

Verifying PowerLogic™ ION7550 / ION7650 Accuracy

All PowerLogic ION7550 / ION7650 meters are tested and verified at the factory according to IEC (International Electrotechnical Commission) and ANSI (American National Standards Institute) standards; however, before a new revenue meter is installed, it is important to perform a final accuracy verification.

ION™ meters are digital and do not require calibration, only verification of their accuracy. This technical note outlines a procedure for verifying the accuracy of ION7550 / ION7650 meters.

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Additional Information

- ◆ *ION7550 / ION7650 Installation Instructions*
- ◆ *ION7550 / ION7650 User Guide*
- ◆ *ION Setup Online Help or User Guide*
- ◆ *ION Reference*

Introduction

The revenue-accurate ION7550 / ION7650 meter is digital and therefore needs no servicing. It is tested for accuracy at the factory and remains accurate for the life of the meter. In contrast, electro-mechanical meters need mechanical adjustment before installation and periodic calibration thereafter. Calibration testing is unnecessary for digital meters.

Digital meters require 'accuracy' testing, or verification, to ensure the meter meets required accuracy specifications. If you know your meter is within required accuracy specifications before installation, errors observed in the field could be attributed to incorrect connections or instrument transformer ratio settings.

Accuracy Standards and Current Ranges

The meter conforms to the following accuracy standards, depending on the meter's current input order option:

Current Input Order Option	Standard	Accuracy Range	Starting Current
C	IEC 62053-22 5A 0.2S (formerly IEC 60687 5A 0.2S)	50 mA to 20 A	5 mA
	ANSI C12.20 current class 20 accuracy class 0.2	150 mA to 20 A	5 mA
E	IEC 62053-22 1A 0.2S (formerly IEC 60687 1A 0.2S)	10 mA to 10 A	1 mA
	IEC 62053-22 5A 0.2S (formerly IEC 60687 5A 0.2S)	50 mA to 10 A	1 mA
	ANSI C12.20 0.2 accuracy specification	15 mA to 10 A	1 mA

NOTE

Current input order options F and G are excluded from this technical note.

Testing Overview

The most common method for testing meters is to inject voltage and current from a stable power source and compare the meter energy readings with readings from a reference energy meter or energy standard. In general, it is recommended that a meter's accuracy be verified using a reference meter or an energy standard, rather than only the source of the test signal. Although meter shops use different methods for testing revenue meters, most test equipment requirements are similar.

Test harness

A test harness is essential for non-socket meters. Ensure that the test harness for the meter is wired properly. The current and voltage transformers must be accurately rated and must perform within specifications to provide accurate results.

Power source

It is important to have a steady power source. Power that energizes the meter must be reliable and must provide: the rated voltage of the meter, unity power factor (1.0) and lagging power factor of 0.0 (for VARh testing) or 0.5.

Test loads

There are three methods of current loading: customer's load (a meter in service), resistance load (characteristics similar to a lighting load), and phantom loading (a test board). Your test load device or other loading circuit must be set within the current capacity ranges for the meter. The procedure outlined in this document describes verification using a phantom load or test board.

The ION7550/ION7650 will maintain its accuracy during signal source variations, but its energy pulsing output needs a stable test signal to produce accurate test pulses. The meter energy pulsing mechanism needs approximately three to four seconds to stabilize after every source adjustment; the meter measurements are accurate during the signal source transitions, but the pulse output should be allowed to stabilize before the start of every test to ensure accuracy.

Control equipment

Control equipment is required for counting and timing the pulse outputs (revolutions) from the front panel pulser LED or the digital outputs. Most standard test benches have an arm with red light sensors used for this purpose.

NOTE

The optical sensors on the test bench can be disrupted by strong sources of ambient light (such as camera flashes, fluorescent tubes, sunlight reflections, floodlights, etc.) and cause test errors. Use a hood if necessary to block out ambient light.

Environment

The meter should be tested at the same temperature as the testing equipment. The ideal temperature is about 23°C (73°F). Ensure the meter is warmed-up sufficiently before testing.

A warm up time of 30 minutes is recommended for ION7550/ION7650 meters before energy accuracy verification testing. At the factory, the meters are warmed up to their typical operating temperature before calibration. This pre-calibration warm up ensures that ION7550/ION7650 meters will reach their optimal accuracy at operating temperature.

Most high precision electronic equipment requires a warm up time before it reaches its specified performance levels. Both ANSI C12.20 and IEC62053-22 energy meter standards allow the manufacturers to specify meter accuracy de-rating due to ambient temperature changes and self-heating. The ION7550/ION7650 accuracy de-rating specifications exceed the requirements of both the ANSI C12.20 and IEC62053-22.

