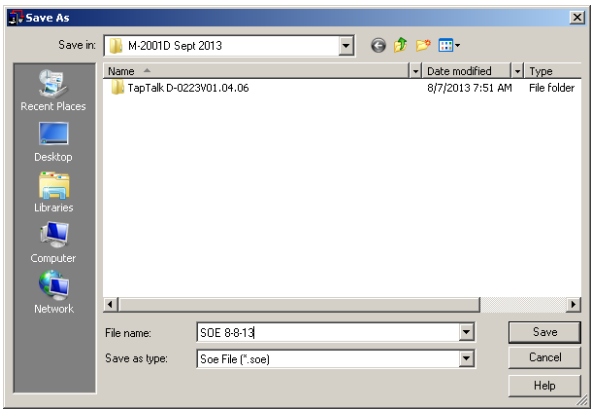


Figure 3-61 Retrieve Sequence of Events File Save As Dialog Screen

Setup/Sequence of Events/View

The **View** command permits the user to display a detailed list of past Sequence of Events and their corresponding captured parameters. (Figure 3-63) The parameters captured in the Sequence of Events file include:

- Local Voltage
- Source Voltage
- Frequency
- Tap Position
- Motor Current
- Load Current
- Resettable Operations Counter
- RMS Voltage
- Meter Out Voltage
- RTN Success Counter
- Profile Number
- Time Stamp
- Trigger Status
- Voltage Harmonics Magnitude
- Current Harmonics Magnitude
- Voltage Harmonics Status (31)
- Current Harmonics Status (31)

Setup/Sequence of Events/Clear

The **Clear** command clears out the Sequence of Events recorder.

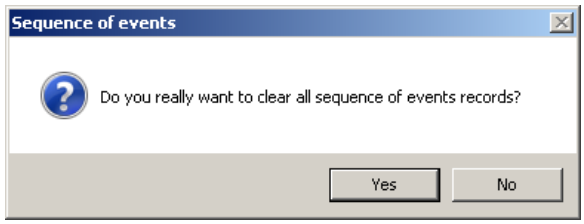


Figure 3-62 Clear Sequence of Events Record Dialog Screen

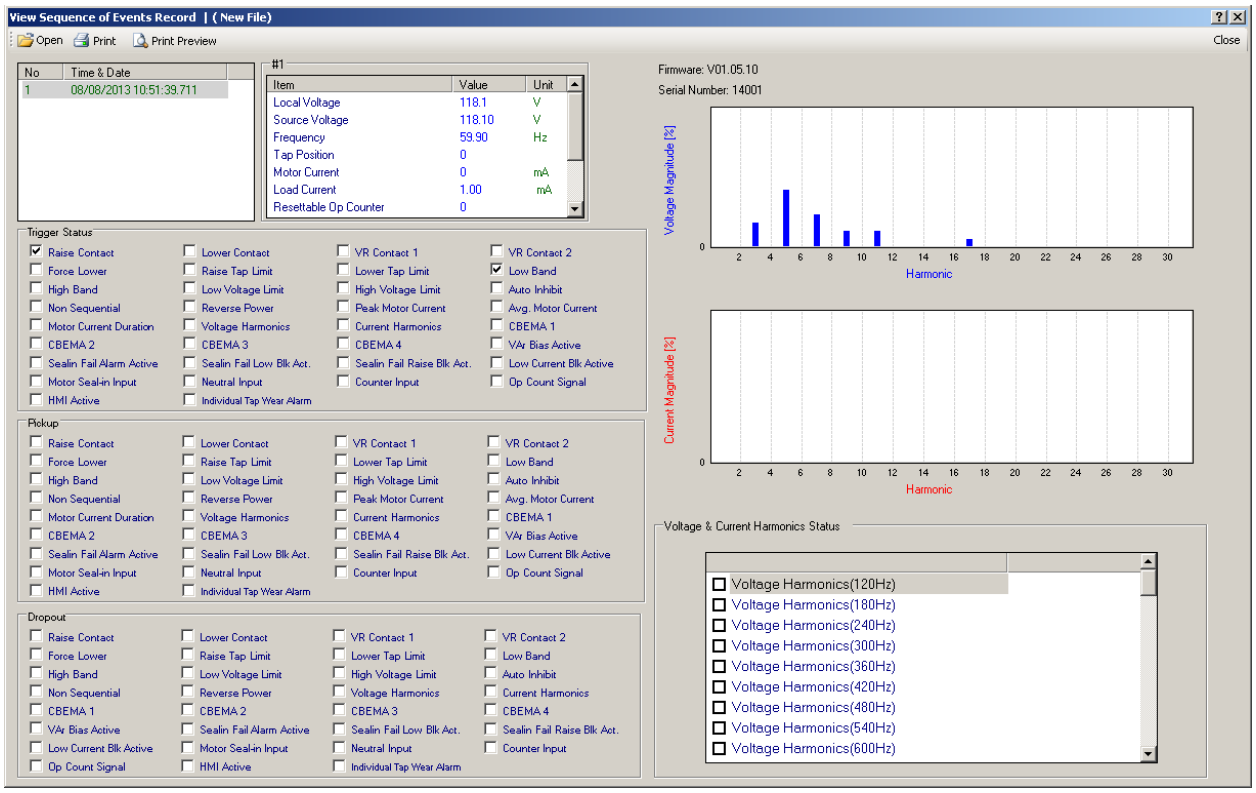


Figure 3-63 View Sequence of Events Record Dialog Screen

Setup/CBEMA Events/Setup

There are a total of 4 Event Monitors in CBEMA (Computer Business Equipment Manufacturers Association). Each CBEMA event monitor has a different minimum duration limit; Event 1, 1 – 60 cycles, Event 2, 1 – 120 cycles, Event 3, 60 – 60000 cycles and Event 4, 1 – 60 cycles. When Pickup is set to less than 100% it operates as a sag (under voltage) function, and when it is greater than 100% it operates as a swell (over voltage) function.

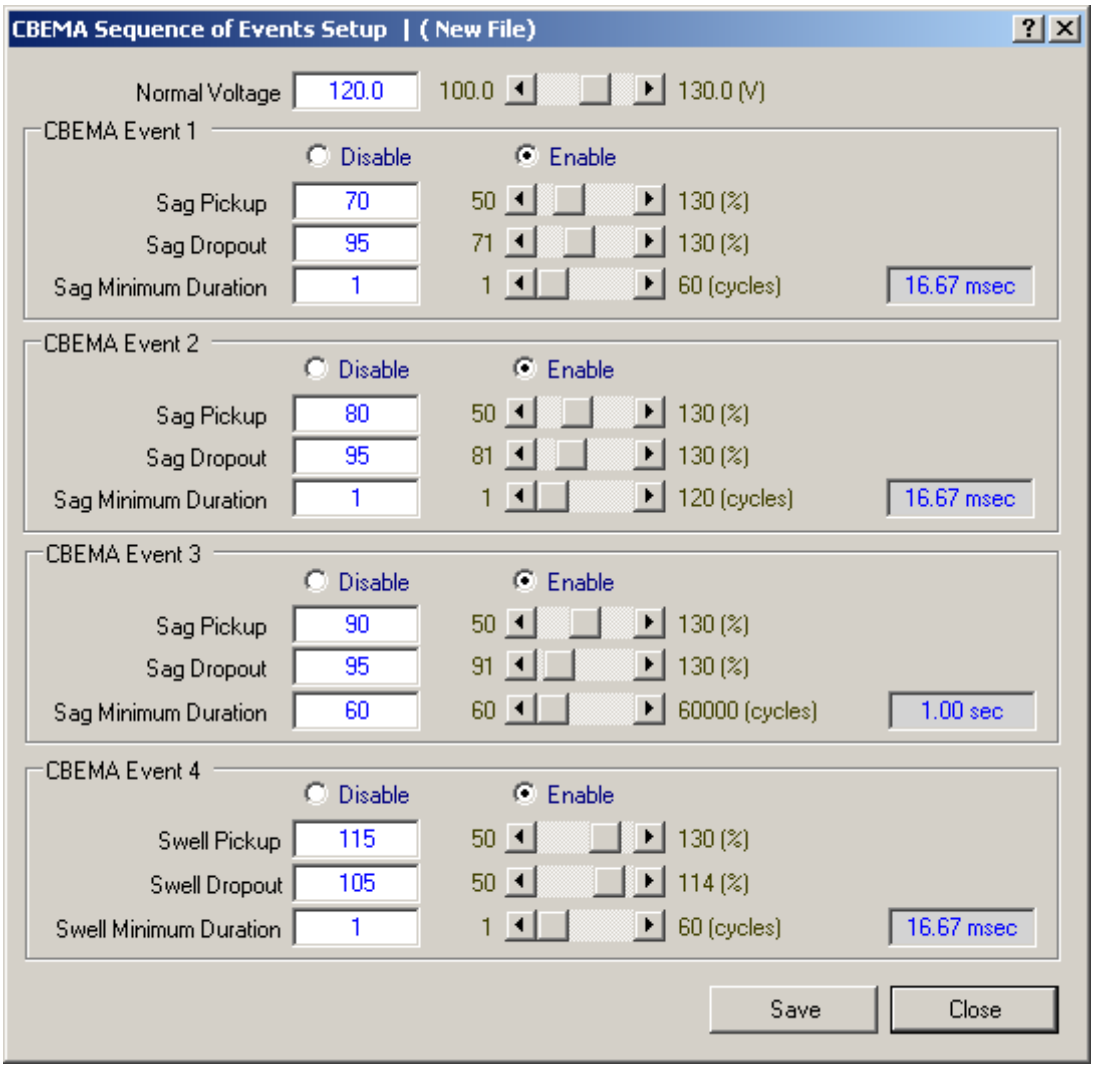


Figure 3-64 CBEMA Setting Dialog Screen

Setup/Display All Settings Command

Selecting **Display All Settings** displays the **All Setpoints** dialog screen (Figure 3-65). This dialog screen contains the settings for each control function within a single window to allow scrolling through all control setpoint and configuration values.

The individual Feature and Function selection buttons are described in the applicable sections.

The All Setpoint Table includes Jump Command Buttons which allow the user to jump from a scrolling dialog screen to an individual control function dialog screen and return to the scrolling dialog screen. All available parameters can be reviewed or changed when jumping to an individual control function dialog screen.

The All Setpoints screen can be printed or saved to a *.HTM file for viewing.

All Setpoints

Print | Print Preview | Save

M-2001D All Setpoints

Software Version: D-0223V01.04.09
Firmware version: D-0214V01.06.12
Serial Number: 1
Beckwith Electric
M-2001D

Setpoints

Profile 1

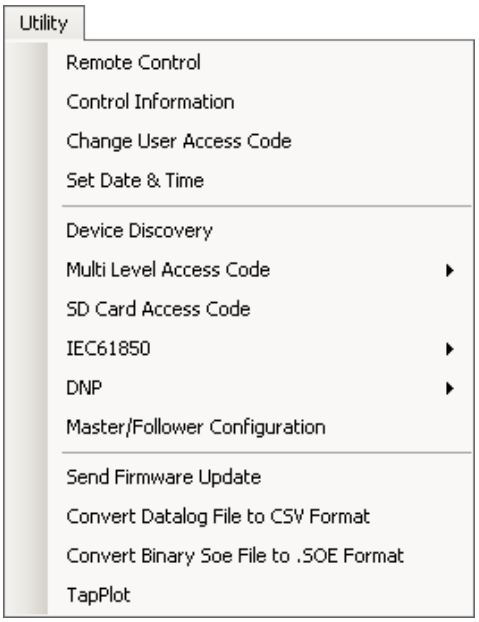
General			
Line Drop Compensation:	R, X	Time Delay Selection:	Definite Time
Basic Timer Type:	Integrating	Power Direction Bias:	None
Forward Power			
Band Center:	120.0 (V)	Band Width:	2.0 (V)
Definite Time Delay:	30 (sec)	LDC-Z:	0 (V)
LDC Resistance:	0 (V)	LDC Reactance	0 (V)
Reverse Power			
Reverse Operation:	Block		
Band Center:	120.0 (V)	Band Width:	2.0 (V)
Definite Time Delay:	30 (sec)	LDC-Z:	0 (V)
LDC Resistance:	0 (V)	LDC Reactance	0 (V)
Voltage Reduction			
Step 1:	2.5 (%)	Step 2:	5.0 (%)
Step 3:	7.5 (%)		
Limit and Runback			
Block Raise:	128.0 (V)	Block Lower:	114.0 (V)
Runback Deadband:	2.0 (V)	Current Limit:	640 (mA)
Runup Enable:	Disable	Runup Deadband:	2.0 (V)

Profile 2

General			
Line Drop Compensation:	R, X	Time Delay Selection:	Definite Time
Basic Timer Type:	Integrating	Power Direction Bias:	None
Forward Power			
Band Center:	120.0 (V)	Band Width:	2.0 (V)
Definite Time Delay:	30 (sec)	LDC-Z:	0 (V)
LDC Resistance:	0 (V)	LDC Reactance	0 (V)
Reverse Power			
Reverse Operation:	Block		
Band Center:	120.0 (V)	Band Width:	2.0 (V)
Definite Time Delay:	30 (sec)	LDC-Z:	0 (V)
LDC Resistance:	0 (V)	LDC Reactance	0 (V)

Figure 3-65 All Setpoints Dialog Screen

UTILITY



The **Utility** menu includes the **Remote Control**, **Control Information**, **Change User Access Code**, **Set Date & Time**, **Device Discovery**, **Multi Level Access Code**, **SD Card Access Code**, **IEC 61850, DNP, Master/Follower Configuration, Send Firmware Update**, **Convert Datalog File to CSV Format, Convert Binary Soe File to .SOE Format** and **TapPlot®** submenu items.

Utility/Remote Control

▲ **CAUTION:** This feature should be used with extreme caution.

The **Remote Control** menu item located in the Utility drop down menu displays the applicable **Remote Control** screen (Figure 3-66). Remote Control allows the user to:

- Remotely raise or lower one tap position.
- Apply Voltage Reduction Step 1 or 2 or 3.
- When the Auto/Manual Switch Type is set to either "Toggle" or "NONE" the Block Auto Control via Communication (Comm Block) setting is available.
- When the Auto/Manual Switch Type is set to "SCAMP" the SCAMP Auto/Manual Control setting is available.

Block Auto Control via Communication

Block – Blocks automatic operation of the addressed control.

Unblock – Initiates automatic operation of the addressed control.

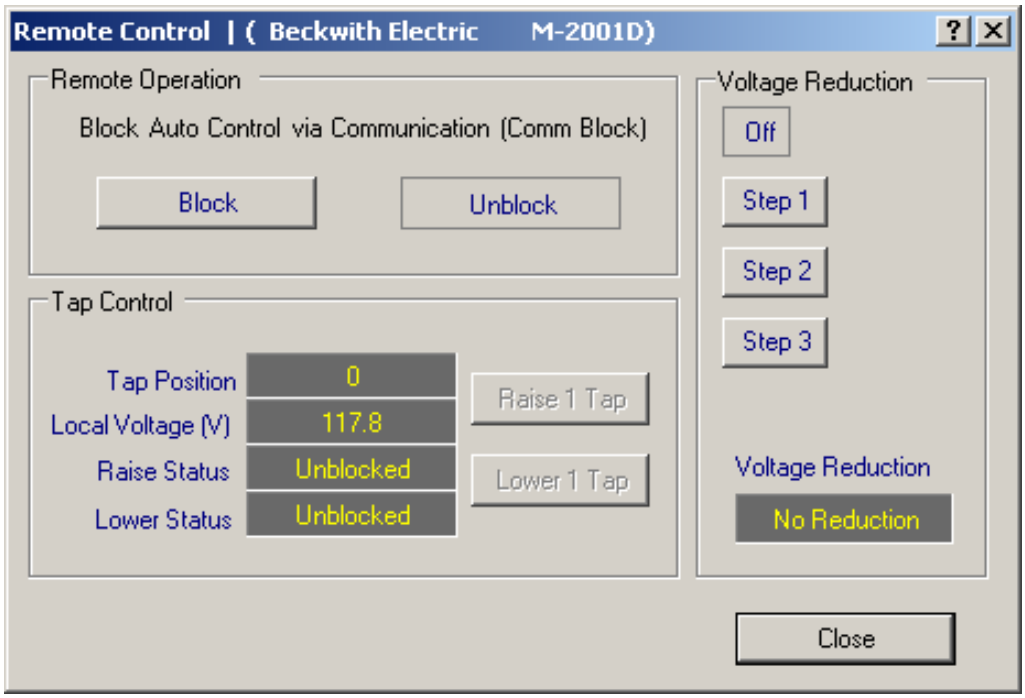
Restoring Automatic Operation (Local)

Automatic operation can be restored from the front panel by removing the "Block Auto Control via Communication" through TapTalk® or by performing the following:

1. From the control front panel pushbuttons change the **Comm Block Auto** setting in the **Configuration/Nameplate** menu to **DON'T SAVE**.
2. Remove power to the control, then reapply power to the control. Automatic operation will then be restored.

SCAMP Control

The SCAMP Control feature (Figure 3-66) allows the user to remotely observe the status of the Adapter Panel SCAMP pushbutton (when equipped). This feature also allows the user to change the state of the Local SCAMP pushbutton on the Adapter Panel/Control.



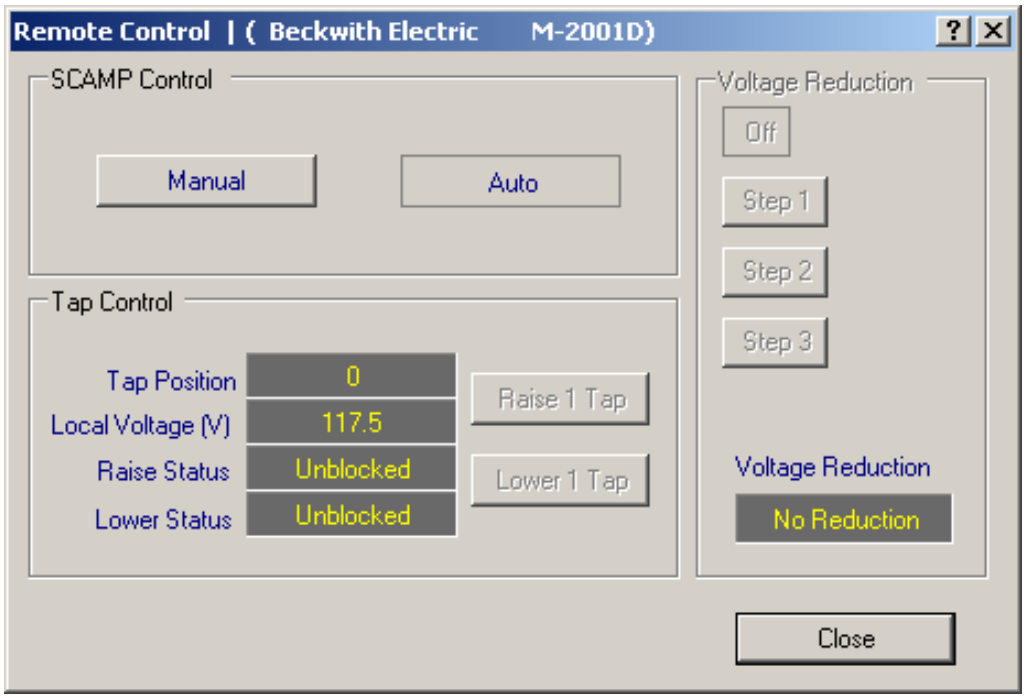


Figure 3-66 Remote Control Screens

Utility/Control Information

The **Control Information** submenu item displays the **Control Information** Screen (Figure 3-67). The **Control Information** screen provides specific information about the addressed control. The **Control Information** screen includes the following:

- The addressed control's serial number
- Control's firmware version
- The text currently displayed in the User Lines 1 and 2

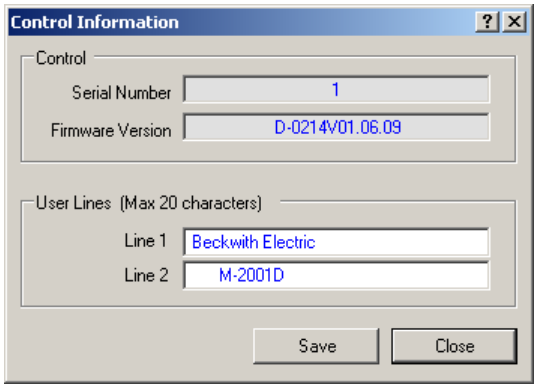


Figure 3-67 Control Information Screen

The Control Information screen also provides the user with the ability to review and change the user lines for the addressed control.

Control Information/Miscellaneous

Save – The **Save** command saves the User Line changes to the control when TapTalk® is connected to a control.

Close – The **Close** command cancels any User Line changes before the changes have been sent to the control.

Utility/Change User Access Code

The User Access Code Level 1 and User Access Code Level 2 protect access to the control from the front keypad and TapTalk.

User Access Code protection, when implemented, is as follows:

Default	View All
Level 1	Change Setpoints, Date/Time
Level 2	Change Setpoints, Configuration, Communication, Set New Access Codes, Start Data Logging, Setup Data Logging, Remote Control, Set User Text Lines, Set Control Date/Time

■ **NOTE:** If additional Access Codes are desired then see Multi Level Access Code later in the Utility section.

To change User Level Access Codes, perform the following:

1. Select **Utility/Change User Access Code** from the TapTalk toolbar. TapTalk will display the Change User Access Code dialog screen (Figure 3-68).

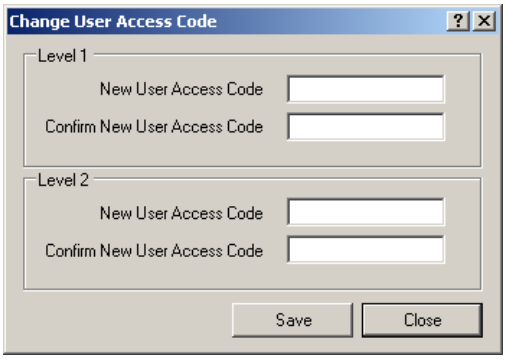


Figure 3-68 Change User Access Code Dialog Screen

2. Input a new Level 1/Level 2 six digit alphanumeric User Access Code.
3. Input the User Access Code from Step 2, in **Confirm New User Access Code**.
4. Select **Save**. TapTalk will display a Save to Device confirmation screen.
5. Select **Yes**. TapTalk will return to the Main Screen.

Utility/Set Date & Time

The **Set Date & Time** submenu item enables the user to review the internal clocks for the PC or the addressed control and also allows the selection of daylight saving.

To set control time/date and/or Daylight Saving, perform the following:

1. From the TapTalk® Main Screen Utility drop down menu select **Set Date & Time**. TapTalk will display a warning (Figure 3-69) regarding time stamped values. Select **OK**. TapTalk will display Figure 3-70.

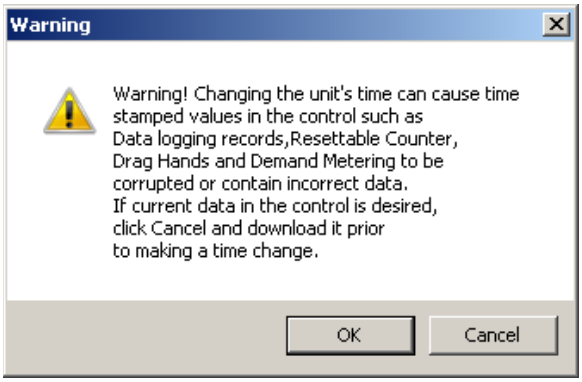


Figure 3-69 Set Date/Time Warning Dialog Screen

2. From the Set Control Date/Time dialog screen (Figure 3-70) select either **Control Clock** or **PC Clock**.

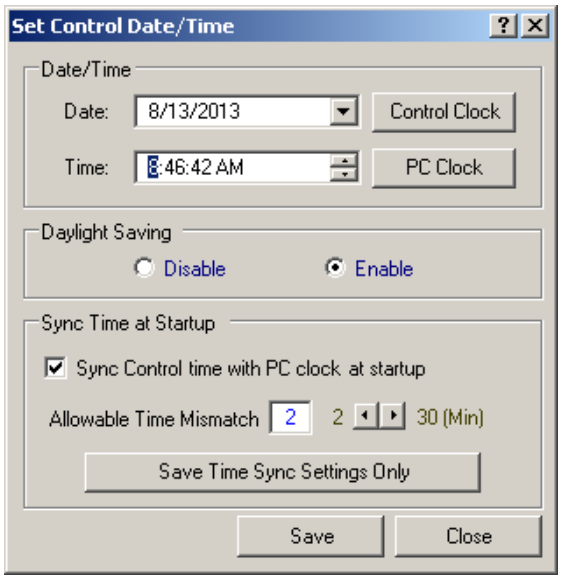


Figure 3-70 Set Control Date/Time Dialog Screen

3. Verify that the desired Daylight Saving setting is selected.
4. If desired select "Sync Time at Startup" and the desired "Allowable time mismatch" value.
5. If PC Clock was selected and the Date/Time of the PC is the desired time to be set in the control. then select **Save**.
6. If Control Clock was selected, then input the desired Date/Time, then select **Save**. TapTalk will respond with a Reset Demand and Energy warning screen (Figure 3-71).

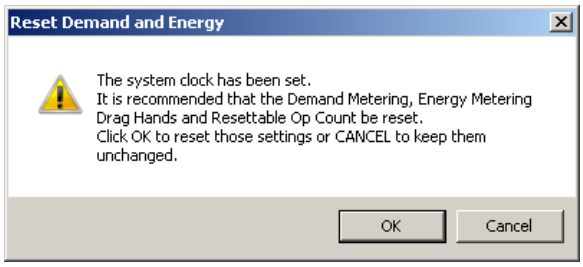


Figure 3-71 Reset Demand and Energy Warning Dialog Screen

▲ **CAUTION**: Whenever the clock is reset and data logging is enabled the data log should be cleared.

7. Select **OK** to reset Demand Metering, Energy Metering, Drag Hands and Resettable Operation Counter or **Cancel** which will not reset these parameters.

   TapTalk will return to the Main Screen.

Utility/ Device Discovery

The **Device Discovery** menu selection can be used when the control exists on an Ethernet network. It allows the user utilizing TapTalk® to discover M-2001D Beckwith Electric products on the network without needing to know the individual IP Addresses of other controls. When a control is found and selected the user can send and receive DNP Configuration files, IEC 61850 CID files and receive Access Code Log files.

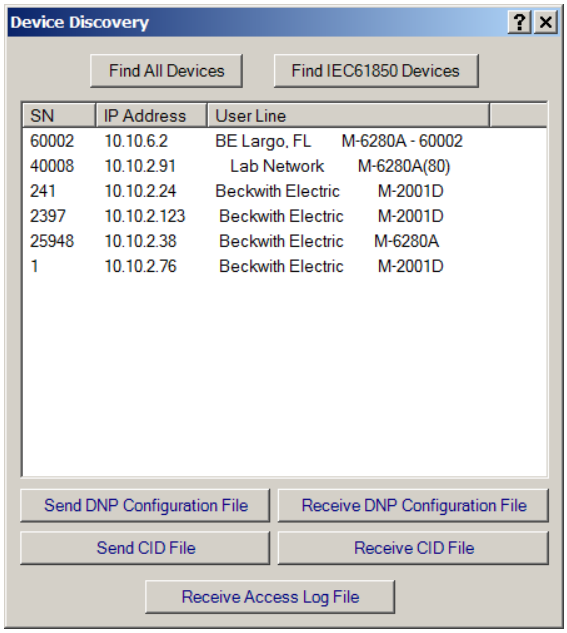


Figure 3-72 Device Discovery Dialog Screen

Utility/Multi Level Access Code

The **Multi Level Access Code** menu selection provides the user with the ability to create up to 30 unique fifteen character Access Codes (Figure 3-73). The list is created in TapTalk and downloaded to the control. Once a control has the list, the user can download a log of date and time each access code was used to access the control as well as when that access was terminated.

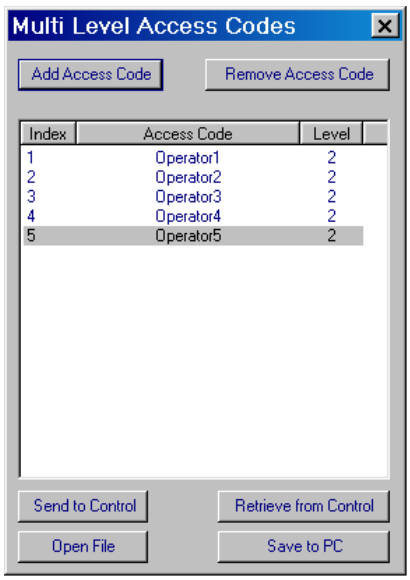


Figure 3-73 Multi Level Access Code Dialog Screen

Utility/SD Card Access Code

This feature allows the user to write a User Access Code Level 1 or 2 to a Smart Flash SD Card. When a User Access Code is present on the SD Card, when inserted, the control reads the User Access Code and does not prompt for the Access Code while the SD Card is inserted.

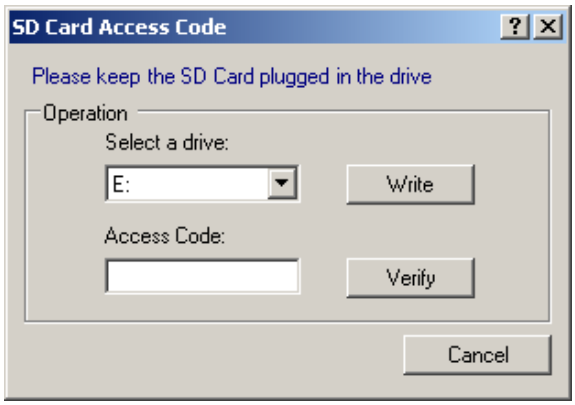


Figure 3-74 SD Card Access Code Dialog Screen

Utility/IEC 61850

The IEC 61850 menu selection (when purchased) provides the user with access to the IEC 61850 Protocol Configuration Editor (Figure 3-75). The following Configuration Editor features are provided:

- File - New, Open, Save Template, Save, Save As
- Schema - 1.4 or 3.0
- Reporting - Metering Dataset and Status Dataset
- GOOSE Publisher - 1 through 5
- GOOSE Subscriber - 1 and 2
- Validate
- Print and Print Preview
- See Appendix D for detailed information

Also, the IEC 61850 menu provides access to "Send" and "Receive" Configuration Files, CID File Identifier and the Non-Standard Data Definition document (.pdf) for reference.

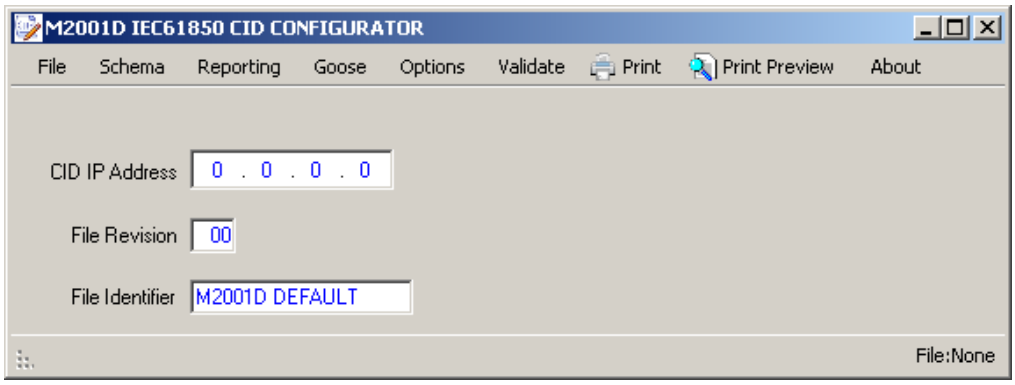


Figure 3-75 IEC 61850 Configuration Editor Dialog Screen

Utility/DNP

The Utility DNP Menu provides access to the **DNP Configuration Editor, Source Address Validation, Send DNP Configuration, Receive DNP Configuration File, DNP File Identifier and UDP Port Settings** features.

Utility/DNP/DNP Configuration Editor

The **DNP Configuration Editor** menu selection opens the **M-2001D DNP Configuration Editor** dialog screen (Figure 3-76) which provides the user with the following capabilities:

- M-2001D default DNP configuration files (*.xml) can be loaded for editing or become the basis for new DNP configuration files.
- Selected DNP configuration files (*.xml) other than M-2001D default files can be loaded for editing or become the basis for new DNP configuration files.
- Binary Inputs, Analog Inputs, Binary/ Control Outputs and Analog Outputs may be added, edited or deleted.
- Dummy positions may be added to allow SCADA table matching.
- Variations may also be edited.
- File can be saved to disk or to the connected control.
- Items in the editor can be moved, added and removed by dragging and dropping.
- Enable/Disable unsolicited response.
- Screen can be printed.
- Master Address for unsolicited responses and/or Source Address Validation.
- See Appendix C for detailed information.

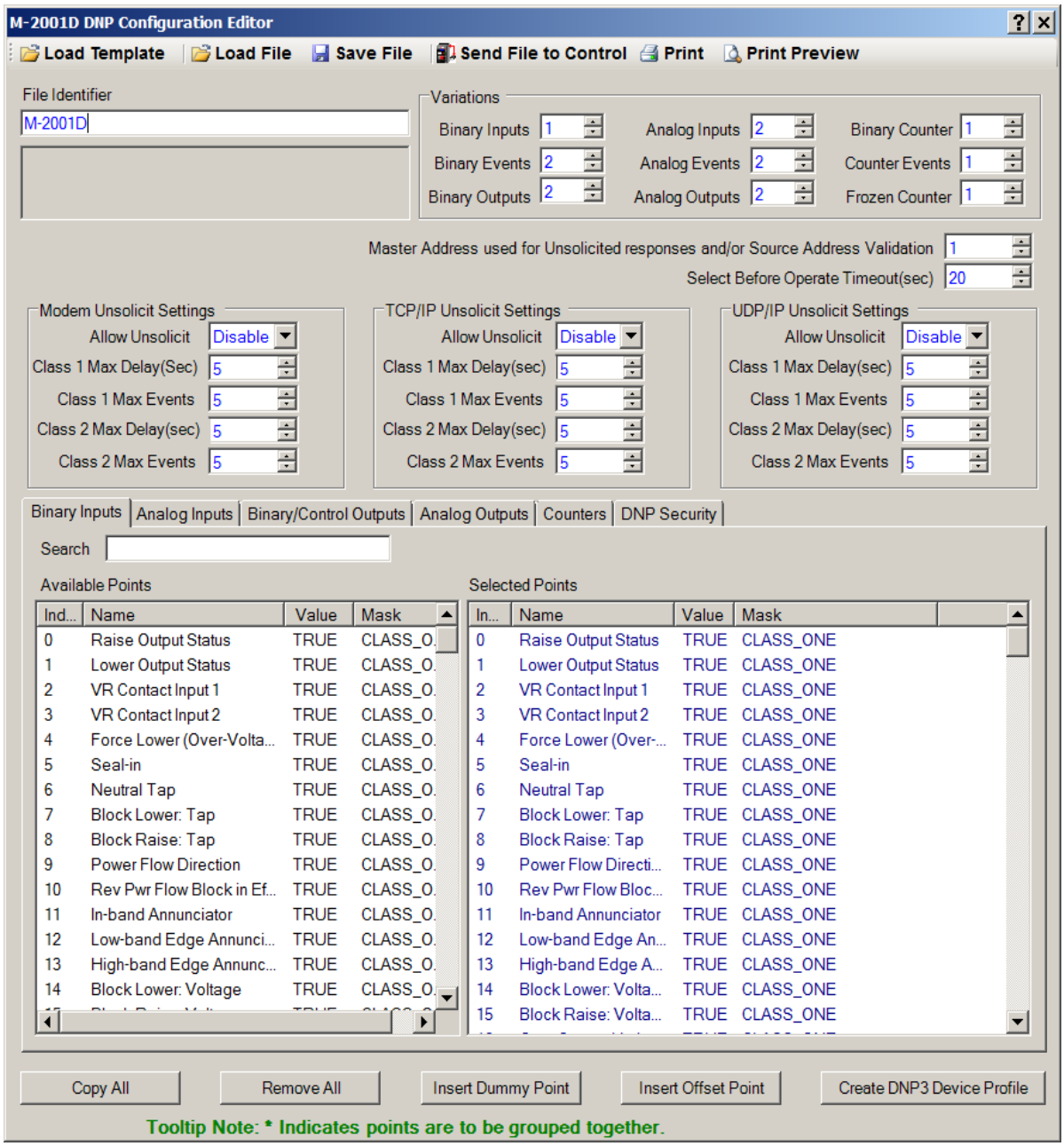


Figure 3-76 M-2001D DNP Configuration Editor Dialog Screen

Utility/DNP/Source Address Validation

The **Source Address Validation** feature is available from the Utility/DNP menu selection. When Source Address Validation is enabled it applies only when DNP3.0 Protocol has been selected regardless of the physical interface. If enabled the client address must match the address set by the user in the DNP Configuration file before accepting the message as a valid one.

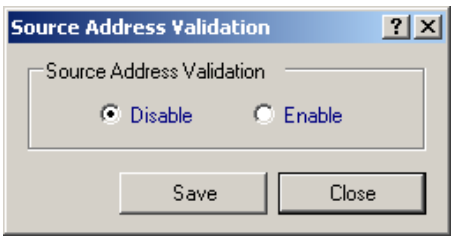


Figure 3-77 Source Address Validation Dialog Screen

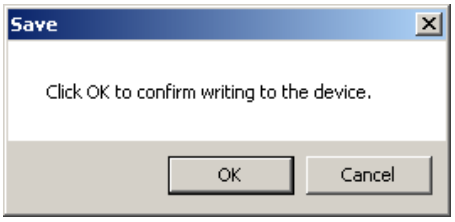


Figure 3-78 Confirm Writing to the Device Dialog Screen

Utility/DNP/Send DNP Configuration File

The **Send DNP Configuration File** menu selection provides the user with the capability to upload a DNP configuration file to the control. To upload a DNP configuration file proceed as follows:

1. From the TapTalk® Main Screen select **Utility/DNP/Send DNP Configuration File**. TapTalk will display the Authentication Key Generated dialog screen (Figure 3-79).

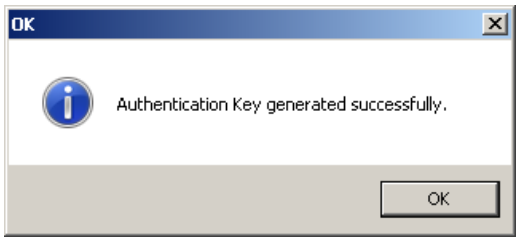


Figure 3-79 Authentication Key Generated Dialog Screen

2. Select **OK.** TapTalk will display the Open File Dialog screen (Figure 3-80) with a default *.xml file extension.

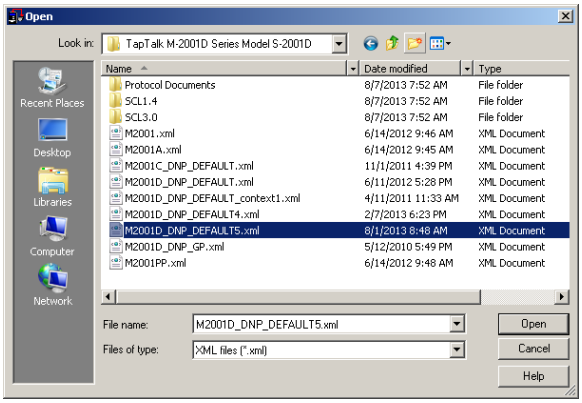


Figure 3-80 DNP Open File Dialog Screen

3. Select the target file, then select **Open**. TapTalk will display the DNP **Send** status screen Figure 3-81.

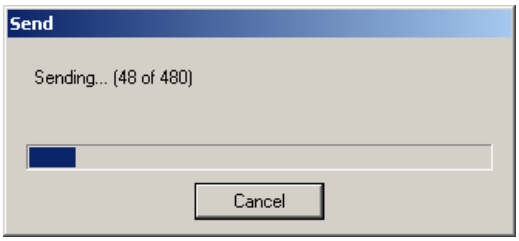


Figure 3-81 Send Status Screen

4. When the DNP Configuration file has been uploaded TapTalk® will display a confirmation screen (Figure 3-82). Select **OK**. TapTalk will return to the Main Screen.

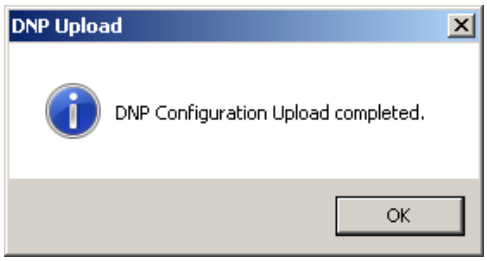


Figure 3-82 DNP Upload Complete Screen

Utility/DNP/Receive DNP Configuration File

The **Receive DNP Configuration File** menu selection provides the user with the capability to download a DNP configuration file from the control. To download a DNP configuration file proceed as follows:

1. From the TapTalk Main Screen select **Utility/DNP/Receive DNP Configuration File**. TapTalk will display the Save As dialog screen (Figure 3-83) with a default *.xml file extension.

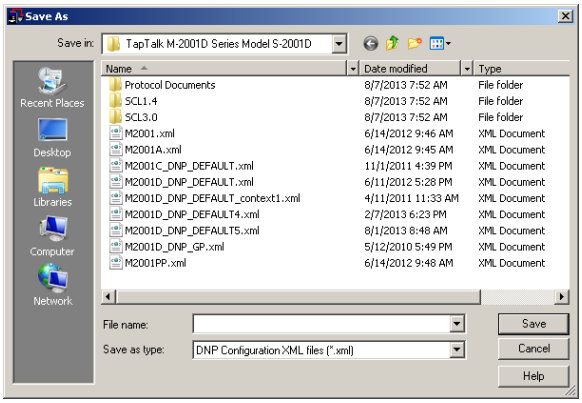


Figure 3-83 Save As File Dialog Screen

2. Select the target file or enter a valid name for the new file, then select **Save**. TapTalk will momentarily display a download status screen.

3. When the DNP Configuration file has been downloaded TapTalk will display a confirmation screen (Figure 3-84). Select **OK**. TapTalk will return to the Main Screen.

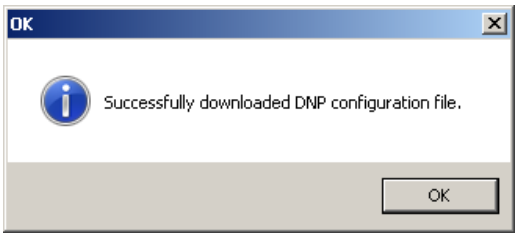


Figure 3-84 Download Complete Dialog Screen

Utility/DNP/DNP File Identifier

The **DNP File Identifier** menu selection when selected displays the DNP File Identifier that is loaded onto the control.

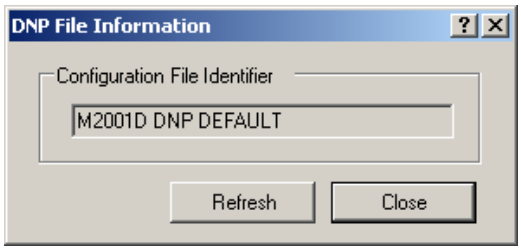


Figure 3-85 DNP File Information Dialog Screen

Utility/DNP/UDP Port Settings

A total of 5 UDP channels exist for DNP. The first channel is reserved for unsolicited messages. The control will send any unsolicited responses to the UDP Remote IP/Port that has been configured. If the Remote IP and Port have not been configured, the unit will not send any unsolicited messages.

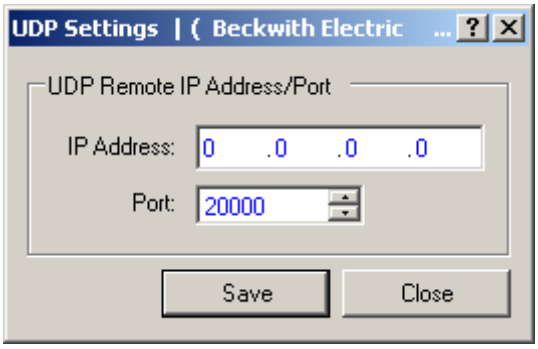


Figure 3-86 UDP Settings Dialog Screen

Utility/ Master/Follower Configuration

The Master/Follower Configuration menu selection (when purchased) provides the user with access to the Master/Follower Configuration Tool dialog screen (Figure 3-87). The Configuration Tool provides the means to:

- Discover Master/Follower controls on the connected network
- Display Control Master/Follower settings
- Edit and apply Master/Follower settings to the selected control
- Reset the Master/Follower Lockout Alarm

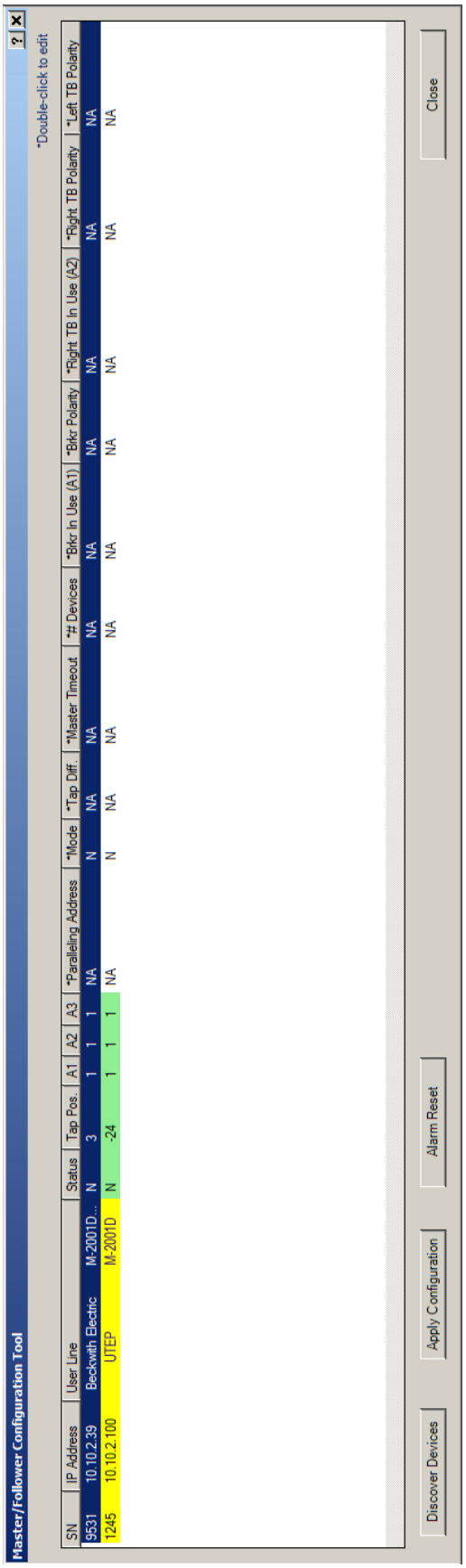


Figure 3-87 Master/Follower Configuration Menu

Utility/Send Firmware Update

The **Send Firmware Update** feature is available from the Utility menu selection. This feature allows the user to upload firmware updates to the control. Firmware updates may be uploaded at any time, as the control settings are not affected. To send a firmware update to the control proceed as follows:

1. Remove the control from service.
2. From the TapTalk® Main Screen select **Utility/Send Firmware Update**. TapTalk will display the Open file dialog screen (Figure 3-88) with a default *.bot file extension.

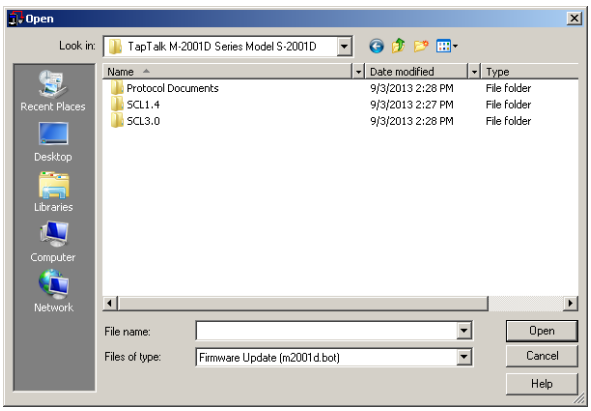


Figure 3-88 Open File Dialog Screen

3. Select the target file, then select **Open**. TapTalk will display the **Firmware Upload** dialog screen Figure 3-89.

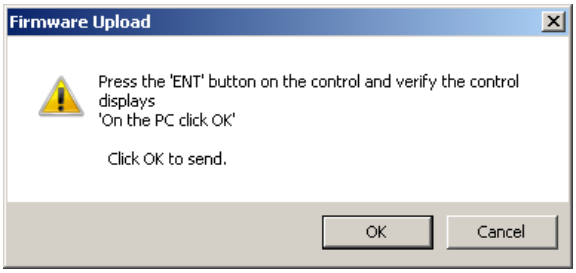


Figure 3-89 Firmware Upload Screen

The dialog screen contains instructions to verify that the control displays "On the PC click OK" the control will display the following:

```
Firmware Update
← Press ENT to begin
```

4. Press the **ENT** pushbutton, the control will display the following:

```
On the PC
Click OK
```

5. From the **Upload** dialog screen Figure 3-89) select **OK**. TapTalk will display the Send Status Screen Figure 3-81).

   When the file transfer has been completed TapTalk will display a Firmware Upload Confirmation screen (Figure 3-90) and close communications.

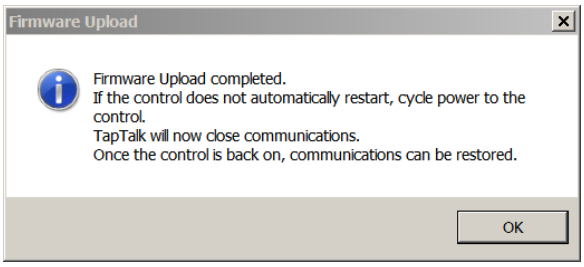


Figure 3-90 File Transfer Confirmation Screen

6. When the control displays the following:

```
Update Complete
Rebooting
```

   The control will reboot automatically.

■**NOTE:** After a Firmware Update, remove power to the control and then reapply power to initialize the unit.

7. Select **OK**. TapTalk will return to the main screen. Communication will need to be reestablished.

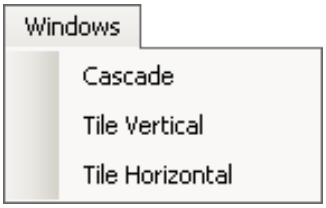
Utility/Convert Datalog File to CSV Format

This feature allows Datalog Files created on the M-2001D to be converted to "*.csv" format files that can be opened in any spreadsheet program.

Utility/Convert Binary Soe File to .SOE Format

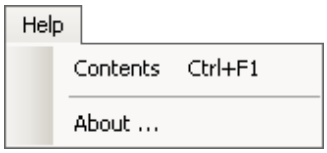
This feature allows the user to convert binary Soe files downloaded from third party software to the Beco (.SOE) format for viewing in the TapTalk SOE Viewer (Figure 3-91).

Windows



The **Windows** toolbar item provides the **Cascade** and **Tile** display options. The **Windows** toolbar item also allows the user to select between open TapTalk® windows.

Help



The **Help** toolbar item provides the user with information about the control and the firmware version that is installed in the unit.

Help/Contents

The Instruction Book menu topic has been indexed to its Table of Contents. By selecting the 'Navigator pane' in Adobe Acrobat Reader, the user can directly access selected topics.

Help/About S-2001D

The **About** submenu item provides the TapTalk software version number, control firmware version, (if connected), and copyright information.

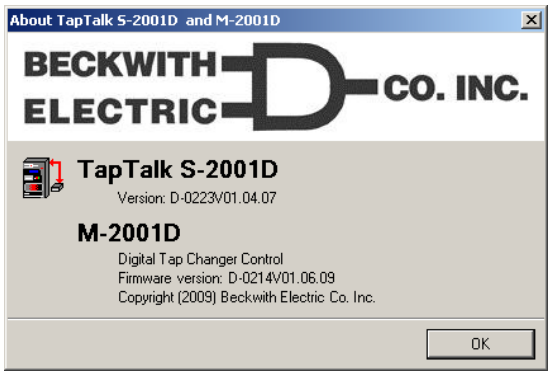


Figure 3-92 About TapTalk

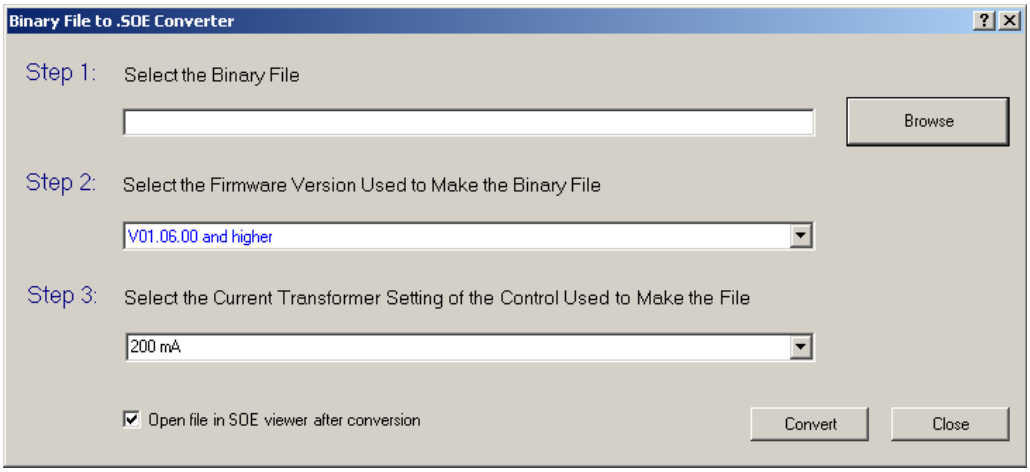


Figure 3-91 Convert Binary File to SOE Format Dialog Screen

3.11 TapPlot Analysis Software

The TapPlot® Analysis Software operates in conjunction with all TapTalk® Communications Software on any computer running Windows™. TapPlot allows the user to plot and print tap data (comtrade*.cfg) retrieved from Beckwith Electric M-2001D series Digital Tapchanger Controls.

Starting TapPlot

1. Select the TapPlot menu item from the TapTalk Menu (Utility/TapPlot.) The TapPlot Window and Toolbar is displayed (Figure 3-93).
2. Select File->Open from the menu, and browse for the .cfg file.
3. Open the file. TapPlot should display the saved data, as shown in Figures 3-94 & 3-95.

Overview

TapPlot® is a windows based program for viewing the data that has been retrieved using the Data Logging feature of TapTalk®.

When TapPlot is started, a menu and tool bar are displayed. This section describes each TapPlot menu selection and explains each TapPlot command in the same order that they are displayed in the software program. Figure 3-93 presents the TapPlot Menu and Submenu Callouts.

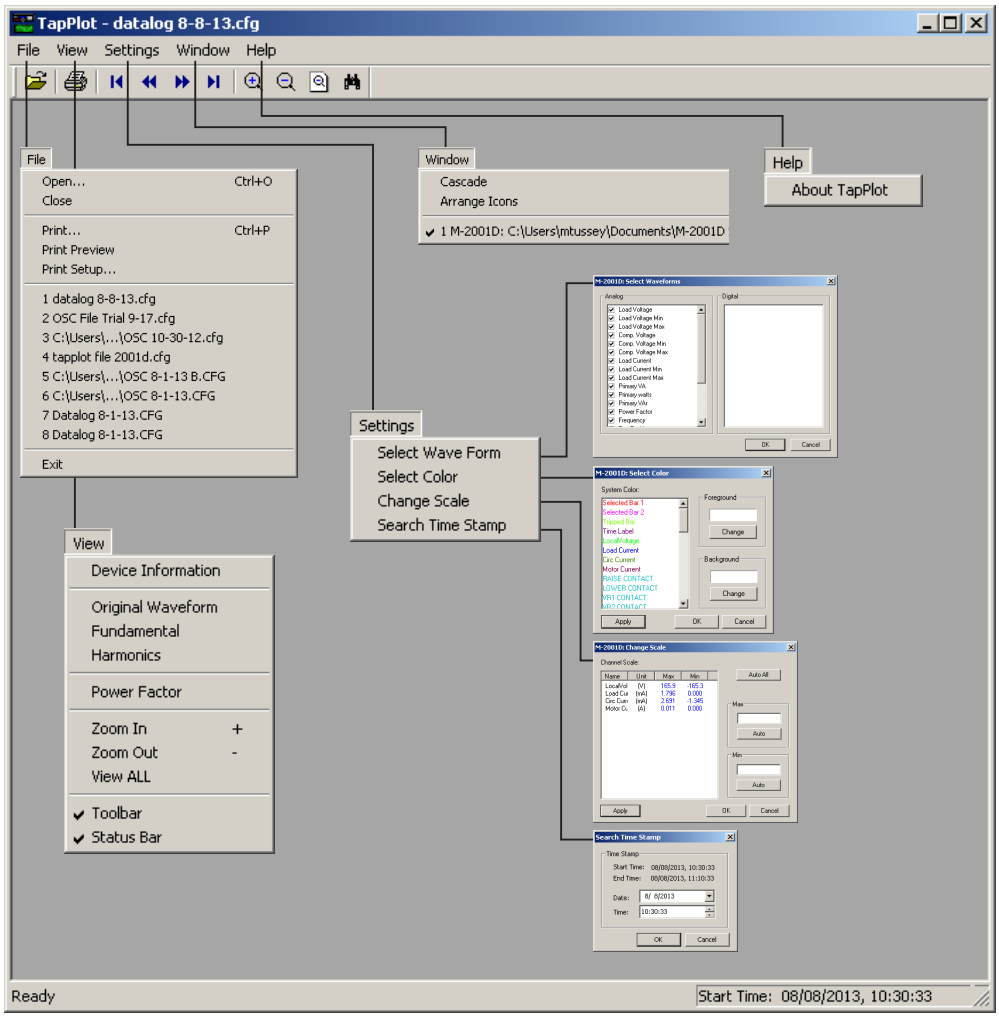


Figure 3-93 TapPlot Main Window with Submenus

Figure 3-94 TapPlot Window with Data Logging Data Example

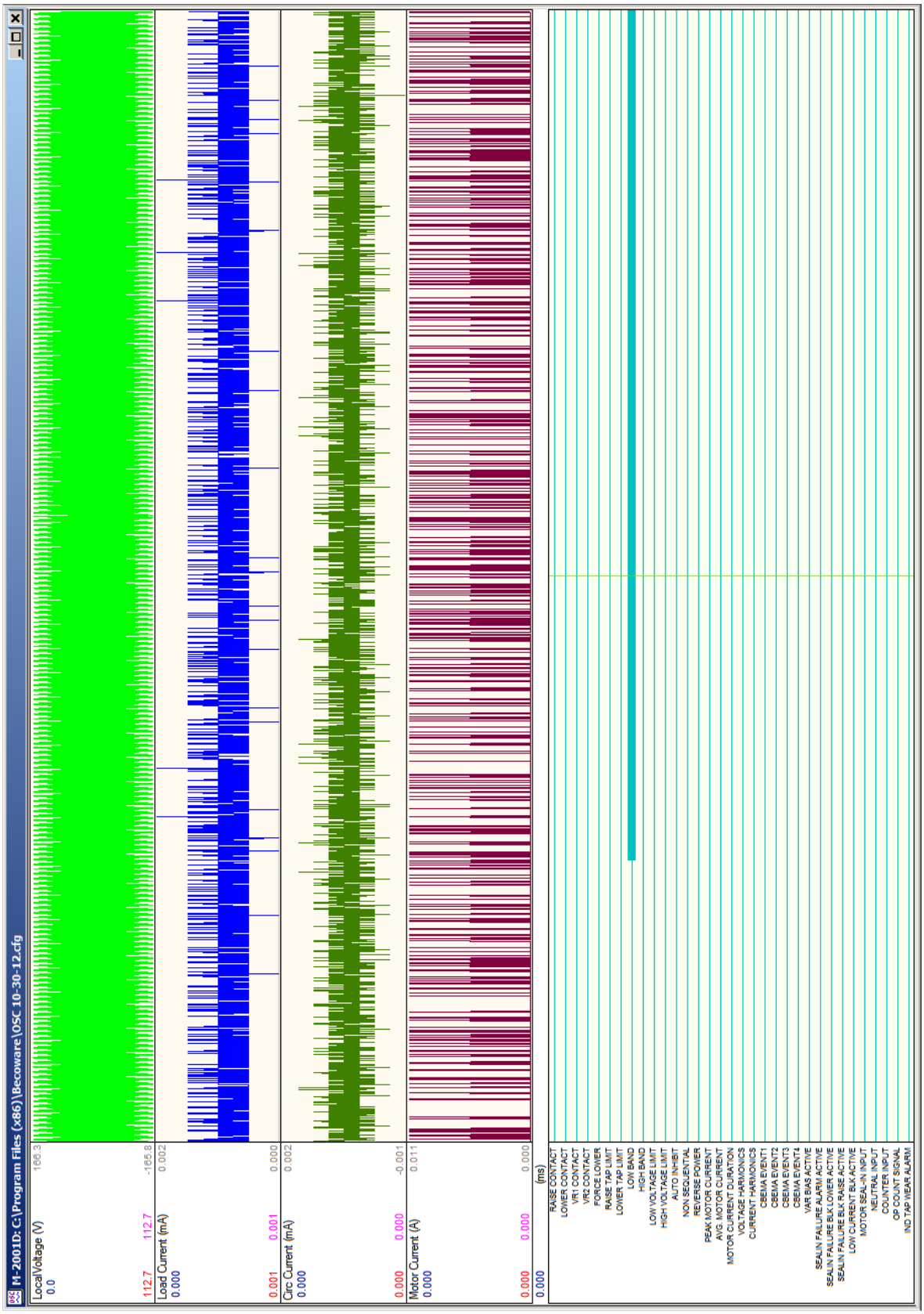


Figure 3-95 TapPlot Window with Oscillograph Data Example

Markers

TapPlot includes two user selectable markers. The first is positioned by double clicking on the plotted wave form data. The second is positioned by pressing and holding the **SHIFT** key and then double clicking on the plotted wave form data.

The markers can be dragged by moving the cursor over the marker until the cursor changes to a double-headed arrow ↔, then holding down the Left mouse button and dragging the marker. The first marker can also be moved an interval at a time by pressing the **LEFT** or **RIGHT** arrow key. The second marker can be moved by pressing the Shift key and the Left or Right arrow key.

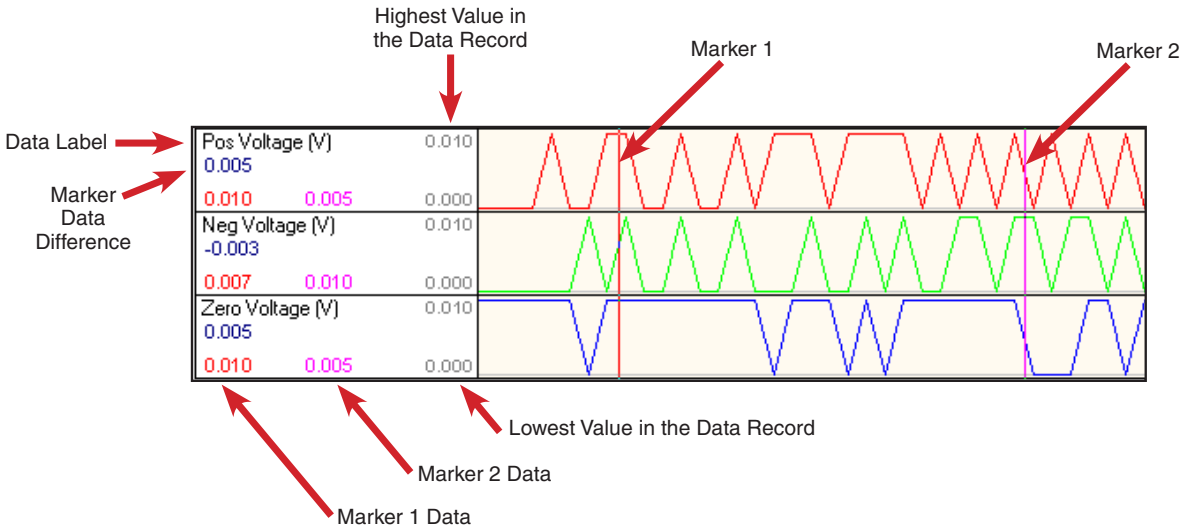


Figure 3-96 TapPlot Screen With Callouts

TapPlot Main Window – Bottom Right Data Display

Figure 3-97 TapPlot Main Screen Data Time Stamp Display

Right-Click Filter Menus

Right-Click menus are available to allow filtering of the data results. Figures 3-98 and 3-99 show the right-click menus available in either a Datalog or Oscillograph file.

Figure 3-98 Datalog File Right-Click Filter Menu

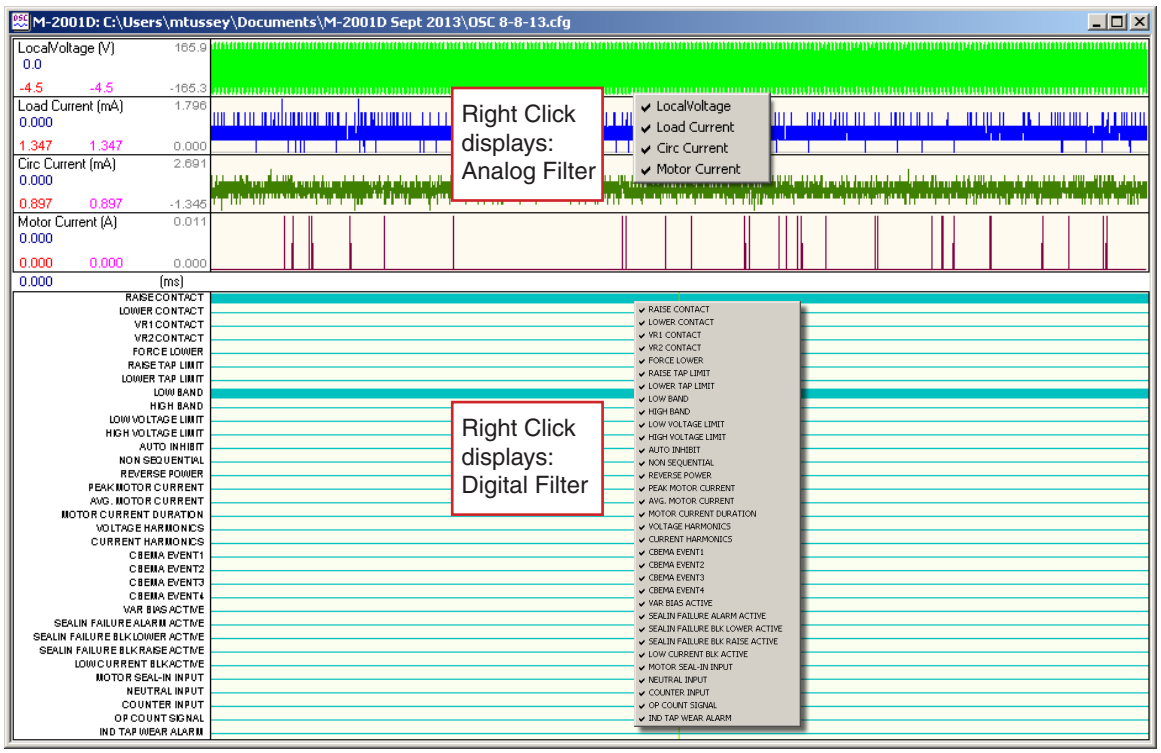
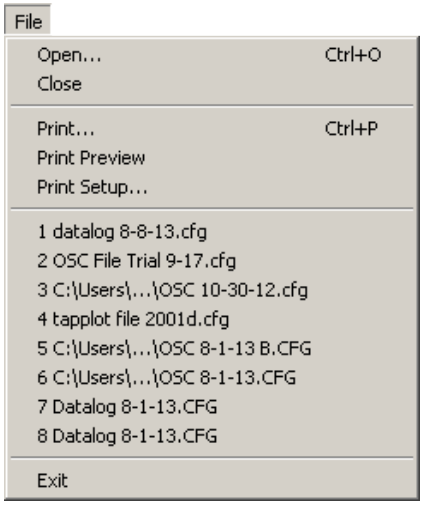


Figure 3-99 Oscillograph File Right-Click Filter Menus

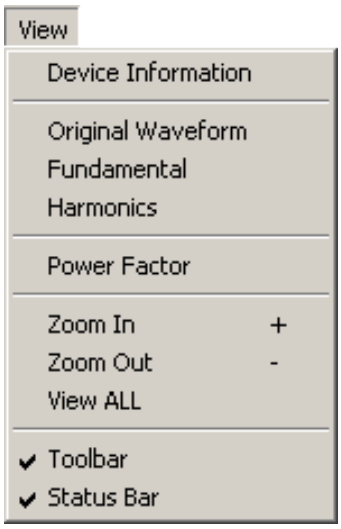
File Menu



The **File** menu allows the user to:

- Open a TapPlot® (.cfg) file previously downloaded by TapTalk®.
- Print the displayed TapPlot data.
- A Print Preview of the displayed TapPlot data.
- Select the printer and printer settings to be used.
- Select from previously viewed .cfg files (the last eight files displayed).
- Exit the TapPlot program.

View Menu



The **View** menu allows the user to:

- Display the Device Information (Figure 3-100) for the corresponding TapPlot data file.
- Fundamental
- Power Factor
- Original Waveform
- Harmonics
- Zoom In, increase the resolution of the tap data displayed on the screen.
- Zoom Out, decrease the resolution of the tap data displayed on the screen.
- View ALL, returns the display to include all data within the record.
- Select which Tool Bar (Toolbar/Status Bar) is available on the display window.

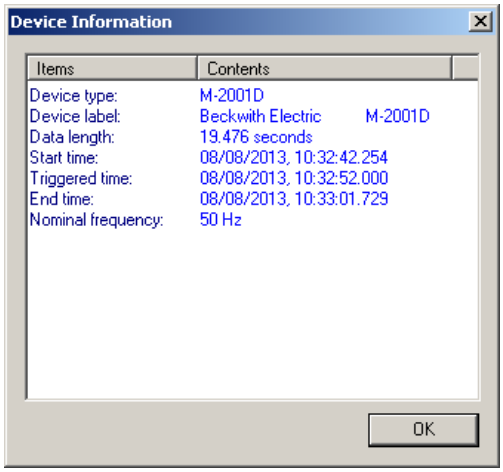
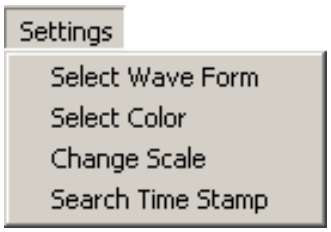


Figure 3-100 Device Information Screen

Settings Menu



The Settings menu allows the selection of the waveforms to be displayed and the format of display colors.

Select Waveform allows the selection of any of the following Data Log Tap Parameters to be plotted or printed:

- Load Voltage (V)
- Compensated Voltage (V)
- Primary Watts (W)
- Primary (VA)
- Primary (VAr)
- Load Current (A)
- Power Factor
- Frequency
- Tap Position
- Source Voltage (V)
- Primary Current (A)
- Circulating Current (mA)
- Operation Counter

The Waveform selections are made from the Select Waveform screen (Figure 3-101).

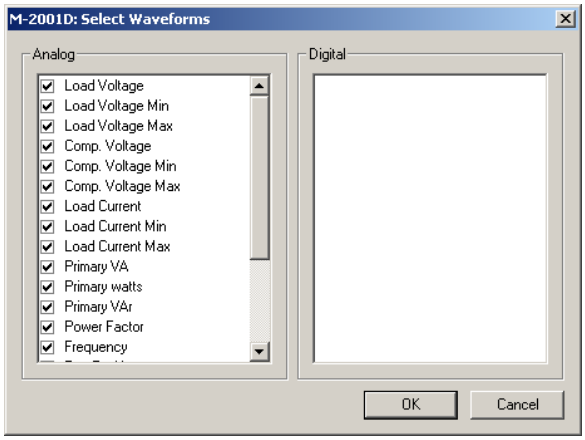


Figure 3-101 Select Waveform Dialog Screen

Select Color provides the user with the capability to change Foreground and Background display color of individual Waveform traces for customized plotting (Figure 3-102).

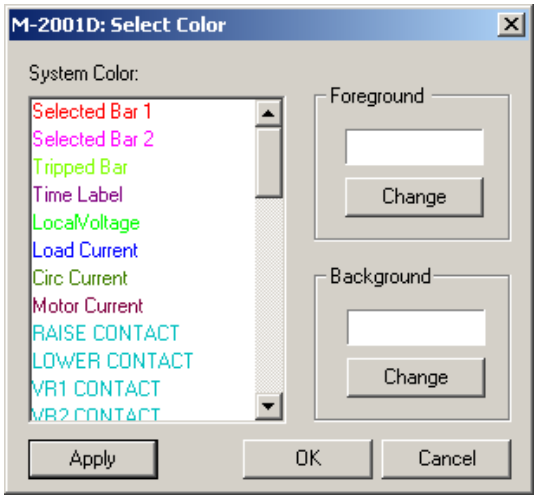


Figure 3-102 Select Color Dialog Screen

Change Scale provides the user with the capability to change the scaling of the displayed parameter.

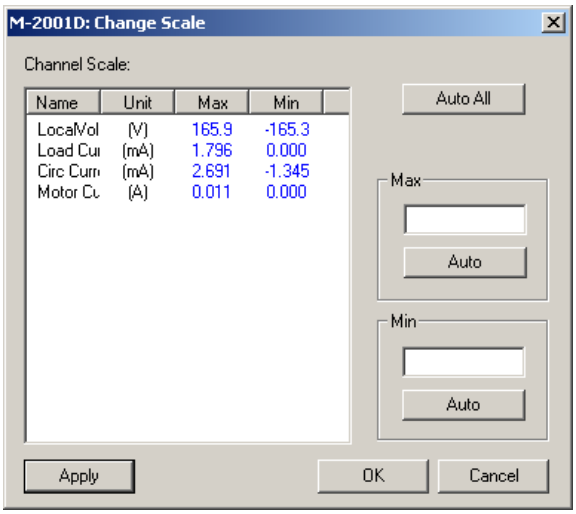


Figure 3-103 Change Scale Screen

Search Time Stamp provides the user with the capability to place the marker exactly at the desired time stamp in the TapPlot® window.

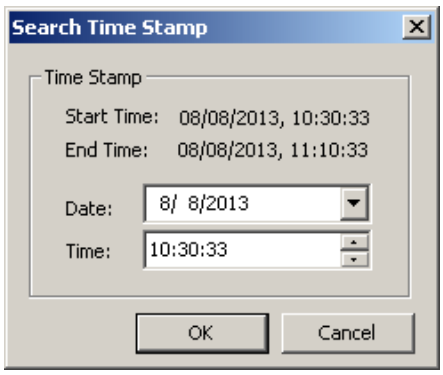


Figure 3-104 Search Time Stamp Screen

Help Menu

The **Help** menu provides access to the **Quick Guide** which provides basic information about TapPlot menus and commands. The **About** command provides version information for TapPlot.

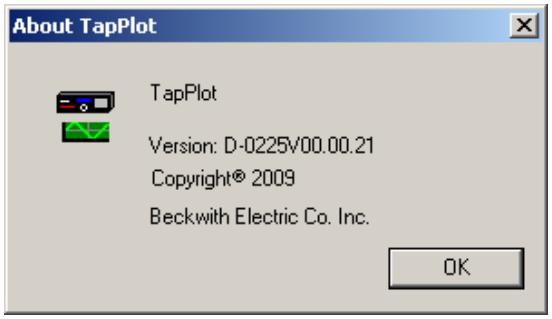


Figure 3-105 About TapPlot Screen

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4 System Setup

4.0 Overview and Quick Index

Chapter four is designed for the person or group responsible for the System Setup of the M-2001D Digital Tapchanger Control.

Chapter 4 consists of the System Setup Section, which consists of general unit setup information:

- User Access Codes
- User Lines
- System Clock
- Oscillograph Setup
- Sequence of Events Setup
- Wakeup Screens
- Communication
- SCADA HeartBeat

The selection of the M-2001D Unit Setup parameters is performed using either the TapTalk® S-2001D Communications Software or the control Front Panel Human Machine Interface (HMI). Instructions for TapTalk and the HMI are provided where applicable.

TapTalk instructions assume that communications have been established with the control.

4.1 System Setup

■ **NOTE**: Appendix A includes the HMI menu structure for reference. Appendix B **Setpoint, Configuration and Communication Record Forms** is available to document control settings.

GENERAL UNIT SETUP

The General Unit setup consists of the setup of the following features and functions:

- User Access Codes
- User Lines
- System Clock
- Time and Date

USER ACCESS CODES

To prevent unauthorized access to the control functions, there are provisions in the software for assigning a Level 1 and/or Level 2 Access Code (up to six characters). A fixed factory assigned Level 3 Access Code is required for changing calibration factors. When Level 1 or Level 2 Access Codes are active, then an additional 30 Level Access Codes (up to 15 characters) can be enabled as either Level 1 or Level 2. The Access Codes can be set in the Communication/HMI Menu or from TapTalk®.

Level Access protection will be automatically reinstated when either of the following conditions are met:

- No HMI menu activity for a period of 15 minutes
- The user exits to the top of the HMI menu for a period of greater than 10 seconds

General access to read setpoints, to monitor status, to reset draghand parameters and the resettable operations counter do not require an Access Code.

The **Level 1** Access Code, if set, is required to make setpoint changes. If the Level 1 Access Code is set to all zeros, this request for an Access Code will not be seen and changes can be made without an Access Code. The default Level 1 Access Code is 000000.

The **Level 2** Access Code, if set, is required to make changes to the configuration, communication, and utilities. If the Level 2 Access Code is set to all zeros, this request for an Access Code will not be seen and changes can be made without an Access Code. The default Level 2 Access Code is 222222.

The **Level 3** Access Code is required to make changes to calibration settings on the control. Contact Beckwith Electric Customer Service for M-2001D Level 3 Access Codes.

■ **NOTE**: Please record all user access codes in a secure location. If the user access code is lost or forgotten, please contact the factory.

Setting Level 1 or Level 2 User Access Codes From The HMI

■ **NOTE**: Level 1 and Level 2 User Access Codes are alphanumeric. The alphabetic characters are upper case only.

When changing an access code, if no key entry is made for approximately 15 minutes, and the screen goes blank, and the digit furthest to the left has not been entered, the user access code will revert to the previous one regardless of digits that have been changed. After a new Level 2 User Access Code has been entered, the new User Access Code must be used to re-enter the **Communications/ HMI** menu. *Be sure to record the new user access code for future use.*

To change User Access Codes from the HMI, perform the following:

1. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
 ←CNFG                    UTIL→
```

OR

```
        Memory Card
 ←                          →
```

2. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                       →
```

3. From either the "Comm Settings" or "Memory Card" menu, press the Right or Left Arrow pushbutton as necessary until "HMI" is displayed.

```
              HMI
←                       →
```

4. Press the Down arrow, as necessary, until the following is displayed.

```
Level 1 Access Code
Pres ENT to change
```

5. Press the ENT pushbutton. If Level 2 Access is not active, or has been previously input, the following will be displayed. Go to Step 8.

```
Change Access Code
      000000
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Change Access Code
      000000
```

   If not, re-enter a valid code.

■**NOTE**: When entering the new user access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Utilizing the arrow pushbuttons, enter the new Level1/Level2 User Access Code, then press the ENT pushbutton. The following will be displayed.

```
Access Code Updated
```

   As soon as new User Access Codes are entered, they will be required to change any setpoint or configuration parameter.

Setting Level 1 or Level 2 User Access Codes From TapTalk

To change User Access Codes from TapTalk®, perform the following:

1. Select **Utility/Change User Access Code** from the TapTalk toolbar. TapTalk will display the "Change User Access Code" dialog screen (Figure 4-1).
2. Input a new Level 1/Level 2 six digit alphanumeric User Access Code.
3. Input the User Access Code from Step 2, in **Confirm New User Access Code**.
4. Select **Save**. TapTalk will display a "Save to Device" confirmation screen (Figure 4-2).

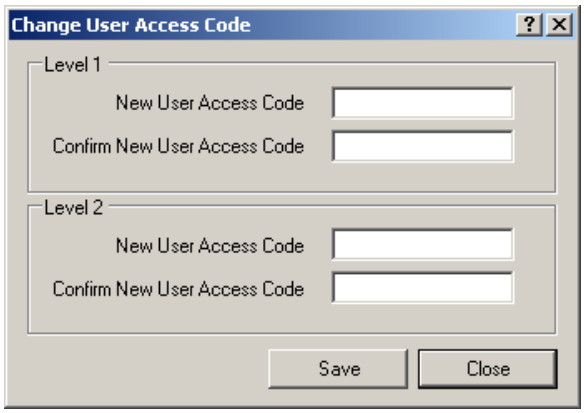


Figure 4-1 Change User Access Code Dialog Screen

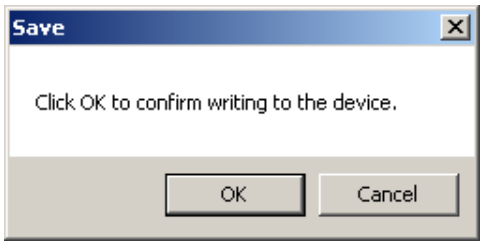


Figure 4-2 Save to Device Confirmation Screen

5. Select **OK**. TapTalk will display an "Access Codes Were Changed Successfully" confirmation screen (Figure 4-3).

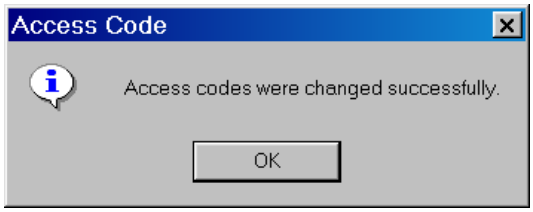


Figure 4-3 Access Codes Were Changed Successfully Dialog Screen

6. Select **OK**. TapTalk will return to the Main Screen.

   As soon as new User Access Codes are entered, they will be required to change any setpoint or configuration parameter.

Setting Multi Level Access Codes From TapTalk

The Multi Level Access Code feature allows the user to create up to 30 unique Access Codes. Each Access Code can be up to 15 characters in length including spaces. After creating a list of Access Codes, the list can be saved to either the host computer or to the control. The Access Code file is encrypted for security measures.

1. Select **Utility/Multi Level Access Code/Send/Retrieve** from the TapTalk® toolbar. TapTalk will display the "Multi Level Access Code" dialog screen (Figure 4-4).

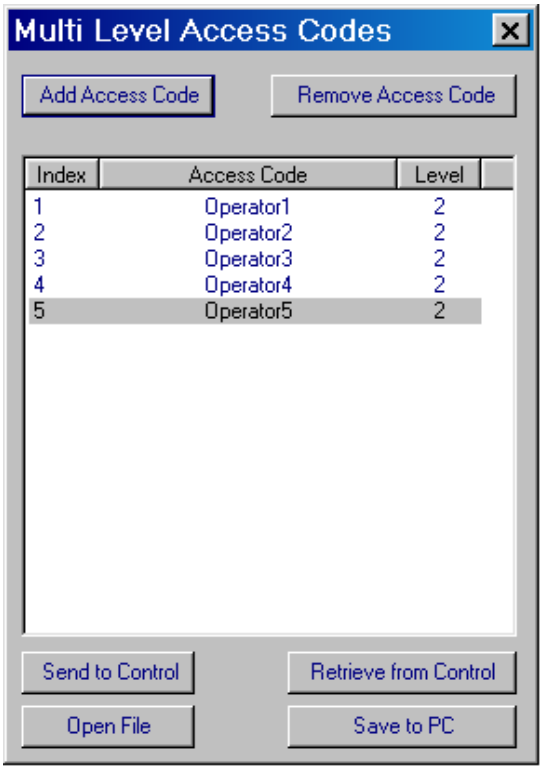


Figure 4-4 Multi Level Access Code Dialog Screen

2. Select "Add Access Code". TapTalk will display the next consecutive Access Code Index with a default Level 2 access.
3. Select the desired index (left click), then double left click. TapTalk will display the Access Code entry/edit dialog box.
4. Enter/Edit the Access Code, then click off the Access Code in the dialog screen.
5. Select "Save to PC". TapTalk will display the "Save As" dialog screen with an *.xml default file extension.
6. Enter the desired file name and destination folder, then select "Save".
7. To send the Multi Level Access Code file to the control select "Send to Control". TapTalk will display the "Access Level Code" dialog screen (Figure 4-5).

Figure 4-5 Access Level Code Dialog Screen

8. Enter a valid Level 2 Access Code, then select **OK**.

   If a valid Level 2 Access Code was entered, then TapTalk will display the "Access granted successfully" dialog screen (Figure 4-6). If not, re-enter a valid code.

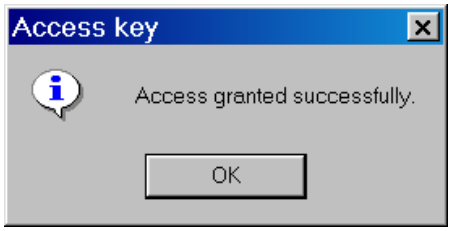


Figure 4-6 Access Key Dialog Screen

9. Select **OK**, TapTalk® will display the "Authentication Key generated successfully" dialog screen (Figure 4-7).

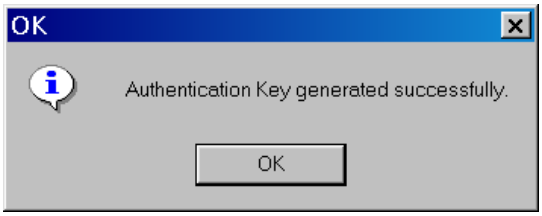


Figure 4-7 Authentication Key Generated Successfully Dialog Screen

10. Select **OK**, TapTalk will display the "Open" dialog screen.
11. Select the Access Code file to be sent to the control, then select "Open". TapTalk will briefly display a status dialog screen followed by a "Multi Access Code Upload" dialog screen (Figure 4-8).

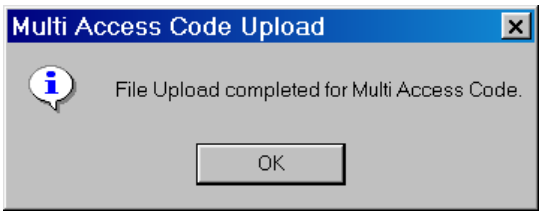


Figure 4-8 Multi Access Code Upload Dialog Screen

12. Select **OK**. TapTalk will return to the Multi Level Access Code dialog screen.

USER LINES

The user station identification lines (User Lines) allow the user to uniquely identify the unit. Each line of this display can have up to 20 ASCII characters. User Lines are factory preset with "Beckwith Electric" for Line 1 and "M-2001D" for Line 2.

When **ENT** is pressed at the Communications/HMI/ User Line 1 or User Line 2 menu, an underline cursor is displayed under the left-most digit. Each digit is changed by using the ⬆ and ⬇ pushbuttons to select the ASCII character (the ASCII character list begins with "!"). The ⬅ or ➡ pushbutton is used to move the underline to the next digit. When the **ENT** pushbutton is pressed, the new user line is stored into nonvolatile memory.

Setting User Lines From The HMI

To change User Lines from the HMI, perform the following:

1. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
          COMMUNICATION
←CNFG                    UTIL→
```

OR

```
          Memory Card
←                          →
```

2. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
          Comm Settings
←                          →
```

3. From either the "Comm Settings" or "Memory Card" menu, press the Right or Left Arrow pushbutton as necessary until "HMI" is displayed.

```
                HMI
←                          →
```

4. Press the Down arrow as necessary until the following is displayed.

```
User Line 1                E
Beckwith Electric
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
New User Line 1
Beckwith Electric
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
New User Line 1
Beckwith Electric
```

   If not, re-enter a valid code.

■**NOTE**: When entering the new User Line the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Utilizing the arrow pushbuttons enter the new Line 1/Line 2 user line(s), then press the ENT pushbutton. The following will be displayed.

```
User Line 1                E
Beckwith Electric
```

Setting User Lines From TapTalk

To change User Lines from TapTalk®, perform the following:

1. Select **Utility/Control Information** from the TapTalk toolbar. TapTalk will display the Control Information dialog screen (Figure 4-9).
2. Input the new Line 1/Line 2 Information.
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 4-2).

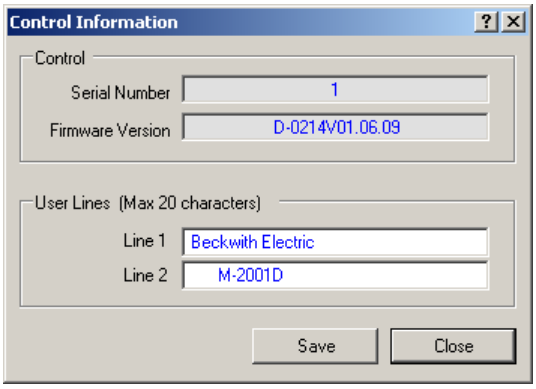


Figure 4-9 Control Information Screen

SYSTEM CLOCK

The control is equipped with a real-time, 24-hour clock which is used with the Demand History feature to record date/time stamp information on quantities saved in memory.

The power source for the clock is maintained for at least 24 hours during a system power outage by a charged capacitor (no battery). If the power outage lasts longer than 24 hours, check the clock and reset if necessary.

The system clock includes the capability to automatically switch to and from daylight savings time.

Setting Time/Date and Daylight Savings From The HMI

To set the Time and Date from the HMI, perform the following:

▲ **CAUTION**: Whenever clock is reset and data logging is enabled, the data log should be cleared.

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                 COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                     →
```

3. Press the Right/Left arrow pushbuttons, as necessary, until the "System Clock" screen is displayed.

```
        System Clock
←                     →
```

4. Press the Down arrow pushbutton, as necessary, until the "Set Date and Time" dialog screen is displayed.

```
Set Date and Time
MM/DD/YY  HH:MM:SS
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Set Date and Time
MM/DD/YY   HH:MM:SS          C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Set Date and Time
MM/DD/YY   HH:MM:SS          C
```

   If not, re-enter a valid code.

■**NOTE**: The cursor will be positioned under the far left hand "Month" element of the date. Utilizing the Up/Down arrow pushbuttons will change the Month. Utilizing the Right/Left arrow pushbuttons will move the cursor between each element of the date and time.

8. Utilizing the arrow pushbuttons enter the desired Date and Time, then press the ENT pushbutton. The following will be displayed reflecting the Date and Time settings that were entered.

```
Set Date and Time
XX/XX/XX   XX:XX:XX
```

9. Press the Down arrow pushbutton, as necessary, until the "Daylight Savings" dialog screen is displayed.

```
Daylight Savings
disable
```

10. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 13.

```
Daylight Savings
disable                      C
```

11. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

12. Enter a valid Level 2 Access Code, press the ENT pushbutton.

    If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Daylight Savings
disable                      C
```

    If not, re-enter a valid code.

13. Utilizing the Up/Down arrow pushbuttons select "ENABLE", then press the ENT pushbutton. The following will be displayed:

```
Daylight Savings
ENABLE
```

Setting Date/Time and Daylight Savings From TapTalk

To set the control Date, Time and Daylight Savings from TapTalk®, perform the following:

1. Select **Utility/Set Date & Time** from the TapTalk toolbar. TapTalk will display a Warning (Figure 4-10) regarding time stamped values. Select **OK**. TapTalk will display Figure 4-11.

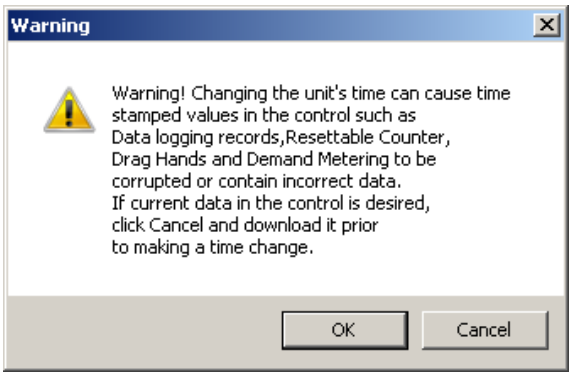


Figure 4-10 Set Date/Time Warning Dialog Screen

2. From the Set Control Date/Time dialog screen (Figure 4-11) select either "Control Clock" or "PC Clock".

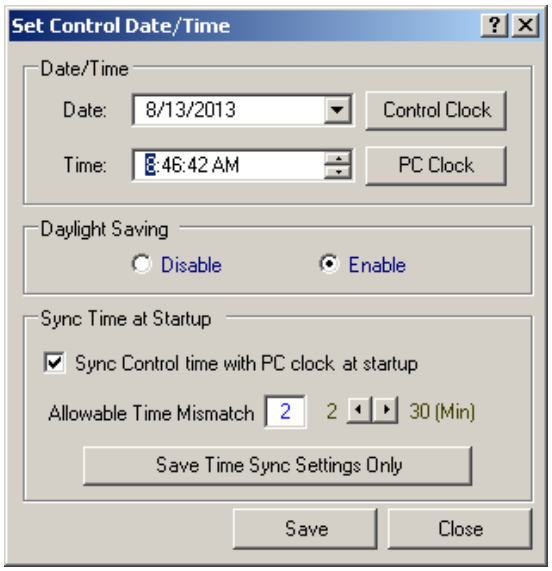


Figure 4-11 Set Control Date/Time Dialog Screen

3. Verify that the desired Daylight Saving setting is selected.
4. If desired select "Sync Time at Startup" and the desired "Allowable Time mismatch" value.
5. Determine if the control is to be set to either "PC Clock" or "Control Clock", then proceed as follows:
   - If "PC Clock" was selected and the Date/Time of the PC is the desired time to be set in the control, then select Save.
   - If "Control Clock" was selected, input the desired Date/Time, then select Save.

   TapTalk will respond with a Reset Demand and Energy warning screen (Figure 4-12).

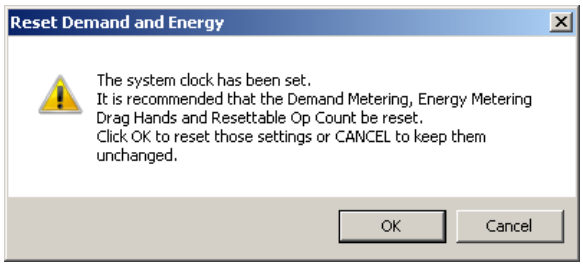


Figure 4-12 Reset Demand and Energy Warning Dialog Screen

▲ **CAUTION**: Whenever the clock is reset and data logging is enabled the data log should be cleared.

6. Select **OK** to reset Demand Metering, Energy Metering, Drag Hands and Resettable Operation Counter or **Cancel** which will not reset these parameters.

   TapTalk will return to the Main Screen.

OSCILLOGRAPH SETUP

The Oscillograph Recorder provides comprehensive data recording (voltage, current, and status input/output signals) for all monitored waveforms. Oscillograph data can be downloaded using the communications ports to any PC compatible personal computer running the TapTalk® S-2001D Communications Software. Once downloaded, the waveform data can be examined and printed using TapPlot® Analysis Software. The waveform data is also available in COMTRADE file format. Oscillograph records are retained if power to the control is interrupted.

The general information required to be input to complete the Oscillograph Setup includes:

- **Number of Partitions** – When untriggered, the recorder continuously records waveform data, keeping the data in a buffer memory. The recorder's memory may be partitioned into 1 to 16 partitions. Table 4-1 illustrates the number of cycles of waveform data per partition.

  When triggered, the time stamp is recorded, and the recorder continues recording for a user-defined period. The snapshot of the waveform is stored in memory for later retrieval using TapPlot Analysis Software.
- **Samples/Cycle** – The number of samples/cycle can be selected to either 16, 32 or 64 samples/cycle.
- **Post-Trigger Delay** – A post-trigger delay of 5% to 95% must be specified. After triggering, the recorder will continue to store data for the programmed portion of the total record before re-arming for the next record. For example, a setting of 80% will result in a record with 20% pre trigger data, and 80% post-trigger data.
- **Inputs and Outputs** – The recorder can be triggered remotely through serial communications using TapTalk, or automatically, using programmed status signals (Figure 4-14).

Number of Partitions	Cycles Per Partition
1	1365
2	910
3	682
4	546
5	455
6	390
7	341
8	303
9	273
10	248
11	227
12	210
13	195
14	182
15	170
16	160

Table 4-1 Recorder Partitions and Cycles for 16 Samples/Cycle

Setup Oscillograph Recorder

■ **NOTE**: Communication must be established with the target control for this procedure. When not connected to the control, the Send selection does not save the Oscillograph Recorder settings to an open file.

To setup the Oscillograph Recorder, perform the following:

1. From the TapTalk® Main Screen menu, select **Setup/Oscillograph/Setup**. TapTalk will display the Oscillograph Setup dialog screen (Figure 4-14).
2. Select the **Number of Partitions**.

   The recorder's memory may be partitioned into 1 to 16 partitions. The Oscillograph Recorder memory buffer is fixed and contains room for a finite number of cycles of recorded data. Consider Table 4-1 when determining the number of Oscillograph records. The number of cycles of recorded data is directly related to the number of records selected.
3. Select the number of **Samples/Cycle.**

   The number of Samples/Cycle can be selected to either 16, 32 or 64 Samples/Cycle.
4. Select the **Post Trigger Delay**.

   A post-trigger delay of 5% to 95% must be specified. After triggering, the recorder will continue to store data for the programmed portion of the total record before re-arming for the next record. For example, a setting of 80% will result in a record with 20% pre-trigger data, and 80% post-trigger data.
5. Select the desired **Pickup Trigger(s)** and **Dropout Trigger(s)** (Figure 4-14).

   The recorder can be triggered remotely through serial communications using TapTalk, or automatically, using programmed status inputs or outputs.
6. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 4-2).
7. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 4-13).

