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A Sierra Monitor Company

**Driver Manual**  
**(Supplement to the FieldServer Instruction Manual)**  
**FS-8700-56 Caterpillar M5X**

**APPLICABILITY & EFFECTIVITY**

**Effective for all systems manufactured after May 1, 2001**

<b>Driver Version:</b>	<b>1.03</b>
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## 1. Caterpillar M5X Driver Description

The Caterpillar M5X driver allows the FieldServer to transfer data to and from devices over RS-232 using Caterpillar M5X protocol. The FieldServer can emulate either a Server or Client.

The driver is capable of communications with any device that uses the Caterpillar M5X protocol but has been designed primarily for connection to a Caterpillar CCM which is in turn connected to the Caterpillar engines to be monitored/controlled.

The driver provides a limited set of M5X protocol commands and may address a sub-set of the parameters available in each device. Details are available in Appendix A

The driver provides formal support for 3500 engines and EMCPII devices only. Other devices may be polled using the address of the parameter required as opposed to user friendly parameter names. Establishing the correct Node\_ID's for the engines being communicated with can be challenging and requires careful research. See Appendix A for further details.

## 2. Driver Scope of Supply

### 2.1. Supplied by FieldServer Technologies for this driver.

FieldServer Technologies PART #	Description
FS-8915-10	UTP cable (7 foot) for RS-232 use
FS-8917-04	RJ45 to DB25M connection adapter
FS-8700-56	Driver Manual.

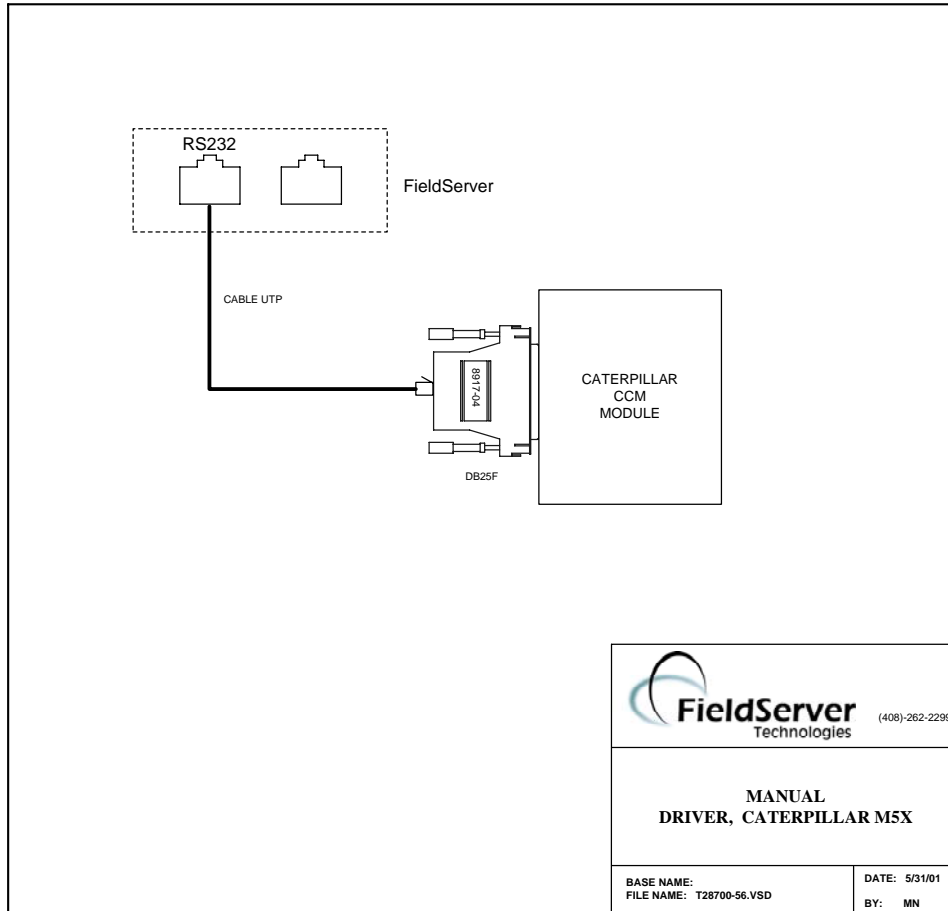
### 2.2. Provided by Supplier of 3<sup>rd</sup> Party Equipment

PART #	DESCRIPTION
	Caterpillar CCM Module
	Power Supply

### 3. Hardware Connections

The FieldServer is connected to the Caterpillar CCM Module as shown below.

Configure the Caterpillar CCM Module according to manufacturer's instructions



#### 3.1. Hardware Connection Hints/Tips

- The FieldServer cannot be connected directly to the generator/engine controller but must be connected via the CCM module.
- If having problems trying to establish the caterpillar Node ID, set the Node\_ID to 0 in the configuration. Watch the error screen on reboot - the remote device will usually send a message back with an error stating that it cannot accept a response message from a certain Node ID. That Node ID is the relevant Node ID.

#### 4. Configuring the FieldServer as a Caterpillar M5X Client

For a detailed discussion on FieldServer configuration, please refer to the FieldServer Configuration Manual. The information that follows describes how to expand upon the factory defaults provided in the configuration files included with the FieldServer (See “.csv” files on the CD provided).

