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### Installation Considerations

Installation and maintenance of the ASCO 5400 Series Power Quality Meters should only be performed by qualified, competent personnel that have appropriate training and experience with high voltage and current devices. The meter must be installed in accordance with all Local and National Electrical Codes and regulations.

This equipment has no user serviceable parts.

### Important Symbols Used in This Manual

#### **DANGER**

DANGER is used in this manual to warn of a hazardous situation which, if not avoided, will result in death or serious injury.

#### **WARNING**

WARNING is used in this manual to warn of a hazardous situation which, if not avoided, could result in death or serious injury.

#### **CAUTION**

CAUTION is used in this manual to warn of a hazardous situation which, if not avoided, could result in minor or moderate injury.

#### **NOTICE**

NOTICE is used in this manual to address practices not related to physical injury.



# Section 1. Introduction

## Safety Information

To avoid electrical shock or fire:



- Review the entire manual before using the instrument and its accessories.
- Observe all warnings and cautions.
- Do not operate the instrument around explosive gas or vapor.
- Avoid working alone.
- Before use, inspect the instrument, leads and accessories for mechanical damage, and replace when damaged. Pay special attention to the insulation surrounding the connectors and plugs.
- Remove all accessories that are not in use.
- Make sure the instrument is properly grounded to a protective earth ground.
- Do not apply input voltages above the rating of the Instrument as shown on the name plate.
- Do not insert metal objects into connectors and openings.
- Never open the instrument's enclosure during operation; dangerous voltages are present.
- Use the instrument only as specified in this manual, or the protection provided by the instrument may be impaired.
- Do not expose the instrument to extreme moisture and or rain.
- Do not operate the instrument or its accessories when found wet for any reason.

## Overview

The ASCO 5400 Series Power Quality Meter, the next generation in electrical Power Quality recorders and analyzers. Powered by revolutionary PQZip<sup>1</sup> compression technology, the 5400 Power Quality Meter is capable of recording up to 1000 times more information than competitive instruments with equivalent memory sizes. Practically, the ASCO 5400 Series Power Quality Meter is designed to store continuously, cycle by cycle, all parameters of data, including waveforms at maximum resolution for more than a year, internally, without the need of an external storage device or computer, as well as providing Power Quality parameters according to EN 61000-4-30 Class A. The optional PowerQuest Analytics software package provides an innovative and convenient way of performing even the most complicated power quality investigations. A State of the Art PowerQuest Investigator application helps to explore power quality events, zooming in and out on any parameter at High Definition resolution, from months to microseconds in mouse-click speed and simplicity.

The Embedded web pages are the user interface to the unit. Real time parameters can be viewed and the unit configuration can be performed using the website. The optional ASCO 5010 Display Unit enables configuring of the Power Quality Meter and also displays all monitored real time values.



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<sup>1</sup> Refer to “PQZip” chapter on page 106 for more information

## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

Product Series	5410	5450	5490
<b>Real-time Measurements</b>			
Voltage/current: per phase, average, unbalance	✓	✓	✓
Power: real, reactive, apparent, power factor, frequency	✓	✓	✓
Energy: bi-directional, total, import, export, net	✓	✓	✓
Demand: block, rolling block, thermal, predicted	✓	✓	✓
Sampling rate, maximum samples/cycle	<b>256</b>	<b>512</b>	<b>1024</b>
Harmonics (individual, even, odd, total) up to	<b>127th</b>	<b>255th</b>	<b>511th</b>
Measurement according to IEC 61000-4-30 Class A	✓	✓	✓
Measurement during overloading (from nominal)	<b>x2</b>	<b>x10</b>	<b>x10</b>
Type of Analog to Digital converter	<b>12 bit</b>	<b>16/20* bit</b>	<b>16/20* bit</b>
<b>Data and Waveforms Logs</b>			
Cycle-by-cycle PQZIP logging	✓	✓	✓
Event logs	✓	✓	✓
Waveform logs	✓	✓	✓
Min/max logs for any parameter	✓	✓	✓
<b>Timestamps, resolution in micro seconds</b>			
- with Ethernet synchronization <sup>1</sup>	<b>50</b>	<b>50</b>	<b>50</b>
- with GPS synchronization <sup>1</sup>	<b>1</b>	<b>1</b>	<b>1</b>
<b>Storage Capacity</b>			
Internal Memory	<b>128 MB</b>	<b>4 GB</b>	<b>16 GB</b>
<b>Power Quality Analysis</b>			
Sag/swell monitoring	✓	✓	✓
Unbalance components: zero, negative, positive	✓	✓	✓
Transient detection, microseconds (50Hz/60Hz)	<b>78.1/65.1µs</b>	<b>39/32.5µs</b>	<b>19.5/16.3µs</b>
Flicker (IEC 61000-4-15)	✓	✓	✓
Fast Flickering	✓	✓	✓
Compliance testing to EN50160	✓	✓	✓
EN50160 Timestamps	✓	✓	✓
Configurable for IEEE 519-1992, IEEE 1159, SEMI	✓	✓	✓
Time stamps of above	-	✓	✓
Inter-harmonics	✓	✓	✓
<b>Input/Output Points</b>			
Analog Inputs	<b>0</b>	<b>4</b>	<b>8</b>
Analog Outputs	<b>0</b>	<b>4</b>	<b>8</b>

## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

Product Series	5410	5450	5490
Digital Inputs	0	4	16
Digital Outputs	0	4	8
<b>Communication Protocols</b>			
OPC	✓	✓	✓
Ethernet Ports	1	2	2
Power Over Ethernet (PoE)- In	✓	✓	✓
Power Over Ethernet (PoE)- Out	–	✓	✓
RS-485/422 port	✓	✓	✓
USB Port (power only)	–	✓	✓
Voltage Ride Through on Power Loss (up to)	<b>10 sec.</b>	<b>25 sec.</b>	<b>25 sec.</b>
Onboard Comprehensive Web Server	✓	✓	✓
DNP3	✓	✓	✓
<b>Email Notifications</b>			
SMTP Client	✓	✓	✓

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<sup>1</sup>Meters require independent network to achieve published performance; 1ms synchronization otherwise.

## Section 2. Quick Start

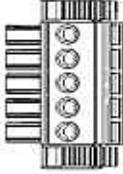
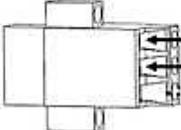
The **Quick Start** chapter covers all relevant procedures relating to the first time hardware installation and wiring as well as the web interface configuration.

### Step 1: Unpacking the Power Quality Meter

The Power Quality Meter comes from the factory in a sealed carton to protect from damage during transport. The small parts are shipped in a sealed bag with the unit.

**To unpack the Power Quality Meter:**

- Remove the unit and all of the following components from the carton.

QTY	Illustration	Part Description
1		Power Quality Meter Models <ul style="list-style-type: none"> <li>• ASCO-5410</li> </ul>
1		Power Quality Meter w/ Multi I/O Module(s) Models <ul style="list-style-type: none"> <li>• ASCO-5450 (shown on left)</li> <li>• ASCO-5490</li> </ul>
1		Voltage terminal block connector – For Sampling
1		AC/DC terminal block connector – For Powering the unit

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QTY	Illustration	Part Description
1		RS485/422 Communication terminal block For communication
1		48VDC terminal block connector - For Supply
1		Temperature Sensor terminal block connector For PT100 type
2		Clamping yoke holder on rail 35mm FM 4
1	<b>ASCO 5400 User's Guide</b>	Power Quality Meter Full User Guide

### Step 2: Before Getting Started

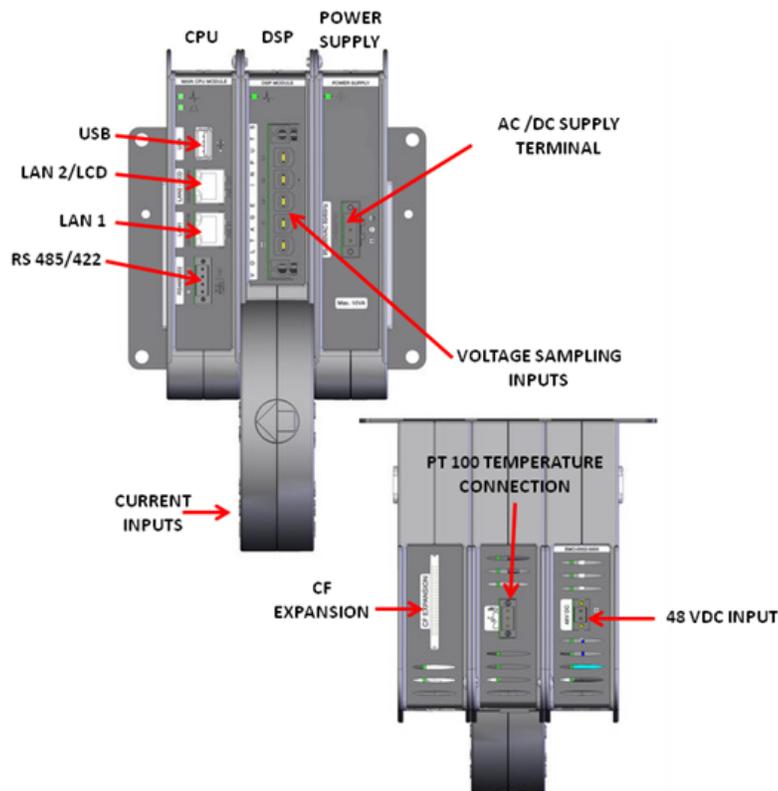
Familiarize yourself with all components of the ASCO 5400 Power Quality Meter device. In addition, follow all of the safety precautions as shown in [Safety Information on page 1](#).

#### What You Will Need

- Wire Strippers
- Phillips Screwdriver
- Flat head screwdriver
- The complete Power Quality Meter unit and components
- This User Guide

## The Power Quality Meter

The Power Quality Meter is a state-of-the-art power monitoring device. The basic unit is comprised of three modules (Central Processing Unit (CPU), Digital Signal Processing (DSP), and Power Supply (PS)). The following is a component identification and physical description:



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**NOTICE**

*For more details, please refer to [Section 4. The Hardware](#) on page 39.*

---

### Step 3: Mounting the Power Quality Meter

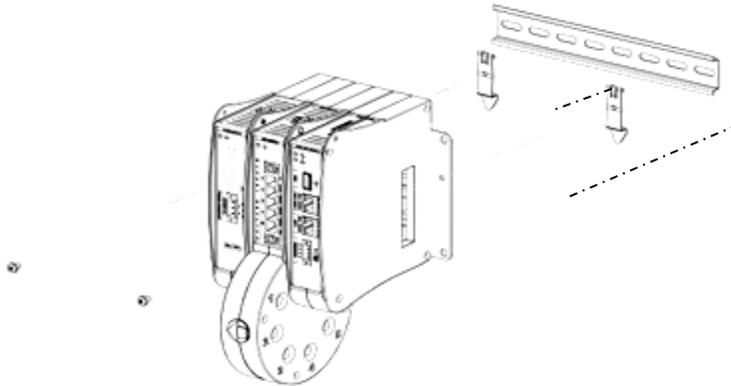
The Power Quality Meter is intended to be mounted in an enclosure either fastened to a DIN Rail or a flat surface.

#### Mounting to a DIN Rail

DIN Rail mounting is the most common method of mounting the Power Quality Meter. Utilizing this method requires the clamping yoke holders provided with each unit.

#### To mount the unit to a DIN Rail:

- Connect the **clamping yoke holders** to the back plate of the Power Quality Meter using the two screws provided.
- Attach the entire unit with the holders to the **DIN rail**.



---

#### **NOTICE**

*The order of the modules (left to right) may differ from the figures provided.*

*For a detailed listing of physical dimensions, please refer to*

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*Physical Dimensions on page 42.*

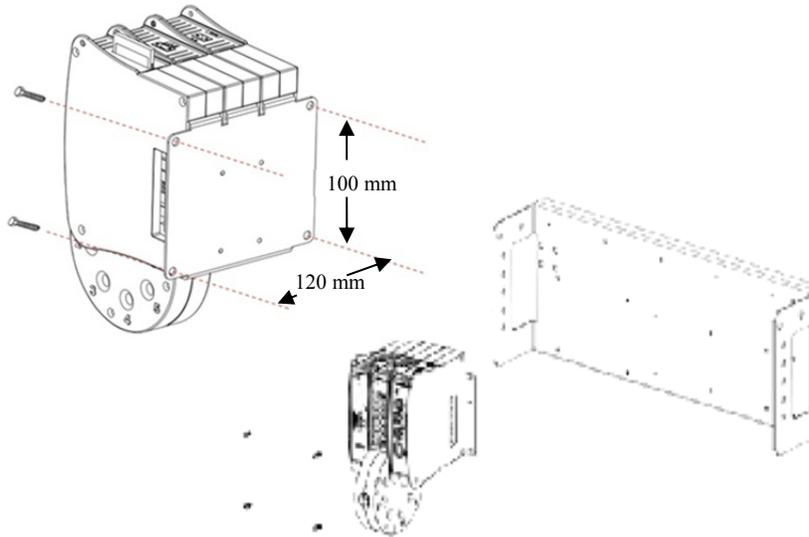
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## Mounting to a Plate

The Power Quality Meter instrument can be directly mounted to a flat surface using four screws (not provided) through the back plate.

### To mount the unit to a plate:

- Follow the diagram below.



---

### **NOTICE**

*Contact your local representative for more information on mounting the unit outside of an enclosure.*

---

## Step 4: Connecting the Power Supply

The Power Supply module converts any of the following inputs to a stable operating voltage to be used for the 5400 system:

- AC/DC Supply Terminal
- 48 VDC Input
- POE Power Over Ethernet

### **WARNING**

*Make sure the panel is de-energized before commencing.*

### Energizing the AC/DC Supply Terminal

This AC terminal can be fed with either AC or DC voltage with the following parameters:  
The procedure to wire both is the same.

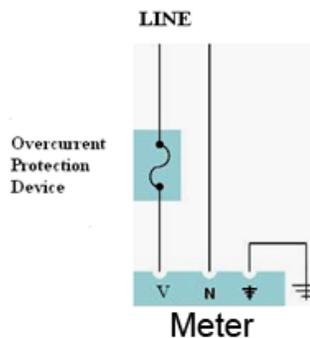
- 100-260VAC 50/60Hz
- 100-300VDC

### To energize the AC/DC Supply terminal:

- Install an Over current protection device on the AC phase line side before the unit.

### **WARNING**

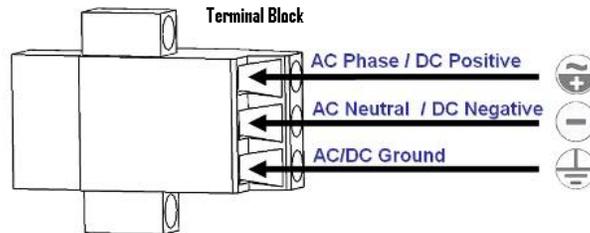
*It is recommended to install a 2A fuse and/or circuit breaker in series to the instrument terminals according to local wiring codes.*



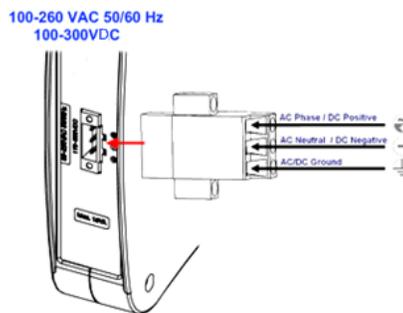
- Remove the **AC/DC terminal block connector** provided with the Power Quality Meter package

## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

- Attach the bared ends of wires to the **AC/DC terminal block connector** using a properly sized flat-head screwdriver.



- Insert the terminal block into the **Power Supply terminal**.
- Verify the correct polarity of the terminal.



### **WARNING**

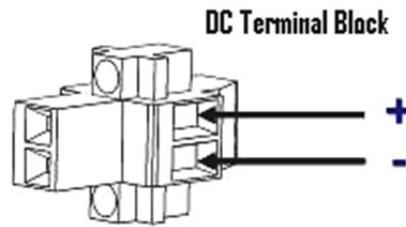
*When powering down the instrument by closing the circuit breaker, internal low voltage remains on the instrument terminals, and consequently on the downstream side of the circuit breaker for up to 25 seconds, due to the ride through back up feature.*

### **Energizing the 48VDC Input**

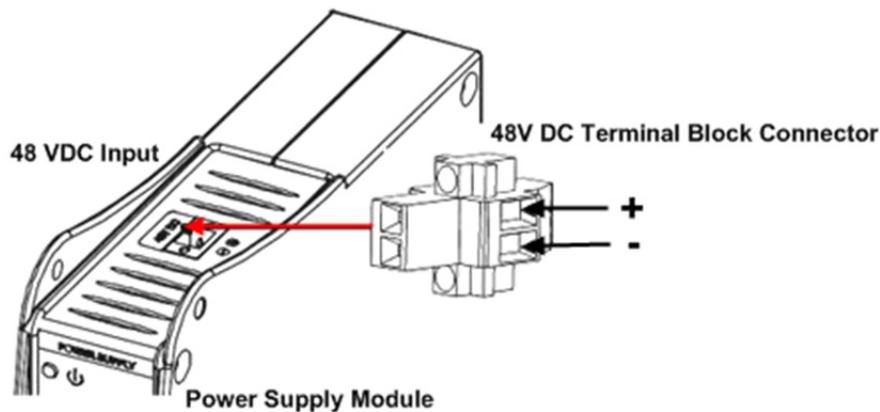
The two wire 48V DC voltage input is positioned on the upper side of Power Supply module.

#### **To energize the 48VDC terminal:**

- Remove the **48VDC terminal block connector** provided with the Power Quality Meter package.
- Attach lugged ends of wires to the terminal block using a properly sized flat head screw driver.



- Insert the **48V DC terminal block connector** into the Power Supply module.
- Verify the correct polarity of the terminal.



## **WARNING**

*When powering down the instrument by closing the circuit breaker, internal voltage remains on the downstream side of the circuit breaker for up to 25 seconds, due to the ride through back up feature.*

## Power Supply Features

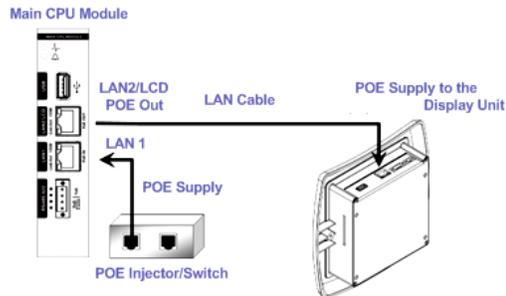
The Power Supply is equipped with the following features:

- The Power Supply module has an automatic power source selection circuit which will automatically switch to the strongest power source available.
- The Power Supply module is equipped with ride-through backup circuitry designed to keep the instrument energized for up to 25 seconds.

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## Power over Ethernet (PoE)

PoE is a standard for feeding DC power to an RTU (Remote Terminal Unit) via the RJ45 interface using the network LAN cable without the need for additional external power.



The Power Quality Meter contains two ports that support PoE:

- The LAN1 port can receive PoE supply for the 5400 unit from a remote source, enabling the ASCO Power Quality Meter to operate. It is suggested that the LAN1 PoE be used as an alternative backup power source. To activate this PoE option, connect an RJ45 jack with PoE to the marked **LAN1 PoE In** on the CPU module.
- The LAN2/LCD, (*Available on 5450/5490 PQM's*) port has PoE out capability for supplying power to other devices. The LAN2/LCD port can supply power for the ASCO 5010 Remote Display Unit. To activate this PoE option, connect an RJ45 jack to the port marked **LAN2/LCD PoE Out** on the CPU module, connecting the other end of the RJ45 jack to an ASCO 5010 RDU.

## Step 5: Wiring the Unit

The DSP (Digital Signal Processing) module receives analog signals and converts them to digital signals to be measured and stored for further process and analysis. This step will provide you with the following:

- Power Configuration
- Wiring Voltage Connections
- Wiring Current Connections
- Establishing Communication Connection



***Make sure the panel is de-energized before commencing.***

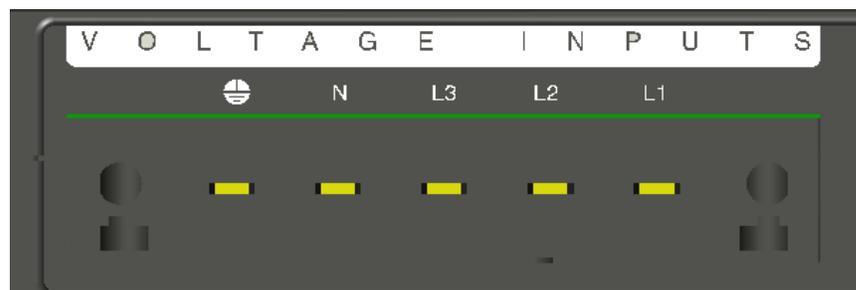
## Power Configuration

The ASCO 5400 Series Power Quality Meter Series is designed to serve in virtually any power topology configuration.

### **NOTICE**

*Please refer to the [Section 3. Power Type Diagrams](#) on page 34 for specific wiring configurations.*

## Wiring Voltage Connections



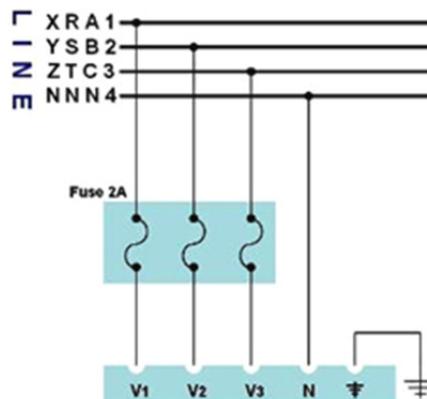
Five terminals are available for the voltage sampling inputs. They are marked as L1, L2, L3, N, and  $\oplus$ . Each of the 4 inputs (V1, V2, V3, N) are capable of receiving electrical signals of up to 1KV continuous RMS (up to 8KV transient).

### To wire voltage connections

- Install an over current device on the AC phase lines.

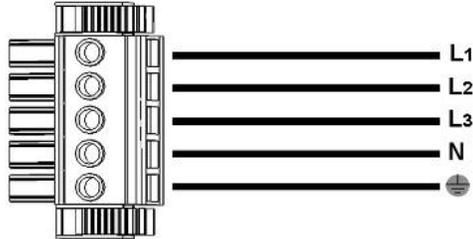
### **WARNING**

**Warning:** You must install a 2A fuse and/or circuit breaker in series to the instrument's voltage sampling input terminals according to local wiring codes.

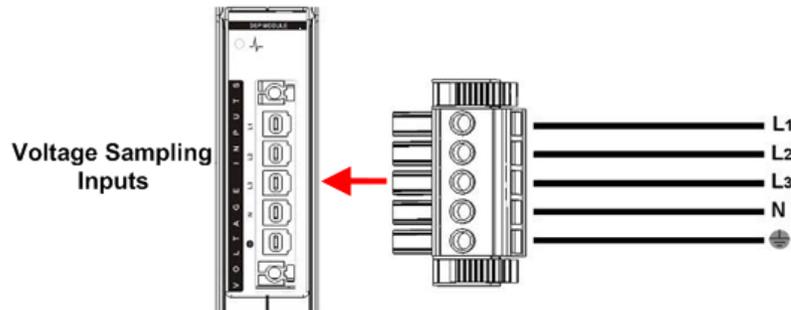


## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

- Remove the **voltage terminal block connector** provided with the Power Quality Meter package.
- Attach lugged ends of wires to the terminal block using a properly sized screw driver.



- Insert the terminal block into the voltage sampling inputs.
- Verify the correct voltage polarity of the terminal.



### **WARNING**

*Powering down the instrument does not remove voltage from the voltage sampling terminals.*

### Detaching the Voltage Terminal Block Connector

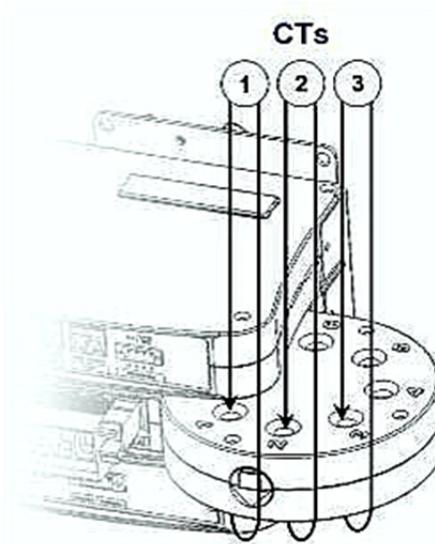
If you need to disconnect the unit from the measured voltages, you need to detach the voltage terminal block connector.

#### To detach the voltage terminal block connector:

- Loosen the screws anchoring the block in place
- Slide the orange thumb locks out.
- Pull out the terminal block.

## Wiring Current Connections

Electric current is sampled as it flows through cylindrical apertures in the circular section of the centrally mounted Digital Signal Processing (DSP) module. There are a total of six (6) apertures. Typically only the first four (4) are used as current inputs for I1, I2, I3, and IN (neutral current optional as the fourth input).



### To wire current connections:

- Install current transformers in series ahead of the unit.

#### **WARNING**

***Current transformers outputs must be short circuited to prevent them from getting damaged. Dangerous voltages exist between the two output leads.***

- Feed the current lines through the cylindrical apertures in the circular section of the DSP module.
1. Verify the polarity of current conductors with the arrows on the circular section of the DSP.