Grounding

The ION7550/ION7650 meter's safety ground terminal must be connected to a low impedance grounding system in order to avoid electric shock and to ensure that the meter's accuracy remains within specifications. The signal source and the reference meter (or energy standard) should also be grounded if recommended by their respective manufacturers.

If the test configuration allows, the meter's neutral voltage terminal should be grounded in any test configuration with unbalanced phase voltages.

Reference Meter or Energy Standard

To ensure accuracy of the ION7550/ION7650 verification test, it is recommended that a reference meter or a reference energy standard, with a specified accuracy of $\pm 0.025\%$ or better, be used.

Before the start of testing, the reference meter or energy standard should be warmed up as recommended by its manufacturer.

NOTE

Verify the accuracy and precision of any measurement equipment you use (i.e., voltmeters, ammeters, power factor meters).

Test Procedure

The following are guidelines for testing the meter; your meter shop may have other testing methods.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices.
- Meter accuracy verification (testing) must be performed by qualified electrical personnel.
- Turn off all power supplying the meter under test and the test equipment before working on it.
- Always use a properly rated voltage sensing device to ensure power is off.
- Connect the meter's protective ground (earth) terminal to the installation's protective ground (earth) system before applying power.

Failure to follow these instructions will result in death or serious injury.

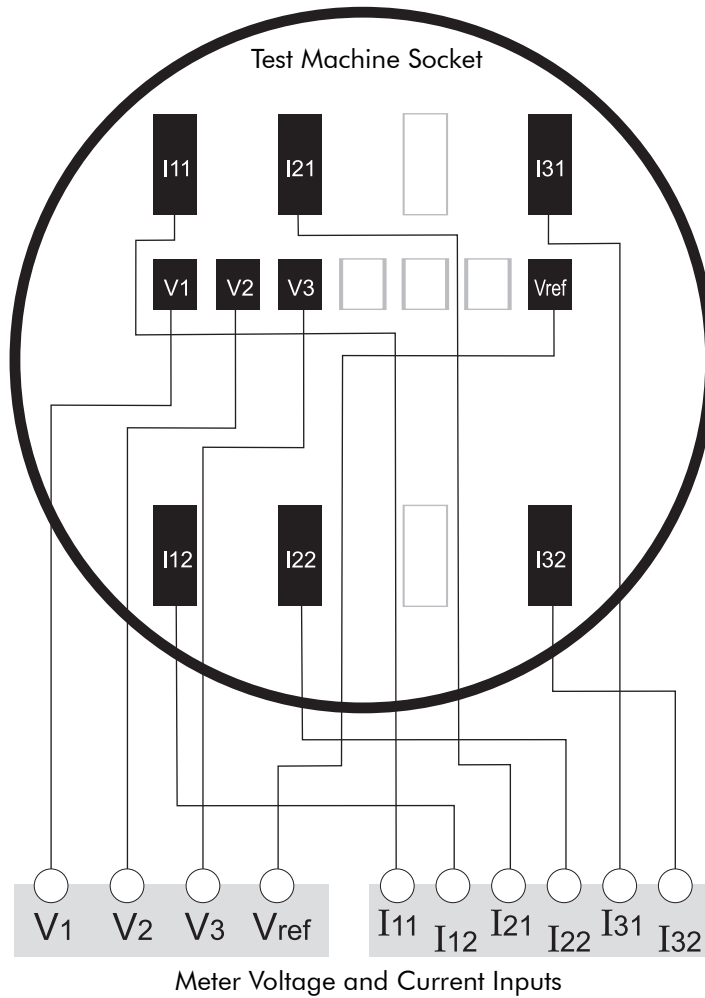
1. Turn off power to the test harness or other standard measuring device to prevent hazardous voltages on meter terminals and connected equipment. Use a properly rated voltage sensing device to confirm power is off.
 2. Place the meter into the test harness or other standard measuring device. Ensure all voltages are in parallel with the meter being tested and all currents are in series (see "Connecting the Test Harness" on page 7). Ensure the meter's protective ground (earth) is connected to the installation's protective ground (earth).
 3. Connect the control equipment used for switching the voltage to the test standard device.
 4. Connect the control equipment used for counting the standard output pulses using one of the methods listed:
 - ◆ align the red light sensor on the standard test bench armature over the front panel pulser LED.
- OR**
- ◆ connect to the meter's digital outputs (see "Connecting the Control Equipment" on page 8).
5. Before performing the verification test, let the test equipment power up the meter. Apply voltage for at least 30 seconds. This warm-up allows the meter's internal circuitry to stabilize.
 6. Apply the rated current and voltage to the terminals of the meter.
 7. Set the meter's volts mode to **4W-WYE**.
 8. Place the meter in test mode, if desired (see "Using Test Mode" on page 11). This allows the meter to enter the field with no kWh values in the registers. If you are performing field testing, put the meter in test mode to avoid affecting customer billing data.