This section documents and describes the parameters necessary for configuring the FieldServer to communicate with a Caterpillar M5X Server.

The configuration file tells the FieldServer about its interfaces, and the routing of data required. In order to enable the FieldServer for Caterpillar M5X communications, the driver independent FieldServer buffers need to be declared in the “Data Arrays” section, the destination device addresses need to be declared in the “Client Side Nodes” section, and the data required from the servers needs to be mapped in the “Client Side Map Descriptors” section. Details on how to do this can be found below.

Note that in the tables, \* indicates an optional parameter, with the bold legal value being the default.

##### 4.1. Data Arrays

Section Title		
Data_Arrays		
Column Title	Function	Legal Values
Data_Array_Name	Provide name for Data Array	Up to 15 alphanumeric characters
Data_Format	Provide data format. Each Data Array can only take on one format.	FLOAT, BIT, UInt16, SInt16, Packed_Bit, Byte, Packed_Byte, Swapped_Byte
Data_Array_Length	Number of Data Objects. Must be larger than the data storage area required for the data being placed in this array.	1-10,000

##### Example

```
// Data Arrays
//
Data_Arrays
Data_Array_Name,      Data_Format,      Data_Array_Length
DA_AI_01,             UInt16,           200
DA_AO_01,             UInt16,           200
DA_DI_01,             Bit,              200
DA_DO_01,             Bit,              200
```

## 4.2. Client Side Connection Descriptors

Section Title		
Connections		
Column Title	Function	Legal Values
Port	Specify which port the device is connected to the FieldServer	P1-P8 <sup>1</sup>
Baud*	Specify baud rate	110 – 115200, standard baud rates only. The default baud rate of a CCM module is <b>9600</b> .
Parity*	Specify parity	<b>None</b>
Data_Bits*	Specify data bits	<b>7, 8</b>
Stop_Bits*	Specify stop bits	<b>1</b>
Protocol	Specify protocol used	CATM5X
Handshaking*	Specify hardware handshaking	RTS, RTS/CTS, <b>None</b>
Poll Delay*	Time between internal polls	0-32000 seconds, <b>1s</b>
Application	Specify whether it is necessary to re-login for next transaction if target Node is different from current node. See Appendix A.4 for detail.	<b>Single_Node</b> , Multidrop

### Example

// Client Side Connections						
Connections						
Port,	Baud,	Parity,	Protocol,	Handshaking,	Poll_Delay,	Application
P8,	9600,	None,	CatM5X,	None,	0.100s,	Multidrop

<sup>1</sup> Not all ports shown are necessarily supported by the hardware. Consult the appropriate Instruction manual for details of the ports available on specific hardware.

**4.3. Client Side Node Descriptors**

Section Title		
Nodes		
Column Title	Function	Legal Values
Node_Name	Provide name for node	Up to 32 alphanumeric characters
Node_ID	<p>The address of the device (engine) connected to the CCM module that you wish to poll. This is also termed the UNIT number or UNIT ID of the engine being polled.</p> <p>The value is specified in decimal. Thus Engine 21H should be specified with a node ID of 33. The value of zero has a special meaning.</p>	<p>0-255</p> <p>The driver will accept entries in the above range. The address of the device is further described in Appendix A.1</p>
Protocol	Specify protocol used	CATM5X
Port	Specify which port the device is connected to the FieldServer	P1-P8 <sup>2</sup>
Password	Specify the node password. The driver logs in to the Cat device before it starts polling. Additional notes provided in Appendix A.5	Max 8 Alpha-Numeric characters.

**Example**

// Client Side Nodes				
Nodes				
Node_Name,	Node_ID,	Protocol,	Port,	Password
Engine1 ,	33 ,	CATM5X,	P8 ,	-
Generator,	88 ,	CATM5X,	P1 ,	-

<sup>2</sup> Not all ports shown are necessarily supported by the hardware. Consult the appropriate Instruction manual for details of the ports available on specific hardware.

#### 4.4. Client Side Map Descriptors

##### 4.4.1. FieldServer Specific Map Descriptor Parameters

Column Title	Function	Legal Values
Map_Descriptor_Name	Name of this Map Descriptor	Up to 32 alphanumeric characters
Data_Array_Name	Name of Data Array where data is to be stored in the FieldServer	One of the Data Array names from "Data Array" section above
Data_Array_Location	Starting location in Data Array	0 to maximum specified in "Data Array" section above
Function	Function of Client Map Descriptor	RDBC, WRBC, WRBX

##### 4.4.2. Driver Specific Map Descriptor Parameters

Column Title	Function	Legal Values
Node_Name	Name of Node to fetch data from	One of the node names specified in "Client Node Descriptor" above
Length	Defines how many Data Array storage locations are reserved for the MapDesc. Additional information is provided in Appendix A.7	1, 2 ....
CatParam	Each parameter has been allocated a name. Use the parameter name with this keyword to tell the driver which parameter in the engine or generator you wish to read / write.  The keywords are not case specific BUT no tabs may be used between the keywords and they must be spelled exactly as in the table provided in Appendix A.2	Example: <i>ECM Hourmeter</i>  <i>System Battery Voltage</i>  See Appendix A.2 for a full list.
CatPID1*	The parameter may be specified in this alternate format in case parameters are added by Caterpillar for which this driver has no keyword description and for engines unknown to this driver. Use catPID1 & catPID2. Specify the values in the hexadecimal format provided in the caterpillar documentation.	E.g. CatPID1 = 00 CatPID2 = F8
CatPID2*		
CatMethod*	Used to override the data extraction method - allows the driver to parse messages with unknown parameters. The method parameter depends on the number and arrangement of data bytes. A table is provided in Appendix A.3	Non zero positive integers.