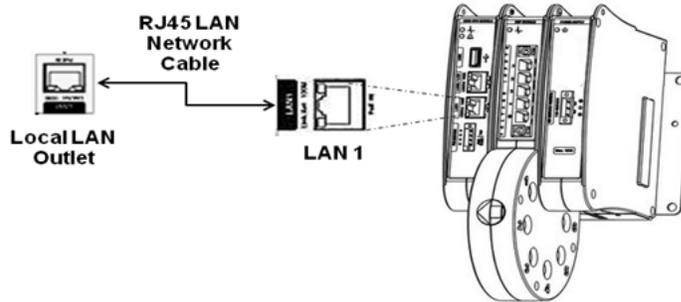
#### **NOTICE**

***The current lines are short circuits to the current transformers (CT's). Take note of the CT ratios for set up later in the firmware. If current polarity is reversed, it can be corrected later in the unit setup.***

## Establishing Communication

The device may be connected using the LAN1 Port directly to an existing local LAN (if one exists). Alternatively, you may connect the device directly to the PC to establish initial communication (see [Establish a Direct Connection on page 147](#)).

**To connect the device to the local LAN:**



### **NOTICE**

*We strongly recommend that you record the device serial number (left side of the unit facing), location on the grid, and physical location for future reference.*

## Attaching the Temperature Connections (Optional)

The DSP module is equipped with an external connection terminal for a PT-100 temperature sensor. The Power Quality Meter is also equipped with two internal temperature sensors, one in the DSP module and the second in the Power supply module. The PT 100 temperature sensor is an optional device. The temperature module from the DSP provides reference for compensation of temperature related reading offsets. For more details on attaching the temperature connections see [Appendix E: Temperature Connection on page 159](#).

## Step 6: Powering Up the Unit

After the unit has been mechanically fastened and all voltage, current, and communication wiring is complete, you need to power up the Power Quality Meter.

### Preliminary Inspection

#### **⚠ WARNING**

**To avoid electrical shock or fire:**

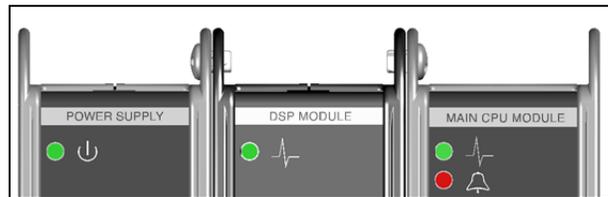
- Verify that the unit is disconnected from the main power supply.
- Inspect all electrical and mechanical connections visually for mechanical damage and integrity of components and accessories.
- Inspect current transformer wiring for proper direction through the cylindrical aperture of the current sampling module.
- Pull-test all control wiring to ensure secure seating in terminals.

## Verify Operation with Indicators

### To verify operation with indicators:

- Turn on the power supplying the unit

The LEDs on the power supply light up.



2. Verify the unit is operating correctly with reference to the following table:

LED	Description
	<b>Power Supply Module:</b> Green signals that external power exists. Red signals external power is out; unit will soon cease to function (25 seconds max.).
	<b>DSP Module:</b> Blinking green signals normal operation and system boot.
	<b>Main CPU: Module:</b> Green signals normal operation.
	<ul style="list-style-type: none"> <li>• <b>Blinking Red:</b> During Shutdown process.</li> <li>• <b>Constant Red:</b> While Alarm is active (based on alarm configuration) May signal malfunction. See <a href="#">Appendix A: Troubleshooting on page 151</a>.</li> </ul>

## NOTICE

*After powering up, wait at least one minute until the startup process is complete.*

*The red indicator light will remain on until the PQZip is enabled by the user. Please refer to [Enabling PQZip on page 32](#).*

## Step 7: Establishing a First Time Connection

This following section describes how to achieve initial communication with the Power Quality Meter for the purpose of configuring the instrument using the LAN port with IP connectivity. In order to achieve communication with the unit, the PC must be on the same LAN as the Power Quality Meter device. This can be accomplished by connecting the device to the local LAN with a DHCP server, then using the **ASCO 5400 Search** utility to identify the devices on the network. For more on ASCO search, see [ASCO Search Utility on page 132](#).

Alternately, you may establish a direct connection between the device and the PC. Please refer to [Establish a Direct Connection on page 147](#).

---

### **NOTICE**

*The Power Quality Meter unit comes from the factory with a default IP address of 169.254.249.247 for a direct connection to a PC (see [Establish a Direct Connection on page 147](#)).*

*The unit also comes DHCP enabled to allow the DHCP on a network to allocate an IP that would place the unit into the same address range as the host PC from the control center.*

*In some circumstances, it may be necessary to change the IP configuration of the PC (see [Change the IP Configuration on page 148](#)) in order to connect to the unit.*

---

### Download the ASCO Search software

The ASCO search software is a utility that enables you to identify all Power Quality Meter (portable and fixed) devices on the local network. For more on ASCO Search see [ASCO Search Utility on page 132](#).

You may obtain the ASCO search software either of the following ways:

- Contact <https://support.ascopower.com> or dial 1-800-800-ASCO(2726) in North America or dial +1 973-360-3600 when International
- Use the Power Quality Meter CD (if available)

## Using the Automatic Search Utility – ASCO Search

### To use Automatic Search

- Click the **ASCO Search** icon.

The Security Warning dialog box appears.

The Utility broadcasts "Discovery" transmissions over the LAN to which every unit responds with its configuration. The search cannot extend beyond the local LAN. The broadcast will extend across most hubs and switches, but will not pass gateways, routers or firewalls. Only one occurrence of the ASCO Search utility can be executed at one time

- Click **Run**.

The ASCO Search window appears displaying the device(s) on the LAN.

#	IP Address	Unit Description	SubnetMask	Gateway IP	IP Mode	PHY	Firmware	Hardware	Serial Number
1	100.100.100.152	Site Name	255.255.255.0	100.100.100.254	DHCP	Main	0.3.20.4	2x2x2	SE.70.04.7F.3B.9E

### **NOTICE**

*If the Login page does not appear, please refer to*

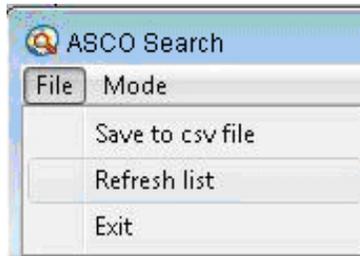
*[Disable Proxy Server in Internet Explorer on page 144.](#)*

### **NOTICE**

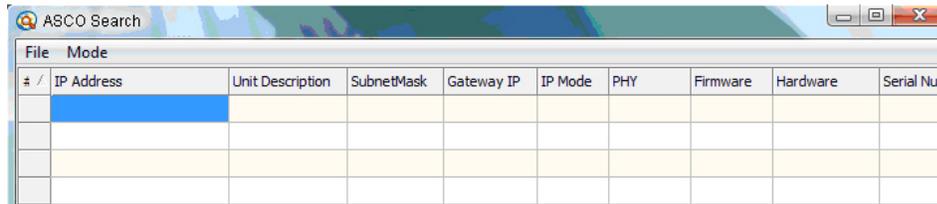
*The unit (specifically identified by the serial number which is the same as the unit's MAC address) has a unique IP address obtained automatically by DHCP or assigned by the network administrator. It is important to record this IP address along with its serial number/MAC address, and associate them with the mapping of the units, during the installation phase. This information will be used to configure the LAN1 settings in Configuration chapter to follow. (See [LAN 1 on page 81](#)).*

- Click **File**→**Refresh list** to update the list of devices on the network.

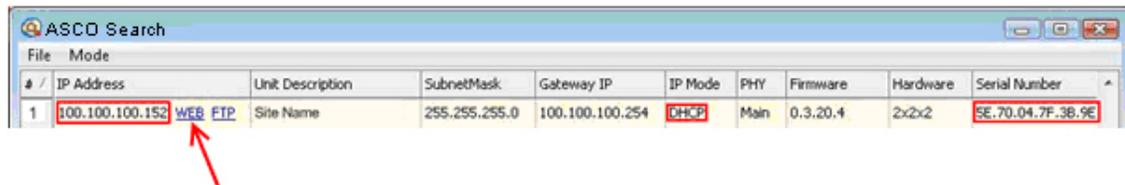
## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL



If the ASCO Search software does not find the unit, a blank screen will appear as below. You then need to do the following:



- Close all other running occurrences of the search or Investigator software
- Click File→Refresh List.



- Select a specific device by clicking on the **WEB** link.

## Step 8: Configuring the Unit

After a connection is established between Internet Explorer and the unit, you may then access the Power Quality Meter's internal Website by clicking the Web link to the specific device. This Web interface is designed to serve as the main user interface with the instrument, providing enhancement, configuration, and real-time monitoring functionality.

### Accessing the Web Interface

When an Ethernet connection is established between a unit and the host computer, the internal Web interface can be accessed most commonly using the ASCO Search utility on a local LAN, or by typing the IP address (if known) directly into the address field of the Web browser application.

---

**NOTICE**

*The Website is optimized to work with Microsoft® Explorer 7. Other web browser applications can limit some functionality and/or show an incorrect layout. (I.E. 8 works in compatibility view mode).*

*For local networking the browser should be configured as working without a proxy server.*

---

## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

#	IP Address	Unit Description	SubnetMask	Gateway IP	IP Mode	PHY	Firmware	Hardware	Serial Number
1	100.100.100.152	Site Name	255.255.255.0	100.100.100.254	DHCP	Main	0.3.20.4	2x2x2	SE.70.04.7F.3B.9E

- After clicking the **WEB** link, the **LOGIN** page appears.



### **NOTICE**

*If the Login page does not appear and you see a screen as below, you need to refer to*

*Disable Proxy Server in Internet Explorer on page 144.*

3. Enter the admin password (**12345**) in order to enable modification of parameters.
4. Click **Login** to enter.

The Web interface opens into the Monitoring Summary page.

Summary	
Frequency	49.953 Hz
$I_{avg}$	0.0009 A
$V(LL)_{avg}$	0.9367 V
$V(LN)_{avg}$	219.32 V
Power factor <sub>total</sub>	0.4081 (Cap)

# ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

## Setting System Parameters

Once a successful communications link has been established with the Power Quality Meter, you need to perform the first time setup and configuration. The following is a list of default parameter settings with a reference on where to find information in order to modify the default setting.

Parameter	Default Setting	For Reference on How to Modify Refer to:
<b>DEVICE SETUP</b>		
<b>Device Info</b>	<ul style="list-style-type: none"> <li>• Site Name: Site Name</li> <li>• Description: 5400 Unit</li> <li>• Operator: Operator Name</li> <li>• Company Name: Company Name</li> <li>• POE Output: Enable</li> </ul>	<a href="#">5400 Unit Configuration on page 72</a>
<b>Network Time</b>	<ul style="list-style-type: none"> <li>• Transport: Automatic</li> <li>• Main SNTP: 169 254 249 254</li> <li>• Alternate SNTP: 169 254 249 254</li> </ul>	<a href="#">Network Time on page 74</a>
<b>Time Setup</b>	<ul style="list-style-type: none"> <li>• Time Zone: UTC +2 (as per installation location)</li> </ul>	<a href="#">Time Setup on page 75</a>
<b>Daylight Savings Time</b>	<ul style="list-style-type: none"> <li>• Disabled (as per installation location)</li> </ul>	<a href="#">Daylight Saving on page 75</a>
<b>Power Configuration</b>	<ul style="list-style-type: none"> <li>• WYE 4 Wire (according to topology of installation point)</li> </ul>	<a href="#">Power Configuration on page 76</a>
<b>Potential Transformer (PT)</b>	<ul style="list-style-type: none"> <li>• Primary: 400</li> <li>• Secondary: 400 (according to installation point)</li> </ul>	<a href="#">Potential Transformer (PT) on page 76</a>
<b>Voltage Polarity</b>	<ul style="list-style-type: none"> <li>• <math>V_n</math>: Normal</li> <li>• <math>V_1</math>: Normal</li> <li>• <math>V_2</math>: Normal</li> <li>• <math>V_3</math>: Normal</li> </ul>	<a href="#">Voltage Polarity on page 77</a>
<b>Voltage Nominals</b>	<ul style="list-style-type: none"> <li>• F(Hz): 50</li> <li>• V(V): 400</li> </ul>	<a href="#">Nominals on page 77</a>
<b>Currents</b>	<ul style="list-style-type: none"> <li>• CT Primary: 50</li> <li>• CT Secondary: 50</li> </ul>	<a href="#">Currents on page 78</a>
<b>Current Nominals</b>	<ul style="list-style-type: none"> <li>• I/A: 50</li> </ul>	<a href="#">Currents on page 78</a>
<b>Current Polarity</b>	<ul style="list-style-type: none"> <li>• <math>I_n</math>: Normal</li> <li>• <math>I_1</math>: Normal</li> <li>• <math>I_2</math>: Normal</li> <li>• <math>I_3</math>: Normal</li> </ul>	<a href="#">Currents on page 78</a>
<b>Non Measured Currents</b>	<ul style="list-style-type: none"> <li>• Calculate Phase: All Measured</li> </ul>	<a href="#">Non-measured Current on page 78</a>

## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

Parameter	Default Setting	For Reference on How to Modify Refer to:
<b>COMMUNICATION</b>		
<b>Security</b>	<ul style="list-style-type: none"> <li>• Password: Open to be defined</li> <li>• FTP Login: ASCO</li> <li>• FTP Password: Open to be defined</li> </ul>	<a href="#">Security on page 79</a>
<b>Network</b>	<ul style="list-style-type: none"> <li>• Auto DHCP: Enable</li> <li>• LAN 1 IP Address: 169.254.249.247 (as a standalone unit for direct non DHCP connections)</li> <li>• Subnet Mask: 255 255 0. 0</li> <li>• HTTP Port: 80</li> <li>• FTP Daemon: 21</li> <li>• FTP Data: 20</li> <li>• SMTP Port: 25</li> <li>• Gateway: 169.254.249.254</li> <li>• SMTP Server: 0.0.0.0</li> <li>• Modbus TCP Slave-Address: 159</li> <li>• Modbus Port: 502</li> <li>• DNP3 Port: 20000</li> <li>• DNP3 Validate ID: Enable</li> <li>• DNP3 Validate Source: Disable</li> <li>• Source Address: 4</li> <li>• Destination Address: 3</li> </ul>	<a href="#">Network on page 80</a>
<b>Serial</b>	<ul style="list-style-type: none"> <li>• RS 485/422 Bitrate: 19200</li> <li>• RS 485/422 Flow: Full</li> <li>• Serial Mode: TTY</li> <li>• Modbus Slave Address: 159</li> <li>• PPP Status: Enable</li> <li>• CHAPStatus: Enable</li> </ul>	<a href="#">Serial Ports on page 85</a>
<b>PQ COMPLIANCE</b>		
<b>Power Compliance</b>	<ul style="list-style-type: none"> <li>• Compliance Type: EN50160</li> <li>• Compliance Status: Stop</li> </ul>	<a href="#">Power Compliance on page 87</a>
<b>ADVANCED</b>		
<b>System Log</b>	<ul style="list-style-type: none"> <li>• Start At: 0</li> <li>• Page Size: 15</li> <li>• Time: UTC</li> </ul>	<a href="#">System Log on page 88</a>
<b>Custom Events</b>	<ul style="list-style-type: none"> <li>• Events Preset: User Defined</li> <li>• Action on Selected Events: Delete</li> </ul>	<a href="#">Custom Events on page 88</a>
<b>PQZip Recording</b>	<ul style="list-style-type: none"> <li>• Status: Disable</li> <li>• PQZip Mode: Fixed Ratio</li> <li>• Monthly Ratio: 700 MB.</li> <li>• V/I Relation (%): 66</li> <li>• File Capacity: 150 minutes</li> </ul>	<b>Error! Reference source not found. on page 94</b>

## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

Parameter	Default Setting	For Reference on How to Modify Refer to:
<b>Email Alerts</b>	<ul style="list-style-type: none"> <li>• Power Up</li> <li>• Power Loss</li> <li>• Supply Voltage Variations</li> <li>• Short Interruptions</li> <li>• Long Interruptions</li> </ul>	<a href="#">Email Alerts on page 95</a>
<b>Reports</b>	<ul style="list-style-type: none"> <li>• Duration: 1/Month</li> <li>• Log Restart: 12:00 on 1<sup>st</sup> of the month</li> </ul>	<a href="#">Reports on page 96</a>
<b>Energy Meter</b>	<ul style="list-style-type: none"> <li>• Metering Interval: 15 minutes</li> <li>• Sliding Window: Enable</li> </ul>	<a href="#">Energy Meter on page 97</a>
<b>Display Setup</b>	<ul style="list-style-type: none"> <li>• Phase Format: N123</li> <li>• PF Unit Format: Cap/Ind</li> <li>• Temperature Format: Celsius</li> <li>• Lightweight Website: Disable</li> <li>• Table Data Accuracy: Regular</li> <li>• Default Language: English</li> </ul>	<a href="#">Display Setup on page 99</a>
<b>Firmware Upgrade</b>	<ul style="list-style-type: none"> <li>• Active Bank: B</li> <li>• FTP Server: 100.100.100.11</li> <li>• FTP Username: g4k</li> <li>• FTP Password: Gg54321</li> <li>• Firmware Filename: Meter_0_3_10_C000.bin</li> </ul>	<a href="#">Firmware Upgrade on page 99</a>

## Setting a Fixed IP Address

Although all default parameters can be configured according to the individual requirements of the installation, it is strongly recommended to set a fixed IP address for LAN 1. This is especially important so that when using the PQSCADA software, you are assured of collecting data from the correct device.

R/O CONFIGURATION » NETWORK

Apply changes Refresh data

LAN1

Auto DHCP	Disable
IP address	100. Enable
Subnet mask	255.255.255.0

To set a fixed IP address:

- From the **Configuration** → **Network** page, set Auto DHCP to **Disable**.

R/O CONFIGURATION » NETWORK

Apply changes Refresh data

LAN1

Auto DHCP	Disable
IP address	100.100.100.122
Subnet mask	255.255.255.0

- Enter the desired IP address. (Consult your IT manager), then click **Apply Changes**.

### **NOTICE**

*Changing the IP address requires a restart of the unit. You will be prompted to restart the unit now or wait as shown in the following.*

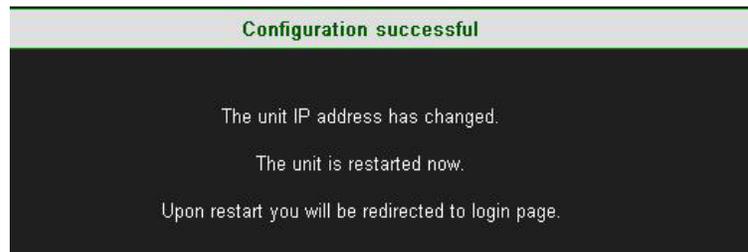
## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

A confirmation window appears.



- Click **OK** to restart the unit now.

A successful configuration window appears to confirm the changed IP address.



**The fixed address of the device is now set and will not change.**

## Step 9: The Final Step

The final step to the Quick Start is to verify the system measurement readings for frequency, voltage, current, and power factor as well as the phase voltage and current polarities. After all these system parameters have been verified, you can then enable the PQZip recording.

### Verifying System Measurements

The Voltage and Current measurement values need to be verified to be within the expected range. (nominals).

#### To verify System Measurements:

- From the main menu, select **Monitoring**→**Summary**.

The System Summary Screen appears:

RIO ■ MONITORING » SUMMARY	
<b>Summary</b>	
<b>Frequency</b>	<b>50.018 Hz</b>
<b><math>I_{avg}</math></b>	<b>0.0844 A</b>
<b><math>V(LL)_{avg}</math></b>	<b>392.87 V</b>
<b><math>V(LN)_{avg}</math></b>	<b>226.86 V</b>
<b>Power factor<sub>total</sub></b>	<b>0.5735 (Cap)</b>
<b>Phase order</b>	<b>123</b>

### Verifying Active Power Polarity

In most cases the active power should be positive unless you are measuring a generating unit.

- To verify the active power polarity.

	Active power	Reactive
Phase1	0.0000 kW	-0.0004
Phase2	0.0328 kW	-0.0457
Phase3	0.0000 kW	0.0003
Neutral	0.0000 kW	0.0000
Total	0.0328 kW	-0.0458

If the active power in one or more of the phases is negative, then you need to reverse the relevant CT polarity in the **Configuration** → **Currents** section.

Apply changes Refresh data

**Current transformer (CT)**  
 Primary 50  
 Secondary 50

**Nominals**  
 I (A) 50

**Current polarity**  
 I<sub>N</sub> Normal  
 I<sub>1</sub> Normal  
 I<sub>2</sub> Reverse  
 I<sub>3</sub> Normal

**Non-measured currents**  
 Calculated phase All Present

PQZip OFF

### NOTICE

*From the image above, you can see that PQZip is off. Also the active power polarities are correct. If you are satisfied that all voltage and current values are within an expected range, then you may proceed to commence with the recording of real data by enabling PQZip (next page).*

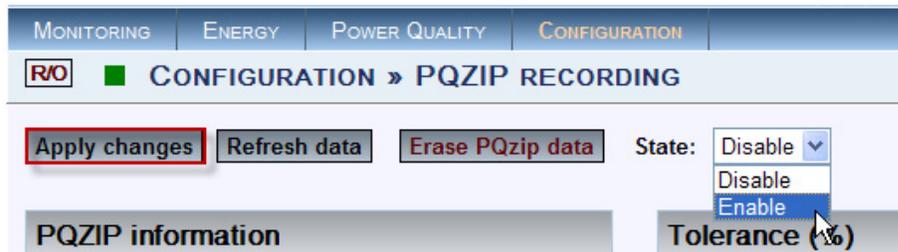
## Enabling PQZip

The enabling of PQZip is the final and most critical step in the Power Quality Meter device setup and configuration. Once the PQZip is enabled, then the unit will begin to commence recording of real time voltage and current.

### To enable PQZip:

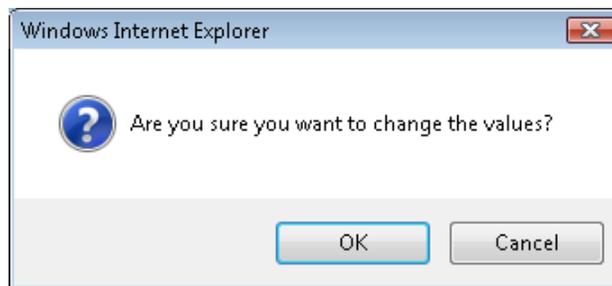
- From the main menu, select Configuration → PQZip Recording

The PQZip Recording Window Appears.



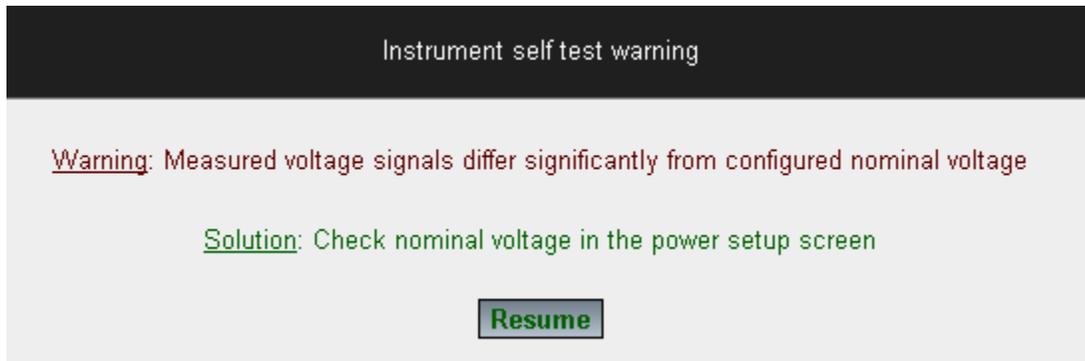
- Click State → Enable.
- Click **Apply Changes** to complete the procedure.

A verification window appears.



- Click **OK** to confirm.