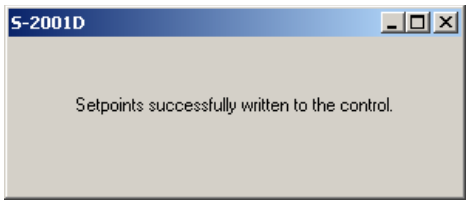


Figure 4-13 Setpoints Successfully Written To The Control Dialog Screen

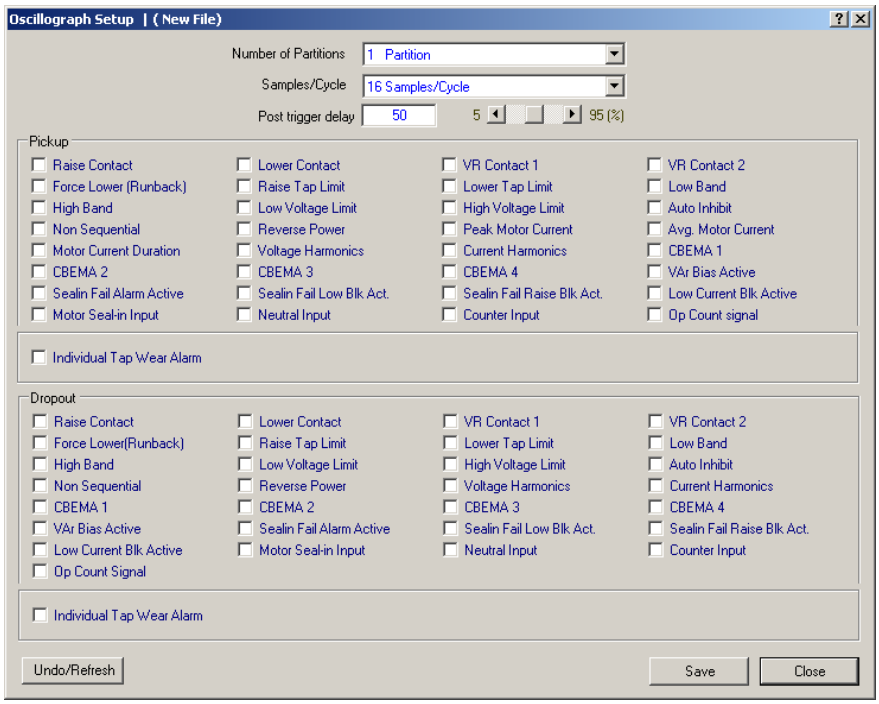


Figure 4-14 Oscillograph Setup Dialog Screen

SEQUENCE OF EVENTS RECORDER

The Sequence of Events recorder provides comprehensive time tagged data recording of the following parameters:

- Time Tag
- Local Voltage
- Source Voltage
- Frequency
- Tap Position
- Motor Current
- Load Current
- Counter Operation (presettable)
- Voltage Harmonics Values
- Current Harmonics Values
- Voltage Harmonics Status
- Current Harmonics Status

The total number of events that can be recorded is 132. Sequence of Events data can be downloaded using the communications ports to any computer running the S-2001D TapTalk® Communications Software. The Sequence of Events Recorder can be triggered by the status change of any of the signals in Table 4-2 or manually by the user from TapTalk.

Sequence of Events Recorder Triggers	State
Raise Command	Initiated
Lower Command	Initiated
VR Contact 1	True
VR Contact 2	True
Force Lower (Runback)	Initiated
Raise Tap Limit	True
Lower Tap Limit	True
Low Band	Exceeded
High Band	Exceeded
Low Voltage Limit	True
High Voltage Limit	True
Auto Inhibit	True
Non-Sequential	Active
Reverse Power	Detected
Peak Motor Current	Exceeded
Average Motor Current	Exceeded
Motor Current Duration	Exceeded
Voltage Harmonics	Exceeded
Current Harmonics	Exceeded
CBEMA Event 1	True
CBEMA Event 2	True
CBEMA Event 3	True
CBEMA Event 4	True
VAr Bias	Active
Seal-in Failure Alarm	Active
Seal-in Failure Raise Block	Active
Seal-in Failure Lower Block	Active
Low Current Block	Active
Motor Seal-in Input	Detected
Neutral Input	Detected
Counter Input	Detected
Op Count Signal	Exceeded
HMI Active	True
Individual Tap Wear Alarm	Active

Table 4-2 Sequence of Events Recorder Triggers

Event Logic

Combinations of the trigger signals in Table 4-2 can be AND'ed and OR'ed to produce the desired trigger logic. Figure 4-15 illustrates the trigger logic that can be applied.

The first level of the Event Logic consists of an "AND" gate and an "OR" gate which uses the trigger parameters in Table 4-2 as inputs. The output of the "AND" and "OR" gates are passed to a logic gate that is user selectable as either an "AND" or "OR" gate. When the logic is true, it triggers the Sequence of Events Recorder.

The event will be recorded in volatile SDRAM and transferred to non-volatile flash memory every four cycles. There is a possibility that events can be lost in cases where the control loses power in the middle of a storage cycle.

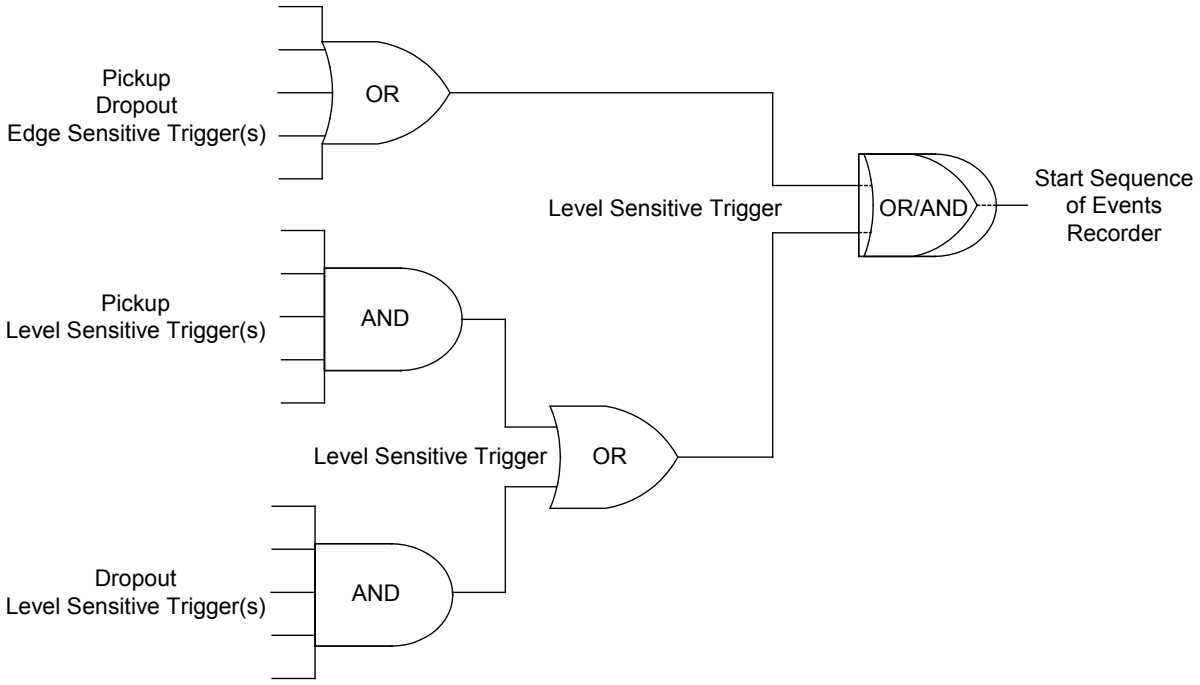


Figure 4-15 Sequence Of Events Recorder Trigger Logic

Setup Sequence of Events Recorder

Pickup or Dropout for each trigger parameter may be selected to trigger the Sequence of Events Recorder.

■ **NOTE**: Communication must be established with the target control for this procedure. When not connected to the control, the Save selection does not save the Sequence of Event settings to the open file.

To setup the Sequence of Events Recorder, perform the following:

1. From the TapTalk® Main Screen menu select **Setup/Sequence of Events/ Setup**. TapTalk will display the Sequence of Events Setup dialog screen (Figure 4-16).
2. If an "OR" type trigger logic is desired, then select "Pickup Dropout Edge Sensitive" in Figure 4-16. TapTalk will display the "OR gate setup" dialog screen (Figure 4-17).

   Select the desired "OR gate setup", Pickup and/or Dropout trigger parameters, and then select **OK**. TapTalk will return to the Sequence of Events setup dialog screen.
3. If an "AND" type trigger logic is desired, then select the AND "Pickup" or "Dropout" in Figure 4-16. TapTalk will display the "AND gate setup" dialog screen (Figures 4-18 and 4-19).

   Select the desired "AND gate setup" Pickup and/or Dropout trigger parameters, then select **OK**. TapTalk will return to the Sequence of Events setup dialog screen.
4. Select the desired logic gate OR/AND for the "OR" and "AND" gates, then select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 4-2).
5. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 4-13).

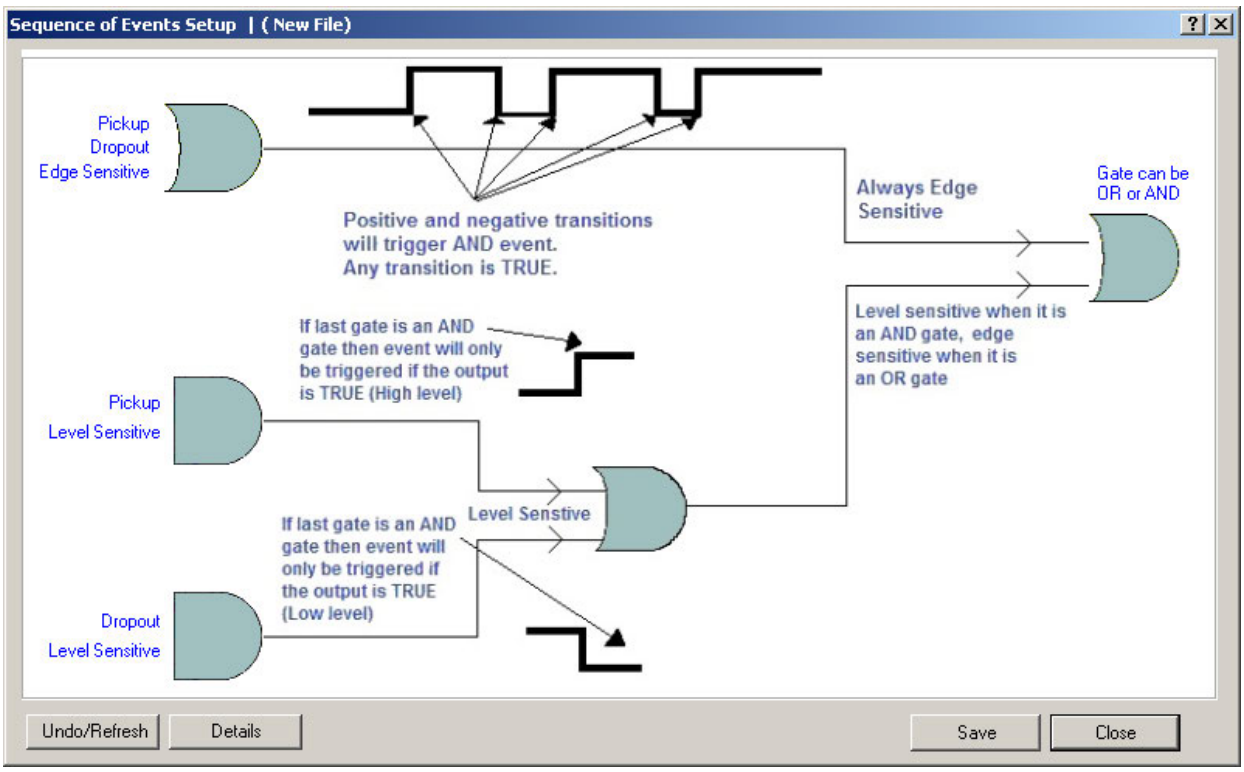


Figure 4-16 Sequence of Events Setup Dialog Screen

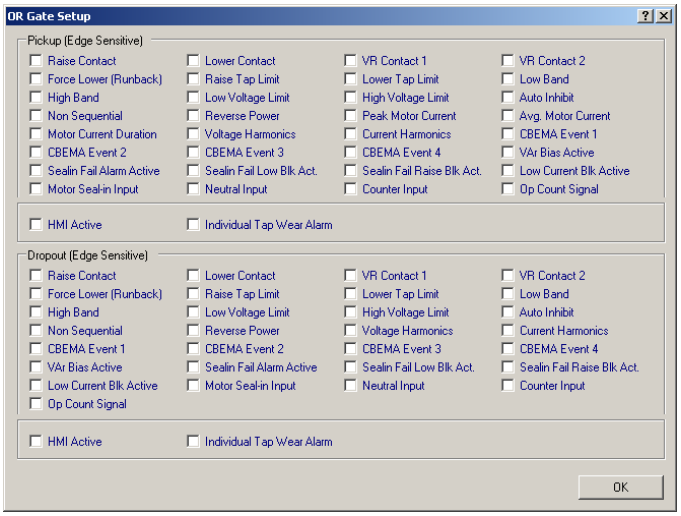


Figure 4-17 Sequence of Events Pickup/Dropout Edge Sensitive OR Gate Setup Dialog Screen

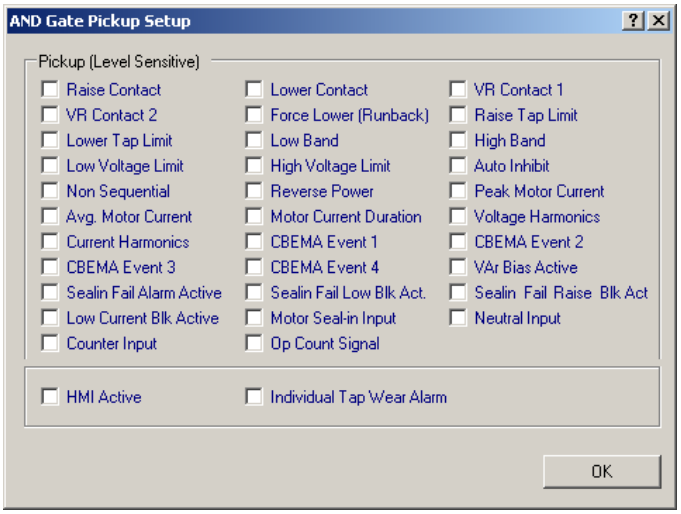


Figure 4-18 Sequence of Events Pickup Level Sensitive AND Gate Pickup Setup Dialog Screen

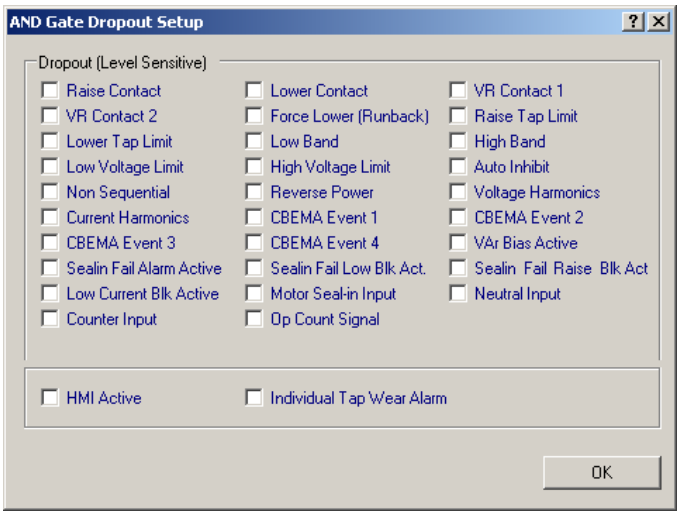


Figure 4-19 Sequence of Events Dropout Level Sensitive AND Gate Dropout Setup Dialog Screen

WAKEUP SCREENS

If the "Wake/EXIT" pushbutton is selected, then control will respond as follows:

- Pressing "EXIT" when User Lines are being displayed will initiate a cycling display of the selected Wakeup parameters for a period of 15 minutes and then return to the User Lines display.
- If no Wakeup screens are selected, then nothing will be displayed and the User Lines will blink for a moment.

■ **NOTE:** The Adapter Panel Drag Hand Reset switches only reset the Tap position Drag Hands value.

- While cycling is in effect, when ENT is pressed on any demand metering value ("E" displayed on screen), all demand metering Drag Hand parameters will be reset. This is also true for all metering Drag Hand values when ENT is pressed on an energy metering menu.
- The Wakeup stepped display can be stopped on the displayed parameter by pressing EXIT. Press EXIT again to terminate the stepped parameter display and return to the User Lines.

  The Wakeup screen values can be browsed by utilizing the Up and Down arrow pushbuttons. In this mode, if the ENT pushbutton is pressed while on a demand or energy metering value, it will only reset that individual Drag Hand value.
- The Wake screen cycles at a 3 second interval between parameters. While the wake screen menu is cycling, if a parameter is missed while recording, press the up arrow to display it again. This displays the previous parameter and then continues cycling to the next parameter 3 seconds later. Pressing ENT stops the cycling and allows the user to utilize the Up and Down Arrows to view the Wake screen parameters at a user defined pace.
- When there is a Smart Flash SD Card present while in the Wakeup screen menu, an additional Smart Flash SD Card menu item will be present. All Wakeup screen parameters can be saved to the Smart Flash SD Card in *.csv format.

Selecting Wakeup Screen Parameters

To select the wakeup screen parameters perform the following:

1. Select **Setup/Wakeup Screens** from the TapTalk® toolbar. TapTalk will display the "Wakeup Screen Menu Setup" dialog screen (Figure 4-20).

■ **NOTE:** The order in which parameters are being displayed can be changed by dragging and dropping items in the active metering window.

2. Select the Wakeup Screen parameters to be displayed by moving, (dragging and dropping), each parameter from the "Disable Metering Items" to the "Active Metering Items" list.
3. Select the Wakeup Screen parameters that are not to be displayed by moving (dragging and dropping) those parameter from the "Active Metering Items" list to the "Disable Metering Items" list.
4. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 4-2).
5. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 4-13).

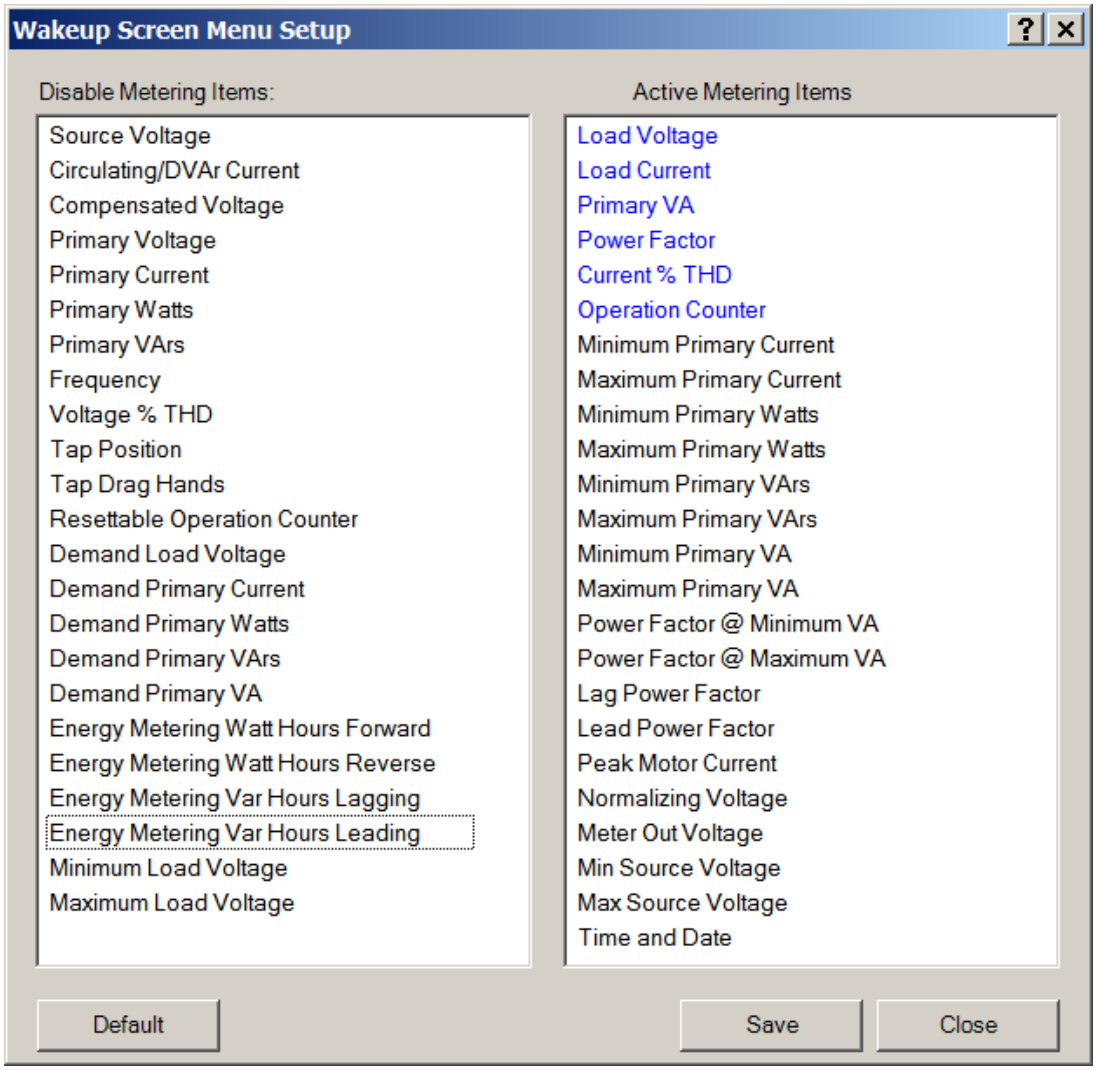


Figure 4-20 Wakeup Screen Menu Setup Dialog Screen

COMMUNICATION

The communication ports provide access to all features, including metering, software updates, and programming of all functions. This is accomplished using a connection from any Windows™ computer running the TapTalk® S-2001D Communications Software or SCADA communications software.

Using a PC, the operator has real-time, remote access to all functions of the Digital Tapchanger Control. The control can act as the monitoring point for all voltage, current, and related power quantities. This simplifies operation while avoiding transducers and multiple Remote Terminal Unit (RTU) analog inputs. The protocols implement half-duplex, two-way communications. This allows all functions, which would otherwise require the presence of an operator at the control, to be performed remotely.

Communication capabilities include:

- Interrogation and modification of setpoints
- Broadcast of commands, such as tapchange inhibit and voltage reduction (up to three steps) to networked controls
- Recognition of alarm conditions, such as voltage extremes and excessive load
- Selective control of raise and lower tapchange operations
- Re-configuration of the control, such as a change to the demand integration time period or a selection of different alarm parameters

TapTalk provides the means to enable or disable installed RS-232 and Bluetooth® modules. This capability is provided by a communication options utility under the Communication menu. Prompts to enable communication hardware are also contained in the individual port setup menus.

Direct Connections

TapTalk supports direct communication (MODBUS® protocol) with a Beckwith Electric Digital Tapchanger Control using the applicable connector (USB cable) for the PC, Fiber Optic communication using ST standard, two-wire RS-485 or RS-232.

Protocols

The standard protocols included in the M-2001D are DNP3.0 and MODBUS. IEC 61850 is available as an option. The USB port uses MODBUS for local communications. The optional Ethernet Port supports DNP over TCP/IP and UDP; MODBUS over TCP/IP and UDP protocol and IEC 61850 over TCP/IP protocols simultaneously. The user must select the protocol that is to be used with the M-2001D Tapchanger Control's RS485/Fiber Optic Port.

Detailed descriptions of the data points used for the standard protocols are available from Beckwith Electric upon request, and are available for download from our website, www.beckwithelectric.com. For information regarding Communication Port connections, please see **Section 7.1, External Connections.**

Communication Access Security and Timeout

When Communication Access Security and Timeout is enabled it applies only when MODBUS has been selected regardless of the physical interface. If enabled the user Level Access Code must match either the Level 1 or Level 2 Access Codes in order to be granted the access to control settings ascribed to each Level. See "User Access Codes" earlier in this chapter for detailed information. If an invalid Access Level Code is entered at the connection prompt, then read only access will be granted. TapTalk must be closed for the timeout period specified (1 to 50,000 seconds) in order for any Access Code changes to take effect when this feature is enabled.

Enabling Communication Access Security and Timeout From The HMI

1. Ensure the control is energized.

■**NOTE**: If password protection has been implemented on the control, then a valid Level 2 Access Code is required to be entered to enable Communication Access Security and set the Timeout.

2. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                 UTIL→
```

OR

```
        Memory Card
←                         →
```

3. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                         →
```

4. If Memory Card is displayed, then press the Right or Left arrow pushbutton, as necessary, until "Comm Settings" is displayed.

```
        Comm Settings
←                         →
```

5. Press the Down arrow pushbutton, as necessary, until the "Comm Access Security" menu item is displayed.

```
Comm Access Security
disable
```

6. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
Comm Access Security
disable                   C
```

7. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen, and then display the following:

```
Comm Access Security
disable                   C
```

   If not, re-enter a valid code.

9. Utilizing the arrow pushbuttons select "ENABLE", then press the ENT pushbutton. The desired Communication Access Security mode will be displayed.

```
Comm Access Security
ENABLE or disable
```

10. Press the Down arrow pushbutton, as necessary, until the "Comm Access Timeout" menu item is displayed.

```
Comm Access timeout
      60  Sec
```

11. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
Comm Access timeout
      60 Sec                C
```

12. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

13. Enter a valid Level 2 Access code, then press the ENT pushbutton.

    If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen, and then display the following:

```
Comm Access timeout
      60 Sec                C
```

    If not, re-enter a valid code.

14. Utilizing the arrow pushbuttons enter the desired Comm Access timeout value, then press the ENT pushbutton. The desired Comm Access timeout value will be displayed.

```
Comm Access timeout
      XX  Sec
```

Enabling Communication Access Security and Setting Timeout From TapTalk

To setup Communication Access Security from TapTalk®, proceed as follows:

1. Select **Communication/Setup/ Communication Access Security** from the TapTalk toolbar. TapTalk will display the "Communication Access Security" dialog screen (Figure 4-21).
2. Select **"ENABLE"**, then enter the desired Communication Access Timeout value from 1 to 50,000 seconds.
3. Select "Save". TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 4-13).

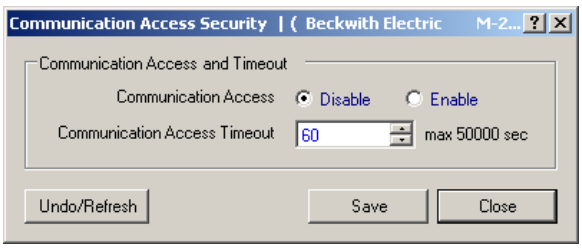


Figure 4-21 Communication Access Security Setup Dialog Screen

Source Address Validation

When Source Address Validation is enabled it applies only when DNP3.0 Protocol has been selected regardless of the physical interface. If enabled the client address must match the address set by the user in the DNP Configuration file before accepting the message as a valid one.

Enabling Source Address Validation From The HMI

1. Ensure the control is energized.

■**NOTE**: If password protection has been implemented on the control, then a valid Level 2 Access Code is required to be entered to enable Source Address Validation.

2. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                    UTIL→
```

OR

```
        Memory Card
←                          →
```

3. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                          →
```

4. If Memory Card is displayed, then press the Right or Left arrow pushbutton, as necessary, until "Comm Settings" is displayed.

```
        Comm Settings
←                          →
```

5. Press the Down arrow pushbutton, as necessary, until the "Source Address Validation" menu item is displayed.

```
Src Addr Validation
disable
```

6. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
Src Addr Validation
disable                    C
```

7. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen, and then display the following:

```
Src Addr Validation
disable                    C
```

   If not, re-enter a valid code.

9. Utilizing the arrow pushbuttons select "ENABLE", then press the ENT pushbutton. The desired Source Address Validation mode will be displayed.

```
Src Addr Validation
ENABLE or disable
```

Enabling Source Address Validation From TapTalk

To setup Source Address Validation from TapTalk®, proceed as follows:

1. Select **Utility/DNP/Source Address Validation** from the TapTalk toolbar. TapTalk will display the "Source Address Validation" dialog screen (Figure 4-22).
2. Select **"ENABLE"**, then select "Save". TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 4-13).

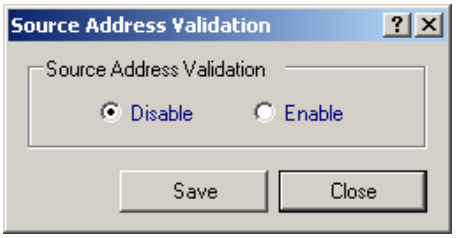


Figure 4-22 Source Address Validation Dialog Screen

Feeder and/or Substation Addressing

Each control has three addresses.

1. Communications address
2. Feeder address
3. Substation address

Any valid DNP command (Figure 4-23) can be used to communicate with individual controls using the **Communications** address. To address a group of controls using the **Feeder** and/or the **Substation** addresses, a DNP command with no acknowledgment shall be used. For example Direct Operate with NO acknowledgment (FC 06). If a command with acknowledgment is sent by the Client, the control will accept the command but will not reply with an acknowledgment.

All addresses range from 0 to 0xFFEF. For feeder and substation addresses, setting the value to zero effectively **Disables** the corresponding address. It is important that there are no duplicate addresses on any device on the network.

In the system depicted in Figure 4-23, there are three substations: S1, S2, and S3. There are a total of 9 feeders, F1-F9, grouped as shown. Each feeder has 3 controls, one for each phase. Each control will have 3 addresses assigned to it.

For example: control D1 on Feeder F4 in substation S2 will have the following.

1. Individual not duplicated communications address (0x212)
2. Feeder address = 0x4003
3. Substation address = 0x5001

In order to poll D1 on an individual basis address, 0x212 is used.

To invoke for example, voltage reduction individually on D1, use direct operate with or without acknowledge for address 0x212 on the appropriate point.

To invoke voltage reduction on Feeder F4, use direct operate without acknowledge to address 0x4003 instead of 3 different commands sent to D1, D2 and D3 individually.

Similarly, invoking voltage reduction on an entire substation requires a direct operate command without acknowledge to be sent to that substation address e.g. substation S2 (address 0x5001).

■**NOTE**: The same concept applies to network configuration (Figure 4-24).

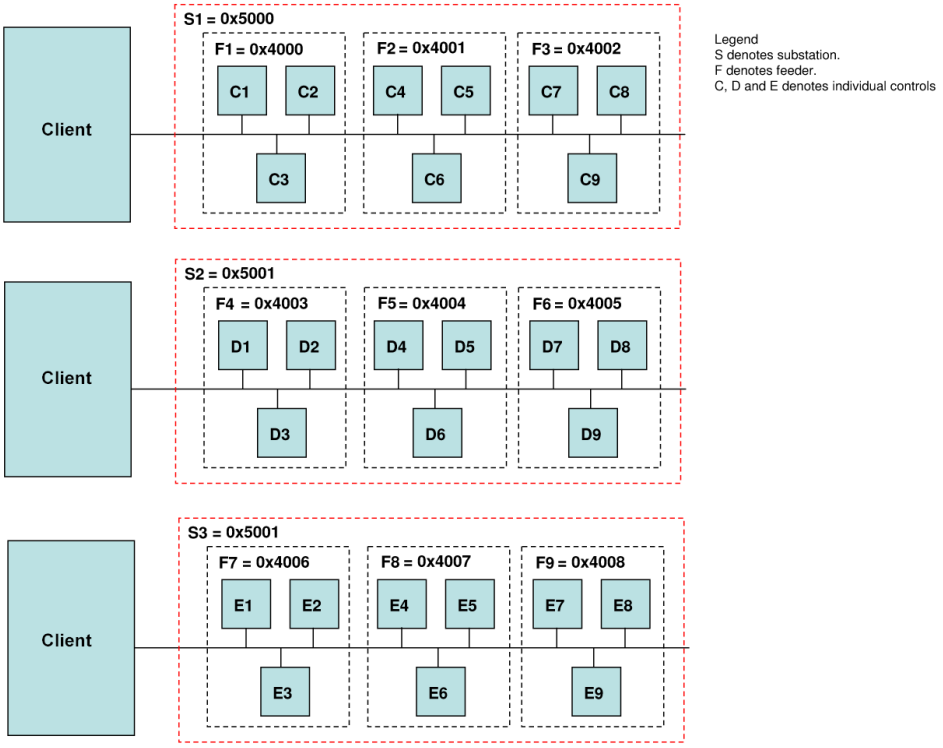


Figure 4-23 Multiple Client, Feeder and/or Substation Addressing

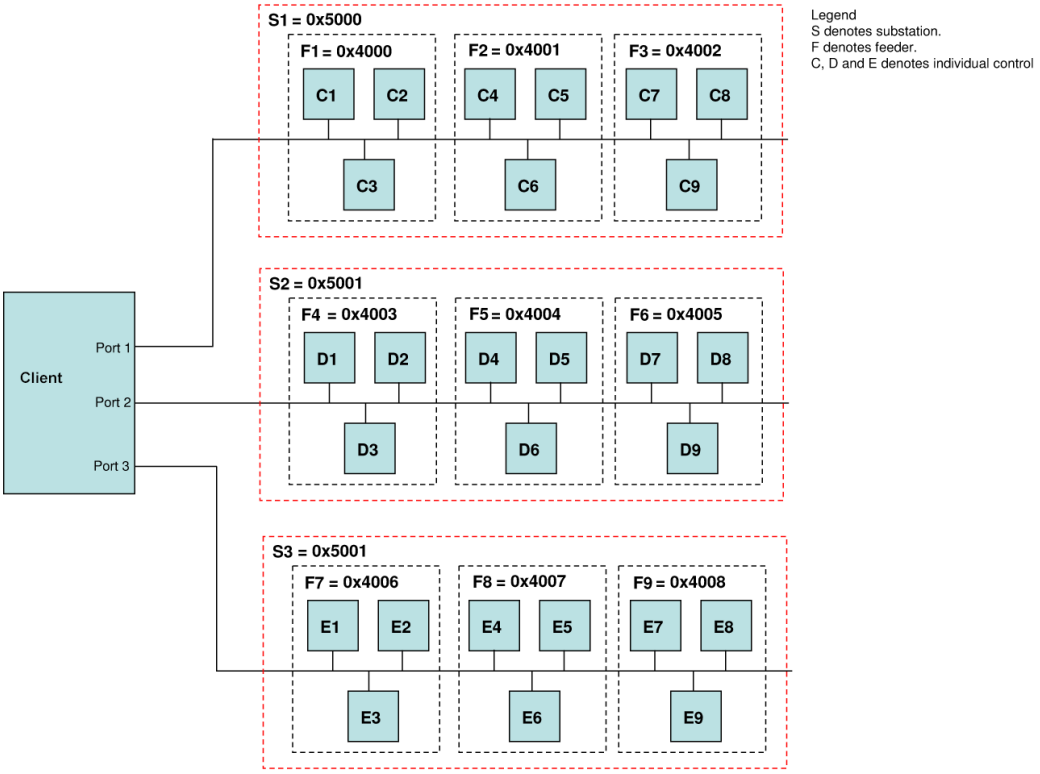


Figure 4-24 Single Client, Feeder and/or Substation Addressing Network Connection

Setting Substation Address From The HMI

1. Ensure the control is energized.

■**NOTE**: If password protection has been implemented on the control, then a valid Level 2 Access Code is required to be entered to set the Substation Address.

2. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                    UTIL→
```

OR

```
        Memory Card
←                          →
```

3. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                          →
```

4. If Memory Card is displayed, then press the Right or Left arrow pushbutton, as necessary, until "Comm Settings" is displayed.

```
        Comm Settings
←                          →
```

5. Press the Down arrow pushbutton, as necessary, until the "Substation Address" menu item is displayed.

```
Substation Address
     0
```

6. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
Substation Address
     0                     C
```

7. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen, and then display the following:

```
Substation Address
     0                     C
```

   If not, re-enter a valid code.

■**NOTE**: When entering the digital values the display will automatically advance the cursor to the next digit when input is momentarily paused.

9. Utilizing the arrow pushbuttons enter the desired Substation Address, then press the ENT pushbutton. The desired Substation Address will be displayed.

```
Substation Address
    xxxxx
```

Setting Feeder Address From The HMI

1. Ensure the control is energized.

■**NOTE**: If password protection has been implemented on the control, then a valid Level 2 Access Code is required to be entered to set the Feeder Address.

2. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                    UTIL→
```

OR

```
         Memory Card
←                          →
```

3. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                          →
```

4. If Memory Card is displayed, then press the Right or Left arrow pushbutton, as necessary, until "Comm Settings" is displayed.

```
        Comm Settings
←                          →
```

5. Press the Down arrow pushbutton, as necessary, until the "Feeder Address" menu item is displayed.

```
Feeder Address
     0
```

6. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
Feeder Address
     0                       C
```

7. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen, and then display the following:

```
Feeder Address
     0                       C
```

   If not, re-enter a valid code.

■**NOTE**: When entering the digital values the display will automatically advance the cursor to the next digit when input is momentarily paused.

9. Utilizing the arrow pushbuttons enter the desired Feeder Address, then press the ENT pushbutton. The desired Feeder Address will be displayed.

```
Feeder Address
    xxxxx
```

Setting Communication Addresses From TapTalk

To set Communication Addresses from TapTalk®, proceed as follows:

1. Select **Communication/Setup/Change Address** from the TapTalk toolbar. TapTalk will display the "Change Address Warning" dialog screen (Figure 4-25).

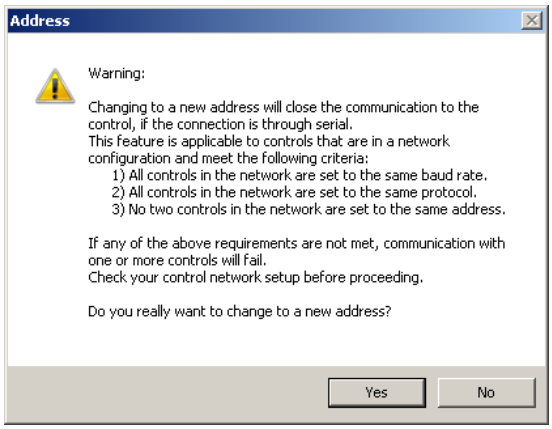


Figure 4-25 Change Address Warning Dialog Screen

2. Select **Yes.** TapTalk will display the "Change Communication Address" dialog screen (Figure 4-26).

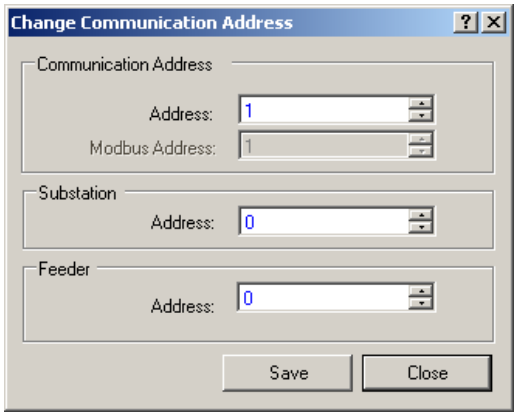


Figure 4-26 Change Communication Address Dialog Screen

3. Enter the desired Communication, Substation or Feeder address, then select "Save". TapTalk will display the "Setpoints Successfully Written to Control" confirmation screen (Figure 4-13).

Automatic Mode Blocking

The Automatic Mode Blocking feature will cause the control to respond in a predefined manner to either a serial communication interruption or power loss to the control. The Control will respond as follows:

- If Automatic control has been Blocked using TapTalk, then Automatic Control will remain Blocked if serial communication is disrupted or lost.
- If Automatic Control has been Blocked using TapTalk, and the **Save Comm Block at Power Off** selection is **Save**, then the Automatic Control Block will be reinstated at power up.
- If Automatic Control has been Blocked using TapTalk, and the **Save Comm Block at Power Off** selection is **Don't Save**, then the Automatic Control Block will not be reinstated at power up.

Comm Block Auto

Comm Block Auto allows the state of the "Block Auto Operation" communication command to be saved or not saved when power has been lost. The default setting is "DON'T SAVE".

■**NOTE**: The Comm Block Auto at power off setting requires the "Auto/Manual Switch Type" in the configuration to be set to either "None" or "Toggle".

Setting Comm Block Auto From The HMI

To set the Comm Block Auto feature, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
            Nameplate
←                          →
```

4. Press the Down arrow pushbutton, as necessary, until "Comm Block Auto" is displayed.

```
Comm Block Auto
DON'T SAVE
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Comm Block auto
DON'T SAVE                    C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen and display the following:

```
Comm Block auto
DON'T SAVE                    C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select "DON'T SAVE or SAVE", then press the ENT pushbutton. The selected setting will be displayed.

```
Comm Block Auto
(DON'T SAVE or SAVE)
```

Setting Comm Block Auto at Power Off From TapTalk

To set Comm Block Auto at Power Off from TapTalk®, proceed as follows:

■**NOTE**: The Comm Block Auto at power off setting requires the "Auto/Manual Switch Type" in the configuration to be set to either "None" or "Toggle".

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the "Configuration" dialog screen (Figure 4-28).
2. Verify that the Auto/Manual Switch Type is set to either "None" or "Toggle". From the "Save Comm Block at Power Off" section, select either "Don't Save" or "Save", then select "Save". TapTalk will display the "Save to Device Confirmation Screen" (Figure 4-27).

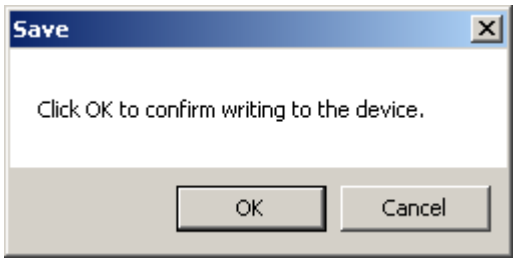


Figure 4-27 Save to Device Confirmation Screen

3. Select "OK". TapTalk will briefly display the "Setpoints successfully written to the control" confirmation screen.

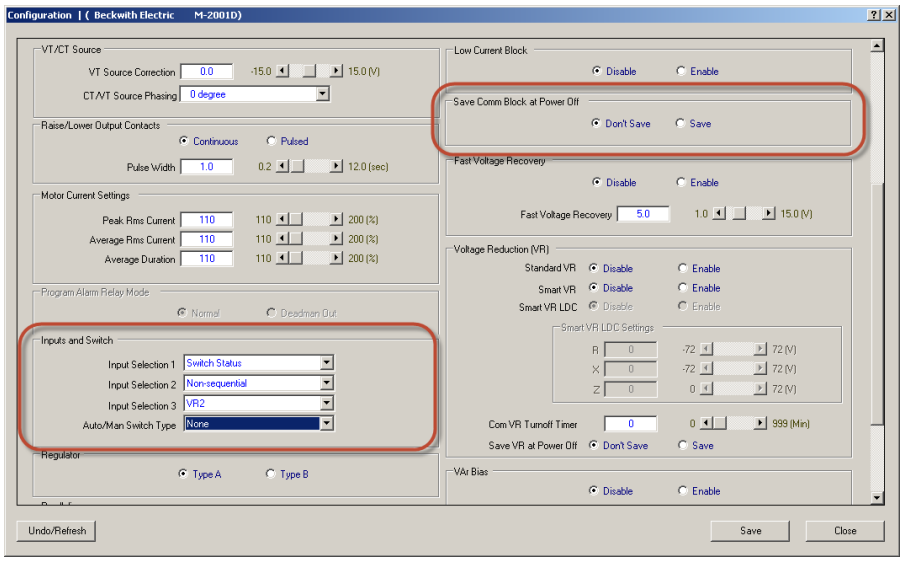


Figure 4-28 Configuration (Save Comm Block at Power Off) Dialog Screen

SCAMP Initialize on Power Up

SCAMP Initialize on Power Up – When **Last Save** is selected, the SCAMP switch is configured in such a way that upon the control performing a cold power up, the state of the SCAMP switch is initialized to the last saved state of the SCAMP switch prior to the control powering off.

For example, if prior to powering off the control, the SCAMP switch was in Manual, then when the control is powered back on the control will initially go back to the Manual state and vice versa. Now when **Auto Mode** is selected, the control always initializes into the Auto Mode after powering up regardless of the saved state of the control prior to powering off.

■**NOTE**: The "Auto/Manual Switch Type" setting in configuration must be set to "SCAMP" to effect this setting change.

Setting SCAMP Initialize on Power Up From The HMI

To set the SCAMP Initialize on Power Up feature, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
            Nameplate
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until "SCAMP Init Pwrup" is displayed.

```
Scamp Init Pwrup
Last Save
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Scamp Init Pwrup
Last Save                C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen and display the following:

```
Scamp Init Pwrup
Last Save                    C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select "Last Save or Auto Mode", then press the ENT pushbutton. The selected setting will be displayed.

```
Scamp Init Pwrup
(Last Save or Auto Mode)
```

Setting SCAMP Initialize on Power Up From TapTalk

To set SCAMP Initialize on Power Up from TapTalk®, proceed as follows:

■**NOTE**: The "Auto/Manual Switch Type" setting in configuration must be set to "SCAMP" to effect this setting change.

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the "Configuration" dialog screen (Figure 4-29).
2. Verify that the Auto/Manual Switch Type is set to "SCAMP". From the "SCAMP Initialize on Power Up" section, select either "Auto Mode" or "Last Save", then select "Save". TapTalk will display the "Save to Device Confirmation Screen" (Figure 4-27).
3. Select "OK". TapTalk will briefly display the "Setpoints successfully written to the control" confirmation screen.

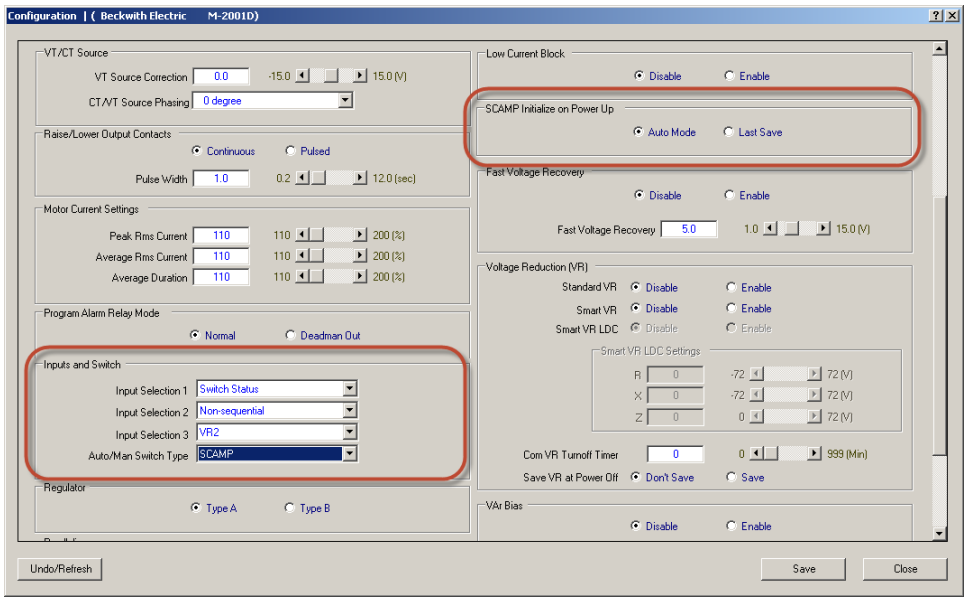


Figure 4-29 Configuration (SCAMP Initialize on Power Up) Dialog Screen

Optional Ethernet Port

The optional Ethernet Port is available through an RJ45 (10/100 Base-T) or a (100 Base-Fx) Fiber Optic interface for ethernet communication to the M-2001D. The port supports up to 17 concurrent connections. The maximum number of allowed DNP connections is five. The maximum number of MODBUS® connections is eight. When IEC 61850 is purchased the maximum number of IEC 61850 connections is four. The port supports DHCP protocol and also allows manual configuration of the Ethernet port. MODBUS protocol "Port Number" and DNP Protocol "Port Number" are required for manual configuration.

If no communication activity is detected on a previously open ethernet socket, for the amount of time specified by the "Keepalive Time" setting, the control will then close the socket and make it available for future connection.

■ **NOTE:** Keepalive Time applies only to Ethernet communication.

Ethernet Port Configuration From TapTalk

■ **NOTE:** Manual configuration of the Ethernet Port (not enabling DHCP Protocol) requires that the IP Address, Net Mask and Gateway settings be obtained from the System Administrator.

1. Ensure the following conditions exist:
   - The control is energized
   - TapTalk is installed on the host computer
   - The host computer is physically connected to the target control through either a USB, Serial Port or Modem connection
   - The host computer and the control are physically connected to the target Ethernet network
2. Start the TapTalk program. TapTalk will display the TapTalk **Main** dialog screen.
3. Select **Connect/USB, Com Port or Modem** from the **Connect** drop-down menu. TapTalk will display the appropriate Connection Dialog Screen (Figures 3-2, 3-14 or 3-15).
4. Enter a valid Level 2 Access Code (if enabled), then select **Connect**, TapTalk will attempt to connect to the target control.
5. If TapTalk returns a Failed to Connect Error screen (Figure 3-3), repeat Steps 3 and 4.
6. Level 2 Access if enabled is necessary to complete the Ethernet Port configuration. If an invalid Access Code was entered, TapTalk will display the connected version of the TapTalk main screen with either "Read-Only" or "Level 1" access.

   Disconnect from the control and repeat Step 4.
7. If Level Access is not active or a valid Level 2 Access Code was entered, TapTalk will briefly display the "Successfully Connected Level 2" screen and then display the connected version of the TapTalk Main Screen (Figure 3-13) with Level 2 Access.
8. From the **Communication** drop-down menu, select **Setup/Ethernet Settings**. TapTalk will then display the Setup Ethernet dialog screen (Figure 4-30).
9. If the Ethernet network that the target control is connected to supports DHCP Protocol, then perform the following:
   a. From the Setup Ethernet dialog screen (Figure 4-30) select **DHCP Protocol** "Enable"
   b. Select the desired "Keepalive Time" duration.
   c. Select "Save" to save the settings to the target control.
   d. Go to Step 12.

10. If the Ethernet network that the target control is connected to does not support DHCP Protocol, or manual configuration is desired, perform the following:
    a. Select **DHCP Protocol** "Disable".
    b. Enter the IP Address, Net Mask, Gateway and the applicable MODBUS® or DNP3.0 Port settings.
    c. Select the desired "Keepalive Time" duration.
    d. Select "Save" to save the settings to the target control. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 4-13).
11. If the Network MODBUS Port address is not "502" or the DNP Port address is not "20000", set these parameters to match the target network settings.

The Ethernet option for the control is now enabled. See **Communication Using Ethernet Connection** section of Chapter 3 to connect to the target control through the Ethernet connection. If Source Address Validation is desired, then see "Enabling Source Address Validation" earlier in this section.

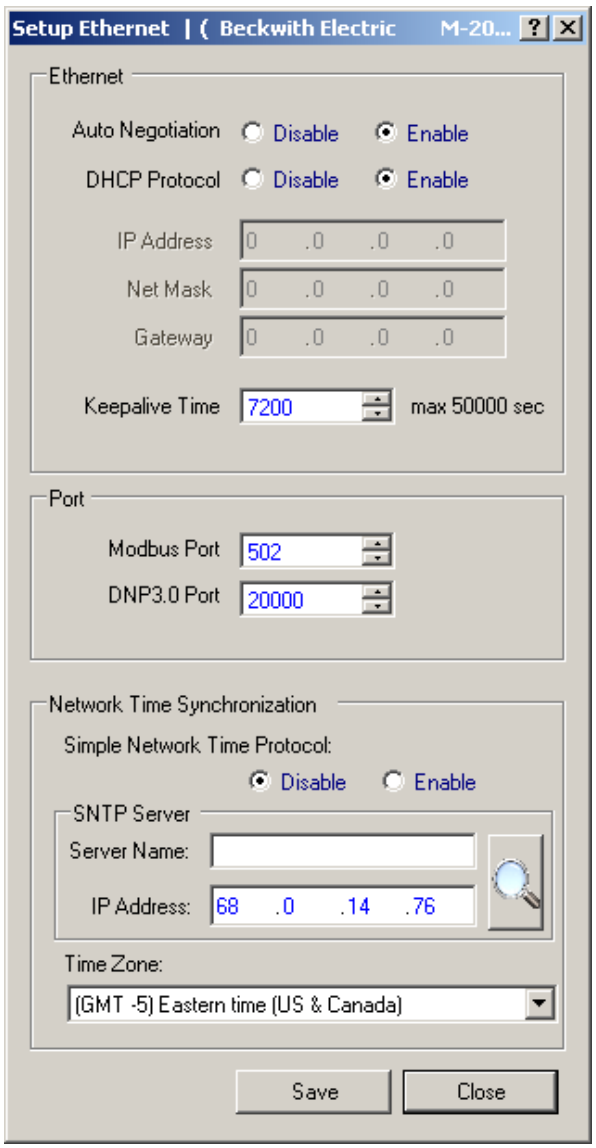


Figure 4-30 Setup Ethernet Dialog Screen

Network Time Synchronization

■**NOTE:** Network Time Synchronization requires the SNTP (Simple Network Time Protocol) "Server Name" or "Server IP Address" to be known and also the Control Location "Time Zone".

1. From the **Communication** drop-down menu, select **Setup/Ethernet Settings**. TapTalk will then display the "Setup Ethernet" dialog screen (Figure 4-30).
2. From the "SNTP Server" section of the dialog screen proceed as follows:
   a. If the Server Name is known, enter the Server Name and then select the magnified glass icon. TapTalk will search for the corresponding IP Address.
   b. If the server IP Address is known, enter the IP Address.
3. Select the Time Zone that the control resides in, then select "Save". TapTalk will display a "Setpoints Successfully Written to Control" Confirmation Screen (Figure 4-13).

HMI Configuration of the Control's Ethernet Port for use on a network that ***supports*** *DHCP Protocol*

1. Ensure the control is energized.

■**NOTE**: If Level Access is active on the control, a valid Level 2 Access Code is required to be entered to manually configure each element of the Ethernet port.

2. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                    UTIL→
```

OR

```
        Memory Card
←                          →
```

3. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                          →
```

4. From either the "Comm Settings" or "Memory Card" menu, press the Right or Left Arrow pushbutton as necessary until "Ethernet" is displayed.

```
          Ethernet
←                          →
```

5. Press the Down arrow pushbutton once. The following will be displayed.

```
DHCP Enable
disable
```

6. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
DHCP Enable
disable                    C
```

7. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen and then display the following:

```
DHCP Enable
disable                    C
```

   If not, re-enter a valid code.

9. Utilizing the Up/Down arrow pushbuttons select **ENABLE**, then press the ENT pushbutton. The following will be displayed.

```
DHCP Enable
ENABLE
```

10. The control is now addressable from TapTalk® over the target network.
    - Also, if the network MODBUS® Port address is not "502" or the DNP Port address is not "20000", go to the MODBUS Port and DNP Port Settings section of this chapter.
    - If Source Address Validation is desired, then see "Enabling Source Address Validation" earlier in this section.

HMI Configuration of the Control's Ethernet Port for use on a network that *<u>does not support</u>* DHCP Protocol

1. Ensure the control is energized.

■**NOTE**: If password protection has been implemented on the control, a valid Level 2 password is required to be entered to manually configure each element of the Ethernet port.

2. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                    UTIL→
```

OR

```
        Memory Card
←                          →
```

3. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                          →
```

4. From either the "Comm Settings" or "Memory Card" menu, press the Right or Left Arrow pushbutton as necessary until "Ethernet" is displayed.

```
        Ethernet
←                          →
```

5. Press the Down arrow pushbutton once. The following will be displayed.

```
DHCP Enable
disable
```

6. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
DHCP Enable
disable                    C
```

7. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen and then display the following:

```
DHCP Enable
disable                    C
```

   If not, re-enter a valid code.

9. Utilizing the Up/Down arrow pushbuttons, select "disable", then press the ENT pushbutton. The following will be displayed.

```
DHCP Enable
disable
```

10. Press the Down arrow pushbutton once. The following will be displayed.

```
IP Address
0.0.0.0
```

■**NOTE**: When entering the digital values the display will automatically advance the cursor to the next digit when input is momentarily paused.

11. Press the ENT pushbutton. The following will be displayed.

```
IP Address
0.0.0.0                    C
```

12. Utilizing the arrow pushbuttons input the desired IP Address, then press the ENT pushbutton, the desired IP Address will be displayed.

13. Press the Down arrow pushbutton once. The following will be displayed.

```
Net Mask
0.0.0.0
```

14. Press the ENT pushbutton. The following will be displayed.

```
Net Mask
0.0.0.0                    C
```

15. Utilizing the arrow pushbuttons, input the desired Net Mask, then press the ENT pushbutton, the desired Net Mask will be displayed.

16. Press the Down arrow pushbutton once. The following will be displayed.

```
Gateway
0.0.0.0
```

17. Press the ENT pushbutton. The following will be displayed.

```
Gateway
0.0.0.0                    C
```

18. Utilizing the arrow pushbuttons input the desired Gateway, then press the ENT pushbutton, the desired Gateway will be displayed.

■**NOTE**: Auto negotiation is an Ethernet procedure by which two connected devices choose common transmission parameters, such as speed and duplex mode. In this process, the connected devices first share their capabilities as for these parameters and then choose the fastest transmission mode they both support.

19. If the control is connected to a host device which is capable of 10 and 100 mbps transmission rates and handles both half or full duplex modes, then the Ethernet port is now configured to support network communications with the MODBUS® port and DNP port default values. If the network requires specific MODBUS port and DNP port settings, then see the MODBUS Port and DNP Port Setting section in this chapter.

■**NOTE:** Auto Negotiation must be disabled if using Fiber Ethernet.

20. If a fixed speed of 100 mbps is desired as in the case of Fiber Optic mode, utilize the Up/Down arrow pushbuttons to navigate to the "Auto Negotiation" menu item.

```
Auto Negotiation
ENABLE
```

21. Press the ENT pushbutton. The following will be displayed.

```
Auto Negotiation
ENABLE                    C
```

22. Utilizing the Up/Down arrow pushbuttons select "disable", then press the ENT pushbutton. The following will be displayed.

```
Auto Negotiation
disable
```

The Ethernet port is now configured to support network communications with the MODBUS port, DNP port, and Keepalive Time default values. If the network requires specific MODBUS port and DNP port settings, see the MODBUS Port and DNP Port Setting section in this chapter. If a Keepalive Time duration other than 7200 seconds is desired, see Keepalive Time section in this chapter.

If Source Address Validation is desired, then see "Enabling Source Address Validation" earlier in this section.

MODBUS Port and DNP Port Settings From The HMI

1. Ensure the control is energized.

■**NOTE**: If password protection has been implemented on the control, then a valid Level 2 Access Code is required to be entered to set MODBUS® port and DNP port settings.

2. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                    UTIL→
```

OR

```
        Memory Card
←                          →
```

3. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                          →
```

4. From either the "Comm Settings" or "Memory Card" menu, press the Right or Left Arrow pushbutton as necessary until "Ethernet" is displayed.

```
          Ethernet
←                          →
```

5. Press the Down arrow pushbutton, as necessary, until the "Enter MODBUS Port" menu item is displayed.

```
Enter Modbus Port
   502
```

6. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
Enter Modbus Port
   502                    C
```

7. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen, and then display the following:

```
Enter Modbus Port
   502                    C
```

   If not, re-enter a valid code.

■**NOTE**: When entering the digital values the display will automatically advance the cursor to the next digit when input is momentarily paused.

9. Utilizing the arrow pushbuttons enter the desired MODBUS® port address, then press the ENT pushbutton. The desired MODBUS port address will be displayed.

10. Press the Down arrow pushbutton once. The following will be displayed.

```
Enter DNP Port
20000
```

11. Press the ENT pushbutton. The following will be displayed.

```
Enter DNP Port
20000                     C
```

12. Utilizing the arrow pushbuttons, input the desired DNP Port address, press the ENT pushbutton, the desired DNP Port address will be displayed.

    The control is now addressable from TapTalk® over the network. Ensure that the MODBUS and DNP Port values are the same as the values manually set when attempting to communicate with the control from TapTalk.

Ethernet Keepalive Time Settings From The HMI

1. Ensure the control is energized.

■**NOTE**: If password protection has been implemented on the control, then a valid Level 2 Access Code is required to be entered to set Ethernet Keepalive Time settings.

2. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                  UTIL→
```

OR

```
        Memory Card
←                         →
```

3. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                         →
```

4. From either the "Comm Settings" or "Memory Card" menu, press the Right or Left Arrow pushbutton as necessary until "Ethernet" is displayed.

```
            Ethernet
←                          →
```

5. Press the Down arrow pushbutton, as necessary, until the "Keepalive time" menu item is displayed.

```
Keepalive time
   7200 sec
```

6. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
Keepalive time
   7200 sec                C
```

7. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen, and then display the following:

```
Keepalive time
   7200 sec                C
```

   If not, re-enter a valid code.

■**NOTE**: When entering the digital values the display will automatically advance the cursor to the next digit when input is momentarily paused.

9. Utilizing the arrow pushbuttons enter the desired Keepalive Time value, then press the ENT pushbutton. The desired Keepalive Time value will be displayed.

```
Keepalive time
    xxx sec
```

RS-485/Fiber Optic Port

M-2001D COM Port can be selected for two different configurations: RS-485 or Fiber Optics.

RS-485/Fiber Optic Port Setup From The HMI

This procedure provides the steps necessary to setup all RS-485 and Fiber Optic parameters. Parameter definitions and the default value (default value) for each parameter are included below:

- Comm Protocol – Allows selection between standard protocols, DNP 3.0 or MODBUS®. (DNP3.0)
- Comm Address – Configures a three-digit numerical address, from 1 to 200, for remote communications. (1)
- Baud Rate – Selects baud rate for COM1, located on the top of the control. (9600)
- Parity – None, odd or even parity is available. (NONE)
- Stop Bits – One or two stop bits are available. (ONE STOPBIT)
- Sync Time – This time delay improves robust operation when communication lines are intermittent. Communication dead-sync time is the time that the control will wait from the last received character and continue without attempting to resynchronize. (2 ms)
- Echo/Repeat – Selects Echo/Repeat on/off as determined by the user. Selector switch is located on side of unit adjacent to the Fiber Optic connection and is accessed through the slot in the cover. Switch position towards the front of the control is the off position. (OFF)

If the default value for a parameter does not need to be changed, skip the applicable steps.

1. Ensure the control is energized.

■**NOTE**: If Access Code protection has been implemented on the control, a valid Level 2 Access Code is required to be entered to manually configure each element of the RS-485/Fiber Optic port.

2. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                 UTIL→
```

OR

```
        Memory Card
←                         →
```

3. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                         →
```

4. If Memory Card is displayed, then press the Right or Left arrow pushbutton, as necessary, until “Comm Settings” is displayed.

```
        Comm Settings
←                         →
```

5. Press the Down arrow pushbutton, as necessary, until "Com Port Type" is displayed.

```
Comm1 Port Type
RS485
```

6. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
Comm1 Port Type
RS485                       C
```

7. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Comm1 Port Type
RS485                       C
```

   If not, re-enter a valid code.

9. Utilizing the Up/Down arrow pushbuttons select "RS485 or FIBER", then press the ENT pushbutton. The selected port type will be displayed.

```
Comm1 Port Type
(RS485 or FIBER)
```

10. Press the Up/Down arrow pushbutton, as necessary, until the "Comm Protocol" menu item is displayed.

```
Comm Protocol
DNP3.0
```

■**NOTE**: From this point on in this procedure it is assumed that a valid Access Level 2 Code has been previously entered. If not, a valid Level 2 Access Code will be required to be entered as described in Step 8.

11. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Comm Protocol
DNP3.0                    C
```

12. Utilizing the arrow pushbuttons select "DNP3.0 or MODBUS®", then press the ENT pushbutton. The selected protocol will be displayed.

```
Comm Protocol
(DNP3.0 or MODBUS)
```

13. Press the Up/Down arrow pushbutton, as necessary, until the "Comm Address" menu item is displayed.

```
Comm Address
     1
```

14. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Comm Address
     1                    C
```

15. Utilizing the Up/Down arrow pushbuttons enter the desired "Comm Address", then press the ENT pushbutton. The entered Comm Address will be displayed.

```
Comm Address
     X
```

16. Press the Up/Down arrow pushbutton, as necessary, until the "Baud Rate" menu item is displayed.

```
Baud Rate
9600
```

17. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Baud Rate
9600                      C
```

18. Utilizing the Up/Down arrow pushbuttons, select the desired Baud Rate:
    - 115,200
    - 57,600
    - 38,400
    - 19,200
    - 9,600
    - 4,800
    - 2,400
    - 1,200
    - 600
    - 300

    When the desired Baud Rate has been selected, then press the ENT pushbutton. The selected Baud Rate will be displayed.

```
Baud Rate
XXXXXXX
```

19. Press the Up/Down arrow pushbutton, as necessary, until the "Parity" menu item is displayed.

```
Parity
NONE
```

20. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Parity
NONE                          C
```

21. Utilizing the Up/Down arrow pushbuttons select "NONE, EVEN or ODD", then press the ENT pushbutton. The selected Parity setting will be displayed.

```
Parity
(NONE, EVEN or ODD)
```

22. Press the Up/Down arrow pushbutton, as necessary, until the "Stop Bits" menu item is displayed.

```
Stop Bits
ONE STOPBIT
```

23. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Stop Bits
ONE STOPBIT                   C
```

24. Utilizing the Up/Down arrow pushbuttons select "ONE STOPBIT or TWO STOPBITS", then press the ENT pushbutton. The selected Stop Bits setting will be displayed.

```
Stop Bits
(ONE STOPBIT or TWO STOPBITS)
```

25. Press the Up/Down arrow pushbutton, as necessary, until the "Sync Time" menu item is displayed.

```
Sync Time
   2 mS
```

26. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Sync Time
   2 mS                       C
```

27. Utilizing the arrow pushbuttons, enter the desired Sync Time value (2 to 5,000 mS in 1 mS increments), then press the ENT pushbutton. The entered Sync Time setting will be displayed.

```
Sync Time
   XXXX mS
```

28. The RS-485 or Fiber Optic Port is now available for communications.

29. If DNP3.0 was selected in Step 12 and Source Address Validation is desired, then see "Enabling Source Address Validation" earlier in this section.

RS-485/Fiber Optic Port Setup From TapTalk

To setup the RS-485/Fiber Optic from TapTalk®, proceed as follows:

1. Select **Communication/Setup/Comm Port** from the TapTalk toolbar. TapTalk will display the "Setup Comm Port" dialog screen (Figure 4-31).

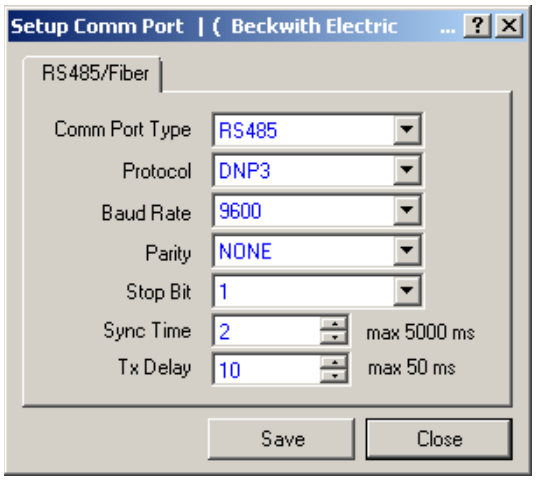


Figure 4-31 Setup Comm Port Dialog Screen

2. Select Comm Port Type "RS-485" or "Fiber".
3. If Echo/Repeat is required then Enable Echo/Repeat by placing the Echo/Repeat on/off switch located adjacent to the Fiber connection on the side of the control in the on position towards the rear of the control.
4. Enter the desired settings for the following parameters:
   - Protocol
   - Baud Rate
   - Parity
   - Stop Bits
   - Sync Time
   - TX Delay
5. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 4-2).
6. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 4-13).
7. If DNP3.0 was selected in Step 4 and Source Address Validation is desired, then see "Enabling Source Address Validation" earlier in this section.

RS-232 Port Setup From The HMI

This procedure provides the steps necessary to setup all RS-232 Port parameters. Parameter definitions and the default value (default value) for each parameter are included below:

- Comm Protocol – Allows selection between standard protocols, DNP 3.0 or MODBUS®. (MODBUS)
- Baud Rate – Selects baud rate for COM2, located on the top of the control. (115,200)
- Parity – None, odd or even parity is available. (NONE)
- Stop Bits – One or two stop bits are available. (TWO STOPBITS)
- Sync Time – This time delay improves robust operation when communication lines are intermittent. Communication dead-sync time is the time that the control will wait from the last received character and continue without attempting to re-synchronize. (50 ms)

If the default value for a parameter does not need to be changed, then skip the applicable steps.

1. Ensure the control is energized.

■**NOTE**: If Access Code protection has been implemented on the control, a valid Level 2 Access Code is required to be entered to manually configure each element of the RS-232 port.

2. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
 ←CNFG                  UTIL→
```

OR

```
        Memory Card
 ←                          →
```

3. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                       →
```

4. From either the "Comm Settings" or "Memory Card" menu, press the Right or Left Arrow pushbutton as necessary until "RS232" is displayed.

```
              RS232
←                       →
```

5. Press the Down arrow pushbutton once. The unit will display the following:

```
Protocol
MODBUS
```

6. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
Protocol
MODBUS                    C
```

7. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen and display the following:

```
Protocol
MODBUS                    C
```

   If not, re-enter a valid code.

9. Utilizing the Up/Down arrow pushbuttons, select "DNP3.0 or MODBUS®", then press the ENT pushbutton. The selected protocol will be displayed.

```
Protocol
(DNP3.0 or MODBUS)
```

10. Press the Up/Down arrow pushbutton, as necessary, until the "Baud Rate" menu item is displayed.

```
Baud Rate
115200
```

■**NOTE**: From this point on in this procedure it is assumed that a valid Access Level 2 Code has been previously entered. If not, then a valid Level 2 Access Code will be required to be entered as described in Step 8.

11. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Baud Rate
115200                    C
```

12. Utilizing the Up/Down arrow pushbuttons select the desired Baud Rate:

    - 115,200
    - 57,600
    - 38,400
    - 19,200
    - 9,600
    - 4,800
    - 2,400
    - 1,200
    - 600
    - 300

    When the desired Baud Rate has been selected, then press the ENT pushbutton. The selected Baud Rate will be displayed.

```
Baud Rate
XXXXXXX
```

13. Press the Up/Down arrow pushbutton as necessary until the "Parity" menu item is displayed.

```
Parity
NONE
```

14. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Parity
NONE                    C
```

15. Utilizing the Up/Down arrow pushbuttons, select "NONE, EVEN or ODD", then press the ENT pushbutton. The selected Parity setting will be displayed.

```
Parity
(NONE, EVEN or ODD)
```

16. Press the Up/Down arrow pushbutton, as necessary, until the "Stop Bits" menu item is displayed.

```
Stop Bits
TWO STOPBITS
```

17. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Stop Bits
TWO STOPBITS            C
```

18. Utilizing the Up/Down arrow pushbuttons select "ONE STOPBIT or TWO STOPBITS", then press the ENT pushbutton. The selected Stop Bits setting will be displayed.

```
Stop Bits
(ONE STOPBIT or TWO STOPBITS)
```

19. Press the Up/Down arrow pushbutton, as necessary, until the "Sync Time" menu item is displayed.

```
Sync Time
  50 mS
```

20. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Sync Time
  50 mS                 C
```

21. Utilizing the arrow pushbuttons, enter the desired Sync Time value (1 to 5,000 mS in 1 mS increments), then press the ENT pushbutton. The entered Sync Time setting will be displayed.

```
Sync Time
  XXXX mS
```

22. If DNP3.0 was selected in Step 9 and Source Address Validation is desired, then see "Enabling Source Address Validation" earlier in this section.

RS-232 Port Setup From TapTalk

To setup the RS-232 Port from TapTalk® proceed as follows:

1. Select **Communication/Setup/RS232 Comm Port** from the TapTalk toolbar. TapTalk will then display the Setup RS-232 Comm Port dialog screen (Figure 4-32).

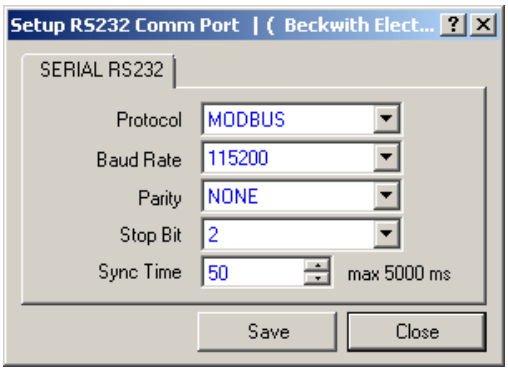


Figure 4-32 Setup RS-232 Comm Port Dialog Screen

2. Enter the desired settings for the following parameters:
   - Protocol
   - Baud Rate
   - Parity
   - Stop Bits
   - Sync Time
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 4-2).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 4-13).
5. If DNP3.0 was selected in Step 2 and Source Address Validation is desired, then see "Enabling Source Address Validation" earlier in this section.

The RS-232 option for the control is now enabled. See **Communication Using Serial Port** section of Chapter 3 to connect to the target control through the RS-232 connection.

INSTALLING MODEMS

Using TapTalk® to interrogate, set or monitor the control using a modem requires both a remote modem connected at the controls location and a local modem connected to the computer with TapTalk installed.

■ **NOTE**: Any compatible modem may be used; however, the unit only communicates at 1200 to 9600 baud.

In order to use TapTalk to communicate with the control using a modem, the following must be provided with the control:

- An external modem (1200 baud or higher), capable of understanding standard AT commands.
- Serial modem cable with 9-pin connector for the control and the applicable connector for the modem.

Similarly, the computer running TapTalk must also have access to a compatible internal or external modem.

Connecting the PC Modem

1. If the computer has an external modem, then use a standard straight-through RS-232 modem cable (M-3933) to connect the computer to the modem.
2. If the computer has an internal modem, then refer to the modem's instruction book to determine which communications port should be selected.
3. Verify that the modem is attached to (if external) or assigned to (if internal) the same serial port as assigned in TapTalk.

   While TapTalk can use any of the 255 serial ports (COM1 through COM255), most computers support only COM1 and COM2.
4. Connect the modem to a telephone line, then energize the modem.

Initializing the PC Modem

1. Verify that the modem is connected as described in "Connecting the PC Modem".
2. Open TapTalk, then select the **Connect/ Modem** menu item.
3. TapTalk will display the Modem Connection Dialog screen (Figure 4-33).
4. Enter the required information in the Modem Settings section of the screen, then select **Connect**.

COMMAND BUTTONS

Add Allows you to review and change the user lines (unit identifier), phone number, and communication address of a selected entry.

Remove Deletes a selected entry.

Save Saves any changes to the displayed information

Connect Dials the entry selected from the directory.

Cancel Ends modem communication, allowing the user to dial again.

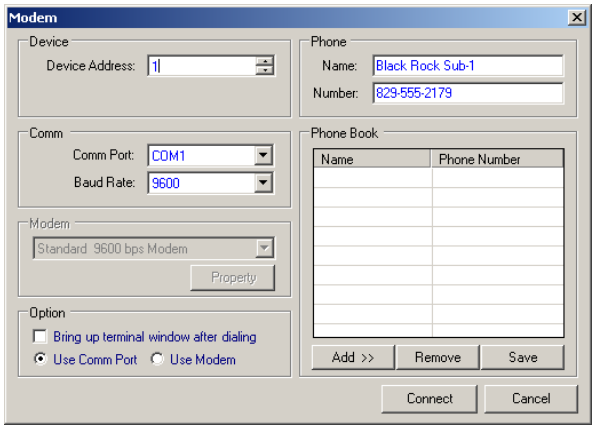


Figure 4-33 Modem Connection Dialog Screen

Connecting the Local Modem to the Control

Setup of the modem attached to the control may be slightly complicated. It involves programming parameters (using the AT command set), and storing this profile in the modem's nonvolatile memory.

After programming, the modem will power up in the proper state for communicating with the control. Programming may be accomplished by using the "Bring Up Terminal Window after dialing" selection (Figure 4-34). Refer to your modem manual for further information.

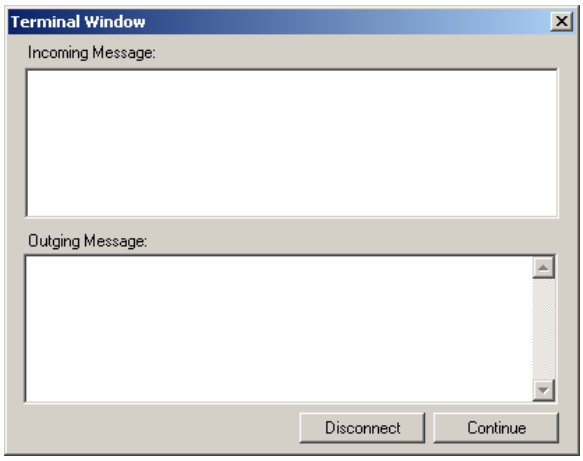


Figure 4-34 Terminal Window

■ **NOTE:** The control does not issue or understand any modem commands. It will not adjust the baud rate and should be considered a "dumb" peripheral. It communicates with 1 start, 8 data, and 0, 1 or 2 stop bits.

Connect the Modem to the control as follows:

1. Connect the unit to an external modem by attaching a standard RS-232 modem cable to the appropriate serial communications port on both the unit and the modem.
2. Connect the modem to a telephone line, then energize the modem.

The modem attached to the control must have the following AT command configuration:

E0	No Echo
Q1	Don't return result code
&D3	On to OFF DTR, hangup and reset
&S0	DSR always on
&C1	DCD ON when detected
S0=2	Answer on second ring

The following commands may also be required at the modem:

&Q6	Constant DTE to DCE
N0	Answer only at specified speed
W	Disable serial data rate adjust
\Q3	Bidirectional RTS/CTS relay
&B1	Fixed serial port rate
S37	Desired line connection speed

When connected to another terminal device, the Terminal Window allows the user to send messages or commands. Outgoing communications are displayed in the top pane and incoming messages are displayed in the bottom two panes, in ASCII text and HEX format.

There are some variations in the AT commands supported by modem manufacturers. Refer to the hardware user documentation for a list of supported AT commands and direction on issuing these commands.

Optional Bluetooth

The Bluetooth® option enables wireless access to the M-2001D. Utilizing the Bluetooth wireless feature the user is able to configure the control, read status and metering values, as well as change setpoints. The following lists the initialization scheme and setpoint options available for Bluetooth.

The M-2001D provides generic serial Bluetooth service. The user must select the generic serial service among any other listed services, if the user's Bluetooth device doesn't automatically recognize the available service.

The following features on the M-2001D are available to the user:

- Enable/Disable – The user can enable or disable Bluetooth functionality.
- Reset – The Bluetooth can be reset to Beckwith factory default values.
- Authentication – The device can be authenticated for security purposes, if enabled, the user can select a passkey to connect to the device.
- Passkey – If authentication is enabled, the customer can assign up to a maximum of 16 alphanumeric characters as a passkey.
- Friendly Name – The user can give the Bluetooth his/her preferred name, which can be a maximum of 20 characters, including alphanumeric as well as the '_' and '-' characters.
- Mode – The following configurations are available for the Bluetooth Mode:
  - Mode 0, the device is discoverable and connectable to any client station.
  - Mode 1, the device is non-discoverable but it is connectable to any client station that knows the control Bluetooth device address indicated under "Control BT Device" in the HMI menu.
- Protocol – MODBUS or DNP.

Bluetooth Module Initialization

■**NOTE**: For first time Bluetooth® module use, the Bluetooth module needs to be reset to ensure that the Bluetooth module functions according to the Beckwith factory values. See "Resetting Bluetooth Module" later in this section.

Bluetooth Initialization Overview

Following a control power cycle, the M-2001D hardware is checked for Bluetooth by sending an AT command and waiting for an 'OK' response. If no response is received, a 'Bluetooth not present' message will be displayed on the HMI. If an 'ERROR' message is received, Bluetooth is reset to factory default values and the hardware is checked again.

The Bluetooth device information, i.e., BD address, friendly name, mode of device, internal operation state and status of authentication and encryption features will be retrieved.

The Beckwith factory default values for device information are:

- Friendly Name – M2001D-Serial Number
- Mode of Device – Mode0
- Internal operation status – Standby
- Authentication: None
- Encryption: None

The retrieved Bluetooth device information is compared to the factory defaults, if they are not the same; they are forced to the default values. If internal operation status is not standby, an AT+BTCANCEL command is issued to force standby status. The mode is set by issuing a AT+BTMODE command. The friendly name is set by AT+BTNAME. The device is now in connectable mode, hence the user can use the Bluetooth device to connect to the M-2001D using the generic serial service.

Bluetooth Setup From the HMI

In order to setup the Bluetooth feature on the M-2001D from the HMI the following conditions must be present:

- The Bluetooth Factory Option must be enabled on the control
- The Bluetooth Status on the control must be "Present" and "Connectable"

To verify that these conditions are present on the control, observe the display while applying power to the control. The following sequence of messages will be displayed during the control boot up:

```
Factory Options
BLUETOOTH
```

```
Bluetooth Status
BLUETOOTH PRESENT
```

```
Bluetooth Status
CONNECTABLE
```

If the unit display messages are consistent with the above, the unit is physically ready to be setup for wireless communication.

■**NOTE**: If it becomes necessary to reset the Bluetooth module during the performance of this procedure, navigate to the Bluetooth Reset menu item and select ENT. See "Resetting Bluetooth Module" later in this section.

To setup the M-2001D Bluetooth module from the HMI, proceed as follows:

1. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                    UTIL→
```

OR

```
        Memory Card
←                          →
```

2. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                          →
```

3. From either the "Comm Settings" or "Memory Card" menu, press the Right or Left Arrow pushbutton as necessary until "Bluetooth®" is displayed.

```
            Bluetooth
←                          →
```

4. Press the Down arrow pushbutton once. The unit will display the following:

```
Bluetooth Enable
disable
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Bluetooth Enable
disable                    C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen and display the following:

```
Bluetooth Enable
disable                    C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select "ENABLE", then press the ENT pushbutton. The following will be displayed.

```
Bluetooth Enable
ENABLE
```

9. Press the Up/Down arrow pushbutton, as necessary, until the "Bluetooth Protocol" menu item is displayed.

```
Bluetooth Protocol
MODBUS
```

■**NOTE**: From this point on in this procedure it is assumed that a valid Access Level 2 Code has been previously entered. If not, then a valid Level 2 Access Code will be required to be entered as described in Step 7.

10. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Bluetooth Protocol
MODBUS                     C
```

11. Utilizing the Up/Down arrow pushbuttons select "MODBUS® or DNP3.0", then press the ENT pushbutton. The selected Protocol setting will be displayed.

```
Bluetooth Protocol
MODBUS or DNP3.0
```

12. Press the Up/Down arrow pushbutton, as necessary, until the "Authentication" menu item is displayed.

```
Authentication
disable
```

13. If "Authentication" is to be ENABLED, press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Authentication
disable                    C
```

14. Utilizing the Up/Down arrow pushbuttons select "ENABLE", then press the ENT pushbutton. The following will be displayed.

```
Please Enter Passkey

_
```

15. Utilizing the arrow pushbuttons enter the desired Passkey (up to 16 characters), then press ENT. The following sequence of screens will be displayed:

```
Please Enter Passkey
Please -WAIT-
```

```
Please Enter Passkey
-DONE-
```

```
Authentication
ENABLE
```

16. Press the Up/Down arrow pushbutton, as necessary, until the "Friendly Name" menu item is displayed.

```
Friendly Name
M2001D-2005
```

17. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Enter New Name
_
```

18. Utilizing the arrow pushbuttons, enter the desired Friendly Name value (up to 21 characters), then press the ENT pushbutton. The entered Friendly Name that was entered will be displayed.

```
Friendly Name
M2001D-2005
```

The Bluetooth® "Device Address" is available by pressing the Down arrow once,

```
Control BT Device
xx:xx:xx:xx:xx:xx
```

19. Press the Up/Down arrow pushbutton, as necessary, until the "Bluetooth Mode" menu item is displayed.

```
Bluetooth Mode
Mode0
```

20. Press the "ENT" pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Bluetooth Mode
Mode0                    C
```

21. Utilizing the arrow pushbuttons, select the desired Bluetooth Mode (0 or 1), then press the "ENT" pushbutton. The selected Bluetooth Mode will be displayed.

```
Bluetooth Mode
ModeX
```

The Bluetooth feature is now available for use.

22. If DNP3.0 was selected in Step 11 and Source Address Validation is desired, then see "Enabling Source Address Validation" earlier in this section.

Bluetooth Setup From TapTalk®

In order to setup the Bluetooth feature on the M-2001D, the following conditions must be present:

- The Bluetooth Factory Option must be enabled on the control
- The Bluetooth Status on the control must be "Present" and "Connectable"

To verify that these conditions are present on the control, observe the display while applying power to the control. The following sequence of messages will be displayed during the control bootup:

```
Factory Options
BLUETOOTH
```

```
Bluetooth Status
BLUETOOTH PRESENT
```

```
Bluetooth Status
CONNECTABLE
```

If the unit HMI display messages are consistent with the above, the unit is physically ready to be setup for wireless communication.

■**NOTE**: If it becomes necessary to reset the Bluetooth module during the performance of this procedure, see "Resetting Bluetooth Module" later in this section.

To setup Bluetooth wireless communication from TapTalk®, proceed as follows:

1. Select **Communication/Setup/ Bluetooth Settings** from the TapTalk toolbar.

   Depending on the status of the Bluetooth option in the control, TapTalk will respond as follows:

   - If the Bluetooth option is disabled in the control, TapTalk will display the Bluetooth Hardware option dialog screen (Figure 4-35).
   - If the Bluetooth option is enabled in the control, TapTalk will display the Bluetooth Information dialog screen (Figure 4-36).

2. If the Bluetooth Hardware option dialog screen (Figure 4-35) is displayed, proceed as follows:

   a. If the Bluetooth hardware is present, then select "OK" to enable. TapTalk will then display the Bluetooth Information dialog screen (Figure 4-36). Go to Step 3.

   b. If the Bluetooth hardware is not present, then select "Cancel". TapTalk will return to the Main screen.

3. Enter the desired settings for the following parameters:

   - Protocol (MODBUS® or DNP3.0)
   - Mode (0 or 1)
   - Friendly Name (20 characters max)
   - Bluetooth (Enable/Disable)
   - Authentication (Enable or Disable)
   - Set Password (16 characters max) if Authentication is "Enabled"

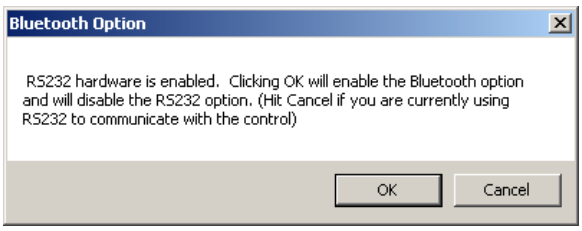


Figure 4-35 Bluetooth Hardware Option Dialog Screen

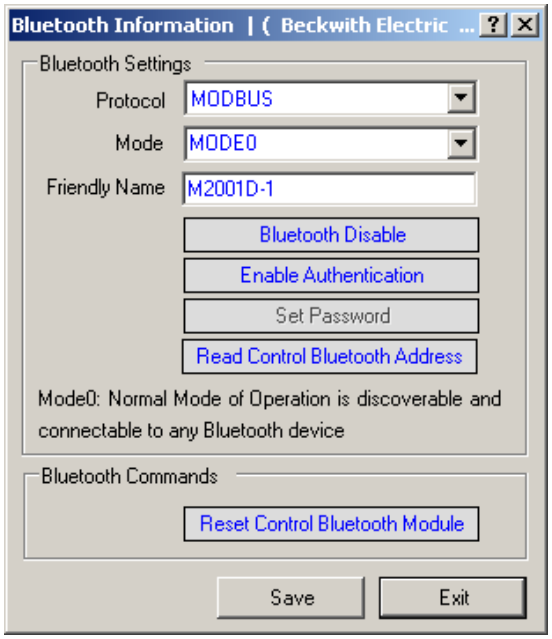


Figure 4-36 Bluetooth Information Dialog Screen

4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 4-13).

5. Verify that removing power to the control will not cause upset operation conditions on the control.

6. Remove power to the control, and then reapply power to the control.

   The Bluetooth feature is now available for use. Consult the Bluetooth wireless device documentation that is to be used to communicate with the M-2001D for setup information.

7. If DNP3.0 was selected in Step 3 and Source Address Validation is desired, then see "Enabling Source Address Validation" earlier in this section.

Bluetooth MODE1 Setup (TapTalk)

When the control's Bluetooth module is set to MODE1, the only way to connect to the control is to use the Secure Non-Discoverable connection method.

1. Select **Connect/Bluetooth** from the TapTalk® toolbar. TapTalk will display the "Secure Bluetooth" dialog screen (Figure 4-37).
2. Enter the Control Name, the control MAC Address, Pass Key if needed and the Device Address.

   The user can create a Bluetooth session and save it to an address book. The session must contain a name unique to the address book, the MAC address, Pass Key and Device address.

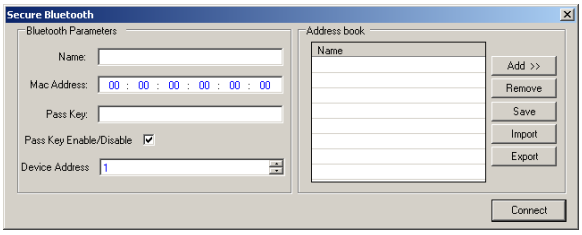


Figure 4-37 Secure Bluetooth Setup Screen

Resetting Bluetooth Module (HMI)

The Bluetooth Module can be reset to Beckwith factory values if necessary.

To reset the Bluetooth Module from the HMI proceed as follows:

1. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                    UTIL→
```

OR

```
        Memory Card
←                          →
```

2. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                          →
```

3. From either the "Comm Settings" or "Memory Card" menu, press the Right or Left Arrow pushbutton as necessary until "Bluetooth" is displayed.

```
          Bluetooth
←                          →
```

4. Press the Down arrow pushbutton as necessary to navigate to the "Bluetooth Reset" menu item.

```
Bluetooth Reset
Ready Press ENTER
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, then the following will be displayed. Go to Step 8.

```
CONFIRM PRESS ENTER
Cancel press EXIT.
```

6. If Level 2 Access is active, then the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, then the display will briefly flash a confirmation screen and then display the following:

```
CONFIRM PRESS ENTER
Cancel press EXIT.
```

   If not, re-enter a valid code.

8. Press the ENT pushbutton. The following sequence of screens will be displayed:

```
Bluetooth Reset
Resetting -WAIT-
```

```
Bluetooth Reset
-DONE-
```

Resetting Bluetooth Module (TapTalk)

The Bluetooth Module can be reset to Beckwith factory values if necessary.

To reset the Bluetooth Module from TapTalk® proceed as follows:

1. Select **Communication/Setup/ Bluetooth Settings** from the TapTalk toolbar. TapTalk will display the "Bluetooth Information" dialog screen (Figure 4-36).
2. Select "Reset Control Bluetooth Module". TapTalk will respond with a "Bluetooth Reset Command Sent Successfully" confirmation screen (Figure 4-38).

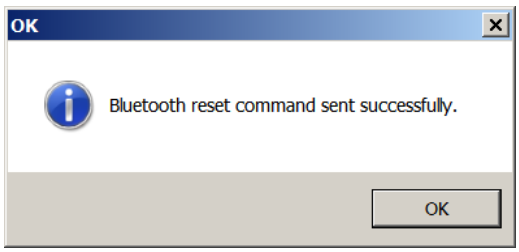


Figure 4-38 Bluetooth Reset Command Sent Confirmation Screen

3. Select "OK". TapTalk will send the "reset" command to the control and display a "Waiting for Bluetooth to Reset" status screen (Figure 4-39).

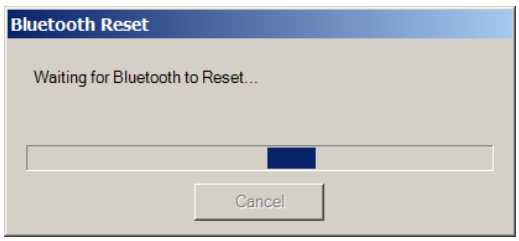


Figure 4-39 Bluetooth Reset Status Screen

When the Bluetooth Module has been reset, TapTalk will display "Bluetooth has been reset successfully" message (Figure 4-40).

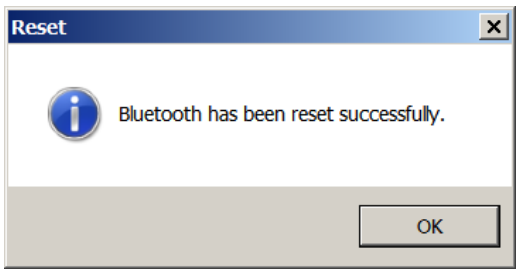


Figure 4-40 Bluetooth Reset Confirmation Screen

4. Select "OK". TapTalk will return to the "Bluetooth Information" Dialog Screen (Figure 4-36).

Resetting Bluetooth Passkey (HMI)

The Bluetooth Passkey can be changed or reset to default conditions (no Passkey and Authentication Disabled) if necessary.

To reset the Bluetooth Passkey from the HMI proceed as follows:

1. Press the Right Arrow (COMM Hot Button) pushbutton to awaken the unit. The menu will advance to either "COMMUNICATION" or if a Memory Card is present in the Smart Flash SD CARD slot "Memory Card".

```
        COMMUNICATION
←CNFG                 UTIL→
```

OR

```
        Memory Card
←                         →
```

2. If the "Communication" menu is displayed, then press the Down Arrow pushbutton once. The unit will display the following:

```
        Comm Settings
←                         →
```

3. From either the "Comm Settings" or "Memory Card" menu, press the Right or Left Arrow pushbutton as necessary until "Bluetooth" is displayed.

```
          Bluetooth
←                         →
```

4. Press the Down arrow pushbutton as necessary to navigate to the "Bluetooth Pass Reset" menu item.

```
Bluetooth Pass Reset
Ready Press ENTER
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, then the following will be displayed. Go to Step 8.

```
Confirm press ENTER
Cancel press EXIT.
```

6. If Level 2 Access is active, then the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, then the display will briefly flash a confirmation screen and then display the following:

```
Confirm press ENTER
Cancel press EXIT.
```

   If not, re-enter a valid code.

8. Press the ENT pushbutton. The following sequence of screens will be displayed:

```
Bluetooth Pass Reset
Resetting -WAIT-
```

```
Bluetooth Pass Reset
-DONE-
```

```
Bluetooth Pass Reset
Ready Press ENTER
```

   The Passkey is now set to NONE and Authentication is disabled.

9. To assign a NEW Passkey, press the Up/Down arrow pushbutton, as necessary, until the "Authentication" menu item is displayed.

```
Authentication
disable
```

10. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, then the following will be displayed. Go to Step 13.