##### 4.4.3. Timing Parameters

Column Title	Function	Legal Values
Scan_Interval	Rate at which data is polled	>0.1s

### 4.4.4. Map Descriptor Example 1

In this example the driver reads the hour meter from a node called engine 5.

```
// Client Side Map Descriptors
Map Descriptors
Map_Descriptor_Name, Data_Array_Name, Data_Array_Offset, Function, Node_Name, Scan_Interval, CATParam, Length
ENGINE5_HOURS, HOUR_DATA , 5 , Rdbc, ENGINE5, 5 , ECM Hourmeter , 1
```

### 4.4.5. Map Descriptor Example 2

In this example the driver reads the hour meter from a node called engine 5 but the parameter being read has been specified by the Caterpillar PID rather than the keyword values provided by the driver.

```
// Client Side Map Descriptors
Map Descriptors
Map_Descriptor_Name, Data_Array_Name, Data_Array_Offset, Function, Node_Name, Scan_Interval, CATPid1, CatPid2, Length
ENGINE5_HOURS, HOUR_DATA , 5 , Rdbc, ENGINE5, 5 , 00 , 5e, 1
```

## 5. Configuring the FieldServer as a Caterpillar M5X Server

For a detailed discussion on FieldServer configuration, please refer to the instruction manual for the FieldServer. The information that follows describes how to expand upon the factory defaults provided in the configuration files included with the FieldServer (See “.csv” files on the CD provided).

This section documents and describes the parameters necessary for configuring the FieldServer to communicate with a Caterpillar M5X Client

The configuration file tells the FieldServer about its interfaces, and the routing of data required. In order to enable the FieldServer for Caterpillar M5X communications, the driver independent FieldServer buffers need to be declared in the “Data Arrays” section, the FieldServer virtual node(s) needs to be declared in the “Server Side Nodes” section, and the data to be provided to the clients needs to be mapped in the “Server Side Map Descriptors” section. Details on how to do this can be found below.

Note that in the tables, \* indicates an optional parameter, with the bold legal value being the default.

### 5.1. Server Side Connection Descriptors

Section Title		
Connections		
Column Title	Function	Legal Values
Port	Specify which port the device is connected to the FieldServer	P1-P8 <sup>3</sup>
Baud*	Specify baud rate	110 – 115200, standard baud rates only. The default baud rate of a CCM module is <b>9600</b> .
Parity*	Specify parity	<b>None</b>
Data_Bits*	Specify data bits	<b>7, 8</b>
Stop_Bits*	Specify stop bits	<b>1</b>
Protocol	Specify protocol used	CATM5X
Handshaking*	Specify hardware handshaking	RTS, RTS/CTS, <b>None</b>

#### Example

// Server Side Connections				
Connections				
Port,	Baud,	Parity,	Protocol,	Handshaking
P8,	9600,	None,	CATM5X,	None

<sup>3</sup> Not all ports shown are necessarily supported by the hardware. Consult the appropriate Instruction manual for details of the ports available on specific hardware.

## 5.2. Server Side Node Descriptors

Section Title		
Nodes		
Column Title	Function	Legal Values
Node_ID	The address of the device (engine) connected to the CCM module that you wish to poll, also termed the UNIT number or UNIT ID of the engine or generator being polled.  The value is specified in decimal. Thus Engine 21H should be specified with a node ID of 33.	0-255  The driver will accept entries in the above range. The address of the device is further described in Appendix A.1
Protocol	Specify protocol used	CATM5X
Port	Specify which port the device is connected to the FieldServer	P1-P8 <sup>4</sup>
Password	Specify the node password. The driver logs in to the Cat device before it starts polling. Additional notes provided in Appendix A.5	Max 8 Alpha-Numeric characters.

### Example

// Server Side Nodes		
Nodes		
Node_Name,	Node_ID,	Protocol
Engine1 ,	33 ,	CATM5X

## 5.3. Server Side Map Descriptors

### 5.3.1. FieldServer Specific Map Descriptor Parameters

Column Title	Function	Legal Values
Map_Descriptor_Name	Name of this Map Descriptor	Up to 32 alphanumeric characters
Data_Array_Name	Name of Data Array where data is to be stored in the FieldServer	One of the Data Array names from "Data Array" section above
Data_Array_Location	Starting location in Data Array	0 to maximum specified in "Data Array" section above
Function	Function of Client Map Descriptor	RDBC, WRBC, WRBX

<sup>4</sup> Not all ports shown are necessarily supported by the hardware. Consult the appropriate Instruction manual for details of the ports available on specific hardware.