If the system recognizes that a parameter may be incorrect in the setup, a warning appears as below:



5. If you wish to proceed, click **Resume**.

---

**NOTICE**

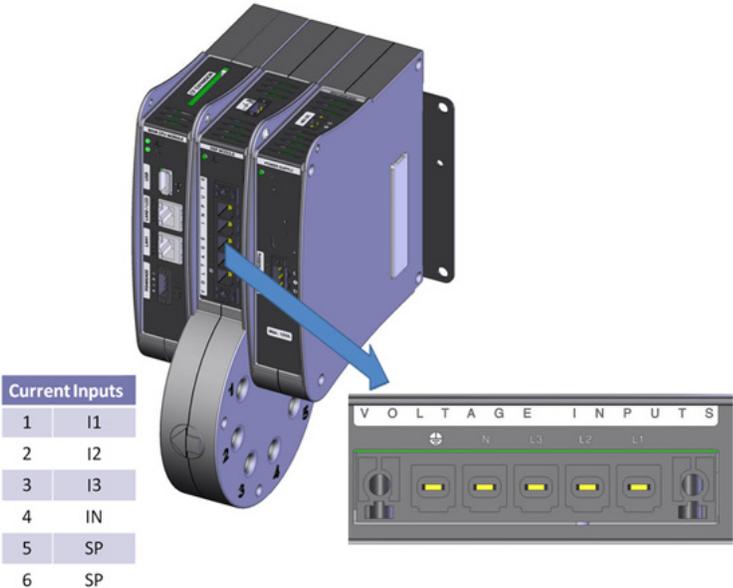
*You must be logged in as an Administrator in order to enable PQZIP. For more on Administrator login see*

*[Login Page on page 50.](#)*

---

# Section 3. Power Type Diagrams

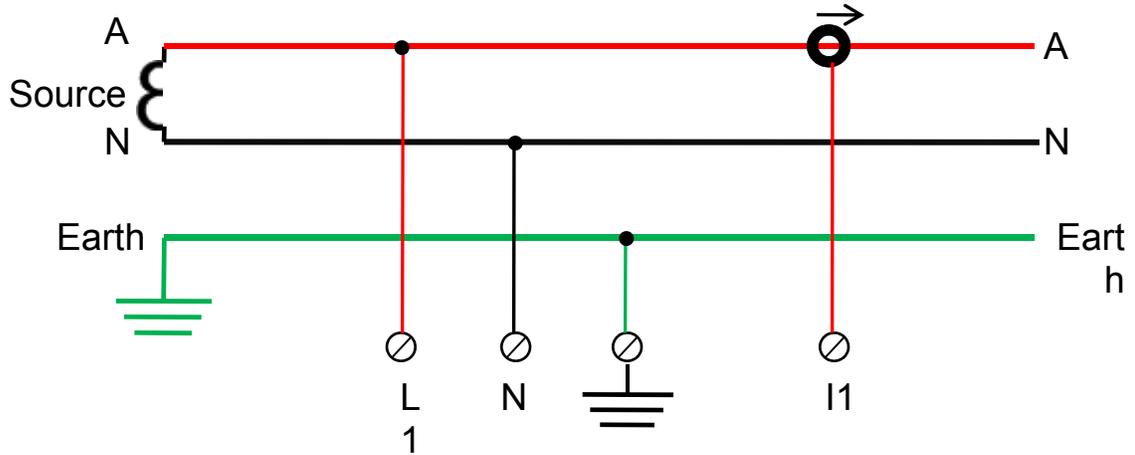
The ASCO 5400 Series Power Quality Meter is designed to serve in virtually any power topology configuration.



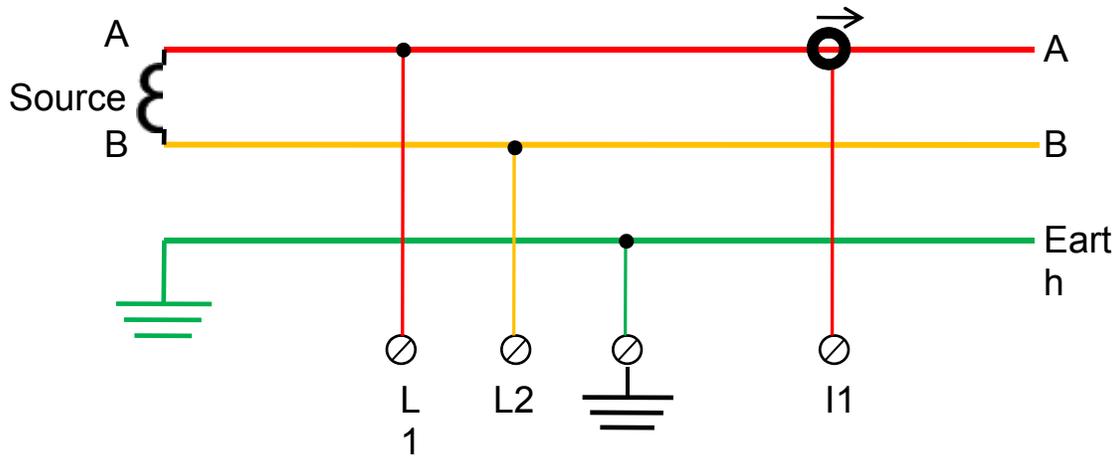
The pages to follow will show some of the most popular power topologies with suggested connection diagrams. The correct **Power Configuration** settings appear in parenthesis next to each configuration. The available choices from the **Configuration**→**Voltage & Frequency** section appear below.

- WYE 4 wires
- Delta 3 wires
- WYE 4 wires
- Single LL
- Single LN
- 2Phase TR

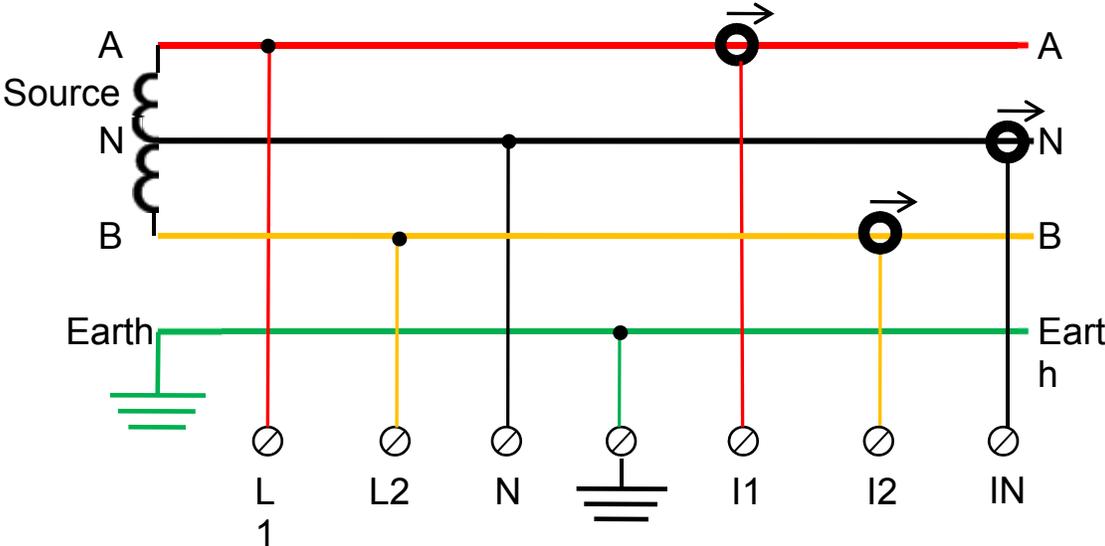
Single Phase with Neutral (Single LN)



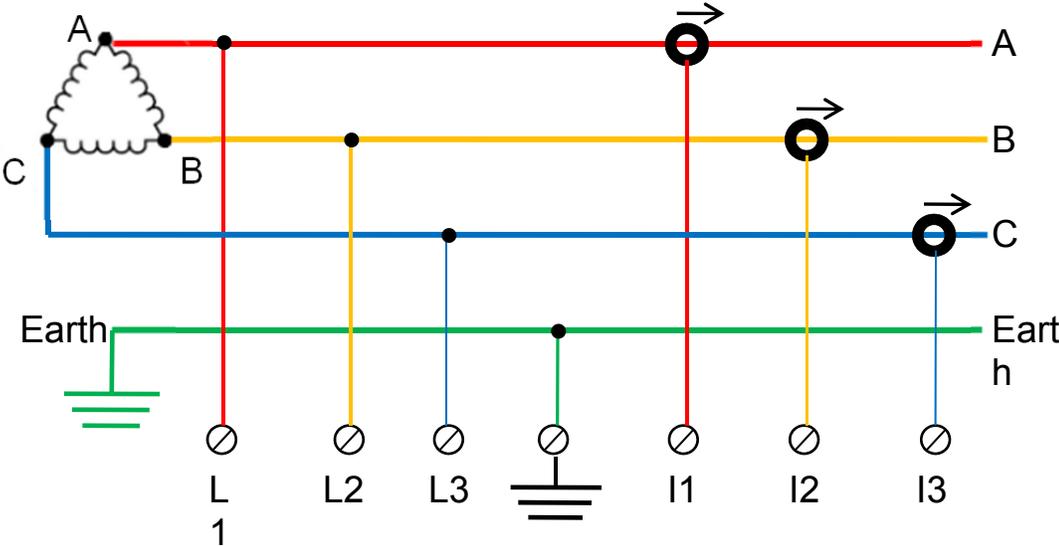
Single Phase without Neutral (Single LL)



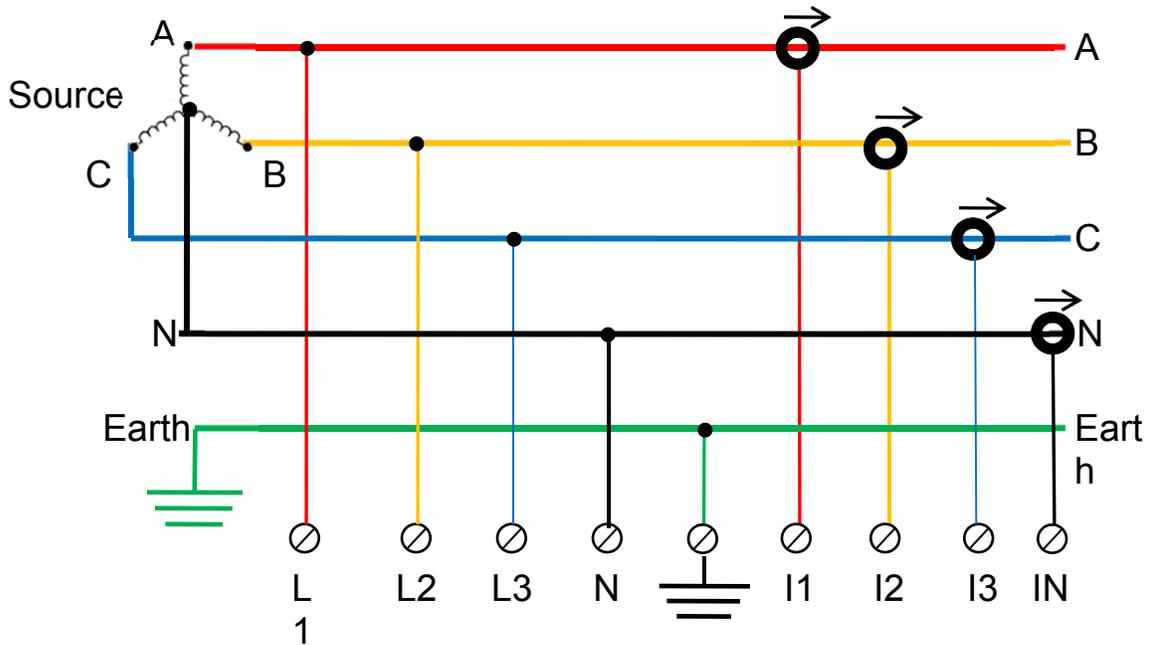
Single Split Phase (2Phase TR)



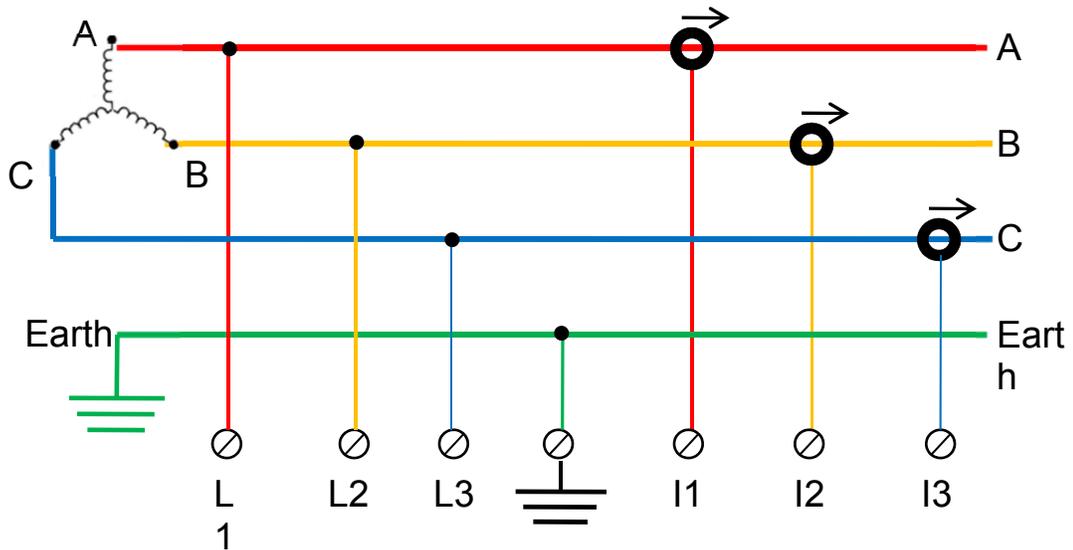
Three Wire Delta (Delta 3 Wires)



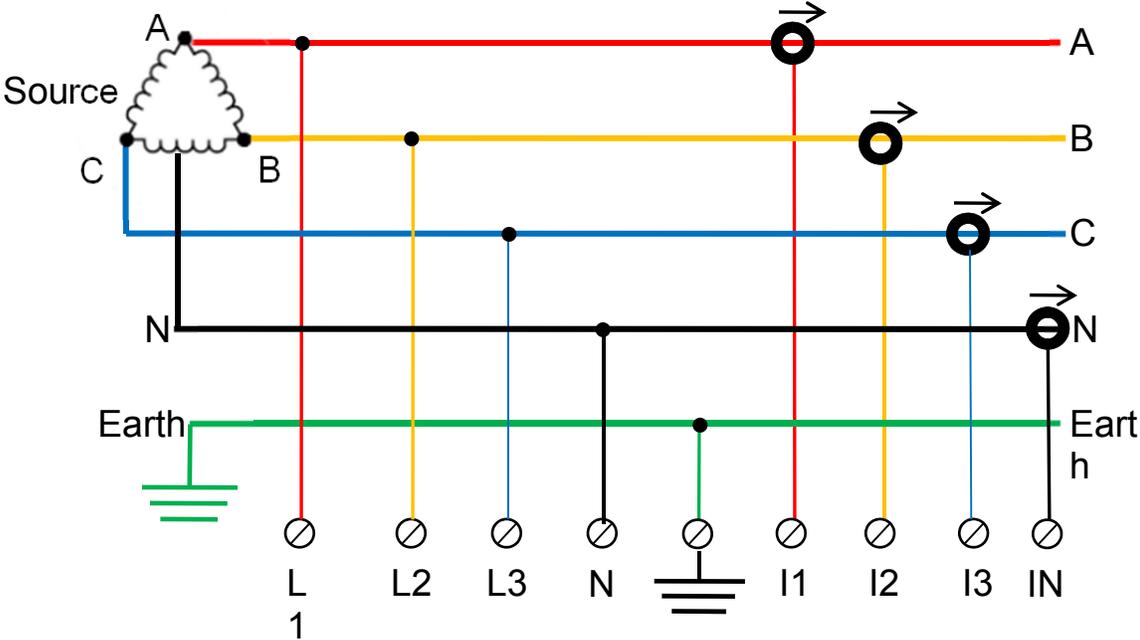
Four Wire WYE (WYE 4 Wires)



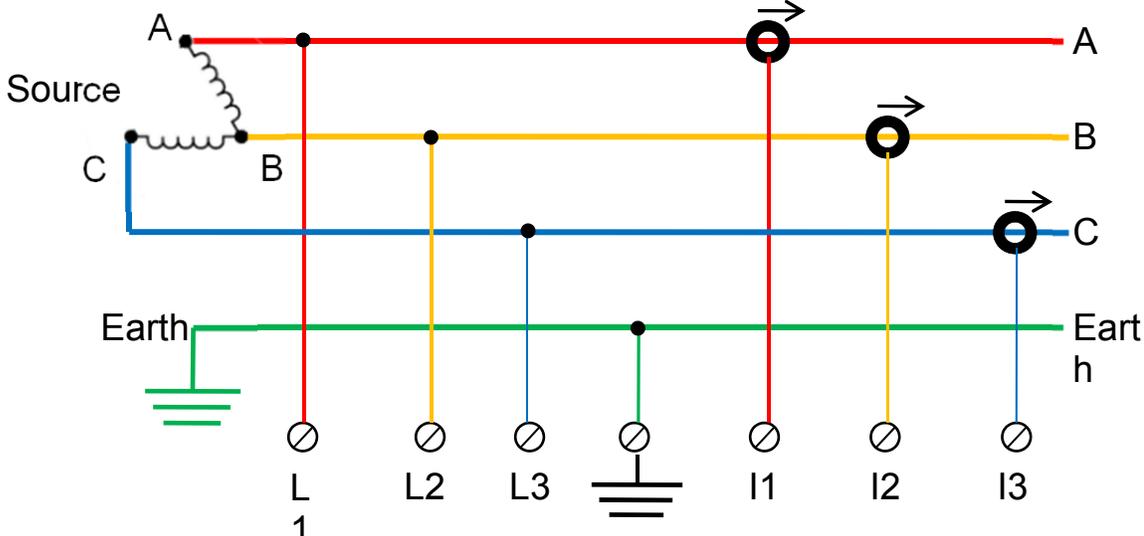
Three Wire WYE (Delta 3 Wires)



Delta High Leg (Delta 3 Wires)



Delta Open Leg (Delta 3 Wires)



# Section 4. The Hardware

## Specifications

<b>Input Specifications</b>	
<b>Power Supply</b>	
Operating Range	100-260 VAC: 50/60 Hz 100-300 VDC
Auxiliary DC Supply	48 Vdc
Auxiliary Supply – POE In	According to 802.3af
Low Voltage Ride Through	Up to 25 Seconds
<b>Voltage Outputs</b>	
Voltage	5 Vdc. 1W
PoE Out	13V (802.3af)
<b>Environmental Conditions</b>	
Operating Temperature	-20°C-70°C (-4°F-158°F)
Storage Temperature	-40°C-85°C (-40°F-185°F)
Humidity	Max 95% non-condensing
Pollution Degree	2
Insulation Category	II
<b>Temperature Sensors</b>	
External Temperature Sensor	-40°C - 99 °C
Int. PSU Temperature Sensor	Informative
Int. DSP Temperature Sensor	Measurements Compensation
<b>Port Specifications</b>	
<b>LAN 1</b>	
Baud Rate	10/100 MBit
Supported Protocols	TCP/IP, FTP; HTTP; Telnet; DHCP Client; SNMP; MODBUS TCP, DNP3, OPC, SMTP client; ELCOM
Connector Type	RJ45 Female w/ LED indicators
<b>LAN 2/LCD</b>	
Baud Rate	10/100 MBit
Supported Protocols	TCP/IP, FTP, HTTP; Telnet; DHCP Client; SNMP; MODBUS TCP, DNP3, SMTP client; ELCOM
Connector Type	RJ45 Female w/ LED indicators
<b>RS232 Connections</b>	
Baud Rate	Configurable:1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200
Duplex	Full
Supported Protocols	GPS
Connector Type	DB9 male
Max. Cable allowed	50 feet (15.2m)
<b>RS485/422 Connections</b>	
Baud Rate	Configurable: 1200/ 2400/ 4800/ 9600/ 14400/ 19200/ 38400/ 57600/ 115200
Duplex	Full/Half
Max. Cable allowed	500 feet (152m)

## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

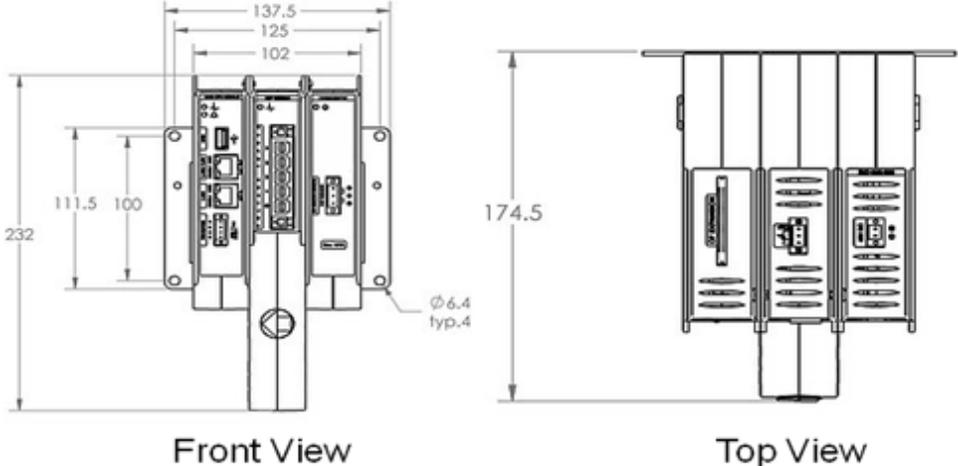
Multi I/O Module	
<b>Digital Inputs</b>	
Channels	8
Sampling	800Hz@50Hz;(16 spc) 960Hz@60Hz (16 spc)
Range	0 - 220Vdc <sup>[1]</sup>
Triggers	Edge, Level, Trigger (debounce)
Isolation Connector	125V
	<sup>[1]</sup> 48V; 110V; 220V(via serial resistor)
<b>Irig-B Input</b>	
Time Synchronizing	IRIG-B (GPS) to 1msec 1PPS (GPS) – better than 100µs
<b>Digital Outputs</b>	
Channels	4
Max Voltage	100V
Functionality	Edge, Level, Trigger, KYZ Pulse Out
<b>Analog Inputs</b>	
Channels	4
Signal	4-20mA (continuous DC)
Impedance	25Ω
Max.Voltage (common mode)	270 V
<b>Analog Outputs</b>	
Channels	4
Signal	4-20mA (continuous DC)
Accuracy	0.1% (10 bit D to A resolution)
<b>Relay Output Module</b>	
Channels	3 x Change Over
Max voltage	277 Vac
Max current	5 A/250 Vac 10A/110 Vac 5 A/30 Vdc
Max. reaction time	10 ms
Max. drop-out time	4 ms
Output Resistance	50mΩ

## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

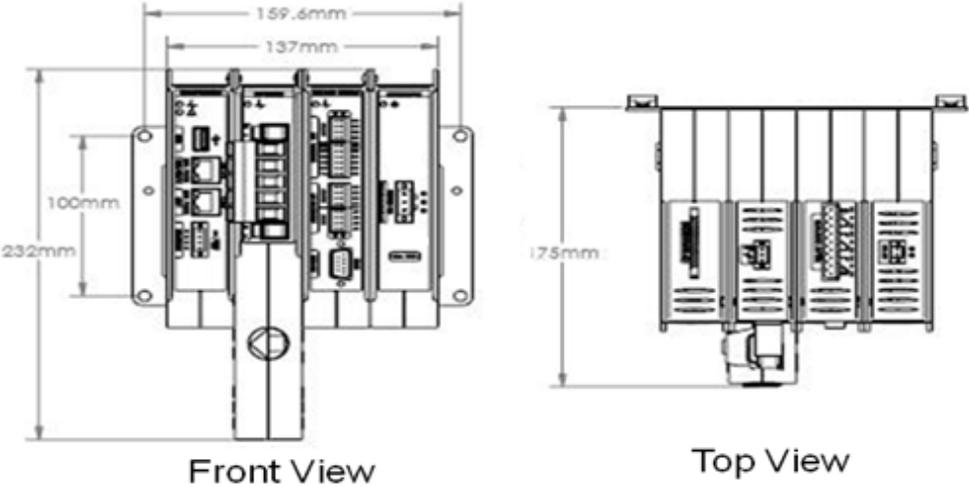
Dimensions (Overall)		
Dimensions w/o Multi I/O (d x h x w)	175mm x 232mm x 138mm	
Dimensions w/Multi I/O (d x h x w)	175mm x 232mm x 160mm	
Measurements		
Current Inputs		
Channels	4	
Nominal Full Scale	50A	
Load/Burden	0.07 VA@100A 0.0001VA@5A	
Phase Shift	0.42° @3A 0.17°@5A	
Voltage Inputs		
Channels	4	
Nominal Full Scale	1KV (8 KV transient)	
Input Impedance	3MΩ	
Standard IEC 61000-4-30 Class A Compliance	<ul style="list-style-type: none"> <li>• Aggregations</li> <li>• Time Clock Uncertainty</li> <li>• Flagging</li> <li>• Transient Influence Quantities</li> </ul>	
	Uncertainty	Measuring Range
Frequency	±10 mHz	42.5 Hz – 69 Hz
Magnitude of Supply Voltage	±0.1% of U <sub>din</sub>	10% – 150% of U <sub>din</sub>
Flicker	±5% of reading	0.2 – 10 Pst
Supply Voltage Dips and Swells	Magnitude: ±0.2% of U <sub>din</sub> Duration: ±1 cycle	N/A
Voltage Interruptions	Duration: ±1 cycle	N/A
Unbalance	±0.15%	0.5% – 5% u <sub>2</sub> 0.5% – 5% u <sub>0</sub>
Harmonics	IEC 61000-4-7 Class I	10% – 200% of Class 3 of IEC 61000-2-4
Interharmonics	IEC 61000-4-7 Class I	10% – 200% of Class 3 of IEC 61000-2-4
Under-Deviation and Over-Deviation	±0.1% of U <sub>din</sub>	10% – 150% of U <sub>din</sub>