```
Authentication
disable                    C
```

11 If Level 2 Access is active, then the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

12. Enter a valid Level 2 Access code, then press the ENT pushbutton.

    If a valid Level 2 Access code was entered, then the display will briefly flash a confirmation screen and then display the following:

```
Authentication
disable                    C
```

    If not, re-enter a valid code.

13. Utilizing the Up/Down arrow pusbuttons select "ENABLE", then press the ENT pushbutton. The following will be displayed:

```
Please Enter Passkey
_
```

14. Utilizing the arrow pushbuttons enter the desired Passkey (up to 16 characters), then press ENT. The following sequence of screens will be displayed:

```
Bluetooth Pass Reset
Resetting -WAIT-
```

```
Bluetooth Pass Reset
-DONE-
```

```
Bluetooth Pass Reset
Ready Press ENTER
```

Resetting Bluetooth Passkey (TapTalk)

The Bluetooth Passkey can be reset if necessary.

To reset the Bluetooth Passkey from TapTalk® proceed as follows:

1. Select **Communication/Setup/ Bluetooth Settings** from the TapTalk toolbar. TapTalk will display the "Bluetooth Information" dialog screen (Figure 4-36).
2. Select "Set Password". TapTalk will display the "Bluetooth Authentication Password" dialog screen (Figure 4-41).

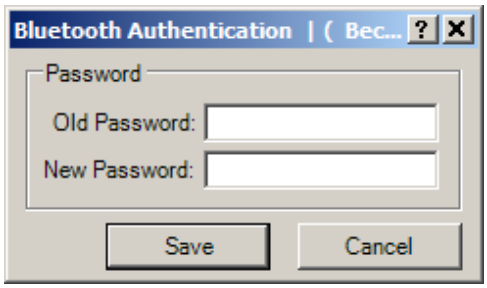


Figure 4-41 Bluetooth Authentication Password Dialog Screen

3. Enter the "Old" Password and then enter the desired "New" Password (up to 16 characters).
4. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 4-2).
5. Select **OK**. TapTalk will display a "New Password written successfully" confirmation screen (Figure 4-42).

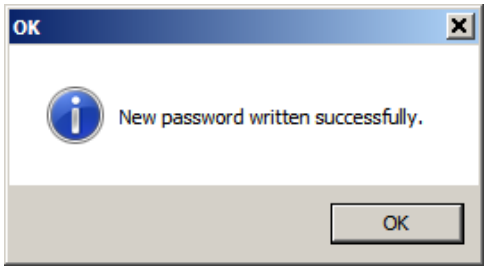


Figure 4-42 New Bluetooth Password Written Successfully Screen

6. Select **OK**. TapTalk will return to the "Bluetooth Information" Dialog screen (Figure 4-36).

SCADA HeartBeat

The purpose of the SCADA HeartBeat feature is to have sets of settings for the control and switch between these settings sets based on the presence or absence of SCADA communications to the control.

In order to determine if the SCADA communications is present a HeartBeat detection algorithm is implemented.

There are four different types of SCADA HeartBeat modes:

- SCADA HeartBeat for transformer control applications (LTC)
- SCADA HeartBeat for regulator control applications (Regulator)
- SCADA HeartBeat for Profile Switching
- Manual HeartBeat Mode

The LTC, Regulator and Profile Switching have to be selected using TapTalk® Communications software or from the HMI, for these modes to be operational. But the Manual HeartBeat Mode does not need to be selected for operation.

SCADA HeartBeat for LTC and Regulator

SCADA HeartBeat, when enabled, provides an additional set of control settings called HeartBeat DNP points (HBBandcenter (Forward), HBBandwidth (Forward), etc), that are only accessible through communications utilizing the DNP protocol. Although LTC and Regulator modes are mutually inclusive (meaning if one of the options is selected, the other selection is also available), the selection is still required due to a difference in the physical input requirement. In LTC mode, the non-sequential input is used as a counter input, and hence an object 10 point "Non-Sequential" is made available to activate non sequential through communication. When SCADA HeartBeat is active, HeartBeat DNP points are used as a second set of settings.

The HeartBeat DNP points (applicable only for forward power settings) include:

- Bandcenter
- Bandwidth
- Time Delay
- LDC R
- LDC X
- Block Lower Voltage
- Block Raise Voltage
- Intertap Time Delay
- Sequential or Non-Sequential
- HeartBeat Timer Period
- Voltage Reduction 1
- Voltage Reduction 2
- Voltage Reduction 3

As the M2001D has 4 different setpoint profiles to choose from, when the SCADA HeartBeat is inactive, the previously selected active profile is used. In order to determine the actively used settings a third group of DNP points called the Active DNP points ("Active Bandcenter (Forward)", "Active Bandwidth (Forward)" etc), can be used. Reading the Active DNP points gives the current used settings, but writing always changes the selected Active Profile.

The SCADA HeartBeat DNP3.0 Protocol sequence for LTC and Regulator are provided in Figure 4-44. Also, Object 40 point "Write HB" is mapped by default to Point 195, "HeartBeat Timer" mapped to 159, "Direct HeartBeat" mapped to 211 and "VRed Turnoff Time" mapped to 212.

SCADA HeartBeat for Profile Switching

In the M-2001D algorithm, the user shall use Object 40 point "ScadaHB Profile Switch" (default Point: 79) to renew the Direct HeartBeat timer (writing to point 79), lower 12 bits of the data will contain the timer reload value in minutes and the most significant 4 bits will have the profile number to be activated when the timer expires. The range for the timer is from 0 to 999 minutes and for the profile is from 0 to 3 (profiles 1 through 4). It is important to know that to terminate the HeartBeat timer at any instant of time and to revert back to the original active profile, a zero value should be entered for the entire 16 bits of the analog point. The SCADA HeartBeat DNP3.0 Protocol sequence for Profile Switching is provided in Figure 4-45.

Additionally an IEC 61850 method of providing a HeartBeat for profile switching is available when the optional IEC 61850 protocol is purchased. The HeartBeat mode for the IEC 61850 algorithm works exactly like profile switching HeartBeat mode in DNP, except that GOOSE subscription is used in case of IEC 61850. The M-2001D subscribes to HeartBeat GOOSE message which has the following attributes:

- VLAN-ID: 0
- VLAN-PRIORITY: 4
- MAC Address: 01-0C-CD-00-00-10
- APPID: 0

Also, the GOOSE dataset contains only one data which is organized as, the most significant 4 bits will have the profile number to be activated and the rest will contain the timer reload value.

Using this method, the IEC 61850 client should repetitively publish a GOOSE message with the above mentioned attributes and data, before the timer reload value expires.

HeartBeat Manual Mode

The purpose of the Manual HeartBeat Mode feature is to provide a method to place the control in Manual operation and automatically place the control back in Auto mode based on a HeartBeat Timer setting (settable only via DNP communication). The HeartBeat Timer setting is Object 40 "Remote Manual Timer".

The Manual HeartBeat Timer is settable from 0 to 999 Minutes. When the timer is set to a non zero value it will place the control in HeartBeat Manual Mode (Auto operation blocked). If the timer expires the control is placed back in auto mode. If the timer is refreshed before it expires, the control stays in HeartBeat Manual mode.

The DNP status point (binary input Object 1) that shows if the control is in the HeartBeat Manual Mode is: "Manual HeartBeat Status". This point will be set to 1 when placed in manual using the Manual HeartBeat Timer only and not by any other means.

The HeartBeat Manual Mode is separate from the original comm block manual mode. They both perform the same function, but use a different method and DNP point to activate auto or Manual mode. When the control is in Comm Blk Manual, the Manual LED will turn on steady as before, but when in the HeartBeat Manual mode it will flash. The HeartBeat manual method can only be activated via the new HeartBeat timer setting point while the old comm blk method can be activated via comms or the toggle/scamp switch as before.

The Comm Blk mode has priority over the HeartBeat Manual mode regardless of how it is enabled (through communication or switch input). When in HeartBeat Manual mode the tap/voltage limit blocks are active just as before with comm blk mode, but in HeartBeat manual the runback due to high Voltage will also be enabled. If the control is in HeartBeat Manual mode and the comm blk manual is also turned on (via comms or switch input), then the HeartBeat timer will continue to count down. If Comm Blk is turned off, then it will go back to HeartBeat Manual mode unless the HeartBeat manual timer has reached 0.

Setting SCADA HeartBeat Option

1. Select **Communication/Setup/ Heartbeat Option** from the TapTalk® toolbar. TapTalk will display the Heartbeat option dialog screen (Figure 4-43).

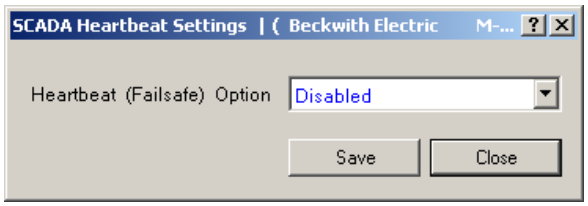


Figure 4-43 SCADA HeartBeat Dialog Screen

2. Select either "Disable," "LTC (DNP)," "Regulator (DNP)," "Profile Switching (DNP)" or "Profile Switching (GOOSE)".
3. Select "Save". TapTalk will momentarily display a "Setpoints Successfully written to control" confirmation screen (Figure 4-13).

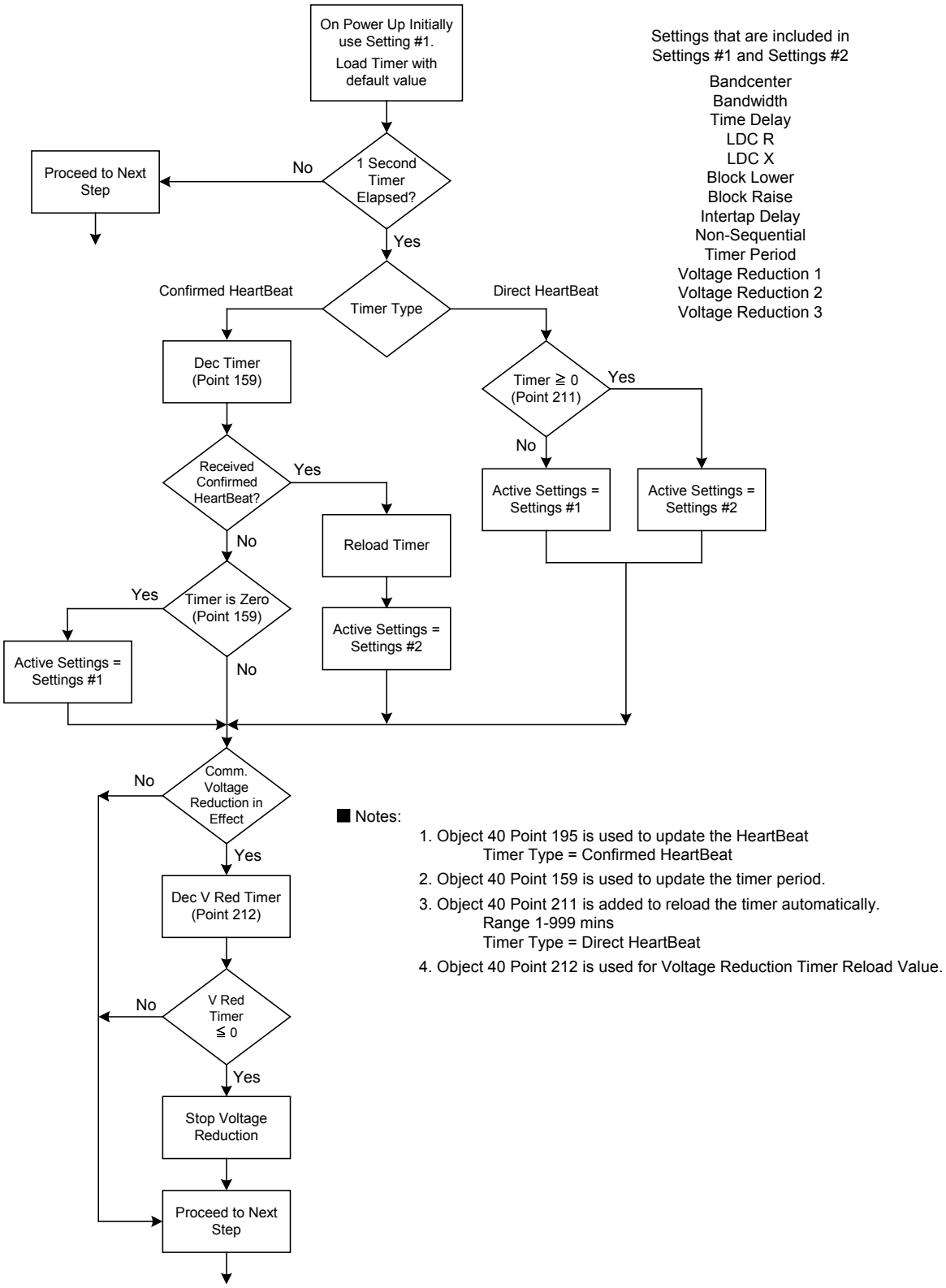


Figure 4-44 SCADA HeartBeat LTC and Regulator DNP 3.0 Protocol Sequence

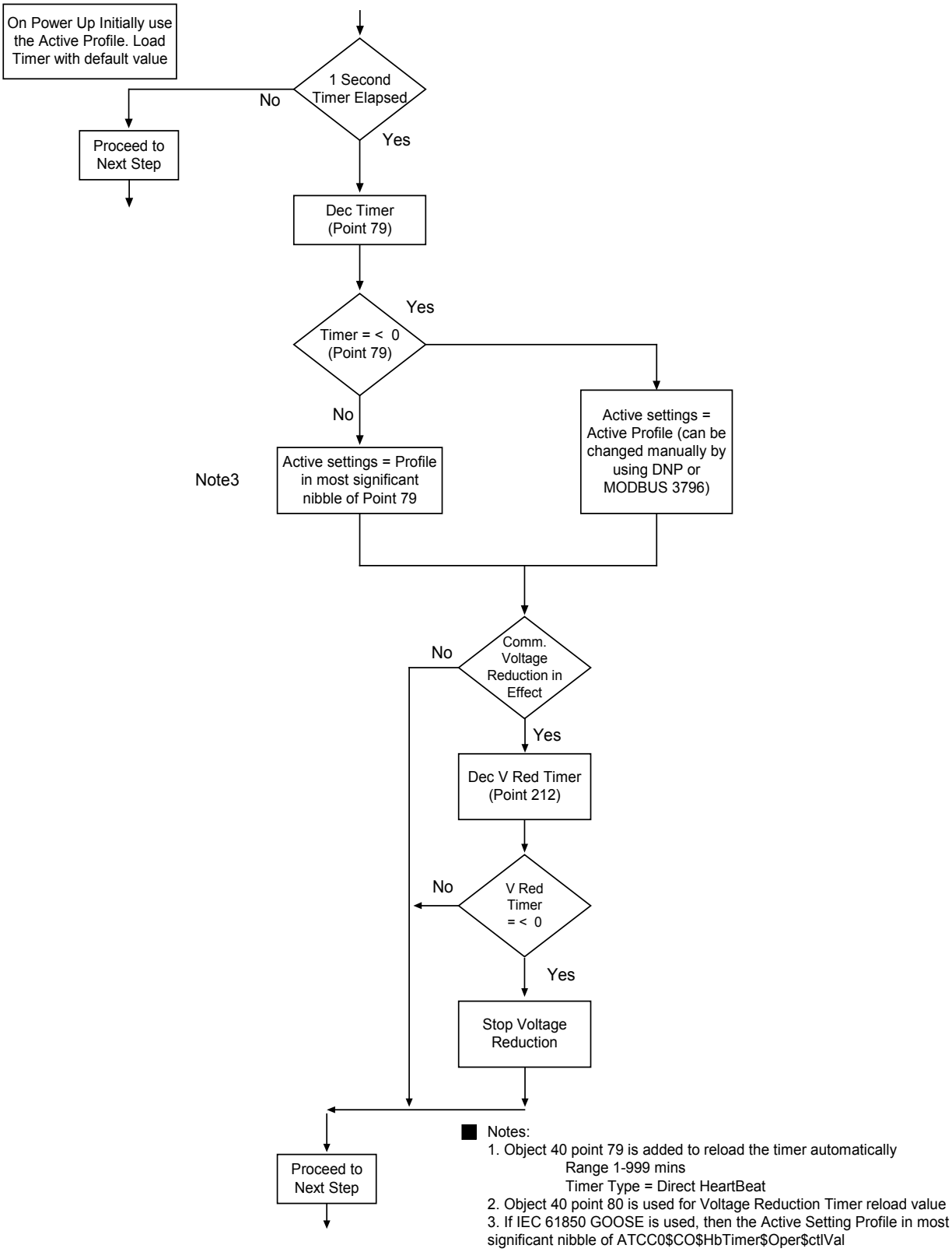


Figure 4-45 Profile Switching

5 Configuration

5.0 Overview and Quick Index

Chapter Five is designed for the person or group responsible for the Configuration of the M-2001D Digital Tapchanger Control.

Chapter 5 provides the definitions of system quantities and equipment characteristics required by the control which include:

- Tapchanger Type
- User Programmable Alarm Relay
- Op Count Signal Alarm
- Counters
- Input Selection 1, 2, and 3
- Auto/Manual Switch Type
- Ratio Multipliers
- Correction Factors
- Metering Factors
- VT/CT Source
- VT/CT Load
- Output Selection
- Motor Current Settings
- Regulator Type
- Remote Voltage Bias
- Run Through Neutral
- Fast Voltage Recovery
- Voltage Reduction
- VAr Bias
- Parallel Operation (ΔVAr®/ Master/Follower)
- Tap Information
- Intertap Time Delay
- Tap Limits
- Data Logging
- Harmonics Setup
- CBEMA Functionality

The selection of the M-2001D Configuration parameters are performed using either the TapTalk® S-2001D Communications Software or the control Front Panel Human Machine Interface (HMI). Instructions for TapTalk and the HMI are provided where applicable.

TapTalk instructions assume that communications have been established with the control.

5.1 Tapchanger Type Selections

The Tapchanger Type Selection feature provides the user with the ability to set vendor specific regulator configuration settings in the control from TapTalk®. These settings can be accessed through the traditional settings screens or from the Tapchanger Type Selections dialog screen (Figure 5-1) located in the Setup dropdown menu. The selectable settings are available for the following vendor regulator models:

- Siemens
- Howard
- General Electric
- Cooper Spring Drive
- Cooper Direct Drive
- Cooper Quick Drive

The Tap Changer Type Selection feature allows the user to easily select the Vendor of the Regulator the control is being installed on and populate the settings specific to that Vendor Regulator type in a single menu. This menu will always display Beckwith recommended settings by default for each vendor when opening it, but the interface allows the user to make changes if desired, and save them to the control or settings file. Once this menu is saved, these settings are written to the control or settings file and can be viewed in their appropriate locations.

Table 5-1 includes the vendor specific settings that are available for each vendor specific regulator.

The Tapchanger "Type" (A or B) and "Regulator Vendor" selection settings can be observed in the HMI in the CONFIGURATION menu "Tapchanger Type" submenu. These settings however, cannot be changed from the HMI.

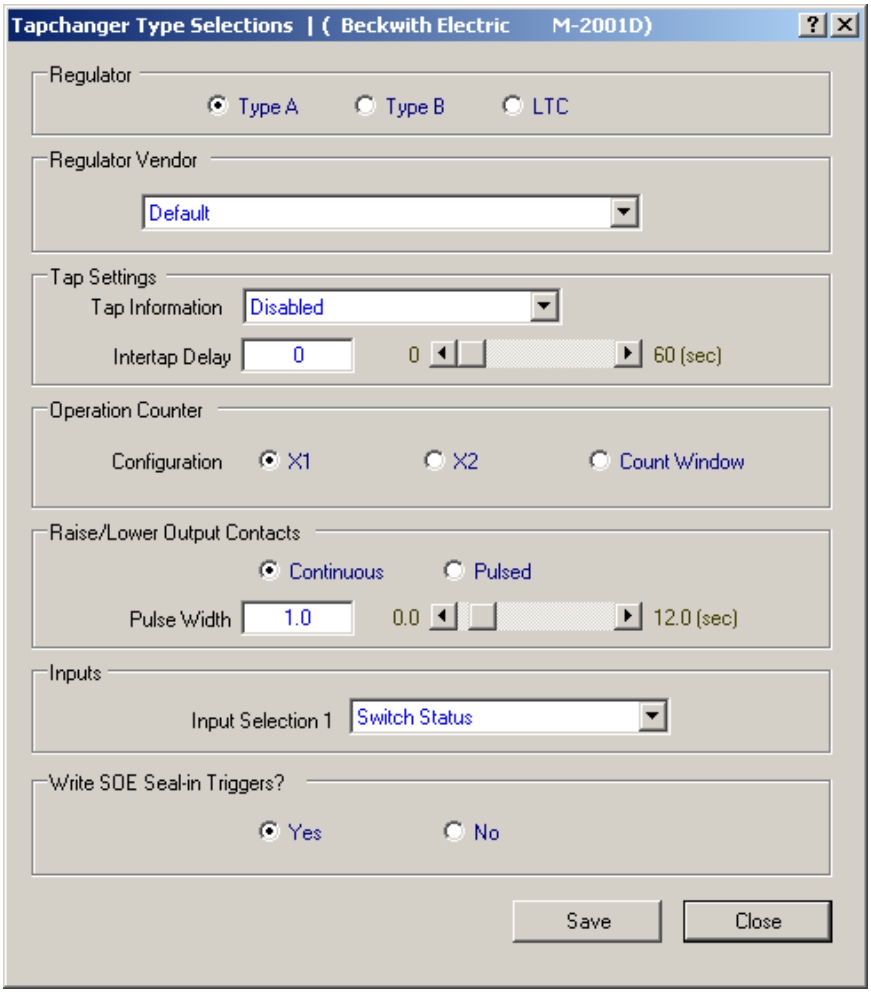


Figure 5-1 Tapchanger Type Selections Dialog Screen

Vendor	Regulator Type	Tap Information	Intertap Delay	Operation Counter Configuration	Raise/Lower Output Contacts Configuration	Raise/Lower Output Contacts Pulse Width	Input Selection 1 Configuration	Write SOE Triggers?
Default	A	Disabled	0	X1	Continuous	1.0 Sec.	Switch Status	N/A
Siemens	A	Regulate Internal (KeepTrack)	1 Sec.	X2	Pulsed	8.0 Sec.	Switch Status	N/A
Howard	A	Regulate Internal (KeepTrack)	1 Sec.	X2	Pulsed	8.0 Sec.	Switch Status	N/A
General Electric	A	Regulate Internal (KeepTrack)	1 Sec.	X1	Pulsed	8.0 Sec.	Switch Status	N/A
Cooper Spring Drive	A	Regulate Internal (KeepTrack)	1 Sec.	X1	Pulsed	3.0 Sec.	Seal-In Input	Yes
Cooper Direct Drive	A	Regulate Internal (KeepTrack)	1 Sec.	X1	Pulsed	0.5 Sec.	Seal-In Input	Yes
Cooper Quick Drive	A	Regulate Internal (KeepTrack)	1 Sec.	X1	Pulsed	0.3 Sec.	Seal-In Input	Yes

Table 5-1 Vendor Specific Regulator Settings

5.2 Configuration

USER PROGRAMMABLE ALARM RELAY

The User Programmable Alarm Relay (Form c) is a non-latching relay that is capable of switching 6 A at 125 Vac or 0.2 A at 125 Vdc and is user-programmable to indicate one or more of the following conditions:

- Block Comm is in effect
- Block-Raise Voltage Limit exceeded
- Block-Lower Voltage Limit exceeded
- Voltage Reduction of any step is invoked
- Reverse Power Flow condition is detected
- Line Current Limit/Limit exceeded
- Tap Block Raise/Lower is in effect
- LDC_LDZ is in effect
- Abnormal Tap position detected
- VAr Bias Lead Limit Exceeded
- VAr Bias Lag Limit Exceeded
- Backup Power Fail (If purchased)
- RTN Fail to Operate
- Individual Tap Wear Limit Exceeded
- Operations Count Limit Exceeded
- Tap Changer Failure

When activated, the LDC/LDZ programmable alarm will initiate when any non-zero setting has been entered as LDC Fwd resistance or reactance, or LDC-Z. It will also alarm when any non-zero setting has been entered as LDC Rev resistance or reactance with the "Rev Power Oper" configuration set to "Regulate in Reverse" and the control in reverse power mode.

The Alarm Relay will de-energize and generate an output without any of the conditions being enabled when power to the unit is lost.

Setting Programmable Alarm Relay Inputs From TapTalk

To set the Programmable Alarm Relay from TapTalk® perform the following:

1. Select **Setup/Alarms** from the TapTalk toolbar. TapTalk will display the Alarms dialog screen (Figure 5-2).

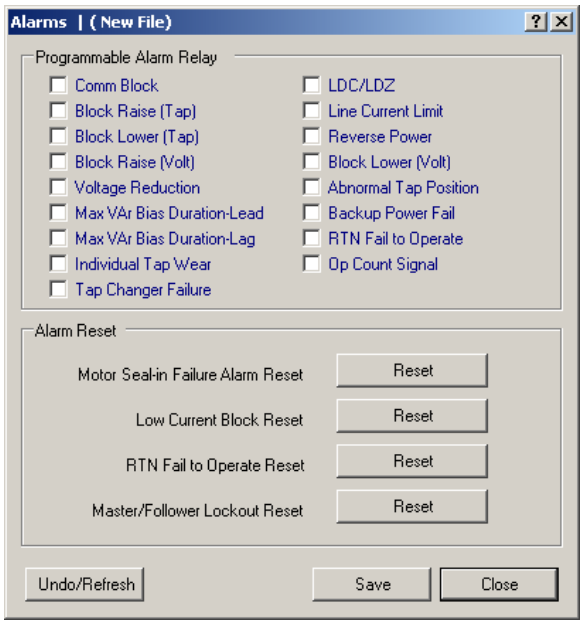


Figure 5-2 Programmable Alarm Relay Setting Dialog Screen

2. Select the desired Programmable Alarm relay inputs.
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).

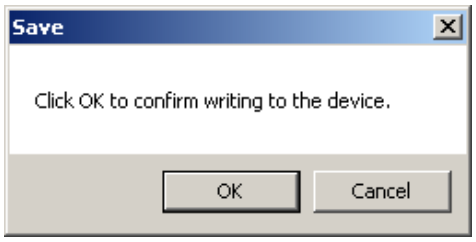


Figure 5-3 Save to Device Confirmation Screen

4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to the Control" confirmation screen (Figure 5-4).

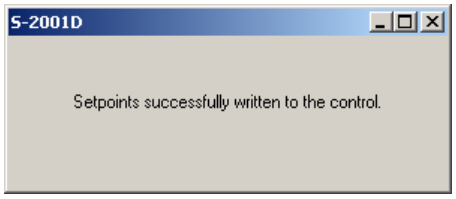


Figure 5-4 Setpoints Successfully Written To The Control Dialog Screen

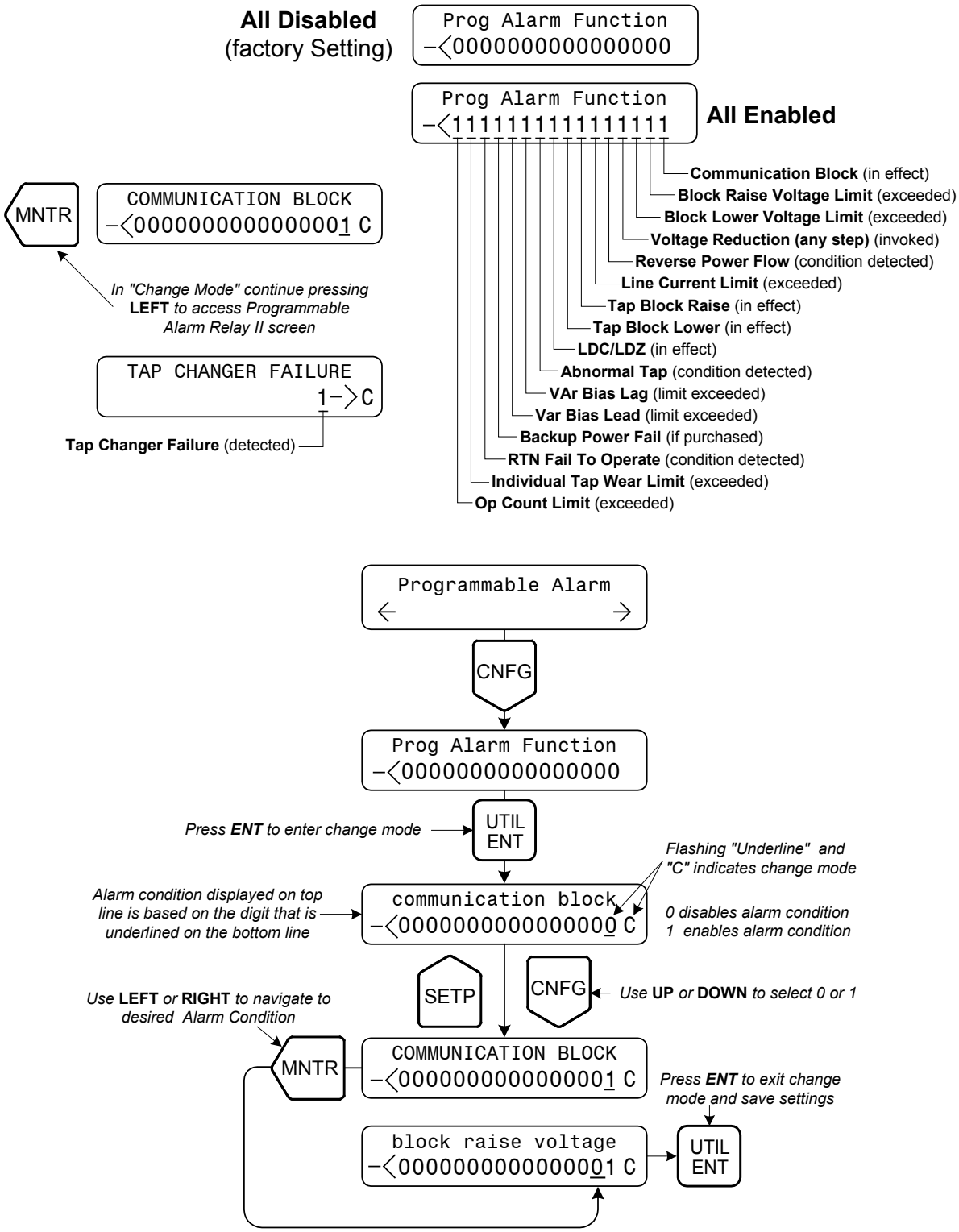


Figure 5-5 Programmable Alarm Function Programming

Programmable Alarm Relay Mode

When the Auto/Man Switch Type is set to "SCAMP", the Programmable Alarm Function can be set to "Normal" or "As a Deadman Output". This option is used since the Deadman Output is not available. The default configuration setting is NORMAL.

Setting Programmable Alarm Relay Mode From The HMI

To set the Programmable Alarm Relay Mode from the HMI, proceed as follows:

■**NOTE**: The "Auto/Man Switch Type Selection" in configuration must be set to "SCAMP" to access this setting.

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Programmable Alarm" menu.

```
        Programmable Alarm
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Programmable Alarm Function" screen is displayed.

```
Prog Alarm Function
NORMAL
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Prog Alarm Function
NORMAL                       C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Prog Alarm Function
NORMAL                       C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, select the desired Programmable Alarm Function Mode (NORMAL or AS DEADMAN OUT), then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Prog Alarm Function
NORMAL or AS DEADMAN OUT
```

Setting Programmable Alarm Relay Mode From TapTalk

■**NOTE**: The "Auto/Man Switch Type Selection" in configuration must be set to "SCAMP" to access this setting.

1. Select **Setup/Configuration** from the TapTalk® toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Programmable Alarm Relay Mode" section of the dialog screen select either "Normal" or "Deadman Out".
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Setting Programmable Alarm Relay Inputs From The HMI

Each alarm condition (Figure 5-5) corresponds to one of the digits on the bottom line of the display: a "0" indicates that the alarm condition is disabled; a "1" indicates that the alarm condition is enabled.

To set the Programmable Alarm, perform the following:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, until "Programmable Alarm" is displayed.

```
      Programmable Alarm
←                        →
```

4. Press the Down arrow, as necessary, until either of the following are displayed depending upon whether the Auto/Manual Switch Type is selected to "SCAMP" or not.

```
Prog Alarm Function
—<0000000000000000
```

OR

```
Prog Alarm Function
NORMAL
```

5. If the unit displays the Programmable Alarm setup screen (zeros and/or ones on Line 2), then go to Step 11.

6. If the unit displays the Programmable Alarm function Relay Mode selection screen ("NORMAL" on Line 2), then press the "ENT" pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
Prog Alarm Function
NORMAL                       C
```

7. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
  _
```

■**NOTE**: When entering the Level 2 Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Prog Alarm Function
NORMAL                       C
```

   If not, re-enter a valid code.

9. Press the "ENT" pushbutton. The following will be displayed.

```
Prog Alarm Function
NORMAL
```

10. Press the "ENT" pushbutton again. The following will be displayed.

```
Prog Alarm Function
—<0000000000000000
```

   Go to Step 11.

11. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 14.

```
communication block
–<0000000000000000          C
```

12. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

 _
```

■**NOTE**: When entering the Level 2 Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

13. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

    If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
communication block
–<0000000000000000          C
```

    If not, re-enter a valid code.

■**NOTE**: See Figure 5-5 for the index of alarm functions.

14. Utilizing the arrow pushbuttons, enter a "1" for those Alarm Functions to be activated and a "0" for those that are to be disabled, then press the ENT pushbutton. The selected alarm will change from "lower case" when disabled (0), to "UPPER CASE" when activated (1). The following will be displayed reflecting the selections that were made.

```
Prog Alarm Function
–<0000000000000000
```

OP COUNT SIGNAL ALARM

The Op Count Signal Alarm feature provides the user with the ability to set a predefined alarm point for the number of tapchanges initiated by the control. When the predefined alarm setting is exceeded, the following alarm message will be displayed on the HMI screen:

```
Op Count Signal Alarm
Rst Op Count  XXX
```

Setting Op Count Signal Alarm From The HMI

To set the Op Count Signal Alarm, perform the following:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                         →
```

3. Press the Right or Left arrow pushbutton, as necessary, until "Programmable Alarm" is displayed.

```
     Programmable Alarm
←                         →
```

4. Press the Down arrow, as necessary, until the following is displayed.

```
Op Count Signal Alrm
  0
```

5. Press the ENT pushbutton. If Level 2 Access is not active, or has been previously input, the following will be displayed. Go to Step 8.

```
Op Count Signal Alrm
  0                       C
```

6. If Level 2 Access is active, then the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Op Count Signal Alrm
  0                          C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons enter the desired alarm value, then press the ENT pushbutton. The following will be displayed reflecting the selections that were made.

```
Op Count Signal Alrm
  X
```

Setting Op Count Signal Alarm From TapTalk

To set the Op Count Signal Alarm from TapTalk® perform the following:

1. Select **Setup/Tap Settings** from the TapTalk toolbar. TapTalk will display the Tap Settings dialog screen (Figure 5-6).
2. From the "Operation Counter" section of the Tap Settings screen select the desired Op Count Signal Alarm setpoint (Alarm Limit).
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to the Control" confirmation screen (Figure 5-4).

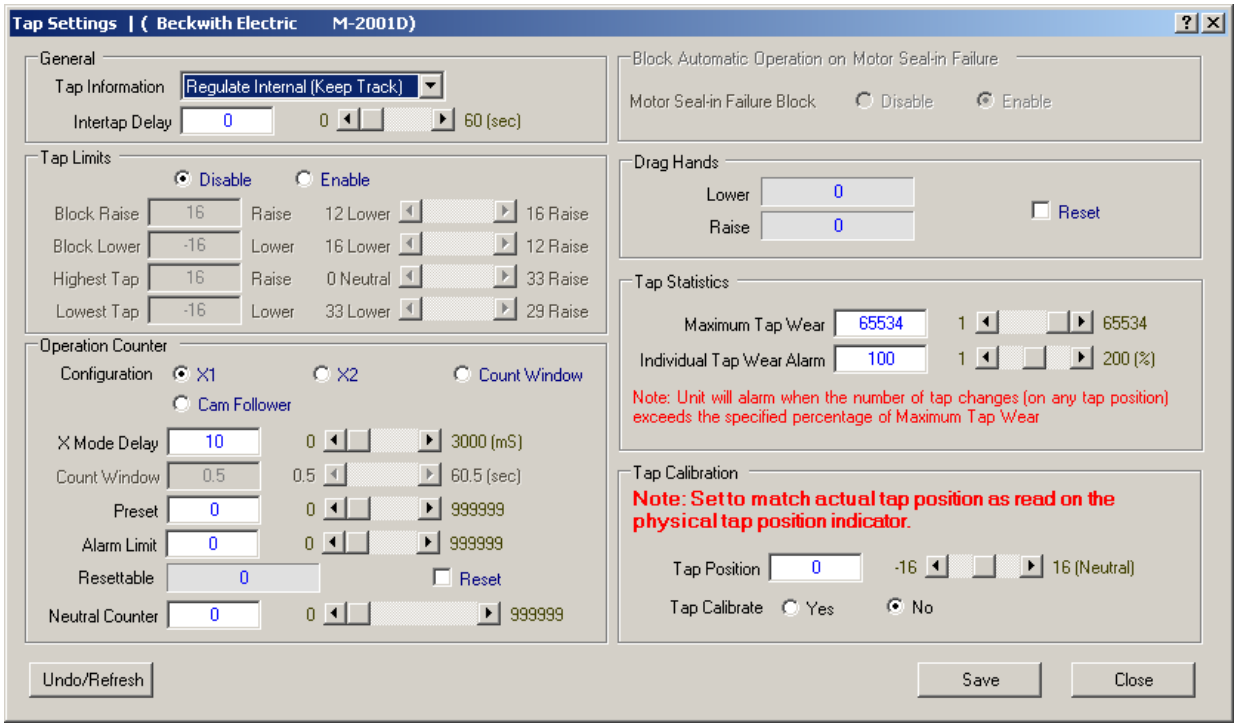


Figure 5-6 Tap Settings Dialog Screen

COUNTERS

Operation Counter

The user must select the method of counting tapchanger operations consistent with the tapchanger.

The Operation Counter accommodates 999,999 operation counts. The number of counts are stored in non-volatile memory and are not affected by a loss of supply power to the control. The total number of operation counts is displayed in the Status Menu. The Operation Counter can be preset to any value up to 999,999.

Cooper Regulators do not provide a counter contact. Therefore, the "Operation Counter Input Configuration" must be set to "Seal-In Input". See "Setting Operation Counter Input Configuration" in this section. The Seal-In Input selection has a fixed 3 second Seal-In Delay.

X1 – Operation count will increment by one with an open-close-open state change on the tapchanger counter switch. The closed state must be present for at least 20 mS. The open state may be present indefinitely.

X Mode Delay (X1) – When the control is using X1 Mode counter contact detection method, the X Mode Delay setting in millisecond is used to define the minimum time duration for the X1 counter contact signal. Any signal duration of less than the X Mode Delay will be considered as an invalid counter contact signal. Depending on the condition of the counter contact switch, the X Mode Delay should be set between 10-20 mS.

For greater noise immunity a debounce window of 160 mS exists after valid count operation.

X2 – Operation count will increment by one with either an open-close or a close-open state change of the tapchanger operation counter switch. Both the closed and open states may exist indefinitely.

X Mode Delay (X2) – When the control is in X2 Mode detection, the X Mode Delay setting is used to delay the detection and processing of the next X2 counter contact signal. This is necessary especially in the case where the neutral signal starts before the next counter contact signal when the voltage regulator is moving to neutral.

Count Window – Operation count will increment by only one count during a set time period of "Count Window". This is true no matter how many counter inputs occur during the count window time. After a counter input is accepted, the count window timer begins and another count won't be accepted until the count window time expires. The count window time can be set from 0.5 to 60.5 seconds.

▲ **CAUTION**: The Count Window setting should not be set to a value greater than the Intertap Delay when in pulsed or continuous mode. Also, it should not be set greater than the Pulse Width setting, if Pulsed mode is used.

Cam Follower – The Cam Follower setting should be selected when a Cam Follower contact input is wired into the Counter contact input of the M-2001D. The operation counter and resettable operation counter will increment when the counter input sees the cam follower open and then close.

▲ **CAUTION:** The Cam Follower contact requires a minimum of 500 milliseconds to open and a minimum of 500 milliseconds to close. For this reason, if configuring the Output Selection to Pulsed Mode, the Pulse Width must be set to longer than the actual time it takes for the Cam Follower switch to complete its operational cycle. If this is not set correctly, tap position could be inaccurate. Beckwith Electric recommends that Output Selection be configured to Continuous unless the LTC mechanism requires Pulsed Mode to operate correctly.

Neutral Switch Counter - The Neutral Switch Counter is updated each time the neutral input is detected. Neutral Switch Counter can also preset to any value. The Neutral Switch Counter is a software counter that is stored in non-volatile memory and has a maximum value of 999,999.

Setting the Operation Counter Configuration From The HMI

■ **NOTE**: This feature is not functional unless Input Selection 1 is set to "Switch Status".

To setup the Operation Counter Configuration, perform the following:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                       →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Tap Settings" menu.

```
          Tap Settings
←                       →
```

4. Press the Down arrow pushbutton, as necessary, until the "Operation Counter Configuration" screen is displayed.

```
Op Counter Config
    1 X
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Op Counter Config
    1 X                 C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Op Counter Config
    1 X                 C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select the desired counter configuration for the application (1 X, 2 X, COUNT WINDOW or CAM FOLLOWER), then press the ENT pushbutton. The following will be displayed reflecting the counter configuration that was entered.

```
Op Counter Config
    1 X                 C
```

9. Depending on the Operation Counter configuration that was selected in Step 8, proceed as follows to complete the Operation Counter configuration:
   - If the "1 X" or "2 X" counter configuration was selected, proceed to the "Setting the Operations Counter X Mode Delay from the HMI" section of this chapter.
   - If the "COUNT WINDOW" counter configuration was selected, proceed to the "Setting the Counter Time Window" section of this chapter.
   - If the "CAM FOLLOWER" counter configuration was selected, the Operation Counter configuration is complete.

Setting Operation Counter X Mode Delay From The HMI

■**NOTE**: This feature is not functional unless Input Selection 1 is set to "Switch Status".

To set the Operation Counter X Mode Delay, perform the following:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                 COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                       →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Tap Settings" menu.

```
          Tap Settings
 ←                          →
```

4. Press the Down arrow pushbutton, as necessary, until the "X Mode Delay" screen is displayed.

```
 X Mode Delay
   10 ms
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 7.

```
 X Mode Delay
   10 ms                    C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
 ENTER LEVEL 2 ACCESS

 _
```

■**NOTE**: When entering the Level 2 Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
 X Mode Delay
   10 ms                    C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons select the desired Counter X Mode Delay value for the application (0 to 3000 ms), then press the ENT pushbutton. The following will be displayed reflecting the X Mode Delay setting that was entered.

```
 X Mode Delay
   XX ms
```

Setting Operation Counter Time Window From The HMI

■**NOTE**: This feature is not functional unless Input Selection 1 is set to "Switch Status".

To set the Operation Counter Time Window, perform the following:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
 ←SETP                      COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
 ←                          →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Tap Settings" menu.

```
          Tap Settings
 ←                          →
```

4. Press the Down arrow pushbutton, as necessary, until the "Counter Time Window" screen is displayed.

```
 Counter Time Window
   0.5 Sec
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
 Counter Time Window
   0.5 Sec                  C
```

6. If Level 2 Access is active, then the Level 2 Access prompt will be displayed.

```
 ENTER LEVEL 2 ACCESS

 _
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Counter Time Window
   0.5 Sec                C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons select the desired "Counter Time Window" value for the application (0.5 to 60.5 Seconds), then press the ENT pushbutton. The following will be displayed reflecting the Counter Time Window setting that was entered.

```
Counter Time Window
   X.X Sec
```

Configuring the Operation Counter From TapTalk

■**NOTE**: This feature is not functional unless Input Selection 1 is set to "Switch Status".

To configure the Operation Counter, perform the following:

1. Select **Setup/Tap Settings** from the TapTalk® toolbar. TapTalk will display the Tap Settings dialog screen (Figure 5-6).
2. Select the desired Operation Counter configuration (X1, X2, Count Window or Cam Follower).
3. If "X1 or X2" configuration was selected in Step 2, enter the desired "X Mode Delay" setting (0 to 3000 mS).
4. If "Count Window" configuration was selected in Step 2, enter the desired "Count Window" setting (0.5 to 60.5 seconds).
5. Select **Save**. TapTalk will display a "Save to Device" confirmation screen (Figure 5-3).
6. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Setting Input Selection 1 Operation Counter Input Configuration to Switch Status From The HMI

To set the Input Selection 1 Operation Counter Input Configuration from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left Arrow pushbutton, as necessary, until "Input Selection" is displayed.

```
      Input Selection
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Input Selection 1" screen is displayed.

```
Input Selection 1
SWITCH STATUS
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Input Selection 1
SWITCH STATUS              C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Input Selection 1
SWITCH STATUS                C
```

   If not, re-enter a valid code.

▲ **CAUTION**: Input Selection 1 is required to be set to "Switch Status" if "Contact KeepTrack™ 1R1L" or "Contact KeepTrack 1N" is selected for Tap Information. The unit will display the following error message if applicable:

```
Tap Info conflict
Any Key to Continue
```

8. Utilizing the Up/Down arrow pushbuttons, select "SWITCH STATUS" then press the ENT pushbutton. The following will be displayed reflecting the mode that was selected.

```
Input Selection 1
SWITCH STATUS
```

   The applicable counter type must be selected in Tap Settings.

Setting Input Selection 1 Operation Counter Input Configuration to Switch Status From TapTalk

To set the Input Selection 1 Operation Counter Input Configuration from TapTalk®, proceed as follows:

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).

▲ **CAUTION**: Input Selection 1 is required to be set to "Switch Status" if "Contact KeepTrack 1R1L" or "Contact KeepTrack 1N" is selected for Tap Information. TapTalk will display the following Error Screen if applicable (Figure 5-7):

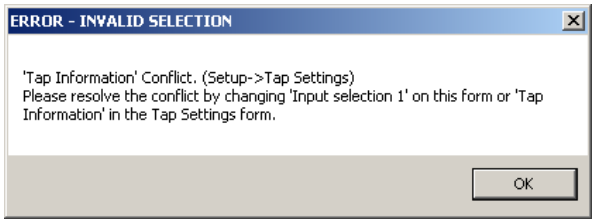


Figure 5-7 Tap Information/Input Selection Conflict Error Screen

2. From the "Inputs and Switch" section of the dialog screen set Input Selection 1 to "Switch Status".
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Configuration | (Beckwith Electric M-2001D)

Primary
Voltage Multiplier 60.0 0.1 3260.0 (X)
Voltage Source Multiplier 60.0 0.1 3260.0 (X)
Current Multiplier 6000 1 32600 (X)
Primary Power Display Single Phase Three Phase

VT/CT Load
Normalizing Volt. Multiplier 1.00 0.80 1.20 (X)
VT Correction 0.0 -15.0 15.0 (V)
CT/VT Phasing 0 degree
Aux Current Transformer 200 mA
VT Configuration Line to Line Line to Ground

VT/CT Source
VT Source Correction 0.0 -15.0 15.0 (V)
CT/VT Source Phasing 0 degree

Raise/Lower Output Contacts
Continuous Pulsed
Pulse Width 1.5 0.2 12.0 (sec)

Motor Current Settings
Peak Rms Current 110 110 200 (%)
Average Rms Current 110 110 200 (%)
Average Duration 110 110 200 (%)

Program Alarm Relay Mode
Normal Deadman Out

Inputs and Switch
Input Selection 1 Switch Status
Input Selection 2 Non-sequential
Input Selection 3 VR2
Auto/Man Switch Type None

Regulator
Type A Type B

Paralleling
Paralleling Type Disable

Remote Voltage Bias
Disable Enable
RVB Scale Factor 1.0 0.1 100.0
RVB Heart Beat Timer 5 2 120 (sec)
Reverse RVB Scale Factor 1.0 0.1 100.0

Run Through Neutral
Disable Enable Counter Reset
Maximum Allowed Taps 4 3 7
Tap Operations Between Runs 1000 10 10000
Maximum Load Current 50 1 100 (mA)
Maximum RTN Standby Operations 20 1 10000

Low Current Block
Disable Enable

Save Comm Block at Power Off
Don't Save Save

Fast Voltage Recovery
Disable Enable
Fast Voltage Recovery 5.0 1.0 15.0 (V)

Voltage Reduction (VR)
Standard VR Disable Enable
Smart VR Disable Enable
Smart VR LDC Disable Enable
Smart VR LDC Settings
R 0 -72 72 (V)
X 0 -72 72 (V)
Z 0 0 72 (V)
Com VR Turnoff Timer 0 0 999 (Min)
Save VR at Power Off Don't Save Save

VAr Bias
Disable Enable
Max 3 Phase Cap Bank Size 12000 4 12000 (kvar)
Lead % Bank Size Pickup 75 10 100 (%)
Lag % Bank Size Pickup 75 10 100 (%)
VAr Bias Voltage Step 1.0 0.1 2.0 (V)
Max VAr Bias Duration 300 10 1440 (min)

Undo/Refresh Save Close

Figure 5-8 Configuration Dialog Screen

Motor Seal-in Failure Block

The Motor Seal-in Failure Block feature addresses the following scenarios that can occur on Cooper regulators which can result in incorrect tap position, a failure of the regulator to regulate voltage, or both conditions simultaneously.

- Failing or open motor capacitor (Stalled Tapchanger). If the motor capacitor degrades over time, it will result in a motor that does not always have enough torque to operate correctly. Eventually, it will degrade enough to prevent any operation of the motor. The result of this scenario is a regulator that intermittently and eventually permanently fails to regulate voltage and cannot track tap position accurately.

  — The Motor Seal-in Failure Block feature will block the regulator from operating and actuate an alarm to alert the user to this malfunction. If the motor capacitor is not open but degraded, then input voltage affects the motor's ability to operate. For this reason, instead of blocking the regulator operation permanently, it will only block in the direction it was moving when the Motor Seal-in Failure Block feature was triggered.

- Low motor voltage (Stalled Tapchanger), for example a brown out condition, could result in a motor temporarily not having enough torque to operate correctly. The result of this scenario is a regulator that intermittently fails to regulate voltage and cannot track tap position accurately.

  — In this scenario, the motor also does not have enough torque to execute a tapchange. The Motor Seal-in Failure Block feature will operate the same as it does for a failing or open motor capacitor except that once voltage is restored, the control will operate normally. The alarm will alert the user to the low voltage condition and its effect on the regulator.

- The Motor Seal-in Switch in the Cooper regulator may malfunction in either one direction or both. The result of this condition is a regulator that cannot track tap position accurately.

  — In this scenario, the motor is capable of turning, but tap position will be inaccurate as the circuit's proper operation is the only method of tracking tap position accurately. Since it is possible for the Motor Seal-in switch to fail in only one direction, the blocking function of the Motor Seal-in Failure feature is designed to be unidirectional such that it will allow the regulator to operate in the opposite direction that caused the block to occur.

  — The Motor Seal-in Failure Block feature actuates an alarm to alert the user to the problem. The operation block would not be needed in this scenario as loss of accurate KeepTrack™ is the only negative consequence of the malfunction. Since the unit cannot detect the difference between this failure and the Stalled Tapchanger scenario, the block must be in effect. The block function of this feature can be disabled by the user if it is desired to continue operating the regulator with this failure until it can be repaired. The alarm however, will remain in effect as long as the failure conditions exist.

- Reaching a Physical Tap Limit as set in the regulator. When the tap limit is reached, motor power is physically disconnected from the raise or lower motor windings in the direction of the tap limit and operation in that direction cannot occur.

  — This scenario removes motor power from the raise or lower motor winding when the associated physical tap limit is reached. There is no negative consequence of this occurring when the Motor Seal-in Failure Block feature is disabled. With the Motor Seal-in Failure Block feature enabled however, the control cannot detect the difference between Reaching a Physical Tap Limit and a Motor Seal-in Switch failure, so it must block and alarm.

— The unidirectional nature of the block is designed for this scenario as well as a Motor Seal-in Switch failure to allow operation of the regulator in the opposite direction when needed. Alarming in this condition can provide the user with information that there may be a settings error or an upstream Fixed Tap Transformer may be tapped incorrectly as a regulator should not normally need to issue a raise or lower command when at its physical limit.

When Motor Seal-in is selected in the control the Motor Seal-in Failure Block feature and the input to the Abnormal Tap Position alarm are enabled by default. The user may choose to disable the Motor Seal-in Block feature. However, the input to the Abnormal Tap Position alarm is always enabled when Motor Seal-in is selected. The feature includes the following:

Abnormal Tap Position Alarm Input – The Motor Seal-in Failure Block feature provides an input to the "Abnormal Tap Position" alarm. This input is actuated on the first occurrence of a tapchange coincident with no motor seal-in current detected for 15 seconds.

Motor Seal-in Failure Alarm – The Motor Seal-in Failure Alarm is actuated on the second occurrence (either direction) of a tapchange coincident with no motor seal-in current detected for 15 seconds. This alarm can be reset by the user from the Human Machine Interface (HMI), from the TapTalk® "Alarms" dialog screen or via SCADA. The alarm is also reset when a successful tapchange operation occurs (motor seal-in current detected) in either direction.

Motor Seal-in Failure Block – The Motor Seal-in Failure Block is actuated on the second occurrence of a tapchange coincident with no motor seal-in current detected for 15 seconds in either direction. The block will be in effect in the direction that produced the second Motor Seal-in Failure occurrence. If a Motor Seal-in Failure is detected in the opposite direction, then operation will be blocked in that direction also.

This Block can be reset by the user from the HMI, from the TapTalk "Alarms" dialog screen or via SCADA. The block is also reset when a successful tapchange operation occurs (motor seal-in current is detected) in the opposite direction.

The internal accumulator that counts the occurrences of failed tapchanges is stored in volatile memory and is set to zero when a loss of power occurs and the unit is not equipped with a backup power supply. This is considered normal operation of the feature.

Setting Input Selection 1 Operation Counter Input Configuration Motor Seal-In From The HMI

▲ **CAUTION**: If Tap Information is selected to either "Contact KeepTrack™ 1R1L" or "Contact KeepTrack 1N" the control will not accept an Input Selection 1 setting of "Seal-In Input". The unit will display the following error message if applicable:

```
Tap Info conflict
Any Key to Continue
```

To Enable/Disable Motor Seal-In from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right/Left arrow pushbutton as necessary to navigate the "Input Selection" screen.

```
        Input Selection
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Input Selection 1" screen is displayed.

```
Input Selection 1
SWITCH STATUS
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Input Selection 1
SWITCH STATUS              C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■ **NOTE**: When entering the Level 2 Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Input Selection 1
SWITCH STATUS              C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select "SEAL-IN INPUT", then press the ENT pushbutton. The following will be displayed reflecting the mode that was selected.

```
Input Selection 1
SEAL-IN INPUT
```

■ **NOTE**: Motor Seal-in Delay is fixed at 3 seconds.

Setting Input Selection 1 Operation Counter Input Configuration Motor Seal-In From TapTalk

▲ **CAUTION**: If Tap Information is selected to either "Contact KeepTrack 1R1L" or "Contact KeepTrack 1N" the control will not accept an Input Selection 1 setting of "Seal-In Input".TapTalk will display the Tap Information/Input Selection Error Screen if applicable (Figure 5-7):

To Enable/Disable Motor Seal-In from TapTalk®, proceed as follows:

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Inputs and Switch/Input Selection 1" section of the dialog screen select "Seal-in Input".
3. Select **Save**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Setting Motor Seal-in Failure Alarm/Block From The HMI

To set the Motor Seal-in Failure Alarm, perform the following:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Tap Settings" menu.

```
        Tap Settings
←                        →
```

4. Press the Down arrow, as necessary, until the following will be displayed.

```
Seal-In Fail Block
disable
```

5. Press the ENT pushbutton. If Level 2 Access is not active, or has been previously input, the following will be displayed. Go to Step 8.

```
Seal-In Fail Block
disable                  C
```

6. If Level 2 Access is active, then the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Seal-In Fail Block
disable                  C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons select enable, then press the ENT pushbutton. The following will be displayed reflecting the selections that were made.

```
Seal-In Fail Block
ENABLE
```

Setting Motor Seal-in Failure Alarm/Block From TapTalk

To set the Motor Seal-in Failure Alarm from TapTalk® perform the following:

1. Select **Setup/Tap Settings** from the TapTalk toolbar. TapTalk will display the Tap Settings dialog screen (Figure 5-6).
2. From the "Block Automatic Operation on Motor Seal-in Failure" section of the Tap settings screen select Motor Seal-in Failure "Enable" or "Disable".
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Input Selection 2 (Non-Sequential or SCADA Cutout)

The Input Selection 2 can be configured to be either an input that initiates Non-Sequential control operation or a SCADA Cutout switch input. The default configuration setting is Non-Sequential.

Setting Input Selection 2 (Non-Sequential or SCADA Cutout) From The HMI

To set the Input Selection 2 (Non-Sequential or SCADA Cutout) from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
       Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Input Selection" menu.

```
       Input Selection
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Input Selection 2" screen is displayed.

```
Input Selection 2
NONSEQ INPUT
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Input Selection 2
NONSEQ INPUT                C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Input Selection 2
NONSEQ INPUT                C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, select the desired Input Selection 2 (Non-Sequential or SCADA Cutout), then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Input Selection 2
NONSEQ INPUT or SCADA CUTOUT
```

Setting Input Selection 2 From TapTalk

1. Select **Setup/Configuration** from the TapTalk® toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Inputs and Switch/Input Selection 2" section of the dialog screen select either "Non-sequential" or "SCADA Cutout".
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Input Selection 3 (VR2 or Aux)

The Input Selection 3 can be configured as the Voltage Reduction 2 input or as an auxiliary input that can be read as a DNP or MODBUS® point. The default configuration setting is Voltage Reduction 2.

Setting Input Selection 3 (VR2/Aux) From The HMI

To set Input Selection 3 (VR2/Aux) from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Input Selection" menu.

```
      Input Selection
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Input Selection 3" screen is displayed.

```
Input Selection 3
VOLTAGE RED 2
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Input Selection 3
VOLTAGE RED 2              C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Input Selection 3
VOLTAGE RED 2              C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, select the desired Input Selection (VR2/Aux), then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Input Selection 3
VOLTAGE RED 2 or AUX INPUT
```

Setting Input Selection 3 From TapTalk

1. Select **Setup/Configuration** from the TapTalk® toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Inputs and Switch/Input Selection 3" section of the dialog screen select either "VR2" or "Aux" for Input Selection 3.
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

AUTO/MANUAL SWITCH TYPE

The Auto/Manual Switch Type setting allows the Auto/Man Switch type on the adapter panel to be set to "Toggle, SCAMP or None". None is used when no Auto/Manual Switch exists. The default configuration setting is None. See **Chapter 4**, "Comm Block Auto at Power Off" and "SCAMP Initialize on Power Up" for additional settings associated with Auto/Manual Switch Type.

■ **NOTE**: When the Auto/Manual Switch Type configuration is set to "SCAMP", then the Programmable Alarm Function can be set to function as "Normal" or "As a Deadman Output". This option is available when SCAMP mode is used since the Deadman Output is not available.

Setting Auto/Man Switch Type From The HMI

To set the Auto/Man Switch Type from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
            Nameplate
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Auto/Man Sw Type" screen is displayed.

```
Auto/Man Sw Type
NONE
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Auto/Man Sw Type
NONE                      C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■ **NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Auto/Man Sw Type
NONE                      C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, select the desired Auto/Manual Switch Type (None, Toggle or SCAMP), then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Auto/Man Sw Type
NONE, TOGGLE or SCAMP
```

Setting Auto/Manual Switch Type From TapTalk

1. Select **Setup/Configuration** from the TapTalk® toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Inputs and Switch/Auto/Man Switch Type" section of the dialog screen select either "None, Toggle or SCAMP".
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Resettable Operation Counter

The resettable operation counter operates with the method selected by X1, X2, Count Window or Cam Follower. This counter can be reset to zero.

To reset this counter to zero from the HMI, perform the following:

1. Press the Left Arrow (MNTR Hot Button) pushbutton to awaken the unit. The menu will advance to "MONITOR".

```
              MONITOR
←UTIL                          SETP→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
            Metering
←                                  →
```

3. Press the Right or Left arrow pushbutton, as necessary to advance to the "Tap Information" screen.

```
        Tap Information
←                                  →
```

4. Press the Down arrow pushbutton, as necessary, to navigate to the "Resettable Counter" menu.

```
Resettable Counter              E
0
```

5. Press **ENT**, a flashing "R" will be displayed. Press **ENT** again to reset the Operations Counter.

Resetting the Resettable Operation Counter From TapTalk

To reset the Operation Counter from TapTalk®, perform the following:

1. Select **Setup/Tap Settings** from the TapTalk toolbar. TapTalk will display the Tap Settings dialog screen (Figure 5-6).
2. Select the "Reset" check box located next to the "Resettable" counter located in the Operation Counter section of the dialog screen.
3. Select **Save**. TapTalk will display a "Save to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Presettable Operation Counters (Operation, Neutral, Lower and Raise)

The Operation, Neutral, Lower and Raise Counters operate with the selected count method (X1, X2, Count Window or Cam Follower). It provides the user with the ability to preset a value up to 999,999. The counters will increment from the preset value based on the selected count method.

Presetting the Operation Counter is described. The steps to preset the Neutral Counter, Lower and Raise Counters are similar.

To preset the Operation Counter from the HMI proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                          COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                                  →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Tap Settings" menu.

```
          Tap Settings
←                                  →
```

4. Press the Down arrow pushbutton, as necessary, until the "Op Counter Preset" screen is displayed.

```
Op Counter Preset
000000
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Op Counter Preset
000000                    C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Op Counter Preset
000000                    C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons enter the desired Operations Counter Preset value from 0 to 999,999, then press the ENT pushbutton. The following will be displayed reflecting the Operations Counter value that was entered.

```
Op Counter Preset
XXXXXX
```

Presetting the Operation Counter From TapTalk

To Preset the Operation Counter from TapTalk®, perform the following:

1. Select **Setup/Tap Settings** from the TapTalk toolbar. TapTalk will display the Tap Settings dialog screen (Figure 5-6).
2. Enter the Operation Counter Preset value located in the Operation Counter section of the dialog screen.
3. Select **Save**. TapTalk will display a "Save to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Presetting the Neutral Counter From TapTalk

To Preset the Neutral Counter from TapTalk, perform the following:

1. Select **Setup/Tap Settings** from the TapTalk toolbar. TapTalk will display the Tap Settings dialog screen (Figure 5-6).
2. Enter the Neutral Counter Preset value located in the Neutral Counter section of the dialog screen.
3. Select **Save**. TapTalk will display a "Save to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

RATIO MULTIPLIERS

Voltage and Current Multipliers

■**NOTE:** The voltage and current multipliers do not affect the regulation of the control. They are only used in the calculation of primary values.

▲ **CAUTION**: The use of a voltage correction factor is incorporated in the calculation of primary quantities in the control. Although the control operation is not affected, erroneous values will be displayed and recorded if the VT correction factor is not included in the PT multiplier.

Primary quantities are displayed when voltage and current multipliers are set in the control. The voltage multiplier is:

$$V_{mult} = V_{pri}/(V_{sec} + V_{corr})$$

For a VT ratio of 7620/117 V and a voltage correction of 3 V, the multiplier is:

$V_{mult} = 7620/(117 + 3) = 63.5$

The voltage multiplier setting range is from 0.1 to 3260.0 in 0.1 steps.

The current multiplier is the value of the line CT primary rating divided by 0.2 A. For a CT primary rating of 1000 A, the multiplier is:

$CT_{mult} = 1000/0.2 = 5000$

The current multiplier setting range is from 1 to 32600 in 1 step increments.

Normalizing Voltage Multiplier

A Normalizing Voltage Multiplier with a range of 0.80 to 1.20 is available to be applied to Meter Out Voltage and displayed in real time as Normalizing Voltage. The purpose of the Normalizing Voltage Multiplier is to allow the user to overcome differences in the ratio of the PT that the Meter Out Voltage input is using versus the PT the end user or other metering methods are using.

Setting The Voltage and Current Multipliers From The HMI

▲ **CAUTION**: The current input to the control is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

■**NOTE:** The CT Multiplier selection in the Configuration/CT and VT menu only changes the scaling factor for current reading and setting.

To set the Voltage and Current Multipliers from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                          COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                              →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
            Nameplate
←                              →
```

■**NOTE:** The following sequence of steps provide direction for setting the Current Multiplier. The steps necessary to set the Load Voltage, Source Voltage and Normalizing Voltage multipliers are similar.

4. Press the Down arrow pushbutton, as necessary, until the "Current Multiplier" screen is displayed.

```
CT Multiplier
   6000  X
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
CT Multiplier
   6000  X                    C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
CT Multiplier
   6000  X                    C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons enter the desired Current Multiplier value from 1 to 32600, then press the ENT pushbutton. The following will be displayed reflecting the Current Multiplier value that was entered.

```
CT Multiplier
   XXXXX  X
```

Setting The Voltage and Current Multipliers From TapTalk

To set the Current, Voltage, Voltage Source and Normalizing Voltage Multipliers from TapTalk®, proceed as follows:

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. Enter the Current, Voltage, Voltage Source and Normalizing Voltage Multipliers.
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Primary Power Display Selection

The Primary Power Display Selection toggles between two modes of operation:

- Single-Phase-based on measured inputs
- Three-Phase-based on measured inputs and presumed balanced system

Factory setting is single-phase.

Setting Primary Power Display Selection From The HMI

To set the Primary Power Display Selection from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
            Nameplate
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Power Display Option" screen is displayed.

```
Power Display Option
SINGLE_PHASE
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Power Display Option
SINGLE_PHASE                C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Power Display Option
SINGLE_PHASE                C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, select the desired Power Display Option (Single or 3 Phase), then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Power Display Option
SINGLE_PHASE or THREE_PHASE
```

Setting Primary Power Display Selection From TapTalk

1. Select **Setup/Configuration** from the TapTalk® toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Primary Power Display" section of the dialog screen select either "Single Phase" or "Three Phase".
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

CORRECTION FACTORS

VT Ratio Correction

The operation of some regulators is such that the internal VT does not provide the desired voltage ratio. In these cases, it is desirable to correct the VT secondary voltage to a 120 Vac reference base. This change is easily made in software, eliminating the need for a multi-tap sensing transformer.

The correction is derived from information provided by the regulator original equipment manufacturer (OEM). The numerical value of the correction is the value, in volts, required to adjust the VT nominal secondary voltage to 120.0 volts. The correction range is ±15 volts in 0.1 volt increments.

■**NOTE**: The maximum allowable continuous VT secondary voltage is 140 volts. The correction is made only in software. As a result, the value of V_{Load} read on the control display will differ from that measured at the voltmeter test terminals by the percent of the correction voltage.

Setting Load VT Correction Factor from the HMI

To set the Load VT Correction Factor from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
            Nameplate
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Load VT Correction" screen is displayed.

```
Load VT Correction
   0.0 Volts
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Load VT Correction
   0.0 Volts            C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Load VT Correction
   0.0 Volts                C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, enter the desired Load VT Correction value from -15.0 to +15.0 Volts, then press the ENT pushbutton. The following will be displayed reflecting the Load VT Correction value that was entered.

```
Load VT Correction
   X.X Volts
```

Setting Source VT Correction Factor from the HMI

To set the Source VT Correction Factor from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
           Nameplate
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Source VT Correction" screen is displayed.

```
Source VT Correction
   0.0 Volts
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Source VT Correction
   0.0 Volts              C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Source VT Correction
   0.0 Volts              C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, enter the desired Source VT Correction value from -15.0 to +15.0 Volts, then press the ENT pushbutton. The following will be displayed reflecting the Source VT Correction value that was entered.

```
Source VT Correction
   X.X Volts
```

Setting Load and/or Source VT Correction Factors From TapTalk

To set either the Load or Source VT Correction Factors from TapTalk®, perform the following:

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. Enter the Load and/or Source VT Correction Factor value(s) (–15.0 to +15.0 Volts).
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

CT/VT Phase Shift

The control will recognize forward and reverse power flow to the load. With the CT and VT (reference) signals in-phase for unity power flow to the load, it will properly calculate line drop compensation.

Depending on the connection of the CT and VT, the phasors may not be in-phase. If this is the case, the phase shift can be corrected in software. The usual characteristics of three phase systems only allow multiples of 30° phase shifts. The control, therefore, has a range of 0° to 330° in 30° increments.

By comparing system operating conditions with power flow direction and power factor as shown on the M-2001D Tapchanger Control, improper phase shift can be determined. An incorrect connection may be resolved using well-known phasor methods. The following procedure may be useful to check the choice of correction or even to determine the correction by trial and error:

1. Place the regulator in manual control.
2. Determine the Watts and VArs load on the regulator from other metering.
3. Read the Watts and VArs indicated by the control, and make certain that they are of the same sign and ratio of magnitudes as obtained from the external readings.
4. If not, change the correction in 30° increments until the control and external readings are in best agreement.

When two single-phase regulators are connected in open delta, the current signals will be out-of-phase with the voltage signals. For one regulator, the current will lead the voltage by 30° and is called the "leading" regulator. For the "lagging" regulator, the current will lag the voltage by 30°.

Contact Beckwith Electric for **Application Note #17** for more information on VT and CT connections.

■**NOTE:** Source Side parameters are used when operation mode is regulate reverse (measured) and the system is in reverse power.

Setting CT/Load and/or CT/Source Phase Shift Quantities From The HMI

To set the CT/Load and/or CT/Source Phase Shift quantities from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
           Nameplate
←                        →
```

■**NOTE:** The following sequence of steps provide direction for setting the CT/Load VT Phasing quantities. The steps necessary to set the CT/Source VT Phasing are similar.

4. Press the Down arrow pushbutton, as necessary, until the "CT/Load VT Phasing" screen is displayed.

```
CT/Load VT Phasing
0 Deg
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
CT/Load VT Phasing
0 Deg                      C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a "Confirmation" screen and display the following:

```
CT/Load VT Phasing
0 Deg                    C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, enter the desired CT/Load VT Phasing value from 0 to 330 Degrees (30 Degree increments), then press the ENT pushbutton. The following will be displayed reflecting the CT/Load VT Phasing value that was entered.

```
CT/Load VT Phasing
X Deg
```

Setting CT/Load and/or CT/Source Phase Shift Quantities From TapTalk

To set the CT/Load and/or CT/Source Phase Shift quantities from TapTalk®, proceed as follows:

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. Enter the CT/Load or CT/Source Phase Shift Quantities (0 to 330 Degrees, in 30 Degree Increments).
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Auxiliary Current Transformer

The current input rating of the M-2001D Tapchanger Control is 200 mA, continuous. Auxiliary CT's are necessary if primary currents exceed this value.

The Current Transformer scaling selection is set in the Configure menu to be 200 mA, 1 A or 5 A. This choice fixes the scale of both the metering readout quantities and the settings of current values.

The metering screens showing this information, **Load Current** and **Circulating Current** will be updated accordingly

▲ **CAUTION**: This selection is for scaling purposes only, and neither 1 A nor 5 A should be input to the control.

The values of the current displayed in the control Load Current, and on Circulating Current screens can be displayed in either 200 mA, 1 A or 5 A scale.

▲ **CAUTION**: The current input to the control is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

The Line Limit Current setpoint screen is also affected by this selection.

Setting Auxiliary Current Transformer Rating From The HMI

To set the Auxiliary Current Transformer Rating from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
          Nameplate
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Aux Current Transformer" screen is displayed.

```
Aux Curr Transformer
200 mA
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Aux Curr Transformer
200 mA                    C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■ **NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Aux Curr Transformer
200 mA                    C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, enter the desired Aux Current Transformer rating (200 mA, 1 Amp or 5 Amps), then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Aux Curr Transformer
200 mA, 1 Amp or 5 Amps
```

Setting Auxiliary Current Transformer Rating From TapTalk

1. Select **Setup/Configuration** from the TapTalk® toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "VT/CT Load/Aux Current Transformer" section of the dialog screen select either "200 mA, 1 Amp or 5 Amps".
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

METERING FACTORS

The control has the capability of displaying measured and calculated secondary quantities and calculated primary quantities. Refer to Figures 2-32 and 2-33.

Secondary

The display will show local voltage, source voltage, compensated voltage, line frequency, and load current in secondary quantities along with load power factor. The voltage is displayed on a 120 V base and the current is displayed on a 200 mA base.

■ **NOTE:** The local voltage displayed will not match the voltage measured at the test terminals on the adapter panel if a sensing VT ratio correction other than 0.0 V has been entered.

Primary

In order to use the calculated primary quantities feature, the user must enter the following data in the Configuration Menu:

- Select line-to-line or line-to-ground VT configuration.
- Select single-phase quantities based on measured inputs, or three-phase quantities based on measured inputs and assume a balanced system.
- Select primary voltage and current multipliers needed to calculate primary quantities.

Present Demand

The Present Demand metering capability provided in the control follows the concept of a lagged demand meter. The demand time interval is selected by the user as 5, 10, 15, 30 or 60 minutes. This is the time it takes for a thermal meter to indicate 90% of a change in load.

Energy Metering

The Energy Metering function of the control displays the following measured values:

- Total Lagging VAr Hours (KVArh, MVArh or GVArh)
- Total Leading VAr Hours (KVArh, MVArh or GVArh)
- Total Reverse Watt Hours (KWh, MWh or GWh)
- Total Forward Watt Hours (KWh, MWh or GWh)

The measured values are retained in non-volatile memory. A real time clock is utilized to record a date/time stamp for each quantity to indicate when the period of measurement was initiated.

When a Energy Metering screen is selected, the screen cycles continuously to indicate the total value, date and time the measurement was initiated. The **E** indicates that the measured value can be reset by pushing **ENT**.

Demand History

Demand History quantities are the maximum and minimum values for the period since the last reset command. These are retained in non-volatile memory. A real-time clock allows the recording of a date/time stamp with each Demand History quantity. The following are available for drag hand use:

- Min/Max tap position (when Tap Position is enabled)
- Min Load voltage (120 V base)
- Max Load voltage (120 V base)
- Max Primary current
- Max Primary watts, kW or MW
- Max Primary VAr, kVAr or MVAr
- Max Primary VA, kVA or MVA
- Power Factor at max VA

Where primary quantities are used, values displayed are single-phase or three-phase as defined in the Primary Power Display Screen of the Configuration Menu.

▲ **CAUTION:** When the M-2001D Tapchanger Control is used with a Beckwith Electric adapter panel, the panel's drag hands reset button only resets the mechanical drag hands of the regulator or LTC transformer. The button does **not** reset the tap drag hands information stored in the control. The maximum and minimum tap position of the control should always be reset when the mechanical drag hands are reset.

The values retained in memory are time-tagged quantities that are calculated using the demand period selected (5, 10, 15, 30 or 60 minutes). For voltage, values are the average of samples taken over a period of 32 seconds which avoids undue retention of momentary voltage transients. The load power factor retained is the value at the time of max VA.

When selected, two screens for each parameter cycle continuously and indicate the value, date and time of each parameter. The **E** indicates that the drag hand can be reset by pushing **ENT**.

The control is equipped with a real-time, 24-hour clock which is used with the drag hand feature to record date/time stamp information on quantities saved in memory. The power source for the clock is maintained for at least 24 hours during a system power outage by a charged capacitor (no battery). If the power outage lasts longer than 24 hours, check the clock and reset if necessary.

Frequency

The control provides for real-time metering of the line frequency. If the control is a 60 Hz model, the operating frequency is 55 to 65 Hz; if the control is a 50 Hz model, the operating frequency is 45 to 55 Hz.

Load VT Configuration

Load VT Configuration toggles between Line-to-Line and Line-to-Ground.

Setting Load VT Configuration From The HMI

To set the Load VT Configuration (Line-to-Line or Line-to-Ground) from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
            Nameplate
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Load VT Configuration" screen is displayed.

```
Load VT Config
LINE_TO_GROUND
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Load VT Config
LINE_TO_GROUND              C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Load VT Config
LINE_TO_GROUND              C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, select the desired Load VT Configuration (Line-to-Line or Line-to-Ground), then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Load VT Config
LINE_TO_LINE or LINE_TO_GROUND
```

Setting Load VT Configuration From TapTalk

1. Select **Setup/Configuration** from the TapTalk® toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "VT/CT Load" section of the dialog screen select either "Line-to-Line" or "Line-to-Ground".
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Output Selection

Output Pulse

▲ **CAUTION**: If an appropriate pulse width setting is not entered, then a misoperation of the tapchanger may occur when a SCADA Manual Raise or Lower is initiated.

When the output selection is "Pulsed", the pulse width can be programmed from 0.2 to 12 seconds, in increments of 0.1 seconds. An initiated pulse will continue until the pulse time has been reached or a counter contact or motor hold input operates.

Under normal conditions, when the output is set to "Pulsed" and the control is calling for Raise/Lower, an output will turn on for the pre-programmed time, or until a counter contact or motor hold input operates, and then turn off the output for a time period of 0.5 seconds plus the intertap time delay setting value. When the control is calling for a Raise/Lower and no non-sequential or counter input or motor hold input is applied, the output will activate for the full pre-programmed time and deactivate for 0.5 seconds, plus the intertap time delay.

When a counter input or motor hold input is applied, and there is an intertap delay, the pulse will cease immediately with counter contact closure for the intertap time delay. After the counter contact or motor hold input opens, the intertap timer will start at the end of the time delay. If there is still a Raise/Lower condition, another pulse will start.

When the non-sequential input is applied, the Raise/Lower timers will reset with the contact closure, and a timer count will start again, if a Raise/Lower condition is still present, the pulse will start once more.

SCADA INITIATED Manual Raise/Lower

When the control is placed in Manual via SCADA, to perform a Manual Raise/Lower, the control will switch to the "Pulsed" output mode until the control is returned to "Auto". This will allow only a single Raise/Lower operation to take place each time a SCADA Raise/Lower command is sent. When the control is returned to "Auto," the control will revert back to the output selection setting. Therefore, an appropriate "Pulsed" output time setting should be set if SCADA initiated Manual Raise/Lower operations are performed.

Continuous

The output is continuous until the voltage returns into the bandwidth.

Setting Output Configuration From The HMI

To set Output Selection from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                        COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                            →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
            Nameplate
←                            →
```

4. Press the Down arrow pushbutton, as necessary, until the "Output Selection" screen is displayed.

```
Output Selection
CONTINUOUS
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Output Selection
CONTINUOUS                    C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Output Selection
CONTINUOUS                    C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select the desired Output configuration (CONTINUOUS or PULSED), then press the ENT pushbutton. The following will be displayed reflecting the Output configuration that was entered.

```
Output Selection
CONTINUOUS or PULSED
```

9. Depending on the Output configuration that was selected in Step 8, proceed as follows to complete the Output configuration:
   - If a "PULSED" Output configuration was selected, proceed to Step 10.
   - If the "CONTINUOUS" Output configuration was selected, the Output configuration is complete.

10. Press the Down arrow pushbutton, as necessary, until the "Output Pulse" screen is displayed.

```
Output Pulse
   1.5 Sec
```

11. Press the ENT pushbutton. The following will be displayed:

```
Output Pulse
   1.5 Sec                    C
```

12. Utilizing the arrow pushbuttons, enter the desired "Output Pulse" (0.2 to 12.0 Sec) duration, then press the ENT pushbutton. The following will be displayed reflecting the Output Pulse value that was entered.

```
Output Pulse
   X.X Sec
```

Setting Output Configuration From TapTalk

To set the Output Configuration from TapTalk®, proceed as follows:

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Raise/Lower Output Contacts" section of the dialog screen select either "Continuous" or "Pulsed", then proceed as follows:
   - If "Continuous" was selected, go to Step 3.
   - If "Pulsed " was selected, enter a "Pulse Width" value (0.2 to 12.0 seconds)
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Motor Current Detection and Monitoring

The M-2001D includes a tapchanger Motor Current Measurement and Recording feature. The M-2001D tapchanger control measures the motor current during tapchange operations. The motor current is sampled at 64 samples per cycle and the total RMS value of the current is computed every cycle (60 Hz or 50 Hz cycle). The dynamic range of the current measurement is from 0 to 10 A.

The tapchange start signal is generated when the control begins a Raise or Lower operation. The tapchange operation is considered complete when the counter contact input is generated. If the tapchanger is making multiple tapchanges where the current is not interrupted between tapchanges then the counter contact can be used to decide the completion of one tap before the start of the next tap.

The Motor Current Monitor feature also includes a Training Mode which will be used during the commissioning of the tapchanger control. In this mode several tapchange operations will be manually conducted and the profile stored. This profile will be compared with the profile during normal tapchange operation to generate alarm signals.

Based on the type of regulator, the counter contact signal will be different:

- **GE:** Counter pulse is used to indicate the completion of the tapchange
- **SIEMENS and Howard:** State change of the counter contact is used to detect the tapchange (X 2 setting)
- **Cooper:** Motor seal-in current is used to detect the tapchange operation. See "Counters" section of this chapter for instructions for Enabling/Disabling "Motor Seal-In".

The following parameters are logged for the motor current profile and are stored in battery backed-up RAM for each tapchange:

- Peak RMS Current

$$\sqrt{\frac{1}{i}\sum_{i=1}^{Totalprofiles} PeakRMSCurrent_i^2}$$

- Average RMS Current

$$\sqrt{\frac{1}{i}\sum_{i=1}^{Totalprofiles} AverageRMSCurrent_i^2}$$

- Average Duration

$$\frac{1}{i}\sum_{i=1}^{Totalprofiles} Duration_i$$

Where i is the training profile number and $Totalprofiles$ is the total number of training profiles (fixed to 20 training operations).

An alarm will be generated when any of the following conditions occur:

- Peak RMS current exceeds a defined percent (programmable from 110% to 200%) of the stored Peak RMS Current which was recorded during the Training Mode.
- Average RMS Current exceeds a certain percent (programmable from 110% to 200%) of the stored Average RMS Current which was recorded during the Training Mode.

  The Average RMS Current is the average of the RMS current for the tapchange duration.
- The Average Duration of the tapchange exceeds a certain percent (programmable from 110% to 200%) of the stored value which was recorded during the Training Mode.

Setting the Motor Current Detection Settings From The HMI

To set the Peak RMS Current Percent Change, Average RMS Percent Change or Average Duration Percent Change setting, perform the following:

■**NOTE**: The steps necessary to set the Peak RMS Current Percent Change setting are described here. The steps to set the Average RMS Percent Change and Average Duration Percent Change are similar.

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Mtr Current Profile" menu.

```
     Mtr Current Profile
←                        →
```

4. Press the Down arrow pushbutton, as necessary, to navigate to the "Peak RMS % Change" (Average RMS Current % Change or Average Duration % Change) settings dialog screen.

```
Peak RMS % Change
110
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Peak RMS % Change
110                      C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Peak RMS % Change
110                      C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons enter the desired Peak RMS Current % Change value (110% to 200%), then press the ENT pushbutton. The following will be displayed reflecting the Peak RMS Current % Change value that was entered.

```
Peak RMS % Change
XXX
```

9. Repeat Steps 4 through 8 for the Average RMS Current % Change and Average Duration % Change settings.

Setting the Motor Current Detection Settings From TapTalk

To set the Peak RMS Current Percent Change, Average RMS Percent Change or Average Duration Percent Change Setting, perform the following:

1. Select **Setup/Configuration** from the TapTalk® toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Motor Current Settings" section of the dialog screen enter the desired Peak RMS Current, Average RMS Current and Average Duration settings (110% to 200%).
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Regulator Type

Regulator Type A or B can be selected. This will allow the source voltage to be calculated correctly for either type of regulator (see Figure 5-9). It will also allow the control to operate more accurately when in the "regulate in reverse power" mode.

General Electric VR-1 voltage regulators are available in two winding configurations; Type "A" non-inverted configuration and type "B" inverted configuration. These types refer to the internal power component connections. See Figure 5-9.

The Type "A" non-inverted configuration regulator includes a wire jumper on the NN terminal block for Potential Transformer tap selection.

On the older regulator controls (those not having power disconnect and CT shorting knife switches), the PT tap selection jumper is usually connected between terminals NN-9 and NN-20, NN-21 or NN-22. On newer regulator controls, (those with power disconnect and CT shorting knife switches), the PT tap selection jumper is usually connected between terminals NN-8 and NN-20, NN-21 or NN-22. There are special cases when a PT ratio correcting transformer is supplied and the jumper position is different. **In all cases please consult the regulator tank nameplate for the proper jumper connections.**

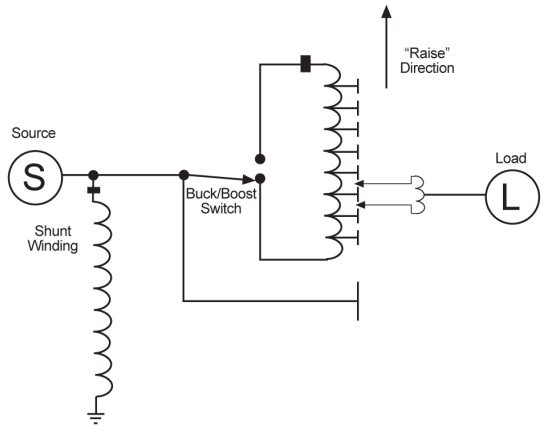
The Type "B" inverted configuration regulator is supplied from the factory with a standard 0.75 ohm resistor installed on the NN terminal block in addition to the PT tap selection jumper. This series resistor limits short circuit currents in the event of an external fault.

On the older regulator controls (those not having a power disconnect and CT shorting knife switches), the resistor is usually connected between terminals NN-9 and NN-22. The PT tap selection jumper is usually connected between terminals NN-22 and NN-20 or NN-21. On newer regulator controls, (those with power disconnect and CT shorting knife switches) the resistor is usually connected between terminals NN-8 and NN-22. The PT tap selection jumper is usually connected between terminals NN-22 and NN-20 or NN-21. **In all cases, please consult the regulator tank nameplate for the proper jumper connections.**

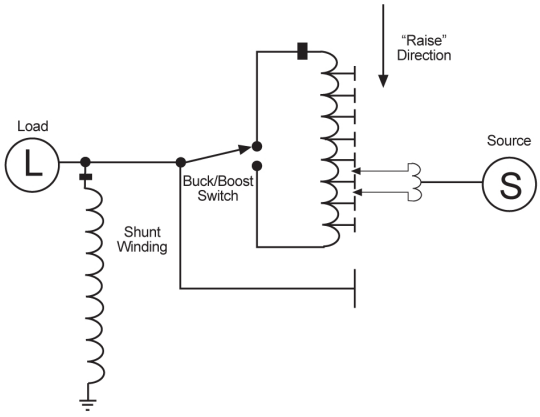
▲ **CAUTION:** The control can be damaged if the PT tap selection jumper is not connected properly when the regulator is energized.

The control is not powered if either the PT tap selection jumper or resistor is missing or open.

The user should always verify proper connections by **consulting the nameplate on the regulator tank.** The user is cautioned that the nameplate on the control cabinet could possibly be incorrect if the control has ever been replaced. If the serial number on the control cabinet matches the serial number on the regulator tank or nameplate, the control cabinet nameplate may be consulted for proper jumper configuration.



Schematic Diagram;
Single-Phase, Type A Step-voltage
Regulator



Schematic Diagram;
Single-Phase, Type B Step-voltage
Regulator

Figure 5-9 Regulator Type

Setting Regulator Type From The HMI

To set Regulator Type from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
           Nameplate
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Regulator Type" screen is displayed.

```
Regulator Type
TYPE A
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Regulator Type
TYPE A                     C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Regulator Type
TYPE A                     C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select the desired Regulator Type (Type A or Type B), then press the ENT pushbutton. The following will be displayed reflecting the Regulator Type that was selected.

```
Regulator Type
TYPE X
```

Setting Regulator Type From TapTalk

To set the Regulator Type from TapTalk®, proceed as follows:

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Regulator "section of the dialog screen select either "Type A" or "Type B".
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

REMOTE VOLTAGE BIAS

The Remote Voltage Bias (RVB) feature is similar to Load Drop Compensation (LDC) that biases the Bandcenter of the control using the difference between a remotely monitored voltage and the control's Load voltage. This method allows the control to operate using the existing timing as well as allow it to respond to the blocking limits and runback functions.

The M-2001D will regulate the measured voltage according to a calculated Effective Bandcenter. The Effective Bandcenter will ONLY be calculated when a Remote measurement is supplied to the control. The Effective Bandcenter calculation is based on the following equations:

Equation #1

$$BC_{bias} = V_{remote} - BC$$

Equation #2

$$EffBC_i = (V_{measured} - BC_{bias})$$

where:

Effective Bandcenter is EffBC

Bandcenter Bias is BC_{bias}

Measured Secondary Voltage is $V_{measured}$

Remote Voltage is V_{remote}

Bandcenter setting is BC

The currently effective high band $(Veff_{hi})_i$ will be at $EffBC_i$ + BW/2 and the currently effective low band $(Veff_{lo})_i$ will be at $EffBC_i$ – BW/2, where BW is the regular bandwidth setting.

Example:

If BC = 120 V, BW = 2 V and the system is in band $V_{measured}$ = 120 V.

Initially before the first V_{remote} is received, $EffBC_i$ = BC = 120 V.

Then, if V_{remote} = 117 V, BC_{bias} = (117–120) = –3, EffBCi = 120 – (–3) = 120 + 3 = 123 V

Since $V_{measured}$ is 120 V, the control will perform approximately 3 tap operations in the RAISE direction to bring the $V_{measured}$ back in band.

The Remote Voltage Bias feature requires a remote voltage parameter to be written to the control within a period defined by a Remote Voltage Heartbeat timer. If the timer times out without the Remote Voltage being written to the control, then the control reverts back to the normal chosen regulating method using the Bandcenter and LDC settings.

A Forward and a Reverse Remote Voltage parameter can be written to the control utilizing DNP3.0, MODBUS or IEC 61850 protocols. The range is determined by the "Remote Voltage Maximum" and "Remote Voltage Minimum" values. Each value has a range from 90.00 to 150.00 volts. Any value received by the control above or below these settings will be discarded and the Remote Voltage Heartbeat Timer will not be refreshed. Upon receiving a valid Forward/Reverse Remote Voltage value, the control will start or restart an internal heartbeat timer with the value set by the "Remote Voltage Heartbeat Timer" setting. Upon timeout, the control removes the Bandcenter bias and controls solely by the Bandcenter and LDC settings.

The Forward parameter will be used as V_{remote} in Forward Power mode only. This point's associated internal timer will only be used in Forward Power mode. Similarly, the Reverse parameter will be used as V_{remote} in Reverse Power mode only. This point's associated internal timer will only be used in Reverse Power mode.

The RVB scale factor is the scale factor by which the raw remote voltage value obtained through the DNP3.0, MODBUS or IEC 61850 analog output point is scaled by before being used in the Remote Voltage Bias feature.

If Voltage Reduction is initiated while RVB mode is enabled and active, it will be calculated based on the regular Bandcenter setting, not the Effective Bandcenter.

If Reverse Power is sensed and the control is set to "Regulate Reverse" or "Regulate Reverse (Measured)", the control will use the "Reverse Remote Voltage" parameter in the Effective Bandcenter calculation. It will also apply BC_{bias} to the Reverse Power Bandcenter setting.

The equation for BC_{bias} when in reverse:

$$BC_{bias} = V_{remote} - BC_{reverse}.$$

Enabling/Disabling Remote Voltage Bias From the HMI

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, until the "Remote Voltage Bias" screen is displayed.

```
     Remote Voltage Bias
←                        →
```

4. Press the Down Arrow pushbutton once. The unit will display the following:

```
Enable/Disable
disable
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Enable/Disable
disable                  C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Enable/Disable
disable                  C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select either "Enable" or Disable", then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Enable/Disable
ENABLE
```

9. Depending on the selection in Step 8, proceed as follows to complete the Remote Voltage Bias setup:
   - If Remote Voltage Bias was "ENABLED", proceed to Step 10.
   - If Remote Voltage Bias was "DISABLED", no further action is required.

■**NOTE**: From this point on in this procedure it is assumed that a valid Level 2 Access Code has been previously entered. If not, a valid Level 2 Access Code will be required to be entered as described in Step 7.

10. Press the Down arrow pushbutton, as necessary, until the "RVB HB Timer" screen is displayed.

```
RVB HB Timer
5 Secs
```

11. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed.

```
RVB HB Timer
5 Secs                   C
```

12. Utilizing the arrow pushbuttons, enter the desired Remote Voltage Bias Heartbeat Timer (2 to 120 Seconds), then press the ENT pushbutton. The following will be displayed reflecting the Remote Voltage Bias Heartbeat Timer value that was entered.

```
RVB HB Timer
XXX Secs
```

13. Press the Down arrow once, the "RVB Scale Factor" screen is displayed.

```
RVB Scale Factor
1.0
```

14. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed.

```
RVB Scale Factor
1.0                          C
```

15. Utilizing the arrow pushbuttons, enter the desired Forward Remote Voltage Bias Scale Factor (0.1 to 100.0), then press the ENT pushbutton. The following will be displayed reflecting the Forward Remote Voltage Bias Scale Factor setting that was selected.

```
RVB Scale Factor
1.0
```

13. Press the Down arrow once, the "Rev RVB Scale Factor" screen is displayed.

```
Rev RVB Scale Factor
1.0
```

14. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed.

```
Rev RVB Scale Factor
1.0                          C
```

15. Utilizing the arrow pushbuttons, enter the desired Reverse Remote Voltage Bias Scale Factor (0.1 to 100.0), then press the ENT pushbutton. The following will be displayed reflecting the Reverse Remote Voltage Bias Scale Factor setting that was selected.

```
Rev RVB Scale Factor
1.0
```

Enabling/Disabling and Remote Voltage Bias From TapTalk

To Enable or Disable the Remote Voltage Bias feature from TapTalk®, proceed as follows:

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the Configuration dialog screen (Figure 5-7).
2. Select "Enable" or "Disable" from the Remote Voltage Bias section of the dialog screen.
3. Depending on the selection in Step 2, proceed as follows to complete the Remote Voltage Bias setup:
   - If Remote Voltage Bias was "ENABLED", proceed to Step 4.
   - If Remote Voltage Bias was "DISABLED", no further action is required.
4. Enter the following Remote Voltage Bias settings:
   - Forward RVB Scale Factor (0.1 to 100.0)
   - RVB Heartbeat Timer (2 to 120 Sec)
   - Reverse RVB Scale Factor (0.1 to 100.0)
5. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
6. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

RUN THROUGH NEUTRAL

The Run Through Neutral feature allows the reversing switch of a regulator to be exercised periodically to prevent contact buildup and coking. The Run Through Neutral feature considers regulator operating parameters to periodically run the regulator through neutral. The frequency is primarily based on the Tap Operations Between Runs setting value. However, in addition to the Tap Operations Between Runs setting, the following regulator operating parameters are also considered and must all be within prescribed limits before the feature will be activated.

- The regulator must be within 2-6 taps of neutral (Actual value based on a Maximum Allowed taps setting). The Run Through Neutral feature will require the control to take one tap in the same direction it was moving once a Neutral input is received to accomplish the swipe of the reversing switch.
- Measured load current is below the user set Maximum Load Current setting.
- The feature will not operate the regulator if its operation would cause the control to exceed any voltage or tap limits. (If tap limits are enabled.)
- The feature will not operate if any of the Motor Current settings are exceeded.

The control also considers the following conditions during operation of the Run Through Neutral feature:

- If detected tap position is determined to be incorrect during the feature's operation, the control will attempt to find neutral within an allowed number of operations, and trigger an Abnormal Tap Position alarm if it is unsuccessful.
- If the control initiates the feature and does not receive a neutral input by the time it reaches the Maximum Allowed Taps setting, it will initiate operations in the opposite direction not to exceed the original starting position, plus the Maximum Allowed Taps setting.

For example, if the Maximum Allowed Taps setting is 4, and Tap Position starts at 3R, the control will move 4 taps towards what it thinks is neutral, and if the Neutral input is not energized, then 7 taps in the opposite direction. It will not take the eighth tap as that is reserved for exercising the reversing switch by passing through neutral).

If Neutral indication is not sensed during this process, the Abnormal Tap Position alarm will be activated and will not reset until the tap position has been re-calibrated.

If Neutral is "found" during this process, but the feature cannot complete the reversing switch swipe successfully due to the Maximum Allowed Taps setting, then the Run Through Neutral feature will standby until the conditions that are necessary to run are met and it can complete.

After the feature has completed successfully, the control will return to regulation and take any taps necessary to satisfy its settings requirements.

▲**CAUTION:** Manipulating the Tap position via communications or HMI while Run Through Neutral is active and in the process of running through neutral will result in the feature not properly executing and could trigger an Abnormal Tap Position Alarm depending on the changes made and where tap position was when it was changed by a user.

Enabling/Disabling and Setting Run Through Neutral From The HMI

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, until the "Run Through Neutral" screen is displayed.

```
      Run Through Neutral
←                        →
```

4. Press the Down Arrow pushbutton once. The unit will display the following:

```
Enable/Disable
disable
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Enable/Disable
disable                    C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS
_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Enable/Disable
disable                    C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select either "Enable" or Disable", then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Enable/Disable
ENABLE
```

9. Depending on the selection in Step 8, proceed as follows to complete the Run Through Neutral setup:
   - If Run Through Neutral was "ENABLED", proceed to Step 10.
   - If Run Through Neutral was "DISABLED", no further action is required.

■**NOTE**: From this point on in this procedure it is assumed that a valid Level 2 Access Code has been previously entered. If not, a valid Level 2 Access Code will be required to be entered as described in Step 7.

10. Press the Down arrow pushbutton, as necessary, until the "Reset RTN Success Counter" screen is displayed.

```
Reset RTN Succ Ctr
Press ENT to begin
```

11. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed.

```
Confirm press ENTER
Cancel press EXIT
```

12. Press the ENT pushbutton. The following will briefly be displayed confirming the reset of the counter and then return to the "Reset RTN Succ Ctr" screen.

```
RTN Succ Ctr Reset
```

13. Press the Down arrow pushbutton, as necessary, until the "Max Allowed Taps" screen is displayed.

```
Max Allowed Taps
4
```

14. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed.

```
Max Allowed Taps
4                          C
```

15. Utilizing the arrow pushbuttons, enter the desired Max Allowed Taps (3 to 7), then press the ENT pushbutton. The following will be displayed reflecting the Max Allowed Taps value that was entered.

```
Max Allowed Taps
X
```

16. Press the Down arrow once, the "Taps Between Runs" screen is displayed.

```
Taps Between Runs
1000
```

17. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed.

```
Taps Between Runs
1000                    C
```

18. Utilizing the arrow pushbuttons, enter the desired Tap Operations Between Runs (10 to 10000), then press the ENT pushbutton. The following will be displayed reflecting the Tap Operations Between Runs setting that was selected.

```
Taps Between Runs
XXXXXX
```

19. Press the Down arrow once, the "Max Load Current" screen is displayed.

```
Max Load Current
50 mA
```

20. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed.

```
Max Load Current
50 mA                   C
```

21. Utilizing the arrow pushbuttons, enter the desired Max Load Current (1 to 100 mA), then press the ENT pushbutton. The following will be displayed reflecting the Max Load Current setting that was entered.

```
Max Load Current
XX mA
```

22. Press the Down arrow once, the "Max RTN Standby Ops" screen is displayed.

```
Max RTN Standby Ops
20
```

23. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed.

```
Max RTN Standby Ops
20                      C
```

24. Utilizing the arrow pushbuttons, enter the desired Max RTN Standby Operations (1 to 10000), then press the ENT pushbutton. The following will be displayed reflecting the Max RTN Standby Operations setting that was entered.

```
Max RTN Standby Ops
XXXXXX
```

Enabling/Disabling and Setting Run Through Neutral From TapTalk

To Enable or Disable the Run Through Neutral feature from TapTalk®, proceed as follows:

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the Configuration dialog screen (Figure 5-7).
2. Select "Enable" or "Disable" from the Run Through Neutral section of the dialog screen.
3. Depending on the selection in Step 2, proceed as follows to complete the Run Through Neutral setup:
   - If Run Through Neutral was "ENABLED", proceed to Step 4.
   - If Run Through Neutral was "DISABLED", no further action is required.
4. Enter the following Run Through Neutral settings:
   - If desired, reset the RTN Successful Operations Counter
   - Maximum Allowed Taps (3 to 7)
   - Tap Operations Between Runs (10 to 10000)
   - Maximum Load Current (1 to 100 mA)
   - Maximum RTN standby operations before Alarm (1 to 10000)
5. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
6. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

FAST VOLTAGE RECOVERY

The Fast Voltage Recovery feature when enabled, bypasses normal timing operation to return voltage to an in-band condition as rapidly as possible. This is required for unplanned and planned load transfers to allow critical loads to be shifted to a transformer quickly without causing that transformer's voltage to decrease too quickly.

When Fast Voltage Recovery is enabled in automatic mode and the voltage exceeds either the Raise or Lower Band edges plus the Fast Voltage Recovery setting, the normal definite or inverse time delay curve and setting is replaced with instantaneous operation (<0.5 seconds). In all cases, once the normal time delay has been replaced with instantaneous operation, normal timing will not be in effect until the voltage returns in band. This feature can be enabled or disabled and will not affect other functions until the Fast Voltage Recovery setting is exceeded.