**5.3.2. Driver Specific Map Descriptor Parameters**

Column Title	Function	Legal Values
Node_Name	Name of Node to fetch data from	One of the node names specified in "Client Node Descriptor" above
CatParam	Each parameter has been allocated a name. Use the parameter name with this keyword to tell the driver which parameter in the engine or generator you wish to read / write.  The keywords are not case specific BUT no tabs may be used between the keywords and they must be spelled exactly as in the table provided in Appendix A.2	Example: ECM Hourmeter  System Battery Voltage  See Appendix A.2 for a full list.
CatPID1*	The parameter may be specified in this alternate format in case parameters are added by Caterpillar for which this driver has no keyword description and for engines unknown to this driver. Use catPID1 & catPID2. Specify the values in the hexadecimal format provided in the caterpillar documentation.	E.g. CatPID1 = 00 CatPID2 = F8
CatPID2*		
CatMethod*	Used to override the data extraction method - allows the driver to parse messages with unknown parameters. The method parameter depends on the number and arrangement of data bytes. A table is provided in Appendix A.3	Non zero positive integers.

**5.3.3. Timing Parameters**

Column Title	Function	Legal Values
Scada_Hold_Timeout	Specifies time server side waits before responding to client that node is offline on FieldServer client side.	>1.0s

**5.3.4. Map Descriptor Example.**

In this example the FieldServer acts a passive server capable of responding to queries for its ECM hourmeter.

```
// Server Side Map Descriptors
Map Descriptors
Map_Descriptor_Name, Data_Array_Name, Data_Array_Offset, Function, Node_Name, catParam
E1_Hour, DA_AI3, 0, Passive, ENG1 , ECM Hourmeter
```

The Data Array named DA\_AI3 will be used to provide data to any poll's processed using this Map Descriptor.

The first element of the array's value will be served as the ECM Hourmeter.

The Map Descriptor is passive. It responds to poll's (read or write) received for this node.

The driver is not capable of processing requests for other Caterpillar parameters until they too have been given a Server Side Map Descriptor.

## Appendix A. Driver Notes

### Appendix A.1. Node ID's

The following are the node ID's defined by the CATM5X protocol. Remember that the Node\_ID must be specified as a decimal number.

Hex Value	Decimal Value	Description
<b>This is the engine unit type</b>		
61	97	CCM
<b>3500B Marine Engine Unit Number</b>		
21	33	Electronic Engine Controller (Port)
22	34	Electronic Engine Controller (Starboard)
24	36	Electronic Engine Controller (Single or Center)
<b>3500B Gen Set</b>		
21	33	Electronic Engine Controller - Unit 1
22	34	Electronic Engine Controller - Unit 2
23	35	Electronic Engine Controller - Unit 3
24	36	Electronic Engine Controller - Unit 4
25	37	Electronic Engine Controller - Unit 5
26	38	Electronic Engine Controller - Unit 6
27	39	Electronic Engine Controller - Unit 7
28	40	Electronic Engine Controller - Unit 8
<b>EMCP II Gen Set</b>		
58	88	GSC - Unit 1
59	89	GSC - Unit 2
5A	90	GSC - Unit 3
5B	91	GSC - Unit 4
5C	92	GSC - Unit 5
5D	93	GSC - Unit 6
5E	94	GSC - Unit 7
5F	95	GSC - Unit 8
0	0	Auto Discover Node number When you specify the Node_ID as zero you are telling the driver to ignore the node number in the responses. Normally the driver compares the polled Node_ID to the Node_ID contained in the response. When you specify zero the driver ignores this validation. When you specify the Node_ID as zero you must ensure that there is only one Cat engine connected to the port.

## Appendix A.2. Engine Parameter Keywords & PID's

The following table provides a list of all the keywords that may be used in the catParam field of the CSV file. Note that they must be spelled and spaced exactly as shown in this table.

Engine Type	PID1	PID2	Extraction Method (see Appendix A.3)	Keyword / Parameter
3500B	00	08	1	Engine Configuration
3500B	00	0d	1	Remote Fault Reset
3500B	00	15	1	Throttle Position
3500B	00	40	2	Engine RPM
3500B	00	44	2	Engine Coolant Temp
3500B	00	46	2	Desired Engine Speed
3500B	00	4d	2	Transmission Oil Temp
3500B	00	4e	2	Transmission Oil Press
3500B	00	53	2	Atmospheric Press
3500B	00	54	2	Filtered Engine Oil Press Gauge
3500B	00	55	2	Boost Press Gauge
3500B	00	58	2	Air Filter Restriction
3500B	00	5a	2	Filtered Engine Oil Press Absolute
3500B	00	5b	2	Boost Press Absolute
3500B	00	5c	2	Left Turbo Inlet Press Absolute
3500B	00	5e	2	ECM Hourmeter
3500B	00	5f	2	Right Turbo Inlet Press Absolute
3500B	00	82	3	ECM Fault Log Codes
3500B	00	83	3	ECM Fault Log Request Additional
3500B	00	84	4	ECM Fault Log Request Additional Response
3500B	00	c8	5	Total Fuel
3500B	f0	13	1	System Battery Voltage
3500B	f0	14	1	Cooldown Duration
3500B	f0	16	1	Cold Mode Status
3500B	f0	1b	1	Engine Prelube Duration
3500B	f0	2a	1	Remote Start Status
3500B	f0	2c	1	Engine Coolant Level Status
3500B	f0	8f	1	Engine Control Switch Position
3500B	f0	9c	1	Shutdown Notify Relay Status
3500B	f0	a6	1	Overspeed Verify Switch Position
3500B	f0	a8	1	Remote Emergency Stop Switch Position
3500B	f0	a9	1	Start-up Mode Status
3500B	f0	aa	1	Air Shutoff Status
3500B	f0	ac	1	Max Number of Crank Cycles
3500B	f0	b1	1	Remote Emergency Stop
3500B	f0	b2	1	Cooldown Override Control
3500B	f0	b5	1	Engine Prelube Status
3500B	f0	b6	1	Engine Fuel Level Status
3500B	f0	c1	1	Acceleration Delay Time
3500B	f0	c2	1	Remote Throttle Override
3500B	f0	f2	1	ECM in Control