### Physical Dimensions

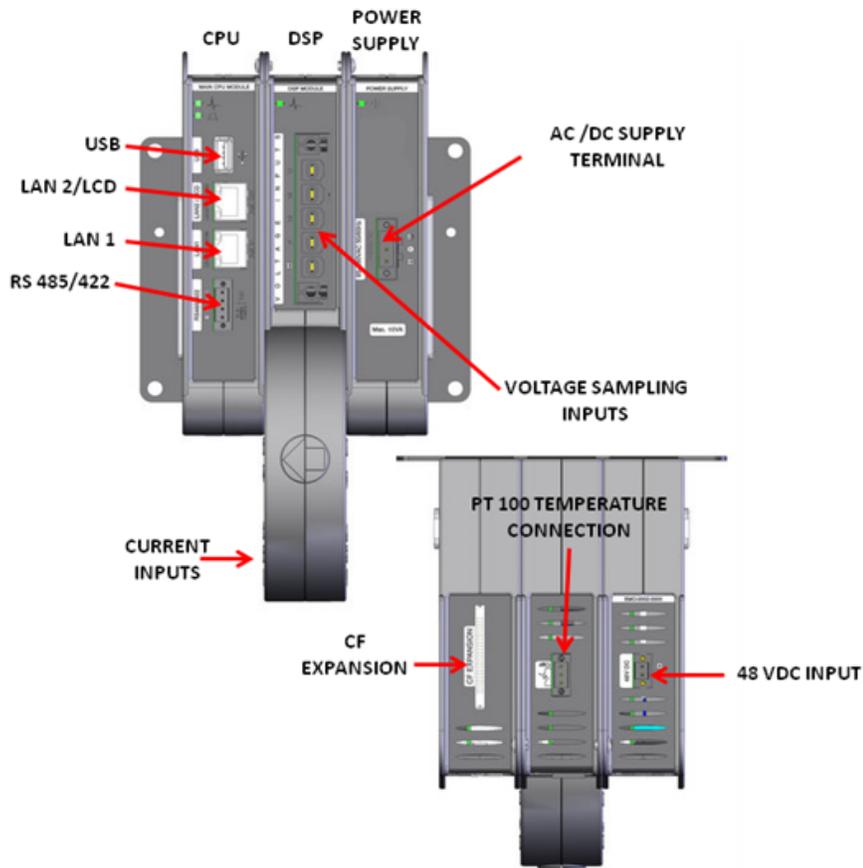
#### Power Quality Meter without Multi I/O



#### Power Quality Meter with Multi I/O



## The Power Quality Meter Unit



### **NOTICE**

*Refer to the Reference section to follow for more details on each component listed.*

The ASCO 5400 Series Power Quality Meter is a state-of-the art power monitoring device. The following is a component identification and physical description:

### Reference

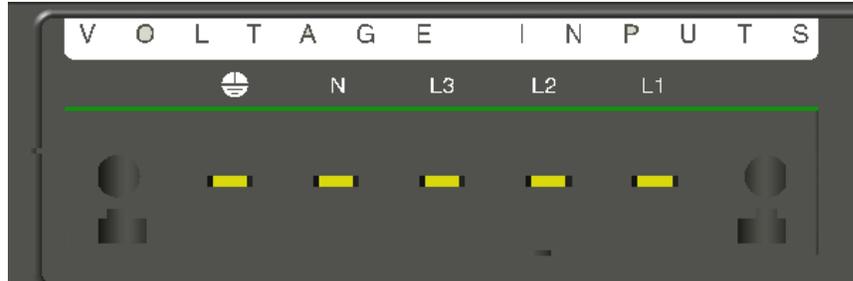
Description	For details refer to:
-------------	-----------------------

## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

Description	For details refer to:
<b>MODULES</b>	Central Processing Unit (CPU), Digital Signal Processing (DSP), Power Supply, Multi I/O (optional)
<b>LAN 1</b>	<a href="#">LAN1 on page 47</a>
<b>LAN 2/LCD</b>	<a href="#">LAN2/LCD on page 47</a>
<b>RS485/422</b>	<a href="#">RS485/422 Interface on page 47</a>
<b>Voltage Sampling Inputs</b>	<a href="#">AC Voltage Channels on page 45</a>
<b>CURRENT INPUTS</b>	<a href="#">AC Current Channels on page 46</a>
<b>PT 100 Temperature Input</b>	<a href="#">Appendix E: Temperature Connection on page 159</a>
<b>48 VDC Input</b>	<a href="#">Energizing the 48VDC Input on page 12</a>
<b>AC/DC Supply Terminal</b>	<a href="#">Energizing the AC/DC Supply Terminal on page 11</a>
<b>Status Indicators</b>	<a href="#">Verify Operation with Indicators on page 19</a>
<b>CF Expansion Slot</b>	<b>Not Currently Supported</b>
<b>USB</b>	<b>Not Currently Supported</b>

## AC Voltage Channels

The Power Quality Meter provides four fast sampling AC Voltage Sampling Inputs.



The fast sampling AC channels are designed for AC network monitoring. The inputs are marked as L1, L2, L3, N, and  (Earth).

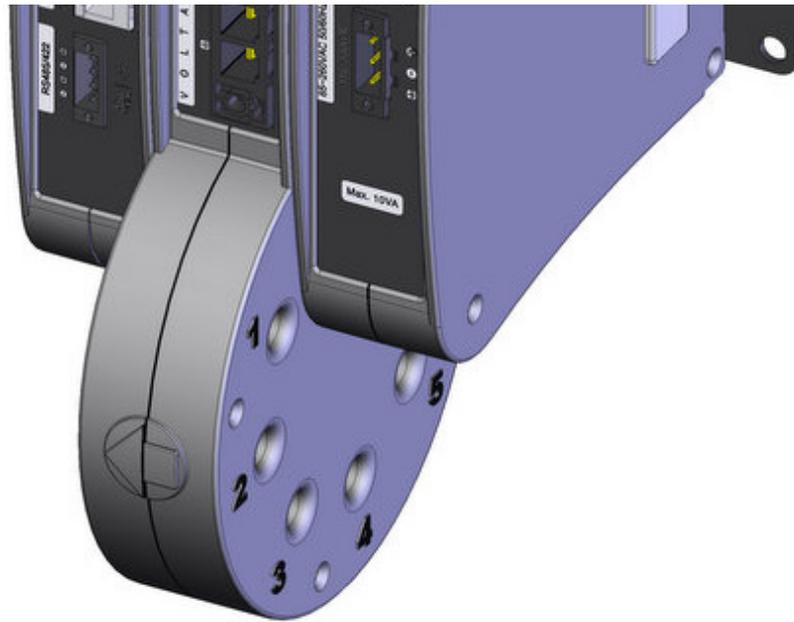
All inputs are sensed/sampled simultaneously and continuously at 1024 samples per cycle (5490 unit only) resolution using the Earth terminal  as a reference. The Phase (line to neutral) and Line (line to line) voltages are further calculated by a digital signal processor unit at the same 1024 samples per cycle resolution (5490 unit only).

### Specifications

<b>Channels</b>	<b>4</b>
<b>Nominal full scale</b>	<b>1KV (8 KV transient)</b>
<b>Input Impedance</b>	<b>3 MΩ</b>
<b>Frequency Range</b>	<b>42.5 - 63Hz</b>
<b>Input capacitance</b>	<b>&lt; 20pF</b>

## AC Current Channels

The ASCO 5400 Series Power Quality Meter provides 4 AC current measurement channels/inputs as follows:



- 1: I1
- 2: I2
- 3: I3
- 4: IN
- 5: Spare
- 6: Spare

## Specifications

<b>Channels</b>	<b>4</b>
<b>Nominal full scale</b>	<b>50A</b>
<b>Load / Burden</b>	<b>0.07 VA@100A 0.0001VA@5A</b>
<b>Phase Shift</b>	<b>0.42°@3A 0.17 °@5A</b>

## Communications

### LAN1

The LAN1 Plug is a standard RJ45 receptacle connecting to any Ethernet LAN. This plug is also a **PoE In** (see [Power over Ethernet \(PoE\) on page 14](#)) plug, allowing supply voltage of 48VDC to be fed to the instrument on the same cable as the communications.

- Connection via RJ45 plug
- Cable is to be of type Cat 5e/6 patch or crossed

### LAN2/LCD

The LAN2/LCD Plug is a standard RJ45 receptacle connecting to any Ethernet LAN. This plug is also a **PoE Out** plug (see [Power over Ethernet \(PoE\) on page 14](#)) allowing the supply of 48VDC to other instruments using the same cable as the communications. This port is used to connect the ASCO 5010 Remote Display unit.

- Connection via RJ45 plug
- Cable is to be of type Cat 5e/6 patch or crossed

### RS485/422 Interface

A standard RS485 (half duplex) or RS422 (full duplex) interface

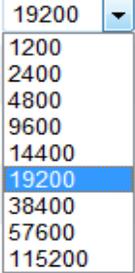
The connector pin description is shown below.



1	2	3	4
TxD	TxD	RxD	RxD
+	-	+	-

# ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

## Specifications

<b>Maximum cable length</b>	Up to 500 feet (152m)
<b>Supported protocols</b>	TTY mode (HyperTerminal, Telnet emulation) MODBUS RTU GPS AT Commands plus PPP modem (GSM, PSTN, DSL)
<b>Duplex</b>	Half/Full
<b>Insulation</b>	2kV
<b>Suitable plug connector type</b>	RS485/422 Communication terminal block (supplied as default accessory, <i>refer to page II-2</i> )
<b>Default configuration</b>	Baud rate: 19200 Data bits: 8 Parity: none Stop bits: 1
<b>Supported data rates</b>	
<b>Wiring requirements</b>	24AWG twisted pair
<b>Termination</b>	Shunt capacitance of 16pF per foot

### USB

Used for power output only.

### CF Expansion

Not currently supported

## Section 5. Website

The ASCO 5400 Series Power Quality Meter's internal Website is designed to serve as a main user interface with the instrument, providing enhanced management, configuration, and real-time monitoring functionality.

### Graphic Data Representation

The ASCO 5400 Series Power Quality Meter's website requires a third party **ActiveX** control (PEGraph designed by Gigasoft) to present graphical data such as waveforms and harmonic spectral charts.

### Access

When an Ethernet connection is established, the internal Website can be accessed by using **5400 Search** (please refer to [ASCO Search Utility on page 128](#)) to find the unit on the local LAN or by simply typing the device IP address in the address field on a WEB browser application.



#### **NOTICE**

*The Website is optimized to work with Internet Explorer 7 or I.E. 8 in “Compatibility View”. Other web browser applications can limit some functionality and/or show an incorrect layout.*

*For local networking the browser should be configured as working without a proxy server. Refer to*

*[Disable Proxy Server in Internet Explorer on page 144.](#)*

## Login Page

The first page to appear is a **Login Page**.

Choose the interface language. The supported languages are:

- English (Default)
- Russian
- German
- Spanish
- French
- Chinese

**(For other languages – please contact your local ASCO distributor.)**

**The Password field defines user level/privileges. Two user levels are supported:**

User level	Password	Role
<b>Viewer</b>	<b>123</b>	Read only, can choose interface language only, no operations related changes are allowed
<b>Admin</b>	<b>12345</b>	Administration, setup, and full control

**The passwords above are factory default values. You are advised to modify Admin password if extended security measures are required.**

## Low Bandwidth

If you have low bandwidth access, it is possible to reduce the site's complexity by using fewer graphics, images, and other data.

To activate a graphics-free interface, press the *Low Bandwidth* button as shown above.

A graphics-free interface appears. To deactivate the feature, press *High Bandwidth*.

## System Limitations

The Power Quality Meter's integrated Web Server is designed to support a maximum of 3 concurrent user interface connections. However, the Admin level can be logged in only one at a time. In the event that a new Admin connection is established (a user has successfully logged in with Admin password), the previous Admin connection will be automatically logged off. Also, any Admin connection which is idle for more than 5 minutes will be automatically logged off.

## The Site Structure

The Power Quality Meter's embedded website is organized into five subsections:

- **Monitoring:** Real time monitoring of a variety of electrical parameters
- **Energy:** Integrated energy meter readings
- **Power Quality:** Power Quality standard compliance monitoring and setup
- **Configuration:** Main entry for setup and device status monitoring
- **Multi I/O:** Integrated digital inputs setup and monitoring (this heading will only appear if the optional hardware is present. Please refer to Multi I/O in a separate document)

Summary	
Frequency	50.016 Hz
$I_{avg}$	0.0012 A
$V(LL)_{avg}$	396.05 V
$V(LN)_{avg}$	228.67 V
Power factor <sub>total</sub>	0.2521 (Ind)
Phase order	123

Synchronization status	
Time synchronization	Alternate Good
DSP synchronization	On

- **R/O** - Read Only mode when logged in as user.
- **R/W** - Read/Write mode when logged in as administrator
- **Version:** The current version of the device's firmware.
- **Serial:** Serial Number/MAC address of the device
- **Unit Time:** The current time according to the device's internal clock.

## Monitoring Section

The Monitoring section displays real time readings and graphs of the grid's parameters. The graph display requires an ActiveX plug-in from Gigasoft (see [Graphic Data Representation on page 49](#)). The ActiveX plug-in allows different view options. The Monitoring section contains the following pages:

MONITORING	ENERGY	POWER QUALITY
Summary	V & I harmonics	
Voltage & Current	P & Q harmonics	
Power	Sub & Inter harmonics	
Temperature	Harmonics table	
Phasors	V/I min/max harmonics	
Waveforms	P/Q min/max harmonics	
Voltage flickering		
Min/max flickering		

## Summary

MONITORING	ENERGY	POWER QUALITY	MULTI-IO	CONFIGURATION
MONITORING » SUMMARY				
Summary <span style="float: right;">PU</span>				
Frequency	50.016 Hz			
$I_{avg}$	0.0012 A			
$V(LL)_{avg}$	396.05 V			
$V(LN)_{avg}$	228.67 V			
Power factor <sub>total</sub>	0.2521 (Ind)			
Phase order	123			
Synchronization status				
Time synchronization	Alternate	Good		
DSP synchronization	On			

- Frequency
- Average Voltage and Currents
- Total Power Factor
- Phase Order
- Synchronization status (See [Section 7. Time Synchronization on page 111](#))
- DSP Synchronization: DSP synchronizes to the sampled voltages.

## Voltage/Current

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V/I				
	RMS	Min value	Max value	THD
$V_1$	229.04 V	49.979 V	239.41 V	1.9544 %
$V_2$	230.00 V	50.312 V	238.84 V	1.8810 %
$V_3$	228.63 V	49.799 V	237.89 V	1.6407 %
$V_N$	1.1193 V	0.2505 V	1.4198 V	----
$V_{12}$	396.40 V	86.524 V	413.77 V	1.4747 %
$V_{23}$	397.45 V	86.759 V	413.53 V	1.5047 %
$V_{31}$	397.12 V	86.664 V	413.06 V	1.4997 %
$I_1$	0.0016 A	0.0003 A	1.1613 A	----
$I_2$	0.0010 A	0.0003 A	1.1798 A	----
$I_3$	0.0011 A	0.0002 A	0.9309 A	----
$I_N$	0.0009 A	0.0002 A	0.0010 A	----

Averages		
	3 sec	10 min
<b>Flag</b>	Not flagged	Not flagged
$V_1$	229.06 V	228.56 V
$V_2$	230.02 V	229.65 V
$V_3$	228.61 V	227.81 V
$V_N$	1.1250 V	1.1629 V
$V_{12}$	396.42 V	395.39 V
$V_{23}$	397.47 V	396.63 V
$V_{31}$	397.13 V	396.12 V
$V_{unbal}$	0.1564 %	0.1849 %

Unbalance		
	Avg	
$V_{Unbalance}$	0.1556 %	
$V_{Positive\ sequence}$	396.97 V	
$V_{Negative\ sequence}$	0.6177 V	
$V_{Zero\ sequence}$	2.6967 V	
$I_{Unbalance}$	0.0000 %	
$I_{Positive\ sequence}$	0.0000 A	
$I_{Negative\ sequence}$	0.0000 A	

- RMS and average Voltages and Currents phase and line
- Unbalance symmetrical sequence Positive, Negative, and Zero

## Voltage/Current

Power summary					
	Active power	Reactive power	Apparent power	True PF	Displacement PF
Phase1	0.0001 kW	0.0003 kVAr	0.0004 kVA	0.3563 (Ind)	0.8169 (Ind)
Phase2	0.0000 kW	-0.0002 kVAr	0.0002 kVA	0.0402 (Cap)	0.9977 (Cap)
Phase3	0.0001 kW	0.0002 kVAr	0.0003 kVA	0.2665 (Ind)	0.7262 (Ind)
Neutral	0.0000 kW	0.0000 kVAr	0.0000 kVA	0.0091 (Cap)	---
<b>Total</b>	<b>0.0002 kW</b>	<b>0.0004 kVAr</b>	<b>0.0008 kVA</b>	<b>0.2437 (Ind)</b>	<b>0.8169 (Ind)</b>

- Reactive Power
- Apparent Power
- True and Displacement Power Factor

## Temperature

RW ■ MONITORING » TEMPERATURE PQZIp OFF

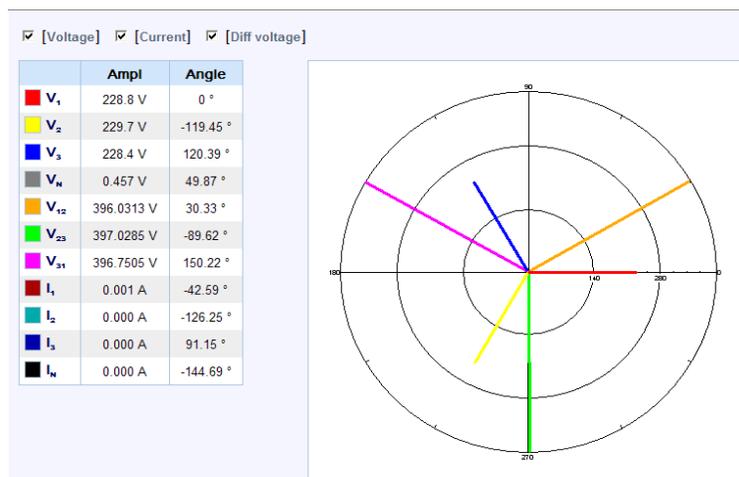
[Reset all min/max](#)

Internal temperature		
Internal <sub>avg</sub>	Internal <sub>min</sub>	Internal <sub>max</sub>
46.59 °C	46.23 °C	51.40 °C

External temperature		
External <sub>avg</sub>	External <sub>min</sub>	External <sub>max</sub>
22.28 °C	20.26 °C	28.28 °C

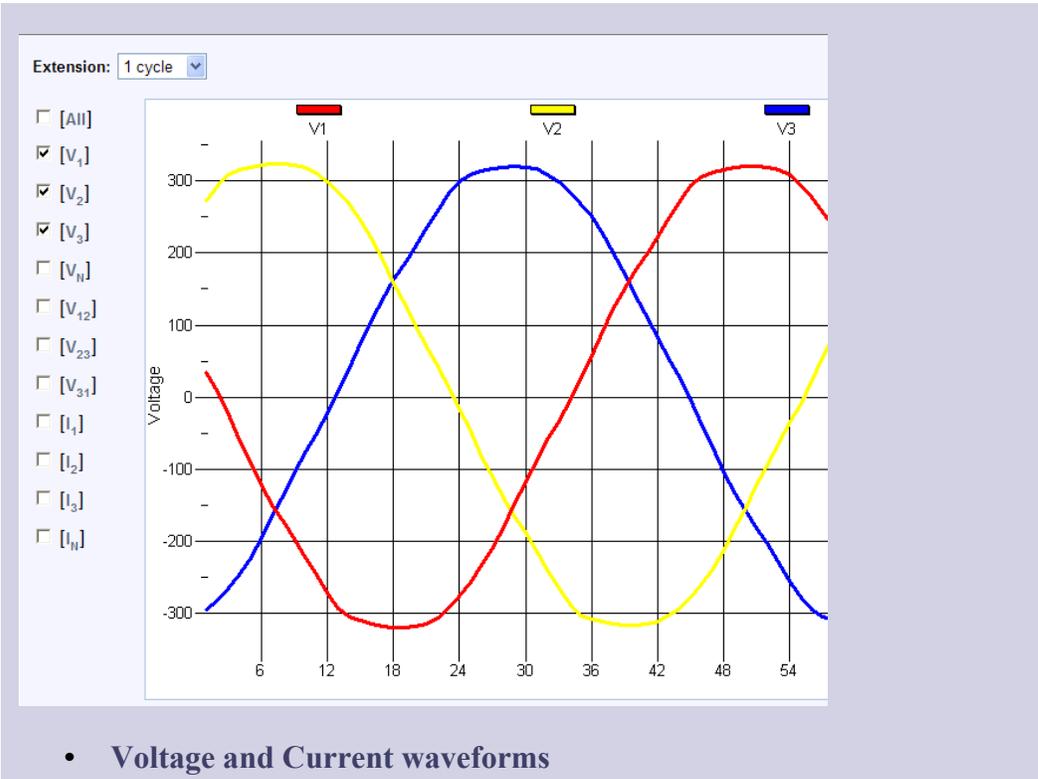
PSU temperature		
PSU <sub>avg</sub>	PSU <sub>min</sub>	PSU <sub>max</sub>
50.59 °C	50.13 °C	55.53 °C

- Internal and External Temperature readings



- Voltage and Current Phase diagram

Waveforms



Voltage Flickering

Voltage flickering								
	PSST 2 sec	PSST 10 sec	PST 10 min	SPLT 1 hour	PLT 2 hour	LPLT 10 hour	LPLT 1 day	LPLT 7 day
V <sub>1</sub>	0.3109	0.2635	<b>0.4574</b>	0.2393	<b>0.2260</b>	0.4825	0.4126	0.0000
V <sub>2</sub>	0.4417	0.4322	<b>0.5618</b>	0.4066	<b>0.4006</b>	0.5521	0.5063	0.0000
V <sub>3</sub>	0.3702	0.3369	<b>0.5162</b>	0.3848	<b>0.3503</b>	0.5560	0.4840	0.0000
V <sub>12</sub>	0.3077	0.2912	<b>0.4631</b>	0.2690	<b>0.2575</b>	0.4200	0.3826	0.0000
V <sub>23</sub>	0.2971	0.2583	<b>0.4398</b>	0.2294	<b>0.2135</b>	0.5037	0.4245	0.0000
V <sub>31</sub>	0.2839	0.2597	<b>0.4501</b>	0.2482	<b>0.2297</b>	0.5320	0.4451	0.0000

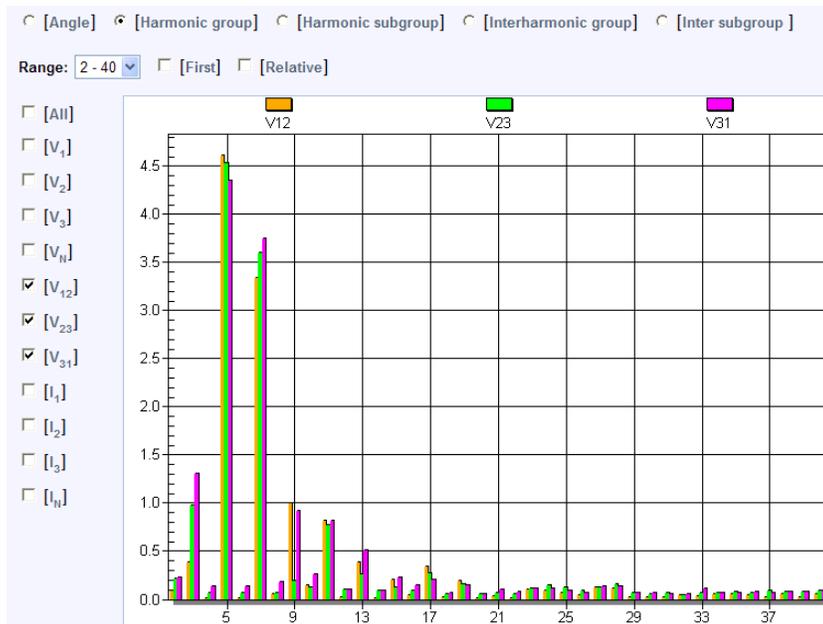
- Short and long term Voltage Flickering

### Min/Max Flickering

Min/max flickering		PSST 2 sec	PSST 10 sec	PST 10 min	SPLT 1 hour	PLT 2 hour	LPLT 10 hour	LPLT 1 day	LPLT 7 day
V <sub>1</sub>	Min	0.0000	0.0000	<b>0.0000</b>	0.0000	<b>0.0000</b>	0.0000	0.0000	0.0000
	Max	6.1599	3.8185	<b>1.5200</b>	1.1455	<b>0.9143</b>	0.6868	0.6676	0.0000
V <sub>2</sub>	Min	0.0000	0.0000	<b>0.0000</b>	0.0000	<b>0.0000</b>	0.0000	0.0000	0.0000
	Max	10.172	4.9779	<b>1.8981</b>	1.1718	<b>0.9766</b>	0.7589	0.7211	0.0000
V <sub>3</sub>	Min	0.0000	0.0000	<b>0.0000</b>	0.0000	<b>0.0000</b>	0.0000	0.0000	0.0000
	Max	9.5654	4.7009	<b>2.0278</b>	1.5689	<b>1.2846</b>	0.9357	0.8794	0.0000
V <sub>12</sub>	Min	0.0000	0.0000	<b>0.0000</b>	0.0000	<b>0.0000</b>	0.0000	0.0000	0.0000
	Max	7.3545	3.6036	<b>1.4425</b>	1.1036	<b>0.8820</b>	0.6443	0.5976	0.0000
V <sub>23</sub>	Min	0.0000	0.0000	<b>0.0000</b>	0.0000	<b>0.0000</b>	0.0000	0.0000	0.0000
	Max	11.386	5.5772	<b>2.1162</b>	1.4584	<b>1.1900</b>	0.8737	0.8150	0.0000
V <sub>31</sub>	Min	0.0000	0.0000	<b>0.0000</b>	0.0000	<b>0.0000</b>	0.0000	0.0000	0.0000
	Max	7.0954	4.4032	<b>1.8262</b>	1.3835	<b>1.1443</b>	0.8239	0.7874	0.0000