9. Perform testing on the test points (see "Test Points" on page 14).
10. Run each test point for at least 30 seconds to allow the test bench equipment to read an adequate number of pulses. Allow 10 seconds of dwell time between test points.

Connecting the Test Harness

The following is an example using the WECO model 8CA-1 adapter, which provides an easy means of connecting an ION7550 / ION7650 meter to a WECO test machine.

1. Connect the harness wires to the meter’s voltage and current inputs:



2. Plug the adapter into the WECO test machine’s socket.
3. Ensure the meter’s ground terminal (earth) and the test set ground (earth) are connected.
4. Set the WECO machine to 9S.

NOTE

Non-specified connections can be left floating (not connected).

Connecting the Control Equipment

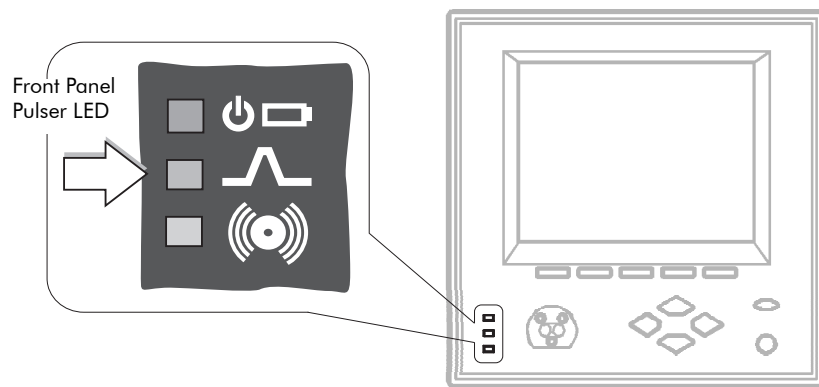
You can use the meter's front panel red pulser LED or the digital outputs for control purposes.

NOTE

For TRAN models, you must use the digital outputs.

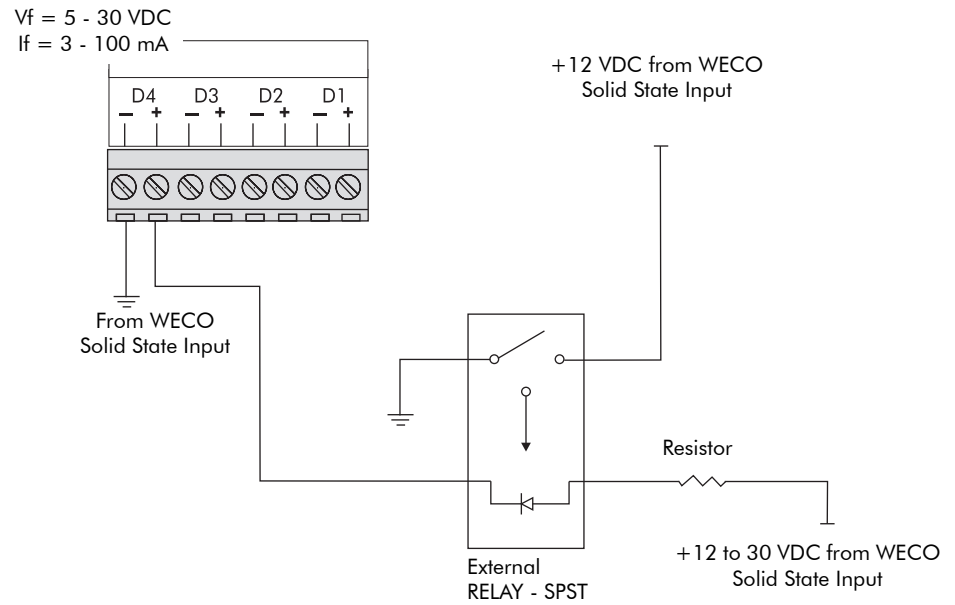
Option A: Using the Front Panel Pulser LED

1. Carefully position the test machine's optical arm over the meter's front panel pulser LED.
2. Set test machine to "adjust optics" and ensure that the meter's LED pulses are being read.