The setting range is from 1.0 to 15.0 volts outside the normal band edges in 0.1 V increments. Once the voltage is back in band, the instantaneous operation curve is replaced by the normal definite or inverse time delay curve and setting. Subsequent excursions outside the bandwidth will use the original time delay unless the voltage again exceeds the Fast Voltage Recovery threshold setting.

When Fast Voltage Recovery is active, Overcurrent Blocking (Current limit setting) will be bypassed should conditions require this block to be in effect. Fast Voltage Recovery is not available if any paralleling method is active. If an Intertap delay is set in the control, it will not be bypassed by this feature.

Enabling/Disabling and Setting Fast Voltage Recovery From The HMI

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, until the "Nameplate" screen is displayed.

```
        Nameplate
←                        →
```

4. Press the Down Arrow pushbutton as necessary to navigate to the "Fast Voltage Recovery" menu item.

```
Fast Volt Recovery
disable
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Fast Volt Recovery
disable                  C
```

6. If Level Access is active, the Level Access prompt will be displayed

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Fast Volt Recovery
disable                  C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select either "Enable" or Disable", then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Fast Volt Recovery
ENABLE or disable
```

9. Depending on the selection in Step 8, proceed as follows to complete the Fast Voltage Recovery setup:
   - If Fast Voltage Recovery was "ENABLED", proceed to Step 10.
   - If Fast Voltage Recovery was "DISABLED", no further action is required.

■**NOTE**: From this point on in this procedure it is assumed that a valid Level 2 Access Code has been previously entered. If not, a valid Level 2 Access Code will be required to be entered as described in Step 7.

10. Press the Down arrow pushbutton, as necessary, until the "Fast Volt R Setting" screen is displayed.

```
Fast Volt R Setting
  5.0 V
```

11. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed.

```
Fast Volt R Setting
  5.0 V                    C
```

12. Utilizing the arrow pushbuttons, enter the desired Fast Voltage Recovery setting (1.0 to 15.0 V), then press the ENT pushbutton. The following will be displayed reflecting the Fast Voltage Recovery value that was entered.

```
Fast Volt R Setting
  XXX V
```

Enabling/Disabling and Fast Voltage Recovery From TapTalk

To Enable or Disable the Fast Voltage Recovery feature from TapTalk®, proceed as follows:

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the Configuration dialog screen (Figure 5-7).
2. Select "Enable" or "Disable" from the Fast Voltage Recovery section of the dialog screen.
3. Depending on the selection in Step 2, proceed as follows to complete the Fast Voltage Recovery setup:
   - If Fast Voltage Recovery was "ENABLED", proceed to Step 4.
   - If Fast Voltage Recovery was "DISABLED", no further action is required.
4. Enter the Fast Voltage Recovery setting (1.0 to 15.0 V).
5. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
6. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

VOLTAGE REDUCTION

The M-2001D allows the selection of either Standard Voltage Reduction or Smart Voltage Reduction. Standard Voltage Reduction lowers the Bandcenter based on a percentage of the existing Bandcenter setting. When initiated, the control immediately begins Lower operations to reduce the voltage until it reaches the new upper band edge (Bandcenter plus ½ the Bandwidth setting). Smart Voltage Reduction will further reduce voltage using a variety of methods detailed in the "Smart Voltage Reduction" section later in this Chapter.

Standard Voltage Reduction

The control allows three steps of voltage reduction initiated by external dry contacts, front panel pushbutton or SCADA. The percentage of voltage reduction at each step is adjustable from 0 to 10% in 0.1% increments. When one or more contacts are closed, the effect is to shift the bandcenter setpoint lower thus causing the control to lower the voltage.

In addition, voltage reduction functionality can be enabled or disabled using Communication MODBUS® and DNP protocols.

The Voltage Reduction feature can be turned off by the Voltage Reduction Turnoff Timer (0 to 999 min). A setting of zero disables the Turnoff Timer.

Recognize that the "effective" bandcenter may have been raised by line drop compensator action when the voltage reduction is initiated and that the resultant voltage setting will be the combination of the two effects. Note also that the undervoltage block setting may limit the lowering of voltage, especially if there is little raising of the local voltage due to LDC action.

When first initiated, or when a subsequent step of voltage reduction is needed, the control will respond immediately to the voltage reduction command without regard to either the intertap time delay setting or the control time delay setting. After the desired voltage reduction, operation will revert back to normal operation with the time delay. Refer to **Section 7.1, External Connections** for contact connections.

When Voltage Reduction is enabled the front panel pushbutton, wired SCADA dry contacts, RS-485, Fiber Optic port or Ethernet connection can be used to provide stepped voltage reduction as described earlier.

Also, the state of the "Voltage Reduction" communications command can be saved or not saved when power has been lost. The default setting is "DON'T SAVE".

Enabling/Disabling Standard Voltage Reduction From The HMI

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                        COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                            →
```

3. Press the Right or Left Arrow pushbuttons as necessary until the following is displayed:

```
            Nameplate
←                            →
```

4. Press the Down Arrow pushbutton as necessary to navigate to the "Standard Voltage Reduction" menu item.

```
Standard VR
disable
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Standard VR
disable                       C
```

6. If Level Access is active, the Level Access prompt will be displayed

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Standard VR
disable                    C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select either "ENABLE" or Disable", then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Standard VR
ENABLE or disable
```

Smart Voltage Reduction

Smart Voltage Reduction, when enabled, will lower voltage to between the new Bandcenter setting and the lower band edge instead of stopping at the upper band edge. It will also disable VAr Bias if it is in effect. When "Smart VR LDC" is enabled, the control will ignore existing LDC settings and instead use the "Smart VR LDC" R and X or Z settings to apply LDC while the Voltage Reduction is in effect. The intent of this is to allow a utility to apply positive compensation such that if capacitor banks are on the feeder, the control will compensate for the result of closed capacitor banks increasing voltage downstream and allow greater voltage drop at the source while keeping end of line customer voltage within acceptable limits.

■**NOTE**: When Smart VR with Smart VR LDC is enabled and the unit goes into Reverse Power operation, the control will apply the selected Reverse Power mode Standard LDC settings and stop using the Smart VR LDC settings.

Enabling/Disabling and Setting Smart Voltage Reduction From The HMI

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left Arrow pushbuttons as necessary until the following is displayed:

```
            Nameplate
←                        →
```

4. Press the Down Arrow pushbutton as necessary to navigate to the "Smart Voltage Reduction" menu item.

```
Smart VR
disable
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Smart VR
disable                    C
```

6. If Level Access is active, the Level Access prompt will be displayed

```
ENTER LEVEL ACCESS
_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Smart VR
disable                    C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select either "ENABLE" or Disable", then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Smart VR
ENABLE or disable
```

9. Depending on the selection in Step 8, proceed as follows to complete the Smart Voltage Reduction setup:
   - If Smart Voltage Reduction was "ENABLED", proceed to Step 10.
   - If Smart Voltage Reduction was "DISABLED", no further action is required.

■**NOTE**: From this point on in this procedure it is assumed that a valid Level 2 Access Code has been previously entered. If not, a valid Level 2 Access Code will be required to be entered as described in Step 7.

10. Press the Down arrow pushbutton, as necessary, until the "Smart VR LDC" screen is displayed.

```
Smart VR LDC
disable
```

11. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed.

```
Smart VR LDC
disable                    C
```

12. Utilizing the Up/Down arrow pushbuttons, select either "ENABLE" or Disable", then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Smart VR LDC
ENABLE or disable
```

13. If "Smart VR LDC" was enabled, press the Down arrow pushbutton, as necessary, until the "Smart VR LDC R" screen is displayed.

```
Smart VR LDC R
   0 Volts
```

■**NOTE:** The following sequence of steps provide direction for the Smart VR LDC R setting. The steps necessary to set the Smart VR LDC X or (if applicable) Z settings are similar.

14. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed.

```
Smart VR LDC R
   0 Volts                 C
```

15. Utilizing the arrow pushbuttons, enter the desired Smart VR LDC R setting (–72 to 72 V), then press the ENT pushbutton. The following will be displayed reflecting the Smart VR LDC R (X or Z) value that was entered.

```
Smart VR LDC R
   X Volts
```

Enabling/Disabling and Setting Standard or Smart Voltage Reduction From TapTalk

1. Select **Setup/Configuration** from the TapTalk® toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Voltage Reduction" section of the Configuration dialog screen select "Standard VR" Enable or "Smart VR" Enable. Only one voltage reduction method can be enabled.
3. If "Smart VR" is enabled, "Smart VR LDC" may also be enabled.
4. Enter the "Smart VR LDC" desired settings.
5. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
6. Select OK. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Save Voltage Reduction at Power Off

Save Voltage Reduction at Power Off allows the state of the "Voltage Reduction" communication command to be saved or not saved when power has been lost. The default setting is "DON'T SAVE".

Setting Save Voltage Reduction at Power Off From The HMI

To set the Save Voltage Reduction at Power Off feature, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left Arrow pushbuttons as necessary until the following is displayed:

```
          Nameplate
←                        →
```

4. Press the Down Arrow pushbutton as necessary to navigate to the "Save VR at Power Off" menu item.

```
Save VR at Power Off
DON'T SAVE
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Save VR at Power Off
DON'T SAVE                C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen and display the following:

```
Save VR at Power Off
DON'T SAVE                C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select "DON'T SAVE or SAVE", then press the ENT pushbutton. The selected setting will be displayed.

```
Save VR at Power Off
(DON'T SAVE or SAVE)
```

Selecting Save Voltage Reduction at Power Off From TapTalk

1. Select **Setup/Configuration** from the TapTalk® toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Voltage Reduction" section of the Configuration dialog screen select Save for the "Save VR at Power Off" option.
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select OK. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

Setting Voltage Reduction Turnoff Timer From The HMI

To set the Voltage Reduction Turnoff Timer from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
           Nameplate
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Voltage Reduction Turnoff Timer " screen is displayed.

```
VRed Turnoff Time
   0 Min
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
VRed Turnoff Time
   0 Min                  C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
VRed Turnoff Time
   0 Min                  C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, select the desired Voltage Reduction Turnoff Timer value (0 to 999 min), then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
VRed Turnoff Time
   0 to 999 Min
```

Setting Voltage Reduction Turnoff Timer From TapTalk

1. Select **Setup/Configuration** from the TapTalk® toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).

■**NOTE**: Entering a value of zero disables the Voltage Reduction Turnoff Timer.

2. From the Voltage Reduction section of the dialog screen enter the desired time period (1 to 999 minutes).
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

VAr BIAS

This feature is intended for but not restricted to use with distribution feeders which have switched capacitor banks controlled by Beckwith Electric Autodaptive® M-2501 Series Capacitor Controls.

The use of VAr Bias allows the M-2001D Tapchanger Control to coordinate its operation with the M-2501 Autodaptive Series Capacitor Control devices on the distribution system in order to minimize losses, subsequent voltage variations, and equipment capacity requirements of transmitting VArs. This function is enabled through TapTalk® Communications Software or from the control HMI.

VAr Bias Setpoints

Max 3 Phase Cap Bank: Adjustable from 4 to 12,000 kVAr.

Lead % Bank Size Pickup: Defines a Lower negative VAr limit in percentage of the Max Cap Bank size below which the control will increase the upper band edge by the amount defined by VAr Bias Voltage Step.

Lag % Bank Size Pickup: Defines an Upper positive VAr limit in percentage of the Max Cap Bank size above which the control will decrease the lower band edge by the amount defined by VAr Bias Voltage Step.

VAr Bias Voltage Step: Amount by which the control will increase or decrease the Upper or Lower band edges when there is a VAr Bias out of band situation.

Max VAr Bias Duration: Maximum allowable time in minutes the control will bias the voltage edge.

Overview

When the control determines that the reactive power is lower or greater than the limits defined by the Lead or Lag % pickup setting, the control will start an inverse VAr Bias Pickup Trigger timer. After the inverse time expires, the control will either increase or decrease the effective bandcenter by the amount defined by the VAr Bias Step Voltage setting depending on the direction of the reactive power. At this moment VAr Bias becomes active. The use of an inverse timer is to avoid jittering in the VAr Bias detection and also to provide a faster response as the difference between the Upper or Lower VAr Bias band edge and the measured VArs increase. For example, suppose the system is highly inductive (positive VArs) the load voltage will tend to decrease, when VAr Bias is in effect, the control will automatically reduce the lower band edge and thus the control will be back in band, allowing the downstream cap controls to operate.

The longest allowable time delay before VAr Bias comes into effect is 10 seconds. The inverse timer follows the following equation:

Time delay = 10 *(Upper or Lower VAr Limit)/IVAr measured.

Upper VAr limit is defined as Lag % Bank Size Pickup multiply by a third of Max Cap Bank size.

Lower VAr limit is defined as Lead % Bank Size Pickup multiply by a third of Max Cap Bank size.

The VAr Bias Pickup trigger timer will instantly reset to ZERO if the reactive power measurement returns within the allowable band before VAr Bias becomes active.

Once VAr Bias is active, the control will remove the VAr Bias condition for the following situations.

1. When Max VAr Bias Duration is exceeded (see description below).
2. When reactive power returns back in band within 90% of the VAr limits set by Lag or Lead % Bank Size Pickup settings.

   For example, if the Upper VAr limit is 75 % of 12000 kVAr bank then the level below which the control will return in band after going out above the Upper VAr limit is 9*3000/10 = 2700 kVAr. Similarly if the Lower VAr limit is at –3000 then the in band limit is –2700 kVAr.

The application of both the M-2001D Tapchanger Control and the Autodaptive® Capacitor Control(s) on a circuit provides for an interaction between the devices that provides for faster response in times of rapidly changing conditions on the distribution system. For example, if one regulator is serving 6 feeders, with each feeder using 1200 kVAr pole-top feeder capacitor banks, and if each feeder is correctly compensating to within 400 kVAr, all feeder bank controls would be considered to be operating correctly. However the regulator would still be transforming up to 2400 kVAr (six feeders times 400 kVAr) from the transmission system. The M-2001D Control on the regulator would detect this condition and affect additional line capacitor operation by making a temporary voltage level setting change. By effectively lowering its setting (delaying a voltage tap RAISE for a short time), line capacitor bank control could be biased into operation sooner by the tapchanger control. This would reduce losses of the circuit, provide a better voltage profile and reduce the number of tapchanges.

In effect, when enabled user sets VAr Bias setting values at which bandcenter/bandwidth is shifted to influence downstream Capacitor Control(s) into operation. Shifted bandcenter/bandwidth returns to prior settings after measured VAr level returns within band. If Max VAr bias Duration is exceeded, the shifted bandcenter/bandwidth returns to prior setting and an ALARM is activated if configured to do so. The alarm will also have corresponding communication events reported. When VAr Bias is active the OSC and SOE may be triggered if selected.

Enable/Disable VAr Bias From The HMI

To Enable/Disable VAr Bias from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
        Nameplate
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Enable VAr Bias" screen is displayed.

```
Enable VAr Bias
disable
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Enable VAr Bias
disable                  C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Enable VAr Bias
disable                  C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select either "ENABLE or disable", then press the ENT pushbutton. The following will be displayed reflecting the mode that was selected.

```
Enable VAr Bias
ENABLE
```

9. Depending on what mode was selected in Step 8, proceed as follows to complete the VAr Bias setup:
   - If VAr Bias was "ENABLED", proceed to Step 10.
   - If VAr Bias was "DISABLED", no further action is required.

10. Press the Up/Down arrow pushbuttons, as necessary, to navigate to the "Max Cap Bank Size" menu item within the "Nameplate" menu.

```
Max Cap Bank Size

12000 KVAr
```

11. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 14.

```
Max Cap Bank Size
12000 KVAr                    C
```

12. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

13. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

    If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Max Cap Bank Size
12000 KVAr                    C
```

    If not, re-enter a valid code.

■**NOTE**: Capacitor Bank size is a single phase value.

14. Utilizing the arrow pushbuttons, enter the desired "Max Cap Bank Size" (4 to 12,000 kVAr), then press the ENT pushbutton. The following will be displayed reflecting the Max Cap Bank Size that was entered.

```
Max Cap Bank Size

XXXXX KVAr
```

■**NOTE**: From this point on in this procedure, it is assumed that a valid Access Level 2 Code has been previously entered. If not, then a valid Level 2 Access Code will be required to be entered as described in Step 13.

15. Press the Up/Down arrow pushbuttons, as necessary, to navigate to the "Lead % Pickup" menu item within the "Nameplate" menu.

```
Lead % Pickup
  75
```

16. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Lead % Pickup
  75                          C
```

17. Utilizing the Up/Down arrow pushbuttons enter the desired "Lead % Pickup" value, then press the ENT pushbutton. The entered setting will be displayed.

```
Lead % Pickup
  XX
```

18. Press the Up/Down arrow pushbuttons, as necessary, to navigate to the "Lag % Pickup" menu item within the "Nameplate" menu.

```
Lag % Pickup
  75
```

19. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Lag % Pickup
  75                          C
```

20. Utilizing the Up/Down arrow pushbuttons enter the desired "Lag % Pickup" value, then press the ENT pushbutton. The entered setting will be displayed.

```
Lag % Pickup
  XX
```

21. Press the Up/Down arrow pushbuttons, as necessary, to navigate to the "VAr Bias Volt Step" menu item within the "Nameplate" menu.

```
VAr Bias Volt Step
   1.0 Volts
```

22. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
VAr Bias Volt Step
   1.0 Volts                  C
```

23. Utilizing the Up/Down arrow pushbuttons enter the desired "VAr Bias Volt Step" value, then press the ENT pushbutton. The entered setting will be displayed.

```
VAr Bias Volt Step
   XX Volts
```

24. Press the Up/Down arrow pushbuttons, as necessary, to navigate to the "Max VAr Bias Time" menu item within the "Nameplate" menu.

```
Max VAr Bias Time
   300 mins
```

25. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Max VAr Bias Time
   300 mins                   C
```

26. Utilizing the Up/Down arrow pushbuttons enter the desired "Max VAr Bias Time" value, then press the ENT pushbutton. The entered setting will be displayed.

```
Max VAr Bias Time
   XXX mins
```

Setting VAr Bias From TapTalk

To enable VAr Bias and establish the Maximum Capacitor Bank Size from TapTalk®, proceed as follows:

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the VAr Bias section of the dialog screen select "Enable".
3. Enter the desired settings for the following:
   - Enter a Maximum Capacitor Bank Size (4 to 12,000 kVAr)
   - Lead % Bank Size Pickup (10 to 100%)
   - Lag % Bank Size Pickup (10 to 100%)
   - VAr Bias Voltage Step (0.1 to 2.0 V)
   - Max VAr Bias Duration (10 to 1440 min)
4. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
5. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

5.3 Parallel Operation

Circulating Current and Delta VAr Methods

Refer to Figures 5-10, 5-11, 5-12, 5-13 and to Appendix A, Figure A-8. The user with access to the Configuration Menu may select the circulating current method of paralleling LTC transformers, or disable the feature. If the optional ΔVAR®1/ΔVAR2 methods were purchased, they may also be selected. Paralleling by the circulating current method or the ΔVAR1 method involves a configuration in which each M-2001D Tapchanger Control is used with a Beckwith Electric M-0115A Parallel Balancing Module. The control is provided with a current input which is representative of the circulating current between two or more LTC transformers operating in parallel.

Circulating Current/ΔVAR1

The general paralleling schemes for two and three transformer paralleling using the circulating current method are shown in Figures 5-10 through 5-12.

Figure 5-10 is a schematic of the current circuit only; redrawn from the Paralleling Scheme figures to allow easier tracing of the load current (I_L) and circulating current (I_p) paths.

A current, proportional to the transformer secondary current, is fed to the M-0115A unit. Because of the secondary parallel connection, however, this is actually the vector sum of the desired load current and any undesired circulating current. The M-0115A separates these currents, and sends them to the proper load (LDC) and circulating current inputs of the associated control.

Two current loops are formed. One involves the K3 auxiliary transformers in each of the M-0115A units. This loop forms a measure of the transformer bank circulating current, subtracted from the LDC control input and forced to flow into the control circulating current input.

The second loop involves the K1 and K2 auxiliary transformers. They force the load current to divide properly between the various controls so that each senses its proper portion of the total bank load. Thus, the LDC setting for each control may properly be the same, regardless of whether or not the associated transformer is being used in parallel.

The first current path shown (Circulating Current) has a current analogous in angle and magnitude to the reactive current circulating through the paralleled transformers. It also includes the M-0127A Overcurrent Relay, which is used to detect excessive circulating current and block the tapchanger movement, if this occurs. Also, a lamp will alert the operator when excessive circulating current is detected.

The second path shown (Balance Current), connecting the K1 auxiliary CT of the M-0115A modules together, has a balance current which forces the two load currents of transformers #1 and #2 to be identical. This means that any difference in currents must flow in the circulating current path.

The third and fourth path shown (Half Current and LDC Current), connecting the K2 auxiliary CT of the M-0115A modules together, ensures proper operation of the Load Drop Compensator circuit if one of the transformers is taken out of service by opening its breaker. For instance, if transformer #2 is taken out of service by opening breaker 52-2, then half of transformer #1's load current is forced to flow through the half current loop. In this way, transformer #1's voltage regulating control sees the same load current as it did before, and the proper amount of line drop compensation in the transformer #1 control is maintained. This circuit configuration and grounding points must be maintained, if transformers are to be successfully paralleled.

A more detailed description of the theory of operation is available from Beckwith Electric upon request. Application Note #11, "*Introduction to Paralleling of LTC Transformers by the Circulating Current Method*" and Application Note #13, "*Advanced Paralleling of LTC Transformers by the Circulating Current Method*" provide a thorough analysis of parallel LTC transformers operating by the circulating current method.

It is suggested that either the non-sequential or Intertap time delay be used when paralleling.

The sensitivity of the control or the amount of control setpoint bias for a 200 mA circulating current is 24 V. For circulating current applications, that is a 24 V setpoint shift for 200 mA of total circulating current input. For ΔVAR1 applications, that is a 24 V setpoint shift for 200 mA of reactive circulating current.

For applications with low transformer impedances, the circulating current or VArs per tap difference is greater than in applications with high transformer impedances. This creates a need for a method to adjust the sensitivity of the control according to the system application.

On the circulating current application method and the ΔVAR1 application method, this is accomplished with a sensitivity adjustment on the M-0115A Parallel Balancing Module (see the M-0115A Instruction Book.)

■ **NOTE**: In all M-0115A applications, the M-0115A sensitivity settings should be equal on all paralleled transformers.

ΔVAR2 Paralleling and ΔVAR2 Paralleling + KeepTrack™

The theoretical basis for the **ΔVAR®2 Method** of paralleling is that paralleled transformers are meant to SHARE the VAr load (as well as the KW load) of the load bus. Since the KW sharing of the parallel transformers is determined by the relative transformer impedances and NOT the tap position, KW flow should not effect tap position choice. Further, that the best choice of loading parallel transformers is to maintain the VAr sharing regardless of KW loading which can be accomplished with relative tap positioning.

The ΔVAR Method will result in the VAr flow to the substation load to be shared in the appropriate ratio of the paralleled transformers' ratings. It should be noted that auxiliary CT's are required in circulating current schemes to balance the currents when transformers with different impedances are paralleled. Those auxiliary CT's are not necessary when the ΔVAR Method is used.

The ΔVAR2 implementation is limited to use with no more than two transformers and each transformer current is input to each control. This eliminates the need for the parallel balancing module and removes the path for the installation of the overcurrent relay. For this implementation, the sensitivity setting is added to the M-2001D Tapchanger Control along with a circulating current overcurrent inhibit function. The ΔVAR2 implementation also contains a CT ratio-matching setting making it unnecessary to match CT ratios exactly to transformer MVA ratings for proper operation.

The ΔVAR2 Method is incorporated in the Beckwith Electric M-2001D Tapchanger Control, as an option. This option internally calculates and compares the individual transformer VAr flows. Decisions for voltage setpoint biasing are then made and implemented to change tap positions in such a manner that the difference in VAr flow is minimized.

Action is taken continuously as the MVAr load is changing such that the magnitude of difference in VAr loading is minimized (depending on the VAr difference of one, off-optimum, tap position).

The use of LDC (line drop compensation) is precluded when ΔVAR2 is used since no provision is made for the increase in load currents in one transformer when the other is out of service. The result would be doubling the LDC effect when in independent operation.

ΔVAR2 Connection

As shown in Figure 5-13, the current input is connected to the load current terminals of the control and then into the circulating current terminals (Ip) of the paralleled transformer control. Each control now sees the same voltage and each transformer current separately. This allows each control to calculate the VAr flows in both transformers for comparison, without externally sorting out the load and circulating current values. Breaker contact 52-3b is used to signal the M-2001D Control to disable paralleling using the neutral light input (Redefined when ΔVAR2 selected). An external independent/parallel switch (43P) is suggested to provide manual control for testing and maintenance. The effectiveness of this grounding is important for the recognition of this condition.

Paralleling by the ΔVAR2 method does not use the M-0115A Parallel Balancing Module. This method of paralleling can only be used for two transformers. Refer to Figure 5-13 for the ΔVAR2 connections. Instead, the two load currents are brought into the control, and the actual ΔVAR's which exist between the paralleled transformers is calculated internally. When using the ΔVAR2 method, the control's load current input is to be connected to the load current CT of the transformer which is controlling the tap position. The control's circulating current is to be connected to the load current CT for the opposite paralleled transformer.

The measured voltage the M-2001D controls on each of the transformers will be biased in such a way as to attempt to minimize the circulating current between the two. In the case of ΔVAR, the tap positions will minimize the difference in VArs from each transformer.

For ΔVAR2 applications, there is a 24 V setpoint shift for 200 mA of calculated reactive current difference between transformers. (ΔVAR2 is only applicable for two parallel transformer applications.)

For applications with low transformer impedances, the circulating current or VArs per tap difference is greater than in applications with high transformer impedances. This creates a need for a method to adjust the sensitivity of the control according to the system application.

On the ΔVAR®2 application method, which uses no M-0115A module, a control setting is provided to accomplishment the sensitivity adjustment.

■ **NOTE**: In all ΔVAR2 applications, the sensitivity settings should be equal on all paralleled transformer controls.

Exclusively for the ΔVAR2 method, there are three functions activated and set in the Configuration menu for proper operation: **ΔVAR2 Sensitivity**, **ΔVAR2 Reac Limit**, and **ΔVAR2 I Ratio**. When the ΔVAR option has not been purchased, these input screens will be disabled.

The **ΔVAR2 Sensitivity** ranges from –4.0 to +4.0, as did the M-0115A adjustment. At a ΔVAR2 Sensitivity setting of 0.0, 100% of calculated reactive current difference will be used to bias the setpoint. At a setting of –4.0, only 50% of the calculated reactive current difference will be used to bias the setpoint, making the control less sensitive to the circulating current. At a setpoint of +4.0, the bias will be adjusted by a value of 200% of the calculated reactive current difference, making the control more sensitive to the system current.

The **ΔVAR2 Circ Limit I** setpoint establishes a limit on the calculated reactive current difference between transformers. The settings range from 5 mA to 200 mA in 1 mA increments. If the calculated reactive current difference reaches this setpoint, the operation of the control will be blocked and the alarm output function will be activated, if enabled. The purpose of this limit is to stop any runaway condition. This feature is required to replace the M-0127A overcurrent relay used in the circulating current and ΔVAR1 applications.

■ **NOTE**: Care must be taken in setting the **ΔVAR2 Circ Limit I**, to ensure it is high enough to allow a two or three tap difference from optimum in transformers before operating. Some knowledge of system impedances are useful in determining this setting, but the current difference may also be tested for immediate system conditions by reading the current change when one tap is changed on either transformer.

The ∆**VAR2 I Ratio** is used to adjust the sensitivity to the line current input versus the circulating current input (opposite transformer load current) to compensate for unequal CT ratios between transformers. For proper operation with a ratio setting of 1, the ratio of the CT ratios must be equal to the ratio of the transformer ratings (CT1/CT2=MVA1/MVA2).

$$\left(\frac{\text{TX1 Rating}}{\text{TX2 Rating}}\right)\left(\frac{\text{TX2 CT Ratio}}{\text{TX1 CT Ratio}}\right) = \text{I Ratio TX 1}$$

$$\left(\frac{\text{TX2 Rating}}{\text{TX1 Rating}}\right)\left(\frac{\text{TX1 CT Ratio}}{\text{TX2 CT Ratio}}\right) = \text{I Ratio TX 2}$$

Example: A 20 MVA transformer is being paralleled with a 15 MVA transformer. If the CT ratios are 2000 A and 1500 A to 0.2 A, no compensation would be required (both transformers are fully loaded when the CT outputs are 200 mA.) However, if they each had 2000 A to 0.2 A CTs, the ∆**VAR2 I Ratio** on the 20 MVA transformer control should be 1.34, and the ∆**VAR2 I Ratio** on the 15 MVA transformer control should be 0.75.

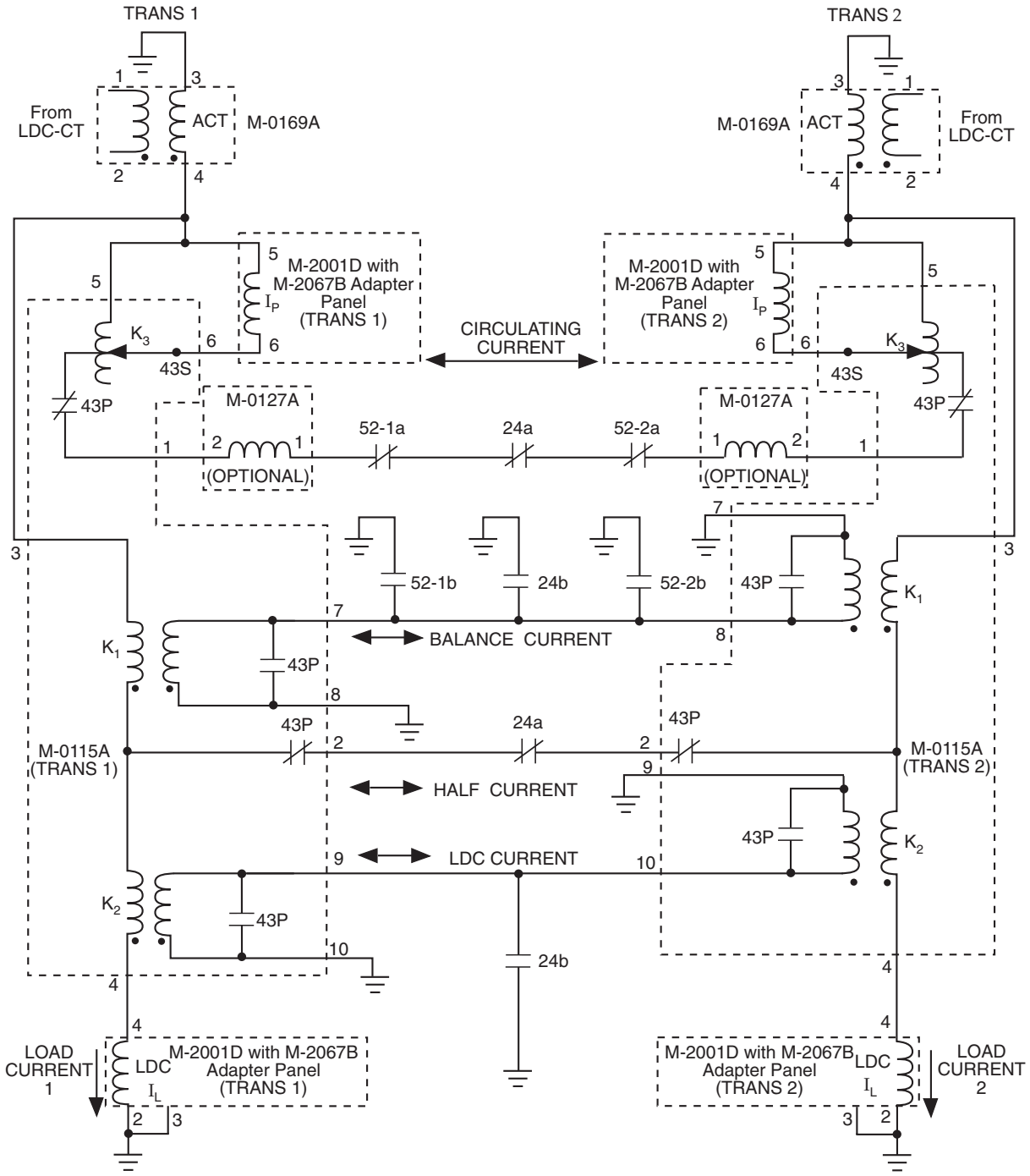
The settings for this ratio are 0.50 to 2.00, in 0.01 increments. When the setting is 0.50, the control will be 0.50 times as sensitive to the VArs from the circulating current input versus the load input current. The default setting for the sensitivity is 1.00, indicating the ratio of the CT ratios are equal to the ratio of the transformer ratings.

This feature can also be used to replace the need for auxiliary transformer for matching transformer CT ratios. No correction is necessary to compensate for impedance differences in the transformers with ∆VAR operation.

For ∆VAR2 applications (without KeepTrack™), paralleling will be disabled if either current input drops to less than approximately 10 mA or if a neutral input is present. When ∆VAR2 operation is configured, the normal neutral input is directed to this duty rather than the normal neutral light operation. It is highly recommended that this input be connected to operate whenever any breaker opens which isolates the transformer from parallel operation.

For ∆VAR2 Paralleling mode the Auxiliary Input A1 will be the ∆VAR2 Disable Input. This is needed since the Neutral Position Input is used for KeepTrack.

■**NOTE:** This input configuration has changed from previous firmware versions (V01.05.13 and prior).



■**NOTES**:

1. 52 contacts are shown in the breaker closed position; 43P in parallel position.
2. K3 is a circulating current sensitivity control.
3. M-0127A is a current relay to detect excessive circulating current.

Figure 5-10 Simplified Schematic of Current Circuit for M-2001D Paralleling Two Transformers using the Circulating Current or ΔVAR® Method

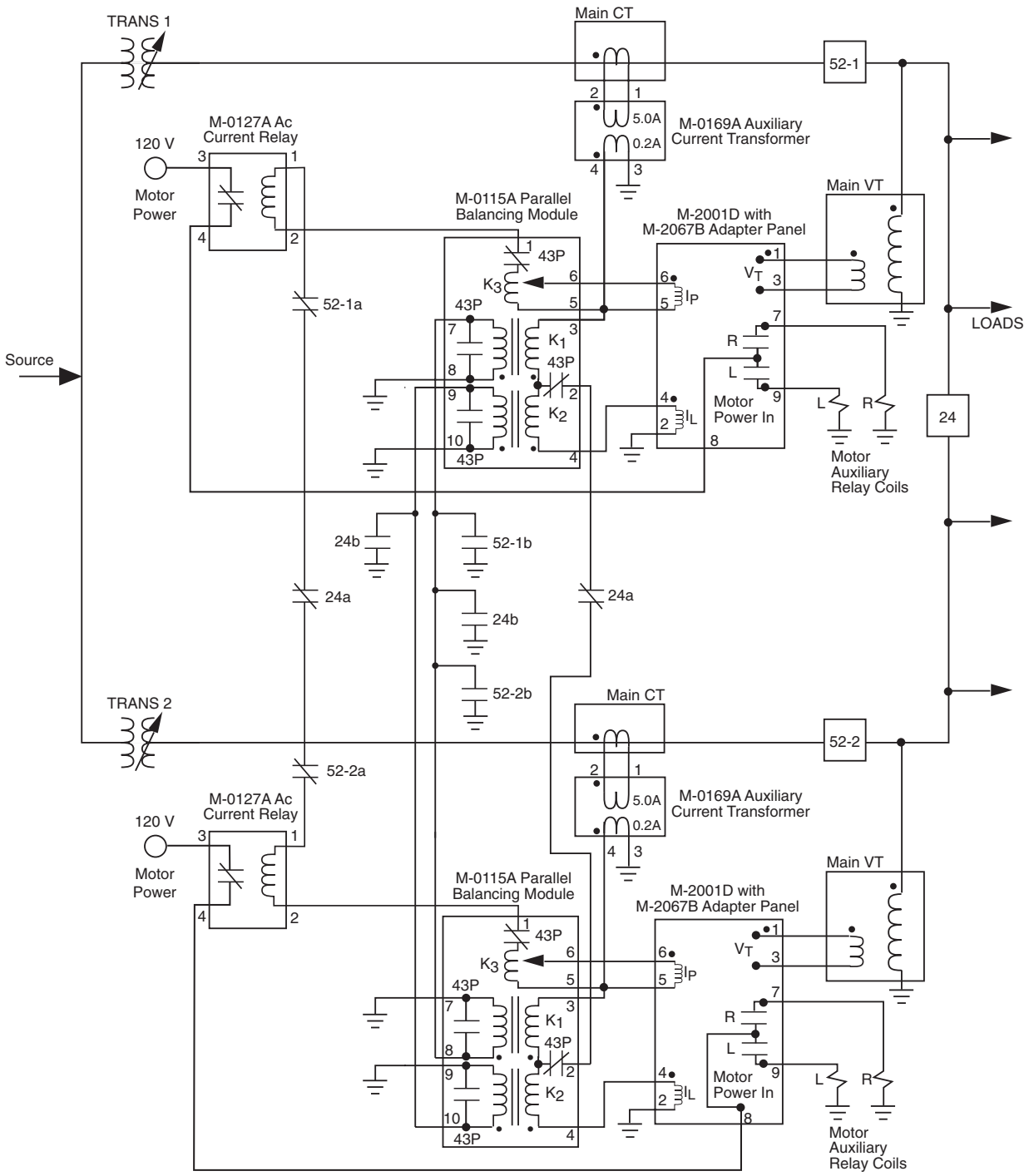


Figure 5-11 M-2001D and M-2067B Paralleling Scheme for Two Transformers using the Circulating Current or ΔVAR® Method

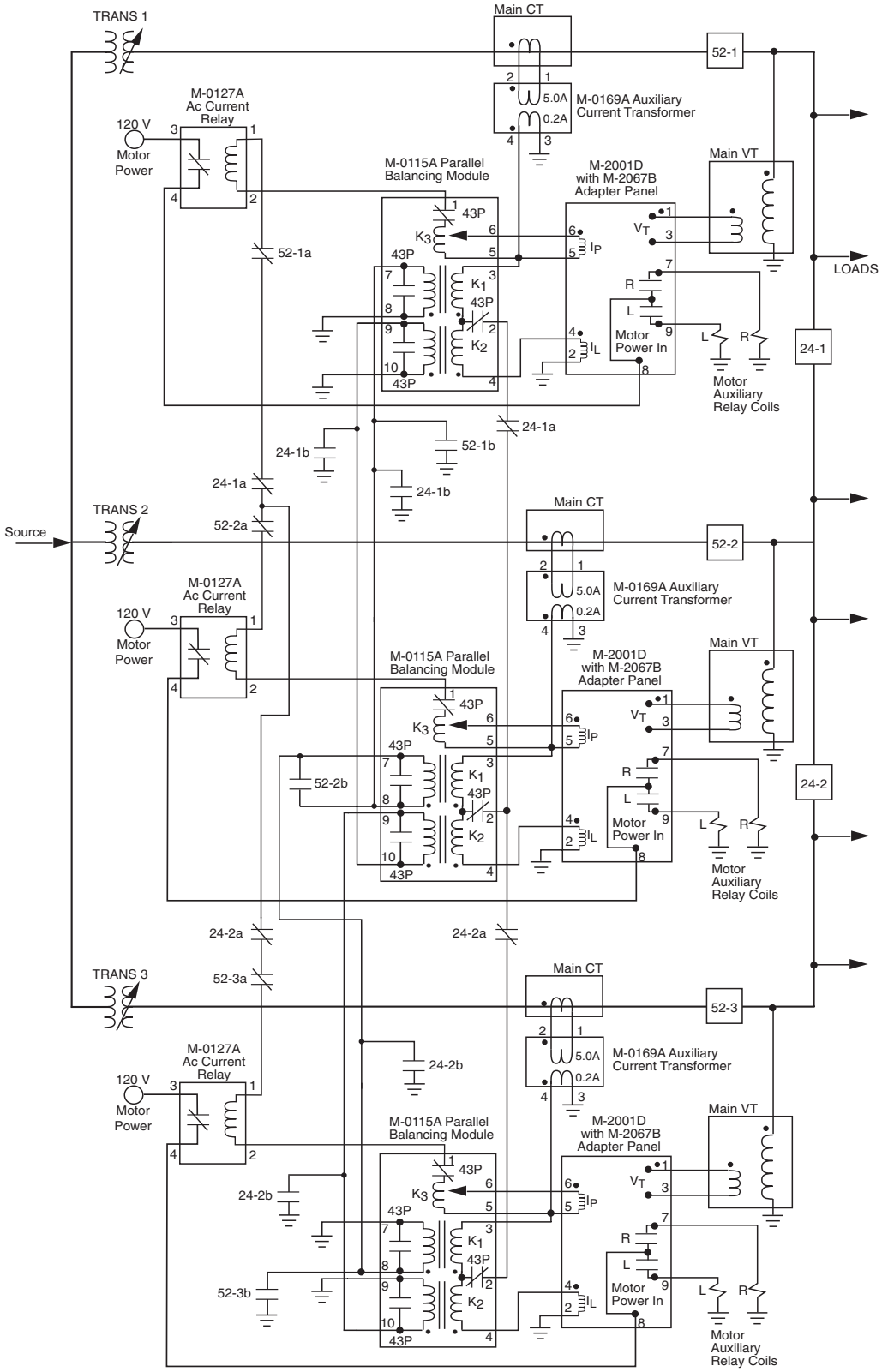


Figure 5-12 M-2001D and M-2067B Paralleling Scheme for Three Transformers using the Circulating Current or ΔVAR® Method

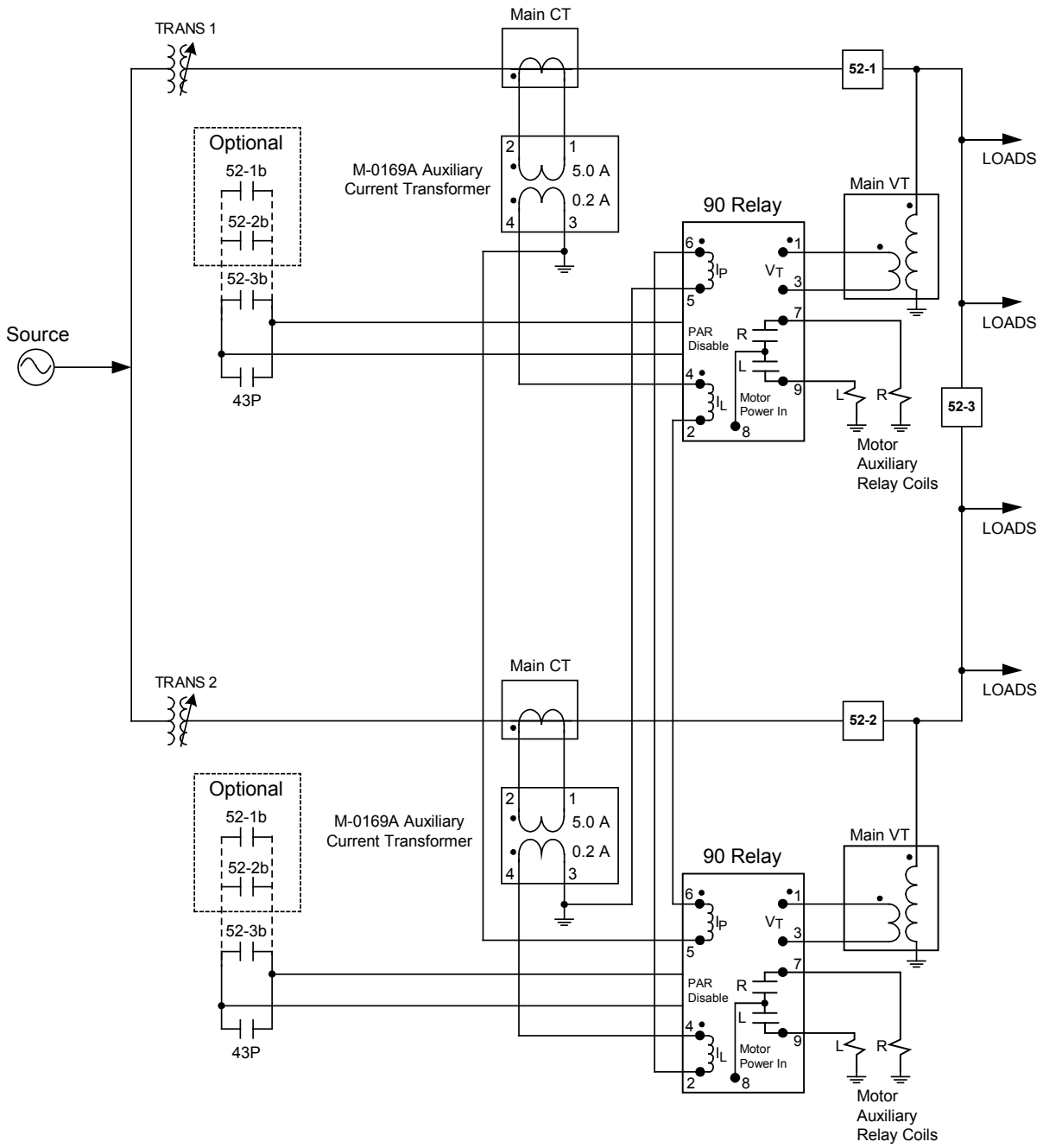


Figure 5-13 ΔVAR®2 Paralleling

Selecting Paralleling Method and ΔVAR2 Settings

The available paralleling methods if purchased are: ΔVAR®2 (KeepTrack™), ΔVAR2, ΔVAR1, Circulating I and Master/Follower.

Selecting Paralleling Method and ΔVAR2 Settings From The HMI

To select the Paralleling Method and ΔVAR2 Settings from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Paralleling" menu.

```
         Paralleling
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Paralleling Type" screen is displayed.

```
Paralleling Type
DISABLE
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Paralleling Type
DISABLE                  C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Paralleling Type
DISABLE                  C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, select the desired Paralleling Type, then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Paralleling Type
DISABLE, MASTER/FOLLOWER,
DELTA VAR #2(KT), DELTA VAR #2,
DELTA VAR #1 or CIRCULATING I
```

9. If DVAR2 or DVAR2 (KeepTrack) was selected in Step 8, then press the Down arrow pushbutton once. The following will be displayed.

```
DVAR2 Sensitivity
 0.0
```

10. Press the ENT pushbutton. The following will be displayed

```
DVAR2 Sensitivity
 0.0                     C
```

11. Utilizing the arrow pushbuttons, select the desired DVAR2 Sensitivity, then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
DVAR2 Sensitivity
 X.X
```

12. If DVAR2 or DVAR2 (KeepTrack™) was selected in Step 8, then press the Down arrow pushbutton once. The following will be displayed.

```
DVAR2 Reac I Lmt
  200 mA
```

13. Press the ENT pushbutton. The following will be displayed

```
DVAR2 Reac I Lmt
  200 mA                C
```

14. Utilizing the arrow pushbuttons, select the desired DVAR2 Reac I Limit, then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
DVAR2 Reac I Lmt
  xxx mA
```

15. If DVAR2 or DVAR2 (KeepTrack) was selected in Step 8, then press the Down arrow pushbutton once. The following will be displayed.

```
DVAR2 I Ratio
   1.00
```

16. Press the ENT pushbutton. The following will be displayed

```
DVAR2 I Ratio
   1.00                 C
```

17. Utilizing the arrow pushbuttons, select the desired DVAR2 I Ratio, then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
DVAR2 I Ratio
   x.xx
```

Selecting Paralleling Method and Settings From TapTalk

1. Select **Setup/Configuration** from the TapTalk® toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Paralleling" section of the dialog screen select the desired Paralleling Type and as applicable DVAr2 Sensitivity, Reactive Current Limit and Input Ratio (Figure 5-14).
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

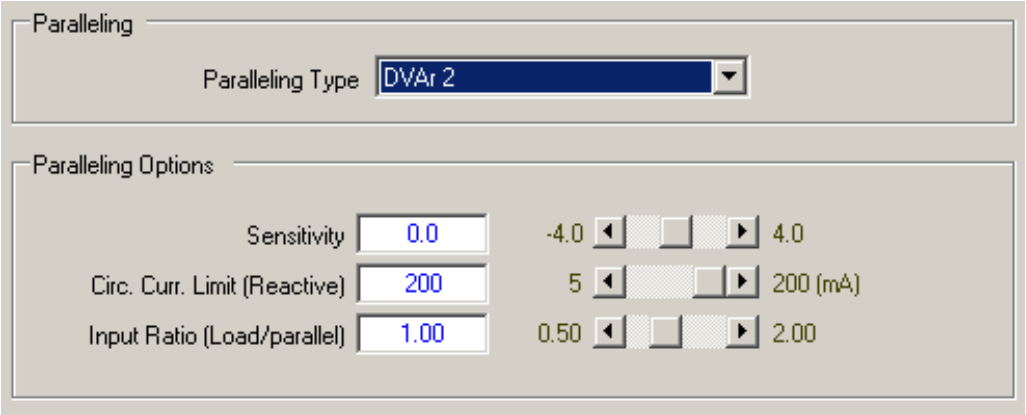


Figure 5-14 DVAr2 and DVAr2 (KeepTrack) Paralleling Settings (Configuration Dialog Screen)

Optional Master/Follower Paralleling Method

The Master/Follower Paralleling scheme employs the GOOSE messaging of the IEC 61850 protocol to provide peer to peer communications. The control can be placed in either the Master or Follower mode if paralleling is to be achieved. The Master/Follower settings can also be changed individually on each control through Setup/Configuration/Paralleling (Figure 5-15). The Master/Follower Configuration Tool (Figure 5-18) includes the settings for each control in the network for the Master/Follower paralleling scheme.

Grouping Operation Algorithm (GOA):

This GOA determines the action that is taken by the control when it detects any OPEN Tie Breakers (Figure 5-16) in the network.

Each control individually monitors the status of the Tie Breakers (A2, A3 Auxiliary Inputs) and broadcasts to all the other controls these statuses via a GOOSE message. Each control in turn processes the tie breaker statuses to produce a map of the network every 64 ms.

Each control upon detecting a change in any Breaker Status or Tap Position will issue a GOOSE message to update all the other controls in the network with the new information.

The following rules are applied to produce the Control Network Map (refer to Figure 5-16):

- The Master in the initial setup of the network should always be at the highest position in the network map (e.g. position 8).
- The paralleling address of each control should be the same as the position it is located in the network map (e.g. position 7 = address 7).
- All GOOSE messages are sorted according to their corresponding paralleling addresses.
- The control scans all the tie breakers statuses (if any) in the downstream positions to find the downstream boundary.

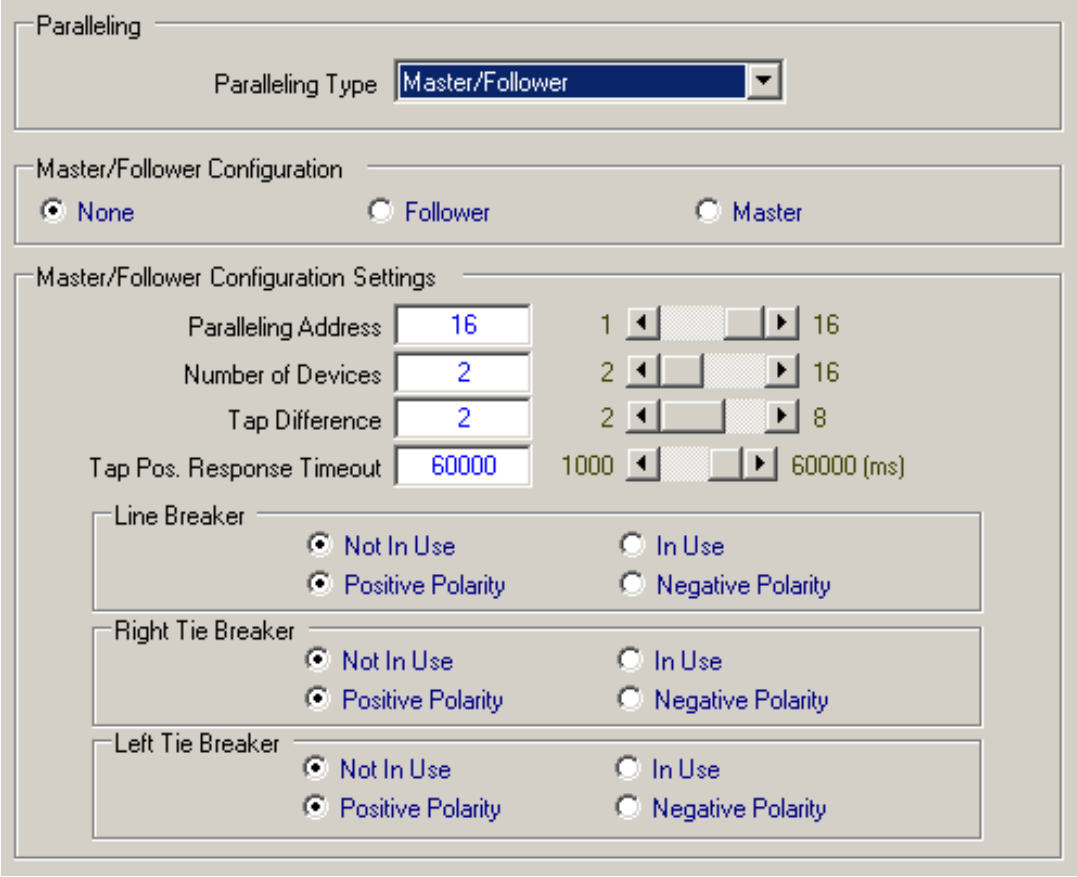


Figure 5-15 Master/Follower Paralleling Settings (Configuration Dialog Screen)

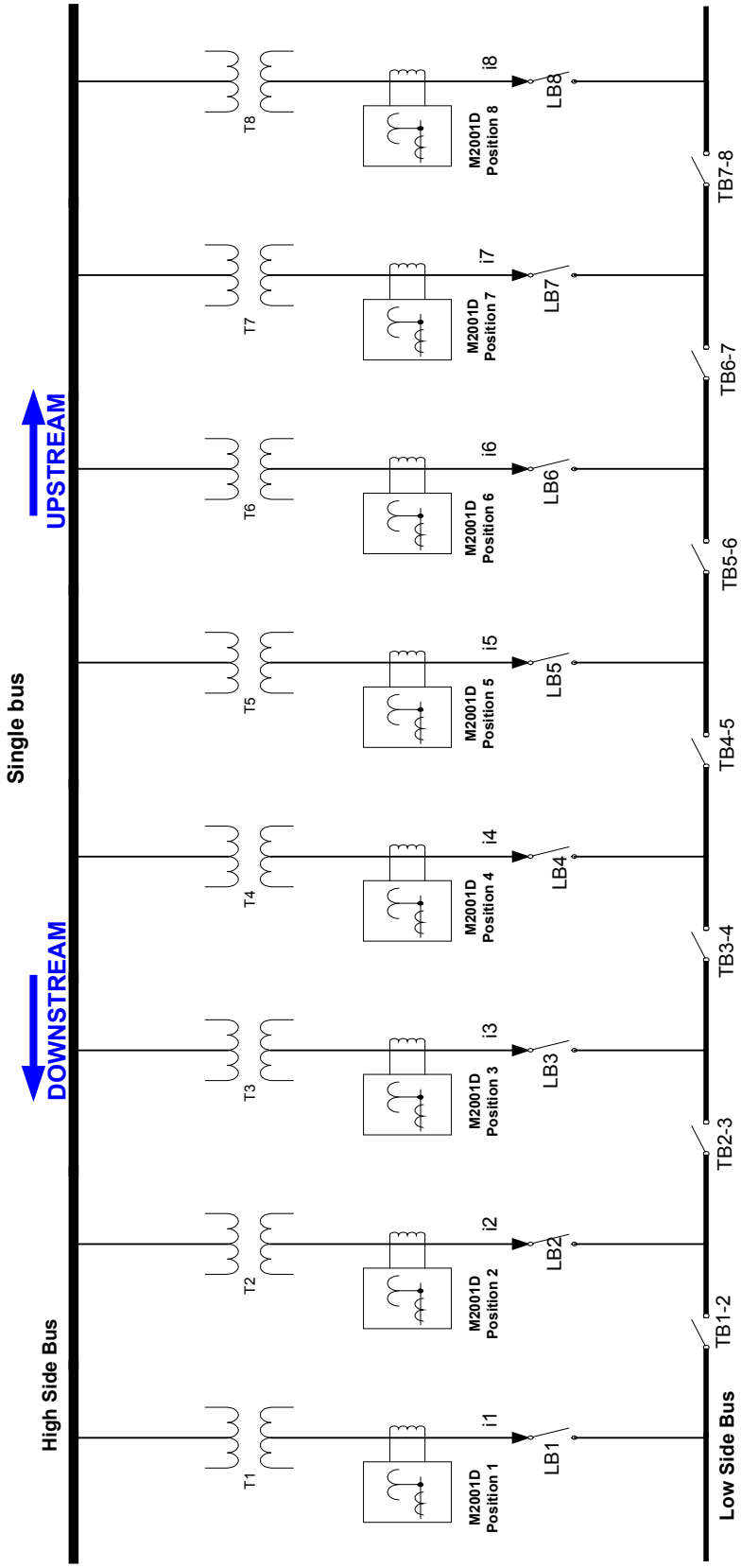


Figure 5-16 Breaker/Control Network Map

- The first OPEN status indicates the boundary has been reached. Similarly the control scans all the upstream tiebreaker statuses (if any) to find the upstream boundary. Once the boundaries are located the sub network is defined.
- If the control is a Master, the control will determine how many Followers are in its network.
- If the control is a Follower, the Master/ Follower Identification will be equal to the address of the Master in that network.

Master/Follower Alarm Messages

The Master/Follower Alarm Messages that are displayed on the Control's HMI display, can be remotely observed (Figure 5-17) from TapTalk® utilizing the Monitor/Master/Follower Alarm Messages menu selection. In addition to the lockout conditions, it also will display the serial number of the Follower that caused the lockout condition for Tap Difference Lockout.

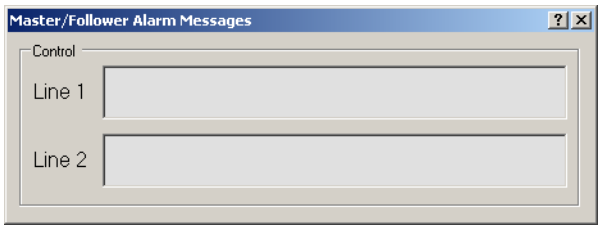


Figure 5-17 Master/Follower Alarm Messages

Lockout Condition

There are two types of lockout conditions, Master Lockout and Follower Lockout. Any lockout of the paralleling mode will initiate a Lockout alarm. When a lockout is active, the unit issuing the lockout will stop any further GOOSE publishing and will stop load voltage regulation. Also, the alarm can be configured as a DNP event, or as a report in the case of IEC 61850. The lockout alarm will be displayed on the control front panel HMI display and in the Master/Follower Configuration Tool (Figure 5-18).

■**NOTE**: Master/Follower Alarm messages can be observed for the connected control from the TapTalk Monitor/Master/ Follower Alarm Messages menu item (Figure 5-17).

Master Lockout

There are four Master Lockouts:

- GOOSE Message Delay – When the control powers up in Master Mode, the control will wait for approximately 65 sec to allow all the GOOSE messages from all the Followers in the network to reach the Master. Once all GOOSE messages have been received, the Master will start its normal algorithm. If within that initial 65 second period the Master does not receive all the GOOSE messages it expected, it will enter the Master lockout state.
- Tap Position Response Timeout Lockout – The Tap Position Response Timeout will start after the Master has published its new tap position message after it has performed a successful tap operation. If it doesn't receive the tap position messages from all the participating Followers in the network before the timer expires, then a Master Lockout is issued.
- Tap Difference Lockout – If the Tap position difference between any Follower and the Master is greater than or equal to Tap Difference setting, the Master will enter the lockout state.
- Follower Communication Loss Lockout – If any follower does not send a valid re-transmitted GOOSE message within a 65 sec internal Follower Detection Lockout "Keep Alive" time, then a lockout is issued, signaling a broken communication link.

Follower Lockout

There are three types of Follower Lockout:

- Master Communication Loss Lockout – When the Follower does not receive a valid re-transmitted GOOSE message from the Master within a 65 second internal "Keep Alive" time, and the previous Master GOOSE message indicates that the breaker statuses were closed, then a Follower Lockout is activated. This Lockout is an indication that communication with the Master has been lost.
- Follower Communication Loss Lockout – If any follower does not send a valid re-transmitted GOOSE message within a 65 sec internal Keep Alive time, then a lockout is activated, indicating a broken communication link.
- Tap Difference Lockout – If the Tap Position Difference between the Follower and the Master is greater than or equal to the Tap Difference setting, a Follower Lockout will be activated.

Master/Follower Configuration Tool

TapTalk® includes a Master/Follower Configuration Tool located in the **Utility** menu (Figure 5-18) to help configure the controls for the Master/Follower Paralleling scheme. The tool allows the user to discover on a Local Area Network (LAN) all the Beckwith M-2001D controls that have the Master/Follower feature. Note that the Master/Follower Paralleling scheme can only be implemented on controls that are on the same network. In addition, if a multiple network adapter exists on the host computer the configuration tool will allow the user to select on which network card the tool should perform the discover of all M-2001D controls. Failure to choose the correct network card may result in the tool not discovering all the available M-2001D controls. Accessing the Master/Follower Paralleling Tool dialog screen requires a Level 2 Access code.

Discovered Devices

Each discovered control and its data is displayed on the Master/Follower Configuration Tool dialog screen. The data is organized into control identifiers, read only statuses, and configurable (writable) settings. The control identifiers are indicated by the color "yellow", read only statuses by "green", and configurable settings are identified by an asterisk. NA indicates the data is not applicable.

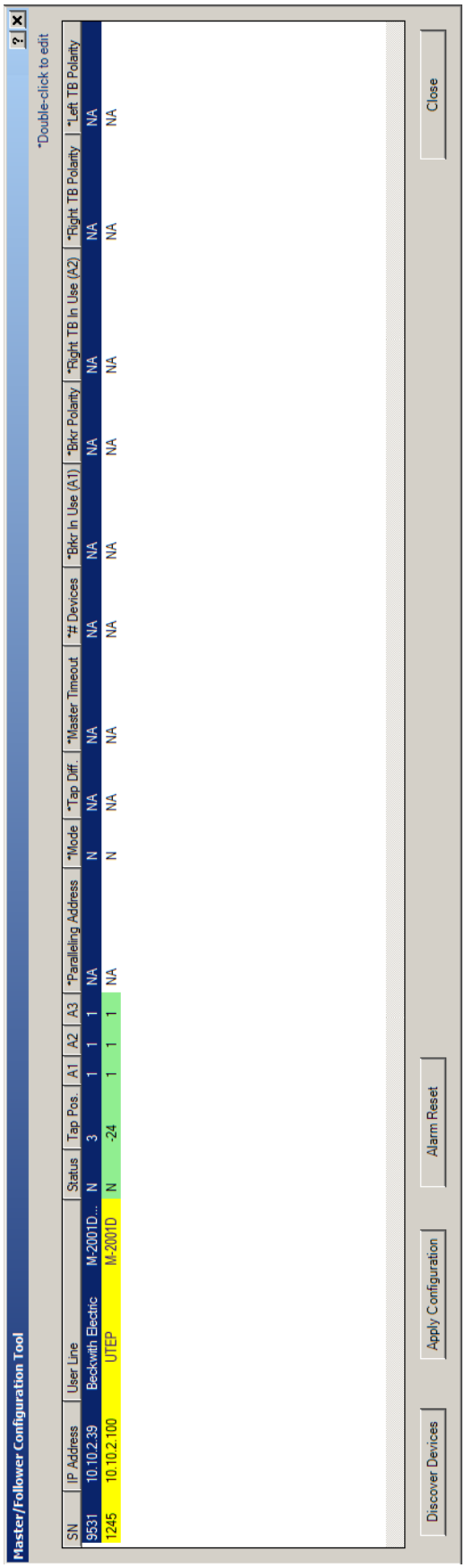
The Control Identifiers are:

- SN – Serial Number of the device
- IP Address – IP address of the device
- User Line – User Logo on the device

The Read Only Statuses are:

- Status – Indicates whether the device is a Master, Follower or None and whether the unit is in Lockout condition.
- Tap Pos – Tap position of the device
- A1 – Line Breaker status of the device
- A2 – Right Tie Breaker status of the device
- A3 – Left Tie Breaker status of the device

■**NOTE**: A1, A2, and A3 are references to the M-2001D Auxiliary Inputs.



SN	IP Address	User Line	Status	Tap Pos.	A1	A2	A3	*Paralleling Address	*Mode	*Tap Diff.	*Master Timeout	*# Devices	*Bkr In Use (A1)	*Bkr Polarity	*Right TB In Use (A2)	*Right TB Polarity	*Left TB Polarity
9531	10.10.2.39	Beckwith Electric M-2001D...	N	3	1	1	1	NA	N	NA	NA	NA	NA	NA	NA	NA	NA
1245	10.10.2.100	UTEP M-2001D	N	-24	1	1	1	NA	N	NA	NA	NA	NA	NA	NA	NA	NA

Figure 5-18 Master/Follower Configuration Tool Dialog Screen

The Configuration Tool allows the user to enter the following settings:

- Paralleling Mode – Master/Follower Paralleling Mode is automatically changed to Master/Follower when settings are written to the control.
- Paralleling Address – The unique address for each device (Range 1 – 16)
- Mode – Master/Follower mode of operation. M = Master, F= Follower, N = None
- Tap Difference – The difference between Master and Follower tap positions for which Lockout will be issued.
- Tap Position Response Timeout – Time within which the Followers have to be at the same tap position as that of the Master (Range 1000 ms – 60000 ms).

  If the Tap Position Response Timeout is greater than the Intertap Delay setting, then the Tap Position Response Timeout is used as the Intertap Delay, so that the Master waits for all the Followers to make a tapchange before the Master takes the next tap.
- # Devices – The number of total devices that are in the paralleling scheme (maximum 16 inclusive of the Master)
- Breaker In Use (A1) – Option to use the Line Breaker Status in the algorithm.
- Breaker Polarity – Positive or negative polarity of the Line Breaker.
- Right TB In Use (A2) – Option to use the Right Tie Breaker Status in the algorithm.
- Right TB Polarity – Positive or negative polarity of the Right Tie Breaker.
- Left TB In Use (A3) – Option to use the Left Tie breaker Status in the algorithm.
- Left TB Polarity – Positive or negative polarity of the Left Tie Breaker.

Setting Masters and Followers From TapTalk

A minimum of 2 controls are required for the paralleling scheme to work. The Master unit will be configured first and then the Follower(s).

■**NOTE**: This procedure requires communication to be established with the target control (Master or Follower) with Level 2 Access.

Master Control Setup From TapTalk

To set up the Master Control(s) utilizing TapTalk® perform the following:

1. Verify that the appropriate Setup Settings have been entered for the control application.
2. Place the Master Control to be setup in Manual by selecting "Block" from the Remote Control dialog screen (Figure 5-19) "Remote Operation/Block Auto Control via Communication (Comm Block)" section.
3. Select Paralleling Type to be "Master/Follower" from the "Paralleling" section of the "Configuration" dialog screen (Figure 5-8) .
4. Select "None" from the "Master/Follower Configuration" section of the "Configuration" dialog screen .

■**NOTE**: The Master/Follower Configuration settings can also be set utilizing the Master/Follower Configuration Tool Figure 5-18.

5. Enter the desired Master/Follower Configuration Settings from the "Master/Follower Configuration Settings" section of the "Configuration" dialog screen:
   - Paralleling Address (1 to 16) – The Master Paralleling Address must be the highest address in the network. All Follower addresses must be a value less than the Master.

     The control's position in the paralleling network is determined by its paralleling address. As shown in Figure 5-16, Position 1 should be assigned a paralleling address of 1, Position 2 a paralleling address of 2 and so on, in an ascending order. In this example the Master control will be in Position 8 with a Paralleling Address of 8.
   - Number of Devices (2 to 16)
   - Tap Difference (2 to 8)
   - Tap Position Response Timeout (1000 to 60000 ms)

     The Tap Position Response Timeout is the time within which the Followers have to be at the same tap position as that of the Master (Range 1000 ms – 60000 ms).

     If the Tap Position Response Timeout is greater than the Intertap Delay setting, then the Tap Position Response Timeout is used as the Intertap Delay, so that the Master waits for all the Followers to make a tapchange before the Master takes the next tap.
   - Line Breaker "Not In Use" or "In Use" (Auxiliary Input A1)
   - Line Breaker Polarity "Positive" or "Negative"
   - Right Tie Breaker "Not In Use" or "In Use" (Auxiliary Input A2)
   - Right Tie Breaker Polarity "Positive" or "Negative"
   - Left Tie Breaker "Not In Use" or "In Use" (Auxiliary Input A3)
   - Left Tie Breaker Polarity "Positive" or "Negative"

■**NOTE**: Followers are in remote manual mode and operate in "Pulse Mode" regardless of the mode of operation of the Raise/Lower Output contacts.

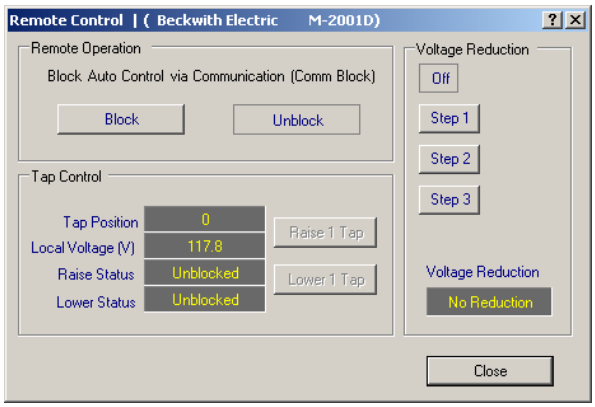


Figure 5-19 Remote Control Dialog Screen

Follower Control Setup From TapTalk

To set up the Follower Control(s) utilizing TapTalk® perform the following:

1. Verify that the appropriate Setup Settings have been entered for the control application.
2. Verify that the designated network Master Control operational mode is as follows:
   - The control is in "Manual".
   - The "Master/Follower Configuration" section of the Configuration dialog screen is selected to "None".
3. Select Paralleling Type to be "Master/Follower" from the "Paralleling" section of the "Configuration" dialog screen (Figure 5-8) .
4. Select "Follower" From the "Master/Follower Configuration" section of the "Configuration" dialog screen .
5. Enter the desired Master/Follower Configuration Settings from the "Master/Follower Configuration Settings" section of the "Configuration" dialog screen:
   - Paralleling Address (1 to 16) – The Follower Paralleling Address must be a value less than the Master.

     The control's position in the paralleling network is determined by its paralleling address. As shown in Figure 5-16, Position 1 should be assigned a paralleling address of 1, Position 2 a paralleling address of 2 and so on, in an ascending order. In this example the Master control will be in Position 8 with a Paralleling Address of 8.
   - Number of Devices (2 to 16)
   - Tap Difference (2 to 8)
   - Tap Position Response Timeout (1000 to 60000 ms)

     The Tap Position Response Timeout is the time within which the Followers have to be at the same tap position as that of the Master (Range 1000 ms – 60000 ms).

     If the Tap Position Response Timeout is greater than the Intertap Delay setting, then the Tap Position Response Timeout is used as the Intertap Delay, so that the Master waits for all the Followers to make a tapchange before the Master takes the next tap.
   - Line Breaker "Not In Use" or "In Use" (Auxiliary Input A1)
   - Line Breaker Polarity "Positive" or "Negative"
   - Right Tie Breaker "Not In Use" or "In Use" (Auxiliary Input A2)
   - Right Tie Breaker Polarity "Positive" or "Negative"
   - Left Tie Breaker "Not In Use" or "In Use" (Auxiliary Input A3)
   - Left Tie Breaker Polarity "Positive" or "Negative"
6. Drive the Follower Tap Position to match the Master Tap Position.
7. Repeat Steps 3 through 6 for each Follower in the Master/Follower scheme.
8. Determine the Master Band Status, then proceed as follows:

- If the Master Band Status is "In-Band", then:

  a. Select "Master" from the Master, "Master/Follower Configuration" section of the "Configuration" dialog screen.

▲ **CAUTION:** After placing the Master control in "Master" the Master will not respond to any tapchange requests for 32 seconds.

  b. When at least 32 seconds have elapsed, initiate a Raise or Lower tapchange from the Master, Remote Control dialog screen (Figure 5-19) "Tap Control" section.

  c. Verify that all Followers initiate tapchanges to match the Master tap position.

d. Return the Master to an "In-Band" tap position.

e. Select "Unblock" from the Master, Remote Control dialog screen (Figure 5-19) "Remote Operation/Block Auto Control via Communication (Comm Block)" section.

- If the Master Band Status is not In-Band, then:

a. Adjust the Master tap position by initiating a tapchange as necessary to bring the Master Band Status "In-Band" from the Master, Remote Control dialog screen (Figure 5-19) "Tap Control" section.

b. Drive each Follower tap position in the Master/Follower scheme to match the Master tap position.

c. Select "Master" from the Master, "Master/Follower Configuration" section of the "Configuration" dialog screen.

▲ **CAUTION:** After placing the Master control in "Master" the Master will not respond to any tapchange requests for 32 seconds.

d. When at least 32 seconds have elapsed, initiate a Raise or Lower tapchange from the Master, Remote Control dialog screen (Figure 5-19) "Tap Control" section.

e. Verify that all Followers initiate tapchanges to match the Master tap position.

f. Return the Master to an "In-Band" tap position.

g. Select "Unblock" from the Master, Remote Control dialog screen (Figure 5-19) "Remote Operation/Block Auto Control via Communication (Comm Block)" section.

9. The Master/Follower Paralleling scheme is now in effect.

Setting Masters and Followers From The HMI

A minimum of 2 controls are required for the paralleling scheme to work. The Master unit will be configured first and then the Follower(s).

Master Control Setup From The HMI

■**NOTE**: This procedure requires Level 2 Access.

To set up the Master Control utilizing the HMI perform the following:

1. Verify that the appropriate Setup Settings have been entered for the control application.
2. Place the Master Control to be setup in Manual.
3. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

4. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

5. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Paralleling" menu.

```
         Paralleling
←                        →
```

6. Press the Down arrow pushbutton, as necessary, until the "Paralleling Type" screen is displayed.

```
Paralleling Type
DISABLE
```

7. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 10.

```
Paralleling Type
DISABLE                    C
```

8. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

9. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Paralleling Type
DISABLE                    C
```

   If not, re-enter a valid code.

10. Utilizing the arrow pushbuttons, select the Paralleling Type to be "MASTER/FOLLOWER", then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Paralleling Type
MASTER/FOLLOWER
```

11. Press the Down arrow pushbutton once, the "Master/Follower" screen will be displayed.

```
Master/Follower
NONE, MASTER, FOLLOWER
```

12. Verify that the Master/Follower Configuration is selected to "NONE".
    - If the Master/Follower Configuration is set to "NONE", go to Step 13.
    - If the Master/Follower Configuration is not set to "NONE" utilize the arrow pushbuttons to select "NONE", then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Master/Follower
NONE
```

■**NOTE**: From this point on in this procedure it is assumed that a valid Access Level 2 has been entered. If the Level 2 Access Prompt is displayed, then it will be necessary to re-enter the valid Level 2 Access Code as described in Step 9.

13. Press the Down arrow pushbutton once, the "Paralleling Address" screen will be displayed.

```
Paralleling Address
  16
```

   The Master Paralleling Address must be the highest address in the network. All Follower addresses must be a value less than the Master.

   The control's position in the paralleling network is determined by its paralleling address. As shown in Figure 5-16, Position 1 should be assigned a paralleling address of 1, Position 2 a paralleling address of 2 and so on, in an ascending order. In this example the Master control will be in Position 8 with a Paralleling Address of 8.

14. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Paralleling Address
  16                       C
```

15. Utilizing the arrow pushbuttons, enter the desired Paralleling Address (1 to 16) then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Paralleling Address
   1 to 16
```

16. Press the Down arrow pushbutton once, the "Num. Devices" screen will be displayed.

```
Num. Devices
   2
```

Number of Devices is the number of total devices that are in the paralleling scheme (maximum 16 inclusive of the Master)

17. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Num. Devices
   2                          C
```

18. Utilizing the arrow pushbuttons, enter the total Number of Devices in the Master/Follower network (maximum of 16 including Master) then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Num. Devices
   2 to 16
```

19. Press the Down arrow pushbutton once, the "T.P.R. Timeout" screen will be displayed.

```
T.P.R. Timeout
   60000 ms
```

The Tap Position Response Timeout is the time within which the Followers have to be at the same tap position as that of the Master (Range 1000 ms – 60000 ms).

If the Tap Position Response Timeout is greater than the Intertap Delay setting, then the Tap Position Response Timeout is used as the Intertap Delay, so that the Master waits for all the Followers to make a tapchange before the Master takes the next tap.

20. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
T.P.R. Timeout
   60000 ms                   C
```

21. Utilizing the arrow pushbuttons, enter the desired Tap Position Response Timeout (1000 ms to 60000 ms) then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
T.P.R. Timeout
   XXXXX  ms
```

22. Press the Down arrow pushbutton once, the "Breaker Option" screen will be displayed.

```
Breaker Option
      000000
```

23. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
line breaker
      000000                  C
```

24. Utilizing the arrow pushbuttons, enter the desired Breaker Options:

■**NOTE**: Position 1 is the first position from the right.

Position 1 – Line Breaker (A1)
"0" = Not Selected
"1" = Selected

Position 2 – Line Breaker Polarity
"0" = Positive
"1" = Negative

Position 3 – Right Tie Breaker (A2)
"0" = Not Selected
"1" = Selected

Position 4 – Right Tie Breaker Polarity
"0" = Positive
"1" = Negative

Position 5 – Left Tie Breaker (A3)
"0" = Not Selected
"1" = Selected

Position 6 – Left Tie Breaker Polarity
"0" = Positive
"1" = Negative

When all Breaker Options have been entered, then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Breaker Option
      XXXXXX
```

25. Press the Down arrow pushbutton once, the "Tap Difference" screen will be displayed.

```
Tap Difference
  2
```

The Tap Difference setting is the difference between Master and Follower tap positions for which Lockout will be issued.

26. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Tap Difference
  2                          C
```

27. Utilizing the arrow pushbuttons, enter the desired Tap Difference setting (2 to 8) then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Tap Difference
   2 to 8
```

Follower Control Setup From HMI

■**NOTE**: This procedure requires Level 2 Access.

To set up the Follower Control(s) utilizing the HMI perform the following:

1. Verify that the appropriate Setup Settings have been entered for the control application.
2. Verify that the designated network Master Control operational mode is as follows:
   - The control is in "Manual"
   - The "Master/Follower Configuration" section of the Configuration dialog screen is selected to "None".

   If the designated network Master Control is not in the operational mode described above, then take the necessary steps to place the control in the described operational mode before continuing in this procedure.
3. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

4. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

5. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Paralleling" menu.

```
          Paralleling
←                        →
```

6. Press the Down arrow pushbutton, as necessary, until the "Paralleling Type" screen is displayed.

```
Paralleling Type
DISABLE
```

7. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 10.

```
Paralleling Type
DISABLE                      C
```

8. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

–
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

9. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Paralleling Type
DISABLE                      C
```

   If not, re-enter a valid code.

10. Utilizing the arrow pushbuttons, select the Paralleling Type to be "MASTER/FOLLOWER", then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Paralleling Type
MASTER/FOLLOWER
```

11. Press the Down arrow pushbutton once, the "Master/Follower" screen will be displayed.

```
Master/Follower
NONE, MASTER, FOLLOWER
```

12. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Master/Follower
NONE                          C
```

13. Utilizing the arrow pushbuttons select "FOLLOWER", then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Master/Follower
FOLLOWER
```

■**NOTE**: From this point on in this procedure it is assumed that a valid Access Level 2 has been entered. If the Level 2 Access Prompt is displayed, then it will be necessary to re-enter the valid Level 2 Access Code as described in Step 9.

14. Press the Down arrow pushbutton once, the "Paralleling Address" screen will be displayed.

```
Paralleling Address
  16
```

The Master Paralleling Address must be the highest address in the network. All Follower addresses must be a value less than the Master.

The control's position in the paralleling network is determined by its paralleling address. As shown in Figure 5-16, Position 1 should be assigned a paralleling address of 1, Position 2 a paralleling address of 2 and so on, in an ascending order. In this example the Master control will be in Position 8 with a Paralleling Address of 8.

15. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Paralleling Address
  16                          C
```

16. Utilizing the arrow pushbuttons, enter the desired Paralleling Address (1 to 16) then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Paralleling Address
   1 to 16
```

17. Press the Down arrow pushbutton once, the "Num. Devices" screen will be displayed.

```
Num. Devices
  2
```

Number of Devices is the number of total devices that are in the paralleling scheme (maximum 16 inclusive of the Master)

18. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Num. Devices
  2                           C
```

19. Utilizing the arrow pushbuttons, enter the total Number of Devices in the Master/Follower network (maximum of 16 including Master) then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Num. Devices
   2 to 16
```

20. Press the Down arrow pushbutton once, the "T.P.R. Timeout" screen will be displayed.

```
T.P.R. Timeout
  60000 ms
```

The Tap Position Response Timeout is the time within which the Followers have to be at the same tap position as that of the Master (Range 1000 ms – 60000 ms).

If the Tap Position Response Timeout is greater than the Intertap Delay setting, then the Tap Position Response Timeout is used as the Intertap Delay, so that the Master waits for all the Followers to make a tapchange before the Master takes the next tap.

21. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
T.P.R. Timeout
  60000 ms                C
```

22. Utilizing the arrow pushbuttons, enter the desired Tap Position Response Timeout (1000 ms to 60000 ms) then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
T.P.R. Timeout
  XXXXX ms
```

23. Press the Down arrow pushbutton once, the "Breaker Option" screen will be displayed.

```
Breaker Option
     000000
```

24. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
line breaker
     000000                C
```

25. Utilizing the arrow pushbuttons, enter the desired Breaker Options:

■**NOTE**: Position 1 is the first position from the right.

Position 1 – Line Breaker (A1)
"0" = Not Selected
"1" = Selected

Position 2 – Line Breaker Polarity
"0" = Positive
"1" = Negative

Position 3 – Right Tie Breaker (A2)
"0" = Not Selected
"1" = Selected

Position 4 – Right Tie Breaker Polarity
"0" = Positive
"1" = Negative

Position 5 – Left Tie Breaker (A3)
"0" = Not Selected
"1" = Selected

Position 6 – Left Tie Breaker Polarity
"0" = Positive
"1" = Negative

When all Breaker Options have been entered, then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Breaker Option
     XXXXXX
```

26. Press the Down arrow pushbutton once, the "Tap Difference" screen will be displayed.

```
Tap Difference
  2
```

The Tap Difference setting is the difference between Master and Follower tap positions for which Lockout will be issued.

27. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed.

```
Tap Difference
  2                          C
```

28. Utilizing the arrow pushbuttons, enter the desired Tap Difference setting (2 to 8) then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Tap Difference
   2 to 8
```

29. Drive the Follower Tap Position to match the Master Tap Position.

30. Repeat Steps 3 through 25 for each Follower in the Master/Follower scheme.

31. Determine the Master "Band Status" by navigating on the Master HMI menu to the "Monitor/Status" menu item, then proceed as follows:

    a. Press the Down arrow pushbutton as necessary to navigate to the "Tapchanger Status" screen.

```
Press ENT to view
Tapchanger Status
```

    b. Press the ENT pushbutton. The control will display a summary of the Tapchanger Status parameters

```
TAP BDS PWR BLK VRD
  0  lo fwd --- off
```

BDS = Band Status "lo, hi, ok"

32. If the Master Band Status is not In-Band, then:

    a. Adjust the Master tap position by initiating a tapchange as necessary to bring the Master Band Status In-Band.

    b. Drive each Follower tap position in the Master/Follower scheme to match the Master tap position

33. If the Master Band Status is In-Band "ok", then:

    a. From the Master Control HMI, navigate to the Master, "Master/Follower" menu.

```
Master/Follower
NONE
```

    b. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step e.

```
Master/Follower
NONE                          C
```

    c. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

    d. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

    If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Master/Follower
NONE                          C
```

If not, re-enter a valid code.

e. Utilizing the arrow pushbuttons select "MASTER", then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Master/Follower
MASTER
```

▲ **CAUTION:** After placing the Master control in "Master" the Master will not respond to any tapchange requests for 32 seconds.

f. When at least 32 seconds have elapsed, initiate a Raise or Lower tapchange.

g. Verify that all Followers initiate tapchanges to match the Master tap position.

h. Return the Master to an In-Band tap position, then place the Master Control in Automatic.

34. The Master/Follower Paralleling scheme is now in effect.

5.4 Tap Settings

TAP INFORMATION

The M-2001D Digital Tapchanger Control tap position information applies to many different configurations of tapchangers, e.g., ±16 taps, 1 to 17 taps, ±10 taps, 1 to 33 taps, etc. Two configuration points, Lowest Tap and Highest Tap, are assigned to allow the user to select the range of a specific tap changer. The Highest Tap range is 0 to 33 taps, and the Lowest Tap range is –33 to +29 taps. The user is able to program the control to select the method of tap position knowledge or to disable this feature. Table 5-1, outlines the ten selections available for the Tap Information screen.

Load Tapchanger (LTC) Positive Tap Position Knowledge

With the advent of Smart Grid initiatives, Utility SCADA systems require positive tap position information for Real Time Power Flow Calculations that are required for proper implementation of their Integrated Volt VAr Management (IVVM) programs. This section reviews several different methods that can be used to provide positive tap position knowledge in LTC transformer applications. The following positive tap position knowledge methods will be reviewed that can be applied in new and retrofit applications depending on installed equipment.

- Contact KeepTrack™
- Shaft Coupled KeepTrack™
- Resistor Divider KeepTrack™
- Motor Direct Drive KeepTrack™

Screen Selections	Tap Position Knowledge Method	Current Range	Screens Disabled
XFMR EXTERNAL #3	Current Loop	0 to 1 mA	Source Voltage
XFMR EXTERNAL #2	Current Loop	4 to 20 mA	Source Voltage
XFMR EXTERNAL #1	Current Loop	0 to 1; 0 to 2; or ±1 mA	Source Voltage
REG EXTERNAL #3	Resistor Divider	Not Applicable	None
REG EXTERNAL #2	Current Loop	4 to 20 mA	None
REG EXTERNAL #1	Current Loop	0 to 1; 0 to 2; or ±1 mA	None
INTERNAL KEEPTRACK	Motor Direct Drive KeepTrack	Not Applicable	None
CONTACT KT 1R1L	Direct Contact KeepTrack	Not Applicable	None
CONTACT KT 1N	Direct Contact KeepTrack	Not Applicable	None
DISABLE	None	None	Source Voltage, Tap Position

Table 5-1 Tap Information Screen Selections

Contact KeepTrack™

M-2001D Tapchanger Control Firmware Version D-0214V01.06.04 and above include the 1R/1L and 1N Contact KeepTrack methods. No cost firmware upgrades are available for M-2001D Tapchanger Controls with earlier firmware versions.

There are two basic methods of Contact KeepTrack. The applicable method used depends on whether a neutral contact is available that will **always stay closed while the LTC is on neutral, including multiple neutrals**. Both methods require that up to four contacts be available and accessible in the LTC to operate correctly.

The original M-2001D Voltage Reduction inputs are now used for the Aux Raise and Aux Lower Inputs required by the Contact KeepTrack methods. Thus, the voltage reduction function via physical contacts will not be available when Contact KeepTrack is selected, but voltage reduction via communications is not affected.

The Raise and Lower Outputs from the control must agree with the operation of the external Aux Raise and Aux Lower status contacts, and this must be maintained whether the tapchanger is on the low or the high side of the transformer.

The Neutral input on the M-2001D is used for Tap Calibration in the Contact KeepTrack method.

Contact KeepTrack Method I – Using 1R/1L Contact Input

If the neutral contact can't be used, the following four Cam switch based dry contacts are required.

- Aux Raise contact – This contact must close and open once between taps each time the LTC takes a tap in only the Raise direction.
- Aux Lower contact – This contact must close and open once between taps each time the LTC takes a tap in only the Lower direction.
- 1R contact – This contact must close when the tapchanger moves onto the 1 Raise tap position and open when leaving it.
- 1L Contact – This contact must close when the tapchanger moves onto the 1 Lower tap position and open when leaving it.

All four contacts must be either dry contacts or run through auxiliary relay contacts if wet. The M-2001D control Voltage Reduction, Neutral, and Counter inputs require dry inputs wetted internally with 12 Vdc. The conceptual diagram illustrated in Figure 5-8 assumes dry contacts are available. The conceptual diagram illustrated in Figure 5-9 assumes the contacts are wetted with 120 Vac.

Example of Contact KeepTrack Method I – Using 1R/1L Contact Input

In this example, an out-of-band condition occurs which causes the raise output from the M-2001D to turn on. This will cause current to flow to the motor causing it to start a raise operation. The Aux Raise contact will close which will send directional feedback to the VR1 Input of the M-2001D. This will tell the control to increment the Contact KeepTrack tap position by 1 tap.

Once the raise operation is completed, the Aux Raise contact will open removing the input to VR1. When the unit no longer requires a raise output the raise output from the control will be turned off. If a lower operation is required then the same steps will occur except that Aux Lower contact will close and VR2 will be used.

Activation of the 1R contact in conjunction with the Aux Raise contact closing, then opening will cause the Contact KeepTrack tap position to be set to 1R. If the next operation results in the 1R contact opening in conjunction with the Aux Lower contact closing then opening, then Contact KeepTrack will increment to Neutral. Once in Neutral, the control will continue to display Neutral until either the 1R or 1L contact operates in conjunction with the appropriate Aux Raise or Lower contact. That allows the control to compensate for multiple neutrals.

M-2001D With Raise/Lower Contact KeepTrack™ Feedback Inputs

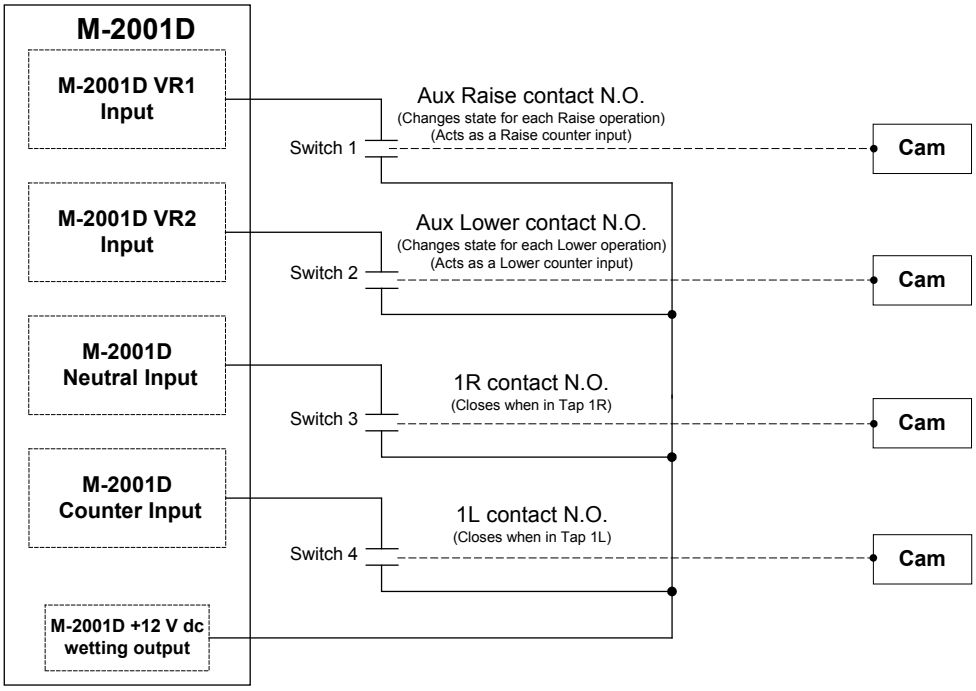


Figure 5-20 Cam Switches Available With Dry Contacts

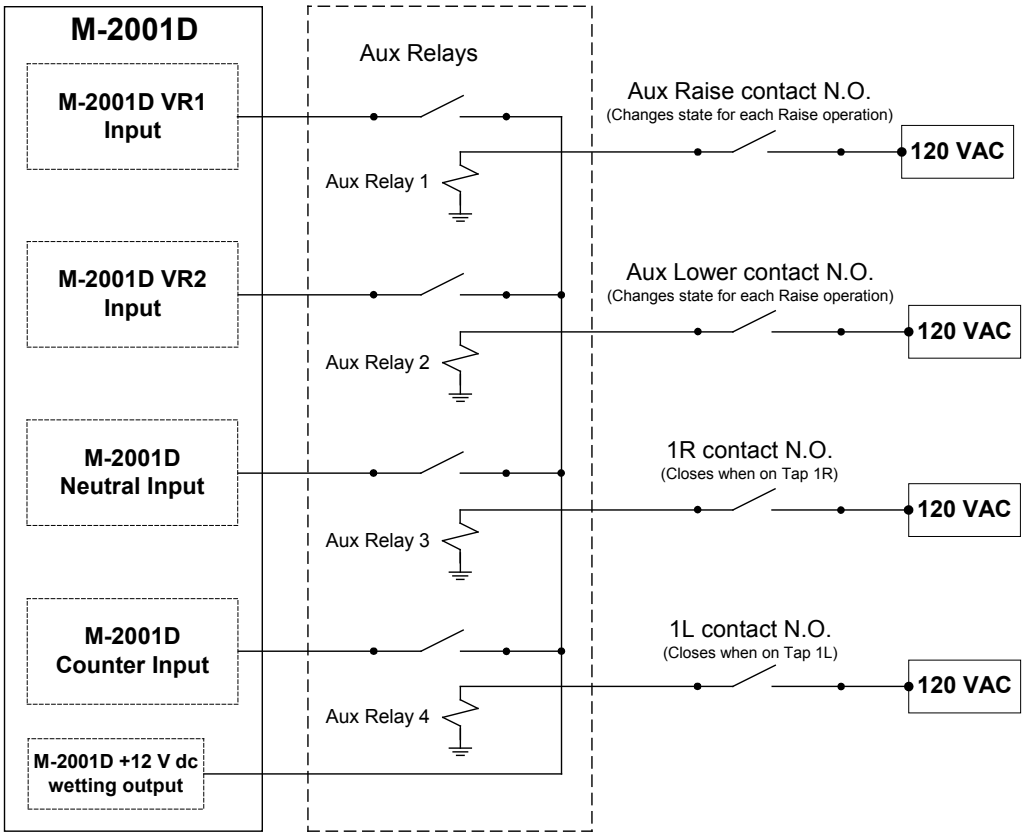


Figure 5-21 Cam Switches Available With Wetted 120 Vac

Contact KeepTrack Method II – Using Neutral Contact Input

This method provides Contact KeepTrack for LTC transformers that have dedicated Raise, Lower, and a Neutral contact that stays closed while the LTC is on neutral, including multiple neutrals. A Counter contact may also be required.

This Contact KeepTrack method requires a pulsed input for each tap operation either raise or lower. The raise contact input to the M-2001D must close and open each time the tap position raises by one tap as is the case when the contacts are derived from Cam switches. Likewise the lower contact input to the M-2001D must close and open each time the tap position lowers by one tap.

If the contacts are derived from 84R and 84L relays, an additional contact derived from the operations counter must be placed in series with them to provide the required pulsed input. With these inputs the M-2001D Control can "keep track" of the tap position since it will always receive either a raise or lower pulse as an indication of which direction the tapchanger is moving.

The neutral contact input recalibrates the control tap position to neutral if needed. This provides an extremely positive indication that the tapchanger is performing either a raise or lower operation.

To implement the Contact KeepTrack™ Method II scheme with contacts derived from Cam switches, the Contact KeepTrack method requires that three contacts be available and accessible in the LTC to operate correctly.

- Aux Raise contact – This contact closes when the LTC takes a tap in the Raise direction.
- Aux Lower contact – This contact closes when the LTC takes a tap in the Lower direction.
- Neutral contact – This contact must close when the unit moves onto the Neutral tap position and open when leaving it.

All three contacts must be either dry contacts or run through auxiliary relay contacts if wet. The M-2001D Voltage Reduction inputs, now used for the Aux Raise and Aux Lower contact inputs, and the Neutral input require dry contacts wetted internally with 12 Vdc. The conceptual diagram illustrated in Figure 5-10 assumes dry contacts are available.

To implement the Contact KeepTrack Method II scheme with 84R and 84L derived contacts, the KeepTrack method requires that four contacts be available and accessible in the LTC to operate correctly.

- Aux Raise contact – This contact closes when the LTC takes a tap in the Raise direction.
- Aux Lower contact – This contact closes when the LTC takes a tap in the Lower direction.
- Counter contact – This contact is only required when using Aux Relays and must close and open when the unit moves in either the Raise or Lower tap position.
- Neutral contact – This contact must close when the unit moves onto the Neutral tap position and open when leaving it.

Auxiliary relays must be connected to the 84R and 84L contacts to provide dry contacts for the Aux Raise and Aux Lower inputs. The Neutral and Counter contacts must be either dry contacts or run through auxiliary relay contacts if wet. The Aux Raise and Aux Lower contacts are connected in series with a dry Operations Counter contact. They are then wetted with the M-2001D's internal 12 Vdc wetting voltage thereby providing the required pulsed signals to properly increment tap position. The conceptual diagram illustrated in Figure 5-11 assumes wet contacts are available.

Example of Contact KeepTrack Method II – Using Neutral Contact Input (with 84R/84L derived contacts)

In this example, an out-of-band condition occurs which causes the raise output from the M-2001D to turn on or a manual operation is initiated. This will cause current to flow to the motor and it will start a raise operation. The Aux Raise contact will close and then the counter contact will close once the tap change is in process. When both of these contacts close they will send directional feedback to the VR1 Input of the M-2001D. This will tell the control to increment the KeepTrack tap position by 1 tap.