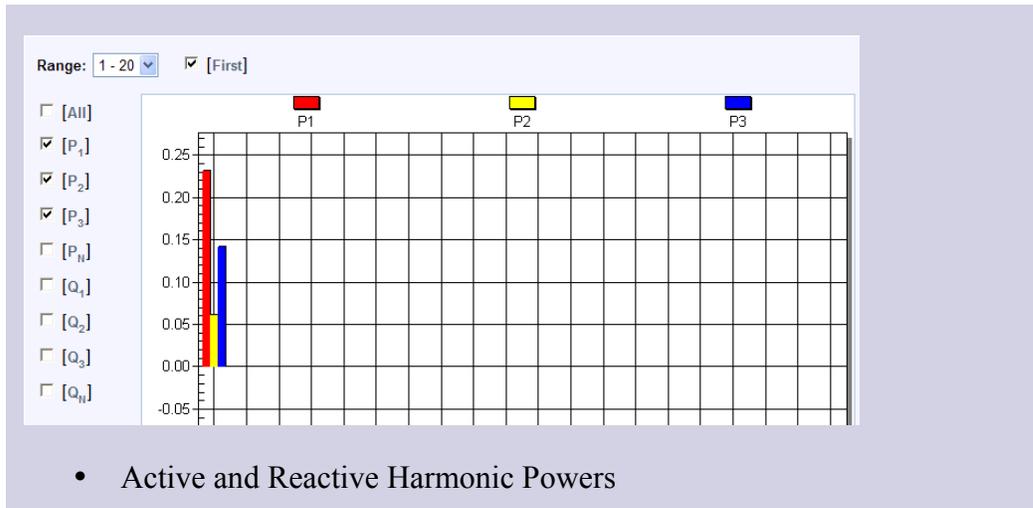
- Minimum and maximum Flickering values

### V & I Harmonics

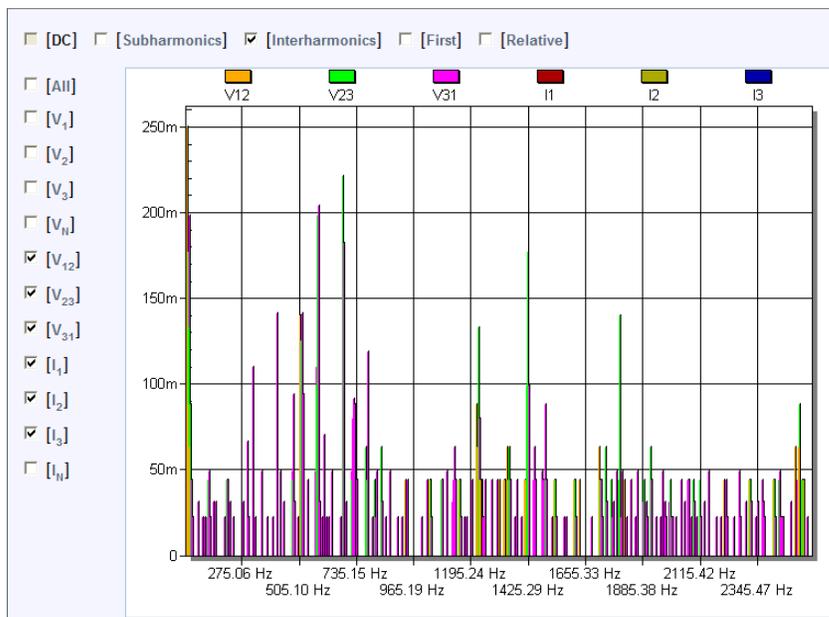


- Voltage and Current Harmonics Spectrum

### P & Q Harmonics



## Sub & Inter Harmonics



## Harmonics Table

# ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

[Angle] 
  [Harmonic group] 
  [Harmonic subgroup] 
  [Interharmonic group] 
  [Inter subgroup]

[Relative]

**V & I harmonics**

	V <sub>1</sub>	V <sub>2</sub>	V <sub>3</sub>	V <sub>N</sub>	V <sub>12</sub>	V <sub>23</sub>	V <sub>31</sub>	I <sub>1</sub>	I <sub>2</sub>
H <sub>1</sub>	229.4065 V	230.2943 V	229.4166 V	0.390093 V	397.1341 V	398.4014 V	398.0492 V	0.000669 A	0.000161 A
H <sub>2</sub>	0.08227 V	0.065107 V	0.117985 V	0.029158 V	0.065561 V	0.141742 V	0.163599 V	0.000197 A	0.00015 A
H <sub>3</sub>	1.528949 V	1.311142 V	0.476851 V	0.47815 V	0.31839 V	1.02009 V	1.153481 V	0.000361 A	0.000182 A
H <sub>4</sub>	0.044372 V	0.013077 V	0.053108 V	0.024511 V	0.019977 V	0.080624 V	0.034604 V	0.000128 A	0.000122 A
H <sub>5</sub>	2.795984 V	3.181225 V	2.431297 V	0.079017 V	5.002001 V	4.913157 V	4.658387 V	0.000199 A	0.000139 A
H <sub>6</sub>	0.041147 V	0.018633 V	0.095612 V	0.039675 V	0.010299 V	0.083086 V	0.087191 V	0.000142 A	0.00013 A
H <sub>7</sub>	1.920702 V	1.856379 V	1.872974 V	0.084444 V	3.174541 V	3.321381 V	3.318864 V	0.000157 A	0.000128 A
H <sub>8</sub>	0.102474 V	0.010986 V	0.104786 V	0.037802 V	0.046427 V	0.076465 V	0.170351 V	0.000123 A	0.000123 A
H <sub>9</sub>	2.340549 V	1.814048 V	1.956712 V	0.758467 V	0.787409 V	0.181282 V	0.747625 V	0.000149 A	0.000136 A
H <sub>10</sub>	0.135778 V	0.020178 V	0.178576 V	0.076537 V	0.14694 V	0.170009 V	0.252268 V	0.000167 A	0.000166 A
H <sub>11</sub>	0.312933 V	0.52419 V	0.394426 V	0.135987 V	0.665897 V	0.707948 V	0.688184 V	0.000148 A	0.000149 A
H <sub>12</sub>	0.052455 V	0.007579 V	0.193502 V	0.129201 V	0.026518 V	0.204156 V	0.227141 V	0.000151 A	0.00014 A
H <sub>13</sub>	0.36761 V	0.08958 V	0.160039 V	0.094258 V	0.407281 V	0.164703 V	0.453863 V	0.000162 A	0.000138 A
H <sub>14</sub>	0.124491 V	0.034983 V	0.146839 V	0.267612 V	0.073669 V	0.151683 V	0.212135 V	0.000531 A	0.000152 A

- Voltage and Current Harmonics in values, %, and angles

## V/I Min/Mix Harmonics

[Harmonic group] 
  [Angle] 
  [Harmonic subgroup] 
  [Interharmonic group]

**Harmonics min & max**

		V <sub>1</sub>	V <sub>2</sub>	V <sub>3</sub>	V <sub>N</sub>	V <sub>12</sub>	V <sub>23</sub>	V <sub>31</sub>	I <sub>1</sub>	I <sub>2</sub>
H <sub>1</sub>	Min	49.96869 V	50.30218 V	49.79218 V	0.074115 V	86.51302 V	86.74825 V	86.65327 V	0.000041 A	0.0001
	Max	239.3723 V	238.7997 V	237.8514 V	0.992649 V	413.7096 V	413.4707 V	413.0085 V	1.16047 A	1.1790
H <sub>2</sub>	Min	0.002413 V	0.000395 V	0.014116 V	0.006752 V	0.000027 V	0.000227 V	0.004229 V	0.000026 A	0.0000
	Max	2.453745 V	2.456555 V	2.232314 V	0.254578 V	4.485771 V	4.108567 V	3.742046 V	0.214672 A	0.2398
H <sub>3</sub>	Min	0.392826 V	0.345581 V	0.093875 V	0.115902 V	0.000629 V	0.228556 V	0.267355 V	0.000031 A	0.0000
	Max	2.869697 V	2.301553 V	1.71922 V	0.636451 V	3.171511 V	3.078852 V	3.539135 V	0.152604 A	0.1315
H <sub>4</sub>	Min	0.000184 V	0.000034 V	0.000486 V	0.006806 V	0.000001 V	0 V	0.000001 V	0.000031 A	0.0000
	Max	0.940293 V	0.890535 V	1.102241 V	0.252986 V	1.547345 V	1.743346 V	1.65374 V	0.069484 A	0.0554
H <sub>5</sub>	Min	0.663134 V	0.725288 V	0.529418 V	0.008762 V	1.173452 V	1.136046 V	1.097734 V	0.000035 A	0.0000
	Max	4.346937 V	4.847661 V	4.239848 V	0.29654 V	7.84479 V	7.610919 V	7.335455 V	0.106447 A	0.0990
H <sub>6</sub>	Min	0.00034 V	0 V	0.000159 V	0.008038 V	0 V	0 V	0.000001 V	0.000026 A	0.0000
	Max	0.672817 V	0.642791 V	0.668044 V	0.253418 V	1.04186 V	1.246891 V	1.016933 V	0.040875 A	0.0210
H <sub>7</sub>	Min	0.353093 V	0.391868 V	0.364744 V	0.009869 V	0.603279 V	0.631948 V	0.669999 V	0.000028 A	0.0000
	Max	3.049919 V	2.980136 V	3.023677 V	0.32314 V	5.264405 V	5.054921 V	4.9126 V	0.032531 A	0.0292

- Minimum and maximum values and angles of Voltage and Current Harmonics

## PQ Min/Max Harmonics

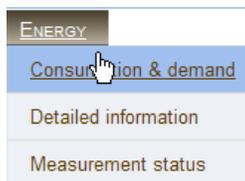
**P & Q min-max harmonics**

		P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>N</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>N</sub>
H <sub>1</sub>	Min	-0.303215 kW	-0.31818 kW	-0.195313 kW	0 kW	-0.509313 kVA <sub>r</sub>	-0.487536 kVA <sub>r</sub>	-0.329655 kVA <sub>r</sub>	0 kV <sub>r</sub>
	Max	0.213779 kW	0.333916 kW	0.346762 kW	0 kW	0.51238 kVA <sub>r</sub>	0.457231 kVA <sub>r</sub>	0.249636 kVA <sub>r</sub>	0 kV <sub>r</sub>
H <sub>2</sub>	Min	-0.000754 kW	-0.000612 kW	-0.000927 kW	0 kW	-0.000447 kVA <sub>r</sub>	-0.001113 kVA <sub>r</sub>	-0.00057 kVA <sub>r</sub>	0 kV <sub>r</sub>
	Max	0.000094 kW	0.00002 kW	0.000109 kW	0 kW	0.000272 kVA <sub>r</sub>	0.000037 kVA <sub>r</sub>	0.000089 kVA <sub>r</sub>	0 kV <sub>r</sub>
H <sub>3</sub>	Min	-0.00083 kW	-0.001182 kW	-0.000947 kW	0 kW	-0.002885 kVA <sub>r</sub>	-0.001473 kVA <sub>r</sub>	-0.001978 kVA <sub>r</sub>	0 kV <sub>r</sub>
	Max	0.000462 kW	0.000187 kW	0.000105 kW	0 kW	0.000165 kVA <sub>r</sub>	0.000131 kVA <sub>r</sub>	0.000117 kVA <sub>r</sub>	0 kV <sub>r</sub>
H <sub>4</sub>	Min	-0.000308 kW	-0.000279 kW	-0.000462 kW	0 kW	-0.000608 kVA <sub>r</sub>	-0.000689 kVA <sub>r</sub>	-0.001173 kVA <sub>r</sub>	0 kV <sub>r</sub>
	Max	0.000111 kW	0.000022 kW	0.000034 kW	0 kW	0.000035 kVA <sub>r</sub>	0.000015 kVA <sub>r</sub>	0.000023 kVA <sub>r</sub>	0 kV <sub>r</sub>
H <sub>5</sub>	Min	-0.000429 kW	-0.000483 kW	-0.000353 kW	0 kW	-0.000196 kVA <sub>r</sub>	-0.000242 kVA <sub>r</sub>	-0.000345 kVA <sub>r</sub>	0 kV <sub>r</sub>
	Max	0.000482 kW	0.000379 kW	0.000613 kW	0 kW	0.000573 kVA <sub>r</sub>	0.000517 kVA <sub>r</sub>	0.000484 kVA <sub>r</sub>	0 kV <sub>r</sub>
H <sub>6</sub>	Min	-0.000056 kW	-0.000103 kW	-0.000064 kW	0 kW	-0.000065 kVA <sub>r</sub>	-0.00014 kVA <sub>r</sub>	-0.000158 kVA <sub>r</sub>	0 kV <sub>r</sub>
	Max	0.00001 kW	0.000006 kW	0.000013 kW	0 kW	0.000009 kVA <sub>r</sub>	0.000003 kVA <sub>r</sub>	0.000006 kVA <sub>r</sub>	0 kV <sub>r</sub>
H <sub>7</sub>	Min	-0.000355 kW	-0.000074 kW	-0.000092 kW	0 kW	-0.000058 kVA <sub>r</sub>	-0.000062 kVA <sub>r</sub>	-0.000037 kVA <sub>r</sub>	0 kV <sub>r</sub>
	Max	0.000085 kW	0.000076 kW	0.000071 kW	0 kW	0.000232 kVA <sub>r</sub>	0.000084 kVA <sub>r</sub>	0.000085 kVA <sub>r</sub>	0 kV <sub>r</sub>

- Minimum and maximum values of Active and Reactive power harmonics

## Energy Section

The Energy section contains the following pages:



Energy is defined as power consumed over time. In electrical distribution systems, the unit of time is one hour for all energy measurements and the kWh is the basis for payment for buying and selling energy. This chapter focuses on the flow of energy or power both within a system (active, reactive) as well as the flow of power to and from the system to the grid (delivered or received). The following are commonly used terms in describing energy flow within a system:

- **Active or Real:** The portion of power flow that, averaged over a complete cycle of the AC waveform, results in the net transfer of energy in one direction expressed as kWh.
- **Reactive /Volt Amperes Reactive (kVA<sub>r</sub>h):** Energy that flows back and forth with no actual power flow. Reactive power flow transfers no net energy to the load and is sometimes referred to as *wattless* power.
- **Apparent:** The combination of active and reactive energy (kVAh).
- **Power Factor:** The ratio between real power and apparent power (a value between 0 and 1).

**Consumption & Demand**

Energy is produced and consumed within an electrical distribution system. Some sites produce energy for the grid (Received Energy), others consume energy from the grid (Delivered Energy), and still others both consume and produce energy for/from the grid. The Net Consumption is the difference between energy that is used and produced. Therefore, a negative value for Net Consumption indicates that the site is producing more than it is consuming, or a *received net consumption*.

Consumption & Demand			
	Net consumption	Demand	Peak demand
Active energy	0.1445 kWh	0.0002 kW	0.0358 kW
Reactive energy	0.0825 kVAh	0.0004 kVA	-0.3028 kVA
Apparent energy	1.2508 kVAh	0.0008 kVA	0.5394 kVA
Power factor	0.8684 (Ind)	0.4962 (Ind)	0.1175 (Cap)

The Consumption & Demand page is a quick look at some of the key components of the Detailed Information page. Here you find a cross-sectional summary view of the amount and makeup (active or reactive) of the Net Energy (Received – Delivered) produced/consumed by a site.

A Demand is an arbitrary measurement of average power usage per configurable unit time. A demand is measured in units of power even though a time element does exist, while Peak Demand is the highest demand calculated since the last demand reset. Please refer to [Energy Meter on page 97](#) to reset the Demand.

**Reset demand**

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## Detailed Info

For a detailed breakdown of energy flow components, the **Detailed Information** page presents all **Active, Reactive, and Power Factor** values individually for both produced and consumed (**Received or Delivered**) energy. Also shown below are the Net difference (**Net Energy**) as well as the sum total (**Total Energy**) computations. The **Total Energy** computation contains the combined figure for Received and Delivered Energy.

As previously stated, the summary page (**Consumption & Demand**) is extracted from the details page. (see below). Note that the red and blue boxed areas are consistent between the different page views. Please note that all values may (not) be absolutely identical due to the delay in page views.

Consumption & Demand			
	Net consumption	Demand	Peak demand
Active energy	0.1445 kWh	0.0002 kW	0.0358 kW
Reactive energy	0.0825 kVArh	0.0004 kVAr	-0.3028 kVAr
Apparent energy	1.2508 kVAh	0.0008 kVA	0.5394 kVA
Power factor	0.8684 (Ind)	0.4962 (Ind)	0.1175 (Cap)

Received energy				
	Current period	Total consumption	Demand	Peak demand
Active energy	0.0000 kWh	0.1446 kWh	0.0002 kW	0.0378 kW
Reactive energy	0.0000 kVArh	0.1654 kVArh	0.0006 kVAr	0.1605 kVAr
Power factor	0.2881 (Ind)	0.6581 (Ind)	0.3046 (Ind)	0.2290 (Ind)

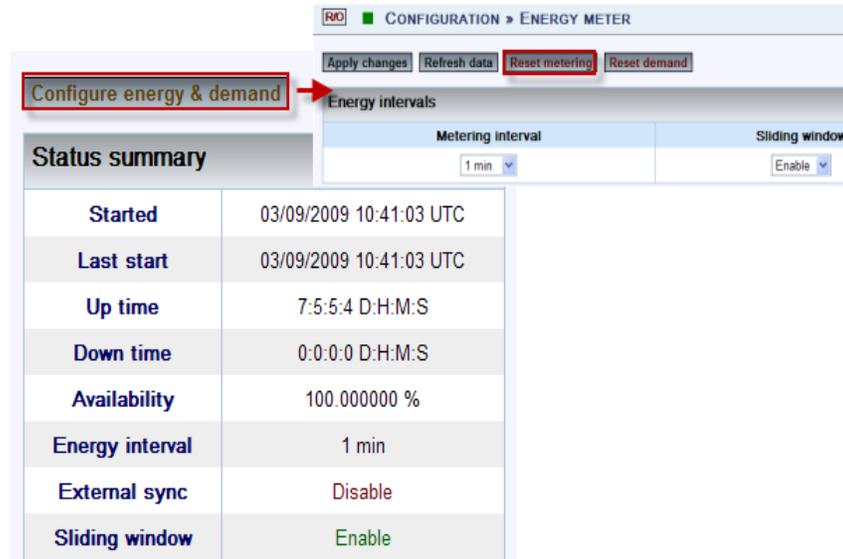
Delivered energy				
	Current period	Total consumption	Demand	Peak demand
Active energy	0.0000 kWh	0.0000 kWh	0.0000 kW	0.0019 kW
Reactive energy	0.0000 kVArh	0.0828 kVArh	0.0000 kVAr	0.4633 kVAr
Power factor	***	0.0003 (Cap)	***	0.0042 (Cap)

Net energy (Received-Delivered)				
	Current period	Total consumption	Demand	Peak demand
Active energy	0.0000 kWh	0.1445 kWh	0.0002 kW	0.0358 kW
Reactive energy	0.0000 kVArh	0.0826 kVArh	0.0006 kVAr	-0.3028 kVAr
Power factor	0.2881 (Ind)	0.8682 (Ind)	0.3046 (Ind)	0.1175 (Cap)

Total energy (Received+Delivered)				
	Current period	Total consumption	Demand	Peak demand
Active energy	0.0000 kWh	0.1446 kWh	0.0002 kW	0.0397 kW
Reactive energy	0.0000 kVArh	0.2482 kVArh	0.0006 kVA	0.6239 kVAr
Power factor	0.2881 (Ind)	0.5034 (Ind)	0.3046 (Ind)	0.0635 (Ind)
Apparent energy	0.0000 kVAh	1.2509 kVAh	0.0008 kVA	0.5394 kVA

## Measurement Status

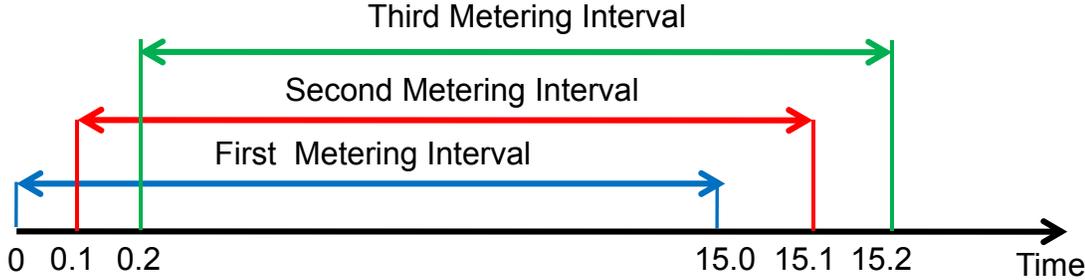
The Measurement Status page provides additional statistical information and necessary energy context information. The parameters and counters on this page are actually set up in the **Configure→Energy Meter** section using the **Configure energy & demand** button below.



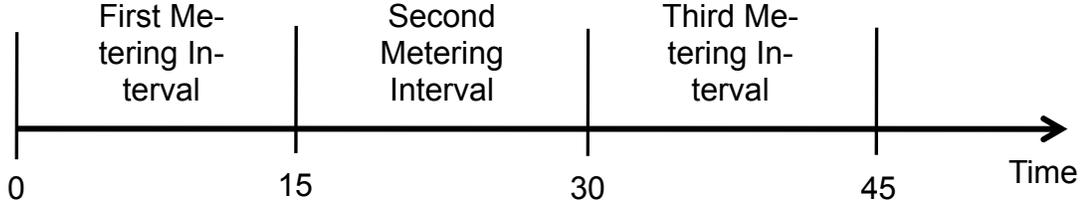
### An explanation of all Status Summary terms follows:

- **Started:** This is the date and time stamp from the last energy reset
- **Last start:** This is the date and time stamp for the last metering reset. Total consumption is reset.
- **Up time:** The total cumulative time the mechanism has been operational during the current period (since last start).
- **Down time:** The total cumulative time the mechanism has not been operational during the current period.
- **Availability:** The percentage of time the system has been operational. This is important because if this time exceeds a certain threshold, the data may not be considered reliable
- **Energy (Metering) interval:** The energy interval is the size of the window used in computing demand (e.g. 1 minute).
- **External Sync:** This function is currently fixed in disable mode.
- **Sliding window:** Information regarding the demand averaging system in use:
- **Enabled:** The demand is calculated using a sliding window averaging system.

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- Disabled: The demand is calculated according to stationary time frames.



## Power Quality Section

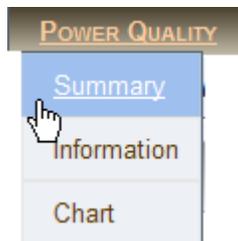
The ASCO 5400 Series Power Quality Meter contains a power quality compliance engine that enables real-time evaluation of power quality according to standards such as EN50160.

Power quality compliance, or in short, PQ Compliance is a set of electrically measured parameters which are typically calculated based on some pre-defined intervals or event triggers and are evaluated over a large observation window. For most of the PQ parameters, the observation window is one week, which means the displayed online information refers to the previous week. However, using ASCO's PQSCADA and Investigator applications, all time intervals are able to be observed.

A PQ parameter is typically based on a power quality event. For example, the DIP PQ parameter is based on counting DIP events over some observation period.

Different national standards vary in the way a specific PQ parameter is being measured or observed. The PQ Engine also supports a user-customizable mode in which all compliance parameters can be self-edited and modified by a user in order to meet new conditions, rules, measuring intervals, and even different observation periods.

The Power Quality section in the WEB interface is used to control and view power quality measurement and compliance information computed by the PQ Engine. This section includes the following pages:



## Compliance Summary

This page enables you to select the specific compliance standard to be evaluated by the unit's internal compliance engine. This page further contains on-line information and compliance status.

POWER QUALITY » SUMMARY	
<b>Events status</b>	
<a href="#">Voltage Frequency</a>	N/A
<a href="#">Supply Voltage Variations</a>	N/A
<a href="#">Rapid Voltage Changes</a>	N/A
<a href="#">Supply Voltage Dips</a>	N/A
<a href="#">Short Interruptions</a>	N/A
<a href="#">Long Interruptions</a>	N/A
<a href="#">Temporary Overvoltage</a>	N/A
<a href="#">Flicker Severity</a>	N/A
<a href="#">Harmonic Voltage</a>	N/A
<a href="#">Supply Voltage Unbalance</a>	N/A
<b>Compliance summary</b>	
<b>Compliance type</b>	EN50160
<b>Running status</b>	Stop
<b>Embedded report</b>	None
<b>Evaluation status</b>	N/A
<b>Start time</b>	***
<b>Window time On</b>	0:0:0:0 D:H:M:S
<b>Window time off</b>	0:0:0:0 D:H:M:S
<b>Measurement flag</b>	Not flagged

The Compliance Type sets the compliance standard. This can be changed in [Power Compliance on page 87](#).