Engine Type	PID1	PID2	Extraction Method (see Appendix A.3)	Keyword / Parameter
3500B	f0	fd	1	Low Idle Switch
3500B	f1	18	1	Percent Engine Load
3500B	f1	4f	1	Backup ECM Status
3500B	f1	89	1	Engine Power Derate Percentage
3500B	f2	13	1	Remote Start Initiate
3500B	f2	4d	1	Emergency Override Switch Status
3500B	f2	4f	1	General Alarm Output Status
3500B	f4	0e	2	Engine Oil Press Differential
3500B	f4	10	2	Effective Rack
3500B	f4	11	2	Effective Rack Limit
3500B	f4	12	2	Effective Smoke Rack Limit
3500B	f4	15	2	Peak Air Filter Restriction
3500B	f4	17	10	Engine Status
3500B	f4	19	2	Unfiltered Engine Oil Press Absolute
3500B	f4	1c	2	Engine Fuel Press Differential
3500B	f4	1f	2	Unfiltered Engine Fuel Press Absolute
3500B	f4	20	2	Engine Aftercooler Temp
3500B	f4	40	2	Right Exhaust Temp
3500B	f4	41	2	Left Exhaust Temp
3500B	f4	5b	2	Acceleration Ramp Rate
3500B	f4	6d	2	Cooldown Time Remaining
3500B	f5	08	2	Crankcase Air Pressure Absolute
3500B	f5	09	2	Crankcase Air Pressure Gauge
3500B	f5	0a	2	Cooldown Engine Speed
3500B	f5	0b	2	Cycle Crank Time Setpoint
3500B	f5	0d	2	Crank Terminate Speed Setpoint
3500B	f5	0e	2	Filtered Engine Fuel Press Absolute
3500B	f5	0f	2	Filtered Engine Fuel Press Gauge
3500B	f5	10	2	Low Idle Speed
3500B	f5	11	2	Intake Manifold Air Temp
3500B	f5	15	2	Percent Droop
3500B	f5	1f	2	Right Air Filter Restriction
3500B	f5	20	2	Left Air Filter Restriction
3500B	f5	25	2	Fuel Consumption Rate
3500B	f5	3e	2	Engine Oil Temp
3500B	f8	14	6	Application Software Part Number
3500B	f8	1a	7	Vehicle System ID
3500B	fc	07	8	Warning Status
3500B	fc	08	8	Shutdown Status
3500B	fc	09	8	Engine Derate Status
EMCP2	00	0d	1	EMCP2 Remote Fault Reset
EMCP2	00	40	2	EMCP2 Generator Set Engine RPM
EMCP2	00	42	2	EMCP2 Generator Set Ring Gear Teeth Setpoint
EMCP2	00	44	2	EMCP2 Engine Coolant Temperature
EMCP2	00	54	2	EMCP2 Engine Oil Pressure kPa
EMCP2	00	5e	2	EMCP2 Generator Set Hourmeter