If more than one tap raise is needed, the raise contact will stay closed and the Counter contact is used to open the Aux Raise contact circuit removing the input to VR1 resulting in the correct tap position being kept. When the unit no longer requires a raise output, the raise output from the control will be turned off. If a lower operation is required, then the same steps will occur except that Aux Lower contact will close and VR2 will be used.

As a verification scheme, a contact that closes when the tapchanger is on the neutral position is also used as an input to the M-2001D control. When this Cam operated contact closes, the control recalibrates the tap position to neutral if needed. As an example, if the tap position is on 1R and a lower command is issued, the tapchanger moves to the neutral position, and when the neutral contact closes, the control would recalibrate the tap position if it was not already indicating neutral. If there are multiple neutral positions the neutral contact would need to be closed on all the neutral positions.

M-2001D With Raise/Lower Contact KeepTrack™ Feedback Inputs

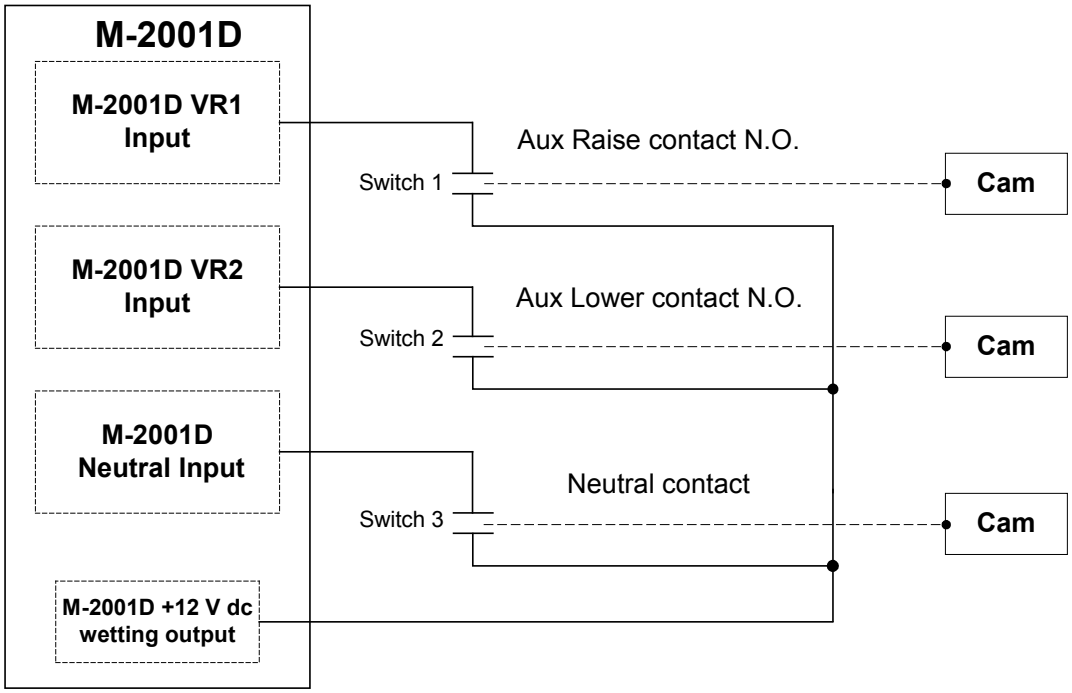


Figure 5-22 Cam Switches Available

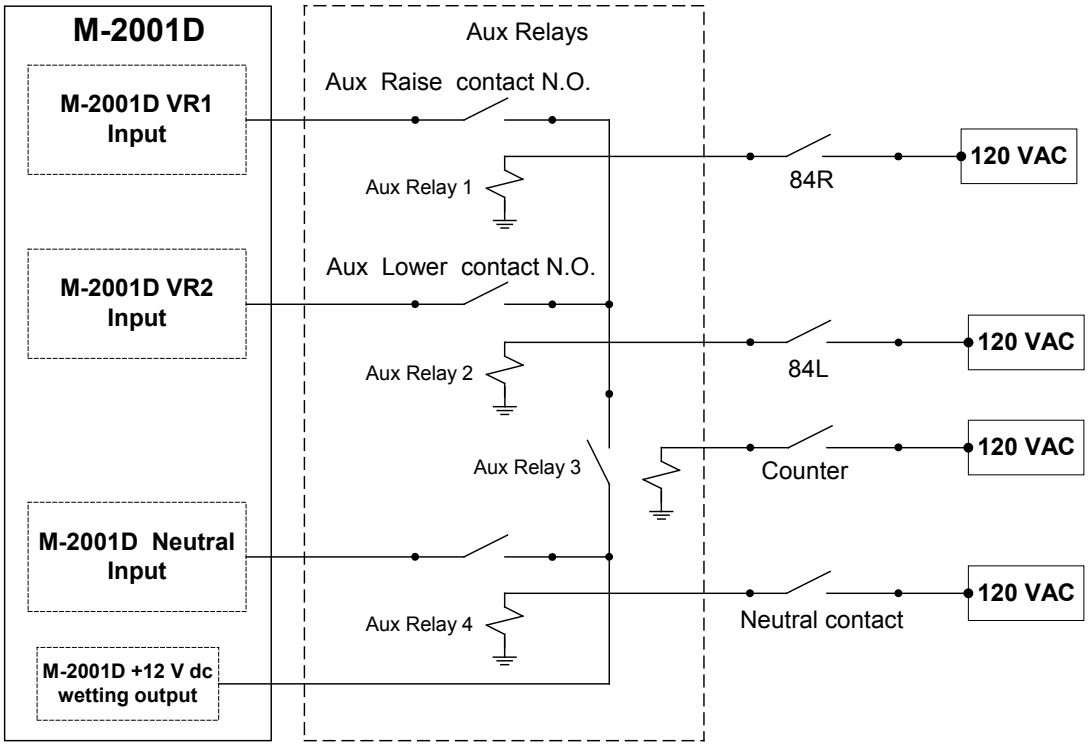


Figure 5-23 84R and 84L Aux Relays Available With Wetted 120 VAC

Shaft Coupled KeepTrack™ Tap Position Knowledge

Applicable controls and accessories for both Shaft Coupled KeepTrack Methods include:

- M-2001D Tapchanger Controls
- Beckwith Electric M-2025B(D) Current Loop Interface
- Beckwith Electric M-2948 Tap Position Sensor

  OR
- INCON 1292 Synchro Transmitter and 1250 Tap Position Monitor

Beckwith Electric Shaft Coupled KeepTrack Method

If Cam positions are not available and switches can not be retrofitted, a Shaft Coupled KeepTrack method can be used. Most LTC tapchangers have an output shaft on the tapchanger mechanism whose angular position is a mechanical analog of the tapchanger tap position. For these applications, the following methods can be used to provide positive tap position knowledge.

Figure 5-24 represents a typical application of the Beckwith Electric Model M-2948 Tap Position Sensor. The tap position sensor is a rotary shaft encoder with a built-in microprocessor that provides stepped output signals in 9 or 10 degree increments. The tap position sensor is available in both clockwise and counter-clockwise rotation configurations for increasing tap position. It has rotations of 0° to 297°, 306°, 315°, 330°, 340° and 350° degrees to accommodate tapchangers with 32 taps, 9 or 10 degrees per tap, and one to three neutral positions.

Thus, the information needed from an individual transformer is: the number of degrees per tap (always 9 or 10), rotation of the Tap Position Sensor, and the number of neutral tap positions. The sensor requires a +12 V dc power input that is supplied from the M-2001 control via the M-2025D. The electrical output of the M-2948 Tap Position Sensor is a 4-20 mA current loop that is converted to a voltage signal at the input of the M-2025D Current Loop Interface with the addition of a shunt resistor. The resultant voltage signal is conditioned in the M-2025D Current Loop Interface and routed to the M-2001D Tapchanger Control where the voltage is converted to a corresponding tap position number. The scheme can be used with all M-2001D Tapchanger Controls.

If replacing an INCON Tap Position Monitoring device, the INCON 1292 Synchro Transmitter is removed and the Beckwith Electric M-2948 Tap Position Sensor mounts in the existing bracket and uses the existing flexible coupling shaft.

Beckwith Electric-INCON Shaft Coupled KeepTrack Method

If tap position sensors already exist such as the INCON 1292 Synchro Transmitter, the shaft coupled KeepTrack method is still applicable. The INCON 1292 Synchro Transmitter is an electromagnetic device that resembles a small electric motor. Although various configurations of internal windings are used, they typically excite rotor winding(s), and induce AC signal voltages in the stator windings which can be compared in amplitude and polarity to determine the angular position of the rotor shaft.

This application is traditionally used with the INCON 1250 Tap Position Monitoring device (Figure 5-25). The INCON 1250 supplies the 120 VAC to the INCON 1292 rotor winding(s). It then measures the resulting signals from the stator winding to determine the shaft's rotational position. This information is converted to a tap number and displayed on the front panel numeric readout. An analog current signal is also generated which corresponds to tap position. The M-2025B(D) Current Loop Interface module accepts this current analog. The scheme can be used with all M-2001D Load Tap Changer models.

Connection of the optional M-2025B(D) will require either a B-0752 (5 pin to 6 pin) or B-0753 (6 pin to 6 pin) interface cable. See M-2025B(D) Specification for details.

The transformer (XFMR) and regulator (REG) external setting is for use with the Positive Knowledge (current loop) system, except REG #3, which is designed to be used with a Toshiba resistive voltage divider. Selecting either **XFMR** or **REG** will determine which screens are disabled, and then selecting either #1, #2, or #3 will depend on the output current or voltage signal from the Tap Position monitor. Table 5-1 outlines the options available for the Tap Information screen.

The user initializes the control at a given, known, tap position upon installation, by following the steps described later in this section. See "Initializing Tap Position when Regulate (Reg or XFMR) External or Contact KeepTrack™ 1R1L/1N is Active" for detailed steps for entering the tap position using the HMI or TapTalk®.

■ **NOTE:** To obtain accurate calibration, it is suggested that the calibration should be performed near the neutral tap for 0 to 1, 0 to 2 and 4 to 20 mA, and at tap position 8 R or 8 L in the case of –1 to +1 mA range.

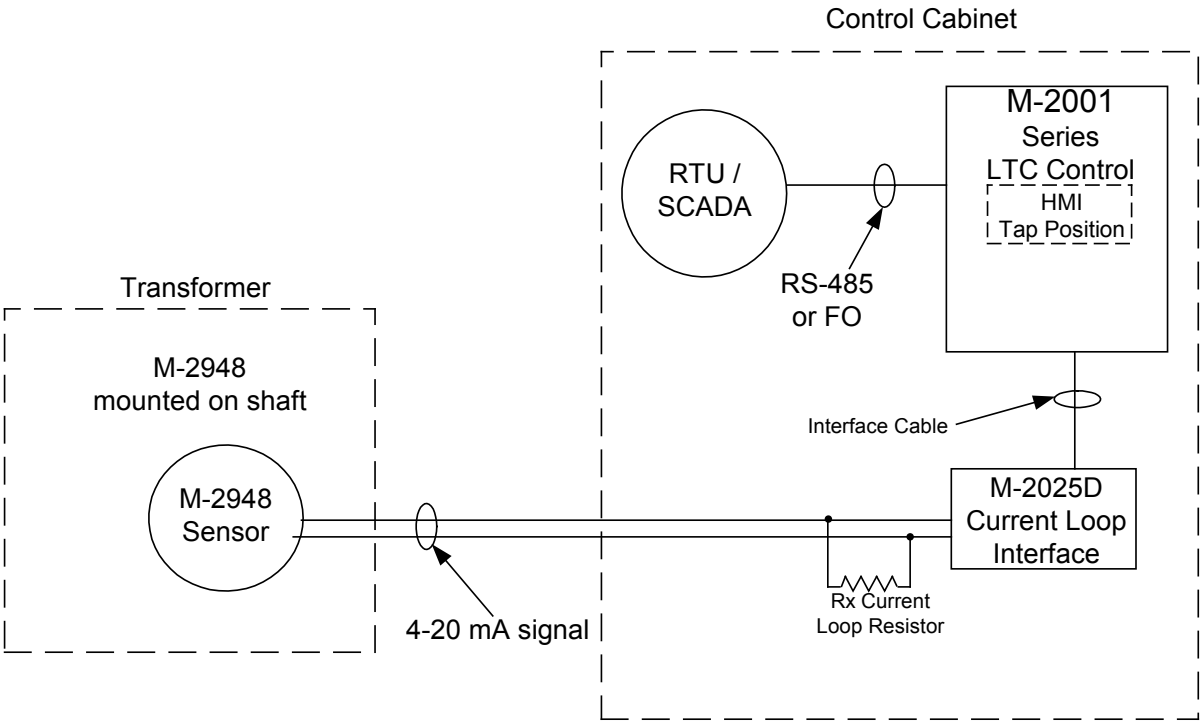


Figure 5-24 Tap Position Scheme Using Shaft Coupled KeepTrack

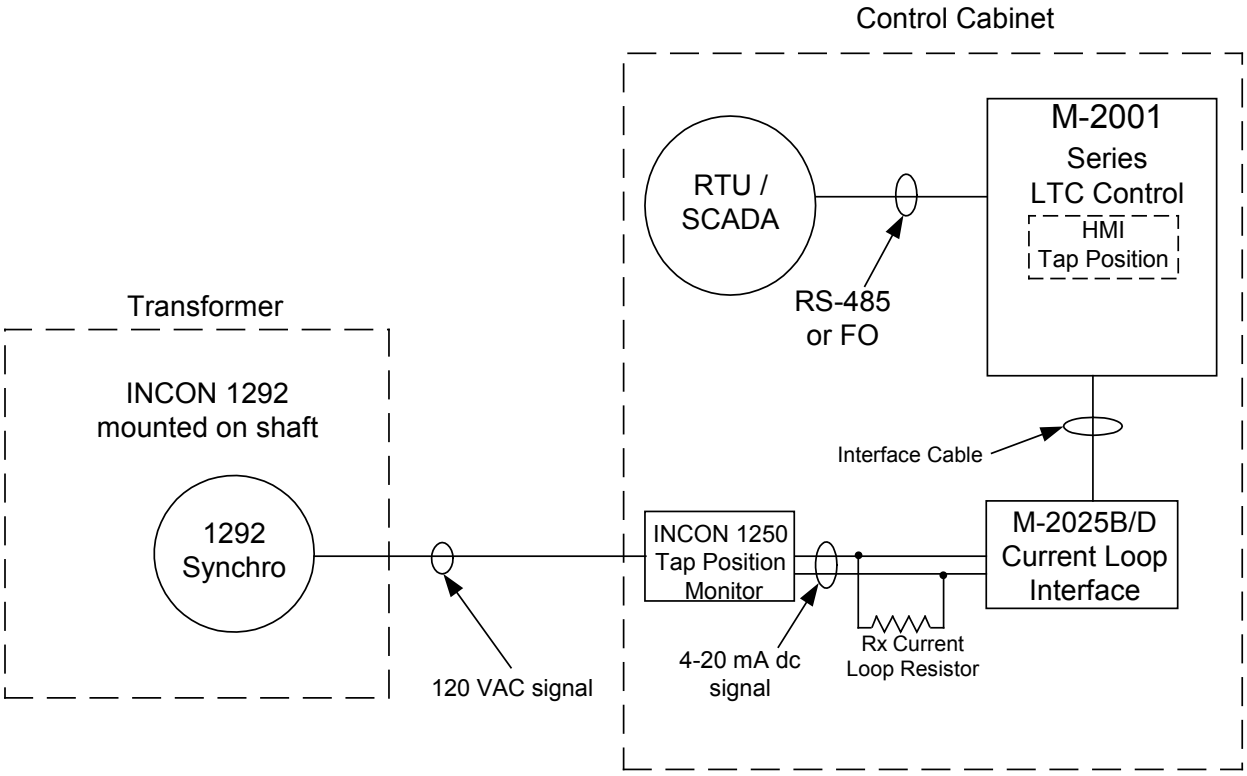


Figure 5-25 Tap Position Scheme Using INCON Devices

Resistor Divider KeepTrack™ Tap Position Knowledge For LTCs

Applicable controls and accessories for Resistor Divider KeepTrack Method include:

- M-2001D Tapchanger Controls
- Beckwith Electric M-2025B(D) Current Loop Interface
- Existing installations may use the Crompton Model 253-TRTU transducer or the Rochester Instrument Systems Model PR-2050 transducer (both now obsolete).
- New installations or existing installations with failed transducers use the Carrel Precision Model T-R Series transducer (or equivalent).

The typical application (Figure 5-26) uses a resistor string mounted on a separate insulating deck within the tap-changing mechanism. The resistor string is comprised of equal value and wattage resistors. Depending on manufacture and age the resistance varies from 10 to 400 ohms between each tap and can have either the same valued resistors between multiple neutral positions or direct wire connections.

The application uses a tap position transducer driven from a customer selectable AC or DC voltage source. The transducer provides a low DC voltage of 1 to 10 volts to the resistor string of the tapchanger mechanism. The transducer measures the DC voltage from the wiper on the currently active tap, comparing it to the voltage applied to the string. The transducer then converts that voltage to a current loop value of 0-1 mA or 4-20 mA for transmission of an analog signal. The M-2025B(D) Current Loop Interface module accepts this current analog signal. The scaling to the correct number of taps is achieved by sizing the scaling resistor to obtain a 3.0 V signal at the maximum tap position.

Older installations may use the Crompton Model 253-TRTU transducer or the Rochester Instrument Systems Model PR-2050 transducer, both of which are now obsolete. The Carrel Precision Model T-R Series transducer (or equivalent) can be used in new installations or to replace failed obsolete transducers. The scheme can be used with all M-2001 Series Load Tap Changer models, M-2001 through M-2001D. This output can then be provided to a M-2025B(D) Current Loop Interface Module and then input to a M-2001D using the XFMR EXT #3 configuration setting.

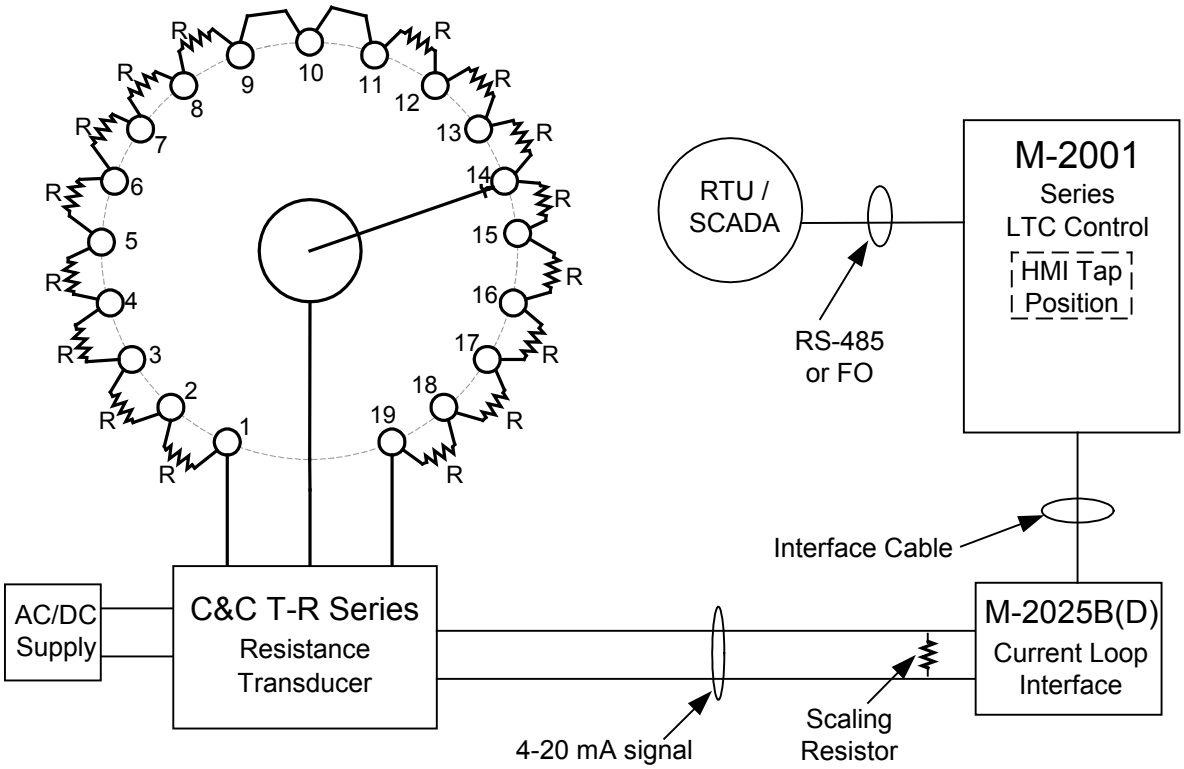


Figure 5-26 Tap Position Scheme Using Resistor Divider KeepTrack

The regulator (REG #3) setting is designed to be used with a Toshiba resistive voltage divider.

The positive knowledge by voltage divider method (REG External #3) is used on regulators that have +/– 16 taps, a voltage divider tap position sensor, and a separate raise/lower output. The Tap Max and Tap Min can only be set to 16 raise and 16 lower, respectively, while in the REG External #3 tap mode. The voltage divider method is designed to read a tap position sensor that contains 18 resistors in a voltage divider network. Each tap position will give a specific output voltage from the tap position sensor. The voltage from the sensor will only be read into the M-2001D control once one (1) second has elapsed after the counter input has toggled. The tap position sensor will not be read again until another tap change occurs, causing the counter input to toggle once more. Also, an external input to the control will be read to determine if a raise or lower condition exists. The raise/lower input and the voltage from the divider network will be used to determine what position the tap is on.

■ **NOTE**: The tap position calibration must be performed at or above the 4 raise tap, but to obtain the best accuracy, it should be calibrated at or above the 8 raise tap.

Motor Direct Drive KeepTrack™ Tap Position Knowledge For LTCs

In most Load Tap Changer (LTC) applications, the M-2001D control does not directly energize the LTC motor. Instead it energizes interposing relays which energize the motor in the raise or lower direction.

Some LTC Transformers however, have been designed such that the control does directly energize the motor similar to a Line or Feeder Voltage Regulator. M-2001A and later Beckwith controls contain a Motor Direct Drive KeepTrack method for Line and Feeder Regulators which may be applicable to these LTC Transformers.

▲ **CAUTION:** Reverse Power Operation must NOT be programmed for "Regulate in Reverse" if the "INTERNAL KEEPTRACK" method is used. Incorrect operation will occur.

This can be easily verified on the LTC transformer by setting the Tap Information setting on the M-2001D Control to Motor Direct Drive KeepTrack "INTERNAL KEEPTRACK" in the control and observing the tap position displayed in the control during both automatic and manual tap operation in both the Raise and Lower directions. It is very important that Reverse Power Operation NOT be programmed for "Regulate in Reverse" if this method is used. "Regulate in Reverse" was designed for Line and Feeder Regulators which have fixed impedances. Since LTC Transformer impedances are not predictable, incorrect operation will occur if Reverse Power Operation is set to "Regulate in Reverse".

Motor Direct Drive KeepTrack™ Tap Position Knowledge For Regulators

▲ **CAUTION:** This feature is applicable to single-phase regulators only.

▲ **CAUTION**: This feature is only applicable for ±16 tap ranges with neutral tap and neutral indicator. The source voltage will only be applicable with a tap range of ±16 taps.

This feature allows the control to keep track of the present tap position. The "INTERNAL KEEPTRACK" setting is selected for this method.

● WARNING: Do not rely on the tap position indication on the M-2001D Tapchanger Control display for neutral position when bypassing voltage regulators.

The motor power source for the manual, automatic, or external (SCADA) initiated tap changes must be the same as the motor power input to the control. The operations counter and neutral light circuit should be operational. The counter input and power source is required for detecting tap changes and determining direction of the tap change. Connecting a regulator neutral tap position indicating contact to the control will reset the tap position to neutral each time the tap goes through the neutral position. It is recommended that the indicated tap position be compared to the mechanical tap position indicator at regular intervals, and that the indicated value be corrected, if necessary.

The tap position stored in memory is not affected by a loss of power. The tap position record is checked and corrected to neutral, if necessary, with the closure of a neutral contact (when the neutral tap position contact is connected to the controls).

▲ **CAUTION**: When the Motor Direct Drive KeepTrack "INTERNAL KEEPTRACK" tap position method is used, it must be calibrated for proper voltage control with reverse power operation.

If desired, the Motor Direct Drive KeepTrack "INTERNAL KEEPTRACK" feature can be disabled in which case the screen will indicate "**Disabled**".

The user initializes the control at a given, known, tap position upon installation, by selecting "INTERNAL KEEPTRACK" in the Tap Information screen in the Configuration Menu and following the steps described later in this section. See "Initializing Tap Position When Motor Direct Drive KeepTrack 'INTERNAL KEEPTRACK' is Active" for detailed steps for entering the tap position using the HMI or TapTalk®.

Or, if the neutral tap position contact is connected to the control, run the regulator to neutral as shown by the tap position indicator on the regulator. The control will recognize the neutral light signal and set the tap position accordingly.

The Motor Direct Drive KeepTrack "INTERNAL KEEPTRACK" procedure recognizes tapchanges commanded via **manual, automatic or external (SCADA)** contacts. The power source for the manual- or SCADA-initiated tapchanges must be the same as the motor power source used for the automatic tapchangers.

The Motor Direct Drive KeepTrack "INTERNAL KEEPTRACK" position knowledge is based on the detection of a closed switch (manual or automatic), and feedback from the operation counter input.

The method by which Motor Direct Drive KeepTrack "INTERNAL KEEPTRACK" is achieved is as follows:

The control includes two Zero Voltage Detection (ZVD) circuits. These circuits individually monitor the AC voltage across the internal raise and lower triacs. This is done since any external raise or lower contacts or manual switches have to be placed in parallel with the triacs to run the tapchanger motor. When the triacs (or any contact paralleled across the triacs) closes, the voltage measure decreases to almost zero. When a counter input event is received while the raise circuit is activated, the Motor Direct Drive KeepTrack "INTERNAL KEEPTRACK" will increment the tap count by one. When a counter input event is received while the lower circuit is activated, the Motor Direct Drive KeepTrack "INTERNAL KEEPTRACK" will decrement the tap count by one.

If the tapchanger reaches the mechanical tap limits of operation, (±16), limit switches open up the appropriate circuit so the control cannot force a raise above +16, or force a lower below –16. This is potentially confusing to the ZVD circuits, since they can see zero voltage on the output with a closed triac and also see zero voltage on the other output due to an open limit switch. When this condition is encountered, the control can only make a best guess of which operation really occurs and moves one step in the direction of neutral, which should be away from the side with the open limit switch.

An additional feature is the neutral zero feature. When a regulator passes through the neutral position, a neutral contact closes. This is most often used to drive a neutral light that is an indicator that the mechanism is in the neutral position, and it is safe to bridge the input and output of the regulator because they are at the same voltage. Upon detection of a neutral circuit closure, Motor Direct Drive KeepTrack "INTERNAL KEEPTRACK" resets the tap position to neutral to resynchronize the circuit.

Selecting Tap Position Knowledge From The HMI

To select the Tap Position Knowledge method of tapchange position monitoring, perform the following:

▲ **CAUTION**: When the Motor Direct Drive KeepTrack™ "INTERNAL KEEPTRACK" tap position method is used, it must be calibrated for proper voltage control with Reverse Power Operation.

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Tap Settings" menu.

```
        Tap Settings
←                        →
```

4. Press the Down arrow as necessary until the "Tap Information" screen is displayed.

```
Tap Information
disable
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Tap Information
disable                  C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Tap Information
disable                  C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select the desired "Tap Position Knowledge" method (Table 5-1), then press the ENT pushbutton. The following will be displayed reflecting the Tap Information selection that was entered.

```
Tap Information
(See Table 5-1)
```

9. If "INTERNAL KEEPTRACK" was selected in Step 8, then proceed to "Initializing Tap Position When Motor Direct Drive KeepTrack is Active" in this section.

10. If an External Tap Position or Contact KeepTrack™ 1R1L/1N method was selected in Step 8, then proceed to "Initializing Tap Position when Regulate (Reg or XFMR) External or Contact KeepTrack is Active" in this section.

Selecting Tap Position Knowledge From TapTalk

To select Tap Position Knowledge from TapTalk®, perform the following:

1. Select **Setup/Tap Settings** from the TapTalk toolbar. TapTalk will display the Tap Settings dialog screen (Figure 5-6).
2. Select either "Disabled" or the desired Tap Position Knowledge (Table 5-1) from the "General" section of the dialog screen.
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).
5. If "INTERNAL KEEPTRACK" was selected, then proceed to "Initializing Tap Position When Motor Direct Drive KeepTrack™ is Active" in this section.
6. If an External Tap Position or Contact KeepTrack™ 1R1L/1N method was selected in Step 7, then proceed to "Initializing Tap Position when Regulate (Reg or XFMR) External or Contact KeepTrack is Active" in this section.

Contact KeepTrack™ 1N – Additional TapTalk Settings Screen

When Contact KeepTrack 1N is selected as the Tap Information method, an additional Contact KeepTrack 1N Tap Configuration window becomes available (Figure 5-27). The Contact KeepTrack 1N method of Tap Position knowledge can function with any combination of taps and multiple neutrals, or with the neutral assigned to a non-zero tap.

This feature will allow the physical neutral input to automatically calibrate the tap position to whatever the Neutral Tap Position setting is set to. The recalibrating "neutral" input can be set for any tap position not just neutral. Also, the Abnormal Tap Position Alarm will function based on this setting instead of 0. For example, if the Neutral Tap position setting is 9R, then an Abnormal Tap Position alarm will occur if the physical neutral input is received with tap position not indicating 8R, 9R, or 10R.

The Neutral Tap Configuration window allows the user to program the following settings:

1. the full tap range of the tapchanger from highest tap to lowest tap (–33 to +33)
2. assign the neutral tap position based on the tapchanger mechanism
3. assign the number of neutrals based on the tapchanger mechanism
4. assign a resting tap to communicate tapchanger position when stopped on neutral
5. assign which neutral taps have an associated closed neutral contact
6. Select Cam Follower as the Operation Counter configuration if desired

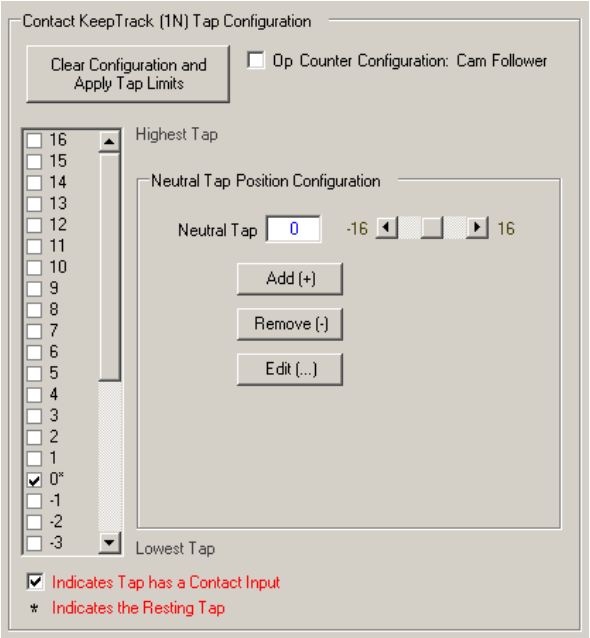


Figure 5-27 Contact KeepTrack 1N Neutral Tap Configuration Dialog Screen

Initializing Tap Position When Motor Direct Drive KeepTrack "INTERNAL KEEPTRACK" is Active From The HMI

▲ **CAUTION**: When the Motor Direct Drive KeepTrack tap position method is used, it must be calibrated for proper voltage control with Reverse Power Operation.

To initialize the control when Motor Direct Drive KeepTrack method of tap position knowledge is active, perform the following:

1. Initialize the control at a given, known, tap position upon installation.
2. Enable **INTERNAL KEEPTRACK** method of tap knowledge as described in this section.
3. Determine the actual tap position from the external tap position indicator on the regulator or transformer.
4. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

5. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

6. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Tap Settings" menu.

```
        Tap Settings
←                        →
```

7. Press the Down arrow pushbutton, as necessary, until the "Tap Position/Cal" screen is displayed.

```
Tap Position/Cal
     0
```

8. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 11.

```
Tap Position/Cal
     0                   C
```

9. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■ **NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

10. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

    If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Tap Position/Cal
     0                   C
```

    If not, re-enter a valid code.

11. Utilizing the Up/Down arrow pushbuttons, enter the tap position determined in Step 3, then press the ENT pushbutton. The following will be displayed reflecting the tap position that was entered.

```
Tap Position/Cal
     X
```

12. If a neutral tap position contact is connected to the control, run the regulator to the neutral tap position as indicated on the regulator.

    The control will recognize the neutral contact/light signal and set the tap position accordingly.

Initializing Tap Position When Motor Direct Drive KeepTrack™ "INTERNAL KEEPTRACK" is Active From TapTalk

▲ **CAUTION**: When the Motor Direct Drive Internal KeepTrack tap position method is used, it must be calibrated for proper voltage control with Reverse Power Operation.

To initialize the control when Motor Direct Drive KeepTrack method of tap position knowledge is active, perform the following:

1. Select **Setup/Tap Settings** from the TapTalk® toolbar. TapTalk will display the Tap Settings dialog screen (Figure 5-6).
2. Verify that "INTERNAL KEEPTRACK" is selected in the "General" section of the dialog screen.
3. Determine the actual tap position from the external tap position indicator on the regulator or transformer.
4. Enter the tap position determined in Step 3, then select "Yes" for Tap Calibrate.
5. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
6. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).
7. If a neutral tap position contact is connected to the control, run the regulator to the neutral tap position as indicated on the regulator.

   The control will recognize the neutral contact/light signal and set the tap position accordingly.

Initializing Tap Position When Regulate (Reg or XFMR) External or Contact KeepTrack™ 1R1L/1N is Active From The HMI

▲ **CAUTION**: When the Regulate (Reg or XFMR) External tap position method is used, it must be calibrated for proper voltage control with Reverse Power Operation.

To initialize the control when Regulate (Reg or XFMR) External or Contact KeepTrack™ method of tap position knowledge is active, perform the following:

1. Initialize the control at a given, known, tap position upon installation.
2. Enable a **Regulate External** method of tap knowledge as described in this section.
3. Determine the actual tap position from the external tap position indicator on the regulator or transformer.
4. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

5. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

6. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Tap Settings" menu.

```
         Tap Settings
←                        →
```

7. Press the Down arrow pushbutton, as necessary, until the "Tap Position/Cal" screen is displayed.

```
Tap Position/Cal
     0
```

8. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 11.

```
Tap Position/Cal
     0                    C
```

9. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■ **NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

10. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

    If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Tap Position/Cal
     0                    C
```

    If not, re-enter a valid code.

11. Utilizing the Up/Down arrow pushbuttons, enter the tap position determined in Step 3, then press the ENT pushbutton. The following will be displayed reflecting the tap position that was entered.

```
Tap Position/Cal
     X
```

12. If a neutral tap position contact is connected to the control, run the regulator to the neutral tap position as indicated on the regulator.

    The control will recognize the neutral contact/light signal and set the tap position accordingly.

Initializing Tap Position When Regulate (Reg or XFMR) External or Contact KeepTrack™ 1R1L/1N is Active From TapTalk

▲ **CAUTION**: When the Regulate (Reg or XFMR) External tap position or Contact KeepTrack method is used, it must be calibrated for proper voltage control with Reverse Power Operation.

To initialize the control when Regulate (Reg or XFMR) External or Contact KeepTrack method of tap position knowledge is active, perform the following:

1. Select **Setup/Tap Settings** from the TapTalk® toolbar. TapTalk will display the Tap Settings dialog screen (Figure 5-6).
2. Verify that a "Regulate (Reg or XFMR) External" mode is selected in the "General" section of the dialog screen.
3. Determine the actual tap position from the external tap position indicator on the regulator or transformer.
4. Enter the tap position determined in Step 3, then select "Yes" for Tap Calibrate.
5. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
6. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).
7. If a neutral tap position contact is connected to the control, run the regulator to the neutral tap position as indicated on the regulator.

   The control will recognize the neutral contact/light signal and set the tap position accordingly.

Setting Highest Tap From The HMI

To set the Highest Tap setting, perform the following:

■ **NOTE**: This setting is applicable to Reg External #1 and #2, and XFMR External #1, #2 and #3, modes of Tap Information.

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Tap Settings" menu.

```
          Tap Settings
←                        →
```

4. Press the Down arrow as necessary until the "Highest Tap" screen is displayed.

```
Highest Tap
  16
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Highest Tap
  16                     C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■ **NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Highest Tap
  16                     C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, enter the desired Highest Tap value, then press the ENT pushbutton. The following will be displayed reflecting the Highest Tap value that was entered.

```
Highest Tap
  XX
```

Setting Lowest Tap From The HMI

To set the Lowest Tap setting, perform the following:

■ **NOTE**: This setting is applicable to Reg External #1 and #2, and XFMR External #1, #2 and #3, modes of Tap Information.

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Tap Settings" menu.

```
          Tap Settings
←                        →
```

4. Press the Down arrow as necessary until the "Lowest Tap" screen is displayed.

```
Lowest Tap
 –16
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Lowest Tap
 –16                     C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■ **NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Lowest Tap
 –16                     C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, enter the desired Lowest Tap value, then press the ENT pushbutton. The following will be displayed reflecting the Lowest Tap value that was entered.

```
Lowest Tap
 XX
```

Setting Highest and Lowest Tap From TapTalk

To set the Highest Tap and Lowest Tap setting from TapTalk®, perform the following:

■ **NOTE**: This setting is applicable to Reg External #1 and #2, and XFMR External #1, #2 and #3, modes of Tap Information.

1. Select **Setup/Tap Settings** from the TapTalk toolbar. TapTalk will display the Tap Settings dialog screen (Figure 5-6).
2. Enter the desired Highest and Lowest Tap values from the "Tap Limits" section of the dialog screen.
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

INTERTAP TIME DELAY

The intertap time delay may be used in conjunction with sequential operation or pulsed output. The normal operation of this delay timer occurs once a tapchange command is initiated, when there would normally be a continuous command (raise or lower) to run the tapchanger until the voltage has returned to within the band setting, there is now an intertap time delay initiated between tapchanges. When the intertap time delay is set to zero, it is disabled.

The intertap time delay will:

- Recognize that a tapchange has occurred, indicated by the counter contact input or motor hold input.
- Remove the output signal and wait for the intertap time delay, even though the voltage remains outside the designated voltage band.
- Command another tapchange after the intertap time delay has expired, without regard to the basic time delay setting, if the voltage remains out of band in the same direction as the previous tapchange.

If the intertap time delay is enabled on a control where non-sequential operation is enabled, the intertap time delay setpoint is disregarded. The basic time delay setting prevails for subsequent tapchange commands in the non-sequential mode.

■**NOTE**: The intertap time delay is similar in operation to non-sequential operation, but the two should not be confused. The intertap time delay applies a short delay after every tapchange. The non-sequential operation time delay will be the same as that of the Basic User-Selected Time Delay as described in this chapter. For application with pulsed output, see **Output Pulse** in this chapter.

Sequential/Non-Sequential/Blocking

The control normally operates in Sequential Mode. In this mode, the tapchange output is initiated after the time delay timer has timed out. The tapchange output will remain "on" until the control senses that the voltage has returned in-band. This permits successive tapchanges to be made in a "sequential" mode with no delay between tapchanges.

If a delay between successive tapchanges is desired, an intertap time delay may be used. The value is set from 0 to 60 seconds and will interrupt tapchange outputs for the preset time after a counter-contact closure or motor hold input is detected by the control's operations counter input #1.

If the full initial time delay is desired, the control may be used in the "non-sequential" mode. Enabling non-sequential mode operation is accomplished by setting the Input Selection 2 setting to "non-sequential". Applying a momentary contact closure to the control's Input Selection 2 will activate non-sequential mode operation.

If the closed contact supplied to Input Selection 2 is maintained, instead of momentary, the initial timer will not time out for the duration of the maintained contact, and the outputs of the control will be effectively blocked.

Setting The Intertap Delay From The HMI

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Tap Settings" menu.

```
        Tap Settings
←                        →
```

4. Press the Down arrow pushbutton, as necessary, to navigate to the "Intertap Delay" menu item.

```
Intertap Delay
  0 Sec
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Intertap Delay
  0 Sec                  C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS
_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Intertap Delay
  0 Sec                  C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons enter the desired Intertap Time Delay value (0 to 60 seconds in 1 second increments), then press the ENT pushbutton. The following will be displayed reflecting the Intertap Time Delay that was entered.

```
Intertap Delay
  X  Sec
```

Setting Intertap Time Delay From TapTalk

1. Select **Setup/Tap Settings** from the TapTalk® toolbar. TapTalk will display the Tap Settings dialog screen (Figure 5-6).
2. From the General section of the Tap Settings dialog screen enter the desired Intertap Delay (0 to 60 seconds in 1 second increments).
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

TAP LIMITS

Tap Limits, when enabled, include "Block Raise" and "Block Lower" limits which are adjustable from the Tap Maximum configuration point to the Tap Minimum value in 1 step increments.

Enabling/Disabling and Setting Tap Limits From The HMI

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Tap Settings" menu.

```
         Tap Settings
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Tap Limits" screen is displayed.

```
Tap Limits
disable
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Tap Limits
disable                  C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS
_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Tap Limits
disable                  C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select either "Enable" or Disable", then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Tap Limits
disable or ENABLE
```

9. Depending on what mode was selected in Step 8, proceed as follows to complete the Tap Limits setup:
   - If Tap Limits were "ENABLED", proceed to Step 10.
   - If Tap Limits were "DISABLED", no further action is required.

10. Press the Down arrow pushbutton, as necessary, until the "Tap Block Raise" screen is displayed.

```
Tap Block Raise
  16
```

11. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 14.

```
Tap Block Raise
  16                     C
```

12. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

13. Enter a valid Level Access Code, then press the ENT pushbutton.

    If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Tap Block Raise
  16                          C
```

    If not, re-enter a valid code.

14. Utilizing the arrow pushbuttons, enter the desired Tap Block Raise limit (–12 to +16), then press the ENT pushbutton. The following will be displayed reflecting the Tap Block Raise limit that was selected.

```
Tap Block Raise
  XX
```

15. Press the Down arrow once, the "Tap Block Lower" screen is displayed.

```
Tap Block Lower
  –16
```

16. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 19.

```
Tap Block Lower
  –16                         C
```

17. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

18. Enter a valid Level Access Code, then press the ENT pushbutton.

    If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Tap Block Lower
  –16                         C
```

    If not, re-enter a valid code.

19. Utilizing the arrow pushbuttons, enter the desired Tap Block Lower limit (–16 to +12), then press the ENT pushbutton. The following will be displayed reflecting the Tap Block Lower limit that was selected.

```
Tap Block Lower
  XX
```

Enabling/Disabling and Setting Tap Limits From TapTalk

To Enable and Set Tap Limits from TapTalk®, proceed as follows:

1. Select **Setup/Tap Settings** from the TapTalk toolbar. TapTalk will display the Tap Settings dialog screen (Figure 5-6).
2. Select "Enable" from the Tap Limits section of the dialog screen.
3. Enter the desired Block Raise and Block Lower limits.
4. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
5. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

5.5 Data Logging and Harmonics

DATA LOGGING

▲ **CAUTION**: Whenever the M-2001D clock is reset and data logging is enabled, the data log should be cleared.

The Data Logging feature allows the user to record data internally into non volatile memory. The data log is transferred in the Comtrade format. The Comtrade format consists of two files, the configuration file (*.cfg) and the data file (*.dat).

Data logging will continue indefinitely as long as the data Interval is set to a non-zero value. A zero value for the data interval will effectively disable data logging. The data log can be downloaded using MODBUS® (see M-2001D Protocol document) or DNP (using file transfer) protocol. The data can be viewed using any Comtrade compatible viewer.

Data logging interval ranges from 0 to 120 min with an increment of 1 minute. Once data logging is enabled, the control will store the data in a data record at the selected interval. Each data record includes the following data:

- Load Voltage*
- Compensated Voltage*
- Load Watts
- Load VA
- Load VAr
- Load Current*
- Power Factor
- Line Frequency
- Tap Position
- Source Voltage*
- Primary Current
- Operation Count
- Circulating/DVAr Current
- Meter Out Voltage

■ **NOTE**: * Load Voltage, Compensated Voltage, Load Current and Source Voltage are the average, maximum and minimum value during the data logging interval.

The Checksum is used to ensure the integrity of the record stored.

Data mask is used to mask off data that the user does not want to retrieve.

Due to the internal structure of the Comtrade format, time stamping is always performed. A total of 200,000 data records can be saved in non volatile memory.

Data Logging Setup From The HMI

To setup Data Logging from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Data Logging" menu.

```
        Data Logging
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Data Log Select" screen is displayed.

```
Data Log Select
   11111111111111
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Data Log Select
   1111111111111_          C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Data Log Select
   11111111111111            C
```

   If not, re-enter a valid code.

■**NOTE**: The cursor will be positioned under the far right hand zero which corresponds to LOCAL VOLTAGE. The remaining Data Log parameter selections are displayed by moving the cursor to the left.

8. Utilizing the arrow pushbuttons enter a "1" for those Data Log parameters to be activated and a "0" for those that are to be disabled, then press the ENT pushbutton. The following will be displayed reflecting the selections that were made.

```
Data Log Select
   XXXXXXXXXXXXX
```

9. Press the Down arrow pushbutton, as necessary, until the "Data Log Interval" screen is displayed.

```
Data Log Interval
   5 mins
```

10. Utilizing the arrow pushbuttons, enter the desired "Data Log Interval" (0 to 120 minutes in 1 minute increments), then press the ENT pushbutton. The following will be displayed reflecting the Data Log Interval that was entered.

```
Data Log Interval
   XXX mins
```

Data Logging Setup From TapTalk

To select the data to be logged and the interval between logs from TapTalk®, proceed as follows:

1. Select **Setup/Data Logging/Setup** from the TapTalk toolbar. TapTalk will display the Data Logging Setup dialog screen (Figure 5-28).

■**NOTE**: The Data Logging Setup dialog screen contains a self calculating Duration parameter that represents the number of Days and the specific time when the data logging buffer will be full. The number of parameters selected to log and the Data Log Interval are considered in this calculation.

2. Enter a Data Log Interval (0 to 120 minutes).
3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

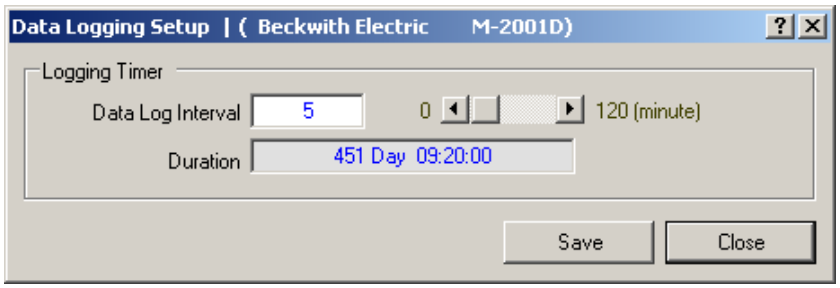


Figure 5-28 Data Logging Setup Dialog Screen

HARMONICS SETUP

The Harmonics Calculation feature provides the user with the ability to set predefined harmonic voltage and current thresholds (individual, voltage percent from 0 to 30%, current percent from 0 to 100%) for the selected harmonics. Current Threshold includes a minimum Current Threshold setting from 0 to 200 mA. Also, a common delay setting from 1 to 10 seconds is available.

The Harmonic voltage and/or current threshold Pickup and Dropout can be selected as inputs to trigger the Oscillograph Recorder. The Harmonic voltage/current Pickup or the voltage/current Dropout can be selected to trigger the Sequence of Events Recorder.

Setting the Active Harmonics Inputs to the Oscillograph and Sequence of Events Recorders From The HMI

To set the Voltage and Current Harmonics Inputs, perform the following:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, until "Harmonics Setup" is displayed.

```
        Harmonics Setup
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the desired Harmonic setting screen is displayed. In this example the "V 2-16 Har. Alarm" will be setup.

```
V 2-16 Har. Alarm
0000000000000000
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Harmonic 2
0000000000000000            C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Harmonic 2
0000000000000000            C
```

   If not, re-enter a valid code.

■**NOTE**: The cursor will be positioned under the far right hand zero which corresponds to Harmonic 2. The remaining Harmonic selections are displayed by moving the cursor to the left.

8. Utilizing the Up/Down arrow pushbuttons enter a "1" for those Harmonics to be activated and a "0" for those that are to be disabled, then press the ENT pushbutton. The following will be displayed reflecting the selections that were made.

```
V 2-16 Har. Alarm
XXXXXXXXXXXXXXXX
```

9. If additional Harmonic Inputs to the Oscillograph and Sequence of Events recorders are to be setup, navigate to the desired harmonic screen within the "Harmonics Setup" menu, then repeat Steps 4 through 8.

10. If all Harmonic inputs have been selected, proceed to the Voltage Alarm Threshold, Current Alarm Threshold and Harmonic Alarm Delay settings in this section.

Setting the Harmonic Voltage, Current Threshold and Minimum Current Threshold Setting(s) From The HMI

■**NOTE**: The following sequence of steps are for setting the Voltage Alarm threshold. The steps used to set the Current Alarm Threshold and Minimum Current Threshold are the same.

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, until "Harmonics Setup" is displayed.

```
        Harmonics Setup
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the desired "Alarm Threshold" setting screen is displayed. In this example the Voltage Alarm Threshold will be setup.

```
V Alarm Threshold
 0 %
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
V Alarm Threshold
 0 %                        C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Alarm Threshold
 0 %                        C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons enter the desired Voltage Alarm Threshold value from 1 to 30%, press the ENT pushbutton. The following will be displayed reflecting the Voltage Alarm Threshold value that was entered.

```
Alarm Threshold
 X %
```

Setting the Harmonic Voltage and Current Threshold Delay From The HMI

To set the Voltage Threshold and Current Threshold delay setting, perform the following:

■**NOTE**: This delay setting applies to both the Voltage Threshold and the Current Threshold.

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
          CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tapchanger Type
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, until "Harmonics Setup" is displayed.

```
        Harmonics Setup
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Harmonic Alarm Delay" setting screen is displayed.

```
Harmonic Alarm Delay
 1 s
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Harmonic Alarm Delay
 1 s                     C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

–
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
Harmonic Alarm Delay
 1 s                     C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, enter the desired Threshold Delay value from 1 to 10 Seconds, then press the ENT pushbutton. The following will be displayed reflecting the Harmonic Alarm Delay value that was entered.

```
Harmonic Alarm Delay
 X s
```

Setting the Active Harmonics Inputs to the Oscillograph and Sequence of Events Recorders From TapTalk

To select the Voltage and Current Inputs, Voltage and Current Threshold settings and the Voltage/ Current Delay perform the following:

1. Select **Setup/Harmonics Setup** from the TapTalk® toolbar. TapTalk will display the Harmonics Setup dialog screen (Figure 5-29).
2. Select the desired Voltage Harmonics and Voltage Threshold setting.
3. Select the desired Current Harmonics, Current Threshold and Minimum Current Threshold setting.
4. Select the desired Voltage & Current Delay setting.
5. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 5-3).
6. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

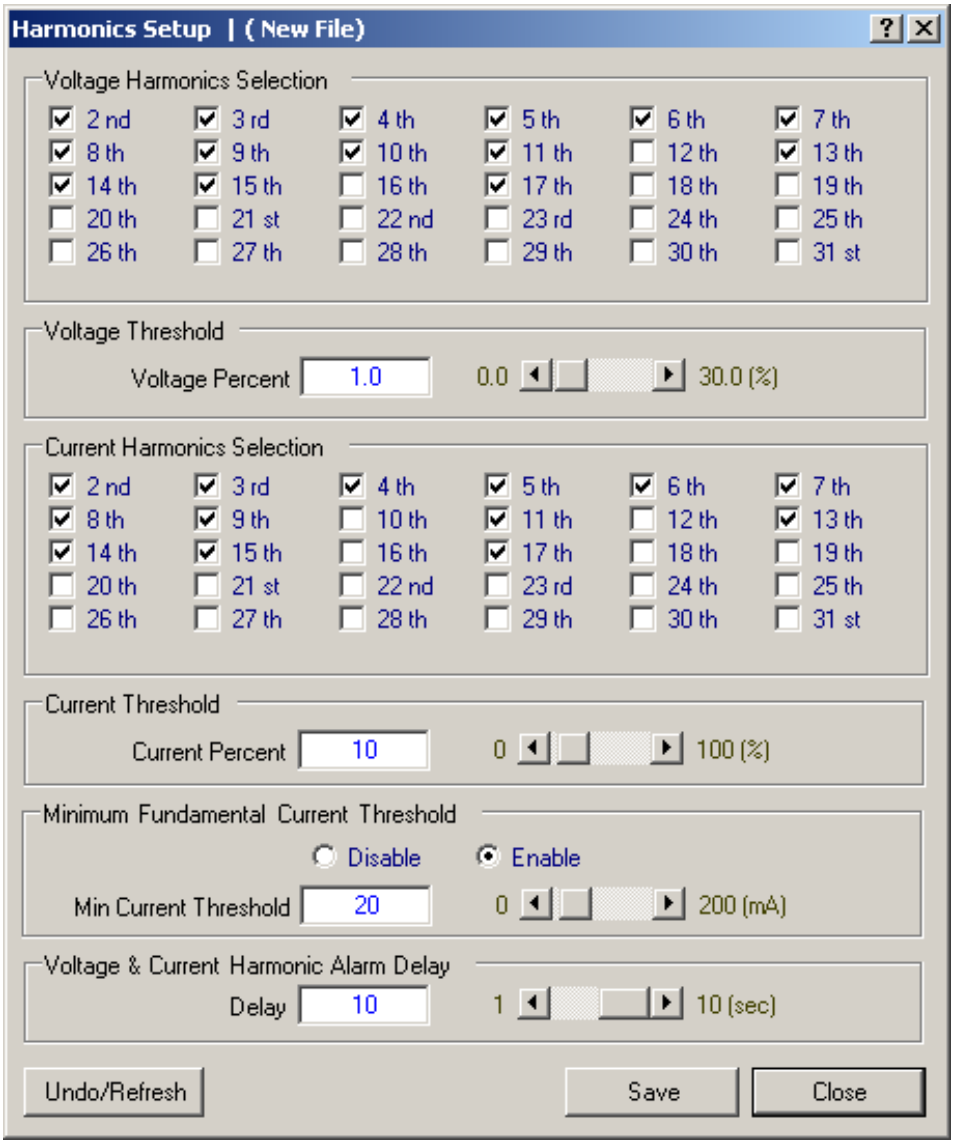


Figure 5-29 Harmonics Setup Dialog Screen

5.6 CBEMA Configuration

CBEMA Functionality

Setpoints

Normal Voltage

CBEMA Event Enable

CBEMA Event Pickup

CBEMA Event Dropout

CBEMA Minimum Duration

Outputs

CBEMA Pickup Status

CBEMA Counters

Triggers

Oscillography

Sequence of Events

Operation

There are a total of 4 Event Monitors in CBEMA (Computer Business Equipment Manufacturers Association). Each CBEMA event monitor has a different minimum duration limit: Event 1, 1 – 60 cycles; Event 2, 1 – 120 cycles; Event 3, 60 – 60000 cycles and Event 4, 1 – 60 cycles. When Pickup is set to less than 100% it operates as a sag (under voltage) function, and when it is greater than 100% it operates as a swell (over voltage) function. Sags and swells can be accurately detected from 90 to 180 Vac.

The following rules need to be followed when setting up CBEMA Setpoints:

- The Dropout should always be greater than Pickup in the Sag case
- The Dropout should be fixed to 100% in the Swell case
- The Pickup cannot be 100%

If any of the above rules are violated, an ERROR message will scroll across the HMI and the error can also be read using DNP.

When the load voltage is sagging or swelling greater than the pickup setting, then a pickup status will be set after the set minimum duration, in addition to incrementing the counter. When the load voltage is back to the dropout level, the status is cleared. Any or all of the Event Pickup statuses can be used to trigger Sequence of Events and/or Oscillography.

The CBEMA counters are cleared after it reaches 10,000 counts, or it can also be cleared through the TapTalk® Communication Software or the HMI.

Each of the CBEMA Events has a Binary Input DNP point associated with it that will indicate the status of the event, as well as an Analog Input that will indicate the duration in cycles of the most recent event.

CBEMA Setup From The HMI

Setting CBEMA Normal Voltage, enabling Event 1, and entering Event 1 parameters are described in this procedure. Enabling Events 2, 3 and 4 and entering their respective settings is similar.

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Tapchanger Type
←                        →
```

3. Press the Right or Left Arrow pushbuttons, as necessary until the "CBEMA Setup" screen is displayed.

```
         CBEMA Setup
←                        →
```

4. Press the Down arrow pushbutton, as necessary, to navigate to the "Normal Voltage" screen.

```
Normal Voltage
   120.0  Volts
```

5. Press the ENT pushbutton, if Level Access is not active or has been previously input, the following will displayed. Go to Step 8.

```
Normal Voltage
   120.0 Volts              C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS
_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, then the display will briefly flash a confirmation screen and then display the following:

```
Normal Voltage
   120.0 Volts              C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, enter the desired "Normal Voltage" (100.0 to 130.0 Volts) value, then press the ENT pushbutton. The following will be displayed reflecting the Normal Voltage value that was entered.

```
Normal Voltage
   XXX.X Volts
```

■**NOTE**: From this point on in this procedure it is assumed that a valid Level 2 Access Code has been previously entered. If not, a valid Level 2 Access Code will be required to be entered as described in Step 7.

9. Press the Down arrow pushbutton, as necessary, to navigate to the "Event 1" screen.

```
Event 1
ENABLE
```

10. Press the ENT pushbutton, if Level Access is not active or has been previously input, the following will displayed.

```
Event 1
ENABLE                      C
```

11. Utilizing the Up/Down arrow pushbuttons, select either "Enable" or Disable", then press the ENT pushbutton. The following will be displayed:

```
Event1
ENABLE or disable
```

12. Press the Down arrow pushbutton, as necessary, to navigate to the "Event1 Sag Pickup" screen.

```
Event1 Sag Pickup
   70 %
```

13. Press the ENT pushbutton, if Level Access is not active or has been previously input, the following will displayed.

```
Event1 Sag Pickup
   70 %                     C
```

14. Utilizing the Up/Down arrow pushbuttons, enter the desired "Event 1 Sag Pickup" (50 to 130 %) value, then press the ENT pushbutton. The following will be displayed reflecting the Event 1 Sag Pickup value that was entered.

```
Event1 Sag Pickup
   XX %
```

15. Press the Down arrow pushbutton, as necessary, to navigate to the "Event1 Sag Dropout" screen.

```
Event1 Sag Dropout
   95 %
```

16. Press the ENT pushbutton, if Level Access is not active or has been previously input, the following will displayed.

```
Event1 Sag Dropout
   95 %                    C
```

17. Utilizing the Up/Down arrow pushbuttons, enter the desired "Event 1 Sag Dropout" (71 to 130 %) value, then press the ENT pushbutton. The following will be displayed reflecting the Event 1 Sag Dropout value that was entered.

```
Event1 Sag Dropout
   XX %
```

18. Press the Down arrow pushbutton, as necessary, to navigate to the "Event 1 Sag Minimum Duration" screen.

```
Event1 Sag Min Dur
   1 Cycles  (17ms)
```

19. Press the ENT pushbutton, if Level Access is not active or has been previously input, the following will displayed.

```
Event1 Sag Min Dur
   1 Cycles                C
```

20. Utilizing the Up/Down arrow pushbuttons, enter the desired "Event 1 Sag Minimum Duration" (1 to 60 Cycles) value, then press the ENT pushbutton. The following will be displayed reflecting the Event 1 Sag Minimum Duration value that was entered.

```
Event1 Sag Min Dur
   X Cycles  (XXms)
```

CBEMA Setup From TapTalk

1. Select **Setup/CBEMA Events/Setup** from the TapTalk® toolbar, TapTalk will display the CBEMA Sequence of Events Setup dialog screen (Figure 5-31).
2. Enter the desired "Normal Voltage" (100.0 to 130.0 Volts) value,
3. From the "CBEMA Event 1" section of the dialog screen select ENABLE, then enter the following CBEMA Event 1 settings;
   - Event 1 Sag Pickup (50 to 130 %)
   - Event 1 Sag Dropout (71 to 130 %)
   - Event 1 Sag Minimum Duration (1 to 60 Cycles)
4. From the "CBEMA Event 2" section of the dialog screen select ENABLE, then enter the following CBEMA Event 2 settings;
   - Event 2 Sag Pickup (50 to 130 %)
   - Event 2 Sag Dropout (81 to 130 %)
   - Event 2 Sag Minimum Duration (1 to 120 Cycles)
5. From the "CBEMA Event 3" section of the dialog screen select ENABLE, then enter the following CBEMA Event 3 settings;
   - Event 3 Sag Pickup (50 to 130 %)
   - Event 3 Sag Dropout (91 to 130 %)
   - Event 3 Sag Minimum Duration (60 to 60,000 Cycles)
6. From the "CBEMA Event 4" section of the dialog screen select ENABLE, then enter the following CBEMA Event 4 settings;
   - Event 4 Sag Pickup (50 to 130 %)
   - Event 4 Sag Dropout (50 to 114 %)
   - Event 4 Sag Minimum Duration (1 to 60 Cycles)

7. Select **Save**, TapTalk® will display a "Do you want to enable CBEMA Sequence of events?" confirmation screen (Figure 5-30).

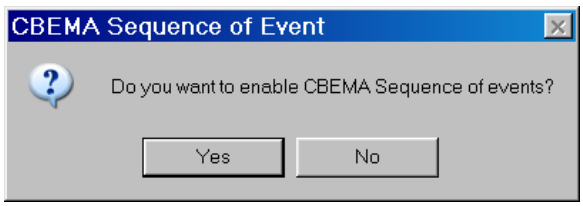


Figure 5-30 CBEMA Sequence of Event Enable Confirmation Screen

8. If CBEMA Events are to be used to trigger the Sequence of Events recorder, then select "Yes". TapTalk will display the Sequence of Events Setup dialog screen (Figure 4-16). **See Sequence of Events Recorder in Chapter 4**, for additional information regarding Sequence of Events Recorder/CBEMA trigger settings.

■**NOTE**: CBEMA Event and counter status can be observed on the Metering and Status screen (Figure 3-28).

9. If CBEMA Events are *Not* to be used to trigger the Sequence of Events recorder, then select "No". TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 5-4).

10. If desired, CBEMA Events can be used to trigger the Oscillograph Recorder. **See Setup Oscillograph Recorder in Chapter 4,** for additional information regarding Oscillograph Recorder/ CBEMA trigger settings.

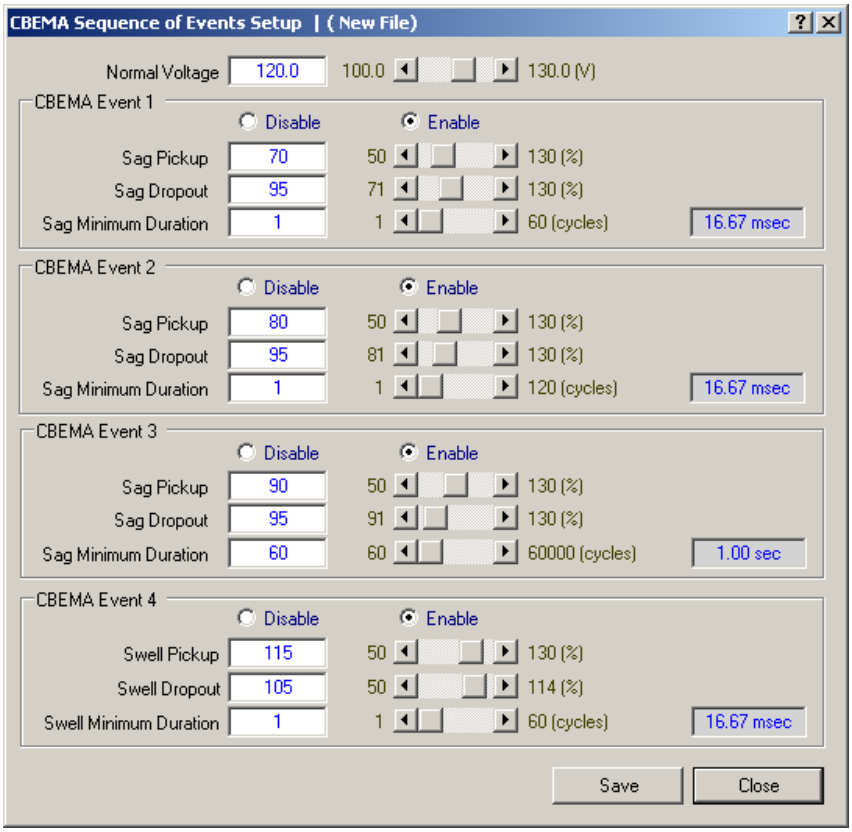


Figure 5-31 CBEMA Setup Dialog Screen

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6 Setpoints

6.0 Overview and Quick Index

Chapter Six is designed for the person or group responsible for the Setpoints of the M-2001D Digital Tapchanger Control.

Chapter 6 consists of Setpoints, which include the following control settings:

- Setpoint Profiles
- Regulation Limits
- Voltage Reduction
- Line Drop Compensation
- Basic Time Delay
- Reverse Power Operation
- Power Flow Settings

The selection of the M-2001D Setpoints is performed using either the TapTalk® S-2001D Communications Software or the control Front Panel Human Machine Interface (HMI). Instructions for TapTalk and the HMI are provided where applicable.

TapTalk instructions assume that communications have been established with the control.

6.1 Setpoints

SETPOINT PROFILES

Editing Setpoint Profiles

Editing setpoints is accomplished only when the specific setpoint profile has been selected for editing in TapTalk® or the HMI. The following setpoint categories are included in the four setpoint profiles:

Setpoints/Limits
Setpoints/Common Settings
Setpoints/Power Flow Forward
Setpoints/Power Flow Reverse

In TapTalk the setpoint profiles are identified by Tabs on the Setpoints dialog screen Figure 6-6. In the HMI, the Limits, Common Settings, Power Flow Forward and Power Flow Reverse submenu headers indicate in the upper right hand corner the setpoint profile that is being edited (Figure 6-2).

If a specific setpoint profile has not been previously selected for editing, then the number in the submenu header (Figure 6-2) will indicate the Active Setpoint Profile. After changing the active setpoint profile the user must exit the Profile Settings sub header for approximately 1 minute to see the Active Setpoint Profile change indicated in the setpoints sub header.

▲ **CAUTION**: The control will immediately respond to the new Active Setpoint Profile settings.

Selecting a Setpoint Profile for Editing From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
            SETPOINTS
←MNTR                    CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                          →
```

3. Press the Down arrow pushbutton as necessary until the unit displays the following:

```
Profile to Edit
Profile: 1
```

4. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 7.

```
Profile to Edit
Profile: 1                 C
```

5. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■ **NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

6. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Profile to Edit
Profile: 1                 C
```

   If not, re-enter a valid code.

7. Utilizing the arrow pushbuttons, select the desired Setpoint Profile for Editing, then press the ENT pushbutton. The following will be displayed reflecting the Setpoint Profile that was selected for Editing.

```
Profile to Edit
Profile: 1, 2, 3, 4
```

Selecting a Setpoint Profile for Editing From TapTalk

Editing Setpoint Profiles from TapTalk is accomplished by selecting the desired Profile Tab in the "Setup/Setpoints" dialog screen (Figure 6-6).

Naming Setpoint Profiles

Custom names may be assigned to Setpoint Profiles 1 through 4. The Profile name may be up to 16 standard alphanumeric characters. Alpha characters may be either upper or lower case. The user may Enter/Edit the Profile name in either the HMI or TapTalk.

Assigning a Setpoint Profile Name From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
              SETPOINTS
←MNTR                          CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                              →
```

3. Press the Down arrow pushbutton as necessary until the unit displays the following:

```
Edit Profile 1 name
0
```

4. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 7.

```
Edit Profile 1 name
0
```

5. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS
_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

6. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Edit Profile 1 name
0
```

   If not, re-enter a valid code.

7. Utilizing the arrow pushbuttons, enter the desired Setpoint Profile Name, then press the ENT pushbutton. The following will be displayed reflecting the Setpoint Profile Name that was entered.

```
Edit Profile 1 name
XXXXXXX
```

Assigning a Setpoint Profile Name (TapTalk)

To assign a Setpoint Profile Name from TapTalk®, proceed as follows:

1. Select **Setup/Profile/Profile Names** from the TapTalk toolbar. TapTalk will display the Profile Names dialog screen (Figure 6-1).
2. Enter the desired names for Setpoint Profiles 1 through 4.
3. Select **Save**. TapTalk will display a "Save to Device" confirmation screen (Figure 6-4).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 6-5).

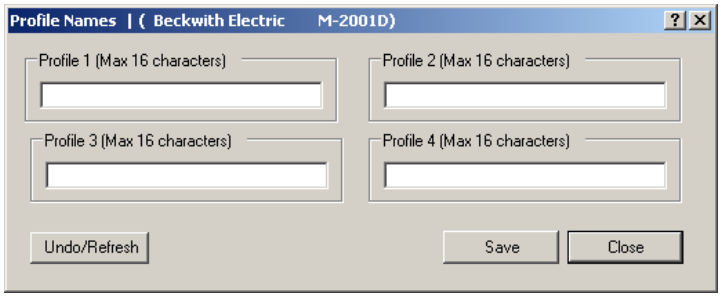

Figure 6-1 Setpoint Profile Names Dialog Screen

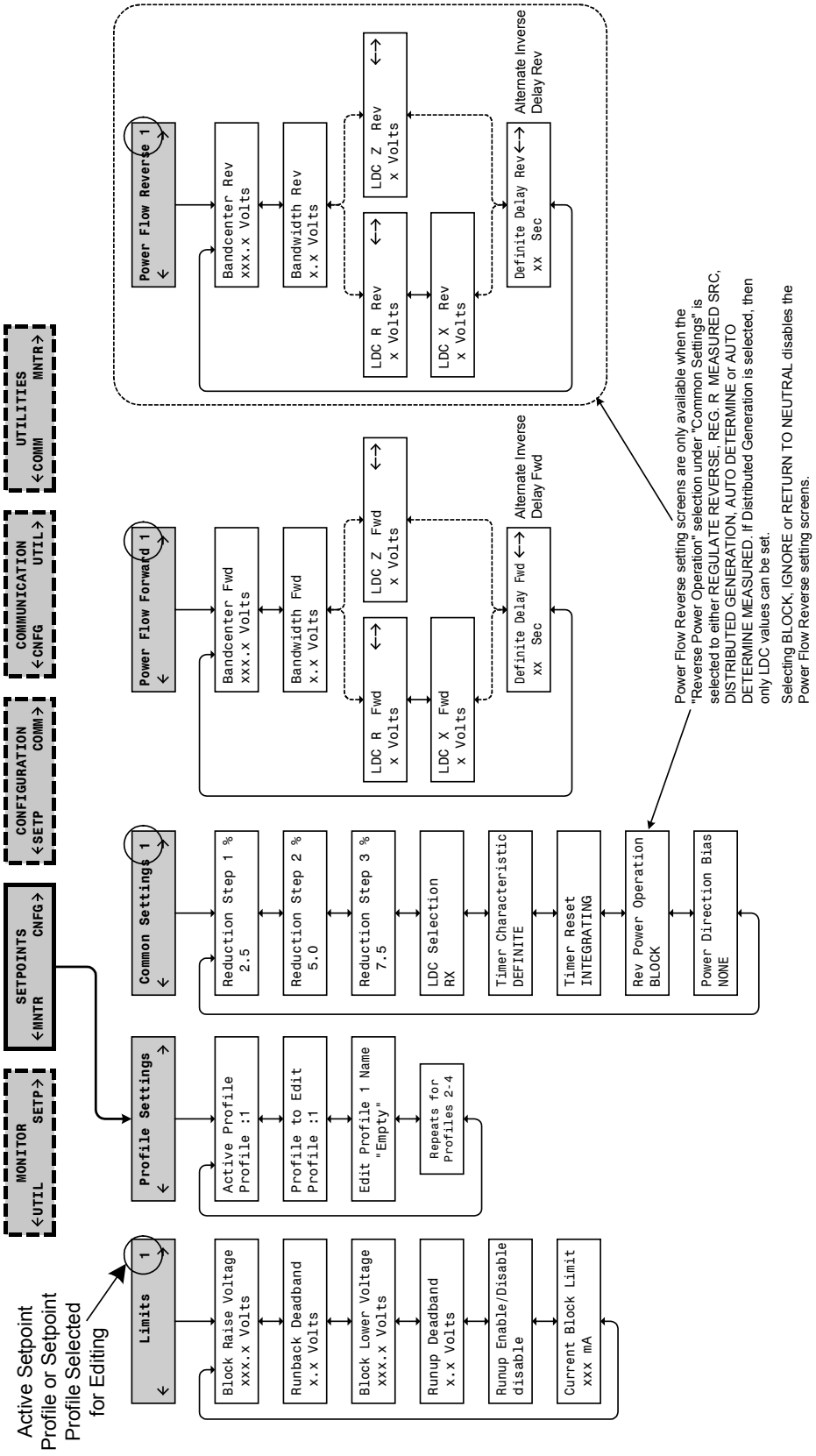

Figure 6-2 Active Setpoint Profile and Setpoint Profile to Edit Identifier

REGULATION LIMITS

Overvoltage Limit and Voltage Runback

Setpoints are available to establish a block raise limit and voltage runback. The overvoltage limit is adjustable from 95.0 V to 135.0 V in 0.1 V increments. The overvoltage limit must be set above the upper control band limit. This limit is one portion of the First Customer Protector to limit overvoltage from line drop compensation action during heavy loading.

The voltage runback level is the Block Raise setting plus the Runback Deadband setting (this establishes the First Customer Protection Level.) This deadband should not be confused with the control deadband above and below the center voltage setpoint, which is generally called the control "bandwidth".

The voltage runback deadband is used to assure that the runback setting is sufficiently above the upper voltage limit setting to limit hunting. It is adjustable from 1.0 to 4.0 V in 0.1V increments, and must be set greater than the voltage change of one single tapchange, or hunting will occur. It is suggested that it be set at approximately twice the voltage change of one tap.

If the voltage exceeds the runback limit, as might be caused by combinations of LDC action and load shifts or by a system disturbance without LDC action, the control will immediately call for an "automatic" lower without any time delay. The lower command will continue until the voltage is reduced below the runback voltage limit. After this occurs, the timer will reset. If the voltage is still high, normal control action will bring the voltage down to within the normal control band.

Overvoltage block can be effectively disabled by setting it to 135 V. By setting the runback deadband to 4 V, the runback voltage becomes 139 V which effectively disables the feature. All automatic raise/lower operations are blocked when the input voltage decreases to less than 85.0 V. Manual tapchanges can be initiated if Motor Power is available.

Undervoltage Block and Voltage Runup

Setpoints are also available to establish a block lower limit and voltage runup. This limit is adjustable from 95.0 V to 135.0 V in 0.1 V increments. This limit can be set to limit low customer voltage to safe limits and will block voltage reduction action that could cause motor stalling and other undesirable low voltage effects.

The voltage runup level is the Block Lower setting plus the Runup Deadband setting (this establishes the First Customer Protection Level.)

The voltage runup deadband is used to assure that the runup setting is sufficiently below the lower voltage limit setting to limit hunting. It is adjustable from 1.0 to 4.0 V in 0.1V increments, and must be set greater than the voltage change of one single tapchange, or hunting will occur. It is suggested that it be set at approximately twice the voltage change of one tap.

If the voltage is lower than the runup limit, as might be caused by combinations of LDC action and load shifts or by a system disturbance without LDC action, the control will immediately call for an "automatic" raise without any time delay. The raise command will continue until the voltage is above the runup voltage limit. After this occurs, the timer will reset. If the voltage is still low, normal control action will bring the voltage up to within the normal control band.

If both "Voltage Runup" and "Fast Voltage Recovery" are enabled, the Fast Voltage Recovery feature has precedence over Voltage Runup operationally.

Undervoltage block can be effectively disabled by setting it to 95 volts. If the voltage is below the Block Lower setpoint, the control will not respond to further lower commands. Raise commands are not affected. All automatic raise/lower operations are blocked when the input voltage decreases to less than 85.0 V. Manual tapchanges can be initiated if Motor Power is available.

Operation of the overvoltage limit, voltage runback and undervoltage block is illustrated in Figure 6-3.

Coordination with Backup Relay

The M-2001D Digital Tapchanger Control provides the first customer protection functions. Use of a backup relay, such as the M-0329B, is recommended since the M-2001D (or any independent control) cannot be expected to be its own backup. The backup relay bandcenter setting is usually set the same as the primary control, with the bandwidth setting 1 or 2 volts greater than the primary control bandwidth, the block raise setting 1 volt greater than the primary control, and the deadband setting 1 or 2 volts. These settings create a runback level 1 or 2 volts above the runback level of the primary control.

If primary control operation is desired first, the block raise setting and the resulting runback level of the backup relay must be higher than those of the primary control and the block lower setpoint must be lower than the primary control setting.

Tap Position Block

The Tap Position Block is disabled by setting the Tap Information screen to the Disable condition. Refer to the Appendix, Figure A-3. If the Tap Information screen is not disabled, the Tap Position block can be disabled by setting the Tap Limits screen to Disable.

When using the M-2025B(D) Current Loop Interface Module, a one-second intertap time delay should be used, due to the time setting of the module.

Overcurrent Block Operation

▲ **CAUTION**: The current input to the control is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

The Current Block Limit setpoint is available to block operation whenever the current exceeds the setting. The setting is adjustable from 50 to 640 mA in 1 mA increments.

This feature can be used to protect the tapchanger switch during periods of excessive current. This feature can be effectively disabled by setting the blocking current to 640 mA.

Low Current Block

When enabled the control determines if Load Current following a tapchange is less than 4 mA, coincident with Tap Delta Voltage being less than .4 Vac. When these conditions exist the control will initiate an alarm and block regulation. The Delta Voltage is measured on every tap operation once Load Current is less than 4 mA.

Regulation will be blocked until one of the following conditions exists:

- Power to the control is cycled
- The control is switched to Manual remotely
- The control is switched to Manual via the Auto/Manual switch on the control adapter panel
- The Low Current Alarm is cleared/reset
- Load Current measurement is greater than or equal to 4 mA for 1 second

The Alarm Reset is located on the "Programmable Alarm" dialog screen and in HMI "Configuration/ Programmable Alarm/CLR Low Current Block.

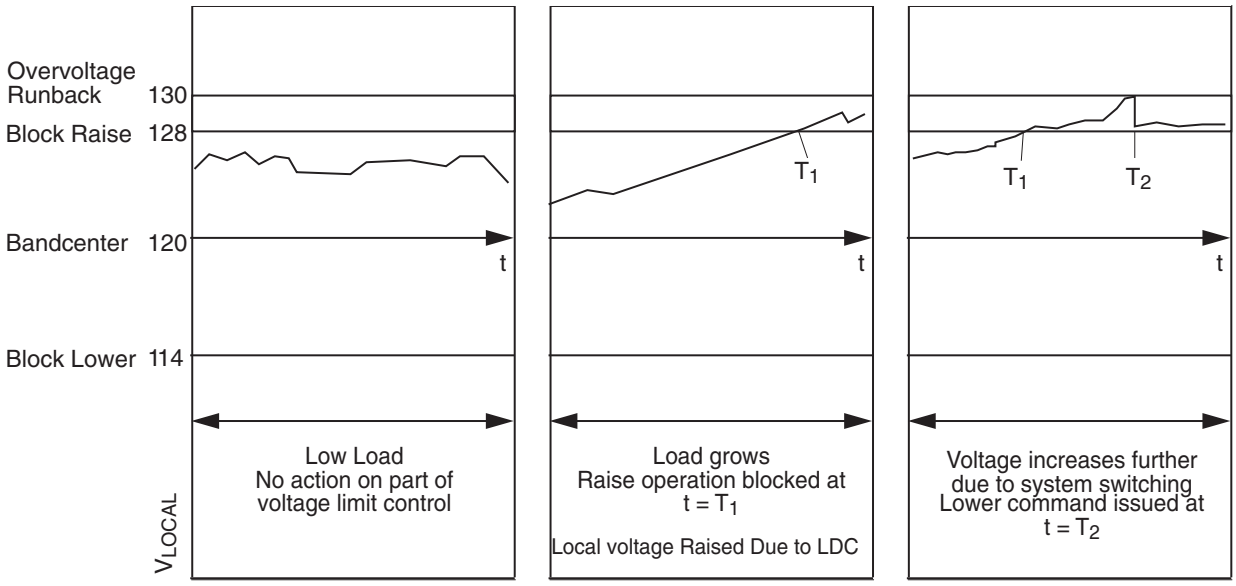

Figure 6-3 Local Voltage as Function of Load Current When Using Line Drop Compensation/ Action of Overvoltage and Overvoltage Runback Control

Setting the Overvoltage Block Raise Limit From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
              SETPOINTS
←MNTR                      CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                          →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Limits" menu.

```
            LIMITS    1,2,3,4
←                          →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Down arrow pushbutton once. The unit will display the following:

```
Block Raise Voltage
   128.0  Volts
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Block Raise Voltage
   128.0 Volts              C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Block Raise Voltage
   128.0 Volts              C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, enter the desired Block Raise Limit (95.0 to 135.0 Volts in 0.1 increments), then press the ENT pushbutton. The following will be displayed reflecting the Block Raise Limit that was entered.

```
Block Raise Voltage
   XXX.X  Volts
```

Setting the Voltage Runback Deadband From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
            SETPOINTS
←MNTR                    CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                        →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Limits" menu.

```
            LIMITS    1,2,3,4
←                        →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Down arrow pushbutton, as necessary, until the following is displayed:

```
Runback Deadband
   2.0 Volts
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Runback Deadband
   2.0 Volts                C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Runback Deadband
   2.0 Volts                C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, enter the desired Runback Deadband (1.0 to 4.0 Volts in 0.1 increments), then press the ENT pushbutton. The following will be displayed reflecting the Runback Deadband value that was entered.

```
Runback Deadband
   X.X Volts
```

Setting the Undervoltage Block Lower Limit From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
              SETPOINTS
←MNTR                      CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                          →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Limits" menu.

```
            LIMITS    1,2,3,4
←                          →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Down arrow pushbutton, as necessary, until the following is displayed:

```
Block Lower Voltage
   114.0 Volts
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Block Lower Voltage
   114.0 Volts             C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Block Lower Voltage
   114.0 Volts             C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, enter the desired Block Lower Limit (95.0 to 135.0 Volts in 0.1 increments), then press the ENT pushbutton. The following will be displayed reflecting the Block Lower Limit that was entered.

```
Block Lower Voltage
   XXX.X  Volts
```

Setting the Voltage Runup Deadband From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
            SETPOINTS
←MNTR                    CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                        →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Limits" menu.

```
            LIMITS    1,2,3,4
←                        →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Down arrow pushbutton, as necessary, until the following is displayed:

```
Runup Deadband
  2.0 Volts
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Runup Deadband
  2.0 Volts                C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Runup Deadband
  2.0 Volts                C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, enter the desired Runup Deadband (1.0 to 4.0 Volts in 0.1 increments), then press the ENT pushbutton. The following will be displayed reflecting the Runup Deadband value that was entered.

```
Runup Deadband
  X.X Volts
```

Enabling/Disabling Voltage Runup From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
            SETPOINTS
←MNTR                    CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                        →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Limits" menu.

```
            LIMITS    1,2,3,4
←                        →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Down arrow pushbutton, as necessary, until the following is displayed:

```
Runup Enable/Disable
disable
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Runup Enable/Disable
disable                    C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Runup Enable/Disable
disable                    C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, select ENABLE or disable, then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Runup Enable/Disable
ENABLE or disable
```

Setting the Current Block Limit From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
            SETPOINTS
←MNTR                    CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                        →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Limits" menu.

```
            LIMITS    1,2,3,4
←                        →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Down arrow pushbutton, until the unit displays the following:

```
Current Block Limit
   640 mA
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Current Block Limit
   640 mA                C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Current Block Limit
   640 mA                C
```

   If not, re-enter a valid code.

8. Utilize the arrow pushbuttons, to enter the desired Current Block Limit (50 to 640 mA in 1 mA increments), then press the ENT pushbutton. The following will be displayed reflecting the Current Block Limit that was entered.

```
Current Block Limit
   XXX mA
```

Enabling/Disabling The Low Current Block/ Alarm From The HMI

■**NOTE**: Enabling the Low Current Block feature also enables the Low Current Block/ Alarm.

To enable/disable the Low Current Block/Alarm from the HMI, proceed as follows:

1. Press the Down Arrow (CNFG Hot Button) pushbutton to awaken the unit. The menu will advance to "CONFIGURATION".

```
        CONFIGURATION
←SETP                    COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Tap Settings
←                        →
```

3. Press the Right or Left arrow pushbutton, as necessary, to navigate to the "Nameplate" menu.

```
          Nameplate
←                        →
```

4. Press the Down arrow pushbutton, as necessary, until the "Low Current Block" screen is displayed.

```
Low Current Block
disable
```

5. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Low Current Block
disable                  C
```

6. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level 2 Access Code, then press the ENT pushbutton.

   If a valid Level 2 Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Low Current Block
disable                  C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons select ENABLE or Disable, then press the ENT pushbutton. The following will be displayed reflecting the selection that was entered.

```
Low Current Block
ENABLE or Disable
```

Enabling/Disabling The Low Current Block/ Alarm From TapTalk

To set the Low Current Block/Alarm from TapTalk®, proceed as follows:

■**NOTE**: Enabling the Low Current Block feature also enables the Low Current Block/ Alarm.

1. Select **Setup/Configuration** from the TapTalk toolbar. TapTalk will display the Configuration dialog screen (Figure 5-8).
2. From the "Low Current Block" section of the configuration dialog screen select "Enable or Disable".
3. Select **Save**. TapTalk will display a "Save to Device" confirmation screen (Figure 6-4).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 6-5).

Setting Block Raise Limit, Runback Deadband, Block Lower Limit, Runup Deadband and Current Block Limit From TapTalk

1. Select **Setup/Setpoints** from the TapTalk® toolbar. TapTalk will display the Setpoints dialog screen (Figure 6-6).

■**NOTE**: Selecting "Undo/Refresh" only affects the displayed profile.

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

2. Select the desired Setpoint Profile (1–4), then from the "Limit and Runback" section of the Setpoints dialog screen enter the desired settings for the following:
   - Block Raise
   - Runback Deadband
   - Block Lower
   - Runup Deadband
   - Runup Enable/Disable
   - Current Limit

■**NOTE**: Selecting "Save" saves all profiles to the control.

3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 6-4).

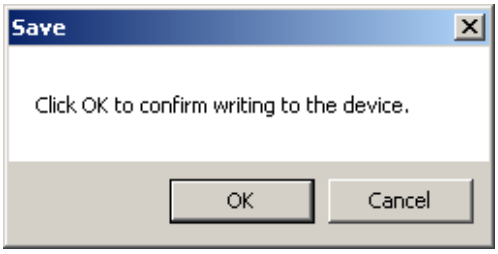

Figure 6-4 Save to Device Confirmation Screen

4. Select **OK**. TapTalk will display a Setpoints "Successfully Written to Control" confirmation screen (Figure 6-5).

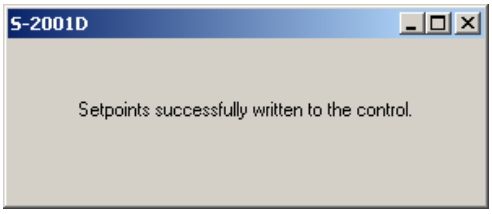

Figure 6-5 Setpoints Successfully Written To The Control Dialog Screen

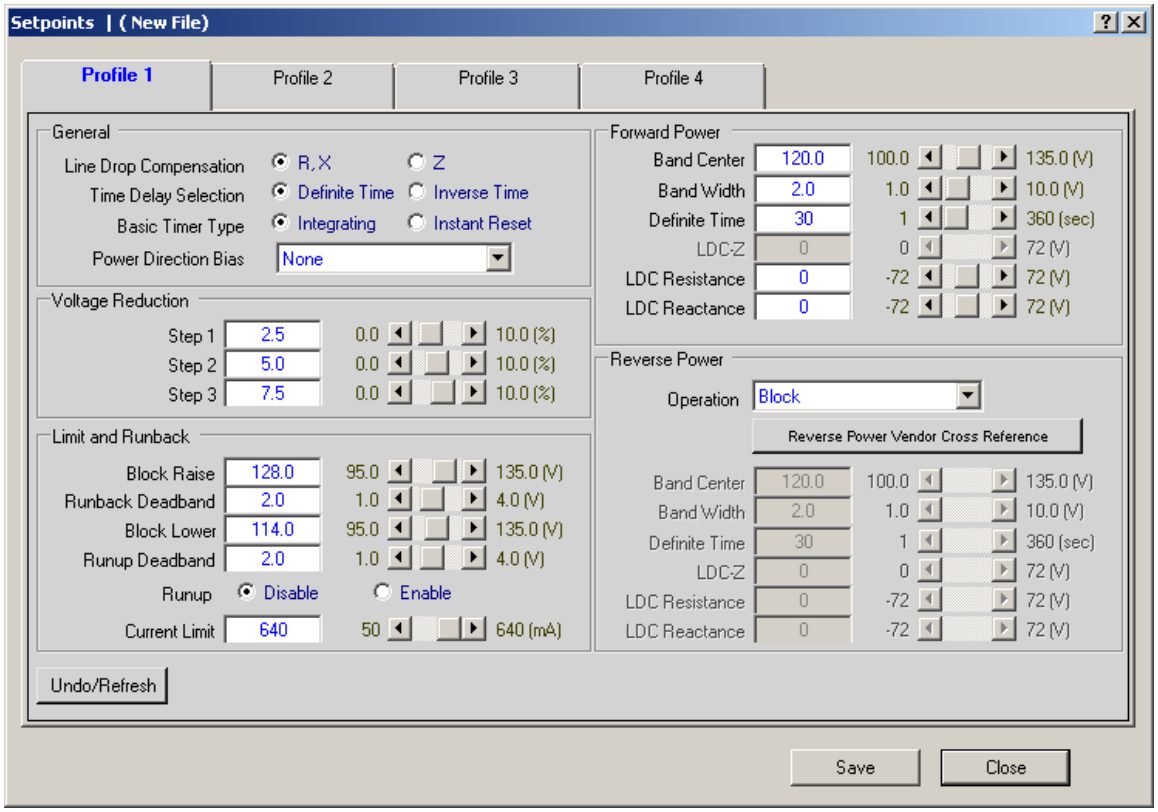

Figure 6-6 Setpoints Dialog Screen

VOLTAGE REDUCTION

The M-2001D allows the selection of either Standard Voltage Reduction or Smart Voltage Reduction. Standard Voltage Reduction lowers the Bandcenter based on a percentage of the existing Bandcenter setting. When initiated, the control immediately begins Lower operations to reduce the voltage until it reaches the new upper band edge (Bandcenter plus ½ the Bandwidth setting). Smart Voltage Reduction will further reduce voltage using several methods detailed in **Section 5.2, Configuration,"Smart Voltage Reduction"**.

The control allows three steps of voltage reduction initiated by external dry contacts, front panel pushbutton or SCADA. The percentage voltage reduction at each step is adjustable from 0 to 10% in 0.1% increments. When one or more contacts are closed, the effect is to shift the bandcenter setpoint lower thus causing the control to lower the voltage.

In addition, voltage reduction functionality can be enabled or disabled using Communication MODBUS® and DNP protocols.

The Voltage Reduction feature can be turned off by the Voltage Reduction Turnoff Timer (0 to 999 min). A setting of zero disables the Turnoff Timer.

Recognize that the "effective" bandcenter may have been raised by line drop compensator action when the voltage reduction is initiated and that the resultant voltage setting will be the combination of the two effects. Note also that the undervoltage block setting may limit the lowering of voltage, especially if there is little raising of the local voltage due to LDC action.

When first initiated, or when a subsequent step of voltage reduction is needed, the control will respond immediately to the voltage reduction command without regard to either the intertap time delay setting or the control time delay setting. After the desired voltage reduction, operation will revert back to normal operation with the time delay. Refer to **Section 7.1, External Connections** for contact connections.

When Voltage Reduction is enabled the front panel pushbutton, wired SCADA dry contacts, RS-485, Fiber Optic port or Ethernet connection can be used to provide stepped voltage reduction as described earlier.

Also, the state of the "Voltage Reduction" communications command can be saved or not saved when power has been lost. The default setting is "DON'T SAVE".

Setting Voltage Reduction Steps 1, 2 and 3 From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
            SETPOINTS
←MNTR                      CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                          →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Common Settings" menu.

```
    Common Settings   1,2,3,4
←                          →
```

■**NOTE**: The following sequence of steps are for setting Voltage Reduction Step 1. The steps used to set the Voltage Reduction Steps 2 and 3 are similar.

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Down arrow pushbutton, as necessary, to navigate to the "Reduction Step 1 %" (or Step 2 or 3) menu item.

```
Reduction Step 1 %
  2.5
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Reduction Step 1 %
  2.5                          C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Reduction Step 1 %
 2.5                          C
```

   If not, re-enter a valid code.

8. Utilize the arrow pushbuttons to enter the desired Voltage Reduction (0.0 to 10.0 % in 0.1 % increments), then press the ENT pushbutton. The following will be displayed reflecting the Voltage Reduction Step #1 Value that was entered.

```
Reduction Step 1 %
 X.X
```

Setting Voltage Reduction Steps 1, 2 and 3 From TapTalk

1. Select **Setup/Setpoints** from the TapTalk® toolbar. TapTalk will display the Setpoints dialog screen (Figure 6-6).

■**NOTE**: Selecting "Undo/Refresh" only affects the displayed profile.

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

2. Select the desired Setpoint Profile, then from the "Voltage Reduction" section of the Setpoints dialog screen enter the desired Voltage Reduction settings (0.0 to 10.0 % in 0.1 % increments) for the following:
   - Step 1
   - Step 2
   - Step 3

■**NOTE**: Selecting "Save" saves all profiles to the control.

3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 6-4).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 6-5).

LINE DROP COMPENSATION

Voltage Regulation Without LDC

When the control is just used to regulate the voltage on the regulator low-side bus, the only input required is voltage from a line-to-line or line-to-ground VT with a nominal 120 Vac secondary.

Voltage Regulation With LDC

When it is desirable to regulate the voltage at some distance from the voltage regulator, or in general to raise the voltage during high load conditions, the Line Drop Compensation (LDC) feature is used.

Two different LDC methods are available in the M-2001D Digital Tapchanger Control. A selection in the Setpoints/General section allows the user to select from either Resistance/Reactance (R/X) or LDC-Z.

The Bandcenter, Bandwidth, and Time Delay functions are set the same as if LDC were not used.

LDC R/X

A classical approach can be used to determine the R/X settings for the LDC, however this assumes a load center point and is usually not applicable to the typical distribution feeder. For more information, contact Beckwith Electric for **Application Note #17**.

A simpler method, which will work for most applications, is recommended. This involves looking at the lines leaving the station and determining the resistance/reactance (R/X) ratio for the main line. The resistive and reactive line drop compensation setpoints should then be entered in this same R/X ratio.

If the CT and VT phasing corrections have been made to compensate for any phase angles between measured voltage and load current, only positive values of R and X compensation need to be used.

Table 6-1 gives the R/X ratio for various wire sizes and typical conductor spacings.

ACSR		COPPER	
MCM	**R/X**	**MCM**	**R/X**
795	4.0	750	6.0
477	2.5	500	4.5
336	2.0	350	3.3
266	1.5	250	2.4
AVG	R/X	AWG	R/X
4/0	1.2	4/0	2.0
2/0	1.0	2/0	1.5
2	0.5	2	0.7
6	.02	6	0.3

Table 6-1 Approximate Ratio of Line Resistance to Reactance (R/X) of Typical Distribution Circuits

By knowing the ratio of the maximum expected load to the present load, the amount of voltage compensation needed is found as shown in the following example.

Example

Desired

local voltage @ min load = 120 volts

local voltage @ max load = 124 volts

Using the following assumptions:

Desired Bandcenter = 120 volts

Desired Bandwidth = 2 volts

The device being controlled is 50% loaded

Setting

Start with R=0 and X=0 and increase both values using the ratio shown in the table for the feeder conductor. Keeping the R/X ratio, increase R_{set} and X_{set} until the difference between the compensated voltage and the local voltage is 2.0 volts.

This example would let the voltage vary from 119 V at no load to 125 V at maximum load taking into account the bandwidth.

With this simplified method of LDC setting, the first customer's voltage will be limited by the upper voltage limit at the highest daily load, depending on the accuracy of the daily load projection. At the same time, the furthest customer will receive the highest voltage possible under the line and loading conditions. The first customer protection can be set on the control. Refer to the **Regulation Limits** section of this chapter.

Since the daily load projections will likely have a seasonal variation, the best balance of first customer to furthest customer voltage may require seasonal adjustment of the LDC settings. Note that the settings of R and X compensation are proportional to the peak load projection and that new settings can be scaled from the first setting obtained by the experimental process just described.

LDC-Z

The second available compensation method is called Z-compensation (LDC-Z). LDC-Z must be selected in the control setpoint portion of the menu or software and the **VOLTAGE RAISE** (V_R) setpoint must be set in order for this feature to be implemented. The LDC-Z application is especially useful on systems where several lines exist with different load centers where the proper compensation is not related to any single R & X values as set in R & X compensation.

Basically, LDC-Z compensation consists of designating a target bus voltage increase (line drop compensation) that correlates to the **magnitude** of the control current rather than to the calculation of input R & X line drop at control current magnitude and angle values.

The setting, (V_R), is the calculated load voltage drop (at maximum load) in the circuit or line that has the ratio of the highest voltage drop at maximum load condition compared to the rated CT output (200 mA).

V_R = 0 to 72 volts in increments of 1 volt.

Example:

- Calculated voltage drop = 5 volts at load level of 150 mA control current.
- V_R setting = 200/150 X 5 = 6.7 volts (rounded) = 7 volts

To calculate the line drop compensation at any given control current level (I):

- V = I/200 X 7 (setting):

  If I = 50 mA; V = 50/200 X 7 = 1.75 volts

As with R & X compensation applications, the "block raise" and "deadband" settings are used for first house protection on all circuits or lines.

■**NOTE**: For additional information about LDC-Z applications, contact Beckwith Electric to obtain Distributech Paper 1/27/05, "*Maximizing Automatic Reverse Power Operations with LTC Transformers and Regulators*."

Function	Setpoint Range	Increment	Default Setting
Bandcenter	100.0 V to 135.0 V	0.1 V	120.0 V
Bandwidth	1.0 V to 10.0 V	0.1 V	2.0 V
Definite Delay	1 second to 360 seconds	1 second	10 seconds
Inverse Delay	1 second to 360 seconds	1 second	10 seconds
LDC Resistance	-72 V to +72 V	1 V	0 V
LDC Reactance	-72 V to +72 V	1 V	0 V
LDC-Z	0 V to 72 V	1 V	0 V

Table 6-2 Line Drop Compensation Setpoint Ranges

Selecting Line Drop Compensation Type and Settings From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
            SETPOINTS
←MNTR                    CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                        →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Common Settings" menu.