Continuous compliance statistical information and events are stored in PQZIP files. In addition, the Embedded Report field further indicates a type of report that is auto-generated internally in the device's file system. Most compliance types do not generate any specific report, and therefore, the report type will be **None**. However, CREG type of compliance (used in Colombia) also auto-generates a specific format of report files as defined by the local regulator. The report files can be found in the [Section 9. Integrated FTP Server on page 135](#).

**The Evaluation Status** field provides an overall status of PASS or FAIL of the entire compliance. Anytime the evaluation period is not complete (typically required is a 1 week observation), the status will be N/A (Not Available).

**The Start Time** field shows the last time the compliance engine was restarted. The entire state and observation window history is stored on the internal non-volatile memory, so even after powering down; the Engine will continue its evaluation and maintain all indications. (Start time remains unchanged after device powered up).

## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

**The Window Time On/Off fields** specify how much aggregated time is already in the observation window. ON refers to the aggregated window time the device was powered on and OFF refers to the amount of window time the device power was off. The format presented is [Days: Hours: Minutes: Seconds]. Ideally the OFF time is all zeroes and the ON time is 7 days (which is the typical full observation period in most of the compliance types). Once the observation window reaches 7 days, it will start to slide in steps of 2 hours. Sliding means the information from the oldest 2 hours is being dropped, where a new up-to-date 2-hour interval is being used for calculations.

**The Measurement Flag field** indicates whether a power quality event such as DIP/SWELL or INTERRUPTION at the moment.

**The Events Status Table** shows a high level PASS or FAIL indication of each PQ parameter. Any PQ parameter that has an incomplete observation period will be presented as N/A (Not Available). Additional information of how a PQ parameter is being evaluated can be seen by simply clicking on the parameter's text. For example, clicking on the **Voltage Frequency** parameter within the EN50160 compliance mode will show an info page as shown in the figure below.

Events status		Compl
<a href="#">Voltage Frequency</a>	N/A	Compl
<a href="#">Supply Voltage</a>		
<a href="#">Rapid Voltage C</a>		
<a href="#">Supply Voltage</a>		
<a href="#">Short Interruptio</a>		
<a href="#">Long Interruption</a>		

**Voltage Frequency**

Frequency compliance is based on statistics: N, N1 & N2. Frequency measurement interval is 10 sec in an entire observation window of 1 week. N - amount of intervals. N1 - intervals frequency exceeded [+1.00%,-1.00%] from nominal freq. N2 - intervals frequency exceeded [+4.00%,-6.00%] from nominal freq. N1 & N2 increment only if valid voltage inside nominal boundary of [+15.0%,-15.0%]. Compliance if both N/N1 >= 95.0% of time and N/N2 >= 100.0% of time.

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## Compliance Information

This page contains detailed compliance information.

Detailed Compliance Info							Status: <span>Running</span> <input type="button" value="v"/>
	Status		Window Interval	Time OK	Time N/A	Total Events	
	Partial	Observation		Time Fail			
<a href="#">Voltage Frequency</a>	OK OK	Complete	1 week 10 sec	100.000 % 0.0000 %	0.0000 %	0	
<a href="#">Supply Voltage Variations</a>	OK OK	Complete	1 week 10 min	100.000 % 0.0000 %	0.0000 %	0	
<a href="#">Rapid Voltage Changes</a>	OK OK	Complete	1 week 3 sec	100.000 % 0.0000 %	0.0000 %	0	
<a href="#">Supply Voltage Dips</a>	OK OK	Complete	1 week 10 ms	100.000 % 0.0000 %	0.0000 %	0	
<a href="#">Short Interruptions</a>	OK OK	Complete	1 week 10 ms	100.000 % 0.0000 %	0.0000 %	0	
<a href="#">Long Interruptions</a>	OK OK	Complete	1 week 10 ms	98.837 % 1.1626 %	0.0000 %	1	
<a href="#">Temporary Overvoltage</a>	OK OK	Complete	1 week 10 ms	100.000 % 0.0000 %	0.0000 %	0	
<a href="#">Flicker Severity</a>	OK OK	Complete	1 week 10 min	100.000 % 0.0000 %	0.0000 %	0	
<a href="#">Harmonic Voltage</a>	OK OK	Complete	1 week 10 min	100.000 % 0.0000 %	0.0000 %	0	
<a href="#">Supply Voltage Unbalance</a>	OK OK	Complete	1 week 10 min	100.000 % 0.0000 %	0.0000 %	0	

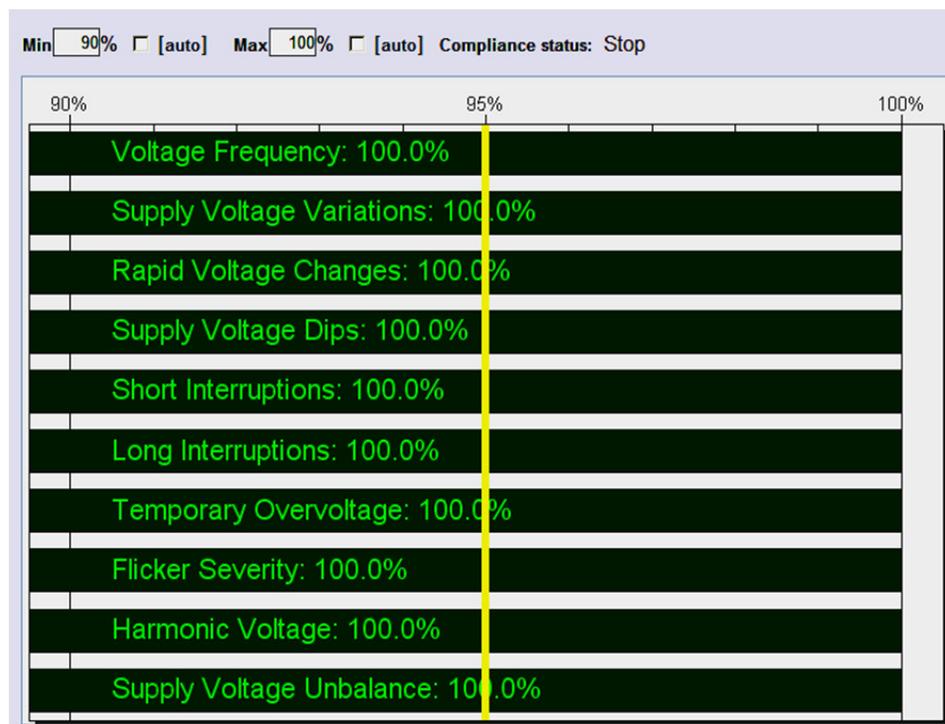
- **Status/Partial** contains two status indicators. The upper indicator refers to the entire observation window's PASS/FAIL result (same status as presented in the Summary page), while the lower indicator is a PASS/FAIL indicator of the most recent period. This recent indicator serves as real-time indicator and typically reflects to only minutes to a few hours of history (this is dependent on the specific PQ parameter measurement intervals and method).
- **Observation** indicates whether the observation window of a specific PQ parameter is complete.

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- **Window/Interval** provides the observation window time in the upper area (contains historical data used for the calculations) and measurement interval time in the lower area (the measured time length for which the PQ parameter). *Time OK/Time FAIL* provides the percentage of time the PQ parameter was OK (as green text on the upper area) and percentage of time the PQ parameter was outside the defined limits or failed (as red text in the lower area).
- **Time N/A** provides the percentage of time the unit was not measuring due to lack of power.
- **Total Events** provides the overall number of PQ events influenced by the PQ parameter in the observation window.

### The Compliance Chart Page

This page displays graphical bars of compliance levels (equals to percentage of time OK). The minimum and maximum values in the chart are configurable.



## Configuration Section

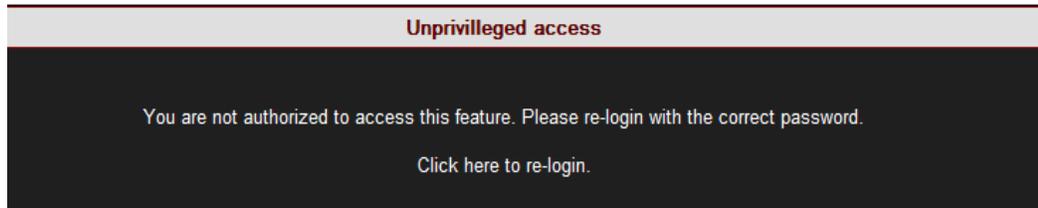
The Configuration pages are used to configure the ASCO 5400 Series Power Quality Meter.

CONFIGURATION	
Device setup	Advanced
Device info	System log
Time	Custom events
Voltages & Frequency	PQZIP recording
Currents	E-mail alerts
Communication	Reports
Security	Energy meter
Network	Display setup
Serial ports	Firmware upgrade
PQ compliance	
Power compliance	
User defined page 1	
User defined page 2	
User defined page 3	

Notice that in order to configure any of the pages and parameters in the Power Quality Meter interface, there is a need to login as Administrator. Refer to

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**Login** Page on page 50. If you are not logged in as Administrator the following message appears:



## NOTICE

*The PQZip should remain off until all configuration is complete.*

*The configuration section is divided into several parts. The order of operations is not critical, however, any change in the Network settings (changing the IP address to fixed) will require an automatic re-boot of the system.*

## Device Info

The screenshot shows a web interface for configuring an ASCO 5400 unit. At the top, there is a breadcrumb trail: "RW" (with a refresh icon), "CONFIGURATION", and "DEVICE INFO". Below this are three buttons: "Apply Changes", "Refresh Data", and "Restart Unit".

The main content is divided into several sections:

- 5400 Unit Configuration:** A table with four rows: "Site Name" (SITE NAME), "Description" (ASCO 5400), "Operator" (Operator NAME), and "Company" (COMPANY NAME).
- Product:** A table with four rows: "Boot" (0.3.02), "Software" (0.4.05.6.B6D5), "Hardware" (3x3x2x33), and "DSP" (4.7).
- Power Status:** A table with five rows: "Powered by" (AC + DC(48v)), "AC" (Off), "PoE Input" (Off), "DC(48v)" (Off), and "Down" (Off). Below this is "Capacitors" (50F).
- PoE Output:** A section with "State:" set to "Enable" (dropdown menu). Below are "PSE Status" (OK) and "PSE Error Code" (On).
- Alarms Configuration:** A grid of checkboxes for various alarm types: General (checked), FTP (unchecked), Drop Data (checked), DSP Sync (unchecked), Flash (checked), Misconfigured (checked), Time Sync (unchecked), Logger (checked), PQZip (checked), and DSP (checked).

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## 5400 Unit Configuration

The Unit Setup page is used to configure the main properties of the Power Quality Meter unit identification.

- **Site Name** enables the user to define a description of the site where the device is installed. This site description also appears in the ASCO Search utility under Unit Description when searching for devices as below:

IP Address	Unit Description	SubnetMask	Gateway IP	IP Mode	PHY	Firmware	Hardware	Serial Number
100.100.100.152 <a href="#">WEB FTP</a>	SITE NAME	255.255.255.0	100.100.100.254	DHCP	Main	0.3.60.6	2x2x2	5E.70.04.7F.3B.9E

- **Description:** an additional text field for optional use.
- **Operator:** an additional text field typically for inputting operator/technician name.
- **Company:** an additional text field typically for inputting company name.

# ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

## Product

The Product section specifies information regarding the attributes (software, hardware) of the Power Quality Meter model in use.

The Version fields specify internal HW and SW versions in which:

- **Boot:** Specific Boot Loader application version. The Boot Loader application is a small separated part of the firmware. The Boot is stored on a secured sector in the internal flash memory chip and is used for the very beginning of HW initialization for loading firmware upgrades and for further execution of the Power Quality Meter firmware. The Boot executes either Bank A or Bank B firmware. (See [Firmware Upgrade on page 99](#)).
- **Software:** Power Quality Meter firmware version. Notice that Power Quality Meter device contains two banks of firmware, while the version in this field refers to the currently executed firmware. (See [Firmware Upgrade on page 99](#)).
- **Hardware:** Power Quality Meter hardware version of the unit's modules.
- **DSP:** Power Quality Meter DSP version. The Power Quality Meter contains a dedicated DSP (Digital Signal Processing) module for high speed calculations. This field defines the firmware version of the code being executed on this DSP.

## Power Status

- **Powered by:** Informs the user as to the type of power currently supplying the instrument.
- **AC:** AC status
- **PoE Input:** Status of the PoE on the LAN1 port; an alternate power input for the instrument
- **DC (48v):** Status of the DC power supply input
- **Down:** This flag will be ON when the instrument has no power supply and is on ride through power supplied by the capacitors.
- **Capacitors:** The size of the super capacitor supplying the ride through power

## POE Output

- **State:** Enable/Disable: the PoE Out for LAN2
- **PSE Status:** The status of the LAN2/LCD port.
- **PSE Error Code:** Fail signifies that this port is malfunctioning. "On" signifies that an LCD screen is currently attached to this port

## Alarms Configuration

A checked item that is malfunctioning causes the red alarm indicator light on the Power Quality Meter unit to turn on. (ie: PQZip disabled by default)

## Time

The Time Setup section is used to set and control the time. Used for displaying and logging of the data and events.

## Network Time

This section controls Time Synchronization with a variety external time sources. Refer to [Error! Reference source not found.](#) **Section 7. Time Synchronization on page 111.**

- **Transport** is used to set whether the Time Sync module selects the source automatically or is manually forced to NTP or GPS source.
- **Main SNTP** is used to configure the IP address of the Primary NTP server to be used.
- **Alternate SNTP** is used to configure the IP address of the secondary NTP server to be used, in case the primary is not available.
- **Slew Mode**: configures the type of time slewing (adjustment) approach to be used by the Time Sync module to compensate for time deviations and network communication jitters. The default and preferred mode is Automatic. When set to automatic, the slewing factor is according to time source communication quality.

## Time Setup

This section is used to set and control the internal clock of the unit.

- **The RTC Counter** refers to the counting of the internal real time clock. The RTC starts its counting from the manufacture date. RTC Counter format is: Days, Hours, Minutes, and Seconds.
- **Time Zone** specifies the date and time to be presented on the WEB interface (time and date are presented at the bottom of the page). The presented time is the local time derived from the GMT time and the configured Time Zone which shifts the GMT time backward or forward in accordance. (Greenwich Mean Time (GMT) means time at Greenwich, London . It is also referred to as UTC.

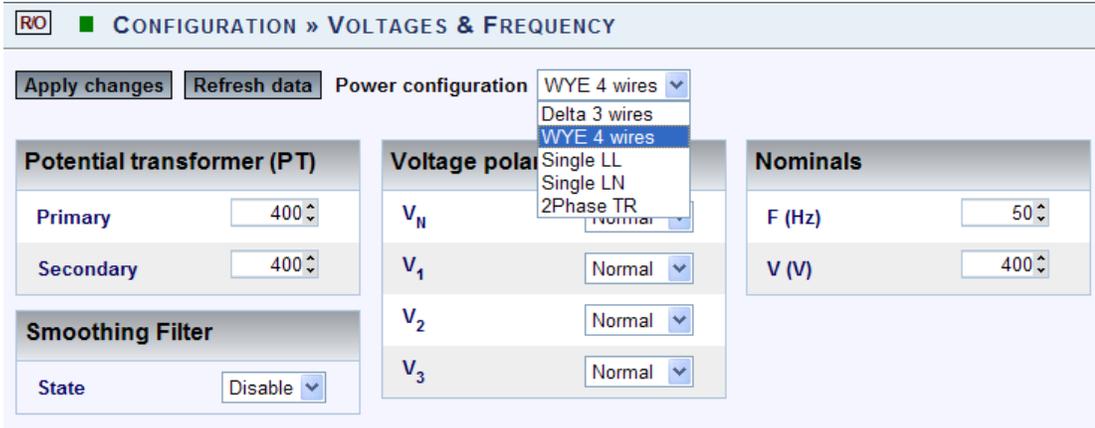
Unit Date & Time allows you to set the current time and date manually. Once you click on the configuration box, the date or time will instantly appear and you can set it. Click on the *Set Date & Time* button and the time is changed. However, if the unit's Time Synchronization module is synchronizing with an external source (like NTP or GPS), the time will be overridden as soon as the updates are received. To prevent automatic updates, set the Time Sync module on Self synchronization. (Refer to [Section 7. Time Synchronization on page 111](#)).

## Daylight Saving

You can enable the daylight saving time feature and set the period in this section. This will cause the time to automatically adjust to daylight savings time during the pre-defined period. This information is passed to the PQSCADA together with all other information via PQZip where it is displayed to the user (PQSCADA also supports DST).

**Voltage and Frequency**

This page defines the network type and nominal voltage and frequency values.



**Power Configuration**

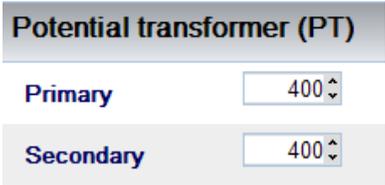
The network type settings are represented by five different configurations, although the actual number of supported networks could be extended to virtually any existing configuration.

The following table proposes the recommended configurations for several supported power types.

Power Type	Power Configuration to use
Single Phase with Neutral	Single LN
Single Phase without Neutral	Single LL
Single split phase	2Phase TR
Three Wire Delta	Delta 3 wires
Four Wire WYE	WYE 4 wires
Three Wire WYE	WYE 4 wires
Delta High Leg	Delta 3 wires
Delta Open Leg	Delta 3 wires

**Potential Transformer (PT)**

Potential Transformer configuration is required only for MV/HV networks where the voltage is measured using PTs, and the correct Primary and secondary ratios can be entered here.



### Voltage Polarity

The Voltage Polarity settings allow for toggling the polarity without it being necessary to change the wiring when the voltage connections are made with incorrect polarity due to a wiring mistake.

Voltage polarity	
V <sub>N</sub>	Normal ▾
V <sub>1</sub>	Normal ▾
V <sub>2</sub>	Normal ▾
V <sub>3</sub>	Normal ▾

### Nominals

Nominals	
F (Hz)	50 ⇅
V (V)	400 ⇅

The Nominals section defines the nominal values for frequency (F) and Voltages (V). The Frequency nominal affects compliance. Please see [Power Quality Section on page 65](#) and the EN61000-4-30 measurement window. When 50Hz nominal is set, the window is 10 cycles, and for 60Hz, it is 12 cycles.

The Voltage Nominal also affects the compliance engine and PQZip recording. Refer to [Section 6. PQZip Recording on page 103](#).

*If incorrect nominal values are entered, the device may not record anything.*

#### **NOTICE**

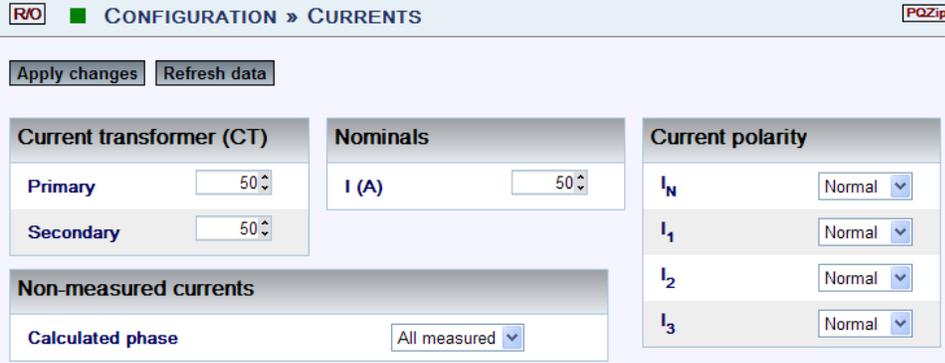
*For maximum logging resolution and efficiency it is recommended keeping NOMINAL values as close to the expected normal condition values and NOT to maximum values!*

**Smoothing Filter**

This filter is introduced according to IEC standard 61000-4-7. It allows (enabled) smoothing of the curve when there is a significant change in a power quality parameter.

**Currents**

Here the Primary and Secondary values for the Current Transformer are set. The Nominal current value is entered in this section.



**NOTICE**

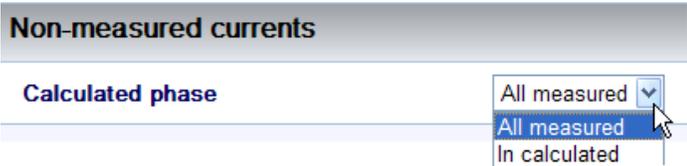
*For maximum logging resolution and efficiency it is recommended keeping NOMINAL values as close to the expected normal condition values and NOT to maximum values!*

The **Current Polarity** settings allow for toggling the polarity without it being necessary to change the wiring when the current connections are made with incorrect polarity due to a wiring mistake.

**Non-measured Current**

The Non-measured Current section helps to configure calculated current channels. The options are different for WYE and DELTA setups.

On WYE network type configurations:



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The neutral current (In) could be optionally calculated from the sum of three-phase currents, or alternatively, measured by the I4-current channel.

### On DELTA network configurations:



One of the three-phase current channels could optionally be calculated from the  $I1+I2+I3=0$ .

## Security

### Password Setup section

This section enables the Administrator to change or reset the passwords of Viewer and Administrator levels. Notice that the default (Reset) passwords are:

- **123:** Viewer (can view but cannot configure)
- **12345:** Administrator (can view as well as configure the device)

### FTP Access

The Power Quality Meter includes an FTP server which is accessed by the PQSCADA for PQZip file retrieval. The PQZip files may be manually retrieved by initiating an FTP session with the Power Quality Meter device. The FTP access controls the FTP login and FTP password for security measures. If no security measures are required, it is suggested to leave the default settings for straightforward PQSCADA connection.

---

### **NOTICE**

*Notice that change of access setup also requires a change in PQSCADA configuration.*

---

**Network**

The Network setup is a crucial part of the Power Quality Meter configuration. This setup procedure establishes the IP address of the unit in the network.

**RW** ■ CONFIGURATION » NETWORK
PQZip C

Apply changes Refresh data

**LAN1**

Auto DHCP Enable ▾

IP address

Subnet mask

**LAN2/LCD**

Auto DHCP Disable ▾

IP address

Subnet mask

**Ports setup**

HTTP port

FTP daemon

FTP data

SMTP port

**Outer access**

Gateway

SMTP server

**Network interface**

Interface	Link	Speed	Duplex	Mode
LAN1 [Link]	On	100 Mbits	Full	Auto negotiate
LAN2 [LCD]	Off	10 Mbits	Full	10Mbit FD

**Connections**

HTTP active	OPC active	LCD active	FTP active	FTP max
1	0	0	0	5

**Modbus TCP**

Slave address	<input type="text" value="159"/>	Modbus port	<input type="text" value="502"/>
---------------	----------------------------------	-------------	----------------------------------

**DNP3 configuration**

DNP3 port	Validate IP	Validate source	Source address	Destination address
<input type="text" value="20000"/>	<span>Enable ▾</span>	<span>Disable ▾</span>	<input type="text" value="4"/>	<input type="text" value="3"/>

**NOTICE**

*If any one of the following: IP address, subnet mask or gateway, have been changed, the unit will reboot and restart with the new Network settings.*

**LAN 1**

In most cases, the unit needs to have a **fixed IP address** (see note below). In each network the available IP numbers are different; therefore before assigning the IP address to the unit, you must consult the IT manager.

**To configure LAN 1:**

- Choose **Auto DHCP Disable**, then enter the IP address, Subnet Mask, and Gateway (optional) obtained from the IT manager.

LAN1	
Auto DHCP	Disable ▾
IP address	100.100.100.152
Subnet mask	255.255.255.0

- **Auto DHCP:** Enabling allows the LAN DHCP server to assign an IP address to the unit while disabling allows all parameters to be fixed and user assigned.
- **IP Address:** The assigned IP address for LAN 1 port of the device.
- **Subnet Mask:** For this port on this instrument. Obtain an available Subnet Mask address from the system administrator.
- 

**NOTICE**

*If the DHCP server assigns a Power Quality Meter unit a new (different) IP, once the PQZip files are downloaded from the unit to the PQSCADA, under the previous IP, the PQSCADA will not be able to automatically associate the new IP with the same database.*

## LAN2/LCD Port Setup (Only on 5450 & 5490 Power Quality Meters)

LAN 2 is used for the ASCO 5010 LCD Remote Display Unit. If no display is used, there is no need to configure LAN 2. If using an ASCO 5010 RDU, most cases do not require changing the default configuration.

### To configure LAN 2:

- Change any relevant parameters.

LAN2/LCD	
Auto DHCP	Disable ▾
IP address	192.168.168.168
Subnet mask	255.255.255.0

- **Auto DHCP:** In order to change any of the settings, this must be disabled.
- **IP Address:** IP address for this port on the instrument. It is recommended that the default address of **192.168.168.168** be retained in order to enable plug and play compatibility with the ASCO 5401 LCD remote screen viewer
- **Sub-Net Mask:** Subnet mask for this port on the instrument. It is recommended that the default address of **255.255.255.0** be retained in order to enable plug and play compatibility with the ASCO 5401 LCD remote screen viewer.