Engine Type	PID1	PID2	Extraction Method (see Appendix A.3)	Keyword / Parameter
EMCP2	00	80	11	EMCP2 Device ID Code
EMCP2	00	82	12	EMCP2 GSC Fault Log Codes Status and Number of Occurrences
EMCP2	00	83	3	EMCP2 GSC Fault Log Request for Additional Data
EMCP2	00	84	13	EMCP2 GSC Fault Log Response for Additional Information
EMCP2	f0	13	1	EMCP2 System Battery Voltage
EMCP2	f0	14	1	EMCP2 GSC Cooldown Timer Setpoint
EMCP2	f0	2a	1	EMCP2 Remote Start Status
EMCP2	f0	8f	1	EMCP2 Engine Control Switch Position
EMCP2	f0	b0	1	EMCP2 Generator Phase Select
EMCP2	f0	b1	1	EMCP2 Remote Emergency Stop
EMCP2	f0	b2	1	EMCP2 Cooldown Override Control
EMCP2	f0	b3	1	EMCP2 Generator AC Voltage Full Scale and External Potential Transformer Setpoint
EMCP2	f0	b4	1	EMCP2 Generator AC Current Full Scale Setpoint
EMCP2	f1	d3	1	EMCP2 Generator Phase A Power Factor Lead/Lag Status
EMCP2	f1	d4	1	EMCP2 Generator Phase B Power Factor Lead/Lag Status
EMCP2	f1	d5	1	EMCP2 Generator Phase C Power Factor Lead/Lag Status
EMCP2	f1	d6	1	EMCP2 Generator Average Power Factor Lead/Lag Status
EMCP2	f2	13	1	EMCP2 Remote Start Initiate
EMCP2	f2	cb	1	EMCP2 EPG Circuit Breaker Status
EMCP2	f2	cc	1	EMCP2 Remote Generator Synchronizer Control
EMCP2	f2	d6	1	EMCP2 Remote Synchronization Control Readiness
EMCP2	f2	d7	1	EMCP2 Generator Synchronizer Control Status
EMCP2	f4	40	2	EMCP2 Right Exhaust Temperature
EMCP2	f4	41	2	EMCP2 Left Exhaust Temperature
EMCP2	f4	42	2	EMCP2 Generator RMS Voltage Phase A-B
EMCP2	f4	43	2	EMCP2 Generator RMS Voltage Phase B-C
EMCP2	f4	44	2	EMCP2 Generator RMS Voltage Phase C-A
EMCP2	f4	45	2	EMCP2 Generator RMS Voltage Phase A to Neutral
EMCP2	f4	46	2	EMCP2 Generator RMS Voltage Phase B to Neutral

Engine Type	PID1	PID2	Extraction Method (see Appendix A.3)	Keyword / Parameter
EMCP2	f4	47	2	EMCP2 Generator RMS Voltage Phase C to Neutral
EMCP2	f4	48	2	EMCP2 Generator Phase A RMS Current
EMCP2	f4	49	2	EMCP2 Generator Phase B RMS Current
EMCP2	f4	4a	2	EMCP2 Generator Phase C RMS Current
EMCP2	f4	4b	2	EMCP2 Generator Frequency
EMCP2	f4	4c	2	EMCP2 GSC Relay Status
EMCP2	f4	4d	2	EMCP2 GSC Relay Control
EMCP2	f4	60	2	EMCP2 GSC Alarm Status
EMCP2	f4	61	2	EMCP2 GSC Shutdown Status
EMCP2	f4	62	2	EMCP2 GSC Spare Fault Alarm Status
EMCP2	f4	63	2	EMCP2 GSC Spare Fault Shutdown Status
EMCP2	f4	64	2	EMCP2 Generator Line-Line Voltage
EMCP2	f4	65	2	EMCP2 Generator Line Current
EMCP2	f4	66	2	EMCP2 Engine Overspeed Setpoint
EMCP2	f4	67	2	EMCP2 Engine Oil Step Speed Setpoint
EMCP2	f4	68	2	EMCP2 Low Engine Oil Pressure at Rated Speed Setpoint
EMCP2	f4	69	2	EMCP2 Low Engine Oil Pressure at Idle Speed Setpoint
EMCP2	f4	6a	2	EMCP2 High Engine Coolant Temperature Setpoint
EMCP2	f4	6b	2	EMCP2 Low Engine Coolant Temperature Setpoint
EMCP2	f4	6c	2	EMCP2 GSC Configuration
EMCP2	f4	6d	2	EMCP2 Remaining Cooldown Time
EMCP2	f4	c3	2	EMCP2 Generator Average RMS Voltage
EMCP2	f4	c4	2	EMCP2 Generator Total RMS Current
EMCP2	f4	c7	2	EMCP2 Generator Power
EMCP2	f4	c8	2	EMCP2 Generator Phase A Power Factor
EMCP2	f4	c9	2	EMCP2 Generator Phase B Power Factor
EMCP2	f4	ca	2	EMCP2 Generator Phase C Power Factor
EMCP2	f4	cb	2	EMCP2 Generator Average Power Factor
EMCP2	f4	cf	2	EMCP2 Generator Bus Frequency
EMCP2	f4	d0	2	EMCP2 Generator Bus RMS Voltage
EMCP2	f4	d1	2	EMCP2 Generator Set Control Output Status
EMCP2	f4	d2	2	EMCP2 Generator Set Shutdown Status