```
    Common Settings   1,2,3,4
←                        →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Down arrow pushbutton, as necessary, to navigate to the "LDC Selection" menu item.

```
LDC Selection
RX
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
LDC Selection
RX                        C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS
_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
LDC Selection
RX                        C
```

   If not, re-enter a valid code.

8. Utilizing the Up/Down arrow pushbuttons, select the desired type of Line Drop Compensation (RX or Z), then press the ENT pushbutton. The following will be displayed reflecting the Line Drop Compensation Type that was selected.

```
LDC Selection
XX
```

9. Depending on the type of Line Drop Compensation that was selected in Step 8, proceed as follows to complete the Line Drop Compensation setup:
   - If "RX" Line Drop Compensation was selected, proceed to "Setting LDC Resistance (R) and Reactance (X) Values" in this chapter.
   - If "Z" Line Drop Compensation was selected, proceed to "Setting LDC-Z" in this chapter.

Setting Power Flow Forward and Power Flow Reverse LDC Resistance (R) and Reactance (X) Values From The HMI

■**NOTE**: The steps necessary to set the Power Flow Forward LDC Resistance (R) and Reactance (X) values are described here. The steps to set the Power Flow Reverse LDC Resistance (R) and Reactance (X) are similar.

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
            SETPOINTS
←MNTR                    CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                        →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Common Settings" menu.

```
    Common Settings   1,2,3,4
←                        →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Right or Left arrow pushbutton, as necessary, to navigate to the "Power Flow Forward" menu.

```
          Power Flow Fwd
←                        →
```

5. Press the Down arrow pushbutton, as necessary, to navigate to the "LDC R Fwd" (or LDC R Rev) menu item.

```
LDC R Fwd                ←→
   0 Volts
```

6. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
LDC R Fwd
   0 Volts                  C
```

7. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
LDC R Fwd
   0 Volts                  C
```

   If not, re-enter a valid code.

■**NOTE**: The double directional arrows in the display indicate that by pressing Right or Left arrow pushbuttons the display will jump to the LDC Selection display in the Common Settings menu. Pressing any other pushbutton except ENT will then jump back to the LDC R(X) Fwd(Rev) display.

9. Utilize the arrow pushbuttons to enter the desired LDC R value (–72 to +72 in 1 Volt increments), then press the ENT pushbutton. The display will advance to the LDC X Fwd display.

```
LDC X Fwd
   0 Volts
```

10. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 13.

```
LDC X Fwd
  0 Volts                    C
```

11. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

12. Enter a valid Level Access Code, then press the ENT pushbutton.

    If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and then display the following:

```
LDC X Fwd
  0 Volts                    C
```

    If not, re-enter a valid code.

■**NOTE**: The double directional arrows in the display indicate that by pressing Right or Left arrow pushbuttons the display will jump to the LDC Selection display in the Common Settings menu. Pressing any other pushbutton except ENT will then jump back to the LDC R(X) Fwd(Rev) display.

13. Utilize the arrow pushbuttons to enter the desired LDC X value (–72 to +72 in 1 Volt increments), then press the ENT pushbutton. The display will advance to the LDC R Fwd display.

```
LDC R Fwd                  ←→
  0 Volts
```

Setting Power Flow Forward and Power Flow Reverse LDC Z Values From The HMI

■**NOTE**: The steps necessary to set the Power Flow Forward LDC Z value are described here. The steps to set the Power Flow Reverse LDC Z value are similar.

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
            SETPOINTS
←MNTR                      CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                          →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Common Settings" menu.

```
    Common Settings   1,2,3,4
←                          →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Right or Left arrow pushbutton, as necessary, to navigate to the "Power Flow Forward" menu.

```
         Power Flow Fwd
←                          →
```

5. Press the Down arrow pushbutton, as necessary, to navigate to the "LDC Z Fwd" (or LDC Z Rev) menu item.

```
LDC Z Fwd                  ←→
  0 Volts
```

6. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
LDC Z Fwd
  0 Volts                    C
```

7. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
LDC Z Fwd
  0 Volts                    C
```

   If not, re-enter a valid code.

■**NOTE**: The double directional arrows in the display indicate that by pressing Right or Left arrow pushbuttons the display will jump to the LDC Selection display in the Common Settings menu. Pressing any other pushbutton except ENT will then jump back to the LDC Z Fwd(Rev) display.

9. Utilize the arrow pushbuttons to enter the desired LDC Z value (0 to 72 in 1 Volt increments), then press the ENT pushbutton. The following will be displayed reflecting the LDC-Z value that was selected.

```
LDC Z Fwd                    ←→
  X Volts
```

Setting Line Drop Compensation From TapTalk

1. Select **Setup/Setpoints** from the TapTalk® toolbar. TapTalk will display the Setpoints dialog screen (Figure 6-6).

■**NOTE**: Selecting "Undo/Refresh" only affects the displayed profile.

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

2. Select the desired Setpoint Profile, then from the "General" section of the Setpoints dialog screen, select the desired type of Line Drop Compensation (R, X or Z).

3. From the "Forward Power" section of the Setpoints dialog screen, enter the desired LDC R, X or Z for Forward Power settings for the following:

   - R, X (–72 to +72 in 1 Volt increments)
   - Z (0 to 72 in 1 Volt increments)

   If Reverse Power Flow settings are required, enter the desired LDC R, X or Z values in the "Reverse Power" section of the Setpoints dialog screen.

■**NOTE**: Selecting "Save" saves all profiles to the control.

4. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 6-4).

5. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 6-5).

BASIC TIME DELAY

The Basic Time Delay setting is required to inhibit the tapchanger from unnecessary operations on temporary voltage excursions and is commonly set at 30 to 60 seconds. The timer includes two selectable elements "Definite/Inverse" and "Integrating/Instant Reset".

The control will only respond to an out-of-band voltage excursion after the Basic Time Delay has timed out. The Basic Time Delay can be set as an integrating timer or an instantaneous reset timer upon the voltage return to an in-band condition. As an integrating timer, it increments during time out-of-band and decrements during time in-band, but not below zero.

The Basic Time Delay can be set to either a Definite or Inverse delay. Both types of delay will work in Forward or Reverse Power Flow. The inverse time delay will follow the curve in Figure 6-7, Inverse Time Delay Curve.

Inverse Time Example

Bandcenter 120 V

Bandwidth 3 V

Inverse Time Delay Setting 120 s

ΔV = (Bandwidth/2) = 1.5 V

V_{in} = 123 V

Voltage deviation in multiples of ΔV

= $[V_{in}$ – Bandcenter$]/\Delta V$

= (123 – 120)/1.5

= 2

Time delay from Figure 6-7

= 50% of Inverse Time Delay setting

= 60 sec

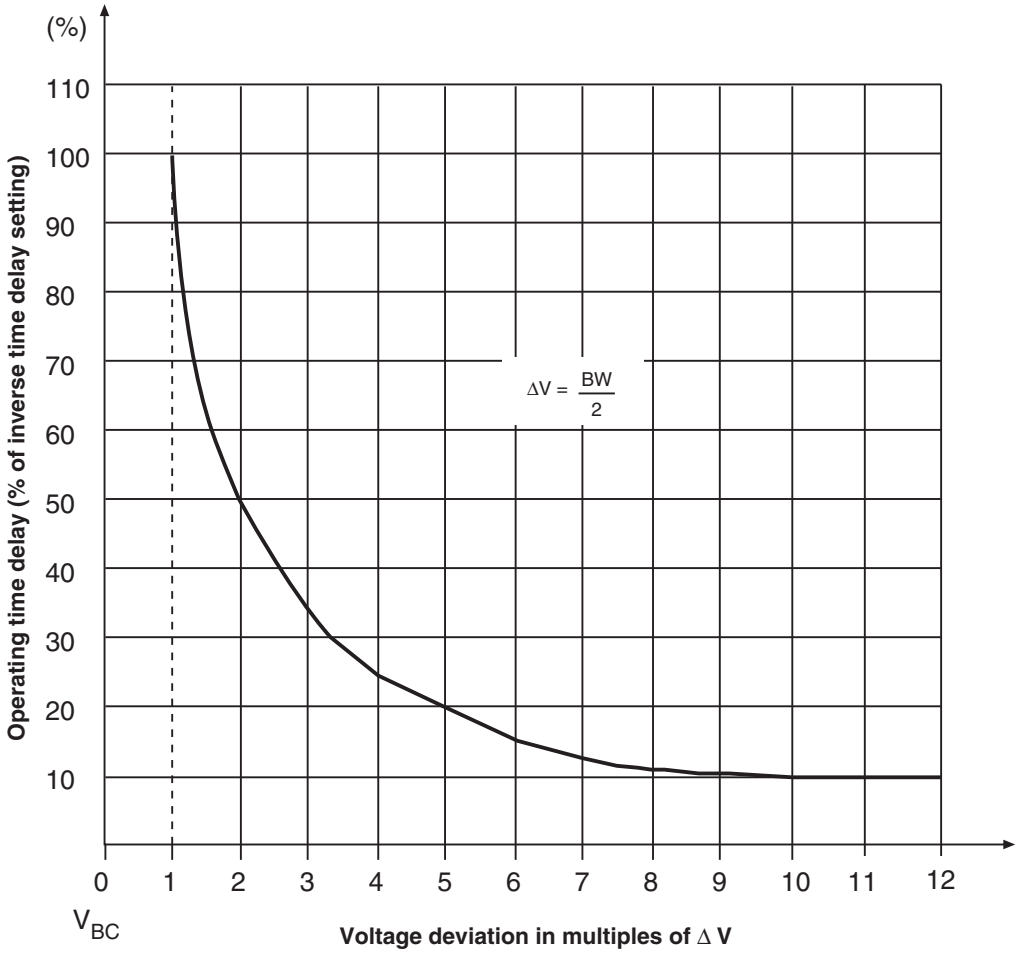

Figure 6-7 Inverse Time Delay Curve

Setting Basic Time Delay Timer Characteristic and Type From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
            SETPOINTS
←MNTR                    CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                        →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Common Settings" menu.

```
    Common Settings   1,2,3,4
←                        →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Down arrow pushbutton, as necessary, to navigate to the "Timer Characteristic" menu item.

```
Timer Characteristic
DEFINITE
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Timer Characteristic
DEFINITE                    C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS
_
```

■**NOTE**: When entering the Level Access Code the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Timer Characteristic
DEFINITE                    C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons, select the desired Timer Characteristic (DEFINITE or INVERSE), then press the ENT pushbutton. The following will be displayed reflecting the Timer Characteristic that was selected.

```
Timer Characteristic
DEFINITE or INVERSE
```

9. Press the Down arrow pushbutton, as necessary, to navigate to the "Timer Reset" menu item.

```
Timer Reset
INTEGRATING
```

10. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 13.

```
Timer Reset
INTEGRATING                 C
```

11. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS
_
```

■**NOTE**: When entering the Level Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

12. Enter a valid Level Access Code, then press the ENT pushbutton.

    If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Timer Reset
INTEGRATING                C
```

    If not, re-enter a valid code.

13. Utilizing the arrow pushbuttons, select the desired Timer Reset (INTEGRATING or INSTANT RESET), then press the ENT pushbutton. The following will be displayed reflecting the Timer Reset type that was selected.

```
Timer Reset
INTEGRATING or INSTANT RESET
```

Setting Basic Time Delay Timer Characteristic and Type From TapTalk

1. Select **Setup/Setpoints** from the TapTalk® toolbar. TapTalk will display the Setpoints dialog screen (Figure 6-6).

■**NOTE**: Selecting "Undo/Refresh" only affects the displayed profile.

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

2. Select the desired Setpoint Profile, then from the "General" section of the Setpoints dialog screen select the desired User Selectable Time Delay type (Definite or Inverse).
3. From the "General" section of the Setpoints dialog screen select the desired User Selectable Time Delay timer type (Integrating or Instant Reset).

■**NOTE**: Selecting "Save" saves all profiles to the control.

4. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 6-4).
5. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 6-5).

REVERSE POWER OPERATION

The importance of the correct operation of the counter extends beyond mere counting operations. One additional feature of the control is distinct "reverse power" operations depending on power flow direction. In addition to normal configurations of "block" or "ignore" during automatic reverse power detection, the control may be configured to "regulate in reverse direction" or "return to the neutral position." The control includes a power direction function for detecting the reversal of power flow in the regulator or transformer. The active power direction is based on the flow of real power and is not confused by reactive power flow in either direction.

The directional operation of the control will be reversed whenever the power flow reverses to as little as 2% (4 mA) of the nominal 200 mA rating of the control. For example, to change from a normal forward power to reverse operation, 4 mA of the real component of the load current must be detected in the reverse direction. To then revert back to the normal forward direction operation, 4 mA of the real component must be detected in the forward direction. This establishes an 8 mA "hysteresis" effect.

Additionally, the control can be "biased" in either the forward or reverse direction depending on circuit or system configuration. This essentially removes the 2% requirement from the change to the biased direction. For example, a control biased in the forward direction will change to the reverse direction as described above. It will require only that the power flow be in the forward direction to change back to forward operation. This biasing reduces the "hysteresis" effect to 4 mA from the original 8 mA.

In order for the "regulate in reverse direction" or "return to the neutral position" to implement properly, two prerequisites are required. The first is Tap Position Knowledge. Without knowledge of the tap position it would be impossible for the control to run the tapchanger to the neutral position. The second is source side voltage. Without knowledge of the source side voltage, it would be impossible to regulate it.

Detecting Reverse Power

Reverse power flow exists whenever the real component of the load current changes direction from forward and remains until another reversal to forward power flow occurs. The control reliably determines power direction with as little as 2% of the real component of the nominal 200 mA load current (4.0 mA). A LED on the front panel will illuminate whenever the control senses a reverse power condition.

Power Direction Bias Setpoints

Power Direction Bias includes three settings to determine how the control will switch between forward and reverse power operation. The three settings are **None**, **Forward Bias**, and **Reverse Bias**.

"None" Setting

When the Power Direction Bias function is set to "None", the control applies an 8 mA hysteresis band with a bandcenter of 0 load current (+4 mA to –4 mA) to switch between forward and reverse power. The control will switch from forward power to reverse power when the load current exceeds –4 mA (reverse direction). The control will switch from reverse power to forward power when the load current exceeds +4 mA (forward direction).

"Forward Bias" Setting

When the Power Direction Bias function is set to "Forward Bias", the control applies a 0 mA to –4 mA hysteresis band to switch between forward and reverse power. The control will switch from reverse power to forward power when load current is $\geq$ 0 mA (forward direction). The control will switch from forward power to reverse power when the load current exceeds –4 mA (reverse direction).

"Reverse Bias" Setting

When the Power Direction Bias function is set to "Reverse Bias", the control applies a 0 mA to +4 mA hysteresis band to switch between forward and reverse power. The control will switch from forward power to reverse power when load current is $\leq$ 0 mA (reverse direction). The control will switch from reverse power to forward power when the load current exceeds +4 mA (forward direction).

Reverse Power Operation Mode

Upon detection of power reversal, after a 5 second delay, the control will operate in the selected mode. The operating mode is selected from the following options:

Block – Inhibits automatic tapchange operation. This locks the tapchanger on the tap position in use at the time reverse power flow is detected. It is the recommended setting for independent power producers or in situations when reverse power flow is not expected. The control will revert to normal operation when forward power flow resumes.

Regulate Forward (Ignore) – The control will take no different action than in the forward direction. It essentially does not use the power direction in the control decisions. This is the same as a control which does not have power direction knowledge.

Regulate Reverse and Regulate Reverse Measured –The control will detect reverse power flow and regulate according to reverse power settings as selected in the Setpoint Menu. With tap position knowledge, the control calculates the source-side potential without the use of a source side VT. This feature is designed for use with feeder voltage regulators which continue to operate in a radial mode after system switching causes the power flow reversal.

For Regulate Reverse the source voltage is calculated by knowing the local voltage, the load current, and the tap position using a presumed regulator impedance. That impedance is a function of the tap position. The calculated source voltage is only valid with a 5/8 % step-voltage regulator.

When Reverse power is detected and the Operation Mode is in "Regulate Reverse Measured", the control will energize an internal contact that will switch the input to the VT from Load side to Source side. After a 4 cycle delay, the source side voltage will be measured, the load voltage at this instant will be displayed as zero. In forward power direction, the control will switch the input back to the load side voltage.

With the control recognizing reverse power flow, the following occurs:

- The **REV PWR** LED is illuminated.
- Reverse power setpoints are used.
- Source voltage is calculated in case of Regulate Reverse and measured in case of Regulate Reverse Measured and motor output commands are reversed. For example, when the voltage is high, the control raises the tap thereby lowering the voltage and a lower is indicated on the front panel LEDs.

Return to Neutral – To use this feature, a counter input must be provided, and KeepTrack™ tap information modes must be enabled.

The Return to Neutral feature will cause the tap position to be driven to neutral when reverse power is detected. Tap position will be driven to neutral regardless of the voltage or currents present at the control. Once neutral is reached, the tap position will remain unchanged as long as reverse power is present. Normal operation will resume when forward power is detected.

This mode is intended as a safe response to a power reversal on a system which can have conflicting situations. As described earlier, a radially operating system with reverse power should be set to "Regulate Reverse Measured" However, if a DG causes a power reversal, the proper setting is usually "Ignore". In an application where both conditions are possible and it is not possible for the control to determine the cause of power reversal, the proper setting of "Return to Neutral" is advised.

Distributed Generation – Distributed Generation allows alternate LDC R and X values to be applied to the control when reverse power is detected. The factory setting is BLOCK. This mode is intended for use on distribution systems that have the possibility of power reversal because of distributed generation (DG) on the feeders. In these applications, the DG usually does not have the capacity to control the voltage with the more powerful system intact.

The condition required for DG to control the voltage is the generation and transmission of large amounts of VArs through the line impedance back towards the system source. Usually two items prohibit this action:

- The ability of the DG to generate those amounts of VArs.
- The contractual obligations enforced by many utilities that the DG only affect KWs on the system.

Smart Reverse Power (Auto Determination)

Due to the increased use and larger capacities of Distributed Generation, it is possible for a regulator to see a reverse power condition requiring more than one reverse power mode depending on the cause of the reverse power condition; either Distributed Generation mode or Regulate In Reverse/Regulate in Reverse Measured. The M-2001D provides two new reverse power modes, "Auto Determination" and "Auto Determination Measured" which allow the control to intelligently choose which reverse power mode applies at the time reverse power is sensed.

Auto Determination and Auto Determination Measured – This feature performs the following sequence when reverse power is detected:

1. Distributed Generation Mode will be applied initially.
2. On the next tap operation, Load Voltage will be measured before and one second after the tap (defined as 1 second after the operation counter has incremented either due to a counter input or motor hold). The absolute magnitude value of this difference is stored internally as the Tap Delta Voltage.
   a. If the Tap Delta Voltage is greater than 0.4 Vac, the control stays in Distributed Generation Mode and will behave normally in this mode with no further measurements of Load Voltage needed.
   b. If the Tap Delta Voltage is less than or equal to 0.4 Vac, the control increments an internal counter designed to keep track of how many times the Tap Delta Voltage is less than 0.4 Vac. The next tap operation will again measure Load Voltage in the same manner. If the control sees two consecutive Tap Delta Voltage measurements less than or equal to 0.4 Vac, the control changes from Distributed Generation Mode to either Regulate Reverse if "Auto Determination" has been selected, or Regulate Reverse Measured if "Auto Determination Measured" has been selected.
   c. If Tap Delta Voltage is greater than 0.4 Vac on the second tap operation, the control does not increment the internal counter, and stays in Distributed Generation Mode. The control will then measure Tap Delta Voltage on the next tap. If that third tap has a Tap Delta Voltage greater than 0.4 Vac, then the control remains in Distributed Generation Mode and the internal counter is cleared. If the third tap has a Tap Delta Voltage less than or equal to 0.4 Vac, the condition meets the requirements of 2b above and the control will respond accordingly.
3. Once the control has determined which Reverse Power mode to apply using the method described above, it will operate in that mode as long as Reverse Power is detected.

TapTalk Reverse Power Vendor Cross Reference

The Reverse Power section of the TapTalk Setpoints screen also contains a link which displays the "Reverse Power Vendor Cross Reference" table showing Cooper/Siemens reverse power names and their Beckwith Electric equivalents (Figure 6-8).

Reverse Power Vendor Cross Reference

Beckwith Reverse Power Mode	Cooper/Siemens Reverse Power Mode
Block	Locked Forward Mode
Regulate Forward (Ignore) *	Reverse Idle Mode
Regulate Reverse	None
Return to Neutral *	Neutral Idle Mode
Regulate in Reverse (Measured) *	Bi-Directional Mode
Distributed Generation	Cogeneration Mode
Auto Determination	None
*Low Current block feature must also be enabled to be equivalent to this Cooper Reverse Power Mode.	

OK

Figure 6-8 TapTalk Reverse Power Vendor Cross Reference Table

Setting Reverse Power Operation and Power Direction Bias Mode From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
            SETPOINTS
←MNTR                    CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                        →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Common Settings" menu.

```
     Common Settings   1,2,3,4
←                        →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Down arrow pushbutton, as necessary, to navigate to the "Rev Power Operation" menu item.

```
Rev Power Operation
BLOCK
```

5. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 8.

```
Rev Power Operation
BLOCK                      C
```

6. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

7. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Rev Power Operation
BLOCK                      C
```

   If not, re-enter a valid code.

8. Utilizing the arrow pushbuttons select the desired Reverse Power Operation mode:

   - BLOCK
   - IGNORE
   - REGULATE REVERSE
   - RETURN TO NEUTRAL
   - REG. R MEASURED SRCC
   - DG Mode
   - AUTO DETERMINE
   - AUTO DETERMINE M

   Press the ENT pushbutton. The following will be displayed reflecting the Reverse Power Operation mode type that was selected.

```
Rev Power Operation
XXXXX
```

9. Press the Down arrow pushbutton, as necessary, to navigate to the "Power Direction Bias" menu item.

```
Power Direction Bias
NONE
```

10. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 13.

```
Power Direction Bias
NONE                          C
```

11. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS
_
```

■**NOTE**: When entering the Level Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

12. Enter a valid Level Access Code, then press the ENT pushbutton.

    If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Power Direction Bias
NONE                          C
```

    If not, re-enter a valid code.

13. Utilizing the arrow pushbuttons select the desired Power Direction Bias mode (NONE, FORWARD or REVERSE), then press the ENT pushbutton. The following will be displayed reflecting the Power Direction Bias mode that was selected.

```
Power Direction Bias
NONE, FWD BIAS or REV BIAS
```

Setting Reverse Power Operation and Power Direction Bias Mode From TapTalk

1. Select **Setup/Setpoints** from the TapTalk® toolbar. TapTalk will display the Setpoints dialog screen (Figure 6-6).

■**NOTE**: Selecting "Undo/Refresh" only affects the displayed profile.

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

2. Select the desired Setpoint Profile, then from the "General" section of the Setpoints dialog screen select the desired Power Direction Bias mode (None, Forward or Reverse).
3. From the "Reverse Power" section of the Setpoints dialog screen select the desired Reverse Power Operation mode:
   - Block
   - Regulate Forward (Ignore)
   - Regulate Reverse
   - Return to Neutral
   - Regulate Reverse (Measured)
   - Distributed Generation
   - Auto Determination
   - Auto Determination (Measured)

■**NOTE**: Selecting "Save" saves all profiles to the control.

4. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 6-4).
5. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 6-5).

POWER FLOW SETTINGS

Bandcenter

The center of the voltage band is adjustable from 100.0 to 135.0 Vac in 0.1 volt increments (for example, 120.0 Vac).

Bandwidth

The regulator uses discrete steps and the Bandwidth must have a width that allows at least one tapchange position where the control remains satisfied. To minimize excessive operations on the regulator, this bandwidth is usually set to include two or three in-band tap operation positions.

The range is settable from 1.0 to 10.0 volts in 0.1 volt increments, and 2 volts minimum is recommended. This setting is the total bandwidth.

Setting Bandcenter and Bandwidth From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
            SETPOINTS
←MNTR                    CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                        →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Common Settings" menu.

```
     Common Settings   1,2,3,4
←                        →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Right or Left arrow pushbutton, as necessary, to navigate to the "Power Flow Forward" menu item.

```
          Power Flow Fwd
←                        →
```

■**NOTE**: The steps necessary to set Bandcenter Forward are described here. The steps to set Bandcenter Reverse are similar.

5. Press the Down arrow pushbutton, as necessary, to navigate to the "Bandcenter Fwd" menu item.

```
Bandcenter Fwd
   120.0  Volts
```

6. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
Bandcenter Fwd
   120.0 Volts              C
```

7. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Bandcenter Fwd
   120.0 Volts              C
```

   If not, re-enter a valid code.

9. Utilizing the arrow pushbuttons enter the desired Bandcenter Fwd value (100.0 to 135.0 in 0.1 Volt increments), then press the ENT pushbutton. The following will be displayed reflecting the Bandcenter Fwd value that was entered.

```
Bandcenter Fwd
   XXX.X Volts
```

10. Press the Down arrow pushbutton, as necessary, to navigate to the "Bandwidth Fwd" menu item.

```
Bandwidth Fwd
   2.0  Volts
```

11. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 14.

```
Bandwidth Fwd
   2.0 Volts                C
```

12. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

13. Enter a valid Level Access Code, then press the ENT pushbutton.

    If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Bandwidth Fwd
   2.0 Volts                C
```

    If not, re-enter a valid code.

14. Utilizing the arrow pushbuttons enter the desired Bandwidth Fwd value (1.0 to 10.0 Volts in 0.1 Volt increments), then press the ENT pushbutton. The following will be displayed reflecting the Bandwidth Fwd value that was entered.

```
Bandwidth Fwd
   X.X Volts
```

Setting Bandcenter and Bandwidth From TapTalk

1. Select **Setup/Setpoints** from the TapTalk® toolbar. TapTalk will display the Setpoints dialog screen (Figure 6-6).

■**NOTE**: Selecting "Undo/Refresh" only affects the displayed profile.

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

2. Select the desired Setpoint Profile, then from the "Forward Power" or "Reverse Power" section of the Setpoints dialog screen enter the desired Bandcenter value (100.0 to 135.0 in 0.1 Volt increments).
3. From the "Forward Power" or "Reverse Power" section of the Setpoints dialog screen enter the desired Bandwidth value (1.0 to 10.0 Volts in 0.1 Volt increments).

■**NOTE**: Selecting "Save" saves all profiles to the control.

4. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 6-4).
5. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 6-5).

Setting The Definite or Inverse Delay From The HMI

1. Press the Up Arrow (SETP Hot Button) pushbutton to awaken the unit. The menu will advance to "SETPOINTS".

```
              SETPOINTS
←MNTR                      CNFG→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Profile Settings
←                          →
```

3. Press the Right or Left arrow pushbuttons, as necessary, to navigate to the "Common Settings" menu.

```
     Common Settings   1,2,3,4
←                          →
```

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

4. Verify that the desired Setpoint Profile is indicated, then press the Right or Left arrow pushbutton, as necessary, to navigate to the "Power Flow Forward" menu item.

```
          Power Flow Fwd
←                          →
```

■**NOTE**: The steps necessary to set Power Flow, Forward Definite (Inverse) Delay are described here. The steps to set Power Flow Reverse Definite (Inverse) Delay are similar.

5. Press the Down arrow pushbutton, as necessary, to navigate to the "Definite (Inverse) Delay Fwd" menu item.

```
Definite Delay Fwd        ←→
   30 Sec
```

6. Press the ENT pushbutton. If Level Access is not active or has been previously input, the following will be displayed. Go to Step 9.

```
Definite Delay Fwd
   30 Sec                    C
```

7. If Level Access is active, the Level Access prompt will be displayed.

```
ENTER LEVEL ACCESS

_
```

■**NOTE**: When entering the Level Access Code, the display will automatically advance the cursor to the next digit when input is momentarily paused.

8. Enter a valid Level Access Code, then press the ENT pushbutton.

   If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and display the following:

```
Definite Delay Fwd
   30 Sec                    C
```

   If not, re-enter a valid code.

■**NOTE**: The double directional arrows in the display indicate that by pressing Right or Left arrow pushbuttons the display will jump to the Timer Characteristic Selection display in the Common Settings menu. Pressing any other pushbutton except ENT will then jump back to the Definite Delay Fwd (Rev) display.

9. Utilizing the arrow pushbuttons, enter the desired Definite (Inverse) Delay Fwd value (1 to 360 Seconds in 1 Second increments), then press the ENT pushbutton. The following will be displayed reflecting the Definite (Inverse) Delay Fwd value that was entered.

```
Definite Delay Fwd        ←→
   xxx Sec
```

Setting The Definite or Inverse Delay From TapTalk

1. Select **Setup/Setpoints** from the TapTalk® toolbar. TapTalk will display the Setpoints dialog screen (Figure 6-6).

■**NOTE**: Selecting "Undo/Refresh" only affects the displayed profile.

▲ **CAUTION**: Editing Setpoints in the wrong Setpoint Profile can cause the control to operate incorrectly.

2. Select the desired Setpoint Profile, then from the "Forward Power" and/or "Reverse Power" section of the Setpoints dialog screen enter the desired Definite (Inverse) Delay Fwd or Rev value (1 to 360 Seconds in 1 Second increments).

■**NOTE**: Selecting "Save" saves all profiles to the control.

3. Select **Save**. TapTalk will display a "Confirm Writing to Device" confirmation screen (Figure 6-4).
4. Select **OK**. TapTalk will display a "Setpoints Successfully Written to Control" confirmation screen (Figure 6-5).

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7 Installation

7.0 Installation

An adapter panel or a M-2050 Surface Mounting Kit must be used with the M-2001D Tapchanger Control. Each panel adapts the control as a transformer or regulator control replacement and provides the external connections necessary for operation via terminal blocks on the rear of the adapter panel.

In lieu of using one of the M-2000 series adapter panels to mount the control, the M-2050 Surface Mounting Kit permits surface mounting. The kit consists of two right angle mounting brackets which bolt to the rear top and bottom of the control. All necessary hardware is included in the kit. Also included is a 24-pin, in-line female connector with six-foot pigtails on each pin to facilitate custom connection of the control in original equipment manufacturers' applications.

7.1 External Connections

Available connectors include:

- One RS-485
- One Fiber Optic connection
- One RJ-45 (optional)
- One 24-pin blue connector
- One RS-232 DE9S connectors
- In-line, 6-pin connector for the M-2025B(D) Current Loop Module
- Control Power Backup Input option
- Source Voltage Input
- 1 Auxiliary Output
- 3 Auxiliary Inputs

See Figure 7-1 for the locations of these external connectors.

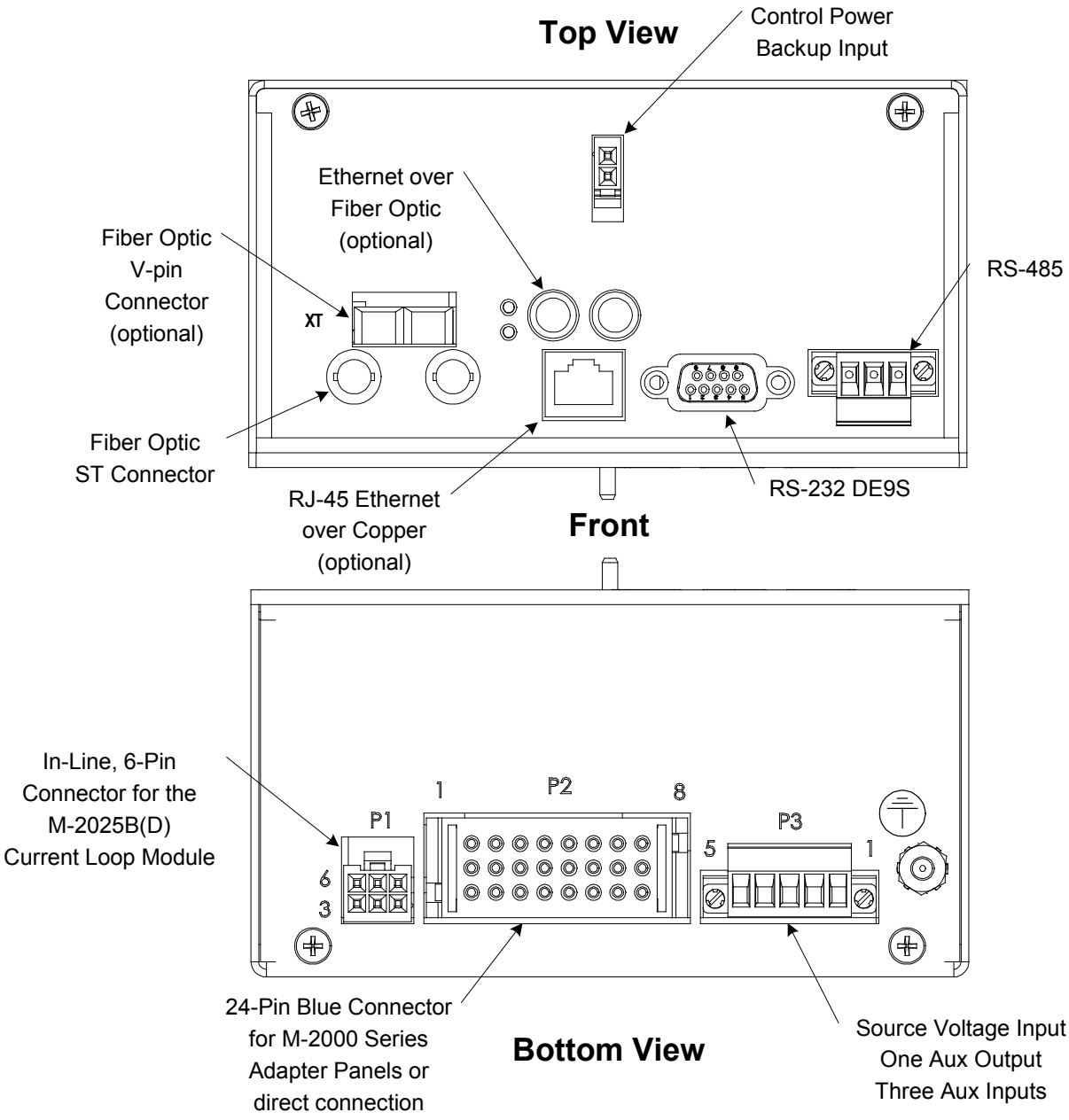


Figure 7-1 External Connection Locations

The external connections for the control are made to the 24-pin connector, P2. For example, if external dry contacts are being used to control the voltage reduction Step #1 function, connections for these contacts may be made between Pin 10 and Pin 18 as shown in Figure 7-2. The dry contact inputs for non-sequential input, voltage reduction, motor seal-in, counter input and neutral detection must be "wetted" by connecting to terminal Pin 10.

▲ **CAUTION:** These binary inputs must be "wetted" by connection to Pin 10 only–a nominal 12 Vdc source. If the contacts are connected to a 120 Vac source, it will result in damage to the control.

The external connections for the control are shown in Figures 7-2 and 7-3.

The communication ports provide remote access to the tapchanger control using the M-2001D TapTalk® Communications Software.

Pin 1 Voltage Input

This input accepts nominal 120 Vac, 60 Hz (or 50 Hz as ordered) to operate the control's power supply and voltage sensing input. The acceptable voltage range for proper control operation is from 90–140 Vac.

Power consumption is less than 8 VA. The input voltage is referenced to line neutral (Pin 3).

Control users may encounter situations where actuating the Drag Hands Reset pushbutton on one of any of our adapter panels results in the loss of a Voltage Sense fuse. The Drag Hands reset solenoid is powered from the circuit that powers the control, and provides the control with sensing voltage. Initially, a 1/4 Ampere fuse was used in this circuit, and most recently a 1 Ampere fuse was substituted to prevent further loss of the fuse. This phenomenon is due to the fact that, as solenoids age, they may become sticky due to mechanical misalignment, hardened grease, or shortened windings.

The adapter panels include a one ampere fuse in the voltage sense circuit. This value should be adequate for all but the most extreme problems. When a Drag Hands Reset Solenoid that consistently blows a one amp fuse is encountered, it is recommended that the customer either remove the solenoid for cleaning and adjustment, or replace it completely.

Pin 2 Load Current Return

This is the non-polarity input to the load current measuring transformer. The companion polarity input is Pin 4. The line current transformer input is isolated from other pins.

Pin 3 Neutral

This is the return for the Voltage Input (Pin 1), and nominal +12 Vdc "wetting" voltage (Pin 10).

Pin 4 Load Current Polarity

The line current input range is 0–640 mA (200 mA continuous) with 200 mA representing the 1.0 per-unit value. The measured current value is used for line drop compensation and metering calculation.

▲ **CAUTION:** The current input to the M-2001D is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

Pin 5 Circulating Current Polarity

The circulating current transformer measures a relative reactive current flow between transformers in parallel configuration. Maximum anticipated current input is 200 mA.

▲ **CAUTION:** The current input to the M-2001D is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

Pin 6 Circulating Current Return

This is the return path for Pin 5. The circulating current transformer input is isolated from other pins.

Pin 7 Tapchanger Raise

This switched output connects the tapchanger raise winding to the source of motor power. When the control calls for a raise, it is capable of switching up to 6 A at 120/240 Vac.

Pin 8 Motor Power Input

The source for powering the tapchanger motor is connected here. It may have a maximum voltage of 240 Vac.

Pin 9

– Voltage Reduction Step #2

This digital input is typically enabled by connecting it to the nominal +12 Vdc wetting source (Pin 10), through an external Form "a" dry contact. The amount of voltage reduction implemented is determined by the setting.

When "Contact KeepTrack™ 1R1L" or "Contact KeepTrack 1N" Tap position knowledge is selected the Voltage Reduction Step 2 Input is utilized as an "Auxiliary Lower Contact Input". In the "Contact KeepTrack" method of Tap Position Knowledge, Voltage Reduction Step 2 is still available through communications.

– Neutral Input Operation

When the parallel configuration mode is set to ΔVAR®2 (KeepTrack™), this input becomes the neutral input. This is due to the standard neutral input being used for ΔVAR2 (Keeptrack) disable input when ΔVAR2 (Keeptrack) configuration is used.

Pin 10 +12 Vdc Wetting Voltage

This is the output of an unregulated dc power supply internal to the control. It is referenced to neutral and can supply up to 100 mA. It is used for powering the digital inputs of the control through external relays. Depending on the voltage supplied to Pin 1 and loading, its output can vary from +10 to +18 Vdc. It is not fused in the control.

Pins 11 & 12 Operations Counter Inputs 1 and 2

▲**CAUTION**: When "Input Selection 1" configuration is set to "Seal-In," the Counter Input is used as the Switch Status Input and the Seal-In Input will cause the counter to increment.

This digital input registers the counter contact closure. The pins are isolated from neutral to permit placing the external contact in series with either the wetting voltage or neutral. The operation count will increment when Pin 12 is grounded via the transformer or regulator dry operation count switch.

This contact is needed for using the intertap time delay. Once the contact is opened, the intertap time delay will begin counting down.

■**NOTE:** With the "Cam Follower" Operation Counter configuration, the Counter Input is used for the Cam Follower contact input.

Pin 13 Input 1 - Motor Seal-In/Switch Status Input

When the **Input Selection (1)** screen in the **Configuration** menu is set to **Seal-In Input**, this input will operate as a seal-in input and Counter Input. In this configuration, the digital input is referenced to line neutral, but is unique in that it is configured to accept only the output of the motor seal-in current detection transformer, from the B-0553 motor seal-in printed circuit board subassembly. The B-0553 is a supplemental circuit board used in the appropriate adapter panels.

When the **Input Selection (1)** screen in the **Configuration** menu is set to **Switch Status Input**, this input will only operate as a switch status input. All seal-in input functions will be disabled. In this mode, the switch status on the adapter panel can be read to determine if it is in Auto or Manual ON/OFF. The status can be read through the seal-in/switch status data point in the communications protocols.

Pins 14 & 15 Neutral Position Detector Inputs 1 and 2/ΔVAR2 (KeepTrack) Disable Input

■**NOTE**: This input will only perform one function, either the Neutral Detect or the ΔVAR2 (KeepTrack) Disable Input.

This digital input registers neutral position switch closures on regulators. The pins are isolated from neutral to permit placement of the external contact in series with either the wetting voltage or neutral. Normally the wetting supply (Pin 10) will be connected to Pin 14.

When using the ΔVAR2 (KeepTrack) paralleling method, this input becomes the disable input for ΔVAR2 (KeepTrack). This is used to keep the paralleled devices from running to their limits (max raise or lower) if they have been un-paralleled for maintenance, etc.

Pin 16 Tapchanger Lower Output

This switched output connects the tapchanger lower winding to the source of motor power. When the control calls for a lower, it is capable of switching up to 6 A at 120/240 Vac.

Pin 17 Input 2 - Non-Sequential Operation/ Auto Tapchange Inhibit/Block SCADA

– Non-sequential Operation

When the **Input Selection (2)** screen (in the **Configuration** menu) is set to **NONSEQ INPUT**, non-sequential operation is invoked by momentarily connecting this input to the nominal +12 Vdc wetting source (Pin 10) through an external Form "a" dry contact. When this function is enabled, the tapchanger control times out with the Time Delay setting between every tapchange.

– Auto Tapchange Inhibit

When the **Input Selection (2)** screen (in the **Configuration** menu) is set to **NONSEQ INPUT**, auto tapchange inhibit is invoked by closing and maintaining a Form "a" dry contact connected to this input and to the nominal +12 Vdc wetting source (Pin 10). As long as this contact is closed, the tapchanger will not time out, thereby prohibiting raise and lower commands.

– SCADA Cutout Input

When the **Input Selection (2)** screen (in the **Configuration** menu) is set to **SCADA CUTOUT INPUT**, all writes using SCADA will be blocked when the non-sequential input is present. Any read operations using SCADA will still be allowed regardless of the input state. When the "SCADA Cutout Input" input mode is selected, all non-sequential input functions will be disabled.

Pin 18 Voltage Reduction Step #1

This digital input is typically enabled by connecting it to the nominal +12 Vdc wetting source (Pin 10) through an external Form "a" dry contact. The amount of voltage reduction implemented is determined by the setting.

■ **NOTE**: Enabling both voltage reduction Step #1 and Step #2 inputs simultaneously will result in the level of voltage reduction as specified on the Voltage Reduction Step #3 screen of the control.

When "Contact KeepTrack™ 1R1L" or "Contact KeepTrack 1N" Tap position knowledge is selected the Voltage Reduction Step 1 Input is utilized as an "Auxiliary Raise Contact Input". In the "Contact KeepTrack" method of Tap Position Knowledge, Voltage Reduction Step 1 is still available through communications

Pin 19 Motor Seal-In Disconnect Output

This output connects to the B-0553 motor seal-in printed circuit board subassembly. When the seal-in detector input is actuated, this output drives a triac on the B-0553 motor seal-in printed circuit board subassembly to temporarily disconnect the motor power to the control. The B-0553 is a supplemental circuit board used in the appropriate adapter panels.

Pins 20 & 22 User-Programmable Alarm

This pair of terminals is a Form "a" alarm relay contact rated for 3 A at 120 Vac, or 100 mA at 120 Vdc. This alarm indicates when any of the programmable alarm conditions are detected. Refer to **Section 5.1, Configuration**.

Pins 21 and 24 Self-Test Alarm

■ **NOTE**: If the M-2001D is configured for the SCAMP pushbutton Auto/Manual Switch type, then the Self-Test Alarm relay is NOT available.

This pair of terminals is a held-open Form "b" alarm relay contact rated for 6 A at 120 Vac, or 100 mA at 120 Vdc. Failure of the power supply or the micro controller results in loss of power to the alarm relay, allowing the contact to close.

Pin 23 Non-Interruptible Power Supply Input

This input is normally connected to Pin 8, the motor power input. The power to Pin 8 is interrupted by the motor seal-in process of the B-0553 motor seal-in printed circuit board. The purpose of Pin 23 is to provide continuous power to the raise and lower KeepTrack™ detection circuits. It should be connected ahead of any motor power interruption (for example, auto/manual, local/remote) of the seal-in circuitry to maintain KeepTrack raise and lower operation. The motor seal-in function is used in the following adapter panels: M-2109, M-2324 and M-2355.

FIVE PIN CONNECTOR (Bottom)

Pin 1 Source Voltage Input

Source Voltage Input when mode of operation is set to "Regulate Reverse with Measured Source Voltage".

Pin 2 Auxiliary Output

Available Auxiliary Output.

Pin 3 Auxiliary Input A1

When using the ΔVAR2 paralleling method, this input becomes the disable input for ΔVAR2. This is used to keep the paralleled devices from running to their limits (max raise or lower) if they have been un-paralleled for maintenance, etc.

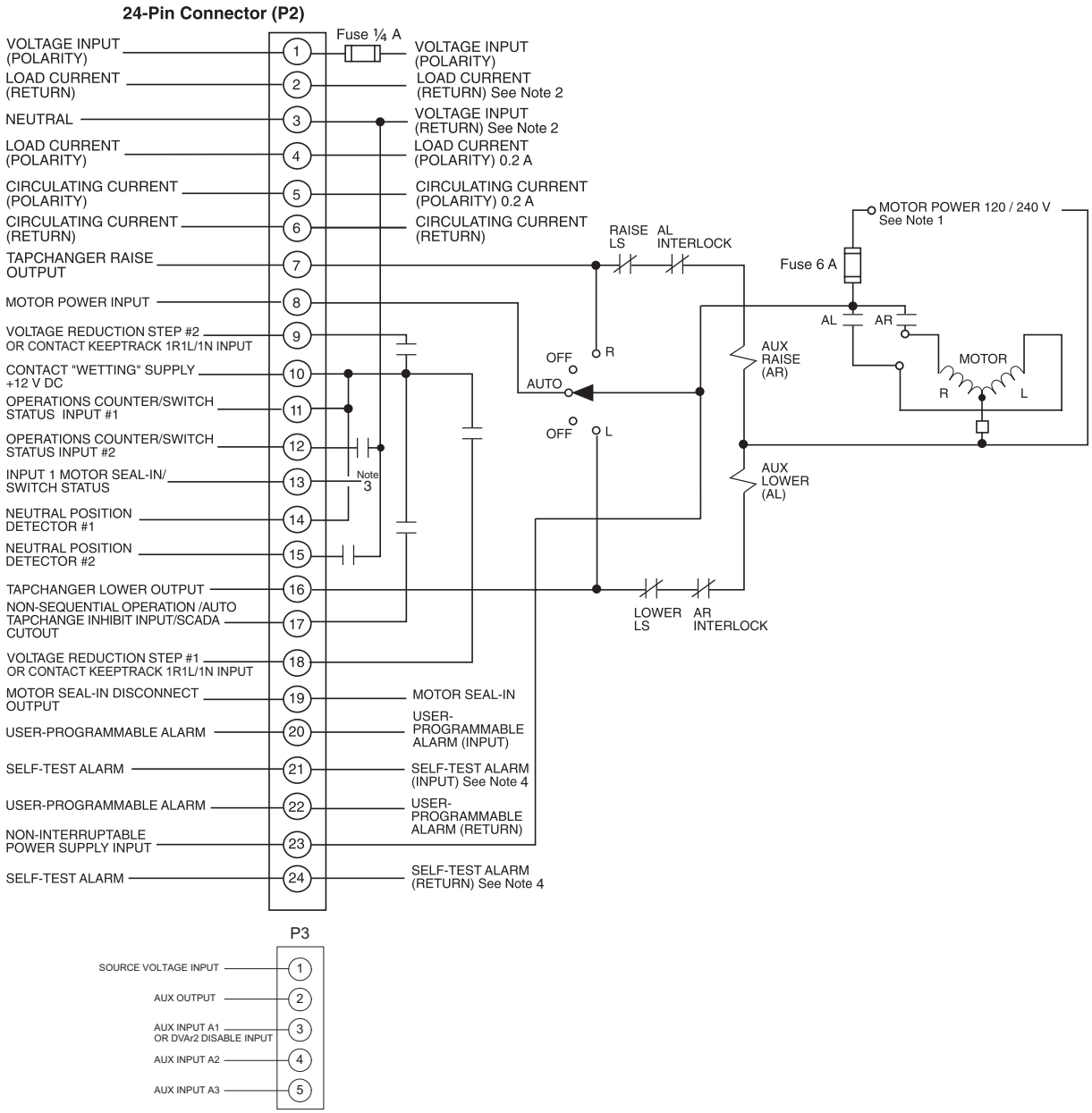
Pins 4 and 5, Auxiliary Inputs - A2, A3

Available Auxiliary Inputs.

7.2 Non-Sequential Operation

▲ **CAUTION:** Voltage applied through dry contacts to actuate non-sequential input, voltage reduction inputs, counter contacts and neutral contacts *must* be nominal +12 Vdc obtained from Pin 10 of the M-2001D Tapchanger Control. The use of 120 Vac will result in damage to the M-2001D.

The operation of the control can be interrupted during tapchanger operation by applying the "wetting" voltage of Pin 10 to Pin 17 (timer reset for non-sequential operation input) on the control through an external contact. This causes the output to de-energize and re-initialize the time delay circuit when the reset signal is removed. This function can be used to cause the LTC transformer, if so equipped, to wait for the unit to time out between tapchanges.

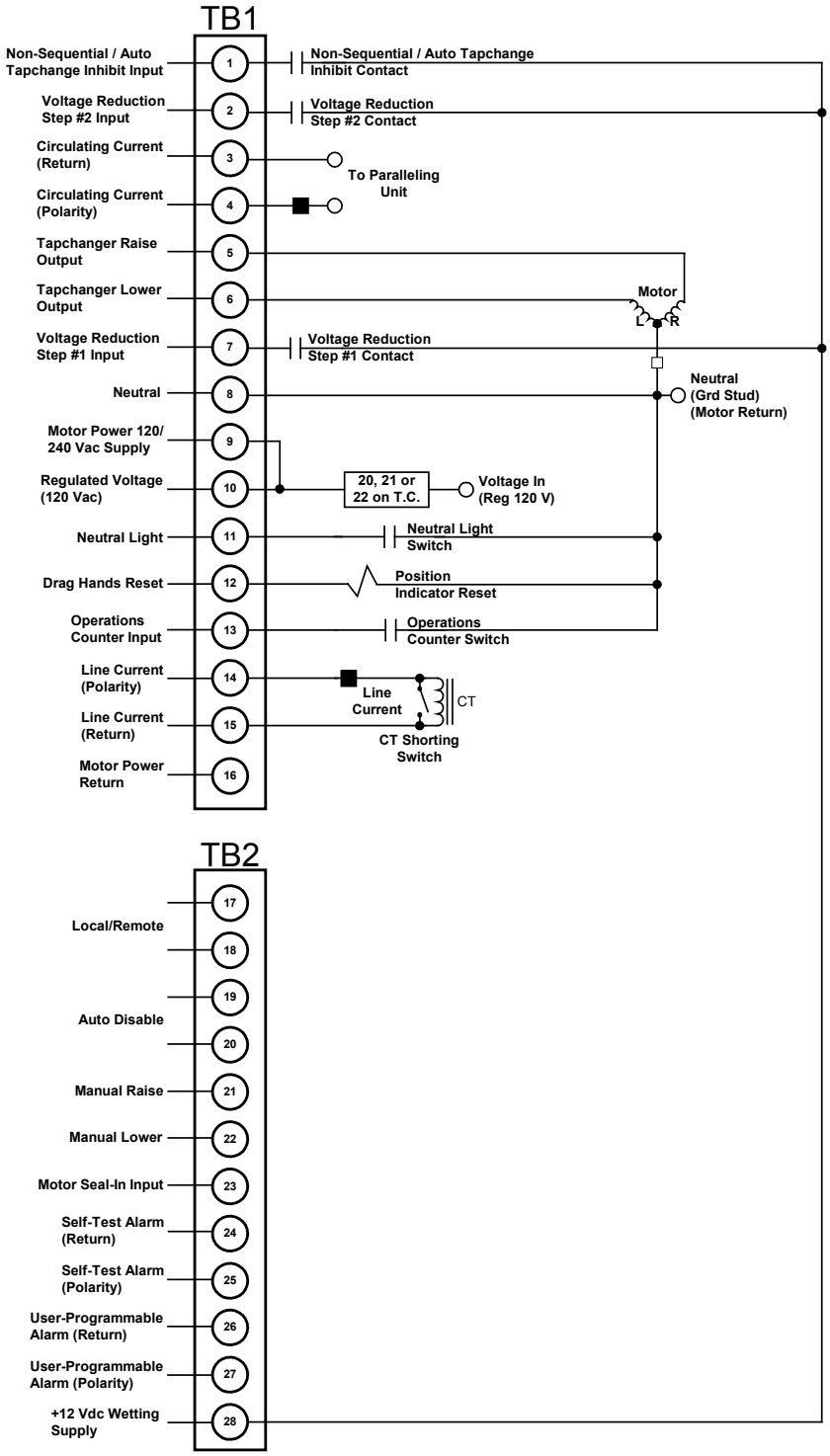


■ **NOTES**:

1. Motor voltage may be 120 or 240 V to neutral, or 240 V phase-to-phase.
2. The customer is to provide an earth ground connection to the CT/VT's neutral connection, external to the control.
3. To Motor Power Seal-In board.
4. If the M-2001D is configured for the SCAMP pushbutton Auto/Manual Switch type, then the Self-Test Alarm relay is NOT available.

● **WARNING**: **When an adapter panel is not used, automatic shorting of CT inputs is not provided by the M-2001D/M-2050; the customer must provide a method for shorting the CT's before the control is disconnected.**

Figure 7-2 Typical M-2001D Stand-Alone External Connections



WARNING: Open CT secondary will result in high voltage at CT terminals. Death, severe injury or damage to equipment can occur.

▲ CAUTION: Do not operate with CT secondary open. Short circuit or apply burden at CT secondary during operation.

Figure 7-3 Typical Adapter Panel External Connections

7.3 Multi-Step Voltage Reduction

▲ **CAUTION:** Voltage applied through dry contacts to actuate non-sequential input, voltage reduction inputs, counter contacts and neutral contacts *must* be nominal +12 Vdc obtained from Pin 10 of the M-2001D Tapchanger Control. The use of 120 Vac will result in damage to the control.

On the M-2001D Tapchanger Control, Pin 9 and Pin 18 on connector P2 are used together to provide up to three levels of voltage reduction. The external connections to achieve these steps are shown in Table 7-1. Voltage reduction amounts are set within the M-2001D Tapchanger Control software. If these voltage reduction steps are instituted by communications, the contacts are not being used simultaneously.

When Contact KeepTrack™ Tap Position Knowledge is selected Voltage Reduction Step 1 (Pin 18) and Voltage Reduction Step 2 (Pin 9) are assigned as Auxiliary Tap position inputs.

7.4 LTC Backup Control

The M-0329B is a single-phase, solid-state backup control that prevents a defective tapchanger control from running the voltage outside the upper and lower voltage limits. The Block Raise and Block Lower voltage levels are set by accurately calibrated dials. Refer to the M-0329B Instruction Book for details.

The M-0329B LTC Backup Control or M-5329 Multi phase Backup Relay are connected as a two-terminal device to the voltage transformer.

7.5 Communication Ports

The control includes three communication ports, COM1, COM 2, and COM3. COM2 supports RS-232 or V-pin, RS-485, and fiber optic lines (ST connector only). COM 3 supports Ethernet using an RJ-45 connector or Fiber ST.

Selection of specific communication parameters may be made through the **COM1** or **COM2 PORT** configuration screen or the **COM3 Port** screen if the optional Ethernet port is installed. USB is an internal port, and supports only MODBUS® protocol and software updates. COM1 and COM2 support baud rates from 300 to 115200.

Fiber Optic Interface

The **COM1 PORT** screen allows the user to select the specific communication equipment to be used: RS-485 (2 wire) or Fiber Optics (ST connector).

The control can be connected to fiber optics in two ways. If Fiber Repeat Switch on the right side of control (as viewed from the rear) is set to OFF, the fiber interface is set in a point-to-point configuration.

Example: A PC to one control. If Fiber Repeat Switch is set to ON, the control can be connected in a loop or daisy chain (the TX of one control connected to the RX of the next, etc.). When connecting the control in this manner through TapTalk®, **Echo Cancel** should be set to ON. The type of fiber used with these optical transceivers is multi mode fiber. It was tested with fiber size 62.5/125. A manufacturer of this product is Amphenol Corporation. A typical part number tested by Beckwith Electric is 943-32255-10030 from Amphenol Corporation, Lisle, Illinois. This is a dual-fiber with a total of four ST connectors. See Figure 7-4 for part number selection.

Voltage Reduction Setpoint: Multiplier Range	Apply "Wetting Voltage" from Pin 10 to Pin #
Voltage Reduction Setpoint #1: 0 to 10%	Pin 18
Voltage Reduction Setpoint #2: 0 to 10%	Pin 9
Voltage Reduction Setpoint #3: 0 to 10%	Pins 18 and 9

Table 7-1 Multi-Step Voltage Reduction External Connections

Ethernet (RJ-45 Interface)

The control includes an optional Ethernet Port (COM3) which is compatible with all protocols in the control. There are eleven configuration screens in the HMI for setting up the ethernet port: DHCP Enable, IP Address, Net Mask, Gateway, MODBUS® Port, DNP Port, Auto Negotiation, Keepalive time, SNTP Enable, SNTP Server Address and Time Zone.

The IP Address screen is used to set the address used to communicate with the control (when DHCP is disabled). The IP Net Mask screen is used for multicasting.

The DHCP Mode screen, when enabled, will allow the control to use any available IP address (which will be shown while booting the Ethernet during control power up. When DHCP is disabled, it will cause the control to use the IP address from the IP Address screen.

RS-485 Interface (Additional Communication Port)

The MODBUS and DNP3.0 communication protocols were set up to be compatible with a 2-wire, half duplex RS-485 link of the M-2001D COM1.

A port-powered converter made by B & B Electronics of Ottawa, IL (Model 485LP9TB) was used to test the two-wire RS-485 link. This converter is available in commercial and extended temperature ranges. When connecting the RS-485, a 120 Ω resistor must be connected at the last control connector across A/B. The two-wire RS-485 port assigns Pin A (+) and Pin B (–). The SH connection on the RS-485 plug should be connected to the cable shield. The shield should only be connected on one end of the RS-485 cable. If more than one M-2001D control is connected via RS-485, only one shield/SH connection should be made. One screen is directly associated with setting an RS-485 network. COM1 port should be set to RS-485. If using TapTalk®, under Communications/Setup/Comm Port menu, RS-485 should be selected. When selecting RS-485 transmission lines, there are cables specifically made for this purpose. These cables have a shunt capacitance of 16 pF or less per foot, and are usually solid wire. Plenum-rated cabling is recommended. The RS-485 connector is designed to hold 12 to 24 AWG wire.

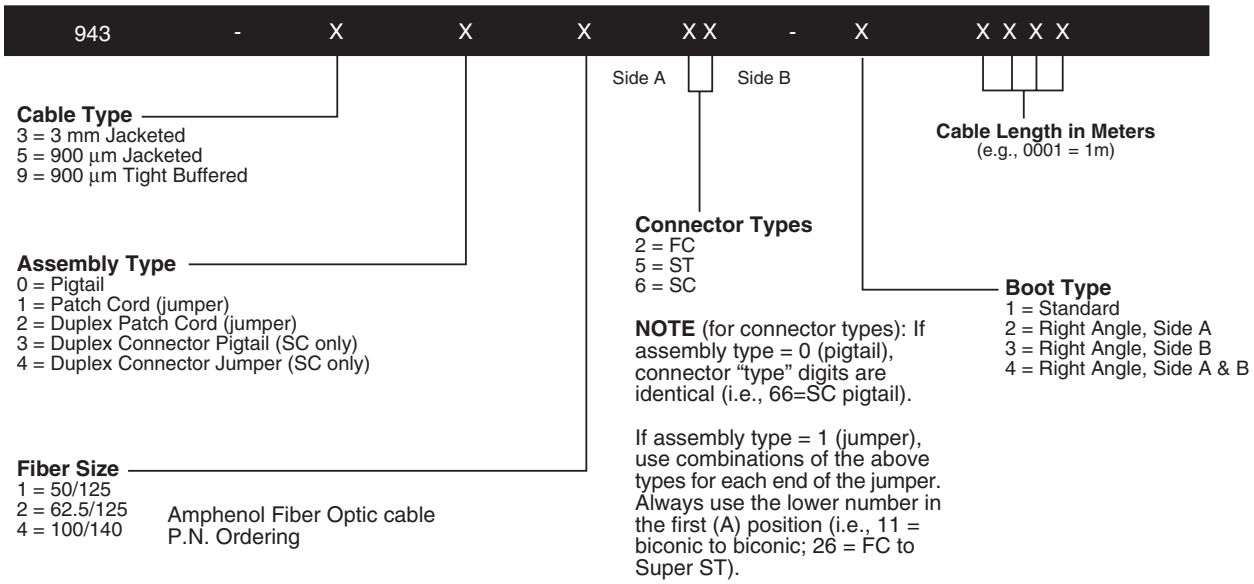


Figure 7-4 Communication Connections

7.6 Communication Cables

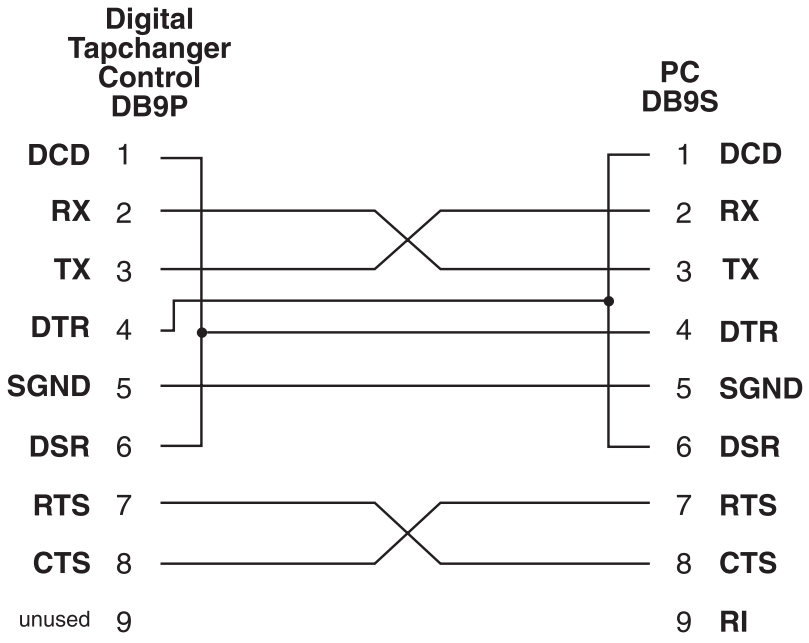


Figure 7-5 Null Modem Cable 9-Pin to 9-Pin

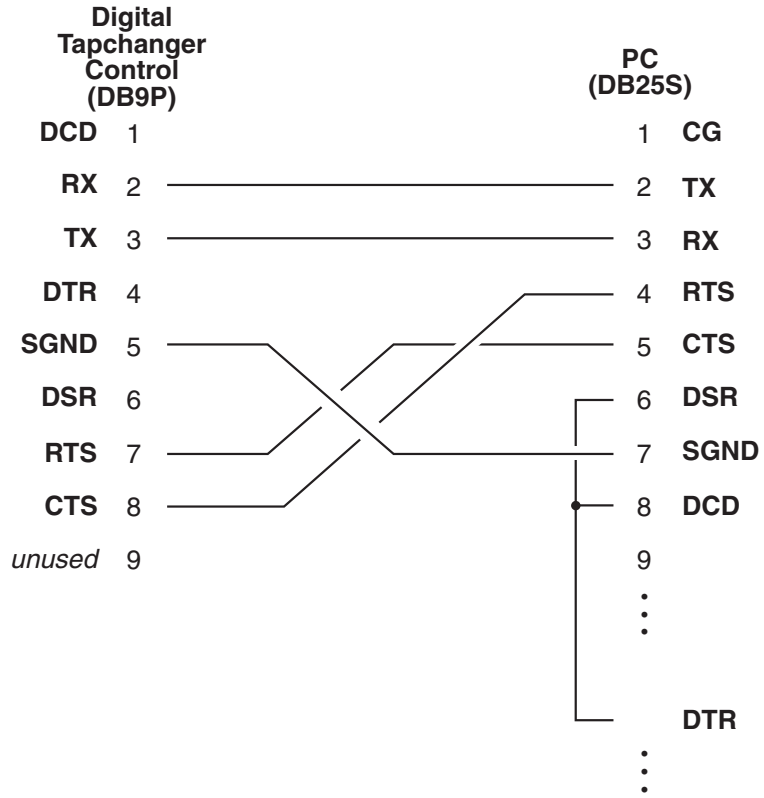


Figure 7-6 Null Modem Cable 9-Pin to 25-Pin

7.7 Grounding

Ground the control by connecting a suitably sized wire from the ground stud on the bottom of the control case, to a solid connection to ground. Do not rely on mounting screws for grounding.

7.8 Typical LTC Connection

Figure 7-7 illustrates an example of connections for a control with an LTC Transformer Control adapter panel. This example does not cover all situations. Motor Power and sensing voltage can be obtained from a common source or from independent sources having a nominal 120 Vac output. Normally, this is line-to-neutral voltage, although line-to-line voltage can be used if recognition is made of any phase shift between the voltage and current signals when using line drop compensation, to avoid introducing an unintentional grounding into the control circuitry that could result in shorting a VT secondary. It is strongly recommended that a 1:1 ratio isolation transformer of 25 VA or greater with required voltage accuracy be used between the control and any line-to-line PT connections. Beckwith Electric has a suitable isolation transformer available in Beckwith Electric model M-0362. Please consult factory for availability.

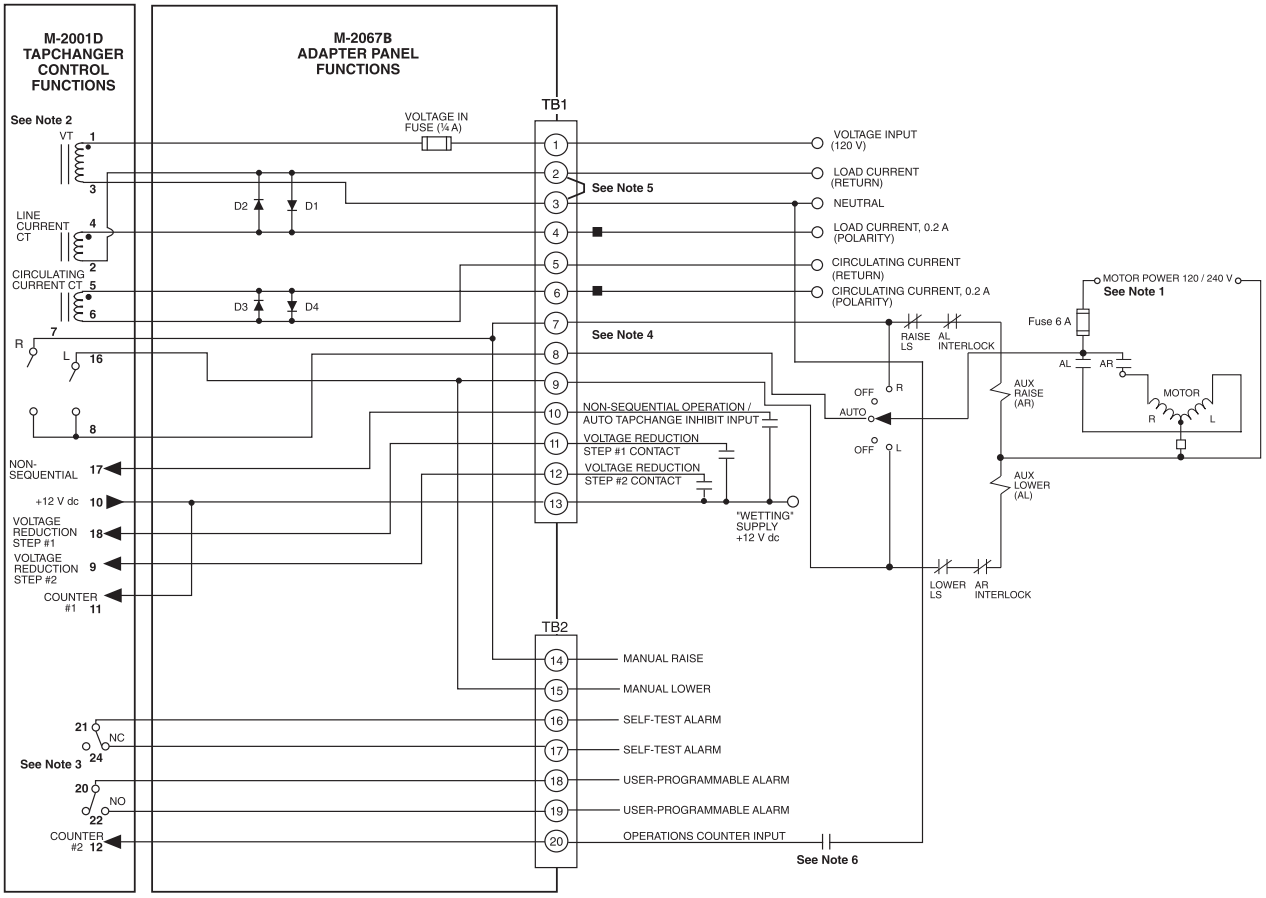
Load current must be reduced by an appropriate auxiliary transformer to 0.2 A "full scale" before connecting to the adapter panel currents. Please obtain an application guide specific to your LTC control adapter panel and follow those instructions.

7.9 Typical Regulator Connection

Figure 7-8 illustrates an example of connections for a control with a Regulator Control adapter panel. This example does not cover all situations. Motor Power and sensing voltage can be obtained from a common source or from an independent source having a nominal 120 Vac output. Normally, this is line-to-neutral voltage, although line-to-line voltage can be used if recognition is made of any phase shift between the voltage and current signals when using line drop compensation, to avoid introducing an unintentional grounding into the control circuitry that could result in shorting a VT secondary. It is strongly recommended that a 1:1 ratio isolation transformer of 25 VA or greater with required voltage accuracy be used between the control and any line-to-line PT connections. Beckwith Electric has a suitable isolation transformer available in Beckwith Electric model M-0362. Please consult factory for availability.

▲ **CAUTION:** The current input to the M-2001D is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

Load current must be reduced by an appropriate auxiliary transformer to 0.2 A "full scale" before connecting to the adapter panel current inputs. Scaling factors may be chosen to resemble 200 mA, 100 mA, or 5 A current transformers in readouts and current magnitude settings. It is important that you obtain an application guide on an adapter panel specific to your regulator application and follow those instructions.

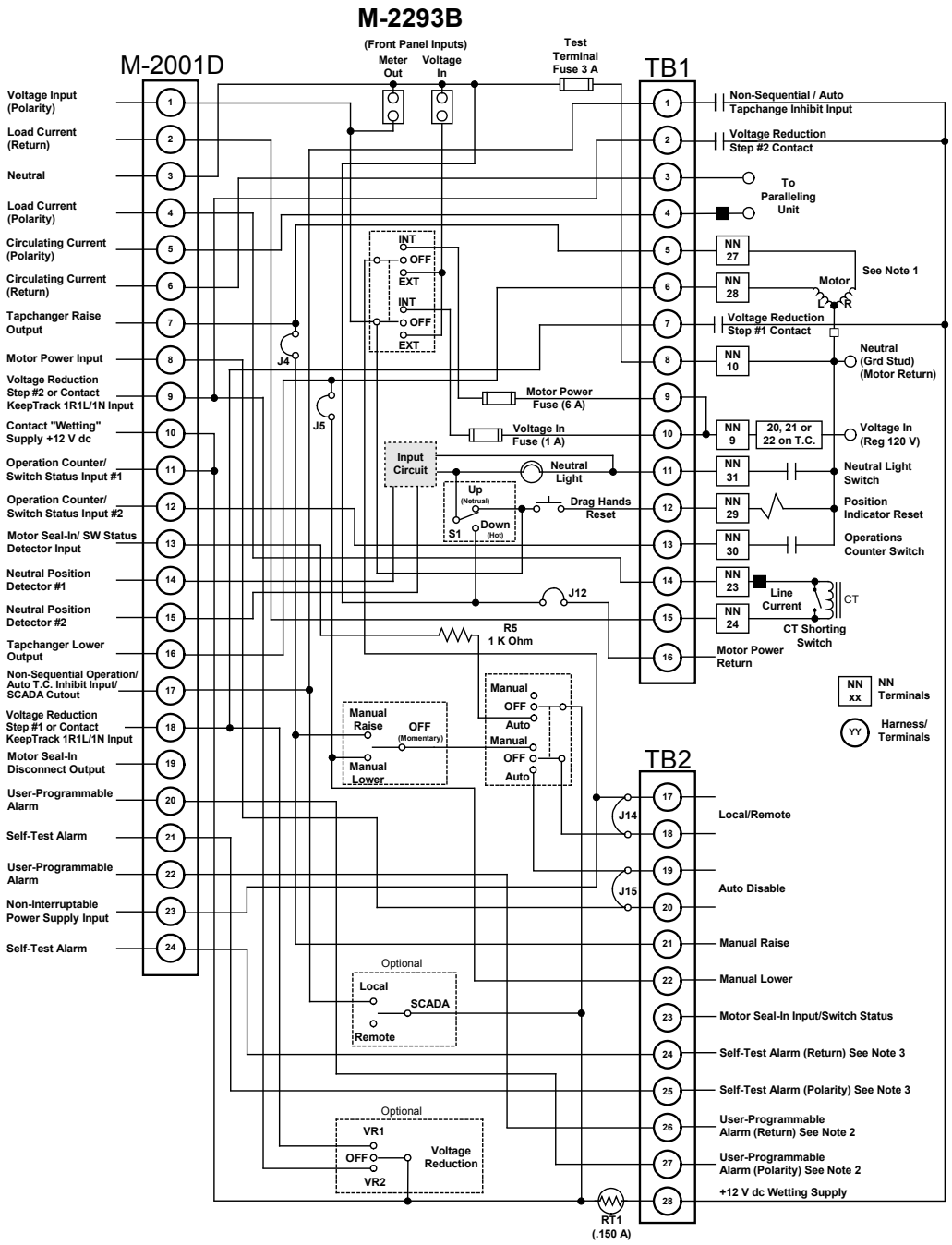


WARNING: In no case should the line current circuit be interrupted with the regulator or transformer energized. Do not remove auxiliary current transformers without shorting the current inputs. Death or severe electrical shock can occur.

■ **NOTES**:

1. Motor voltage may be 120 or 240 V to neutral or 240 V phase to phase.
2. The customer is to provide earth ground connection to CT/VT's neutral connection, external to the control.
3. The self-test alarm and user-programmable alarm contacts are shown in the de-energized state (no voltage applied). The self-test alarm contacts open after the control passes the internal self-test.
4. The wiring from terminal 7 and 9 may or may not go directly to the motor. Depending on installation, local codes and standards, the wiring may go to interposing relay contacts, limit switch, seal-in circuits, starters contactors, SCADA, test switches etc.
5. To isolate the load current, remove the jumper from TB1-2 to TB1-3.
6. For counter operation, connect TB2-20 to neutral TB1-3 through an external dry contact. This connection is required for the intertap time delay operation.

Figure 7-7 M-2001D and LTC Transformer Control Adapter Panel Typical Connections



■ **NOTES**:

1. The wiring from terminal 5 and 6 may or may not go directly to the motor. Depending on installation, local codes and standards, the wiring may go to interposing relay contacts, limit switch, seal-in circuits, starters contactors, SCADA, test switches etc.
2. The self-test alarm and user-programmable alarm contacts are shown in the de-energized state (no voltage applied). The self-test alarm contacts open after the control passes the internal self-test; the user-programmable alarm contacts close when an alarm is recognized.
3. If the M-2001D is configured for the SCAMP pushbutton Auto/Manual Switch type, then the Self-Test Alarm Relay is not available.

Figure 7-8 M-2001D and Regulator Control Adapter Panel Typical Connections

7.10 Control Power Backup Input Connection

The Control Power Backup Input option is designed to sustain communication port operation in the event of the loss of AC control power. In the event of a loss of AC input power to the control, the option permits uninterrupted operation of the control by supplying +12 Vdc to the control. In addition, the control retains functionality with the exception of the actual operation of the tapchanger mechanism.

When the AC input voltage drops below approximately 85 Vrms, the Control Power Backup Input will activate and all automatic tapchange operations will then be suspended. If Motor Power is available, manual tapchanges may be initiated.

When the control is being powered from the Control Power Backup Input, it will continue to read any input voltage present.

The control retains full functionality, and if the control's Motor Power remains energized then Raise and Lower commands are possible. Fiber-Optic port operation is maintained. All communication ports, data-logging, status monitoring, configuration, and setpoint capability are also maintained.

The Control Power Backup Input option is installed at the factory, and is wired through the two-pin connector located on the top rear of the control.

Beckwith Electric offers two Control Power Backup supplies for use with the M-2001D when the Control Power Backup Input option is purchased. The M-2026 AC-DC Control Power Backup Supply is a fused, surge protected and reverse polarity protected AC-DC Control Power Supply that accepts an AC or DC input (21 to 32, 42 to 60 and 105 to 145 V) and outputs regulated +12 Vdc at up to 1.5 Amp.

The M-2027 Control Power Backup Supply - AC Only is a fused and surge protected Control Power Backup Supply that will accept an AC input range of 105 to 140 Vac, 50/60 Hz and output +12 Vdc to 1 A.

Both the M-2026 and M-2027 are housed in non-weathertight enclosures and are equipped with screw terminal blocks for both input and output connections.

▲ **CAUTION**: Use of Non-Beckwith Electric converters to provide +12 V to the Control Power Backup Input may compromise system integrity due to a lack of adequate protection of the power converter. For reliability of the M-2001D, the power converter must meet the following requirements:

Temperature: –40° C to + 80° C

IEC 60068-2-1 Cold, –40° C for 96 hours
IEC 60068-2-2 Dry Heat, +80° C for 96 hours
IEC 60068-2-3 Damp Heat, +40° C @ 95% RH for 96 hours

Transient Protection

High Voltage – All input and output terminals will withstand 1500 Vac rms to chassis or instrument ground for one minute with a leakage current not to exceed 25 mA, for all terminals to ground. Input and output circuits are electrically isolated from each other, from other circuits and from ground.

Surge Withstand Capability

IEEE C37.90.1-2002	2,500 Vpk-pk Oscillatory 4,000 Vpk Fast Transient Burst
IEEE C37.90.1-1989	2,500 Vpk-pk Oscillatory 5,000 Vpk Fast Transient

Radiated Electromagnetic Withstand Capability – All units are protected against electromagnetic radiated interference from portable communications transceivers.

Electrostatic Discharge Test

EN 60255-22-2-1997 (EN61000-4-2)

Class 4	(8 Kv) – Point Contact Discharge (15 Kv) – Air Discharge

Fast Transient Disturbance Test

EN 60255-22-4-2002 (EN61000-4-4)

Class A	(4 Kv, 2.5 kHz)

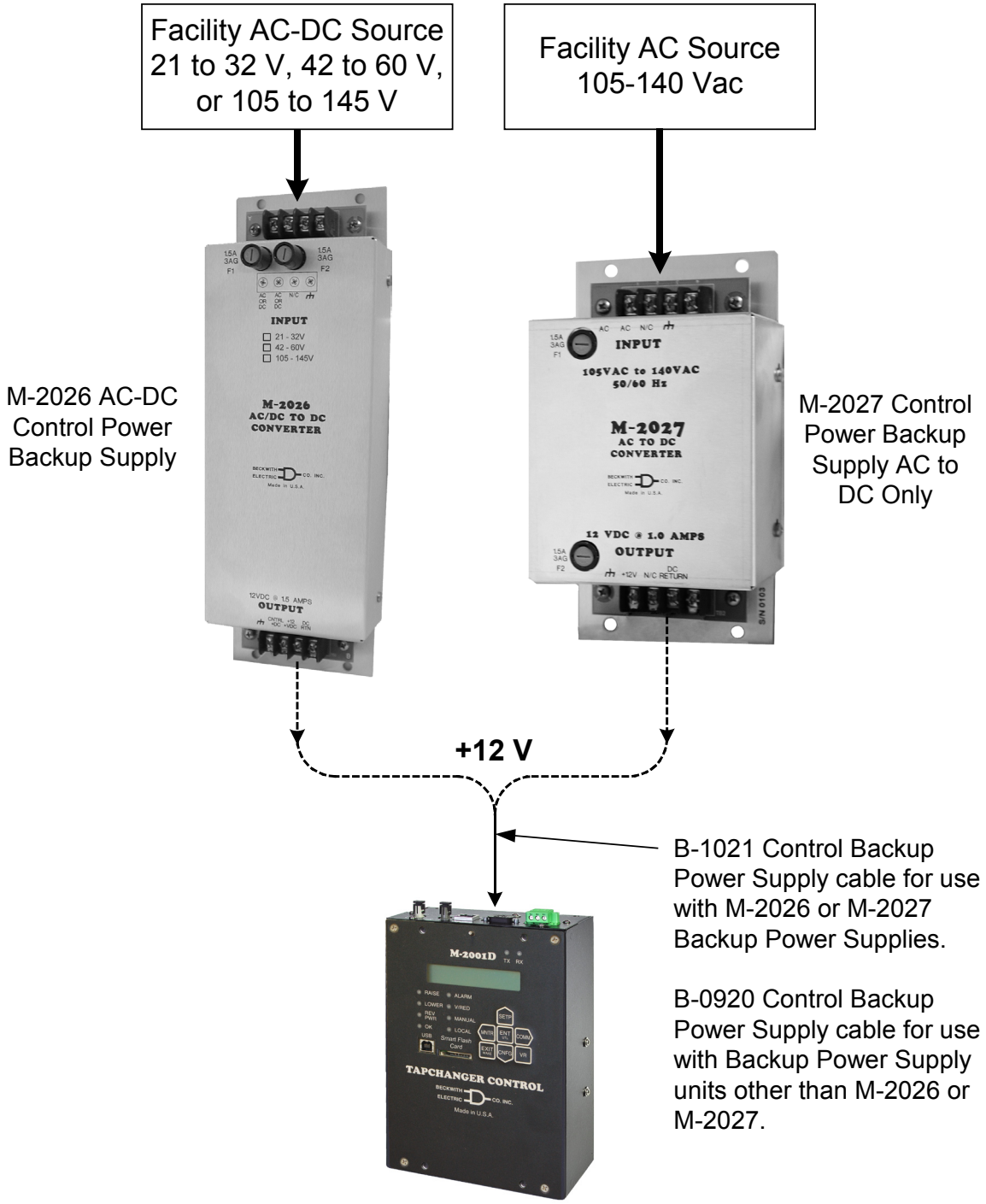


Figure 7-9 Typical Control Power Backup Connection for M-2001D

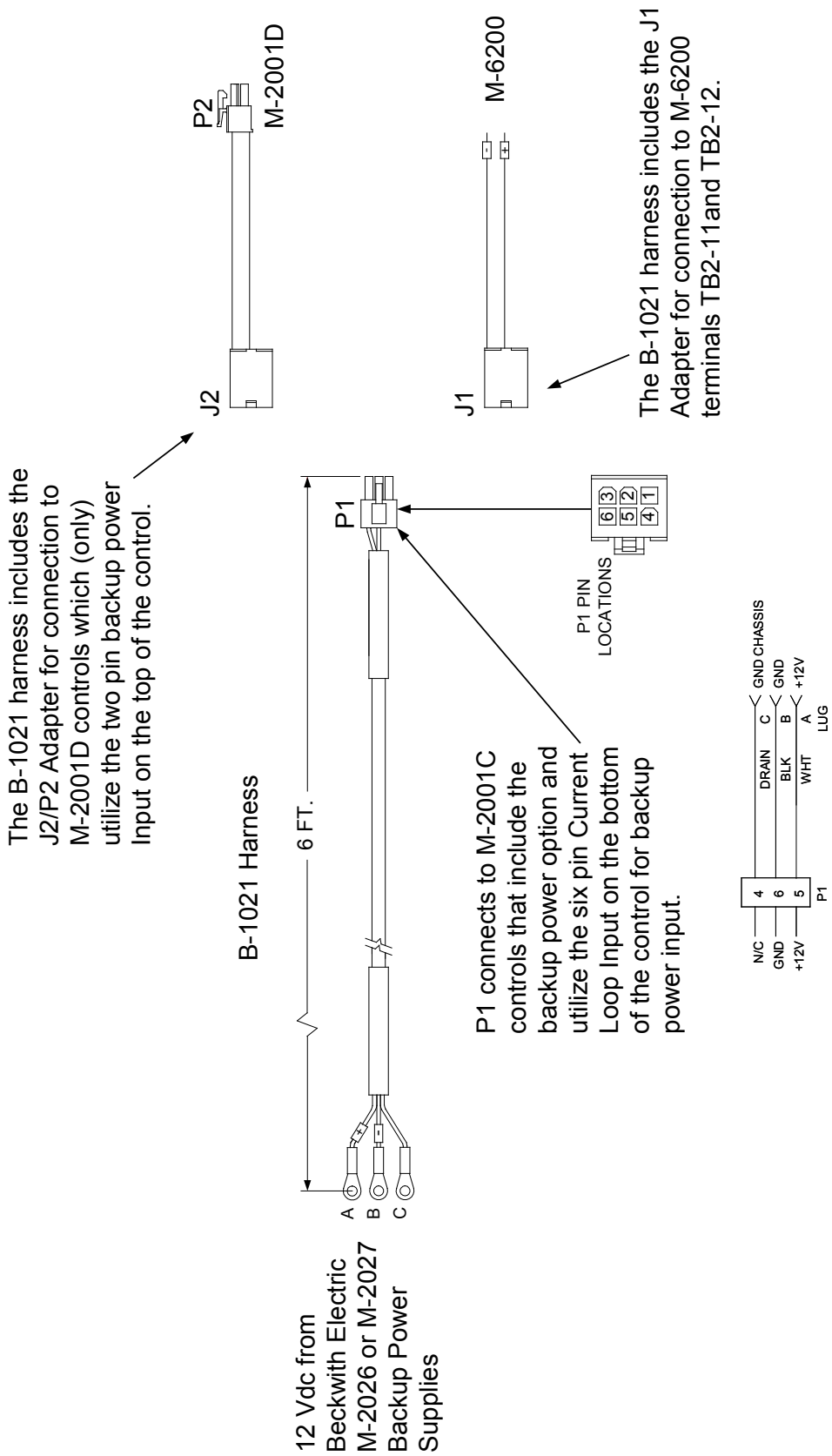


Figure 7-10 Control Power Backup Input Cable Assembly

7.11 TapTalk S-2001D Communications Software Installation

The TapTalk® S-2001D installation program has been written to overwrite previous versions of TapTalk. However, considering variations in installed software, hardware and operating systems, if you are upgrading from a previous version of TapTalk, it is recommended that any older versions of the TapTalk program be removed before installing the new TapTalk.

TapTalk runs with the Windows 2000®, Windows XP®, Windows Vista® or Windows 7® operating system. Familiarity with Windows™ is important in using TapTalk, as the conventions defined in the Windows documentation are strictly followed.

TapTalk will be installed on the host PC's hard disk. While it does not require special installation procedures, an installation utility has been provided to make the process easier.

To install TapTalk:

▲**CAUTION:** The USB cable must be disconnected from the M-2001D control before installing TapTalk.

1. Insert the TapTalk software into your CD-ROM drive.
2. Select **Run** from the **Start Menu**.
3. In the **Run** dialog box, initiate software installation by typing **D:\Setup.exe** (or other drive designator:\Setup.exe, depending on the letter designation for the CD-ROM drive).
4. The Installation Wizard will prompt the user through the installation process. After installation, the TapTalk program icon (located in the Becoware folder) can be placed on the desktop (Figure 7-11).

Starting TapTalk

1. Select the TapTalk program-item icon from the Becoware group in the Program Manager, or select TapTalk from the program list using the **Start** Menu. The TapTalk Main Screen will be displayed.

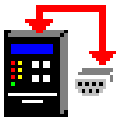


Figure 7-11 S-2001D TapTalk Program-Item Icon

7.12 Activating Initial Local Communications

The M-2001D and TapTalk S-2001D Communications Software are shipped from the factory with the same default communication parameters. Therefore, it may not be necessary to setup communication parameters.

To use TapTalk to interrogate, set, or monitor the M-2001D Digital Tapchanger Control using a direct USB connection, the appropriate driver must be loaded. The driver that is required to be resident in the "windows/inf" folder on the host PC is "beco_usb.inf." This driver is automatically loaded by the TapTalk installation software.

When the control is connected to the PC utilizing a USB cable, Windows will enumerate the control as a serial com device and will assign an unused COM Port to the control.

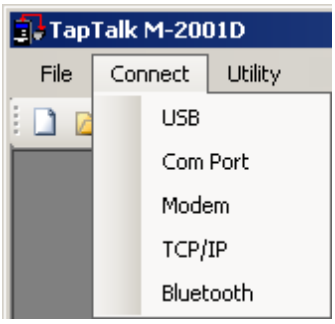
Refer to Section 4.1 System Setup, Communication Protocols and Figure A-4, Communication Menu Flow Screens, for additional setup information.

Activating Initial Communication using USB (Serial) Connection and Default Communication parameters is accomplished as follows:

1. Ensure the following conditions exist:
   - TapTalk® is installed on the host computer
   - The control is energized
2. Plug the USB cable into the host PC USB port.
3. Plug the USB cable into the USB port on the control. The host PC will:
   a. Interrogate the control to determine the type of hardware device it is.

■**NOTE:** If the host PC cannot identify the proper driver for the M-2001D, the driver can be found on the TapTalk software installation disk.

   b. Load any required drivers.
   c. Assign the next available COM port to the USB connection.
4. Start the TapTalk program, TapTalk will display the TapTalk **Main** dialog screen.
5. Select **Connect/USB** from the **Connect** drop-down menu.



TapTalk will display the USB Port dialog screen (Figure 7-12).

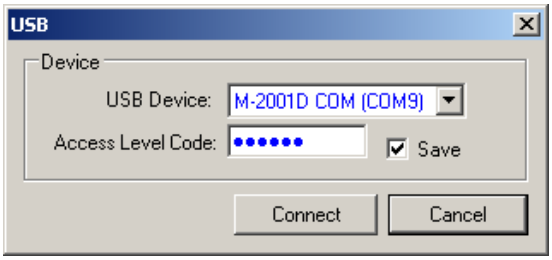


Figure 7-12 USB Port Connection Dialog Screen

6. Ensure that the correct COM port is displayed for the selected USB device.

■**NOTE:** TapTalk will automatically choose the port for the control you just connected to.

7. Enter "Access Level Code" and check "Save" if desired.

   Default Values:

   Level 1 000000 (Disabled)

   Level 2 222222
8. Select **Connect**, TapTalk will attempt to connect to the target control.
9. If TapTalk returns a Failed to Connect to the device screen (Figure 7-13), then repeat Steps 6, 7 and 8.

Figure 7-13 Failed to Connect to the Device Screen

10. If Level Access is not active or the proper access code was entered, then TapTalk will display the connected version of the TapTalk Main Screen (Figure 3-12).
11. If Level Access is active and an invalid access code was entered, then the Successfully Connected read-only dialog screen will be displayed (Figure 7-14).

Figure 7-14 Successfully Connected Read Only Access Dialog Screen

12. Select **OK**, TapTalk will display the connected version of the TapTalk Main Screen (Figure 3-12).

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8 Testing

This chapter assumes that the M-2001D Tapchanger Control is **not** being used with a M-2050B Mounting Kit or an adapter panel (for example, when used by an original equipment manufacturer for use in a control panel). If the control is being used with an M-2050B Mounting Kit or an adapter panel, refer to the Test Procedures chapter of the corresponding Application Guide rather than this chapter.

8.0 Set-up Procedure

Equipment List

▲ **CAUTION**: The current input to the M-2001D is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

- 0 – 200 mA current supply with phase angle settings of 0° to +90°
- 90 – 145 Vac voltage source at 60 Hz
- High impedance true RMS voltmeter with accuracy on ac of at least ±0.2% of reading
- Accurate stop watch

Procedure

1. Make electrical connections as shown in Figure 8-1, External Connections for Test Procedure.

■ **NOTE:** Refer to the Appendix, Figures A-1 through A-5, for the locations of screens within the software.

■ **NOTE:** There is a one-second delay between the out-of-band condition and panel LED indication.

2. Enter initial settings:

Function	Initial Setting
Bandcenter	120.0 V
Bandwidth	2.0 V
LDC Resistance	0.0 V
LDC Reactance	0.0 V
Paralleling	Circulating Current Method
Block Raise	135.0 V
Block Lower	105.0 V
Deadband	2.0 V
Time Delay	5.0 Seconds

Table 8-1 Initial Settings

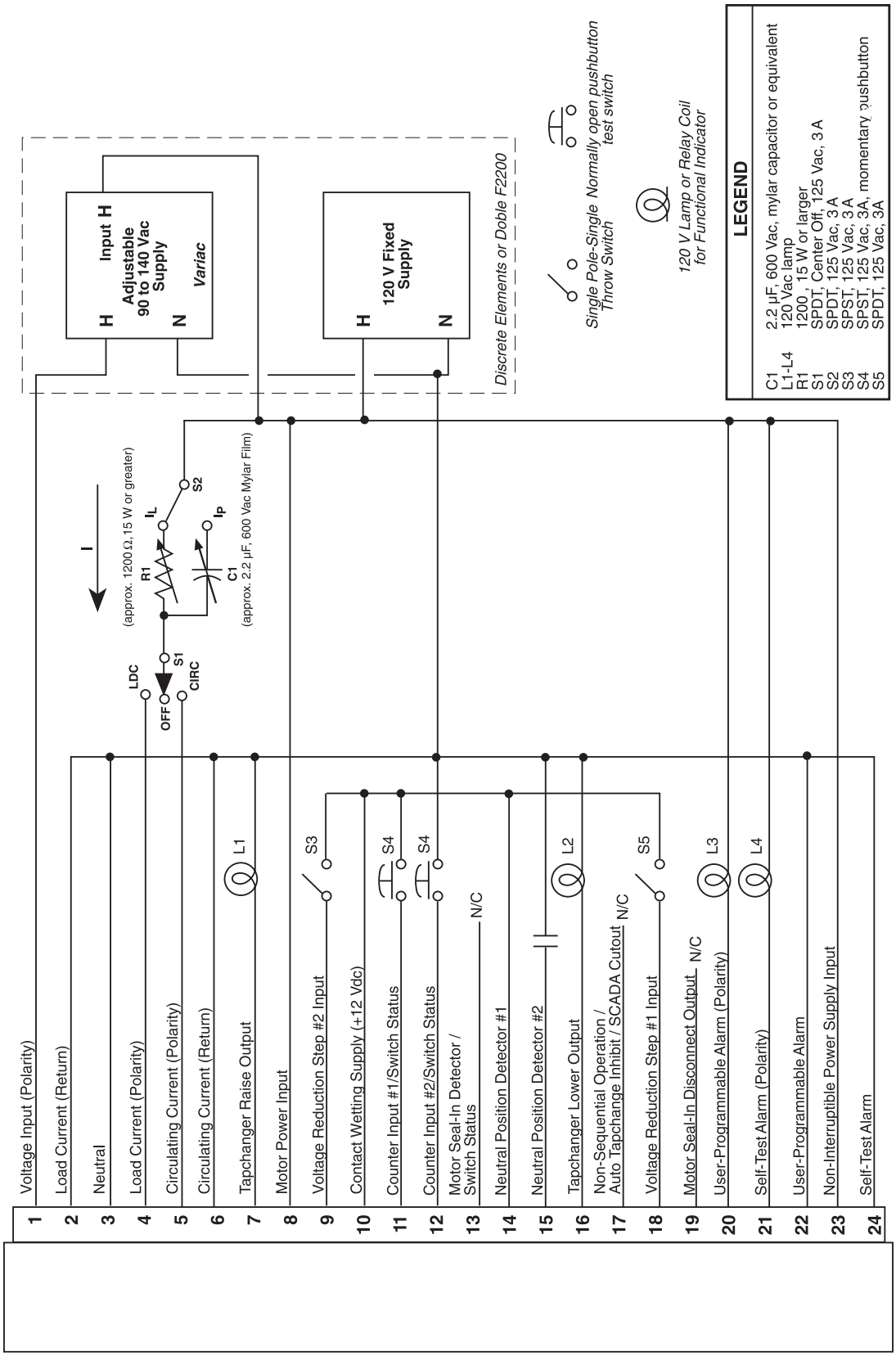


Figure 8-1 External Connections for Test Procedure

8.1 Bench Test

▲ **CAUTION:** Do not reverse the ground and hot wires when connecting an external source.

1. Apply 120 Vac from power source. The display of the M-2001D will automatically advance to the Local Voltage screen.
2. Increase voltage to 121.2. The **LOWER** LED should illuminate.
3. Decrease voltage to 118.8. The **RAISE** LED should illuminate.
4. Set the input voltage to 120.0 Vac. Wait for **RAISE** and **LOWER** LEDs to extinguish.
5. Increase voltage to 122.0 Vac, then start timing when voltage passes 121.0 V.
6. Stop timing when the lamp connected to the **LOWER** output illuminates (should be approximately 5 seconds).

Resistance

1. Apply a 100.0 mA in-phase current to Pin 4 (load current-polarity) and Pin 2 (load current-return) of the P2 connector.
2. Set S_1 to LDC and S_2 to I_L.
3. Set LDC Resistance to 24.0 V. The **RAISE** LED should illuminate.
4. Increase the input voltage to 132.0 Vac. The **RAISE** and **LOWER** LEDs should be extinguished.
5. Set the LDC Resistance to –24.0 V. The **LOWER** LED should light.
6. Decrease the input voltage to 108.0 Vac. Both **RAISE** and **LOWER** LEDs should extinguish.
7. Set the LDC Resistance to 0.0 V.
8. Decrease the input voltage to 120 Vac.

Reactance

1. Apply 100.0 mA 90° leading current to Pin 4 (load current-polarity) and Pin 2 (load current-return) of the P2 connector.
2. Set S_1 to LDC and S_2 to I_L.
3. Set LDC Reactance to 24.0 V. The **LOWER** LED should illuminate.
4. Decrease the input voltage to 108.0 Vac. The **RAISE** and **LOWER** LEDs should be extinguished.
5. Set LDC Reactance to –24.0 V; the **RAISE** LED should illuminate.
6. Increase input voltage to 132.0 Vac. Both **RAISE** and **LOWER** LEDs should be extinguished.
7. Set the LDC Reactance to 0.0 V.
8. Decrease the input voltage to 120 Vac.

Voltage Reduction

1. Set Voltage Reduction Step #1 to 2.5% (default setting).
2. Close S_5 to enable Voltage Reduction Step #1. The **LOWER** LED should illuminate.
3. Decrease the voltage to 117.0 Vac. The **LOWER** LED should be extinguished.
4. Open S_5 and decrease the input voltage to 120.0 V.
5. Set Voltage Reduction Step #2 to 5% (default setting).
6. Close S_3 to enable Voltage Reduction step #2. The **LOWER** LED should illuminate.
7. Decrease voltage to 114.0 Vac. The **LOWER** LED should extinguish.
8. Open S_3 and decrease the input voltage to 120.0 Vac.

Paralleling

1. Apply 100.0 mA 90° leading current to Pin 5 (circulating current-polarity) and Pin 6 (circulating current-return) of the P2 connector.
2. Set S_1 to CIRC and S_2 to I_P. The **LOWER** LED should illuminate.
3. Decrease the voltage to 108.0 Vac. Both **RAISE** and **LOWER** LEDs should be extinguished.
4. Set S_1 to OFF.

Counter

1. Set the M-2001D Tapchanger Control to display the Operations Count screen for the Total Operations Counter.
2. Verify counter operation by depressing S4 wired to Pin 11 and Pin 12 (counter in).
3. The operations counter should increment.

Block Raise/Block Lower/Deadband

1. Set Block Raise to 126.0 V.
2. Set Block Lower to 114.0 V.
3. Set the unit to display the Bias Voltage screen.
4. Press **ENT**.
5. Increase voltage to 126.5 V. BR should be displayed on the screen.
6. Increase voltage to 128.5 V. FL is displayed on the screen.
7. Decrease voltage to 113.5 V. BL is displayed on the screen.

—Bench Test Complete—

8.2 Check-out Procedure

■ **NOTE:** All Beckwith Electric units are fully calibrated at the factory. There is no need to recalibrate the units before initial installation.

Applying Power

1. Remove any external connection between Pin 1 (voltage input) and Pin 8 (motor power input).
2. Using a voltmeter, ensure that the voltage applied to Pin 1 is nominal 120 Vac with respect to Pin 3 (neutral).

▲ **CAUTION:** Do not reverse the ground and hot wires when connecting an external source.

3. Apply motor auxiliary voltage to Pin 8 (motor power input) and Pin 3 (neutral).
4. Verify that the motor runs in the proper direction when conditions of sensed voltage result in activation of Raise and Lower outputs.

WARNING: In no case should the load current circuit be interrupted with the regulator or transformer energized.

WARNING: Do not remove auxiliary current transformers without shorting the current inputs. Death or severe electrical shock can occur.

5. As shown in Figure 8-2, Setup for Current Checkout Procedures, temporarily place a shorting device across the LDC-CT secondary to short the line drop compensator circuit, and place another shorting device to short the circulating current paralleling output, for the load current check.
6. Insert an ammeter between the polarity input and Pin 4.
7. Open the load current shorting device and with a known load on the transformer or regulator, measure the current in the load current circuit to ensure that this current is correct for 0.2 A full load.

▲ **CAUTION:** The current input to the control is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

8. Replace the shorting device across the load current input and remove the ammeter.
9. Reconnect polarity to the unit and remove both jumpers. The Line Drop Compensator will be activated. Correct CT polarity can be checked by simply incorporating sufficient +R compensation. The regulator should time out and run so as to raise the output voltage.

8.3 Operational Test

1. Set VT Ratio Correction = 0 V; CT/VT phasing = 0° from the appropriate screen in the software.
2. Return to the Local Voltage screen.
3. Apply 120.0 Vac to Pin 1 (hot) and Pin 3 (neutral) of the adapter panel.
4. Verify local voltage = input voltage ±0.3 V.
5. Apply 100.0 mA in-phase current to Pin 4 (load current-polarity) and Pin 2 (load current-return).
6. Verify Control Load I =100 mA and Power Factor =1.0 ±0.02 from the appropriate software screens.
7. Apply 100.0 mA 90° leading current to Pin 5 (circulating current-polarity) and Pin 6 (circulating current-return).
8. Verify Control Circ I = 100.0 mA ±2 mA.
9. Verify the ⬆ , ⬇ and **ENT** pushbuttons function properly.
10. De-energize the current source.

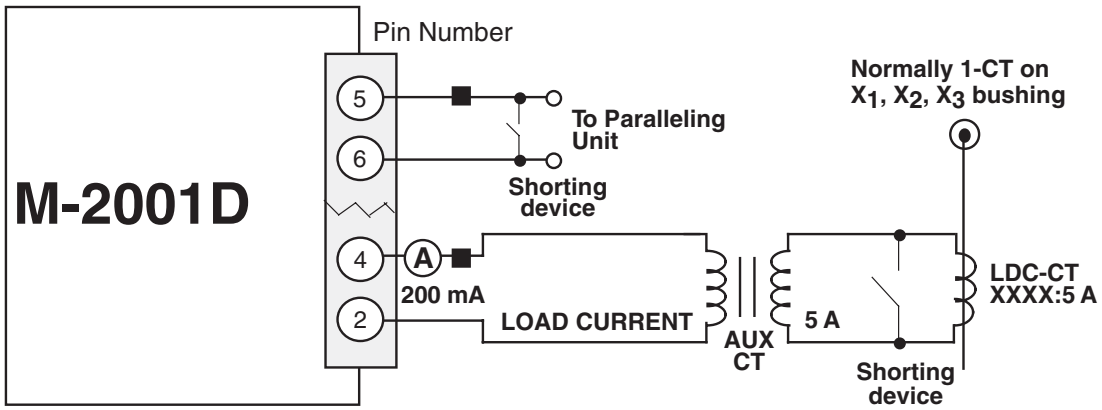
—Checkout Procedure Complete—

8.4 In-Service Test

1. Set the M-2001D Tapchanger Control to display the Bias Voltage screen.
2. Press **ENT**.
3. Use the ⬆ and ⬇ pushbuttons to cause **RAISE** and **LOWER** outputs.

   If either output is blocked, verify that the unit is not at the maximum tap position.
4. Press **ENT** to return to the Local Voltage screen.

—In-Service Test Complete—



■ **NOTE:** Pin numbers indicated above are accurate for the M-2050B Mounting Kit only; check the Application Guide of the specific adapter panel used for proper pin numbers.

Figure 8-2 Setup for Current Checkout Procedure

8.5 Bias Voltage Status/Test Mode

This convenient feature permits entering a bias voltage for simulating the raising or lowering of the sensed input voltage. This exercises the control as if the input voltage were being changed. The contacts actually operate.

This feature is valuable in the rapid determination of operating quantities present to influence the normal operation of the control. Items that will block operations or change setpoints are described here and illustrated by LEDs on the face of the control.

The Test Mode/Status screen displays control status information that includes:

- Output Status
- Compensated Voltage
- Band Status
- Runback/Blocking Status
- Voltage Reduction Status

This feature automatically resets on exit or in 15 minutes if not exited.

Bias Voltage Testing

To apply a bias voltage to test the control proceed as follows:

1. Press the ENT (UTIL Hot Button) pushbutton to awaken the unit. The menu will advance to "UTILITIES".