---

### **NOTICE**

*The IP/Subnet of LAN1 and LAN2 need to be configured for different networks.*

---

## Ports Setup

This is a legacy option for remote access. Port Setup enables changing the standard configuration of internet port numbers for standard communication protocols (Emails, File Transfer, & Web browsing). This might be used in networks where standard port numbers are forbidden or reserved by firewalls or in case you want to reserve the standard port number for a legacy modem/router that does not support port forwarding. (Notice that most external modems/routers on the market today do support port forwarding). It is suggested to leave the port addresses in their default setup so that it will be straightforward for web browsers or FTP clients to access the device via LAN/Internet.

Ports setup	
HTTP port	<input type="text" value="80"/>
FTP daemon	<input type="text" value="21"/>
FTP data	<input type="text" value="20"/>
SMTP port	<input type="text" value="25"/>

- **HTTP Port:** used for setting port address of Web browsing.
- **FTP Daemon:** used for setting port address of File transfer (control channel).
- **FTP Data:** used for setting port address of File transfer (data channel).
- **SMTP Port:** used for setting port address of mail transfer.

---

### **NOTICE**

*Notice that change of FTP ports also requires a change in PQSCADA configuration.*

---

## Outer Access

Outer access	
Gateway	<input type="text" value="100.100.100.254"/>
SMTP server	<input type="text" value="0.0.0.0"/>

- **Gateway:** used for setting the Power Quality Meter's default Gateway IP address. This address is used when the Power Quality Meter needs to send data to IP addresses outside its LAN.
- **SMTP Server:** used for setting an IP Address for the Email Server to be used for sending notification emails.

## Modbus TCP

Modbus TCP allows the unit to communicate in Modbus protocol, as well as, serve as a Modbus slave over the Ethernet. This protocol is used to retrieve data from the device.

Modbus TCP			
Slave address	<input type="text" value="159"/>	Modbus port	<input type="text" value="502"/>

- **Slave Address:** ID address of a unit on a Modbus network.
- **Modbus Port:** TCP port on which the protocol operates.

## DNP3 Config

An Ethernet protocol used to retrieve data from the device. The Power Quality Meter incorporates a DNP3 server.

DNP3 configuration				
DNP3 port	Validate IP	Validate source	Source address	Destination address
<input type="text" value="20000"/>	<input type="button" value="Enable"/> ▾	<input type="button" value="Disable"/> ▾	<input type="text" value="4"/>	<input type="text" value="3"/>

- **DNP3 port:** TCP port for the DNP3 protocol.
- **Validate IP:** When this option is enabled (default), it is possible to verify that the IP address of the UDP broadcast messages (if present) is equal to the current active TCP connection address in order to avoid unwanted inbound access.

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- **Validate source:** When this option is enabled, it is possible to check if the source address (the address of the client which sent the message to the Meter) of a message (any message) is equal to the destination address that the user inserts.
- **Source address:** The local DNP address of the device.
- **Destination address:** for the “Validate source”.

### Serial Ports

The setup configures the parameters of RS485/RS422 interface.

The screenshot shows a web-based configuration interface for SERIAL PORTS. At the top, there are buttons for 'Apply changes', 'Refresh data', 'Connect', 'Disconnect', and 'Reset modem'. Below these is a table for RS-485 / RS-422 settings:

Bitrate	Data bits	Parity	Stop bits	Flow
19200	8 bit	None	1	Full
Serial mode			ModBus slave address	
TTY			159	

### RS485/422

- **Bitrate:** The transfer rate of data.
- **Data Bits:** Number of data bits in a byte.
- **Parity:** Parity method for error detecting code..
- **Stop Bits:** Number of stop bits used to mark the end of a byte transmission.
- Flow:
  - **Full:** using full duplex for communication (4 wire)
  - **Half:** using half duplex for communication (2 wire)
- Serial Mode
  - TTY: Debug shell mode
  - **ModBus RTU:** ModBus protocol (serving as a slave on a Modbus network)
  - **GPS:** When GPS is attached to this serial port
  - **ModBus Slave Address:** Unique ID of the Power Quality Meter on a Modbus network.

### PPP Status

This indicates the status of the PPP. You can select or deselect the message log to allow logging of this protocol's activity in the log.

PPP status <span style="float: right;">☑ [Message log]</span>		
PPP IP	PPP subnet	Signal quality
Not Available	Not Available	-----
Message log		
Empty		

### PPP Configuration

The purpose of PPP Setup is to configure the Point to Point protocol parameters.

PPP configuration			
PAP status	CHAP status	Username	Password
Enable ▾	Enable ▾	<input type="text"/>	<input type="text"/>

- **PAP Status:** Enable/Disable PAP feature
- **CHAP Status:** Enable/Disable CHAP feature
- **Username:** This is the username that you receive from your ISP
- **Password:** This is the password that you receive from your ISP

### Modem Configuration

The following strings require setup when working with a standard AT commands modem.

Modem configuration			
<b>Init string</b>	<input type="text"/>	<b>Reset string</b>	<input type="text"/>
<b>Default init</b>	<input type="text"/>	<b>Phone number</b>	<input type="text"/>

- **Init String:** AT command string to initialize the modem
- **Reset String:** AT command string to reset the modem.
- **Default Init:** AT command string to set the modem to default configuration.
- **Phone Number:** Dial up number.

## Power Compliance

This page enables you to select the specific compliance standard to be evaluated by the unit's internal compliance engine.

### In order to change or to activate a new compliance type:

- If the PQ Engine is already running, set the Compliance Status to **Stop**, then click **Apply changes**.

Wait for the WEB page to refresh.

- Select the desired compliance type, then change Compliance Status to **Running**.
- Click **Apply changes**, then wait for the WEB page to refresh.

The new compliance type is now activated and running.

- Verify that the Start Time field has changed in **Power Quality**→**Summary**.

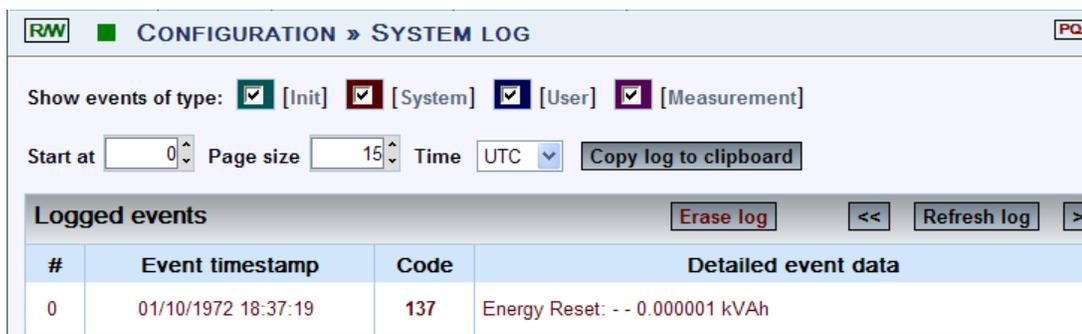
Compliance summary	
Compliance type	EN50160 Async
Running status	Stop
Embedded report	None
Evaluation status	N/A
Start time	***

## User Defined Pages

These pages allow you to fully customize the compliance parameters. In order to be able to configure, you first need to change the compliance type to **User Defined** (**Configuration**→**Power Compliance Page**).

## System Log

The System Log shows existing user events. All events are created in the Custom Events section to follow.



- **Show Events of type:** You may choose the type of events to display in the list.
- **Start at:** Specify the event range and page size to limit your event selection.
- **Time:** UTC or Local time.
- **Logged Events:** Displays the event information (for Code definition refers to Custom Events Configuration page to follow).

## Custom Events

The Custom Events page is used for configuring custom events. While in the compliance configuration pages you are limited to configure only power quality events, in this page you are free to define any type of event notification. Events can be triggered based on any measured parameters and conditioned by complex logical or mathematical functions.

Custom Events is not related to power quality events. The Events setup is based on a custom events engine that works in parallel to the power quality events engine allowing the user to define tailored events according to his specific needs.

**The Power Quality Meter contains following event types:**

Type	Event Code range
System Events	1-200
User Custom Events Setup	201-232
Power Quality and Compliance Events	233-300
Reserved for other/future usage	301...

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All events triggered in the ASCO 5400 Series Power Quality Meter are stored in the logger (flash memory) which is viewable through the System Log page.

In addition, all events are also stored in the PQZIP files and can be further analyzed in the ASCO PQSCADA/Investigator software.

Events can generate an email-notification. See [Email Alerts on page 95](#).

Codes 201 – 232 are used for configuring up to 32 different, fully customized events.

A custom event is typically built from one or more logical/mathematical conditions. When the conditions are met, the event is triggered and the following information is generated and stored:

- Time Stamp of beginning
- Event Code number
- Duration of event
- Magnitude (A parameter value recorded during the event)
- Magnitude deviation (from the normal/configured value/treshold)
- Phases that were influenced
- Severity of the Event (value indicating how severity of the event is)

Although the information implies a power related event, you are free to configure other type of events that are not related to specific power network parameters, such as digital input-based events or even temperature-based events and so on. (In such cases the Phases involved information should be left blank/ignored.)

Events can also be based on multiple conditions, for example an event which is triggered, if both, voltage is above some treshold and outside (PT-100) temprature exceeds a certain limit.

This page contains buttons for applying changes/creating/deleting and performing various actions on selected events.

The screenshot shows a web-based configuration interface for 'CUSTOM EVENTS'. At the top, there is a navigation bar with 'R/O' on the left and 'PQZ' on the right. Below the navigation bar, there are several controls: 'Apply changes' and 'Refresh data' buttons, followed by an 'Events preset:' dropdown menu currently set to 'User Defined'. Below these are 'New event' and 'Clear all' buttons, followed by an 'Action on selected events:' dropdown menu set to 'Delete' and an 'Apply action' button. The main content area is titled 'Events list' and currently displays the message 'No events defined for this mode' in red text.

There are a few modes to use. A user may create events manually (**User Defined**) or select a pre-prepared set of events from a pre-set list (**Preset**). Preset events are pre-prepared event configurations (hard coded in the firmware). Preset 2 is very useful for **DFR** (Digital Fault Recording) applications.

**NOTICE**

*Notice that changing between presets will erase the content of what is already defined.*

When selecting User Defined, you can create multiple events. Once an event is created, it is added to the Logged Events. (See System Log on page 88).

Logged events				Erase log
#	Event timestamp	Code	Details	
0	01/10/1972 18:37:19	137	Energy Reset: -- 0.000001 kVAh	
1	01/10/1972 18:37:19	137	Energy Reset: -- 0.000001 kVAh	

For the selected event, you may select a specific action from the Action on selected events list and then press the **Apply Action** button.

**Creating a Custom Event**

- From the Configuration → Custom Events window, click **New event**.

The Custom Event Configuration window appears:

Custom event configuration		Cancel	Save	More
<u>Description</u>	Event 201	Code: 201		
<u>Condition</u>	Add new	Edit condition		
<u>Trigger</u>	On both begin and end	<input checked="" type="checkbox"/> Notify by e-mail		

**NOTICE**

*Notice the underlined fields (Condition and Trigger) which can be clicked for hints (below) that provide online information about the field and its usage.*

Event is based on one or more conditions. There are two types of conditions "Single" and "Multiple", refer the condition configuration area for further information. No matter what type of condition is linked to the event, the linkage between an event and its dependent condition is by its ID string which appear in the selection list below.

- **The Description** is used to set a meaningful name for the event.
- **The Code** is the event code #. The code number is selected automatically from the available user events codes.
- **An event** is based on one or more conditions. There are two types of conditions Single and Multiple. No matter what type of condition is linked to the event, the link between an event and its dependent condition/s is by a condition ID string as selected in the Condition selection box. Use the *Edit Condition* button to create new or edit an existing condition.
- **An event** is basically a logic signal. Anytime a condition is not active, the event remains in a "0" state. When a condition is met, the event becomes "1" state (beginning of event). The event remains on "1" state until the condition is de-activated (end of event). The trigger configuration field defines what situations will generate an event record. Notification is either on the beginning state, end state, or at both states.

---

**NOTICE**

*Notice that if selecting the beginning of an event, the duration indication of the event will be recorded as zero.*

---

User events are stored automatically in the system log and PQZIP. In addition, you may set the Notify by Email to create an email notification as soon as the event is triggered.

- The *Save* button is used to save the configuration.
  - The *More* button displays more advanced settings that you can control.

### Creating Event's Conditions

- **The Single type** of condition is defined as the result of some rule (mathematical operation on some system parameters), For instance, a percentage voltage drops below the threshold or a change of digital input and so on. The condition has 2 logic states, Activated (1) and De-activated (0). Transition to each state is fully user configurable.
- **A Multiple-type** of condition is a combination of 2 other sub conditions. A Multiple-type condition must be linked to 2 sub conditions, each of these 2 sub conditions can be either Multiple or Single type. Therefore, the Multiple-type condition can be used to create a complex hierarchy of conditions.

**NOTICE**

*Notice that until there are at least 2 conditions defined, it is impossible to create a Multiple condition.*

- **The ID Condition** is identified by a text ID. Two conditions cannot be set to the same ID string.
- **The Type** selects the type of condition (either Single or Multiple).

### Single Type Condition

- **The Based on list box** is used to select a group of parameters for further user selection.

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- **The Parameter list box** is used to select the specific parameter from a previously selected group. The selected parameter will be used as the "X" variable in the condition rules (operation).
- **The Activation area** is used to configure the rules that will be applied to cause real-time activation of the condition (change from 0 -> 1). For example, if you set the following: Voltage RMS 1 (X = V1), Compare to is set to the configured Nominal voltage (say, V = 230V), Deviation is set 10 (D = 10%) and Operation is set  $100 * (|X - V| / V) \geq D$ , the condition will be activated when the RMS voltage of channel 1 goes 10% above or 10% below nominal voltage.
- **The Deactivation area** is used to configure the rules that will be applied to cause real-time de-activation of the condition (change from 1 -> 0). For example, if you set the following: Voltage RMS 1 (X = V1), Compare to is set to the configured Nominal voltage (say, V = 230V), Deviation is set 10 (D = 10%) and Operation is set  $100 * (|X - V| / V) < D$ , the condition will be de-activated when the RMS voltage of channel 1 goes below 10% deviation from nominal.
- **The Compare to list** is used to select the type of reference value ("V") to compare to the X parameter value.
- **The Parameter** is for setting reference to system parameter such as nominal voltage value.
- **User Value** enables the user to edit his own reference value.
- **Interval average** enables user to compare X to its averaged value over a defined time interval.
- **Value  $\Delta$**  enables dX/dt (time deviation) operation, which means X is compared to its previous sample value. For instance, if the selected X parameter is V1 RMS (from group 10[ms] Fast RMS than V = X[-1] (meaning, previous 10ms RMS value).
- **Deviation** defines the Deviation ("D") value used in the operation formula. Notice that some operations do not contain deviation; in such cases the deviation configuration is not in use.
- **Operation** defines the rule or mathematical operation to apply for Activation or Deactivation of condition.

## Multiple Type Condition

- **Condition A** is used to select ID of first sub-condition.
- **Condition B** is used to select ID of second sub-condition.
- **Logic** is used to define the combined logic state between the two sub-conditions A and B.
- **Magnitude Combination** instructs the events engine how to compute the Magnitude resulting from a combined condition. For instance, say condition A and condition B are both voltage parameters. In this case, selecting Avg. (Average) or Max (Maximum) is practical. However if condition A is voltage and condition B is current, then AVG or MAX is irrelevant, while A-only option is more practical (meaning only magnitude of voltage from condition A will be taken).

## PQZip Recording

After **all** configuration procedures are complete, the Power Quality Meter is ready to continuously record the voltage and current waveforms. The last step necessary to begin recording is to enable the PQZip recording. This patented algorithm compresses the data as it is recorded, enabling continuous recording of all waveforms to the desired resolution. For more on PQZip, please refer to the [Section 6. PQZip Recording on page 103](#).

## Email Alerts

The Power Quality Meter can be configured to send email alerts to a selected recipient. (TO address: below) The configuration of the email address to the recipient and the desired events are selected in on this page.

R/O   ■ CONFIGURATION » E-MAIL ALERTS

Apply changes   
 Refresh data   
 Send test alert

**E-mail configuration**

'TO' address:

**System**

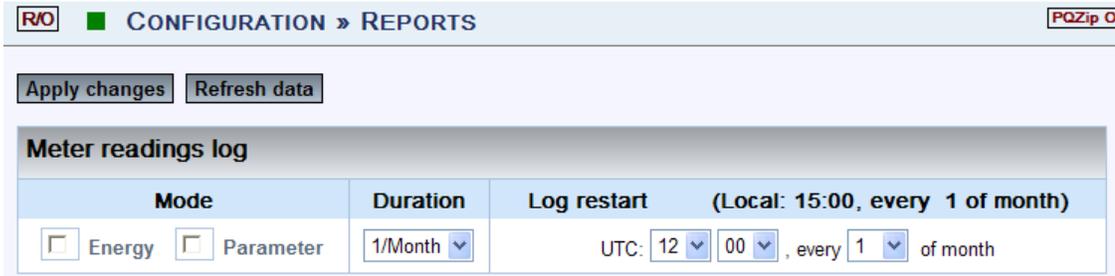
<input checked="" type="checkbox"/> Power up	<input type="checkbox"/> Watchdog reset
<input checked="" type="checkbox"/> Power loss	<input type="checkbox"/> System startup
<input type="checkbox"/> Shutdown started	<input type="checkbox"/> Shutdown done
<input type="checkbox"/> Shutdown on power loss	<input type="checkbox"/> Shutdown on error
<input type="checkbox"/> User shutdown	<input type="checkbox"/> Event log erased
<input type="checkbox"/> Parameters block corrupted	<input type="checkbox"/> Read meter log file end
<input type="checkbox"/> Voltage dropdown	<input type="checkbox"/> Reserved

**Connections**

<input type="checkbox"/> HTTP connected	<input type="checkbox"/> TCPIP connected
<input type="checkbox"/> OPC connected	<input type="checkbox"/> Serial connected
<input type="checkbox"/> FTP login	<input type="checkbox"/> Telnet login
<input type="checkbox"/> Main SNTP	<input type="checkbox"/> Alternative SNTP
<input type="checkbox"/> IP changed	<input type="checkbox"/> Time synchronized
<input type="checkbox"/> Connection closed	<input type="checkbox"/> Network reset

**Reports**

The Power Quality Meter is capable of logging and saving on the compact flash two types of logs; energy log and parameter log:



**Meter Readings Log**

**Energy Mode:** The information from the total energy meter. The information is saved on the compact flash in /CF\_UPMB/Reports in a .csv file format. (Comma separated values) and can be viewed in Excel. This report can also be configured to be sent as an email attachment. The values that are saved in this report:

- Kwh In
- Kwh Out
- KVArh In
- KVArh Out
- KVAh

**NOTICE**

*The values of the total energy meter are saved in the PQZip files even if the Meter Readings Log is disabled.*

**Parameter Mode**

Parameter log saved by default the following values:

- **KW (Power)** – average, standard deviation, maximum and minimum values
- **Frequency** – average, standard deviation, maximum and minimum values
- **KVAr** – average, standard deviation, maximum and minimum values
-

**NOTICE**

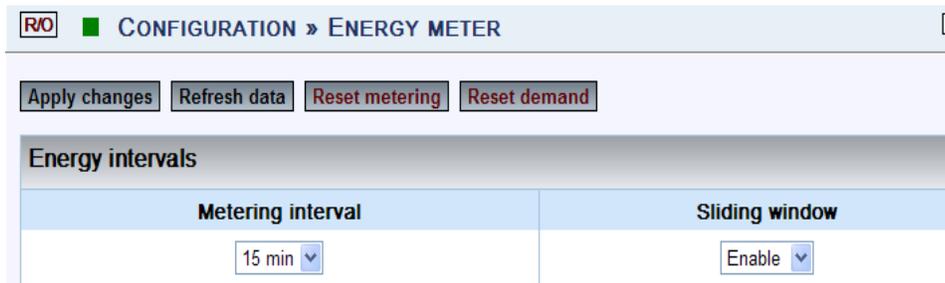
*The parameter log can be customized to any other three parameters. The configuration needs to be done only through ASCO.*

**Duration** is the report period and the **Log Restart** is the starting time point for the report period expressed according to UTC.

**Energy Meter**

The Power Quality Meter utilizes three energy meters:

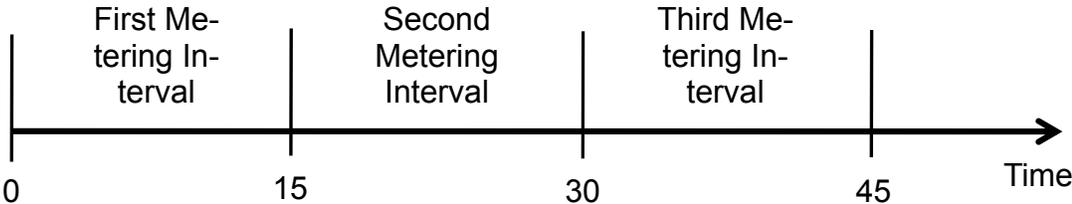
- Current Period
- Total Consumption
- Demand



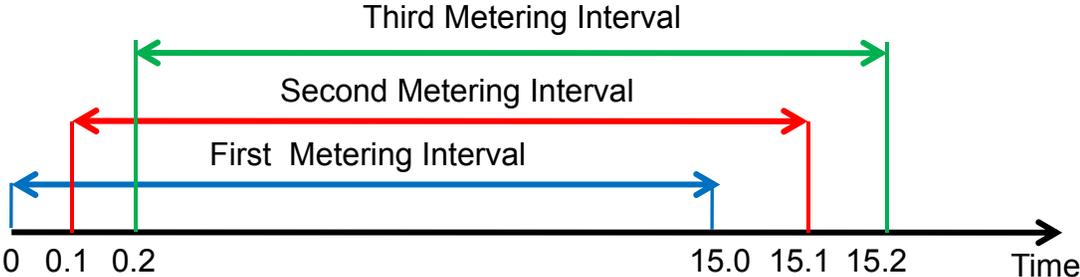
The energy calculations are configurable with regards to the time and the method of averaging.

- **Metering Interval:** Establish a configurable period of time (interval) of 5, 10, 15, 30, 60 minutes, to measure energy according to the preset interval.
- **Sliding Window: refers only to the demand meter.** The energy is calculated using moving average time intervals (1 second).
- **Disable:** the energy is calculated using the **fixed metering interval**. (See [Fixed Metering Interval on page 98](#)).
- **Enable:** the energy is calculated using a **sliding window**. (See [Sliding Window on page 98](#)).

**Fixed Metering Interval**



**Sliding Window**

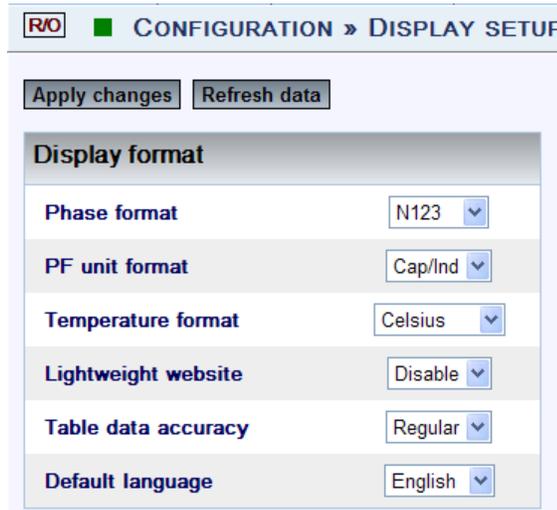


**NOTICE**

*In the figure above, the sliding window time difference is 0.1 minute. In reality, the time increment is one second.*

## Display Setup

The Display Setup page enables customization for regional and generic display-related settings.



R/O ■ CONFIGURATION > DISPLAY SETUP

Apply changes Refresh data

**Display format**

Phase format	N123
PF unit format	Cap/Ind
Temperature format	Celsius
Lightweight website	Disable
Table data accuracy	Regular
Default language	English

## Firmware Upgrade

The ASCO 5400 Series Power Quality Meter's internal software (firmware) can be upgraded on demand using the Firmware Upgrade page.

### Firmware Banks

The Power Quality Meter implements a comprehensive firmware management mechanism designed to insure a failure-free field upgrading functionality. The mechanism insures that at any time there are two firmware images available, where only one is active (running). The user may select which one of the two banks is the active bank. When the user initiates a firmware upgrade, the newly added firmware will load into the inactive bank. Once the process of uploading the new firmware is completed, the unit will reboot from the inactive bank, turning it into the active bank.

The firmware images are stored in a dedicated non-volatile flash memory block referred to as Bank. The Bank's status is displayed on the Banks section on Firmware Upgrade page.

Banks	
Bank A version	0.3.10
Bank B version	0.3.60.6

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- **Active Bank** shows which firmware Bank is actually in use.
- **Bank A/B version** displays a Bank's firmware and condition. A numeric- only firmware name means valid firmware, which is ready to use. In some situations the firmware could be further marked with a prefix character to identify a firmware status. The table below describes status prefixes available:

Prefix	Status
"*" <b>(Asterisk)</b>	The firmware was upgraded and reboot is pending to activate the image for the first time. The user is free to initiate reboot manually to complete the upgrading procedure.
"F"	The firmware image failed to complete the initialization process successfully. The firmware was declared as "Faulty", another bank is being used.
"+"	The firmware bank is being upgraded at the moment, wait for a completion.
"E"	The bank is empty.