Engine Type	PID1	PID2	Extraction Method (see Appendix A.3)	Keyword / Parameter
				Extension #1
EMCP2	f5	0b	2	EMCP2 Cycle Crank Time Setpoint
EMCP2	f5	0c	2	EMCP2 GSC Total Crank Time Setpoint
EMCP2	f5	0d	2	EMCP2 GSC Crank Terminate Speed Setpoint
EMCP2	f5	3e	2	EMCP2 Engine Oil Temperature
EMCP2	f5	57	2	EMCP2 Bus to Generator Phase Difference
EMCP2	f8	14	9	EMCP2 Application Software Part Number
EMCP2	fc	0d	8	EMCP2 Spare Outputs
EMCP2	fc	0f	5	EMCP2 Generator Total Real Power
EMCP2	fc	10	8	EMCP2 Relay Driver Module Relay State
EMCP2	fc	11	5	EMCP2 Generator Phase A Real Power
EMCP2	fc	12	5	EMCP2 Generator Phase B Real Power
EMCP2	fc	13	5	EMCP2 Generator Phase C Real Power
EMCP2	fc	14	5	EMCP2 Generator Phase A Reactive Power
EMCP2	fc	15	5	EMCP2 Generator Phase B Reactive Power
EMCP2	fc	16	5	EMCP2 Generator Phase C Reactive Power
EMCP2	fc	17	5	EMCP2 Generator Total Reactive Power
EMCP2	fc	18	5	EMCP2 Generator Phase A Apparent Power
EMCP2	fc	19	5	EMCP2 Generator Phase B Apparent Power
EMCP2	fc	1a	5	EMCP2 Generator Phase C Apparent Power
EMCP2	fc	1b	5	EMCP2 Generator Total Apparent Power
EMCP2	fc	1c	5	EMCP2 Generator Total kW hours
EMCP2	fc	1d	5	EMCP2 Generator Total kVAR hours
EMCP2	fc	1e	8	EMCP2 Generator Shutdown Status
EMCP2	fc	1f	8	EMCP2 Generator Alarm Status

### **Appendix A.3. Data Extraction Methods**

These methods correspond to data formats described in the CATM5X protocol document. Each parameter (PID) is assigned a data format by Caterpillar. The format defines the number of data bytes and their internal arrangement.

#	Format	Implemented	Length
1	A	Yes	1
2	AA	Yes	1
3	AAB	Yes	2
4	CDDEE	No	3
5	AAAA	Yes	1
6	10 x A	Yes	10
7	17 x A	No	17
8	ABCD	Yes	4
9	8 x A	Yes	10
10	AB	Yes	2
11	AABBCC	Yes	3
12	AAB[C]	Yes	3
13	AAB[CDDEE]	Yes	5
14	AABB	No	2

### **Appendix A.4. Data Retrieval from Multiple Hosts**

Caterpillar protocol only allows the retrieval of data from one host per port at a time. If a module (like CCM) connected to the FieldServer is in turn connected to multiple devices, the FieldServer may need to log in and out of these devices sequentially in order to collect data from each device. To facilitate this, the Driver uses the “application” keyword on connection (see section 4.2) to determine whether FieldServer should re-login for the next transaction. If the application type is “Multidrop” then FieldServer will re-login whenever the next transaction is for different Node, otherwise, whether specified or not, application type is considered as “Single\_Node” and FieldServer will not re-login.

## Appendix A.5. Passwords

### Example 1 – Cat device has blank password.

To configure a node to poll a Cat device with a blank password define the client node as follows

```
// Client Side Nodes

Nodes
Node_Name,      Node_ID,      Protocol,      Port,      Password
Engine1 ,      33 ,      CATM5X,      P8 ,      -
```

### Example 2 – Cat device has password.

Every variable (PID) in the Cat device has an associated security level (0, 1, 2 or 3). A user with a particular security level may access variables of the same or lower level. The Caterpillar vendor documentation provides details of the security level of each variable. Most variables can be read by a user of any level.

The password protection of the CCM device is initially enabled. Changing the password protection and passwords can be done with the PC software for the CCM. This software is provided by Caterpillar.

We note that in many places in the Caterpillar vendor documentation we have seen references to a password of “11112222” and suspect that this password may be commonly used.

```
Client Side Nodes

Nodes
Node_Name,      Node_ID,      Protocol,      Port,      Password
Engine1 ,      33 ,      CATM5X,      P8 ,      11112222
```

### Example 3 – Password causes Configuration file Errors.

A node definition which will produce configuration file errors is provided. The problem can easily be rectified by using a client node definition similar to example 1 or 2.

```
// Client Side Nodes

Nodes
Node_Name,      Node_ID,      Protocol,      Port,      Password
Engine1 ,      33 ,      CATM5X ,      P8,
```

If the FieldServer is configured to emulate a Caterpillar device (driver acts as server) then any password can be specified as the driver does not perform password verification when a remote device logs in prior to polling.

**Appendix A.6. Scaling**

**Using the driver as a client.**

When the driver reads data from a Caterpillar device the response contains values for each parameter that is read. These ‘raw’ values are scaled by the driver to represent engineering values before storing. This scaling activity is not configurable. The scaling is only applied for variables known to the driver. Some variables may be read by specifying the PID1/2 parameters but if the variable is unknown to the driver (not listed in Appendix A.2) – no scaling is applied to these variables.

The benefit of this system is that the user does not have to know how the Caterpillar devices transmit the values of the variables they are interested in.

**Example:**

“Generator Bus Value” returns a value of 0-65503 representing 0-6535.3 Hz. The driver stores the scaled engineering value in Hertz as a floating point number.

The driver ignores the MapDesc keywords “Data\_Array\_Low\_Scale, Data\_Array\_High\_Scale, Device\_Low\_Scale, Device\_High\_Scale” as it has already performed the scaling.

**Using the driver as a server**

No scaling is applied. The diver transmits the values it finds in the Data Arrays.