```
          UTILITIES
←COMM                    MNTR→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
          Calibration/Test
←                          →
```

3. Press the Down arrow pushbutton as necessary to navigate to the "Bias Voltage Status Test Mode" menu item.

```
Bias Voltage
Status/Test Mode
```

4. Press the ENT pushbutton. The unit will display the following:

```
Bias Voltage 0.0
-- XXX.X --
```

The upper line of the display will initially indicate "0.0" bias volts.

The second line will display the sequence of parameters indicated in Figure 8-3. By increasing/decreasing the applied bias voltage the control will respond based on the settings entered into the control.

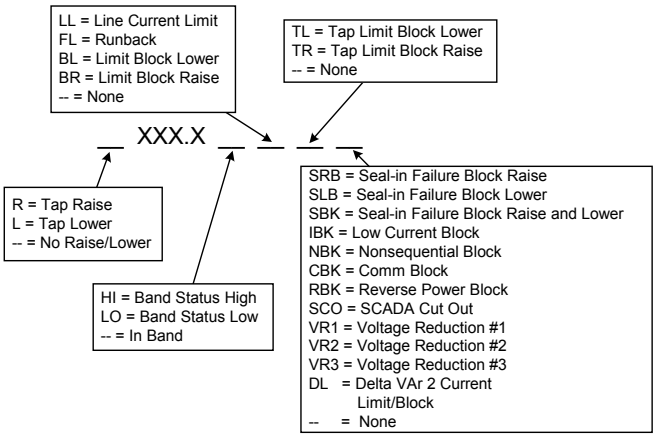


Figure 8-3 Bias Voltage Test Index

8.6 LED Scroll Test

To test the control front panel LEDs proceed as follows:

1. Press the ENT (UTIL Hot Button) pushbutton to awaken the unit. The menu will advance to "UTILITIES".

```
            UTILITIES
←COMM                    MNTR→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Calibration/Test
←                        →
```

3. Press the Down arrow pushbutton, as necessary, to navigate to the LED Scroll Test menu item.

```
LED Scroll Test
Press ENT to begin
```

4. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 7.

```
LED Scroll Test
Test in Progress...
```

5. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

6. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen and display the following:

```
LED Scroll Test
Test in Progress...
```

   If not, re-enter a valid code.

7. The control will illuminate each of the eight LEDs. To stop the LED test press the EXIT pushbutton.

8.7 Input Test

To test the control inputs proceed as follows:

1. Press the ENT (UTIL Hot Button) pushbutton to awaken the unit. The menu will advance to "UTILITIES".

```
            UTILITIES
←COMM                    MNTR→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Calibration/Test
←                        →
```

3. Press the Down arrow pushbutton, as necessary, to navigate to the Input Test menu item.

```
Input Test
Press ENT to begin
```

4. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 7.

```
Input Test ←→
vr1  vr2  ns  c  n  l  r  t
```

5. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

6. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen and display the following:

```
Input Test ←→
vr1  vr2  ns  c  n  l  r  t
```

   If not, re-enter a valid code.

7. Determine the inputs to be tested and the corresponding position (from left to right) in the input test screen.
   - **vr1**, Voltage Reduction #1
   - **vr2**, Voltage Reduction #2
   - **ns**, Non-Sequential Input
   - **c**, Operations Counter Contact
   - **n**, Neutral Light Switch
   - **l**, Lower Status
   - **r**, Raise Status
   - **t**, Current Loop Input
   - **a1**, Aux Input 1
   - **a2**, Aux Input 2
   - **a3**, Aux Input 3
   - **ms**, Motor Sealin

   As each input is activated the corresponding indicator will change from lower case to upper case to indicate that the control has read the input.

8. Verify that the control is in a configuration that supports input testing, then proceed as follows based on control status:
   - If the control is not connected to field connections, then utilize Figure 8-1 to connect test equipment and test the desired inputs.
   - If the control is connected to field connections, then determine the necessary test method(s) for testing the desired input.

     Draghands, Lower and Raise status can be tested by utilizing the corresponding front panel switches.

9. When all input testing has been completed, restore the control back to pre-test conditions.

8.8 Output Test

To test the control outputs proceed as follows:

1. Press the ENT (UTIL Hot Button) pushbutton to awaken the unit. The menu will advance to "UTILITIES".

```
          UTILITIES
←COMM                    MNTR→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
       Calibration/Test
←                        →
```

3. Press the Down arrow pushbutton, as necessary, to navigate to the LED Scroll Test menu item.

```
Output Test
Press ENT to begin
```

4. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 7.

```
alarm contact
0000000
```

5. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS
_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

6. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen and display the following:

```
alarm contact
0000000
```

   If not, re-enter a valid code.

7. The cursor will be located under the far right zero which corresponds to the control "Alarm Contact". Positions 2 through 7 are:

   - Position 2, Raise Contact
   - Position 3, Lower Contact
   - Position 4, Source Contact
   - Position 5, Aux Output 1
   - Position 6, Seal-In Output
   - Position 7, Deadman Output

   To test output contacts proceed as follows for the desired output:

   a. Verify that the control is in a configuration that supports output contact testing.
   b. Utilizing the Up/Down arrow pushbutton for the desired output contact set the value to "1". The contact output will be active. Verify that the desired output is activated.
   c. Utilizing the Up/Down arrow pushbutton for the desired output contact set the value to "0". The contact output will be deactivated. Verify that the desired output is deactivated.
   d. Repeat for the remaining outputs.

8.9 Button Test

Front Panel Pushbutton Testing

To test the control front panel pushbuttons, proceed as follows:

1. Press the ENT (UTIL Hot Button) pushbutton to awaken the unit. The menu will advance to "UTILITIES".

```
            UTILITIES
←COMM                    MNTR→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
        Calibration/Test
←                        →
```

3. Press the Down arrow pushbutton, as necessary, to navigate to the Button Input Test menu item.

```
Button Input Test
Press ENT to Begin
```

4. Press the ENT pushbutton. If Level 2 Access is not active or has been previously input, the following will be displayed. Go to Step 7.

```
Button Input Test
Press A Key...
```

5. If Level 2 Access is active, the Level 2 Access prompt will be displayed.

```
ENTER LEVEL 2 ACCESS

_
```

■**NOTE**: When entering the Level 2 Access code the display will automatically advance the cursor to the next digit when input is momentarily paused.

6. Enter a valid Level 2 Access code, then press the ENT pushbutton.

   If a valid Level 2 Access code was entered, the display will briefly flash a confirmation screen and display the following:

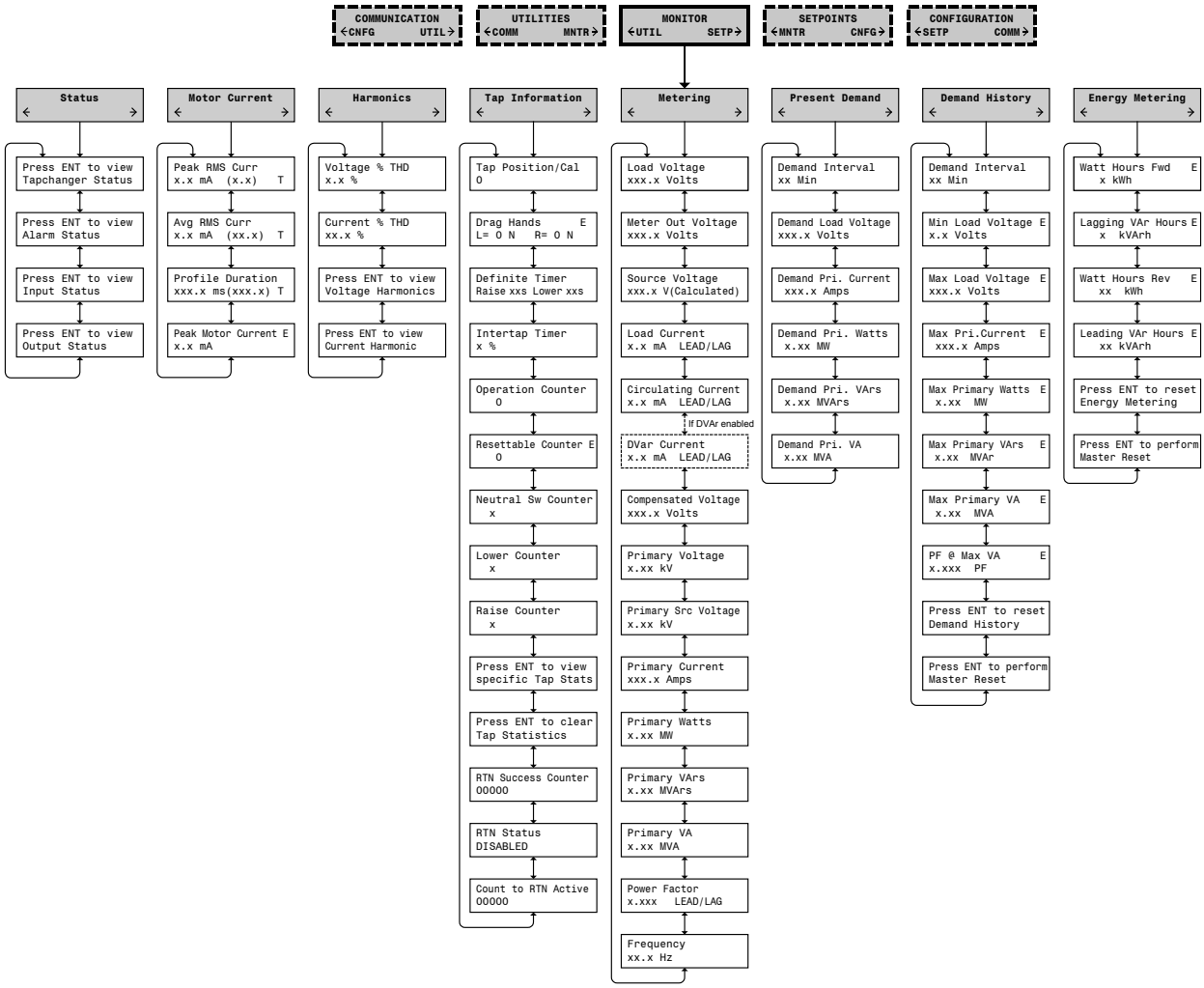
```
Button Input Test
Press A Key...
```

   If not, re-enter a valid code.

7. Test the desired pushbutton by pressing and holding the pushbutton. The display will identify the pushbutton if it is working correctly.

A Appendix

A.1 HMI Menu Flow



At any menu screen:

Press EXIT to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-1 Monitor Menu Flow

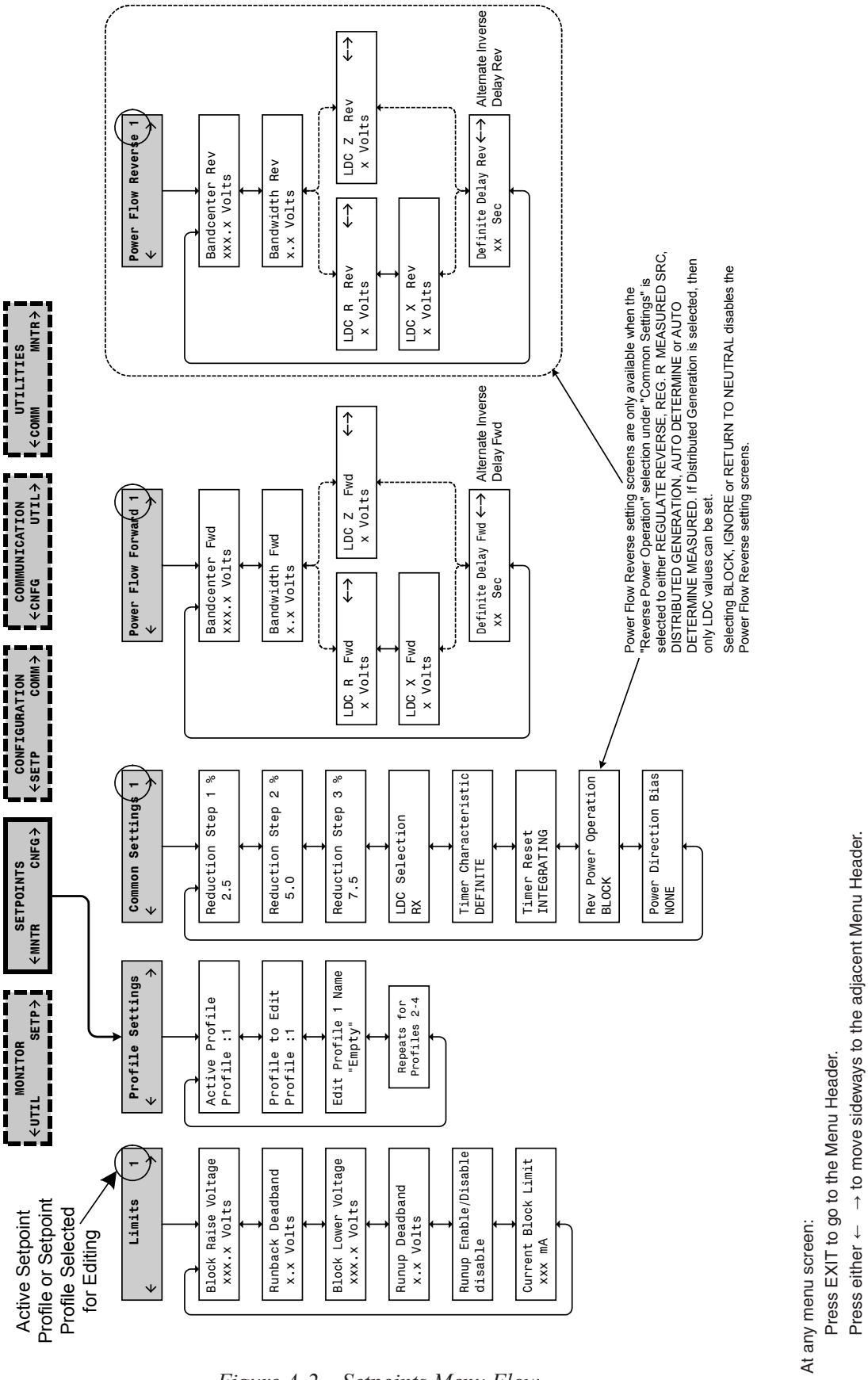
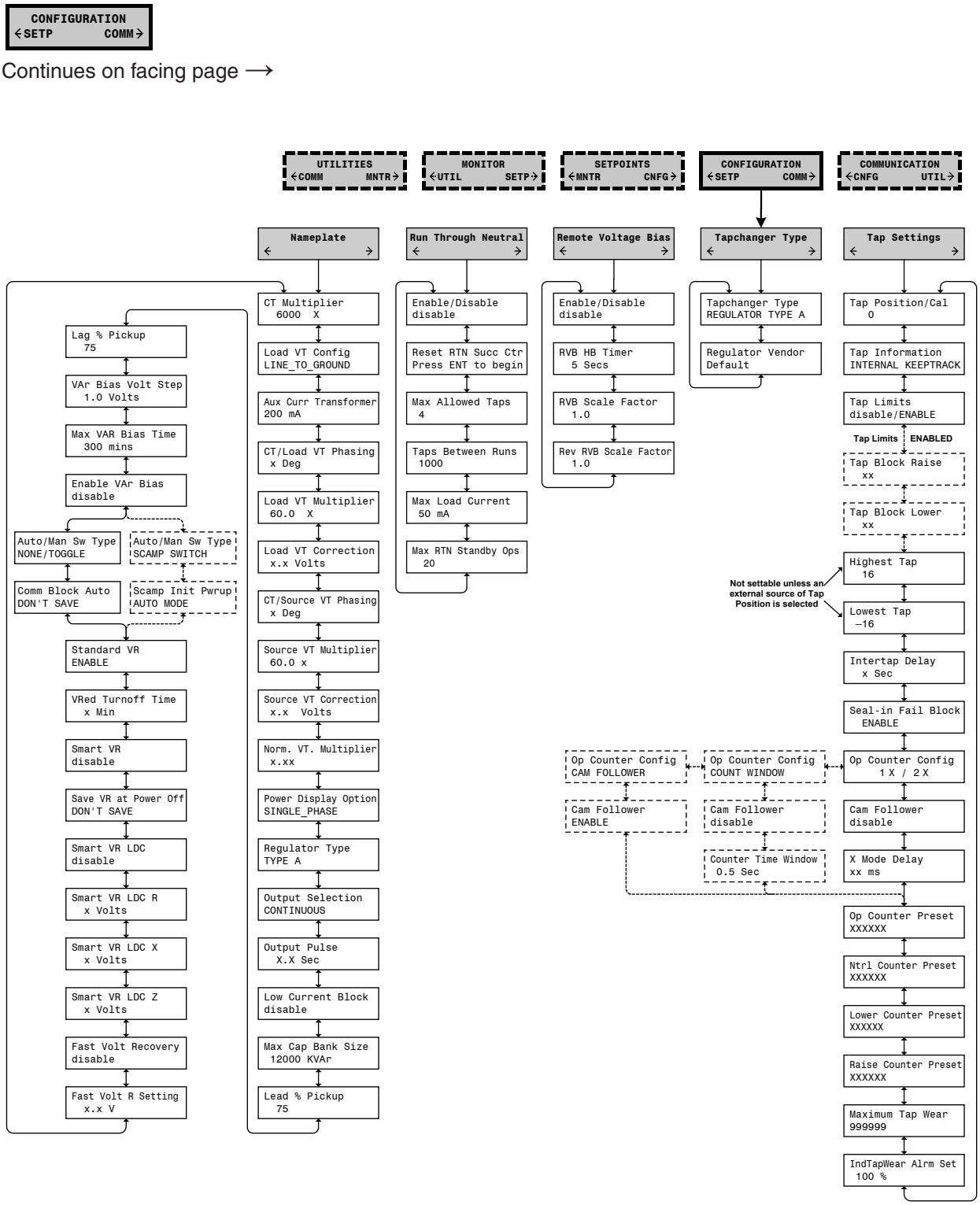


Figure A-2 Setpoints Menu Flow



At any menu screen:

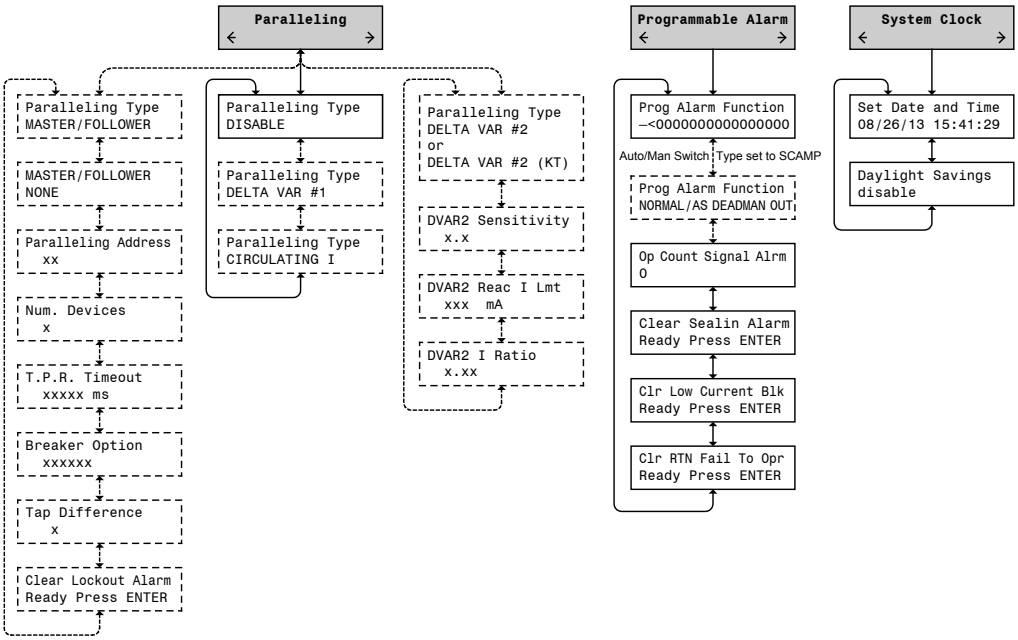
Press EXIT to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-3 Configuration Menu Flow (1 of 3)

← Continues on facing page

Continues on next page →

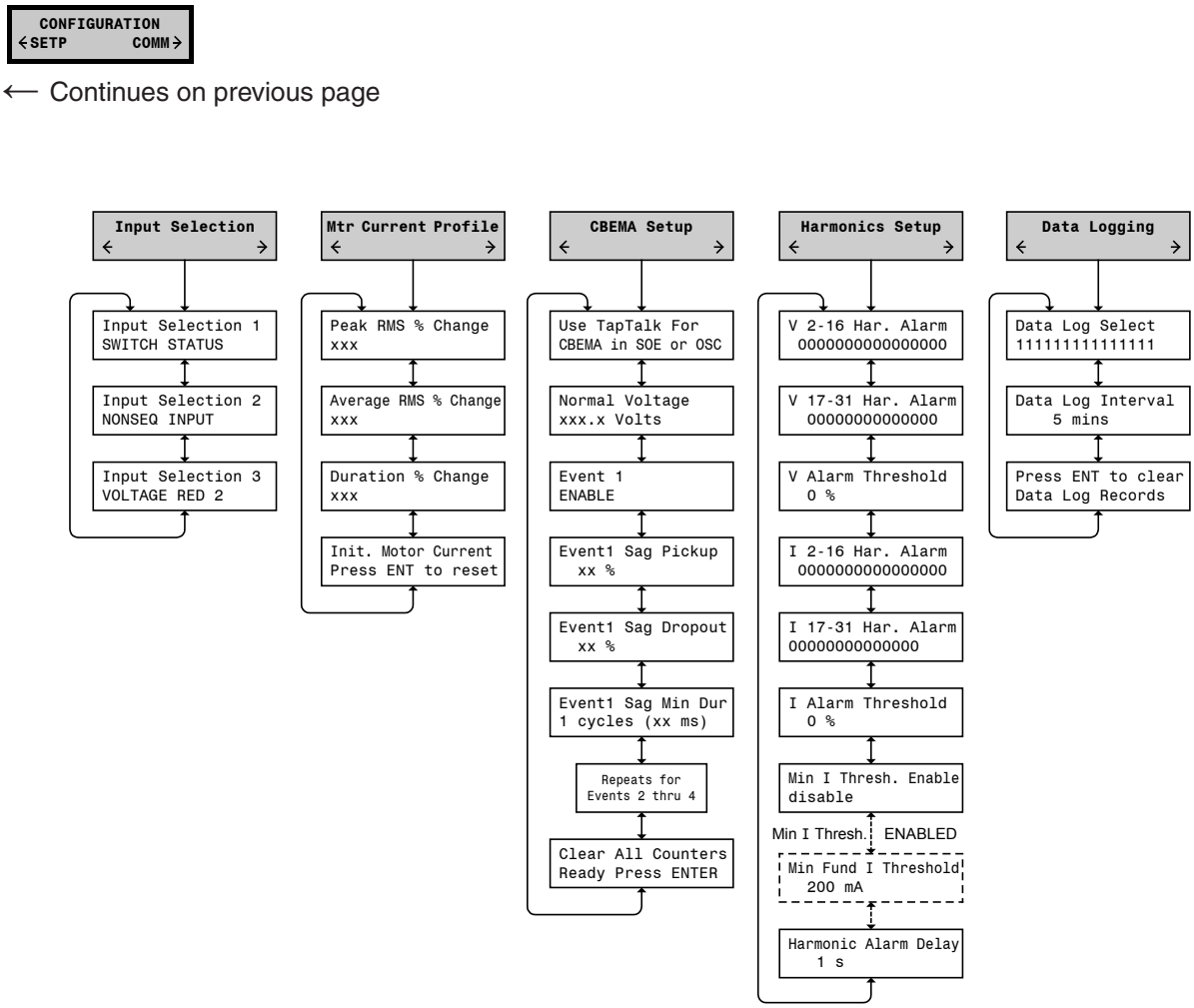


At any menu screen:

Press EXIT to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-3 Configuration Menu Flow (2 of 3)



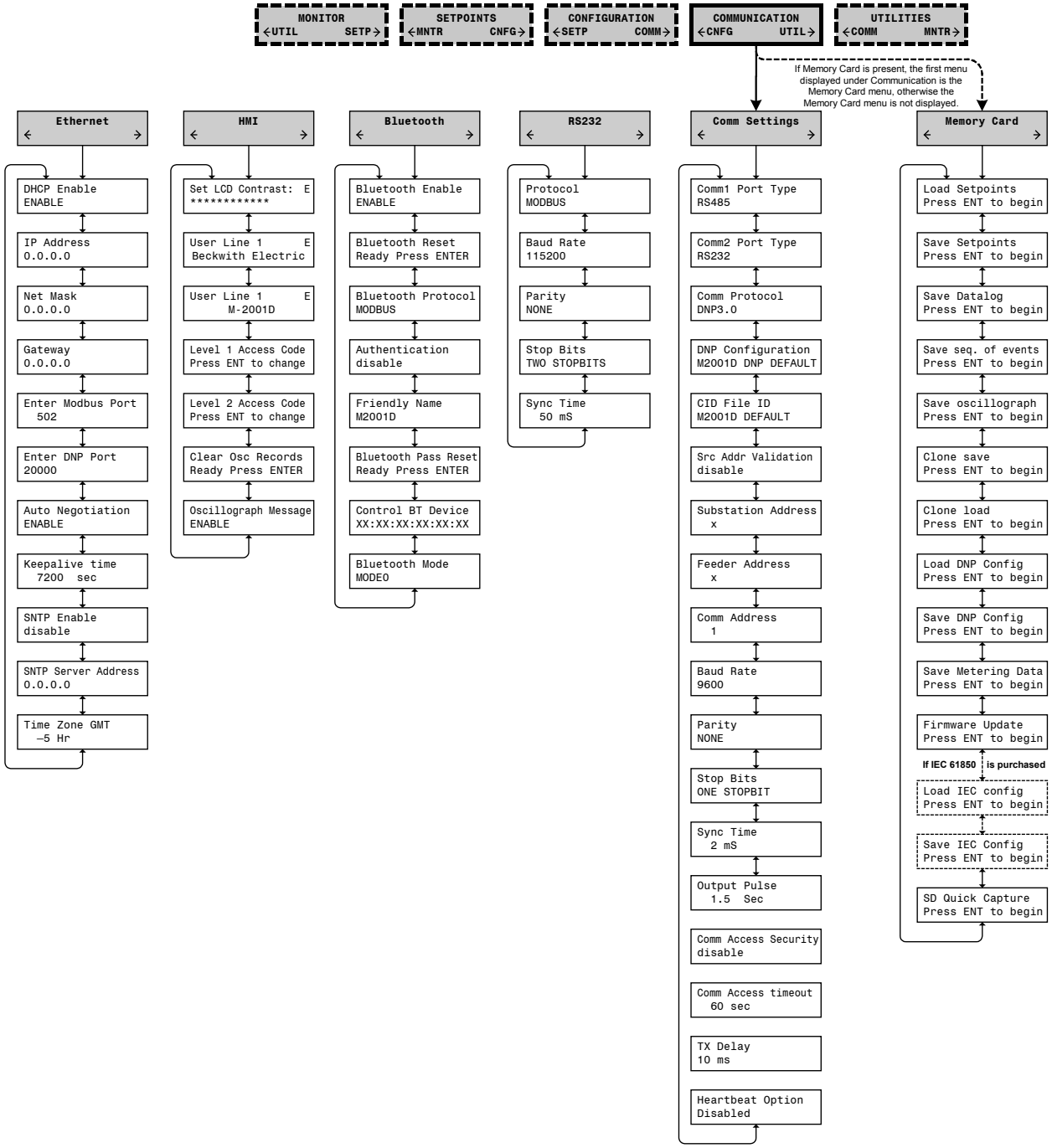
⟵ Continues on previous page

At any menu screen:

Press EXIT to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-3 Configuration Menu Flow (3 of 3)

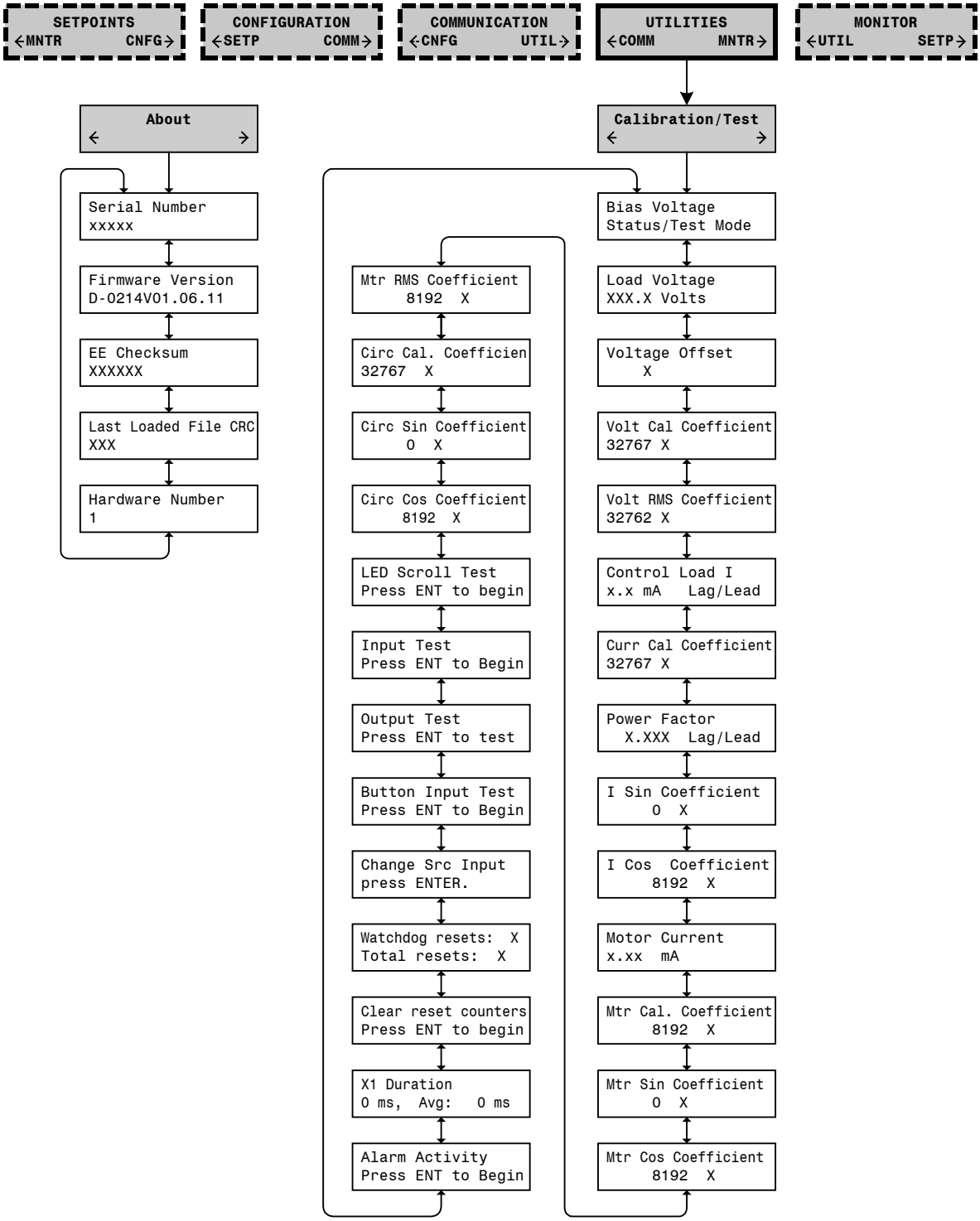


At any menu screen:

Press EXIT to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-4 Communication Menu Flow



At any menu screen:

Press EXIT to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-5 Utilities Menu Flow

A.2 HMI Screen Review

Monitor/Metering

```
Load Voltage
XXX.X Volts
```

Displays the real-time measured value of voltage at the regulator or the transformer, including the voltage reduction if applicable and any corrections made using the user-selected VT correction voltage.

```
Meter Out Voltage
XXX.X Volts
```

Displays the measured voltage at the terminals of the M-2001D without any software modifications. Used as the base for normalizing voltage.

```
Source Voltage
XXX.X V (Calculated) or (Measured)
```

Calculated - Displays the real-time calculated source voltage-only applicable in regulator control applications and includes any corrections made using the user-selected VT correction voltage.

Measured - Displays the real-time measured source voltage when Reverse Power is detected and Reverse Power Operation is "Regulate Rev Measured".

```
Load Current
X.X mA   LEAD/LAG
```

Displays the real-time measured value of load current related to the scaling factor Current Transformer of 200 mA.

```
Circulating Current
X.X mA   LEAD/LAG
```

Displays the representable value of circulating current, if the control is used with a Beckwith Electric M-0115A Parallel Balancing Module or equivalent. Displays the value of DVAr Current when DVAr Paralleling method is enabled.

```
Compensated Voltage
XXX.X Volts
```

Displays the calculated voltage at the “load center,” based on load current and the LDC settings.

```
Primary Voltage
X.XX kV
```

Displays the calculated primary voltage based on the user-selected voltage multiplier and measured secondary voltage.

```
Primary Src Voltage
X.XX kV
```

Displays Primary Source Voltage based on the user-selected Source VT Correction.

```
Primary Current
XXX.X Amps
```

Displays the calculated primary current based on the user-selected current multiplier and measured secondary current.

```
Primary Watts
X.XX MW
```

Displays the calculated primary quantity based on the user-selected multipliers and measured secondary voltage and current.

```
Primary VArs
X.XX MVArs
```

Displays the calculated primary quantity based on the user-selected multipliers and measured secondary voltage and current.

```
Primary VA
X.XX MVA
```

Displays the calculated primary quantity based on the user-selected multipliers and measured secondary voltage and current.

```
Power Factor
X.XXX   LEAD/LAG
```

Displays the real-time calculated value of power factor.

```
Frequency
XX.X Hz
```

Displays the line frequency.

Figure A-6 Monitor Screens (page 1 of 6)

Monitor/Present Demand

```
Demand Interval
XX Min
```

Toggles between 5, 10, 15, 30 and 60 minute interval with a factory setting of 15 minutes. The time interval is the amount of time it takes for a thermal meter to indicate 90% of a change of load.

```
Demand Load Voltage
XXX.X Volts
```

Displays the real-time measured value of voltage at the regulator or transformer. This value continuously averaged over consecutive 32-second intervals.

```
Demand Pri. Current
XXX.X Amps
```

Displays the calculated primary demand current based on the user-selected current multiplier and measured secondary current.

```
Demand Pri. Watts
X.XX MW
```

Displays the demand value based on the user-selected voltage and current multipliers or secondary voltage and current.

```
Demand Pri. VArs
X.XX MVArs
```

Displays the demand value based on the user-selected voltage and current multipliers and measured secondary voltage and current.

```
Demand Pri. VA
X.XX MVA
```

Displays the demand value based on the user-selected voltage and current multipliers and measured secondary voltage and current.

Monitor/Demand History

```
Demand Interval
XX Min
```

Toggles between 5, 10, 15, 30 and 60 minute interval with a factory setting of 15 minutes. The time interval is the amount of time it takes for a thermal meter to indicate 90% of a change of load.

```
Min Load Voltage     E
X.X Volts
```

Displays minimum local voltage at the regulator or transformer. Bottom line toggles between date/time/Volts.

```
Max Load Voltage     E
XXX.X Volts
```

Displays maximum local voltage at the regulator or transformer. Bottom line toggles between date/time/Volts.

```
Max Pri. Current     E
XXX.X Amps
```

Displays maximum primary current. Bottom line toggles between date/time/Amps.

```
Max Primary Watts    E
     X.XX  MW
```

Displays maximum Watts. Bottom line toggles between date/time/W.

```
Max Primary VArs     E
     X.XX  MVAr
```

Displays maximum VAr. Bottom line toggles between date/time/VAr.

```
Max Primary VA       E
     X.XX  MVA
```

Displays maximum VA. Bottom line toggles between date/time/VA.

Figure A-6 Monitor Screens (page 2 of 6)

Monitor/Demand History (Cont.'d)

```
PF @ Max VA
X.XXX  PF
```

Displays power factor at time of maximum VA. Resets automatically when MAX VA screen, below, is reset.

```
Press ENT to reset
Demand History
```

```
Press ENT to perform
Master Reset
```

Monitor/Energy Metering

```
Watt Hours Fwd        E
XX.XXX kWh
```

Displays total forward WHr. Bottom line toggles between date/time/WHR.

```
Lagging VAr Hours     E
XX.XXX kVArh
```

Displays total forward VArHr. Bottom line toggles between date/time/VArHr.

```
Watt Hours Rev        E
X kWh
```

Displays total reverse WHr. Bottom line toggles between date/time/WHr.

```
Leading VAr Hours     E
X kVArh
```

Displays total reverse VArHr. Bottom line toggles between date/time/VArHr.

```
Press ENT to reset
Energy Metering
```

```
Press ENT to perform
Master Reset
```

Monitor/Status

```
Press ENT to view
Tapchanger Status
```

TAP	BDS	PWR	BLK	VRD
1	OK	fwd	---	Off

TAP	Tap Position
BDS	Band Status (Lo, Hi, OK)
PWR	Power Direction (Fwd, Rev)
BLK	Blocks in Effect
VRD	Voltage Reduction (Off, 1, 2, 3)

```
Press ENT to view
Alarm Status
```

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

A = Block Raise Tap
B = Block Lower Tap
C = Block Raise Voltage
D = Block Lower Voltage
E = Voltage Reduction
F = Power Direction
G = Current Limit
H = Comm Block
I = LDC/LDZ
J = Abnormal Tap
K = VAr Bias Lag
L = VAr Bias Lead
M = Backup Fail (If purchased)
N (*M) = DVar2 Over Curr (If purchased)
O (*N/**M) = Seal-in Failure
P (*O/**N) = Low Current Blk
Q (*P/**O) = RTN Fail
R (*Q/**P) = Ind Tap Wear
S (*R/**Q) = Op Count Signal
T (*S/**R) = Tap Changer Fail

*These parameters will decrement by 1 letter if Backup Power (M) is not purchased.

**These parameters will decrement by 2 letters if Backup Power (M) and DVAr2 (N) are not purchased.

Figure A-6 Monitor Screens (page 3 of 6)

Monitor/Status (Cont.'d)

Alarm Status Key

1 Alarm Enabled/Condition Met

0 Alarm Enabled/Condition Not Met

X Alarm Disabled/Condition Met

- Alarm Disabled/Condition Not Met

```
Press ENT to view
Input Status
```

C	NS	VR	TC	KT	N	MS
00	00	— —	0	RL	0	0

C = Counter Contact

NS = Non-Sequential Input

VR = Voltage Reduction Inputs 1 and 2

TC = Tap Connection

KT = Keeptrack Lower and Raise Input

N = Neutral Tap Position

MS = Motor Seal-In

Key

1 = True (on)

0 = False (off)

```
Press ENT to view
Output Status
```

RAISE	LOWER	ALARM
1	0	0

RAISE Raise Contact

LOWER Lower Contact

ALARM Alarm Contact

Key

1 = True (on)

0 = False (off)

Monitor/Motor Current

```
Peak RMS Curr
X.X mA        (X.X) T
```

Displays the Peak RMS Current of the last operation (profile). Also displays the average Peak RMS Current from the Training Mode (x.x). If a "T" is present, the Training Mode is active.

```
Avg RMS Curr
X.X mA       (XX.X) T
```

Displays the Average RMS Current of the last operation (profile). Also displays the average of the Average RMS Current from the Training Mode (x.x). If a "T" is present, the Training Mode is active.

```
Profile Duration
XXXXX.X ms  (XXXX.X) T
```

Displays the Profile Duration of the last operation (profile). Also displays the average of the Profile Duration from the Training Mode (x.x). If a "T" is present, the Training Mode is active.

```
Peak Motor Current    E
X.X mA
```

Displays the Peak Motor Current recorded. This parameter is the highest Peak Motor Current recorded by the control. This parameter is independent of the Peak RMS Current in the Motor Current Profile.

Figure A-6 Monitor Screens (page 4 of 6)

Monitor/Harmonics

```
Voltage % THD
X.X %
```

Displays the percent of Voltage THD.

```
Current % THD
XX.X %
```

Displays the percent of Current THD.

```
Press ENT to view
Voltage Harmonics
```

Allows the user to view individual Voltage Harmonic Values (2-31).

```
Press ENT to view
Current Harmonic
```

Allows the user to view individual Current Harmonic Values (2-31).

Monitor/Tap Information

```
Tap Position/Cal
      0
```

Displays the tap position of the tapchanger. Recognizes tapchanges commanded via manual, automatic or external (SCADA) means, if tap position is not disabled. The tap position can be calibrated by selecting ENT, then setting the tap position using the ⬆/⬇ pushbuttons and selecting ENT to confirm the new tap position.

```
Drag Hands          E
L= 0 N    R= 0 N
```

Displays minimum and maximum values of tap position since reset. (Section 5.2, Configuration)

```
Definite Timer
Raisexxs  Lowerxxs
```

Displays the status of the raise, lower, and intertap timers; inverse or linear.

```
Intertap Timer
X %
```

Displays the status of the raise, lower, and intertap timers; inverse or linear.

```
Operation Counter
0
```

Records the total number of raise and lower operations. The operation counter will advance based on the Operation Counter Configuration, as set by user. This counter is not resettable, but can be preset to any value between 0 and 999,999.

```
Resettable Counter    E
X
```

Records the total number of raise and lower operations as does the total operations counter, discussed above. This counter is reset by pressing **ENT** at this screen. This counter can be used to monitor the number of tapchanges since the last time it was checked.

Figure A-6 Monitor Screens (page 5 of 6)

Monitor/Tap Information (Cont.'d)

```
Neutral Sw Counter
x
```

The Neutral Switch Counter is updated each time the neutral input is detected. Neutral Switch Counter can also preset to any value. The Neutral Switch Counter is a software counter that is stored in non-volatile memory and has a maximum value of 1,000,000.

```
Lower Counter
x
```

Records the number of Lower operations, can be Preset/Reset in Configuration/Tap Settings.

```
Raise Counter
x
```

Records the number of Raise operations, can be Preset/Reset in Configuration/Tap Settings.

```
Press ENT to view
specific Tap Stats
```

```
Tap    Tap Number
 0      0    0.0    A
```

TAP = Tap Position

TAP Number = The number of tapchanges and the Accumulated Primary Current for each individual tap position on the Tapchanger control.

```
Press ENT to clear
Tap Statistics
```

Press ENT to confirm clearing tap statistics.

```
RTN Success Counter
xxxxx
```

The RTN counter increments after each successful operation of the Run Through Neutral feature.

```
RTN Status
Disabled/Enabled
```

Displays the status of the Run Through Neutral Feature.

```
Count to RTN Active
xxxxx
```

Displays the number of counter operations since the operations between runs setting was set, or since the feature was enabled. The counter will reset to zero if the feature is enabled and successfully runs through neutral.

Figure A-6 Monitor Screens (page 6 of 6)

Setpoints/Profile Settings

```
Active Profile
Profile: 1
```

Provides the means to select the Active Profile (1, 2, 3 or 4).

```
Profile to Edit
Profile: 1
```

Selects the Setpoint Profile to be edited (1, 2, 3 or 4).

```
Edit Profile 1 Name (2,3 or 4)
       "Empty"
```

Allows the user to assign a profile name up to 16 standard alphanumeric characters. Alpha characters may be either upper or lower case.

Setpoints/Common Settings

```
Reduction Step 1 %
     2.5
```

Voltage reduction can be achieved by contact or communication methods. First of three independent steps of voltage reduction adjustable from 0% to 10% in 0.1% increments of the bandcenter setpoint. Factory setting is 2.5% .

```
Reduction Step 2 %
     5.0
```

Voltage reduction can be achieved by contact or communication methods. Factory setting is 5.0%.

```
Reduction Step 3 %
     7.5
```

Voltage reduction can be achieved by contact or communication methods. Third voltage reduction step. Factory setting is 7.5%.

```
LDC Selection
RX
```

Allows the user to select between Line Drop Compensation Resistance/Reactance or Z.

```
Timer Characteristic
DEFINITE
```

Allows setting control timer for Definite or Inverse time. There are four setpoints associated with this selection: Time Delay F/R, and Inverse Time F/R.

```
Timer Reset
INTEGRATING
```

Toggles between integrating timer and instantaneous reset (INST_RESET) timer upon voltage return to in-band condition.

```
Rev Power Operation
 BLOCK
```

Toggles between eight modes of operation:

- BLOCK – to inhibit automatic tapchange operation (Factory Setting)
- REGULATE REVERSE/
  REG. R MEASURED SRC – to detect a reverse power condition and regulate according to reverse power settings
- RETURN TO NEUTRAL – to drive the tap position to Neutral
- IGNORE – to continue unit action as though Forward Power Flow continued to exist
- DG Mode (Distributed Generation) – when distribution systems have the possibility of power reversal to control voltage
- AUTO DETERMINE/
  AUTO DETERMINE M – to allow the control to intelligently choose which reverse power mode applies at the time reverse power is sensed, either Distributed Generation mode or Regulate In Reverse/ Regulate in Reverse Measured

```
Power Direction Bias
 NONE
```

Allows one of three methods to be used for the control to switch between forward/reverse power operation. The three settings are None, Forward Bias, and Reverse Bias.

Figure A-7 Setpoints Screens (page 1 of 4)

Setpoints/Power Flow Forward

```
Bandcenter Fwd
XXX.X Volts
```

Forward power bandcenter is adjustable from 100.0 V to 135.0 V in 0.1 V increments with a factory setting of 120.0 V.

```
Bandwidth Fwd
X.X Volts
```

Forward power bandwidth is adjustable from 1.0 V to 10.0 V in 0.1 V increments with a factory setting of 2.0 V.

LDC RES-REAC

```
LDC R Fwd        ←→
  X Volts
```

Forward power Line Drop Compensation resistance is adjustable from -72 V to +72 V in 1 V increments with a factory setting of 0 V.

```
LDC X Fwd
  X Volts
```

Forward power Line Drop Compensation reactance is adjustable from -72 V to +72 V in 1 V increments with a factory setting of 0 V.

LDC-Z

```
LDC-Z Fwd        ←→
  X Volts
```

Adjustable from 0 to 72 volts in 1 volt increments.

DEFINITE DELAY

```
Definite Delay Fwd  ←→
   XX Sec
```

Forward power time delay for a tapchange is adjustable from 1 sec. to 360 sec. in 1 second increments with a factory setting of 30 sec.

INVERSE DELAY

```
Inverse Delay Fwd  ←→
   XX Sec
```

Forward power inverse delay for a tapchange is adjustable from 1 sec. to 360 sec. in 1 second increments with a factory setting of 30 sec.

Figure A-7 Setpoints Screens (page 2 of 4)

Setpoints/Power Flow Reverse

```
Bandcenter Rev
XXX.X Volts
```

Reverse power bandcenter is adjustable from 100.0 V to 135.0 V in 0.1 V increments with a factory setting of 120.0 V.

```
Bandwidth Rev
X.X Volts
```

Reverse power bandwidth is adjustable from 1.0 V to 10.0 V in 0.1 V increments with a factory setting of 2.0 V.

LDC RES-REAC

```
LDC R Rev        ←→
  X Volts
```

Reverse power Line Drop Compensation resistance is adjustable from -72 V to +72 V in 1 V increments, with a factory setting of 0 V.

```
LDC X Rev
  X Volts
```

Reverse power Line Drop Compensation reactance is adjustable from -72 V to +72 V in 1 V increments, with a factory setting of 0 V.

LDC-Z

```
LDC-Z Rev        ←→
  x Volts
```

Adjustable from 0 to 72 volts in 1 volt increments.

DEFINITE DELAY

```
Definite Delay Rev ←→
   xx Sec
```

Reverse power Definite delay for a tapchange is adjustable from 1 sec. to 360 sec. in 1 second increments with a factory setting of 30 sec.

INVERSE DELAY

```
Inverse Delay Rev  ←→
   xx Sec
```

Reverse power inverse delay for a tapchange is adjustable from 1 sec. to 360 sec. in 1 second increments with a factory setting of 30 sec.

Figure A-7 Setpoints Screens (page 3 of 4)

Setpoints/Limits

```
Block Raise Voltage
  XXX.X Volts
```

Overvoltage limit is adjustable from 95.0 V to 135.0 V in 0.1 V increments with a factory setting of 128.0 V. The Block Raise setpoint should always be set above the Block Lower setpoint and above the upper band limit (the bandcenter plus one-half of the bandwidth) for the control to operate. All automatic Raise/Lower tap operations are blocked, when input voltage is less than 85.0 Vdc.

```
Runback DeadBand
   X.X Volts
```

Runback Deadband is adjustable from 1.0 V to 4.0 V in 0.1 V increments with a factory setting of 2.0 V.

```
Block Lower Voltage
  XXX.X Volts
```

Undervoltage limit is adjustable from 95.0 V to 135.0 V in 0.1 V increments with a factory setting of 114.0 V. The Block Lower setpoint should always be set below the Block Raise setpoint and below the lower band limit (the bandcenter minus one-half of the bandwidth) for the control to operate. All automatic Raise/Lower tap operations are blocked, when input voltage is less than 85.0 Vdc.

```
Runup Deadband
   X.X Volts
```

Runup Deadband is adjustable from 1.0 V to 4.0 V in 0.1 V increments with a factory setting of 2.0 V.

```
Runup Enable/Disable
disable
```

Enables or disabled the Voltage Runup feature.

```
Current Block Limit
  XXX mA
```

Current Block Limit is adjustable from 50 mA to 640 mA in 1 mA increments with a factory setting of 640 mA with hysteresis of 5 mA. If the value of the current exceeds the Current Block Limit setpoint, the unit will not permit automatic control.

Figure A-7 Setpoints Screens (page 4 of 4)

Configuration/Tapchanger Type

■**NOTE:** These screens display the Tapchanger settings as selected by the user in TapTalk and are for information purposes only. The settings may not be changed in the HMI.

```
Tapchanger Type
REGULATOR TYPE A
```

```
Regulator Vendor
Default
```

Configuration/Tap Settings

```
Tap Position/Cal
      0
```

Allows input of known tap position to calibrate the unit tap position. This function is disabled when Tap Information is disabled.

```
Tap Information
INTERNAL KEEPTRACK
```

Toggles between ten modes of operation: XFMR External #3, XFMR External #2, XFMR External #1, Reg External #3, Reg External #2, Reg External #1, Contact KeepTrack™ 1R1L, Contact KeepTrack 1N, Internal KeepTrack™ and Disable.

```
Tap Limits
disable
```

Allows the tap position limits to be enabled/disabled. When enabled, the following Tap Block Raise and Lower setting screens will appear.

```
Tap Block Raise
   XX
```

When enabled the Tap Block Raise Limit is adjustable from –12 to +16 which includes a neutral tap position. Default setting is 16.

```
Tap Block Lower
   XX
```

When enabled the Tap Block Lower Limit is adjustable from –16 to +12. Default setting is –16.

```
Highest Tap
   XX
```

Not settable unless an external source of Tap Position is selected. Allows the user to select the range of a specific tapchanger (0 to 33 Taps).

```
Lowest Tap
   XX
```

Not settable unless an external source of Tap Position is selected. Allows the user to select the range of a specific tapchanger (–33 to +29 Taps).

```
Intertap Delay
   XX sec
```

Adjustable from 0 to 60 Seconds in 1.0 second increments with a factory setting of 0 seconds.

```
Seal-in Fail Block
ENABLE
```

When enabled the operation of the tapchanger is blocked when the control determines that a Motor Seal-in Failure has occurred.

```
Op Counter Config
      1 X
```

Selects the contact operation sequence that will cause the software counter to increment by one. Open/close/open (1X), open/close or close/open contact operation (2X). The Count Window mode registers any activity as a valid input within the count window time setting. The Cam Follower setting is used when a Cam Follower contact input is wired into the Counter contact input of the M-2001D. The counter will increment when the counter input sees the cam follower open and then close.

```
Cam Follower
disable
```

Enables or disables the Cam Follower feature.

Figure A-8 Configuration Screens (page 1 of 10)

Configuration/Tap Settings (Cont.'d)

```
X Mode Delay
  XX ms
```

When the control is using 1X or 2X Mode counter contact detection method, the X Mode Delay setting in milliseconds can be used to delay the detection of the NEUTRAL position switch.

```
Counter Time Window
 0.5 Sec
```

When the control is using Count Window Mode counter contact detection method, the counter time window may be set from 0.0 to 60.5 Seconds with a default setting of 0.5.

```
Op Counter Preset
XXXXXX
```

The counter cannot be reset, but can be preset to any value up to 999,999 in the Tap Settings menu.

```
Ntrl Counter Preset
XXXXXX
```

Provides the user with the capability to preset the Neutral Counter to any value up to 999,999.

```
Lower Counter Preset
XXXXXX
```

The Lower Counter Preset allows the user to either preset or reset the lower counter.

```
Raise Counter Preset
XXXXXX
```

The Raise Counter Preset allows the user to either preset or reset the raise counter.

```
Maximum Tap Wear
999999
```

Allows the user to set a value from 1 to 999,999 for the maximum number of times the regulator has been on each tap before an alarm occurs.

```
IndTapWear Alrm Set
 100 %
```

A percentage setting with a range from 1 to 200% which is used in conjunction with the Maximum Tap Wear setting to determine when the Individual Tap Wear Alarm is triggered. Default setting is 100%.

Configuration/Paralleling

```
Paralleling Type
DISABLE
```

Toggles between six modes of operation, if purchased: Circulating I, DVAR1, DVAR2, DVAR2 + KeepTrack™, Master/Follower and Disable. Factory setting is Disable.

```
DVAR2 Sensitivity
  XX
```

(DVAr2 and DVAr2 KT) Provides a method to control how much the voltage bandcenter is shifted relative to the delta VArs present between the circulating current input and the load current input. The settings for this screen are –4.0 to +4.0 in 0.1 increments, which correspond to a sensitivity of 0.5 to 2 times as sensitive (i.e., –4.0 = .5, –2.0 = .75, 0 = 1.00, 2.0 = 1.50, 4.0 = 2.00). The default setting is 0.0, for a sensitivity of 1.

```
DVAR2 Reac I Lmt
  XX mA
```

(DVAr2 and DVAr2 KT) Provides a method to set a reactive current (VArs) limit between the circulating current input and the load current input. If the reactive current reaches this setpoint, the operation of the M-2001D will be blocked, and the alarm output function will be activated, if enabled. The settings for this screen are 5 mA to 200 mA in 1 mA increments.

Figure A-8 Configuration Screens (page 2 of 10)

```
DVAR2 I Ratio
  X.XX
```

(DVAr2 and DVAr2 KT) Provides a method to adjust the sensitivity to the circulating current input versus the load current input. When the setting is 0.50, the control will be 0.50 times as sensitive to the VArs from the circulating current versus the load current input. At 1.00, the control will be equally sensitive to both current inputs. At 2.00, the control will be 2.00 times as sensitive to the VArs from circulating current input versus the load current input. The settings for this screen are 0.50 to 2.00 in 0.01 increments. The default setting is 1.00 to obtain equally sensitive current inputs.

```
Master/Follower
None (Master,Follower)
```

Determines the controls status in the Master/Follower paralleling scheme. A "None" setting allows the control to be removed from the scheme.

```
Paralleling Address
XX
```

The Paralleling Address is the unique address for each device in the network. (1-16).

```
Num. Devices
X
```

The number of total devices that are in the paralleling scheme (maximum of 16 inclusive of the master).

```
T.P.R. Timeout
XXXXXX ms
```

The Tap Position Response Timeout is the period (1000-60000 ms) that the Master waits following a tapchange and subsequent message sent to followers to make the same tapchange that when expired will initiate a lockout if all followers have not issued messages to the master confirming the follower tapchange.

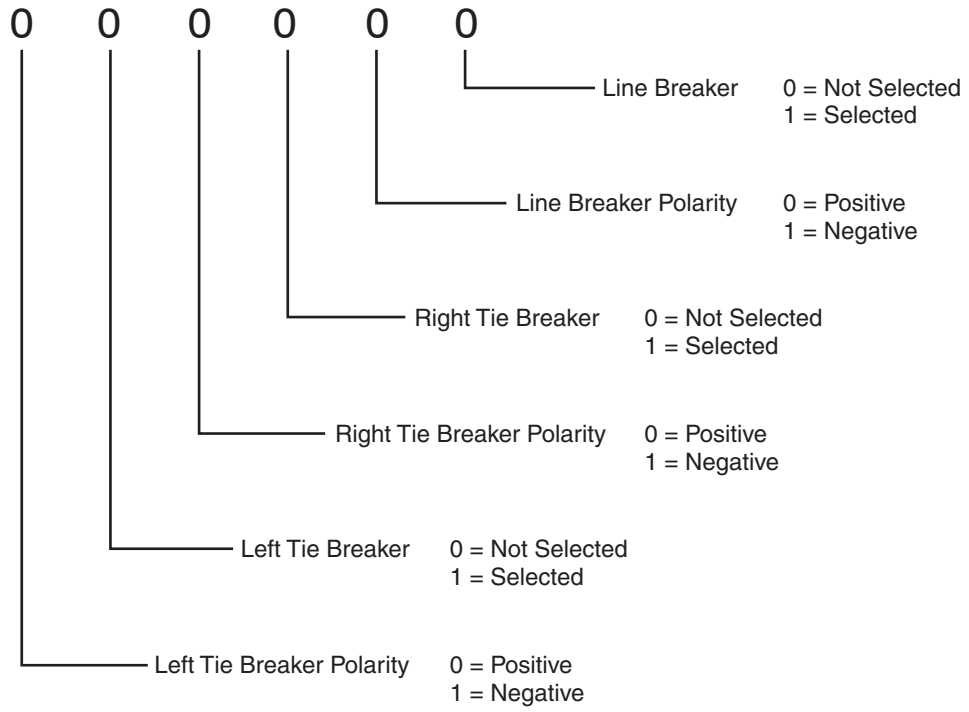


Figure A-8(B) Master/Follower Breaker Option Settings

Figure A-8 Configuration Screens (page 3 of 10)

Configuration/Paralleling (Cont.'d)

```
Breaker Option
XXXXXX
```

The Breaker Option setting, see Figure A-8(B), allows the user to include Line Breaker Status, Right Tie Breaker Status and Left Tie Breaker Status in the Master/Follower scheme. Breaker Polarity (Negative/Positive) is also able to be set.

```
Tap Difference
X
```

The Tap Difference setting is the number of tap positions between the Master and Follower tap positions that when exceeded will result in lockout of the control.

```
Clear Lockout Alarm
Ready Press ENTER
```

Allows the user to reset the lockout alarm at the control front panel.

Configuration/Programmable Alarm

```
Prog Alarm Function
–<0000000000000000
```

Provides alarm for one or more of the following user-selected conditions: Communication Block, Block Raise Limit exceeded, Block Lower Limit exceeded, Voltage Reduction (any step) invoked, Reverse Power Flow condition detected, Line Limit Current exceeded, Tap Block Raise in effect, Tap Block Lower in effect, LDC/LDZ in effect, Abnormal Tap Position detected, VAr Bias Lag exceeded, VAr Bias Lead exceeded, Backup Power fail detected (if purchased), Tap Wear Limit exceeded, Operation Count Limit exceeded, RTN Fail to Operate and Tap Changer Failure detected. Factory setting is Disable. (Bottom line of display indicates available alarms.) See Figure 5-5.

```
Op Count Signal Alrm
       0
```

When the resettable operations counter matches the Op Count Signal Alarm Setting, the control will display a message that the Op Count Signal Alarm Setting has been exceeded.

```
Clear Sealin Alarm
Ready Press ENTER
```

Allows the user to reset the Motor Seal-In Alarm when the motor hold input has been restored.

```
Clr Low Current Blk
Ready Press ENTER
```

Allows the user to clear the Low Current Block Alarm and Block. Alarm and Block occurs when the control determines that load current is less than 4 mA and Tap Delta Voltage is less than .4 VAC.

```
Clr RTN Fail To Opr
Ready Press ENTER
```

Allows the user to clear the Run Through Neutral Failure to Operate Alarm.

Configuration/System Clock

```
Set Date and Time
03/26/07 15:41:29
```

Displays and allows resetting of the time and date. Press **ENT** to set date; change mode indicated by "C". Used in conjunction with drag hands memories where the date/time stamp will be recorded for each drag hand quantity.

```
Daylight Savings
disable
```

Allows automatic Daylight Savings time adjustment to be enabled or disabled.

Configuration/Input Selection

```
Input Selection 1
SWITCH STATUS
```

Allows the Input Selection 1 to be used as a seal-in input or a switch status input. When the Switch Status input mode is selected, all Seal-In input functions will be disabled (Section 5.2, Configuration). The factory setting is Switch Status. A Switch Status setting is also required for "Contact KeepTrack™ 1R1L" and "Contact KeepTrack 1N" methods of tap knowledge.

Figure A-8 Configuration Screens (page 4 of 10)

```
Input Selection 2
NONSEQ INPUT
```

Allows the non-sequential input to be used as the Non-Sequential Input or as a SCADA Cutout input. When SCADA Cutout is selected, all nonsequential functions are disabled. (Section 5.2, Configuration) Factory setting is Non-Sequential.

```
Input Selection 3
VOLTAGE RED 2
```

Allows VR2 Input to be used as an Aux Status Input that can be read via DNP or MODBUS®.

Configuration/Mtr Current Profile

```
Peak RMS % Change
  xxx
```

Setting for Peak RMS current programmable from 110% to 200% of the stored Peak RMS current to activate an alarm.

```
Average RMS % Change
  xxx
```

Setting for Average RMS current programmable from 110% to 200% of the stored Average RMS current to activate an alarm.

```
Duration % Change
  xxx
```

Setting for Duration current programmable from 110% to 200% of the stored Duration current to activate an alarm.

```
Init. Motor Current
Press ENT to reset.
```

Allows the user to reset all Motor Current Profiles and initiate the "Training Mode".

Configuration/CBEMA Setup

```
Normal Voltage
xxx.x Volts
```

This parameter establishes the target voltage around which the Event settings determine "Sag" or "Swell" conditions.

```
Event 1 (2,3,4)
ENABLE
```

Enables/Disables CBEMA Event 1, 2, 3 or 4.

```
Event 1(2,3,4) Sag(Swell)Pickup
  xx %
```

When pickup is set to less than 100% it operates as a Sag (undervoltage), greater than 100% it operates as a Swell (overvoltage).

```
Event 1(2,3,4) Sag(Swell)Dropout
  xx %
```

Sag Dropout is always set greater than Sag Pickup. Swell Dropout is fixed at 100%.

```
Event 1(2,3,4) Sag(Swell)Min Dur
1 cycles  (xx ms)
```

Establishes the minimum duration that Sag or Swell condition exists before an Event is registered.

```
Clear All Counters
Ready Press ENTER
```

Clears all CBEMA Event Counters.

Figure A-8 Configuration Screens (page 5 of 10)

Configuration/Harmonics Setup

```
V 2-16 Har. Alarm
0000000000000000
```

Provides the user with the means to select active harmonics for voltage alarm 2-16.

```
V 17-31 Har. Alarm
00000000000000
```

Provides the user with the means to select active harmonics for voltage alarm 17-31.

```
V Alarm Threshold
   0 %
```

Allows the user to select the Harmonic Voltage Alarm Threshold value.

```
I 2-16 Har. Alarm
0000000000000000
```

Provides the user with the means to select active harmonics for current alarm 2-16.

```
I 17-31 Har. Alarm
00000000000000
```

Provides the user with the means to select active harmonics for current alarm 17-31.

```
I Alarm Threshold
   0 %
```

Provides Current Alarm Threshold value input.

```
Min I Thresh. Enable
disable
```

Enables/Disables Minimum Current Threshold feature.

```
Min Fund I Threshold
   200 mA
```

Establishes minimum fundamental Current Threshold for Current Harmonics 0 to 200 mA.

```
Harmonic Alarm Delay
   1 s
```

Allows Harmonic Alarm Delay setting which is applicable to both Voltage and Current Threshold settings.

Configuration/Data Logging

```
Data Log Select
11111111111111
```

Position From Right

1. Local Voltage
2. Compensated Voltage
3. Line Current
4. Load VA
5. Load W
6. Load VAr
7. Power Factor
8. Line Frequency
9. Tap Position
10. Source Voltage
11. Primary Current
12. Circulating/DVAr Current
13. Operation Count
14. Meter Out Voltage

Key

1 = Enabled for Logging
0 = Logging Disabled

```
Data Log Interval
   5 mins
```

```
Press ENT to clear
Data Log Records
```

Figure A-8 Configuration Screens (page 6 of 10)

Configuration/Nameplate

```
CT Multiplier
    6000  X
```

Adjustable from 1 to 32600 in 1 increments with a factory setting of 6000. User selection must include knowledge of CT ratio, from primary rating to 0.2 A rating of control.

```
Load VT Config
LINE_TO_GROUND
```

VT configuration toggles between Line-to-Line and Line-to-Ground with a factory setting of Line-to-Ground.

```
Aux Curr Transformer
200 mA
```

▲ CAUTION: The current input to the control is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for one second.

Selection of display current can be made to be either 200 mA, 1 A or 5 A. This screen allows load and circulating current displays to be viewed on 200 mA, 1A or 5A scales. Line Limit I settings also affected. (Section 5.1)

```
CT/LOAD VT Phasing
0     Deg
```

CT/VT phasing correction is adjustable from 0° to 330° in 30° increments with a factory setting of 0°. This setting will advance the current phasor by the indicated value.

```
Load VT. Multiplier
     60.0  X
```

Adjustable from 0.1 to 3260.0 in 0.1 increments with a factory setting of 60.0. User selection must include knowledge of VT ratio, sensing VT ratio correction.

```
Load VT Correction
     0.0 Volts
```

VT ratio correction is adjustable from –15 V to +15 V in 0.1 V increments with a factory setting of 0 V.

```
CT/Source VT Phasing
0   Deg
```

CT/VT phasing correction is adjustable from 0° to 330° in 30° increments with a factory setting of 0°. This setting will advance the current phasor by the indicated value.

```
Source VT. Multiplier
     60.0 X
```

Adjustable from 0.1 to 3260.0 in 0.1 increments with a factory setting of 60.0. User selection must include knowledge of Source VT Ratio and sensing Source VT Ratio correction.

```
Source VT Correction
     0.0 Volts
```

VT ratio correction is adjustable from –15 V to +15 V in 0.1 V increments with a factory setting of 0 V.

```
Norm. VT. Multiplier
     1.00
```

Normalizing Voltage Multiplier 0.80 to 1.20 times the Compensating Voltage.

```
Power Display Option
SINGLE_PHASE
```

Toggles between two modes of operation: Single-Phase-based on measured inputs, and Three-Phase-based on measured inputs and presumed balanced system. Factory setting is single-phase.

```
Regulator Type
TYPE A
```

Allows the regulator type to be selected as Type A or B for correct source voltage calculation. Factory setting is Type A.

Figure A-8 Configuration Screens (page 7 of 10)

Configuration/Nameplate (Cont.'d)

```
Output Selection
CONTINUOUS
```

Allows choice of output at tapchanger Raise/Lower output terminal. Choices are continuous or pulsed. For continuous, the control must wait to be in band or counter input valid for output to become disabled. For pulsed, an adjustable pulse width will be applied to the output triacs of 0.2 to 12 seconds.

```
Output Pulse
   1.5 Sec
```

Adjustable from 0.2 to 12 seconds in 0.1 second increments. Factory set at 1.5 seconds.

```
Low Current Block
disable
```

Enables and disables the Low Current Block and Alarm feature. When enabled allows the control to determine when load current is less than 4 mA and Tap Delta Voltage is less than .4 VAC to block regulation and initiate the Low Current Block alarm.

```
Max Cap Bank Size
 12000 KVAr
```

When VAr Bias is enabled provides the user with the ability to set the largest capacitor bank size from 4 to 12,000 KVAr.

```
Lead % Pickup
   75
```

Defines a Lower negative VAr limit in percentage of the Max Cap Bank size below which the control will increase the upper band edge by the amount defined by VAr Bias Voltage Step.

```
Lag % Pickup
   75
```

Defines an Upper positive VAr limit in percentage of the Max Cap Bank size above which the control will decrease the lower band edge by the amount defined by VAr Bias Voltage Step.

```
VAr Bias Volt Step
   1.0 Volts
```

Amount by which the control will increase or decrease the Upper or Lower band edges when there is a VAr Bias out of band situation.

```
Max VAR Bias Time
   300 mins
```

Maximum allowable time in minutes the control will bias the voltage edge.

```
Enable VAr Bias
disable
```

Enables and disables the VAr Bias feature.

```
Auto/Man Sw Type
NONE
```

Allows the Auto/Man switch type on the adapter panel to be set to toggle, SCAMP or NONE. NONE is used when no Auto/Manual switch exists.

```
Comm Block Auto
DON'T SAVE
```

If Auto/Manual Switch Type is set to "None" or "Toggle" allows the state of the "Block Auto Operation" communication command to be saved or not saved when power has been lost.

```
SCAMP Init Pwrup
AUTO MODE/LAST SAVE
```

If Auto/Manual Switch Type is set to "SCAMP" allows the control to initialize the SCAMP status in either "Auto Mode" or the "Last Save" position.

```
Standard VR
ENABLE
```

Allows the user to Enable or Disable Standard Voltage Reduction on the Control.

Figure A-8 Configuration Screens (page 8 of 10)

```
VRed Turnoff Time
   0 Min
```

Settable from 0 to 999 minutes. 0 = Disabled. When set from 1 to 999 it turns off any voltage reduction invoked (via comms only) after the set time expires.

```
Smart VR
disable
```

Allows the user to Enable or Disable Smart Voltage Reduction on the Control. Smart Voltage Reduction, when enabled, lowers voltage to between the Bandcenter setting and the lower band edge instead of stopping at the upper band edge. It also disablesVAr Bias if it is in effect.

```
Save VR at Power Off
DON'T SAVE
```

Allows any Voltage Reduction command communicated to the control to be saved or not saved at power down.

```
Smart VR LDC
disable
```

Allows the user to Enable or Disable Smart Voltage Reduction LDC on the Control. When "Smart VR LDC" is enabled, the control ignores existing LDC settings and instead uses the "Smart VR LDC" R and X or Z settings to apply LDC while the Voltage Reduction is in effect.

```
Smart VR LDC R
   x Volts
```

Smart VR Line Drop Compensation resistance is adjustable from -72 V to +72 V in 1 V increments with a factory setting of 0 V.

```
Smart VR LDC X
   x Volts
```

Smart VR Line Drop Compensation reactance is adjustable from -72 V to +72 V in 1 V increments with a factory setting of 0 V.

```
Smart VR LDC Z
   x Volts
```

Adjustable from 0 to 72 volts in 1 volt increments.

```
Fast Volt Recovery
disable
```

Allows the user Enable or Disable Fast Voltage Recovery on the Control.

```
Fast Volt R Setting
   x.x V
```

The Fast Voltage Recovery setting range is from 1.0 to 15.0 volts outside the normal band edges in 0.1 V increments.

Figure A-8 Configuration Screens (page 9 of 10)

Configuration/Run Through Neutral

```
Enable/Disable
disable
```

Enables and Disables the Run Through Neutral Feature.

```
Reset RTN Succ Ctr
Press ENT to begin
```

Resets the Run Through Neutral Success Counter.

```
Max Allowed Taps
x
```

The Maximum Allowed Taps Setting (3 to 7) determines the maximum number of taps that can be taken to swipe the reversing switch.

```
Taps Between Runs
xxxxx
```

This setting (10 to 10000) establishes the number of taps that must be taken before the Run Through Neutral Feature is activated.

```
Max Load Current
xx mA
```

Establishes the Maximum Measured Load current value (1 to 100 mA) that Load Current must be less than to allow the Run Through Neutral feature to activate.

```
Max RTN Standby Ops
xxxxx
```

The Maximum RTN Standby Operations setting (1 to 10000) is the number of Tap Operations that when exceeded initiates the "RTN Fail to Operate" alarm.

Configuration/Remote Voltage Bias

```
Enable/Disable
disable
```

Enables and Disables the Remote Voltage Bias Feature.

```
RVB HB Timer
xxx
```

The Remote Voltage Bias Heartbeat Timer setting (2 to 120 sec) is the period that upon receiving the remote voltage value the voltage bias is applied to the Bandcenter. If no remote voltage value is received and the timer times out the control will revert to existing settings.

```
RVB Scale Factor
xxx.x
```

The Forward RVB Scale Factor (0.1 to 100.0) is the scale factor applied to the raw remote voltage value obtained through communications.

```
Rev RVB Scale Factor
xxx.x
```

The Reverse RVB Scale Factor (0.1 to 100.0) is the scale factor applied to the raw remote voltage value obtained through communications.

Figure A-8 Configuration Screens (page 10 of 10)

Communication/Comm Settings

```
Comm1 Port Type
RS485
```

M-2001D COM Port can be selected for two different configurations: RS-485 or Fiber Optics.

```
Comm2 Port Type
RS232
```

M-2001D COM Port can be selected for two different configurations: RS-232 or Bluetooth.

```
Comm Protocol
DNP3.0
```

Allows selection between standard protocols, DNP 3.0 or MODBUS®.

```
DNP Configuration
M-2001D DNP DEFAULT
```

Displays the current DNP configuration. If no DNP configuration is present, then "File does not exist" will be displayed.

```
CID File ID
M2001D DEFAULT
```

Provides the user with the current CID File name (up to 20 characters) loaded on the control.

```
Src Addr Validation
disable
```

Enables or Disables Source Address Validation in the DNP3.0 protocol.

```
Substation Address
    x
```

The Substation Address is utilized to set a specific communication identification for network addressing. If set to zero the address is not in effect. The address can be set from 1 to 65519.

```
Feeder Address
    x
```

The Feeder Address is utilized to set a specific communication identification for network addressing. If set to zero the address is not in effect. The address can be set from 1 to 65519.

```
Comm Address
     1
```

Configures a three-digit numerical address, from 1 to 200, for remote communications. The factory setting is 1.

```
Baud Rate
9600
```

Selects baud rate for COM1, located on the top of the control.

```
Parity
NONE
```

None, odd or even parity is available.

```
Stop Bits
ONE STOPBIT
```

One or two stop bits are available.

```
Sync Time
    2 mS
```

This time delay improves robust operation when communication lines are intermittent. Communication dead-sync time is the time that the control will wait from the last received character and continue without attempting to resynchronize. Factory setting is 2 msec; range is 0-32000 msec.

```
Output Pulse
1.5 Sec
```

Adjustable from 0.2 to 12 seconds in 0.1 second increments. Factory set at 1.5 seconds.

Figure A-9 Communication Screens (page 1 of 5)

Communication/Comm Settings (Cont.'d)

```
Comm Access Security
disable
```

The Comm Access feature when enabled allows the user to establish Level Access security for MODBUS® communications regardless of physical connection.

```
Comm Access Timeout
   60 sec
```

Establishes the duration at which time communications will be closed with the control when no communication activity is sensed.

```
TX Delay
   10 ms
```

Provides the means to delay transmission of a response of a Serial Bus (RS-232, RS 485 or Fiber Optic).

```
Heartbeat Option
Disabled
```

Toggles between five modes of operation: LTC (DNP), Regulator (DNP), Profile Switching (DNP), Profile Switching (GOOSE) and Disabled.

Communication/Memory Card

```
Load Setpoints
Press ENT to begin
```

Provides the user with the ability to load setpoint files (Unit or Master) from a Smart Flash SD Card into the unit.

```
Save Setpoints
Press ENT to begin
```

Provides the user with the ability to save setpoint files (Unit or Master) to a Smart Flash SD Card from the unit.

```
Save Datalog
Press ENT to begin
```

Provides the user with the ability to save data log files to a Smart Flash SD Card from the unit.

```
Save seq. of events
Press ENT to begin
```

Provides the user with the ability to save Sequence of Events files to a Smart Flash SD Card from the unit.

```
Save oscillograph
Press ENT to begin
```

Provides the user with the ability to save Oscillograph files to a Smart Flash SD Card from the unit.

```
Clone save
Press ENT to begin
```

Provides the user with the ability to save the entire control settings to a Smart Flash SD Card with the exception of the serial number.

```
Clone load
Press ENT to begin
```

Provides the user with the ability to load a clone file on to a control to duplicate settings. Does not overwrite serial number of the target control.

```
Load DNP Config
Press ENT to begin
```

Provides the user with the ability to load DNP configuration files from a Smart Flash SD Card into the unit.

```
Save DNP Config
Press ENT to begin
```

Provides the user with the ability to save DNP configuration files to a Smart Flash SD Card from the unit.

Figure A-9 Communication Screens (page 2 of 5)

```
Save Metering Data
Press ENT to begin
```

Provides the user with the capability to save all metering data to a Smart Flash SD Card.

```
Firmware Update
Press ENT to begin
```

Provides the user with the ability to update the unit firmware.

```
Load IEC Config
Press ENT to begin
```

Provides the user with the capability to load IEC Configuration files (*.cid) when IEC 61850 protocol has been purchased.

```
Save IEC Config
Press ENT to begin
```

Provides the user with the capability to save IEC Configuration files (*.cid) when IEC 61850 protocol has been purchased.

```
SD Quick Capture
Press ENT to begin
```

The SD Card Quick Capture feature provides the means (in one step) to initiate a save of the following data files to the inserted SD Card (if they exist on the control).

- Control Clone
- Data Logging
- Oscillography
- Sequence of Events
- DNP Map
- Multi-user Access Code
- Multi-user Access Code Log

Communication/Ethernet

```
DHCP Enable
ENABLE
```

Allows DHCP Protocol to be enabled or disabled.

```
IP Address
0.0.0.0
```

Either displays the assigned IP Address when DHCP is enabled or allows the IP Address to be manually assigned.

```
Net Mask
0.0.0.0
```

Either displays the assigned Net Mask when DHCP is enabled or allows the Net Mask to be manually assigned.

```
Gateway
0.0.0.0
```

Either displays the assigned Gateway when DHCP is enabled or allows the Gateway to be manually assigned.

```
Enter MODBUS Port
   502
```

Allows the MODBUS® port ID to be set. Default value is "502".

```
Enter DNP Port
20000
```

Allows the DNP port ID to be set. Default value is "20000".

```
Auto Negotiation
ENABLE
```

When enabled allows the user to set the Ethernet Port to a fixed speed of 100 mbps.

Figure A-9 Communication Screens (page 3 of 5)

Communication/Ethernet (Cont.'d)

```
Keepalive time
   7200 sec
```

The Keepalive Time feature applies only to the Ethernet connection. If no communication activity is detected on a previously open Ethernet socket longer than the timeout setting the control will close the socket and make it available for connection. The setting range is from 1 to 50,000 seconds.

```
SNTP Enable
disable
```

Enables the SNTP (Simple Network Time protocol) to allow Network Time Synchronization.

```
SNTP Server Address
0.0.0.0
```

Allows the user to enter the IP Address of the network server.

```
Time Zone GMT
  -5 Hr
```

Allows the user to select the Time Zone that the control resides in.

Communication/HMI

```
Set LCD Contrast:      E
```

Allows contrast to be adjusted from +10 (lightest) to –10 (darkest). Factory setting is 0, which provides a neutral contrast.

```
User Line 1            E
Beckwith Electric
```

Allows input of 20 ASCII characters to configure a unit locator or description. If not configured, a row of 15 asterisks will appear in top row of User Line #1 screen.

```
User Line 2            E
M-2001D
```

Allows input of 20 ASCII characters to configure a unit locator or description. If not configured, a row of 15 asterisks will appear in bottom row of User Line #2 screen.

```
Level 1 Access Code
Press ENT to change
```

Configures a six-digit alpha/numerical Access Code for Level 1. Factory setting is 000000 (disabled).

```
Level 2 Access Code
Press ENT to change
```

Configures a six-digit alpha/numerical Access Code for Level 2. Factory setting is 222222.

```
Clear Osc Records
Ready Press ENTER
```

Allows the user to clear Oscillograph records from the HMI.

```
Oscillograph Message
ENABLE
```

Feature enables or disables the OSC Triggered Message to be scrolled on the unit display when an OSC record is available.

Figure A-9 Communication Screens (page 4 of 5)

Communication/Bluetooth

Bluetooth Enable
ENABLE

Enables or disables the Bluetooth® feature when installed on the control.

Bluetooth Reset
Ready Press ENTER

Allows the user to reset the Bluetooth Module to "Beckwith" factory default settings.

Bluetooth Protocol
MODBUS

Provides the ability to select either MODBUS® or DNP3.0 protocol.

Authentication
disable

Enables or disables Authentication and provides the means to enter a Pass Key when set (1 to 16 characters).

Friendly Name
M2001D

Allows the user to name the unit (maximum of 32 characters).

Bluetooth Pass Reset
Ready Press ENTER

The Bluetooth Passkey can be reset to default conditions (no Passkey and Authentication Disabled) if necessary.

Control BT Device
XX:XX:XX:XX:XX:XX

Displays the Bluetooth MAC address of the control.

Bluetooth Mode
MODE0

The Bluetooth mode can be set to Mode0 in which the control is discoverable and connectable to any client station, or Mode1 in which the control is non-discoverable but is connectable to any client station that knows the control Bluetooth device address.

Communication/RS232

Protocol
MODBUS

Allows selection between standard protocols, DNP3.0 or MODBUS.

Baud Rate
115200

Selects Baud Rate for the RS232 port.

Parity
NONE

None, odd or even parity is available.

Stop Bits
TWO STOPBITS

One or Two Stop Bits are available.

Sync Time
50 mS

This time delay improves robust operation when communication lines are intermittent. Communication dead-sync time is the time that the control will wait from the last received character and continue without attempting to resynchronize. Factory setting is 50 msec; range is 0-32000 msec.

Figure A-9 Communication Screens (page 5 of 5)

Utilities/Calibration-Test

```
Bias Voltage
Status/Test Mode
```

When **ENT** is pressed, the control status can be checked, and a bias test voltage can be entered to test the control's automatic operation (see Chapter 8, Section 8.5, Bias Voltage Status/Test Mode, Figure 8-3).

```
Load Voltage
XXX.X Volts
```

Displays the real-time measured value of voltage at the regulator or the transformer, including the voltage reduction if applicable and any corrections made using the user-selected VT correction voltage.

```
Voltage Offset
      X
```

Voltage calibration count offset from ADC reference value. Requires Level 3 Access to change.

```
Volt Cal Coefficient
32767 X
```

Voltage calibration factor. Requires Level 3 Access to change.

```
Volt RMS Coefficient
32762 X
```

Voltage RMS calibration factor. Requires Level 3 Access to change.

```
Control Load I
x.x   mA  Lag
```

Displays the real-time measured value of load current related to the scaling factor Current Transformer of 200 mA, 1 A or 5A.

```
Curr Cal Coefficient
32767 X
```

Current calibration factor. Requires Level 3 Access to change.

```
Power Factor
  X.XXX   Lag
```

Provides the user with the real-time Power Factor value.

```
I Sin Coefficient
    0 X
```

Current Sine Coefficient calibration factor. Requires Level 3 Access to change.

```
I Cos Coefficient
   8192 X
```

Displays the PF Factor Cosine correction factor as determined by Autocal. Can also be manually set. However, Beckwith Electric does not recommend manual setting of this parameter.

```
Motor Current
x.xx  mA
```

Displays the real-time measured value of motor current.

```
Mtr Cal. Coefficient
   8192 X
```

Motor Calibration Coefficient calibration factor. Requires Level 3 Access to change.

```
Mtr Sin Coefficient
   0 X
```

Motor Sine Coefficient calibration factor. Requires Level 3 Access to change.

```
Mtr Cos Coefficient
   8192 X
```

Motor Cosine Coefficient calibration factor. Requires Level 3 Access to change.

Figure A-10 Utilities Screens (page 1 of 3)

Utilities/Calibration-Test (Cont.'d)

```
Mtr RMS Coefficient
   8192  X
```

Motor RMS calibration factor. Requires Level 3 Access to change.

```
Cir Cal. Coefficien
32767  X
```

Circulating Current calibration factor. Requires Level 3 Access to change.

```
Circ Sin Coefficient
    0  X
```

Circulating Current Sine Coefficient calibration factor. Requires Level 3 Access to change.

```
Circ Cos Coefficient
   8192  X
```

Circulating Current Cosine Coeffiecient calibration factor. Requires Level 3 Access to change.

```
LED Scroll Test
Press ENT to begin
```

Momentarily illuminates each LED on the control panel. Push EXIT to stop.

```
Input Test
Press ENT to Begin
```

Provides the means to test all external inputs to the control.

```
Output Test
Press ENT to test
```

Provides the means to test all outputs from the control.

```
Button Input Test
Press ENT to Begin
```

Provides the means to verify proper operation of each front panel pushbutton from the HMI.

```
Change Src Input
press ENTER.
```

Pressing Enter will cause the source side PT voltage to be measured instead of being calculated. The second line on the LCD screen will display

Measured XXXXX V

Pressing Enter will toggle to the calculated source side voltage and the second line on the LCD screen will display

Calculated XXXX V

```
Watchdog resets: X
Total resets: X
```

This shows the total number of watchdog resets and total resets which include Power down and watchdog resets.

```
Clear reset counters
Press ENT to begin
```

This clears Watchdog Resets and Total Resets counters.

Figure A-10 Utilities Screens (page 2 of 3)

Utilities/Calibration-Test (Cont.'d)

```
X1 Duration
0 ms,     Avg:0 ms
```

When the Operation Counter is configured as X1, the X1 duration is the instantaneous measure of the X1 pulse generated by the counter contact switch. It also displays the average X1 pulse duration over the last 8 tap operations. The user can use this measurement to set the X mode Delay.

When the Operation Counter is configured as X2, the X1 Duration will always display ZERO since this is not applicable to X2 mode of Operation.

```
Alarm Activity
Press ENT to Begin
```

The Alarm Activity feature provides the means to display all active screen messages that are active on the control.

Utilities/About

```
Serial Number
XXXXX
```

Displays the unit serial number.

```
Firmware Version
D-0214V01.00.04
```

Displays the firmware version that is loaded onto the control.

```
EE Checksum
XXXXXX
```

Displays EE Prom Checksum value.

```
Last Loaded File CRC
XXX
```

Displays the CRC of the Last Loaded Settings file.