Option B: Using the Digital Outputs

Connect the meter's digital outputs to the WECO test machine. These captured wire connectors are found on the rear of the meter. See below for details:



Typical Sources of Test Errors

If excessive errors are observed during verification testing, the test setup should be examined to eliminate typical sources of measurement errors:

- ◆ Loose connections of voltage or current circuits, often caused by worn-out contacts or terminals. Inspect terminals of test equipment, cables, test harness and the meter under test.
- ◆ Meter ambient temperature significantly different than 23°C (73°F). See “Environment” on page 3 for an explanation.
- ◆ Floating (ungrounded) neutral voltage terminal in any configuration with unbalanced phase voltages.
- ◆ Ambient light interference or sensitivity issues with the optical sensor.
- ◆ Unstable power source causing energy pulsing fluctuations.
- ◆ Incorrect test setup: not all phases connected to the reference meter or the energy standard. All phases connected to the meter under test should also be connected to the reference meter/standard.
- ◆ Moisture (condensing humidity), debris or pollution present in the meter under test.
- ◆ Meter not properly grounded to the test set. Ensure the meter ground (earth) and the test set ground (earth) are connected

Using Test Mode

When the meter is in test mode, it does not accumulate billable quantities. The test measurements collected by the meter are sent to different registers so that the billing quantities are not changed.

The ITC (Instrument Transformer Compensation) operation should be disabled during the meter energy accuracy verification (Disable PT and CT compensation by setting the *Ratio Correction Type* and *Phase Correction Type* setup registers in all ITC modules to “None”.)

NOTE

Hardware locked meters must be unlocked before they can enter test mode. See the *ION7550 / ION7650 Hardware Lockable* product option document for more information on locking and unlocking meters.

Switching to Test mode

Place the meter into test mode using ION Setup. The meter’s front panel displays the Test Mode screen when the meter is in test mode.

Entering Test Mode using ION Setup

1. Open ION Setup and connect to the meter using Basic Mode.
2. Click on the Setup Assistant and select the Verification folder. Select the Verification tab.
3. Select Test Mode and click **Display**. If security is enabled, you are prompted for the meter’s password. A dialog box informs you the meter is in test mode.
4. Click **OK**. The Test Mode window is displayed.

Test data is grouped on three tabs:

- ◆ Energy: kWh, kVAh, kVARh delivered and received data.
- ◆ Rolling Demand: kW Demand, kW Peak Demand delivered and received, and Test Demand settings (number of sub-intervals, sub-interval length). Click **Peak Reset** to reset the test-mode demand registers.
- ◆ Volts, Amps and Power: real-time values, updated once per second. Click **Loss Mode** to select single-phase or three-phase loss mode.

Click **Test Reset** on any tab to reset the test mode registers.

5. Click **Close**. A dialog box informs you the meter has returned to normal mode.

NOTE

All test mode registers are reset when the meter returns to normal mode.

Configuring Energy Measurements

Use ION Setup to configure the meter’s energy measurement test parameters.

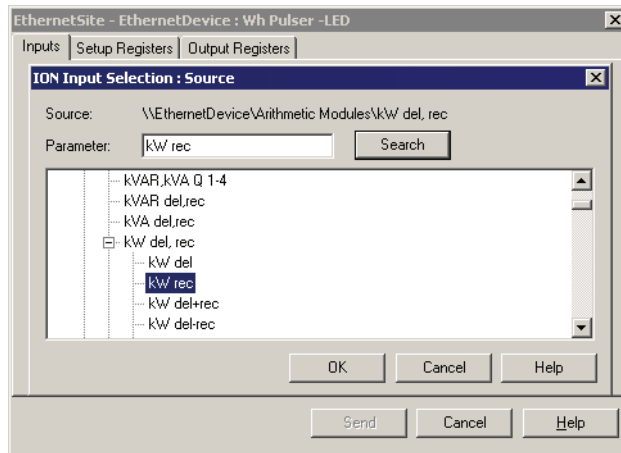
Changing the Energy Measurement

You can test accuracy over either of the meter’s two hardware channels (the front panel pulser LED or the DO4 digital output) by configuring the channel to pulse based on one of the following energy measurements:

- ◆ kWh del+rec (default)
- ◆ kVARh del
- ◆ kVARh rec
- ◆ kWh del
- ◆ kWh rec

Using ION Setup to configure the pulse source

1. Open ION Setup and connect to the meter in Advanced Mode.
2. Open the Calibration Pulser Modules folder.
3. Double-click the **Wh Pulser -LED** module to edit the front panel pulser LED or the **Wh Pulser -D4** module to edit the DO4 digital output. If security is enabled on the meter, you are prompted for the meter’s password.
4. Select the Inputs tab.
5. Select the *Source* register and click **Edit**. The ION Input Selection: Source dialog is displayed.