**Appendix A.7. Map Descriptor Lengths**

When a MapDesc is defined one of the parameters specified is the ‘Length’. For this driver the meaning of this parameter is defined as the number of Data Array locations reserved for storage of the data read by the Map Descriptor. Section 4.1 and Appendix A.3 are used to determine how many Data Array locations must be reserved for a Map Descriptor.

When data is read from the Caterpillar device, in most cases, for each read, a single value is returned. For some read’s, however, even though you are reading a single location in the Caterpillar device’s memory, the data returned consists of several values and the driver separates these values and attempts to store them in multiple consecutive locations in the specified Data Array.

**Example:**

If you wish to read the ‘Warning Status’ you will find the following entry in table 0. The Data extraction method is 8.

fc	07	8	Warning Status
----	----	---	----------------

From Appendix A.3 you note that data extraction method 8 requires a length of 4. You therefore define the MapDesc length as 4.

8	ABCD	Yes	4
---	------	-----	---

## Appendix B. Driver Error Messages

Message	Explanation
CatM5X:#1 Error. Node=<%s> not connected to a port.	This protocol requires that nodes are connected to ports as the driver checks the relationship between the port, the Node_ID and port a message was received on. <sup>∞</sup>
CatM5X:#2 Error. Node=<%s> Station Rqd/Actual=(0-255)/%d.	Valid Node_ID are 0 –255. Not all of the values correspond to legal Unit ID's defined by Caterpillar, however. The Node_ID must be specified as a decimal number. Thus engine \$21 should be specified as 33. <sup>∞</sup>
CatM5X:#3 Error. Invalid PID. MapDesc=<%s> requires a catParam.	The PID provided is not recognized by the driver and the keyword may have been misspelled or mis-spaced. If using the catPID1/2 parameters then specify a method also. <sup>∞</sup> OR A PID1/2 was specified that is not available in the list of supported PID's. This problem can be avoided by specifying a catMethod. See Appendix A.3 <sup>∞</sup>
CATM5X:#4 Error. Polls from Masters only	These messages are associated with driver events that cause the FieldServer to panic. You cannot correct the problem and should call FieldServer Technologies.
CATM5X.#5 Error. Expected/Rcvd Function (34 or 24)/%c%c	
CATM5X:#6 Error. Driver cannot process IID=%x(h)	
CATM5X:#7 Error. Storing. Method for PID %x %x is unknown.	
CATM5X:#8 Error. Incoming data from unit=%x(hex) is being abandoned.	This message is produced when data is being written to the FieldServer but the FieldServer cannot find a Map Descriptor to process the message with. For example an ECM Hourmeter is being written to the FieldServer but a Map Descriptor with catParam = "ECM Hourmeter" cannot be found. The error message will identify the unit the message originated from and the PID1/2 of the incoming data. <sup>∞</sup>

<sup>∞</sup> Correct the CSV file and reset the FieldServer.

Message	Explanation
CATM5X:#9 Error. Responses from CCM's only	These messages are associated with driver events that cause the FieldServer to panic. Take a log and contact FieldServer Technologies.
CATM5X:#10 Error. Expected/Rcvd Function 35/%c%c	
CATM5X:#11 Error. Expected/Rcvd Unit 61/%c%c	
CATM5X:#12 Error. Expected/Rcvd PID F012/%c%c%c%c	
CATM5X:#13 Error. Responses from CCM's only	
CATM5X:#14 Error. Expected/Rcvd Function (25 or 35)/%c%c	
CATM5X:#15 Error. Driver cannot process IID=%x(h)	
CATM5X:#16 Error. Cannot Login. Incorrect Password.	Determine the correct password for the Caterpillar device. <sup>∞</sup>
CATM5X:#17. FYI. Logged in. Level= %d	The driver is reporting the access level at which it has logged into the remote device. This is an information message which may be ignored.
CatM5X:#18 Error. Method Not Supported. MapDesc=<%s>	The data extraction method specified in the csv file is not supported. Appendix A.3 lists supported methods. <sup>∞</sup>
CATM5X:19 Error. Data Method for PID %x %x is unknown.	This error should have been prevented by the driver. If an invalid method has been specified in the CSV file then error 18 should be produced. If this error is produced without error 18 in the log file then call FST for support
CATM5X:#20.%d Err. Retriving. Array <%s> too short. Index=%d	The Data Array offset specified is too large as its points beyond the end of the Data Array. When sending a response (as a server) the driver is trying to extract data beyond the end of the array. This could arise as some methods use more than one array location to get data to build the response. For example, if the method requires 4 consecutive array locations and the offset specified is that last location in the array then this will produce an error. <sup>∞</sup>
CATM5X:#21.%d Err. Storing. Array <%s> too short. Index=%d	
CATM5X:#22 FYI. Node is responding with Node_ID=%d	This message is printed when a node is polled as Node_ID zero but responds with another Node_ID. This is part of the auto discovery system. You can ignore this message or follow our recommendation to change the configuration file so that the Node_ID of the station you are polling is equal to the Node_ID of the station that is responding. The reason for this recommendation is that once specifically configured there is no possibility of confusion if anyone were to introduce a second engine controller on the same communications port. Formatting and spelling updates.

<sup>∞</sup> Correct the CSV file and reset the FieldServer.

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