```
Hardware Number
1
```

The Hardware Number is used for identifying the control hardware type.

1 = Pre 180 V Version of M-2001D hardware.

3 = 180 V Version of M-2001D hardware.

Figure A-10 Utilities Screens (page 3 of 3)

B Appendix
Setpoint, Configuration and Communication Record Forms

Setpoints

PROFILE 1

General

Line Drop Compensation	❏ R, X [R, X]		❏ Z
Time Delay Selection	❏ Definite Time [Definite Time]		❏ Inverse Time
Basic Timer Type	❏ Integrating [Integrating]		❏ Instant Reset
Power Direction Bias	❏ None [None]	❏ Forward	❏ Reverse

Voltage Reduction

Step 1	0.0 to 10.0 (%) of Bandcenter Setpoint [2.5]	(_____)
Step 2	0.0 to 10.0 (%) of Bandcenter Setpoint [5.0]	(_____)
Step 3	0.0 to 10.0 (%) of Bandcenter Setpoint [7.5]	(_____)

Limit and Runback/Runup

Block Raise	95.0 to 135.0 (V) [128.0]	(_____)
Block Lower	95.0 to 135.0 (V) [114.0]	(_____)
Runback Deadband	1.0 to 4.0 (V) [2.0]	(_____)
Runup Deadband	1.0 to 4.0 (V) [2.0]	(_____)
Runup	❏ Disable [Disable]	❏ Enable
Current Limit	50 to 640 (mA) [640]	(_____)

Forward Power

Band Center	100.0 to 135.0 (V) [120.0]	(_____)
Band Width	1.0 to 10.0 (V) [2.0]	(_____)
Definite Time	1 to 360 (sec) [30]	(_____)
LDC-Z	0 to 72 (V) [0]	(_____)
LDC Resistance	–72 to +72 (V) [0]	(_____)
LDC Reactance	–72 to +72 (V) [0]	(_____)

■ **NOTE**: [ ] Default Setting

Figure B-1 Setpoints Record Form (1 of 6)

Setpoints (Cont'd)

Profile 1 (Cont'd)

Reverse Power

Operation	❑ Block [Block]	❑ Regulate Forward (Ignore)
	❑ Regulate Reverse	❑ Return to Neutral
	❑ Regulate Reverse (Measured)	❑ Distributed Generation
	❑ Auto Determination (Measured)	❑ Auto Determination

Band Center	100.0 to 135.0 (V [120.0]	(_____)
Band Width	1.0 to 10.0 (V) [2.0]	(_____)
Definite Time	1 to 360 (sec) [30]	(_____)
LDC-Z	0 to 72 (V) [0]	(_____)
LDC Resistance	–72 to +72 (V) [0]	(_____)
LDC Reactance	–72 to +72 (V) [0]	(_____)

PROFILE 2

General

Line Drop Compensation	❑ R, X [R, X]		❑ Z
Time Delay Selection	❑ Definite Time [Definite Time]		❑ Inverse Time
Basic Timer Type	❑ Integrating [Integrating]		❑ Instant Reset
Power Direction Bias	❑ None [None]	❑ Forward	❑ Reverse

Voltage Reduction

Step 1	0.0 to 10.0 (%) of Bandcenter Setpoint [2.5]	(_____)
Step 2	0.0 to 10.0 (%) of Bandcenter Setpoint [5.0]	(_____)
Step 3	0.0 to 10.0 (%) of Bandcenter Setpoint [7.5]	(_____)

■**NOTE**: [ ] Default Setting

Figure B-1 Setpoints Record Form (2 of 6)

Setpoints (Cont'd)

Profile 2 (Cont'd)

Limit and Runback/Runup

Block Raise	95.0 to 135.0 (V) [128.0]	(_____)
Block Lower	95.0 to 135.0 (V) [114.0]	(_____)
Runback Deadband	1.0 to 4.0 (V) [2.0]	(_____)
Runup Deadband	1.0 to 4.0 (V) [2.0]	(_____)
Runup	❏ Disable [Disable]	❏ Enable
Current Limit	200 to 640 (mA) [640]	(_____)

Forward Power

Band Center	100.0 to 135.0 (V) [120.0]	(_____)
Band Width	1.0 to 10.0 (V) [2.0]	(_____)
Definite Time	1 to 360 (sec) [30]	(_____)
LDC-Z	0 to 72 (V) [0]	(_____)
LDC Resistance	–72 to +72 (V) [0]	(_____)
LDC Reactance	–72 to +72 (V) [0]	(_____)

Reverse Power

Operation	❏ Block [Block]	❏ Regulate Forward (Ignore)
	❏ Regulate Reverse	❏ Return to Neutral
	❏ Regulate Reverse (Measured)	❏ Distributed Generation
	❏ Auto Determination (Measured)	❏ Auto Determination

Band Center	100.0 to 135.0 (V [120.0]	(_____)
Band Width	1.0 to 10.0 (V) [2.0]	(_____)
Definite Time	1 to 360 (sec) [30]	(_____)
LDC-Z	0 to 72 (V) [0]	(_____)
LDC Resistance	–72 to +72 (V) [0]	(_____)
LDC Reactance	–72 to +72 (V) [0]	(_____)

■ **NOTE**: [ ] Default Setting

Figure B-1 Setpoints Record Form (3 of 6)

Setpoints (Cont'd)

PROFILE 3

General

Line Drop Compensation	❑ R, X [R, X]		❑ Z
Time Delay Selection	❑ Definite Time [Definite Time]		❑ Inverse Time
Basic Timer Type	❑ Integrating [Integrating]		❑ Instant Reset
Power Direction Bias	❑ None [None]	❑ Forward	❑ Reverse

Voltage Reduction

Step 1	0.0 to 10.0 (%) of Bandcenter Setpoint [2.5]	(_____)
Step 2	0.0 to 10.0 (%) of Bandcenter Setpoint [5.0]	(_____)
Step 3	0.0 to 10.0 (%) of Bandcenter Setpoint [7.5]	(_____)

Limit and Runback/Runup

Block Raise	95.0 to 135.0 (V) [128.0]	(_____)
Block Lower	95.0 to 135.0 (V) [114.0]	(_____)
Runback Deadband	1.0 to 4.0 (V) [2.0]	(_____)
Runup Deadband	1.0 to 4.0 (V) [2.0]	(_____)
Runup	❑ Disable [Disable]	❑ Enable
Current Limit	200 to 640 (mA) [640]	(_____)

Forward Power

Band Center	100.0 to 135.0 (V) [120.0]	(_____)
Band Width	1.0 to 10.0 (V) [2.0]	(_____)
Definite Time	1 to 360 (sec) [30]	(_____)
LDC-Z	0 to 72 (V) [0]	(_____)
LDC Resistance	–72 to +72 (V) [0]	(_____)
LDC Reactance	–72 to +72 (V) [0]	(_____)

■**NOTE**: [ ] Default Setting

Figure B-1 Setpoints Record Form (4 of 6)

Setpoints (Cont'd)

Profile 3 (Cont'd)

Reverse Power

Operation	❑ Block [Block]	❑ Regulate Forward (Ignore)
	❑ Regulate Reverse	❑ Return to Neutral
	❑ Regulate Reverse (Measured)	❑ Distributed Generation
	❑ Auto Determination (Measured)	❑ Auto Determination

Band Center	100.0 to 135.0 (V [120.0]	(_____)
Band Width	1.0 to 10.0 (V) [2.0]	(_____)
Definite Time	1 to 360 (sec) [30]	(_____)
LDC-Z	0 to 72 (V) [0]	(_____)
LDC Resistance	–72 to +72 (V) [0]	(_____)
LDC Reactance	–72 to +72 (V) [0]	(_____)

PROFILE 4

General

Line Drop Compensation	❑ R, X [R, X]		❑ Z
Time Delay Selection	❑ Definite Time [Definite Time]		❑ Inverse Time
Basic Timer Type	❑ Integrating [Integrating]		❑ Instant Reset
Power Direction Bias	❑ None [None]	❑ Forward	❑ Reverse

Voltage Reduction

Step 1	0.0 to 10.0 (%) of Bandcenter Setpoint [2.5]	(_____)
Step 2	0.0 to 10.0 (%) of Bandcenter Setpoint [5.0]	(_____)
Step 3	0.0 to 10.0 (%) of Bandcenter Setpoint [7.5]	(_____)

■ **NOTE**: [ ] Default Setting

Figure B-1 Setpoints Record Form (5 of 6)

Setpoints (Cont'd)

Profile 4 (Cont'd)

Limit and Runback/Runup

Block Raise	95.0 to 135.0 (V) [128.0]	(_____)
Block Lower	95.0 to 135.0 (V) [114.0]	(_____)
Runback Deadband	1.0 to 4.0 (V) [2.0]	(_____)
Runup Deadband	1.0 to 4.0 (V) [2.0]	(_____)
Runup	❑ Disable [Disable]	❑ Enable
Current Limit	200 to 640 (mA) [640]	(_____)

Forward Power

Band Center	100.0 to 135.0 (V) [120.0]	(_____)
Band Width	1.0 to 10.0 (V) [2.0]	(_____)
Definite Time	1 to 360 (sec) [30]	(_____)
LDC-Z	0 to 72 (V) [0]	(_____)
LDC Resistance	–72 to +72 (V) [0]	(_____)
LDC Reactance	–72 to +72 (V) [0]	(_____)

Reverse Power

Operation	❑ Block [Block]	❑ Regulate Forward (Ignore)
	❑ Regulate Reverse	❑ Return to Neutral
	❑ Regulate Reverse (Measured)	❑ Distributed Generation
	❑ Auto Determination (Measured)	❑ Auto Determination

Band Center	100.0 to 135.0 (V [120.0]	(_____)
Band Width	1.0 to 10.0 (V) [2.0]	(_____)
Definite Time	1 to 360 (sec) [30]	(_____)
LDC-Z	0 to 72 (V) [0]	(_____)
LDC Resistance	–72 to +72 (V) [0]	(_____)
LDC Reactance	–72 to +72 (V) [0]	(_____)

■**NOTE**: [ ] Default Setting

Figure B-1 Setpoints Record Form (6 of 6)

Configuration

Primary

Voltage Multiplier	0.1 to 3260.0 (X) [60.0]	(_____)
Voltage Source Multiplier	0.1 to 3260.0 (X) [60.0]	(_____)
Current Multiplier	1 to 32600 (X) [6000]	(_____)
Primary Power Display	❏ Single Phase [Single Phase]	❏ Three Phase

VT/CT Load

Normalizing Voltage Multiplier	0.80 to 1.20 (X) [1.00]	(_____)
VT Correction	–15.0 to +15.0 (V) [0.0]	(_____)
CT/VT Phasing	❏ 0 degree [0 degree]	❏ 30 degrees
	❏ 60 degrees	❏ 90 degrees
	❏ 120 degrees	❏ 150 degrees
	❏ 180 degrees	❏ 210 degrees
	❏ 240 degrees	❏ 270 degrees
	❏ 300 degrees	❏ 330 degrees
Aux Current Transformer	❏ 200 mA [200 mA] ❏ 1 Amp	❏ 5 Amp
VT Configuration	❏ Line to Line ❏ Line to Ground [Line to Ground]	

VT/CT Source

VT Source Correction	–15.0 to +15.0 (V) [0.0]	(_____)
CT/VT Source Phasing	❏ 0 degree [0 degree]	❏ 30 degrees
	❏ 60 degrees	❏ 90 degrees
	❏ 120 degrees	❏ 150 degrees
	❏ 180 degrees	❏ 210 degrees
	❏ 240 degrees	❏ 270 degrees
	❏ 300 degrees	❏ 330 degrees

Raise/Lower Output Contacts

	❏ Continuous [Continuous]	❏ Pulsed
Pulse Width	0.2 to 12.0 (sec) [1.5]	(_____)

■ **NOTE**: [ ] Default Setting

Figure B-2 Configuration Record Form (1 of 4)

Configuration (Cont'd)

Motor Current Settings

Peak Rms Current	110 to 200 (%) [110]	(_____)
Average Rms Current	110 to 200 (%) [110]	(_____)
Average Duration	110 to 200 (%) [110]	(_____)

Program Alarm Relay Mode

❏ Normal [Normal] ❏ Deadman Out

Low Current Block

❏ Disable [Disable] ❏ Enable

Inputs and Switch

■**NOTE**: Input Selection 1 must be set to "Switch Status" if Tap Position Knowledge is to be selected to either "Contact KeepTrack™ 1R1L" or "Contact KeepTrack 1N".

Input Selection 1	❏ Switch Status [Switch Status]		❏ Seal-In Input
Input Selection 2	❏ Non-sequential [Non-sequential]		❏ SCADA Cutout
Input Selection 3	❏ VR2 [VR2]		❏ Aux
Auto/Man Switch Type	❏ None [None]	❏ Toggle	❏ SCAMP

Regulator

❏ Type A [Type A] ❏ Type B

Voltage Reduction (VR)

Standard Voltage Reduction	❏ Disable	❏ Enable [Enable]	
Smart Voltage Reduction	❏ Disable [Disable]	❏ Enable	
Smart VR LDC	❏ Disable [Disable]	❏ Enable	
Smart VR LDC Resistance	–72 to +72 (V) [0]		(_____)
Smart VR LDC Reactance	–72 to +72 (V) [0]		(_____)
Smart VR LDC-Z	0 to 72 (V) [0]		(_____)
Com VR Turnoff Timer	0 to 999 (Min) [0]		(_____)
Save VR at Power Off	❏ Don't Save [Don't Save]	❏ Save	

■**NOTE**: [ ] Default Setting

Figure B-2 Configuration Record Form (2 of 4)

Configuration (Cont'd)

Var Bias

❏ Disable [Disable] ❏ Enable

Max Capacitor Bank Size	4 to 12000 (Kvar) [12000]	(_____)
Lead % Bank Size Pickup	10 to 100% [75]	(_____)
Lag % Bank Size Pickup	10 to 100% [75]	(_____)
VAr Bias Voltage Step	0.1 to 2.0 (V) [1.0]	(_____)
Max VAr Bias Duration	10 to 1440 (min) [300]	(_____)

Remote Voltage Bias (RVB)

❏ Disable [Disable] ❏ Enable

RVB Scale Factor	0.1 to 100.0 [1.0]	(_____)
RVB Heartbeat Timer	2 to 120 (sec) [5]	(_____)
Reverse RVB Scale Factor	0.1 to 100.0 [1.0]	(_____)

Run Through Neutral (RTN)

❏ Disable [Disable] ❏ Enable

Maximum Allowed Taps	3 to 7 [4]	(_____)
Tap Operations Between Runs	100 to 10000 [1000]	(_____)
Maximum Load Current	1 to 100 (mA) [50]	(_____)
Max RTN Standby Operations	1 to 10000 [20]	(_____)

Fast Voltage Recovery

❏ Disable [Disable] ❏ Enable

Fast Voltage Recovery	1.0 to 15.0 (V) [5.0]	(_____)

Save Comm Block at Power Off

❏ Save ❏ Don't Save [Don't Save]

SCAMP Initialize on Power Up

❏ Last Save ❏ Auto Mode [Auto Mode]

■ **NOTE**: [ ] Default Setting

Figure B-2 Configuration Record Form (3 of 4)

Configuration (Cont'd)

Paralleling

Paralleling Type	❑ Disable [Disable]	❑ Circ. Current
	❑ DVAr 1	❑ DVAr 2
	❑ DVAr 2 (Keep Track)	❑ Master/Follower

DVAr2/DVAr2 (KeepTrack) Settings

Sensitivity	–4.0 to 4.0 [0.0]	(_____)
Cir. Current Limit (Reactive)	5 to 200 (mA) [200]	(_____)
Input Ratio (Load/parallel)	0.50 to 2.0 [1.00]	(_____)

Master/Follower Settings

Master/Follower Configuration	❑ None [None]	❑ Follower	❑ Master
Paralleling Address	1 to 16 [1]	(_____)	
Number of Devices	2 to 16 [2]	(_____)	
Tap Difference	2 to 8 [2]	(_____)	
Tap Pos. Response Timeout	1000 to 60000ms [1000]	(_____)	
Line Breaker	❑ Not in Use [Not in Use]	❑ In Use	
	❑ Positive Polarity [Positive Polarity]	❑ Negative Polarity	
Right Tie Breaker	❑ Not in Use [Not in Use]	❑ In Use	
	❑ Positive Polarity [Positive Polarity]	❑ Negative Polarity	
Left Tie Breaker	❑ Not in Use [Not in Use]	❑ In Use	
	❑ Positive Polarity [Positive Polarity]	❑ Negative Polarity	

■ **NOTE**: [ ] Default Setting

Figure B-2 Configuration Record Form (4 of 4)

Tap Settings

General

Tap Information ❑ Disabled ❑ Regulate Internal (KeepTrack™) [Regulate Internal]

❑ Reg external #1 ❑ Reg external #2

❑ XFMR external #1 ❑ XFMR external #2

❑ XFMR external #3 ❑ Reg external #3

❑ Contact Keep Track 1R1L ❑ Contact Keep Track 1N

Intertap Delay	0 to 60 (sec) [0]	(_____)

Tap Limits

❑ Disable [Disable] ❑ Enable

Block Raise	12 Lower to 16 Raise [16]	(_____)
Block Lower	16 Lower to 12 Raise [–16]	(_____)
Highest Tap	0 Neutral to 33 Raise [16]	(_____)
Lowest Tap	33 Lower to 29 Raise [–16]	(_____)

Operation Counter

Configuration ❑ X1 [X1] ❑ X2 ❑ Count Window ❑ Cam Follower

X Mode Delay	0 to 3000 (mS) [10]	(_____)
Count Window	0.5 to 60.5 (sec) [0.5]	(_____)
Preset	0 to 999999 [0]	(_____)
Alarm Limit	0 to 999999 [0]	(_____)
Neutral Counter	0 to 999999 [0]	(_____)

■ **NOTE**: [ ] Default Setting

Figure B-3 Tap Settings Record Form (1 of 2)

Tap Settings (Cont'd)

Block Automatic Operation on Motor Seal-in Failure

Motor Seal-in Failure Block ❑ Disable ❑ Enable [Enable]

Tap Statistics

Maximum Tap Wear	1 to 65534 [65534]	(_____)
Individual Tap Wear Alarm	1 to 200% [100%]	(_____)

Tap Calibration

■**NOTE**: Set to match actual tap position as read on the physical tap position indicator.

Tap Position	–16 to +16 (Neutral) [0]	(_____)

Tap Calibrate ❑ Yes ❑ No [No]

■**NOTE**: [ ] Default Setting

Figure B-3 Tap Settings Record Form (2 of 2)

Alarms

Programmable Alarm Relay

- ❑ Comm Block
- ❑ Block Raise (Tap)
- ❑ Block Lower (Tap)
- ❑ Block Raise (Volt)
- ❑ Voltage Reduction
- ❑ Op Count Signal
- ❑ Max VAr Bias Duration - LEAD
- ❑ Max VAr Bias Duration - LAG
- ❑ Individual Tap Wear
- ❑ LDC/LDZ
- ❑ Line Current Limit
- ❑ Tap Changer Failure
- ❑ Reverse Power
- ❑ Block Lower (Volt)
- ❑ Abnormal Tap Position
- ❑ Backup Power Fail
- ❑ RTN Fail to Operate

Wakeup Screens

- ❑ Load Voltage
- ❑ Source Voltage
- ❑ Load Current
- ❑ Circulating/DVAr Current
- ❑ Compensated Voltage
- ❑ Primary Voltage
- ❑ Primary Current
- ❑ Primary Watts
- ❑ Primary VArs
- ❑ Primary VA
- ❑ Power Factor
- ❑ Frequency
- ❑ Voltage % THD
- ❑ Current % THD
- ❑ Tap Position
- ❑ Tap Drag Hands
- ❑ Operation Counter
- ❑ Resettable Op Counter
- ❑ Demand Load Voltage
- ❑ Demand Primary Current
- ❑ Demand Primary Watts
- ❑ Demand Primary VArs
- ❑ Demand Primary VA
- ❑ Energy Metering Watt Hrs Fwd
- ❑ Energy Metering Watt Hrs Rev
- ❑ Energy Metering VAr Hrs Lag
- ❑ Energy Metering VAr Hrs Lead
- ❑ Minimum Load Voltage
- ❑ Maximum Load Voltage
- ❑ Minimum Primary Current
- ❑ Maximum Primary Current
- ❑ Minimum Primary Watts
- ❑ Maximum Primary Watts
- ❑ Minimum Primary VArs
- ❑ Maximum Primary VArs
- ❑ Minimum Primary VA
- ❑ Maximum Primary VA
- ❑ Power Factor @Minimum VA
- ❑ Power Factor @Maximum VA
- ❑ Lag Power Factor
- ❑ Lead Power Factor
- ❑ Peak Motor Current
- ❑ Normalizing Voltage
- ❑ Meter Out Voltage
- ❑ Min Source Voltage
- ❑ Max Source Voltage
- ❑ Time and Date

■ **NOTE**: [ ] Default Setting

Figure B-4 Alarms and Wakeup Screens Record Form

Data Logging

Logging Timer

Data Log Interval 0 to 120 (minute) [5] (_____)

Duration [451 Day 09:20:00] (_____)

Harmonics Setup

Voltage Harmonics Selection (☑ Default Selection)

☑ 2nd	☑ 3rd	☑ 4th	☑ 5th	☑ 6th	☑ 7th	☑ 8th	☑ 9th
☑ 10th	☑ 11th	❑ 12th	☑ 13th	☑ 14th	☑ 15th	❑ 16th	☑ 17th
❑ 18th	❑ 19th	❑ 20th	❑ 21st	❑ 22nd	❑ 23rd	❑ 24th	❑ 25th
❑ 26th	❑ 27th	❑ 28th	❑ 29th	❑ 30th	❑ 31st		

Voltage Alarm Threshold V Percent 0.0 to 30.0 % [0.0] (_____)

Current Harmonics Selection (☑ Default Selection)

☑ 2nd	☑ 3rd	☑ 4th	☑ 5th	☑ 6th	☑ 7th	☑ 8th	☑ 9th
❑ 10th	☑ 11th	❑ 12th	☑ 13th	☑ 14th	☑ 15th	❑ 16th	☑ 17th
❑ 18th	❑ 19th	❑ 20th	❑ 21st	❑ 22nd	❑ 23rd	❑ 24th	❑ 25th
❑ 26th	❑ 27th	❑ 28th	❑ 29th	❑ 30th	❑ 31st		

Current Alarm Threshold I Percent 0 to 100 % [0] (_____)

Minimum Fundamental Current Threshold ❑ Disable [Disable] ❑ Enable

Min Fund I Threshold 0 to 200.0 mA [200.0] (_____)

Harmonic Alarm Delay 1 to 10 Sec. [1] (_____)

■**NOTE**: [ ] Default Setting

Figure B-5 Data Logging and Harmonics Setup Record Form

Oscillograph Setup

Number of Partitions	1 to 16 [5]	(_____)
Samples/Cycle	16, 32, 64 [32]	(_____)
Post Trigger Delay	5 to 95 % [50]	(_____)
Front Panel Message	❑ Enable [Enable]	❑ Disable

Pickup (☑ Default Selection)

❑ Raise Contact	❑ Lower Contact	❑ VR Contact 1	❑ VR Contact 2
❑ Force Lower (Runback)	❑ Raise Tap Limit	❑ Lower Tap Limit	❑ Low Band
❑ High Band	☑ Low Voltage Limit	☑ High Voltage Limit	❑ Auto Inhibit
❑ Non Sequential	❑ Reverse Power	❑ Peak Motor Current	❑ Avg. Motor Curent
❑ Motor Current Duration	❑ Voltage Harmonics	❑ Current Harmonics	☑ CBEMA 1
☑ CBEMA 2	☑ CBEMA 3	☑ CBEMA 4	❑ VAr Bias Active
❑ Sealin Fail Alarm Active	❑ Sealin Fail Low Blk Act.	❑ Sealin Fail Raise Blk Act.	❑ Low Current Blk Act.
❑ Motor Seal-in Input	❑ Neutral Input	❑ Counter Input	❑ Op Count Signal

❑ Individual Tap Wear Alarm

Dropout

❑ Raise Contact	❑ Lower Contact	❑ VR Contact 1	❑ VR Contact 2
❑ Force Lower (Runback)	❑ Raise Tap Limit	❑ Lower Tap Limit	❑ Low Band
❑ High Band	❑ Low Voltage Limit	❑ High Voltage Limit	❑ Auto Inhibit
❑ Non Sequential	❑ Reverse Power	❑ Voltage Harmonics	❑ Current Harmonics
❑ CBEMA 1	❑ CBEMA 2	❑ CBEMA 3	❑ CBEMA 4
❑ VAr Bias Active	❑ Sealin Fail Alarm Act.	❑ Sealin Fail Low Blk Act.	❑ Sealin Fail Raise Blk Act.
❑ Low Current Blk Act.	❑ Motor Seal-in Input	❑ Neutral Input	❑ Counter Input
❑ Op Count Signal			

❑ Individual Tap Wear Alarm

■ **NOTE**: [ ] Default Setting

Figure B-6 Oscillograph Setup Record Form

Sequence Of Events Setup

OR Gate Setup

Pickup (Edge Sensitive) **(☑ Default Selection)**

❑ Raise Contact	❑ Lower Contact	❑ VR Contact 1	❑ VR Contact 2
☑ Force Lower (Runback)	☑ Raise Tap Limit	☑ Lower Tap Limit	❑ Low Band
❑ High Band	☑ Low Voltage Limit	☑ High Voltage Limit	☑ Auto Inhibit
☑ Non Sequential	☑ Reverse Power	❑ Peak Motor Current	❑ Avg. Motor Curent
❑ Motor Current Duration	❑ Voltage Harmonics	❑ Current Harmonics	☑ CBEMA Event 1
☑ CBEMA Event 2	☑ CBEMA Event 3	☑ CBEMA Event 4	☑ VAr Bias Active
❑ Sealin Fail Alarm Active	❑ Sealin Fail Low Blk Act.	❑ Sealin Fail Raise Blk Act.	❑ Low Current Blk Act.
❑ Motor Seal-in Input	❑ Neutral Input	❑ Counter Input	❑ Op Count Signal

❑ HMI Active ❑ Individual Tap Wear Alarm

Dropout (Edge Sensitive) **(☑ Default Selection)**

❑ Raise Contact	❑ Lower Contact	❑ VR Contact 1	❑ VR Contact 2
☑ Force Lower (Runback)	☑ Raise Tap Limit	☑ Lower Tap Limit	❑ Low Band
❑ High Band	☑ Low Voltage Limit	☑ High Voltage Limit	☑ Auto Inhibit
❑ Non Sequential	❑ Reverse Power	❑ Voltage Harmonics	❑ Current Harmonics
❑ CBEMA Event 1	❑ CBEMA Event 2	❑ CBEMA Event 3	❑ CBEMA Event 4
☑ VAr Bias Active	❑ Sealin Fail Alarm Act.	❑ Sealin Fail Low Blk Act.	❑ Sealin Fail Raise Blk Act.
❑ Low Current Blk Act.	❑ Motor Seal-in Input	❑ Neutral Input	❑ Counter Input
❑ Op Count Signal			

❑ HMI Active ❑ Individual Tap Wear Alarm

■**NOTE**: [ ] Default Setting

Figure B-7 Sequence of Events Setup Record Form (1 of 2)

Sequence Of Events Setup

AND Gate Setup

Pickup (Level Sensitive)

❏ Raise Contact	❏ Lower Contact	❏ VR Contact 1	❏ VR Contact 2
❏ Force Lower (Runback)	❏ Raise Tap Limit	❏ Lower Tap Limit	❏ Low Band
❏ High Band	❏ Low Voltage Limit	❏ High Voltage Limit	❏ Auto Inhibit
❏ Non Sequential	❏ Reverse Power	❏ Peak Motor Current	❏ Avg. Motor Curent
❏ Motor Current Duration	❏ Voltage Harmonics	❏ Current Harmonics	❏ CBEMA Event 1
❏ CBEMA Event 2	❏ CBEMA Event 3	❏ CBEMA Event 4	❏ VAr Bias Active
❏ Sealin Fail Alarm Active	❏ Sealin Fail Low Blk Act.	❏ Sealin Fail Raise Blk Act.	❏ Low Current Blk Act.
❏ Motor Seal-in Input	❏ Neutral Input	❏ Counter Input	❏ Op Count Signal

❏ HMI Active ❏ Individual Tap Wear Alarm

Dropout (Level Sensitive)

❏ Raise Contact	❏ Lower Contact	❏ VR Contact 1	❏ VR Contact 2
❏ Force Lower (Runback)	❏ Raise Tap Limit	❏ Lower Tap Limit	❏ Low Band
❏ High Band	❏ Low Voltage Limit	❏ High Voltage Limit	❏ Auto Inhibit
❏ Non Sequential	❏ Reverse Power	❏ Voltage Harmonics	❏ Current Harmonics
❏ CBEMA Event 1	❏ CBEMA Event 2	❏ CBEMA Event 3	❏ CBEMA Event 4
❏ VAr Bias Active	❏ Sealin Fail Alarm Act.	❏ Sealin Fail Low Blk Act.	❏ Sealin Fail Raise Blk Act.
❏ Low Current Blk Act.	❏ Motor Seal-in Input	❏ Neutral Input	❏ Counter Input
❏ Op Count Signal			

❏ HMI Active ❏ Individual Tap Wear Alarm

SOE Final Gate ❏ OR [OR] ❏ And

■**NOTE**: [ ] Default Setting

Figure B-7 Sequence of Events Setup Record Form (2 of 2)

CBEMA Settings

Normal Voltage	100.0 to 130.0 V [120.0]	(_____)
CBEMA Event 1	❏ Disable	❏ Enable [Enable]
Sag/Swell/Swell Pickup	50 to 130% [70]	(_____)
Sag/Swell Dropout	71 to 130% [95]	(_____)
Sag/Swell Minimum Duration	1 to 60 Cycles [1]	(_____)
CBEMA Event 2	❏ Disable	❏ Enable [Enable]
Sag/Swell Pickup	50 to 130% [80]	(_____)
Sag/Swell Dropout	81 to 130% [95]	(_____)
Sag/Swell Minimum Duration	1 to 120 Cycles [1]	(_____)
CBEMA Event 3	❏ Disable	❏ Enable [Enable]
Sag/Swell Pickup	50 to 130% [90]	(_____)
Sag/Swell Dropout	91 to 130% [95]	(_____)
Sag/Swell Minimum Duration	60 to 60000 Cycles [60]	(_____)
CBEMA Event 4	❏ Disable	❏ Enable [Enable]
Sag/Swell Pickup	50 to 130% [115]	(_____)
Sag/Swell Dropout	50 to 114% [105]	(_____)
Sag/Swell Minimum Duration	1 to 60 Cycles [1]	(_____)

■**NOTE**: [ ] Default Setting

Figure B-8 CBEMA Setup Record Form

Comm Settings

RS485/Fiber

Comm Port Type	❏ RS485 [RS485]		❏ Fiber
Protocol	❏ DNP3 [DNP3]		❏ MODBUS®
Baud Rate	❏ 300		❏ 600
	❏ 1200		❏ 2400
	❏ 4800		❏ 9600 [9600]
	❏ 19200		❏ 38400
	❏ 57600		❏ 115200
Parity	❏ NONE [NONE]	❏ EVEN	❏ ODD
Stop Bit	❏ 1 [1]	❏ 2	
Sync Time	1 to 5000 [2] max 5000 ms	(_____)	
Tx Delay	1 to 50 [10] max 50 ms	(_____)	

Serial RS232

Protocol	❏ MODBUS [MODBUS]		❏ DNP3
Baud Rate	❏ 300		❏ 600
	❏ 1200		❏ 2400
	❏ 4800		❏ 9600
	❏ 19200		❏ 38400
	❏ 57600		❏ 115200 [115200]
Parity	❏ NONE [NONE]	❏ EVEN	❏ ODD
Stop Bit	❏ 1	❏ 2 [2]	
Sync Time	1 to 5000 [50] max 5000 ms	(_____)	

■ **NOTE**: [ ] Default Setting

Figure B-9 Comm Settings Record Form (page 1 of 3)

Comm Settings (Cont'd)

Ethernet

Auto Negotiation ❑ Disable ❑ Enable [Enable]

DHCP Protocol ❑ Disable ❑ Enable [Enable]

IP Address [0.0.0.0] (_____)

Net Mask [0.0.0.0] (_____)

Gateway [0.0.0.0] (_____)

Keepalive Time 1 to 50,000 (Sec) [7200] (_____)

Port

MODBUS® Port 0 to 65,535 [502] (_____)

DNP3.0 Port 0 to 65,535 [20000] (_____)

Network Time Synchronization

SNTP ❑ Disable [Disable] ❑ Enable

SNTP Server Address [X.X.X.X] (_____)

Time Zone [GMT –5 Hr] (_____)

Change Communication Address

Communication Address

Address: 1 to 65519 [1] (_____)

Modbus Address: (_____)

Substation

Address: 0 to 65519 [0] (_____)

Feeder

Address: 0 to 65519 [0] (_____)

Communication Access Security

Communication Access and Timeout

Communication Access ❑ Disable [Disable] ❑ Enable

Communication Access Timeout 1 to 50,000 (max 50,000 sec) [60] (_____)

■**NOTE**: [ ] Default Setting

Figure B-9 Comm Settings Record Form (page 2 of 3)

Comm Settings (Cont'd)

SCADA Heartbeat Setting

Heartbeat (Failsafe) DNP Option ❏ Disabled [Disabled] ❏ LTC (DNP)
❏ Regulator(DNP) ❏ Profile Switching (DNP)
❏ Profile Switching (GOOSE)

Bluetooth®

Protocol ❏ MODBUS® [MODBUS] ❏ DNP3

Friendly Name [M2001D] (_____)

❏ Bluetooth Enable [Enable] ❏ Bluetooth Disable

❏ Enable Authentication ❏ Disable Authentication [disable]

Bluetooth Passkey (_____)

Bluetooth Device Address (_____)

Bluetooth Mode ❏ Mode 0 [Mode 0] ❏ Mode 1

■ **NOTE**: [ ] Default Setting

Figure B-9 Comm Settings Record Form (page 3 of 3)

C Appendix
Utilizing the DNP Configuration Editor

The DNP Configuration Editor includes the following features and functions (Figure C-1):

Variations – The variation of an object gives a different representation of the same data point, such as the size of the object or whether or not the object has flag information. Accordingly, the **Variations** section will configure listed objects with the desired and supported variations.

Master Address used for Unsolicited responses and/or Source Address Validation – This address will be used as the address to send unsolicited responses and/or Source Address Validation.

Modem Unsolicit Setting – Applies to RS-232 interface connected to an Ethernet Modem. TCP/IP and UDP/IP unsolicit settings are used when DNP is being deployed over an Ethernet network. The setting elements are described below:

- Allow Unsolicit: Determines whether unsolicited null responses will be sent when session comes online. If enabled, subsequent unsolicited responses will be enabled through function code 0x14 (Enable unsolicited responses) and disabled through function code 0x15 (Disable unsolicited responses). If "Allow Unsolicit" is disabled, then function codes 0x14 and 0x15 will be responded to with an error.
- Class 1 Max Delay (Sec): If unsolicited responses are enabled, this parameter specifies the maximum amount of time after an event in the corresponding class is received before an unsolicited response will be generated.
- Class 1 Max Events: If unsolicited responses are enabled, the parameter specifies the maximum number of events in the corresponding class to be allowed before an unsolicited response will be generated.
- Class 2 Max Delay (Sec): If unsolicited responses are enabled, this parameter specifies the maximum amount of time after an event in the corresponding class is received before an unsolicited response will be generated.
- Class 2 Max Events: If unsolicited responses are enabled, the parameter specifies the maximum number of events in the corresponding class to be allowed before an unsolicited response will be generated.

Choosing Points – The Available Points window is populated when a DNP source file is opened. The selection of points from the Binary Inputs, Analog Inputs, Binary/Control Outputs and Analog Outputs tabs can be accomplished by either individually selecting, dragging and dropping points in the Selected Points window or utilizing the "Copy All" feature. The Copy All feature only copies the points in the open tab to the Selected Points window. The "Remove All" feature removes all the points displayed in the Selected Points window for the tab that is open.

M-2001D DNP Configuration Editor

Load Template | Load File | Save File | Send File to Control | Print | Print Preview

File Identifier: M-2001D DNP

Variations

Binary Inputs	1	Analog Inputs	2	Binary Counter	1
Binary Events	2	Analog Events	2	Counter Events	1
Binary Outputs	2	Analog Outputs	2	Frozen Counter	1

Master Address used for Unsolicited responses and/or Source Address Validation: 1

Select Before Operate Timeout(sec): 20

Modem Unsolicit Settings		TCP/IP Unsolicit Settings		UDP/IP Unsolicit Settings	
Allow Unsolicit	Disable	Allow Unsolicit	Disable	Allow Unsolicit	Disable
Class 1 Max Delay(Sec)	5	Class 1 Max Delay(sec)	5	Class 1 Max Delay(sec)	5
Class 1 Max Events	5	Class 1 Max Events	5	Class 1 Max Events	5
Class 2 Max Delay(sec)	5	Class 2 Max Delay(sec)	5	Class 2 Max Delay(sec)	5
Class 2 Max Events	5	Class 2 Max Events	5	Class 2 Max Events	5

Binary Inputs | Analog Inputs | Binary/Control Outputs | Analog Outputs | Counters | DNP Security

Search

Available Points

Index	Name	Value	M
0	Raise Output Status	TRUE	Cl
1	Lower Output Status	TRUE	Cl
2	VR Contact Input 1	TRUE	Cl
3	VR Contact Input 2	TRUE	Cl
4	Force Lower (Over-Voltage Ru...	TRUE	Cl
5	Seal-in	TRUE	Cl
6	Neutral Tap	TRUE	Cl
7	Block Lower: Tap	TRUE	Cl
8	Block Raise: Tap	TRUE	Cl
9	Power Flow Direction	TRUE	Cl
10	Rev Pwr Flow Block in Effect	TRUE	Cl
11	In-band Annunciator	TRUE	Cl
12	Low-band Edge Annunciator	TRUE	Cl
13	High-band Edge Annunciator	TRUE	Cl
14	Block Lower: Voltage	TRUE	Cl

Selected Points

Ind...	Name	Value	Mask
0	Raise Output Status	TRUE	CLASS_ONE
1	Lower Output Status	TRUE	CLASS_ONE
2	VR Contact Input 1	TRUE	CLASS_ONE
3	VR Contact Input 2	TRUE	CLASS_ONE
4	Force Lower (Over-Volta...	TRUE	CLASS_ONE
5	Seal-in	TRUE	CLASS_ONE
6	Neutral Tap	TRUE	CLASS_ONE
7	Block Lower: Tap	TRUE	CLASS_ONE
8	Block Raise: Tap	TRUE	CLASS_ONE
9	Power Flow Direction	TRUE	CLASS_ONE
10	Rev Pwr Flow Block in ...	TRUE	CLASS_ONE
11	In-band Annunciator	TRUE	CLASS_ONE
12	Low-band Edge Annunc...	TRUE	CLASS_ONE
13	High-band Edge Annun...	TRUE	CLASS_ONE
14	Block Lower: Voltage	TRUE	CLASS_ONE

Copy All | Remove All | Insert Dummy Point | Insert Offset Point | Create DNP3 Device Profile

Tooltip Note: * Indicates points are to be grouped together.

Figure C-1 DNP Configuration Editor Dialog Screen

Ordering Selected Points – Selected points can be reordered to match the users SCADA, RTU or Master setup by selecting, dragging and dropping the desired point within the Selected Points window.

Adding Dummy Points – The purpose of the Dummy Point is to allow the user to match other device DNP maps that contain points that are not supported in the control. This feature allows the user to communicate with the M-2001D control when it is connected to an RTU that contains other brands of controls and eliminates the need to re-configure the RTU or the other controls.

To insert a Dummy point, select "Insert Dummy". The Dummy Point will be inserted at the end of the Selected Points list. To move the Dummy Point, select, drag and drop the point at the desired location in the Selected Points list. The Dummy point will assume the Index Position and the remaining Selected Points will be modified to accommodate the Dummy Point.

Insert Offset – This allows an offset to be created in the DNP map without the point number being transmitted, thus providing the ability to construct a DNP profile that has non-consecutive point numbers within a group.

Additional Mask Values – Four new mask categories have been added.

CLASS_NONE: If a point is defined as CLASS_NONE, then it will not be sent during any CLASS polling although the point is present in the DNP map. The only mean to access this point is by querying the point individually.

CLASS_ONE_NOTCLASS0: If a point is defined as CLASS_ONE_NOTCLASS0, it will be present in a CLASS 1 poll but not an integrity CLASS 0 poll.

CLASS_TWO_NOTCLASS0: If a point is defined as CLASS_TWO_NOTCLASS0, it will be present in a CLASS 2 poll but not an integrity CLASS 0 poll.

CLASS_THREE_NOTCLASS0: If a point is defined as CLASS_THREE_NOTCLASS0, it will be present in a CLASS 3 poll but not an integrity CLASS 0 poll.

Editing Binary Input Points – The Binary Input "Value" and "Mask" values can be edited by double left clicking on the desired point Value or Mask elements. The default value for Value is TRUE, which means that the point will return a High or True when the item being monitored is active in the control. It can be changed to "FALSE" to match a SCADA Master if necessary. The "Mask" value defaults to "CLASS ONE" and defines what polling class type the point is mapped to. The Mask value can also be set to CLASS TWO, CLASS THREE, CLASS NONE, CLASS ONE NOT CLASS 0, CLASS TWO NOT CLASS 0 or CLASS THREE NOT CLASS 0 by double left clicking on the desired point Mask element.

Editing Analog Input Points – The Analog Input "Deadband" and "Mask" values can be edited by double left clicking on the desired point Deadband or Mask elements. The Deadband can be set to define when the point will report by exception under the class type in the Mask setting. When the point change exceeds the deadband value, it will initiate a report by exception to the master. The "Mask" value defaults to "CLASS TWO" and defines what polling class type the point is mapped to. The Mask value can also be set to CLASS ONE, CLASS THREE, CLASS NONE, CLASS ONE NOT CLASS 0, CLASS TWO NOT CLASS 0 or CLASS THREE NOT CLASS 0 by double left clicking on the desired point Mask element.

Editing Binary/Control Output Points – The Binary/Control Output Point "Crob", "Mask" and "Inverse" values can be edited by double left clicking on the desired point Crob, Mask or Inverse elements. The Crob (Control Relay Output Block) setting is used to define what control method will be used to operate the point. The possible settings for "Crob" are listed below:

- Latch On
- Latch Off
- Latch OnOff
- Latch OnOff_TC
- Pulse On
- Pulse Off
- Pulse OnOff
- Pulse OnOff_TC
- Paired Close
- Paired Trip
- Paired TripClose

The "Mask" value defaults to "CLASS ZERO" and defines what polling class type the point is mapped to. The Mask value can also be set to CLASS NONE by double left clicking on the desired point Mask element.

Inverse defines whether the command to be sent would be inverted, meaning that when TRUE is selected, sending a Trip, Close, etc will have the opposite effect. This was implemented due to variations seen in RTU manufacturer's implementation of direct control with DNP to allow full compatibility the widest possible number of RTU's.

The Binary/Control Outputs Tab includes a help selection. When selected TapTalk will launch two pdf documents (Figures C-6 and C-7) which provide an explanation of each individual Binary point with respect to different CROB.

Editing Analog Output Points – The Analog Output "Mask" value can be edited by double left clicking on the desired point Mask element. The "Mask" value defaults to "CLASS ZERO" and defines what polling class type the point is mapped to. The Mask value can also be set to CLASS NONE by double left clicking on the desired point Mask element.

Editing Counters – The Counters "Mask" value can be edited by double left clicking on the desired point Mask element. The "Mask" value defaults to "CLASS THREE" and defines what polling class type the point is mapped to. The Mask value can also be set to CLASS ONE, CLASS TWO, CLASS NONE, CLASS ONE NOT CLASS 0, CLASS TWO NOT CLASS 0 or CLASS THREE NOT CLASS 0 by double left clicking on the desired point Mask element.

■**NOTE**: For security reason, DNP Security tab will only be active when Taptalk is connected to a control with an Access Code of Level 2, otherwise it will be grayed out.

DNP Security – DNP authentication is now available and can be independently enabled in the DNP security tab for either serial or Ethernet (both TCP or UDP) interfaces.

The concepts of the Hashed Message Authentication Code (HMAC) and challenge-response as defined in the DNP3 specification for Secure Authenticate Version 2.0 document is employed.

When authentication is enabled, the following settings should be selected:

- HMAC Algorithm and Update key
- Challenge Response timeout
- Duration of session key
- Aggressive Mode
- Critical Request Function Codes

■**NOTE**: Before TapTalk® allows a user to change the Update key, the user has to enter the old update key.

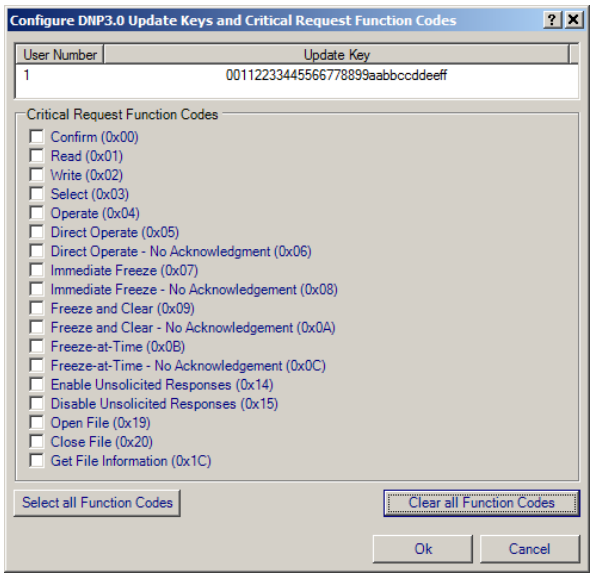


Figure C-2 Configure Update Keys and Critical Request Function Codes Dialog Screen

HMAC Algorithm and Update Key – The HMAC algorithm is either SHA1 (4 OCT) or SHA1(10OCT). An Update key is necessary to provide secure SESSION key negotiation. Once a SESSION key is obtained any subsequent challenge/ response session will employ that session key. The Update key can be up to 32 hex characters (0123456789ABCDF) (128 bits).

Challenge Response Timeout – The range is from 0-100 seconds. This is the response time within which the control is expecting a response to a challenge.

Duration of Session Key – This duration must be configured in minutes (0-100) and in count 0-65535. This duration represents the maximum time or the maximum number of challenges a particular session key is used before key negotiation is again performed.

Aggressive Mode – Full challenge/response exchanges increase the number messages in the protocol, which affects throughput performance. Therefore, DNP Secure Authentication provides an aggressive mode in which the data from a single challenge can be used to authenticate many subsequent messages. The sender of the critical message includes the HMAC at the end of the critical message without having to be challenged. At least one challenge must occur, however, before aggressive mode can be used.

Critical Request Function Codes – This represents the function codes that will require authentication if selected. If none is selected, authentication will not be performed on any function code although authentication has been enabled.

Example of DNP Confiuration Editor Use – The following sequence of steps provides an example of utilizing the DNP Configuration Editor.

1. From the TapTalk® S-2001D Main Screen (Figure 3-12) select **Utility/ DNP Configuration Editor**. TapTalk will display the DNP Configuration Editor dialog screen (Figure C-1).

■ **NOTE:** The M-2001D default file contains points that are unique to the M-2001 product line. It should be used if installing the control in a communications network where the same RTU is communicating with both M-2001C and M-6200A controls.

2. Select **Load Template/M-2001D Default** from the DNP Configurator menu bar. The Binary Inputs tab is displayed. The Available Points list for each DNP Points Group tab will also be populated.
3. Select the Binary Input points you wish to include in the DNP map by selecting Copy All or dragging the desired point(s) to the Selected Points window.
4. Edit the Selected Points for each tab as necessary to match your SCADA, RTU or Master setup.
5. Select **Save File** from the DNP Configurator menu bar. TapTalk will display a **Save As** dialog screen with a *.xml file extension.
6. Name the file and then select **Save**.
7. If TapTalk is connected to the target control then the **Send to Control** menu feature can be used as follows:
   a. Select **Send to Control**. TapTalk will display the "Authentication Key generated successfully" (Figure C-3).

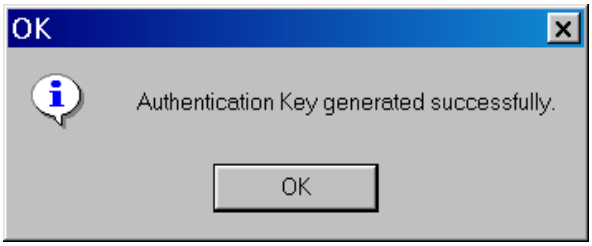


Figure C-3 Authentication Key Generated Successfully Confirmation Screen

   b. Select **OK**. TapTalk will display the "Open File" dialog screen with a *.xml file extension.
   c. Select the file to be opened, then select Open. TapTalk will initiate the file transfer as indicated by the "Send" dialog screen (Figure C-4), followed by a "DNP Upload" confirmation screen (Figure C-5).

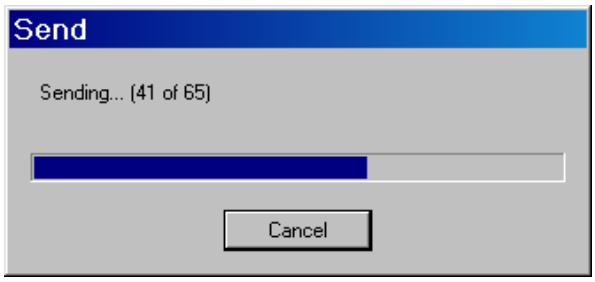


Figure C-4 Send Dialog Screen

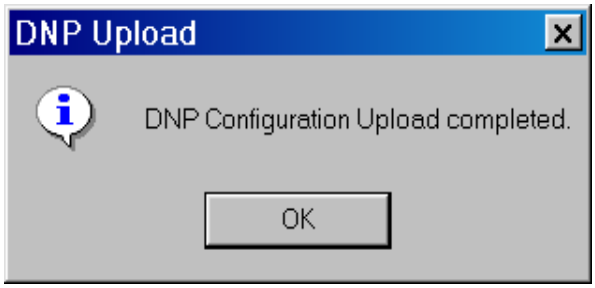


Figure C-5 DNP Upload Confirmation Screen

Point	Latch On	Latch Off	Latch ON/OFF	Trip	Close	Trip/Close
Manual Raise 1 Tap,	Lon -does nothing	Loff - raise	Lon -Does nothing, Loff -Raise	Trip - Does nothing	Close -Raise	Trip - Does nothing, close - Raise
Manual Lower 1 Tap	Lon-Does nothing	Loff - Lower	Lon -Does nothing, Loff -Lower	Trip - does nothing	Close - Lower	Trip - Does nothing, close - Lower
Block Automatic Control via Comm	Lon - UnBlock	Loff - block	Lon -UnBlock, Loff- block	Trip - UnBlock	Close - Block	Trip - UnBlock, close -block
Voltage Reduction Step 1	Lon-VR0ff	Loff- VR1	Lon-VROff, Loff-VR1	Trip - VROff	Close - VR1	Trip - VROff, close -VR1
Voltage Reduction Step 2	Lon-VR0ff	Loff- VR2	Lon-VROff, Loff-VR2	Trip - VROff	Close - VR2	Trip - VROff, close -VR2
Voltage Reduction Step 3	Lon-VR0ff	Loff- VR3	Lon-VROff, Loff-VR3	Trip - VROff	Close - VR3	Trip - VROff, close -VR3
Reset Counter to Zero	Lon - fails	Loff - RST	Lon - fail, Loff - RST	Trip - fail	Close - RST	Trip - fail, close - RST
Remote Auto/Manual	Lon- Auto	Loff - Man	Lon - Auto, Loff - Man	Trip- Auto	Close- Man	Trip - Auto, close - Man
Fwd Voltage Level	Lon- dec 0.1	Loff - incr 0.1	Lon - dec 0.1, Loff - inc 0.1	Trip -dec 0.1	Close - inc 0.1	Trip - dec 0.1, Close - inc 0.1
Bandwidth Voltage	Lon - dec 0.1	Loff - incr 0.1	Lon - dec 0.1, Loff - inc 0.1	Trip - dec 0.1	Close - inc 0.1	Trip - dec 0.1, Close - inc 0.1
Fwd Time Delay	Lon - dec 5	Loff - incr 5	Lon - dec 5, Loff - inc 0.1	Trip - dec 5	Close - inc 5	Trip - dec 5, Close - inc 5
Fwd Reactive Comp	Lon -dec 1	Loff - incr 1	Lon - dec 1, Loff - inc 1	Trip - dec 1	Close - inc 1	Trip - dec 1, Close - inc 1
Level 1Voltage Reduction	Lon-VR0ff	Loff- VR1	Lon-VROff, Loff-VR1	Trip - VROff	Close - VR1	Trip - VROff, close -VR1
Level 2Voltage Reduction	Lon-VR0ff	Loff- VR2	Lon-VROff, Loff-VR2	Trip - VROff	Close - VR2	Trip - VROff, close -VR2
Local Voltage Reduction	Lon -dec step1 0.5	Loff -inc step1 0.5	Lon-dec step1 0.5, Loff-inc step1 0.5	Trip - dec step1 0.5	Close - inc step1 0.5	Trip-dec step1 0.5, Close-inc step1 0.5
Remote Voltage Reduction	Lon -dec step2 0.5	Loff -inc step2 0.5	Lon-dec step2 0.5, Loff-inc step2 0.5	Trip - dec step2 0.5	Close - inc step2 0.5	Trip-dec step2 0.5, Close-inc step2 0.5
Fwd Resistive Comp	Lon - decr 1	Loff - incr 1	Lon - dec 1, Loff - inc 1	Trip - dec 1	Close - inc 1	Trip - dec 1, Close - inc 1
Reset Demands	Lon - fails	Loff - RST	Lon - fail, Loff - RST	Trip - fail	Close - RST	Trip - fail, close - RST
Reset Energies	Lon - fails	Loff - RST	Lon - fail, Loff - RST	Trip - fail	Close - RST	Trip - fail, close - RST
Manual Raise/Lower 1 Tap	Lon -Rise	Loff- Lower	Lon - Raise, Loff - Lower	Trip - Raise	Close- Lower	Trip - Raise, Close - Lower
Scamp Switch	Lon - Man	Loff - Auto	Lon - Man, Loff - Auto	Trip - Man	Close - Auto, rest fail	Trip - Man, Close - Auto
Voltage Reduction Enable	Lon -Disable	Loff - Enable	Lon - Disable, Loff - Enable	Trip - Disable	Close - Enable, rest fail	Trip - Disable, Close - Enable
Non-Sequential	Lon -Disable	Loff - Enable	Lon - Disable, Loff - Enable	Trip - Disable	Close - Enable, rest fail	Trip - Disable, Close - Enable
Clear Sealin Failure Alarm	Lon - fails	Loff - Clear	Lon - Fails, Loff - Clear	Trip - Fails	Close - Clear	Trip - Fails, Close - Clear
Clear Low Current Block Alarm	Lon - fails	Loff - Clear	Lon - Fails, Loff - Clear	Trip - Fails	Close - Clear	Trip - Fails, Close - Clear

Point	Pulse on	Pulse off	Pulse onoff	Latch onoff TC	Pulse onoff TC
Manual Raise 1 Tap,	Pon - Does nothing	Poff - Raise	Pon - Does nothing, Poff- Raise	Latch Onoff and TC work	Pulse onoff and TC work
Manual Lower 1 Tap	Pon - Does nothing	Poff - Lower	Pon - Does nothing, Poff- Lower	Latch Onoff and TC work	Pulse onoff and TC work
Block Automatic Control via Comm	Pon - UnBlock	Poff - block	Pon - UnBlock, Poff - block	Latch Onoff and TC work	Pulse onoff and TC work
Voltage Reduction Step 1	Pon - VR0ff	Poff - VR1	Pon -VRoff, Poff - VR1	Latch Onoff and TC work	Pulse onoff and TC work
Voltage Reduction Step 2	Pon - VR0ff	Poff - VR2	Pon -VRoff, Poff - VR2	Latch Onoff and TC work	Pulse onoff and TC work
Voltage Reduction Step 3	Pon - VR0ff	Poff - VR3	Pon -VRoff, Poff - VR3	Latch Onoff and TC work	Pulse onoff and TC work
Reset Counter to Zero	Pon - fail	Poff - RST	Pon - fail, Poff - RST	Latch off Close work	Pulse off and close work
Remote Auto/Manual	Pon - Auto	Poff - Man	Pon - Auto, Poff - Man	Latch Onoff and TC work	Pulse onoff and TC work
Fwd Voltage Level	Pon -dec 0.1	Poff- inc 0.1	Pon - dec 0.1, Poff- inc 0.1	Latch Onoff and TC work	Pulse onoff and TC work
Bandwidth Voltage	Pon -dec 0.1	Poff- inc 0.1	Pon - dec 0.1, Poff- inc 0.1	Latch Onoff and TC work	Pulse onoff and TC work
Fwd Time Delay	Pon - dec 5	Poff- inc 5	Pon - dec 5, Poff- inc 5	Latch Onoff and TC work	Pulse onoff and TC work
Fwd Reactive Comp	Pon - dec 1	Poff- inc 1	Pon - dec 1, Poff- inc 1	Latch Onoff and TC work	Pulse onoff and TC work
Level 1Voltage Reduction	Pon - VR0ff	Poff - VR1	Pon -VRoff, Poff - VR1	Latch Onoff and TC work	Pulse onoff and TC work
Level 2Voltage Reduction	Pon - VR0ff	Poff - VR2	Pon -VRoff, Poff - VR2	Latch Onoff and TC work	Pulse onoff and TC work
Local Voltage Reduction	Pon - dec step1 0.5	Poff - inc step1 0.5	Pon- dec step1 0.5, Poff - inc step1 0.5	Latch Onoff and TC work	Pulse onoff and TC work
Remote Voltage Reduction	Pon - dec step2 0.5	Poff - inc step2 0.5	Pon- dec step2 0.5, Poff - inc step2 0.5	Latch Onoff and TC work	Pulse onoff and TC work
Fwd Resistive Comp	Pon - dec 1	Poff- inc 1	Pon -dec 1, Poff- inc 1	Latch Onoff and TC work	Pulse onoff and TC work
Reset Demands	Pon - fail	Poff - RST	Pon - fail, Poff - RST	Latch off Close work	Pulse off and close work
Reset Energies	Pon - fail	Poff - RST	Pon - fail, Poff - RST	Latch off Close work	Pulse off and close work
Manual Raise/Lower 1 Tap	Pon - Raise	Poff - Lower	Pon - Raise, Poff- Lower	Latch Onoff and TC work	Pulse onoff and TC work
Scamp Switch	Pon - Man	Poff - Auto	Pon - Man, Poff- Auto	Latch Onoff and TC work	Pulse onoff and TC work
Voltage Reduction Enable	Pon - Disable	Poff - Enable	Pon - Disable, Poff- Enable	Latch Onoff and TC work	Pulse onoff and TC work
Non-Sequential	Pon - Disable	Poff - Enable	Pon - Disable, Poff- Enable	Latch Onoff and TC work	Pulse onoff and TC work
Clear Sealin Failure Alarm	Pon - Fails	Poff - Clear	Pon - Fails, Poff- Clear	Latch off Close work	Pulse off and close work

Figure C-6 Inverse CROB

Point	Latch On	Latch Off	Latch ON/OFF	Trip	Close	Trip/Close
Manual Raise 1 Tap,	Lon - raise	Loff - does nothing	Lon - raise, Loff -Does nothing	Trip - Raise	Close - Does nothing	Trip - Raise, close - Does Nothing
Manual Lower 1 Tap	Lon-lower	Loff - does nothing	Lon - Lower, Loff -Does nothing	Trip - Lower	Close - Does nothing	Trip - Raise, close - Does Nothing
Block Automatic Control via Comm	Lon - Block	Loff - Unblock	Lon -Block, Loff- Unblock	Trip - Block	Close - UnBlock	Trip - Block, close -Unblock
Voltage Reduction Step 1	Lon-VR1	Loff- VRoff	Lon-VR1, Loff-VRoff	Trip - VR1	Close - VROff	Trip - VR1, close -VR off
Voltage Reduction Step 2	Lon-VR2	Loff- VRoff	Lon-VR2, Loff-VRoff	Trip - VR2	Close - VR2	Trip - VR2, close -VR off
Voltage Reduction Step 3	Lon-VR3	Loff- VRoff	Lon-VR3, Loff-VRoff	Trip - VR3	Close - VR3	Trip - VR3, close -VR off
Reset Counter to Zero	Lon -RST	Loff - fails	Lon - RST, Loff - fail	Trip - RST	Close - fail	Trip - RST, close - fail
Remote Auto/Manual	Lon-Man	Loff - Auto	Lon - Man, Loff - Auto	Trip- Man	Close- Auto	Trip - Man, close - Auto
Fwd Voltage Level	Lon- incr 0.1	Loff - decr 0.1	Lon - inc 0.1, Loff - dec 0.1	Trip - inc 0.1	Close - dec 0.1	Trip - inc 0.1, Close - dec 0.1
Bandwidth Voltage	Lon - incr 0.1	Loff - decr 0.1	Lon - inc 0.1, Loff - dec 0.1	Trip - inc 0.1	Close - dec 0.1	Trip - inc 0.1, Close - dec 0.1
Fwd Time Delay	Lon - incr 5	Loff - decr 5	Lon - inc 5, Loff - dec 0.1	Trip - inc 5	Close - dec 5	Trip - inc 5, Close - dec 5
Fwd Reactive Comp	Lon - incr 1	Loff - decr 1	Lon - inc 1, Loff - dec 1	Trip - inc 1	Close - dec 1	Trip - inc 1, Close - dec 1
Level 1Voltage Reduction	Lon- VR1	Loff- VRoff	Lon-VR1, Loff-VRoff	Trip - VR1	Close - VR1	Trip - VR1, close -VR off
Level 2Voltage Reduction	Lon - VR2	Loff- VRoff	Lon-VR2, Loff-VRoff	Trip - VR2	Close - VR2	Trip - VR2, close -VR off
Local Voltage Reduction	Lon -inc step1 0.5	Loff -dec step1 0.5	Lon-inc step1 0.5, Loff-dec step1 0.5	Trip - inc step1 0.5	Close - dec step1 0.5	Trip-inc step1 0.5, Close-dec step1 0.5
Remote Voltage Reduction	Lon -inc step2 0.5	Loff -dec step2 0.5	Lon-inc step2 0.5, Loff-dec step2 0.5	Trip - inc step2 0.5	Close - dec step2 0.5	Trip-inc step2 0.5, Close-dec step2 0.5
Fwd Resistive Comp	Lon - incr 1	Loff - decr 1	Lon - inc 1, Loff - dec 1	Trip - inc 1	Close - dec 1	Trip - inc 1, Close - dec 1
Reset Demands	Lon -RST	Loff - fails	Lon - RST, Loff - fail	Trip - RST	Close - fail	Trip - RST, close - fail
Reset Energies	Lon -RST	Loff - fails	Lon - RST, Loff - fail	Trip - RST	Close - fail	Trip - RST, close - fail
Manual Raise/Lower 1 Tap	Lon - Lower	Loff- Raise	Lon - Lower, Loff -Raise	Trip - Lower	Close- Raise	Trip - Lower, Close - Raise
Scamp Switch	Lon - Auto	Loff - Manual	Lon - Auto, Loff - Manual	Trip - Auto	Close - Manual, rest fail	Trip - Auto, Close - Manual
Voltage Reduction Enable	Lon - Enable	Loff - Disable	Lon - Enable, Loff - Disable	Trip - Enable	Close - Disable, rest fail	Trip - Enable, Close - Disable
Non-Sequential	Lon - Enable	Loff - Disable	Lon - Enable, Loff - Disable	Trip - Enable	Close - Disable, rest fail	Trip - Enable, Close - Disable
Clear Sealin Failure Alarm	Lon - Clear	Loff - Fails	Lon - Clear, Loff - Fails	Trip - Clear	Close - fail	Trip - Clear, Close - Fail
Clear Low Current Block Alarm	Lon - Clear	Loff - Fails	Lon - Clear, Loff - Fails	Trip - Clear	Close - fail	Trip - Clear, Close - Fail

Point	Pulse on	Pulse off	Pulse onoff	Latch onoff TC	Pulse onoff TC
Manual Raise 1 Tap,	Pon - Raise	Poff - Does Nothing	Pon - Raise, Poff- Does nothing	Latch Onoff and TC work	Pulse onoff and TC work
Manual Lower 1 Tap	Pon- Lower	Poff- Does Nothing	Pon - Lower, Poff- Does nothing	Latch Onoff and TC work	Pulse onoff and TC work
Block Automatic Control via Comm	Pon - Block	Poff - Unblock	Pon - Block, Poff - Unblock	Latch Onoff and TC work	Pulse onoff and TC work
Voltage Reduction Step 1	Pon - VR1	Poff - VRoff	Pon -VR1, Poff - VRoff	Latch Onoff and TC work	Pulse onoff and TC work
Voltage Reduction Step 2	Pon - VR2	Poff - VRoff	Pon -VR2, Poff - VRoff	Latch Onoff and TC work	Pulse onoff and TC work
Voltage Reduction Step 3	Pon - VR3	Poff - VRoff	Pon -VR3, Poff - VRoff	Latch Onoff and TC work	Pulse onoff and TC work
Reset Counter to Zero	Pon - RST	Poff - fail	Pon - RST, Poff -fail	Latch On Trip work	Pulse on and Trip work
Remote Auto/Manual	Pon - Man	Poff - Auto	Pon - Man, Poff - Auto	Latch Onoff and TC work	Pulse onoff and TC work
Fwd Voltage Level	Pon - inc 0.1	Poff- dec 0.1	Pon - inc 0.1, Poff- dec 0.1	Latch Onoff and TC work	Pulse onoff and TC work
Bandwidth Voltage	Pon - inc 0.1	Poff- dec 0.1	Pon - inc 0.1, Poff- dec 0.1	Latch Onoff and TC work	Pulse onoff and TC work
Fwd Time Delay	Pon - inc 5	Poff- dec 5	Pon - inc 5, Poff- dec 5	Latch Onoff and TC work	Pulse onoff and TC work
Fwd Reactive Comp	Pon - inc 1	Poff- dec 1	Pon - inc 1, Poff- dec 1	Latch Onoff and TC work	Pulse onoff and TC work
Level 1Voltage Reduction	Pon - VR1	Poff - VRoff	Pon -VR1, Poff - VRoff	Latch Onoff and TC work	Pulse onoff and TC work
Level 2Voltage Reduction	Pon - VR2	Poff - VRoff	Pon -VR2, Poff - VRoff	Latch Onoff and TC work	Pulse onoff and TC work
Local Voltage Reduction	Pon - inc step1 0.5	Poff - dec step1 0.5	Pon- inc step1 0.5, Poff - dec step1 0.5	Latch Onoff and TC work	Pulse onoff and TC work
Remote Voltage Reduction	Pon - inc step2 0.5	Poff - dec step2 0.5	Pon- inc step2 0.5, Poff - dec step2 0.5	Latch Onoff and TC work	Pulse onoff and TC work
Fwd Resistive Comp	Pon - inc 1	Poff- dec 1	Pon - inc 1, Poff- dec 1	Latch Onoff and TC work	Pulse onoff and TC work
Reset Demands	Pon - RST	Poff - fail	Pon - RST, Poff -fail	Latch On Trip work	Pulse on and Trip work
Reset Energies	Pon - RST	Poff - fail	Pon - RST, Poff -fail	Latch On Trip work	Pulse on and Trip work
Manual Raise/Lower 1 Tap	Pon - Lower	Poff - raise	Pon - Lower, Poff- Raise	Latch Onoff and TC work	Pulse onoff and TC work
Scamp Switch	Pon - Auto	Poff - Manual	Pon Auto, Poff- Manual	Latch Onoff and TC work	Pulse onoff and TC work
Voltage Reduction Enable	Pon - Enable	Poff - Disable	Pon - Enable, Poff- Disable	Latch Onoff and TC work	Pulse onoff and TC work
Non-Sequential	Pon - Enable	Poff - Disable	Pon - Enable, Poff- Disable	Latch Onoff and TC work	Pulse onoff and TC work
Clear Sealin Failure Alarm	Pon - Clear	Poff - Fails	Pon - Clear, Poff- Fail	Latch On Trip work	Pulse on and Trip work
Clear Low Current Block Alarm	Pon - Clear	Poff - Fails	Pon - Clear, Poff- Fail	Latch On Trip work	Pulse on and Trip work

Figure C-7 Individual Binary Points and Different CROB

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D Appendix
Utilizing the IEC 61850 Configuration Editor

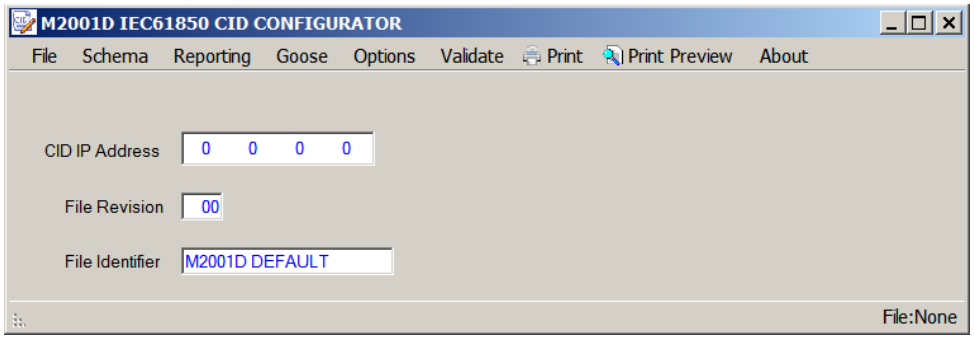

Figure D-1 IEC 61850 Configuration Editor Dialog Screen

The IEC 61850 Configuration Editor includes the following features and functions:

CID IP Address – The IP Address of the Server (control). Setting the proper IP Address to match the control IP Address, will enable a CLIENT software to establish a connection to the control.

File Revision – The file revision allows 0-99 different revisions of the CID file.

Buffered and UnBuffered Control Blocks – The user is able to choose 2 Buffered Report Control Blocks and 2 UnBuffered Report Control Blocks.

Buffered Report Control Block – The events caused by trigger options such as data change, data update, quality change will generate reports immediately. Events not transmitted are buffered to a practical limit for later transmission. Events are not lost due to loss of connection or transport flow constraints.

UnBuffered Report Control Block – The events caused by trigger options such as data change, data update, quality change will generate reports immediately on a best effort basis. The reports are not guaranteed to be delivered if there is loss of connection or if the connection is slow.

RptEna (Report Enable/Disable) – Enables or Disables the report.

RptID (Report Identifier) – The Report Identifier will be the client specified report identifier of the buffered report control block or unbuffered control block that caused the generation of the report.

Having no rptID in the Report Control Block of the CID file will fail validation in Schema 1.4 (as rptID is required) and passes validation for Schema 3.0.

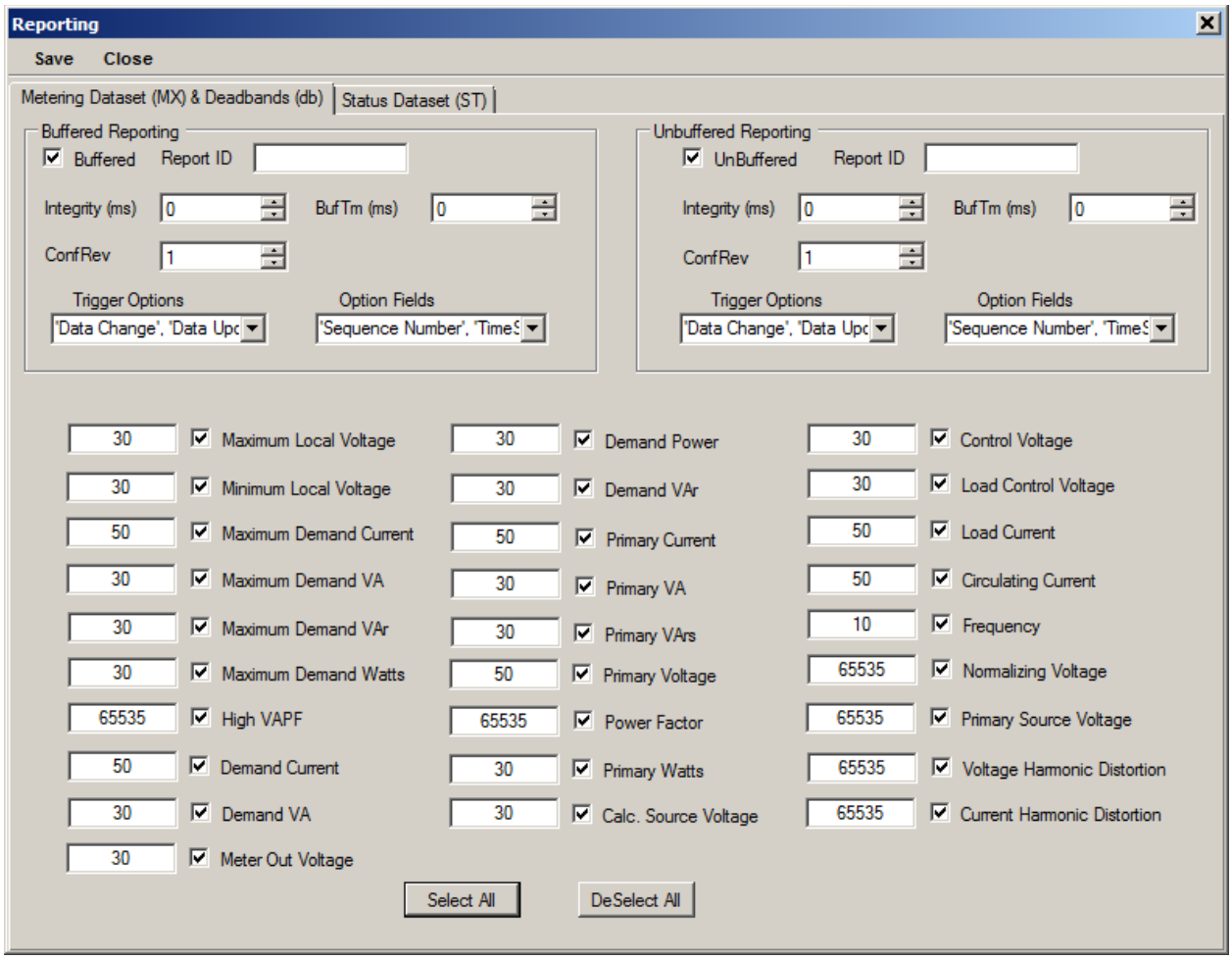

Figure D-2 IEC 61850 Configuration Editor Reporting Metering Dataset Dialog Screen

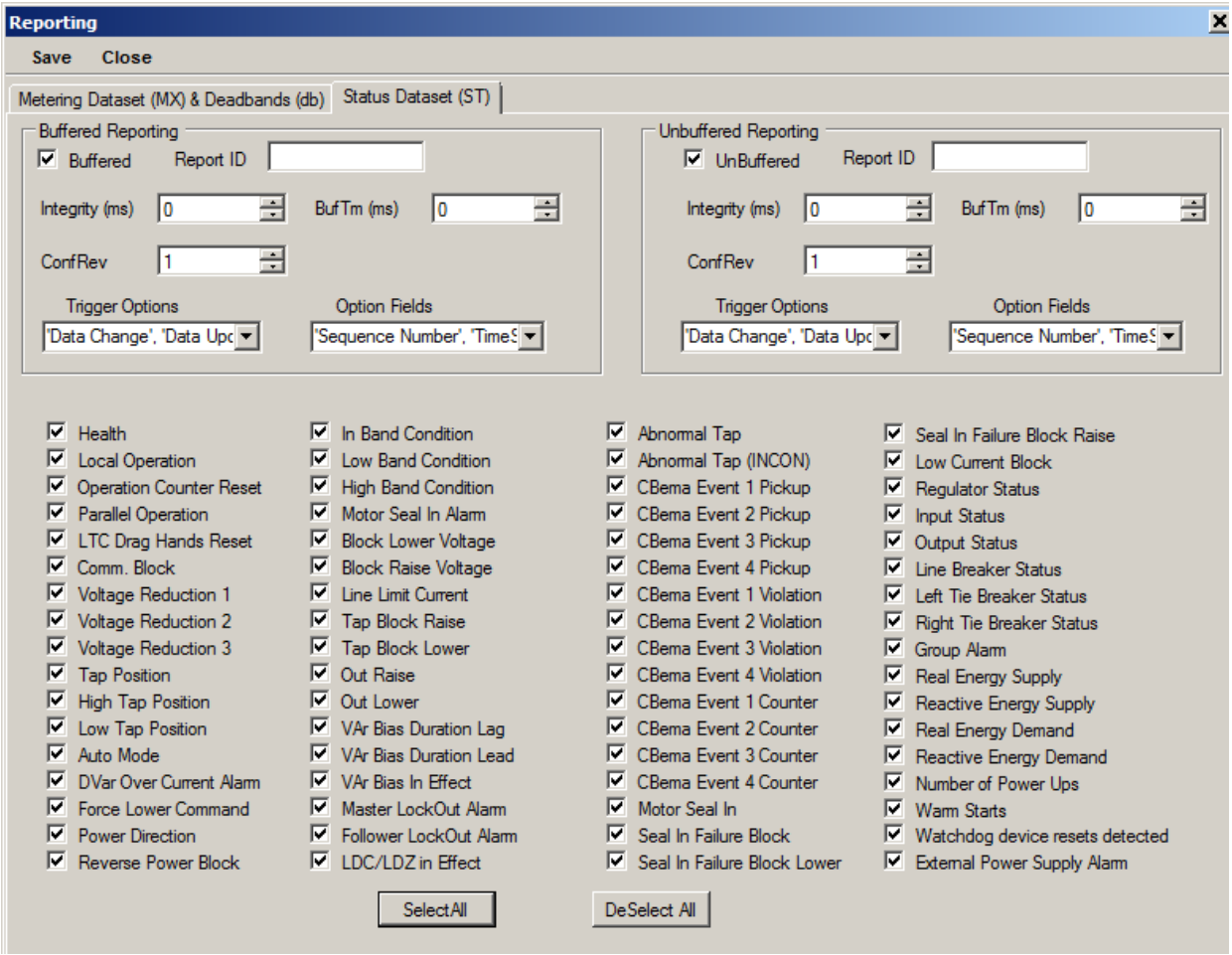

Figure D-3 IEC 61850 Configuration Editor Reporting Status Dataset Dialog Screen

Reporting Trigger Options – (for both Unbuffered and Buffered report control blocks)

■ **NOTE:** Schema 1.4 does not support General Interrogation. Schema 3.0 does support General Interrogation.

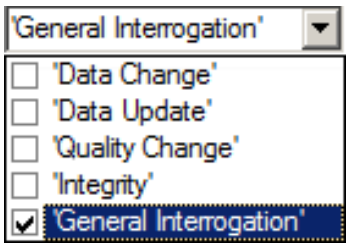

Figure D-4 Report Trigger Options Dialog Screen

- Data Change/Data Update – For measurements, if the value of the data attribute exceeds (either lower or higher) the deadband value the report is generated.

  For status, if the value of the data attributes changes, the report is generated.

- Data Update – is treated the same as Data Change.
- Quality Change – For any measurement or status, the source is a PROCESS. The settings are SUBSTITUTED values.

  Supported Quality bits are:

  - Good
  - Invalid
  - Questionable
  - Out of Range
  - Bad Reference
  - Inaccurate

  If system error or checksum error is detected, the validity are **questionable** and **inaccurate**. If self test fails, then validity is **Invalid**. **Good** means there is no abnormal condition of the acquisition function or the source. If a value is out of range **outofrange** is set. **Badreference** is set when ever error 8198 (voltage reference error) is detected.

- Integrity – For the integrity time period, set in seconds, a snapshot of the dataset with values of the data attributes is reported. If the integrity time period is set to zero, No integrity reports are generated.
- General Interrogation (GI) – As soon as GI value is set to true, a snapshot of the dataset with values of the data attributes is reported and GI is immediately set to false. Supported in Schema 3.0

BufTm (in Seconds) – Specifies the time in seconds that cause buffering of events caused by trigger options such as data change, data update, quality change. BufTm of 0 is supported.

Configuration Revision – Contains the count of the number of times that the configuration in the dataset has changed either due to deletion or addition or reordering of members in the dataset. The user must keep track of this number.

■ **NOTE:** Buffer Overflow is not supported in Schema 1.4

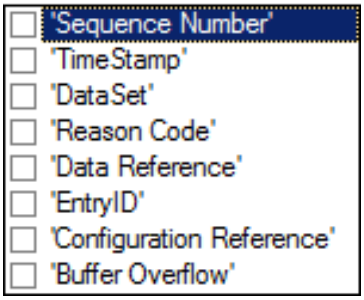

Figure D-6 Option Fields For Buffered Report Control Block

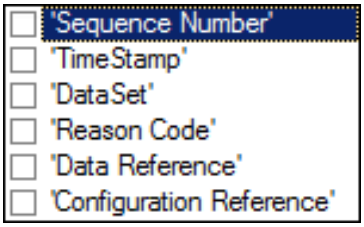

Figure D-7 Option Fields For Unbuffered Report Control Block

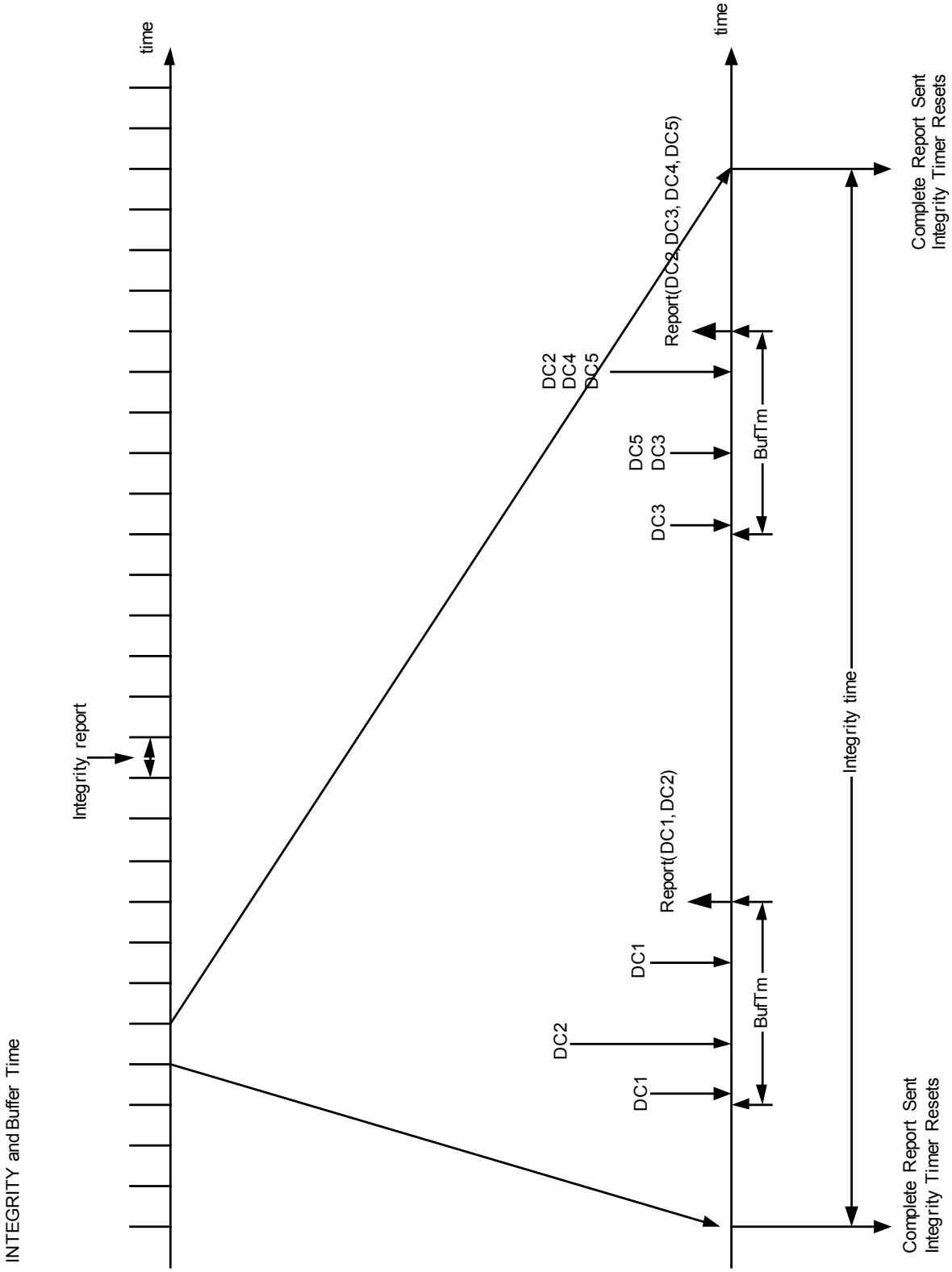

Figure D-5 Integrity and Buffer Time

Sequence Number – The Sequence Number is included in the report if the "Sequence Number" bit is set to true. This value is incremented for every report generated. The first report generated as soon as Report Enable is set to true will have the sequence number as zero. The sequence number will rollover to zero at its maximum value.

TimeStamp – A Time Stamp is included in the report if the "TimeStamp" bit is set to true. This parameter tells the time at which the report was generated.

DataSet – Data Set is included in the report if the "DataSet" bit is set to true. The dataset reference shall be included in the report and derived from the member of the dataset.

ReasonCode – A Reason Code is included in the report if the "ReasonCode" bit is set to true. The report will contain the trigger option that is responsible for generation of the report.

DataReference – Data Reference is included in the report if the "DataReference" bit is set to true. It shall contain the Functional Constraint Data (FCD) of the data attribute values included in the report.

EntryID – An Entry ID is included in the report if the "EntryID" bit is set to true. This parameter represents OCTET string which is used to identify the sequence of events in a buffered report control block.

Configuration Revision – It is included in the report if the "Configuration Revision" bit is set to true. This parameter shall contain the corresponding attribute ConfRev of the referenced BRCB.

Buffer Overflow – The Buffer Overflow is included in the report if the "Buffer Overflow" bit is set to true. It indicates to the client that a buffer overflow has occurred. The buffered report control block will set this bit in the first report after the events that occurred after the overflow. The second report will have it set to zero again.

Goose (Generic Object Oriented Substation Events)

Goose data is directly transmitted on a publisher - subscriber mechanism bases on multicast MAC addresses. Since it is a connectionless network layer protocol, in order to guarantee message delivery, a retransmission scheme is employed.

GOOSE Message Retransmission Timing After Initial GOOSE Message

1. Retransmit after 2 ms with TAL = 2
2. Retransmit after 4 ms with TAL = 4
3. Retransmit after 8 ms with TAL = 8
4. Retransmit after 16 ms with TAL = 16
5. Retransmit after 32 ms with TAL = 32
6. Retransmit after 64 ms with TAL = 64

And so on until a maximum of 65535/2 ms after which it repeats at a fixed interval of 32765 ms.

Goose Publisher – The user can configure up to 5 generic goose control blocks. All the Goose publishers should have the different mac addresses. The user can select a total of 16 data attributes for each dataset referenced in the goose control block. The Trigger options can be periodic or data change or both.

The user can also select the trigger options for any member in the dataset. The available periodic change for which the goose can be generated is 250ms -5000000ms.

Goose Subscriber – The user can configure up to 2 generic goose control blocks. All the Goose subscribers should have different mac addresses. The user can select a total of 255 data attributes for each dataset referenced in the goose control block. In the 255 attributes one has to be a command. The list of commands supported include:

- Operation Counter Reset
- Drag Hands Reset
- Block Auto Via Comm
- Voltage Reduction 1
- Voltage Reduction 2
- Voltage Reduction 3
- Tap Position
- Tap Change
- Clear Motor Seal-In Alarm
- Clear Master Follower LockOut Alarm

The user publishing the goose message should configure the appropriate command and its appropriate position in the dataset and configure the remaining data attributes GsSubscOfs (Offset) in the dataset referenced in the goose subscription control block.

Goose Parameters (Publisher/Subscriber)

DSRef – Contains the object reference of the members of the dataset whose members of the dataset will be transmitted.

CBRef – Contains the reference of the goose control block.

GoID – Contains the identifier of the logical device in which the goose control block is located.

CfgRev – Contains the count of the number of times that the configuration in the dataset has changed either due to deletion or addition or reordering of members in the dataset.

AppID – The Application Identifier (APPID) is used to select ISO/IEC 8802-3 frames containing sampled value messages and to distinguish the application association. Since the M-2001D does not publish or subscribe to sample value, the value of AppID is limited to 0-0x3FFF.

Validation – The configurator validates against Schema 1.4 or Schema 3.0. The Schema drop down menu (Figure D-8) allows the user to select either Schema 1.4 and 3.0. Each file saved is validated against the appropriate Schema.

The "Validate" selection on the IEC 61850 Configuration Editor Dialog Screen (Figure D-1) will validate any CID file against Schema 1.4 or Schema 3.0.

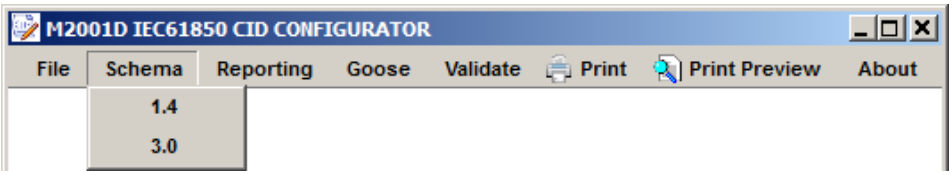

Figure D-8 IEC 61850 Configuration Editor Schema Selection Dialog Screen

Goose Publisher

Save Close

#1 #2 #3 #4 #5

Enable/Disable

Ethernet

Mac Address 01 : 0c : cd : 00 : 00 : 00

Goose Parameters

App ID 0 CfgRev 1

DSRef M2001D/LLN0$DS1

CBRef M2001D/LLN0GOgcCO1

GoID

VLAN

Priority 0

ID 0

Metering DataSet (MX)

- Maximum Local Voltage
- Minimum Local Voltage
- Maximum Demand Current
- Maximum Demand VA
- Maximum Demand VAr
- Maximum Demand Watts
- High VAPF
- Demand Current
- Demand VA
- Demand Power
- Demand VAr
- Primary Current
- Primary VA
- Primary VArs
- Primary Voltage
- Power Factor
- Primary Watts
- Calc. Source Voltage
- Control Voltage
- Load Control Voltage
- Load Current
- Circulating Current
- Frequency
- Normalizing Voltage
- Primary Source Voltage
- Voltage Harmonic Distortion
- Current Harmonic Distortion
- Meter Out Voltage

Deadbands

Status DataSet (ST)

- Health
- Local Operation
- Operation Counter Reset
- Parallel Operation
- LTC Drag Hands Reset
- Comm. Block
- Voltage Reduction 1
- Voltage Reduction 2
- Voltage Reduction 3
- Tap Position
- High Tap Position
- Low Tap Position
- Auto Mode
- DVar Over Current Alarm
- Force Lower Command
- Power Direction
- Reverse Power Block
- In Band Condition
- Low Band Condition
- High Band Condition
- Motor Seal In Alarm
- Block Lower Voltage
- Block Raise
- Line Limit Current
- Tap Block Raise
- Tap Block Lower
- Out Raise
- Out Lower
- VAr Bias Duration Lag
- VAr Bias Duration Lead
- VAr Bias In Effect
- Master LockOut Alarm
- Follower LockOut Alarm
- LDC/LDZ in Effect
- Abnormal Tap
- Abnormal Tap (INCON)
- CBema Event 1 Pickup
- CBema Event 2 Pickup
- CBema Event 3 Pickup
- CBema Event 4 Pickup
- CBema Event 1 Violation
- CBema Event 2 Violation
- CBema Event 3 Violation
- CBema Event 4 Violation
- CBema Event 1 Counter
- CBema Event 2 Counter
- CBema Event 3 Counter
- CBema Event 4 Counter
- Motor Seal In
- Regulator Status
- Input Status
- Output Status
- Low Current Block
- Line Breaker Status
- Left Tie Breaker
- Right Tie Breaker Status
- Group Alarm
- Real Energy Supply
- Reactive Energy Supply
- Real Energy Demand
- Reactive Energy Demand
- Number of Power Ups
- Warm Starts
- Watchdog device resets detected
- External Power Supply Alarm
- Seal In Failure Block
- Seal In Failure Block Lower
- Seal In Failure Block Raise

DeSelect All

Trigger Options

Trigger

Periodic Change

Timer 250 250 5000000 (ms)

Figure D-9 IEC 61850 Configuration Editor Goose Publisher Dialog Screen

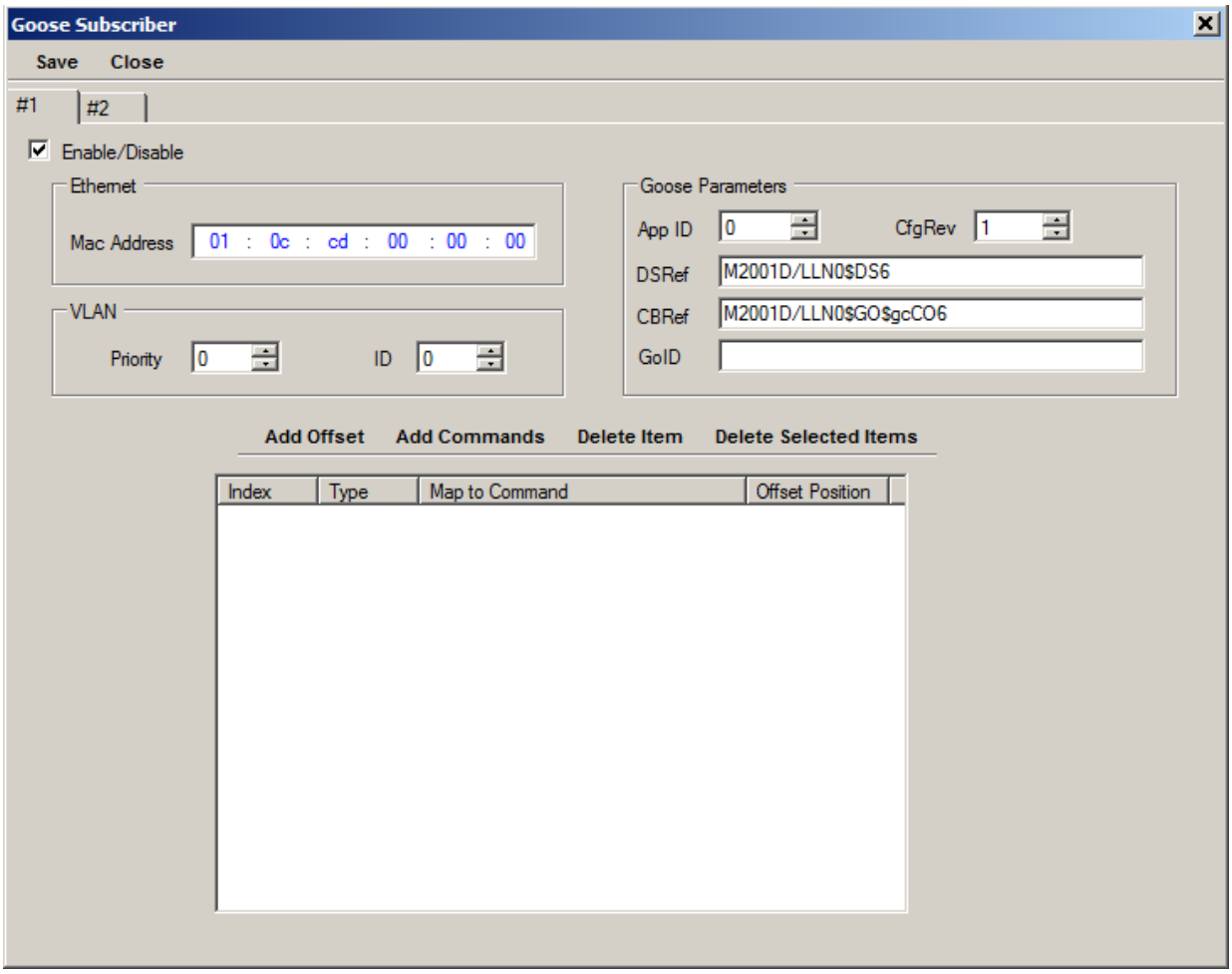

Figure D-10 IEC 61850 Configuration Editor Goose Subscriber Dialog Screen

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E Appendix
Self-Test Error Codes

8100 ERROR_EE_WR_BYTE

This code is displayed when:

- Writing to EEPROM takes more than 10 ms
- OS failed to lock eeprom_semaphore
- No ack from eeprom while it's being accessed

8101 ERROR_EE_WR_WORD

This code is displayed when:

- Writing to EEPROM takes more than 10 ms
- No ack from eeprom while it's being accessed

8102 ERROR_EE_WR_LONG

This code is displayed when:

- Writing to EEPROM takes more than 10 ms
- No ack from eeprom while it's being accessed

8103 ERROR_EE_RD_BYTE

This code is displayed when:

- No ack from eeprom while it's being accessed

8104 ERROR_EE_RD_WORD

This code is displayed when:

- No ack from eeprom while it's being accessed

8105 ERROR_EE_RD_LONG

This code is displayed when:

- No ack from eeprom while it's being accessed

8106 ERROR_EE_WR_OUT_OF_MEM

Error code indicates that the buffer used for temporary storage of the eeprom data before it is actually written is full.

8107 ERROR_EE_WR_MSG_CREATE

Error code indicates that eeprom write command message creation has failed (possibly too many writes were done prior to it and buffer got full).

8108 ERROR_EE_WR_PAGE

This code is displayed when:

- Page Writing to EEPROM takes more than 10 ms
- No ack from eeprom while it's being accessed

8109 ERROR_EE_RD_PAGE

This code is displayed when:

- No ack from eeprom while it's being accessed

8198 ERROR_VREF

Reference voltage error

2200 ERROR_SDCARD_SPI_TIMEOUT

Error code indicates that OS has failed to lock the spi semaphore.

2300 ERROR_DAT_REC_CURRUPT

Error code indicates that data logging record is corrupted (this error code appears when data log records are being retrieved via communication or being saved to sd card).

2301 ERROR_DAT_REC_STORE

Error code indicates that verification of data log record stored in flash has failed.

2302 ERROR_DAT_REC_BUFF_OVERFLOW

Error code indicates that temporary data log buffer allocated in ram is full and no more records can be saved.

2351 ERROR_SOE_REC_STORE

Error code indicates that verification of SOE record stored in flash has failed.

2352 ERROR_SOE_RECSIZE_UNDEF

Error code indicates that number of SOE events per flash page is not defined (error appears immediately during boot up process if code is not properly configured).

2353 ERROR_SOE_TEMPREC_ERROR

SOE temp buffer is not big enough (error appears immediately during boot up process if code is not properly configured).

2354 ERROR_SOE_REC_PER_PAGE_ ERROR

Incorrect number of SOE events per flash page (error appears immediately during boot up process if code is not properly configured).

2355 ERROR_SOE_RECSIZE_ERROR

Not enough space to store temp SOE events in one page (error appears immediately during boot up process if code is not properly configured).

2356 ERROR_SOE_TOTLEN_ERROR

Not enough space to store all the events in the flash section allocated for SOE storage (error appears immediately during boot up process if code is not properly configured).

2401 ERROR_FLASH_WRONG_PG_SIZE

Flash page size in the configuration table is not valid (error appears immediately during boot up process if code is not properly configured).

2402 ERROR_FLASH_ACCESS_TIMEOUT

The response for get flash id command was never received (error appears immediately during boot up process if code is not properly configured).

2403 ERROR_FLASH_CFG_MISSING

Flash chip installed on the board is not supported in configuration table (error appears immediately during boot up process if code is not properly configured).

2404 ERROR_FLASH_WRONG_CFG_FLG

Flash configuration flag is not valid (error appears immediately during boot up process if code is not properly configured).

2405 ERROR_FLASH_SECTION_MISSING

The requested flash section ID is not defined in the configuration table (error appears immediately during boot up process if code is not properly configured).

2406 ERROR_FLASH_SECTION_RANGE

The requested read/write address in particular section of flash is exceeding the section's size.

2407 ERROR_FLASH_SECTION_OUT_OF_ MEM

Not enough space for particular section in the flash configuration table (error appears immediately during boot up process if code is not properly configured).

2408 ERROR_FLASH_CONFIG

Error occurs during firmware update if the program flash is not set to 1024 bytes.

2409 ERROR_FLASH_OUT_OF_MEMORY

Error occurs during firmware update if there is not enough space in RAM for firmware storage.

2500 ERROR_FFS_OUT_OF_MEM_INIT

There is not enough space in flash file system table to hold particular file (error appears immediately during boot up process if code is not properly configured).

2501 ERROR_RECEIVE_FAILED

Error occurs during firmware update if received firmware file doesn't pass certain checks (file length, crc error).

2502 ERROR_PROGRAM_FLASH

Error occurs during firmware update if verification of programmed flash fails.

2503 ERROR_ACCESSING_FLASH

Error occurs if during the firmware update flash memory was accessed by another process.

2600 ERROR_TERM_FLASH_BUFF_ERR

Error occurs in the terminal mode if the allocated temp ram buffer can't fit one page of flash memory.

2700 ERROR_XML_SP_OUT_OF_MEM

Error occurs during setpoint file or password file xml parsing if there is not enough space in ram for parser.

2710 ERROR_TAP_STAT_SIZE

Tap statistic structure has incorrect size.

2800 ERROR_XML_DNPCFG_OUT_OF_ MEM

Error occurs during dnp config file xml parsing if there is not enough space in ram for parser.

9020 ERROR_UNAUTH_PROG_FL_ACCESS 9000

Error occurs if unauthorized read/write access from/to program flash memory is detected (during normal operation).

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Legal Information

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