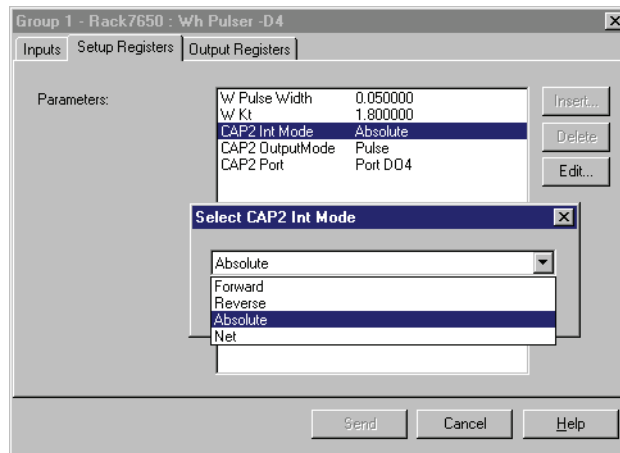


6. Scroll down to Integrator Modules and double-click to view all Integrator Module sources. Select your pulse source from the list and click **OK**.

NOTE

Your *Source* input must be in kW (not Watts).

- Click on the Setup Registers tab. Select *CAP Int Mode* and click **Edit**.



Select the *CAP Int Mode* setting that corresponds to your energy measurement and click **OK**.

Energy Measurement	CAP INT Mode Setup Value
kWh del+rec, kVARh del+rec	Absolute
kVARh del, kWh del	Forward
kVARh rec, kWh rec	Reverse
kWh del-rec, kVARh del-rec	Net

- Click **Send** to save your changes to the meter.

Changing the Pulse Weight

Use ION Setup to adjust the number of energy units per pulse.

Using ION Setup

- Open ION Setup and connect to your meter in Advanced Mode.
- Open the Calibration Pulser Modules folder.
- Double-click the **Wh Pulser -LED** module to edit the front panel pulser LED or the **Wh Pulser -D4** module to edit the DO4 digital output. If security is enabled on the meter, you are prompted for a password.
- Select the Setup Registers tab.
- Select the *W Kt* register and click **Edit**.
- The Enter W Kt dialog box is displayed. Enter the desired pulse weight in Wh/pulse.

NOTE

The pulse rate must be less than 10 Hz for the meter’s LED or digital output to operate accurately.

- Click **OK** and then **Send** to save your changes to the meter.

The Kt value entered defines how much energy the module accumulates before a pulse is sent to the hardware channel. The front panel pulser LED and D4 output are factory set to the same pulse rate. The default Kt value is shown on the label located on the top of the meter, and depends on the meter's form factor and current input option.

Current Input Option	Default Pulser LED rate	Default D4 pulse rate
1 A	0.18 Watt-hours per pulse	0.18 Watt-hours per pulse
5 A	1.8 Watt-hours per pulse	1.8 Watt-hours per pulse

Test Points

Refer to “Configuring Energy Measurements” on page 12 for instructions on how to select and configure the energy measurement source.

Wh test points

It is common practice to test these watt-hour test points:

Watt-hour Test Point	Specifications
Full Load	100% of the rated current, test voltage and rated frequency at unity power factor, or one (1).
Light Load	10% of the rated current, test voltage and rated frequency at unity power factor, or one (1).
Lagging Power Factor	100% of the rated current, test voltage and rated frequency at 0.50 lagging power factor (current lagging voltage by 60° phase angle).

VARh points

It is common practice to test these VAR-hour test points:

VAR-hour Test Point	Specifications
Full Load	100% of the rated current, test voltage and rated frequency at zero power factor (current lagging voltage by 90° phase angle).
Light Load	10% of the rated current, test voltage and rated frequency at zero power factor (current lagging voltage by 90° phase angle).
Lagging Power Factor	100% of the rated current, test voltage and rated frequency at 0.87 lagging power factor (current lagging voltage by 30° phase angle).

NOTE

The rated current is located on the ION7550 / ION7650 serial number label, found on the top of the meter.