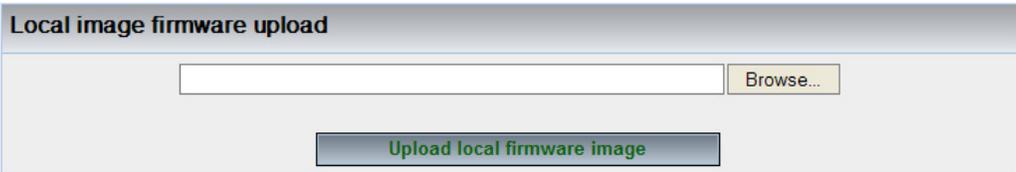
For example, if firmware 0.3.60.6 would be found faulty/damaged/corrupted it will appear as F0.3.60.6 on the Bank A/B version field. In such a case it is recommended to check if the firmware file is authentic and attempt to upgrade it again.

### Firmware File

- New, complimentary firmware upgrades that can offer new and improved functionalities are released often. Usually, new firmware can be expected to be released every couple of months. The latest firmware file is available by contacting <https://support.ascopower.com> or dial 1-800-800-ASCO(2726) in North America or dial +1 973-360-3600 when International.

### HTTP Upgrade

Probably, the simplest way of upgrading your instrument is by using the HTTP Upgrade functionality.



This can be initiated by using the **Local Image Firmware Upload** section.

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- Press the *Browse* button and select the image file of the firmware you've downloaded on your local computer.
- Click *Open*.
- Click the *Upload local firmware image* button to initiate an actual upgrade process.

### **NOTICE**

*It is recommended to use "simple" folders such as "c:\Temp" for local firmware upgrades. Keep the path shorter than 30 characters.*

*Folders which require a special security, such as "My Documents" or "Desktop" may not operate correctly with HTTP upload.*

### **FTP Upgrade**

An alternative option of upgrading your instrument is by using an FTP (File Transfer Protocol) interface. The Power Quality Meter employs an FTP client module which is capable of downloading a firmware image file from an external FTP server automatically.

The FTP firmware upgrade functionality is configured in the FTP Firmware Upgrade section. The factory default configuration settings define an ASCO Corporate FTP server which is loaded with the latest released firmware. Alternatively, any other FTP server could be used. We recommend Filezilla, a free FTP server (<http://filezilla-project.org/>) or similar.

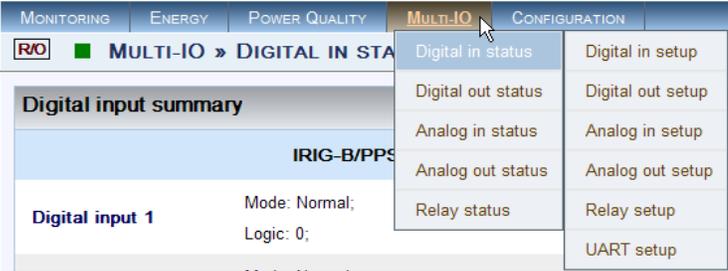
<b>FTP server</b>	The IP address of the external FTP server where the firmware file is located. The default setting is: <b>212.143.246.204</b> which is the ASCO's FTP server which is loaded with a latest released firmware
<b>FTP username</b>	The username to login to the FTP server. The default is <b>ASCO</b>
<b>FTP password</b>	The password to login to the FTP server. The default is <b>ASCOASCO</b> ,
<b>Firmware filename</b>	The firmware filename. As default, the latest firmware located under ASCO's FTP server is <b>Meter.bin</b>

- When ready, press *Upgrade FW* to initiate the upgrade process.

The unit will automatically restart when the upgrade is complete.

### Multi-IO Section

The Multi I/O is an optional module available for the Power Quality Meter. The Multi I/O Expansion module extends the monitoring capabilities of the Power Quality Meter with additional digital and analog I/O ports. This heading option will not appear if the hardware is not present. Please refer to a separate document on Multi I/O.



### LCD Section

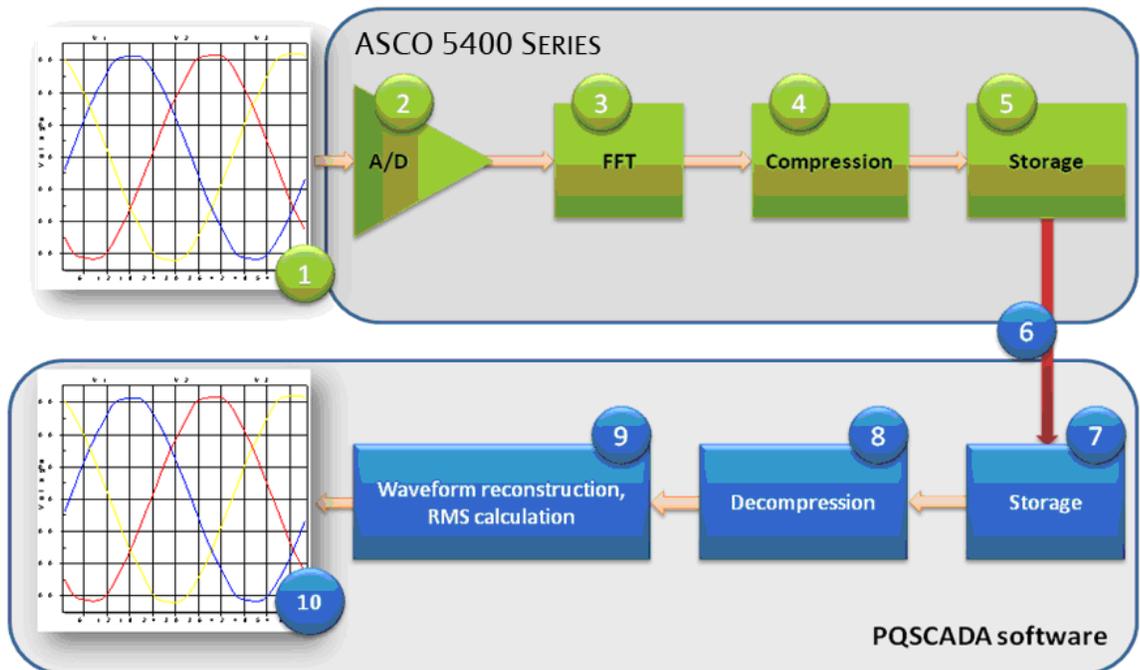
The LCD Section main page emulates an optional B/W display interface. Please refer to a separate document on Multi I/O.

## Section 6. PQZip Recording

The ASCO 5400 Series Power Quality Meter utilizes a unique compression technology (referred as PQZip) which enables continuous gap-less recording of all electrical parameter related data for a significant time duration without the need of event thresholds of any kind. The Power Quality Meter device with standard 8GB of internal memory can record continuously for a duration of several months or even a year depending on the network pollution level.

### Principle of Operation

PQZip compression technology is based on Compression Method protected under US Federal Patent Law (as well as by patent laws in several other countries).



This figure shows a simplified diagram of the compression/decompression process performed according to ASCO PQZip technology. A detailed explanation of the process to follow:

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- 1 Voltages and currents are being sensed and scaled to achieve a maximum resolution using the following A/D process.
- 2 The waveforms are being sampled at 1024 samples per cycle resolution for voltages and 256 samples per cycle resolution for currents.
- 2 The resulting digital waveform representation is being passed thru FFT computation, resulting 512 spectral components (harmonics) per cycle or voltages and 128 for currents.
- 4 Every harmonic component is being analyzed and compressed individually. Zero value components are being skipped. No zero harmonic components are being evaluated over time and only changes in a value or angle are being recorded. The resulting data is being compressed using industry known Lossless compression algorithms.
- 5 The compressed harmonic data is being organized in blocks of up to 5 minutes of concurrent cycles and being stored along with the measured frequency of every cycle and reference time stamps into a PQZip file residing on the onboard flash memory. The typical compression ratio expected as a ratio between incoming data volume on block 3 and the data being stored is 1000:1.
- 6 The PQZip files can be downloaded automatically or manually using the integrated embedded FTP server to the Mobile Analysis Lab or any other computer system for further storage and analysis.
- 7 The compressed data is then reorganized and optimized for fast access while in a compressed state. The resulting data is stored in the SQL database for long term storage.
- 8 When required, the data is decompressed, recovering a full harmonic spectrum for each cycle along with the associated time stamps.
- 9 The spectral data can further be used to reconstruct any individual cycle's waveform in the same resolution as at the input module (1) with accurate time and cycle duration. Any possible electrical parameters can be calculated based on the data by retrieving precise accuracy and wave shape.
- 1 The waveform displayed by the Investigator application is reconstructed based on compressed spectral data of every concurrent network cycle. In addition, virtually any electrical parameter can be calculated based on that data and displayed at any resolution or time span.

## Operation

The PQZip recording does not require any site-specific configurations. As default, all units leave the factory with PQZip recording being **Disabled/Off**. The instrument does not start recording until PQZip is enabled.



## Configuration

The PQZip status and Configuration page is located at **Configuration→PQZIP Recording**.

The screenshot displays the 'CONFIGURATION » PQZIP RECORDING' page. It includes control buttons for 'Apply changes', 'Refresh data', and 'Erase PQzip data', along with a 'State' dropdown set to 'Disable'. The page is divided into several sections:

- PQZIP information:**
  - Compression: 100.000 %
  - Start time: DDMMYYYY HH:MM:SEC UTC
  - Current file: 0
- Compact flash information:**
  - Free CF space: 1092.4 MBytes
  - Total CF space: 1999.3 MBytes
  - CF model: SMART CF
  - CF revision: SMICF+ABSMART CF
  - CF serial #: 2003012000F8C0E8
- Tolerance (%):**

V <sub>1</sub>	0.0000
V <sub>2</sub>	0.0000
V <sub>3</sub>	0.0000
V <sub>N</sub>	0.0000
I <sub>1</sub>	0.0000
I <sub>2</sub>	0.0000
I <sub>3</sub>	0.0000
I <sub>N</sub>	0.0000
- PQZip configuration:**

PQZip mode	Monthly ratio	V/I Relation (%)
Fixed Ratio	700 MB	66
- File capacity, Record mode, and Record type:**

File capacity	Record mode	Record type
150 min	FULL	PQSCADA 3.x

## **ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL**

Administrator-user privileges are required to perform any change in configuration See

[Login Page on page 50.](#)

When modification is requested and the logged-in user privileges (the login password) are less than administrator, you will be prompted to perform a login with the Administrator password to allow modification.

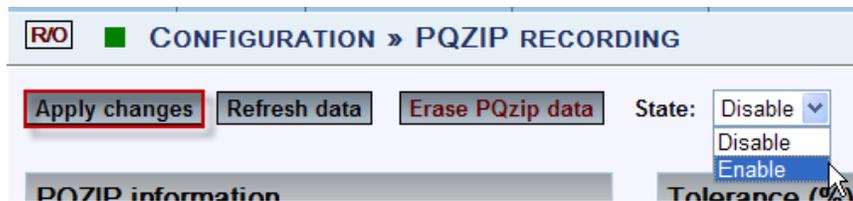
## NOTICE

*By enabling PQZIP, the device commences recording. Therefore, the PQZip should remain off/disabled until all configuration is complete. See [Configuration Section on page 70.](#)*

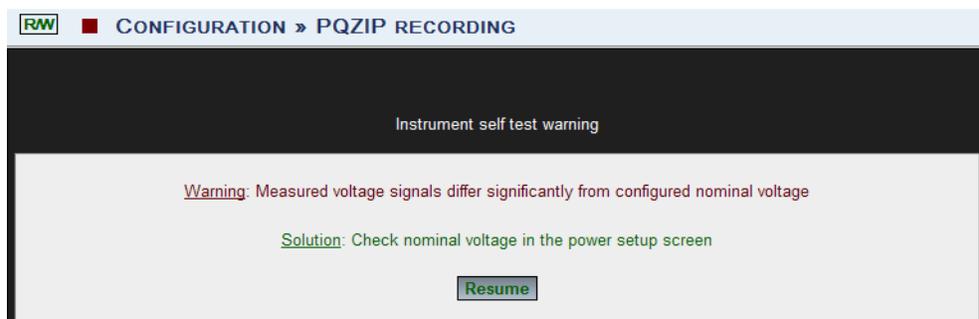
## Enabling/Disabling PQZIP

To enable PQZIP recording:

- To enable the recording operation, change state to **Enabled** and press the **Apply changes** button.

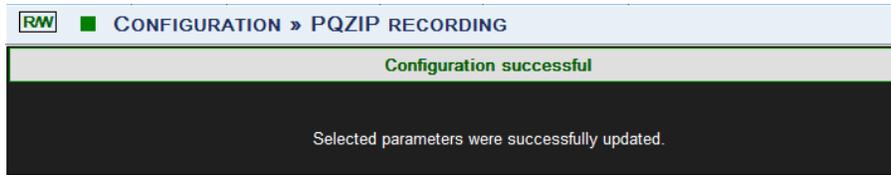


The following warning may appear if some parameter readings are inconsistent with the configuration. In this case make sure all parameters are correct before enabling the PQZIP.



- To confirm, click **Resume**.

The following screen appears to confirm the change:



## FIFO Concept

PQZip files are maintained on a local flash memory in a FIFO (First In First Out) concept. This means that the file storage operation never stops, and when memory becomes full, the oldest files are deleted automatically to free required space for the newest data.

## Fixed Quality versus Fixed Ratio

The most important parameter defining the actual compression ratio, (which determines the amount of storage required and maximum time continuous data can be stored) is a PQZip threshold value or Tolerance as it referred on the WEB page.

The Tolerance defines what change in an individual harmonic would be defined as significant enough to be stored and reproduced afterwards. The tolerance value is defined in percentage to the full scale or nominal reading for the specific channel.

It is assumed that changes within 0.1% of nominal would have no importance in further power quality investigation, and the values within that range are averaged to store the representative value only. The basic and factory default tolerance value is normally defined as 0.1%. However, on some sites/networks that value can still be considered too low, for example, a highly fluctuating load or voltage lines.

It is most likely that a user would prefer increasing a tolerance value for currents or voltages or even both in order to achieve better compression ratios on highly polluted network locations. The Power Quality Meter provides the possibility of automatic adjustment of the actual tolerance value presuming a compression ratio defined as amount of data being stored per month.

That option is called **Fixed Ratio**. When selected, the user is requested to define the amount of data to be stored per month (**Monthly Ratio**) in MB.

PQZip configuration		
PQZip mode	Monthly ratio	V/I Relation (%)
Fixed Ratio <input type="button" value="v"/>	<input type="text" value="700"/> MB	<input type="text" value="66"/> V

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Usually, slight voltage spectral changes have higher importance than current changes. Therefore, the amount of data which could be stored for voltages may be determined as greater than for currents. The **V/I Relation** parameter defines the relationship between the data (a part of the Monthly Ratio) reserved for voltage. If the voltage portion is larger than currents, the system will define a tighter tolerance for voltages than for currents.

The alternative way is to define and fix the tolerance values for both voltages and currents to some user preferred value. This option is called **Fixed Quality** since, in that case, the data will be stored at the same tolerance/quality at all times.

PQZip mode	Quality thresholds (%)
Fixed Quality	V <input type="text" value="0.1"/> I <input type="text" value="0.1"/>
Fixed Quality	
Fixed Ratio	

Record mode Record type

When Fixed Quality mode is selected, you are requested to define the tolerance value for voltages and currents separately where the factory default value is 0.1%.

### File Capacity

The File Capacity parameter is used to define the maximum time each PQZip file will take to compress. The file can be downloaded and data can be analyzed only when the file is closed, so if you expect to monitor the data in the Investigator application shortly after the data is being collected, you should choose low time durations. For all other cases, longer durations are recommended so compression ratios can be slightly improved.

PQZip configuration			
File capacity	mode	Quality thresholds (%)	Record mode
5 min	Quality	V <input type="text" value="0.1"/> I <input type="text" value="0.1"/>	
30 min			
60 min			
90 min			
120 min			
150 min			
150 min			

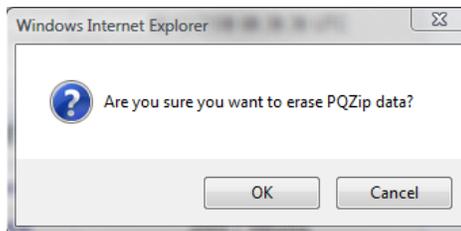
Record mode FULL Record type PQSCADA 3.x

### NOTICE

*Please be aware that setting thresholds to 0 creates large amounts of data that can fill up all available disk space. This should only be done when investigating localized faults for brief periods of time.*

## Erasing All PQZip Data

By pressing the *Erase PQZip Data* button it is possible to clean the memory from the all files being recorded. This operation requires Administrator-level privileges and prompts for confirmation to avoid unauthorized data deletion.



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**NOTICE**

*The closed PQZip files are removed from the CF memory inside the device.*

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## Section 7. Time Synchronization

The ASCO 5400 Series Power Quality Meter contains a Time Synchronization module. This module maintains and tracks time that is being used by the entire Power Quality Meter system and specifically by the PQZIP engine for storing compressed waveforms in an accurate time stamp.



The Time Sync module is a multi-time-source receiver and manager that utilizes a unique algorithm to select the optimal time source, to adjust time and to compensate on various delays, jitters and other communication-related distortions.

The main purpose of synchronizing a Power Quality Meter device is to be able to analyze and compare among multiple devices via the ASCO PQSACADA/Investigator system, such as analyzing an event's source or propagation over multiple points across the power network.

The following time sources are supported:

- Primary NTP Network Server
- Alternative NTP Network Server
- GPS Receiver
- RTC (internal real-time clock)

Typically, the Time Sync module selects the time source automatically per availability and quality of the existing time sources. However, the Time Sync module can be configured to work manually and force a specific time source (*explained later in this section*).

- **The NTP Network Server** is an external server machine that provides NTP Clients (such as a Power Quality Meter or a PC) a time over IP network using NTP standard protocol. Time Sync supports two NTP Servers. The first is acting as primary, and the second is an alternative in case the primary is not available. The NTP server is identified by an Internet (IP) address. The Power Quality Meter is basically acting as an NTP Client that initiates time requests towards NTP servers. **However the Power Quality Meter also acts as an NTP time server, and therefore, it can respond and provide time for other Power Quality Meter units that are configured to its NTP server.**

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- Synchronizing more than five Power Quality Meter units to the same Power Quality Meter is not recommended, as it may overload its NTP server. Instead, use a maximum of five Power Quality Meter client units to request time from one Power Quality Meter server, and then direct up to five others to one of the previous five, etc.. The NTP Time synchronization method is recommended anywhere there is a relatively good internet or intranet communication.
- **A GPS Receiver** is a GPS unit that receives a satellite signal and therefore requires special installation with a sky view or transponder from a GPS receiver with a sky view. A GPS unit provides location and time information via a serial port (typically RS232/RS485 communication port to the Power Quality Meter). The GPS option is for remote sites where internet/intranet communication is not an option or, alternatively, network communication is poor. In some specific time sync topologies, a Power Quality Meter unit would sync to a GPS source, while other units in the same installation would sync to the Power Quality Meter device. With the optional Multi I/O module, other high precision formats are also available such as GPS with IRIG B and GPS with 1PPS.
- The **RTC** is an internal peripheral in the Power Quality Meter unit that serves as a default time source when no other external source available. The RTC is powered by a battery to maintain clock progress even when the Power Quality Meter device power is off.
- **The Time Sync module** provides the Power Quality Meter system with a global time format called GMT or UTC. Using a global time approach enables the Power Quality Meter to synchronize measurements with other Power Quality Meters located somewhere else around the globe. While the time being recorded with PQZIP files is always GMT, the time shown on the WEB interface is the local time (refer to Unit Time at the bottom of the WEB page). The Local time is internally computed by the Power Quality Meter from the UTC obtained from the Time SYNC module plus the Time Zone (which is the number of hours offset per specific country/area). The Time Zone is configurable (under **Configuration**→**Time** page as below).

Time setup	
RTC counter	1021:22:20:1 D:H:M:S
Time zone	UTC +2
Unit date & time	<input type="text"/> <input type="text"/>
<input type="button" value="Set date &amp; time"/>	

Unit time 19/10/1972 00:20:01

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The Time SYNC module also provides the source and the expected quality of time in Synchronization Status (Refer to [Monitoring Section on page 53](#)).

Synchronization Status		
Time Synchronization	Main	Good
DSP Synchronization	On	

In this example the Main refers to the primary NTP Server, while the Good refers to a good quality of time synchronization (meaning the learned/estimated time is very close to the true GMT obtained from the external time source).

Displayed Time Sources:

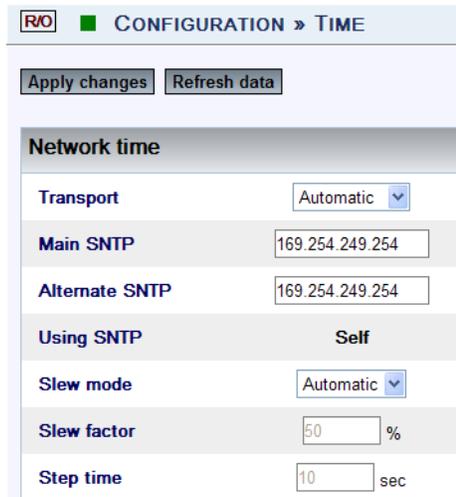
- **Main:** Primary NTP Server source is currently the active time source.
- **Alternate:** Alternative NTP Server is currently the active time source. This is used when the main NTP server is not available.
- **GPS:** GPS is currently the active time source.
- **Self:** RTC is currently the active time source.

### Displayed Time Synchronization Quality/Accuracy:

- **Perfect:** Perfect time quality, expected less than 10 [microseconds] deviation from GMT
- **Good:** Good time quality, expected less than 100 [microseconds] deviation from GMT
- **Moderate:** Moderate time quality, expected less than 10[millisecond] deviation from GMT
- **Poor:** Poor time quality, expected less than 1[Second] deviation from GMT
- **No Time Synchronization:** No external time source available/expected more than 1 second deviation from GMT

## Configuring the Time Sync Module

In order to configure the Time Synchronization module go to **Configuration**→**Time** page, **The Network Time** section.



Network time	
Transport	Automatic
Main SNTP	169.254.249.254
Alternate SNTP	169.254.249.254
Using SNTP	Self
Slew mode	Automatic
Slew factor	50 %
Step time	10 sec

- **Transport** is used to set whether the Time Sync module selects the source automatically or is manually forced to NTP or GPS source.
- **The Main SNTP** is used to configure the IP address of Primary NTP server to be used.
- **The Alternate SNTP** is used to configure the IP address of secondary NTP server to be used, in case primary is not available.

**Using SNTP** shows the current NTP server in use (Main, Alternate or Self if no external NTP is used)

- **Slew Mode** configures the type of time slewing (adjustment) approach to be used by the Time Sync module to compensate for time deviations and network communication jitters. The default and preferred mode is Automatic. When set to automatic, the slewing factor is according to the time source communication quality and you may only view the auto selected slew factor and step time in the below fields.

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You may further configure the slewing mode to manual and set the Slew Factor and Step Time fields.

- **Slew Factor** is a percentage value between 0 to 100%, defining how much to correct time in percentage towards the new GMT learned from time source. 100% means full correction, or a step towards the received time as is, and 0% means no change at all.
- **Step Time** is time in seconds and defines the threshold value. Above this value, the Time Sync module will simply step towards the new learned GMT time in one step.
- **Manual slew** modes contain Master and Slave, which are manual modes with the same user control. The only difference is that the defaults are automatically written in the WEB interface (SLEW Factor and Step Time fields). While the Master values fit more to a situation of a Power Quality Meter receiving unstable time and acting as an NTP server that further feeds other Power Quality Meter units with its learned time. Alternately, Slave values fit a situation of a Power Quality Meter only acting as an NTP client without further spreading time to other units.

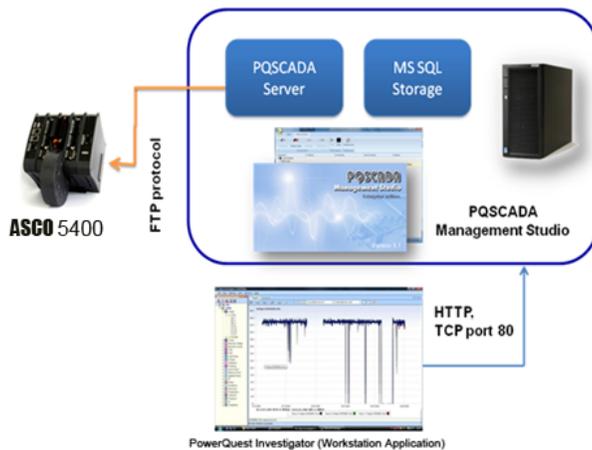
### Time Sync and PQZIP Time Stamping

Since the main purpose of the Power Quality Meter is to continuously record and measure channels for analysis, it is essential to maintain a very accurate UTC time stamp. A PQZIP file is built from time records; typically a record represents several minutes. Each record contains a beginning and an end UTC time stamp. Once the Time Sync module detects that time is continuously drifting beyond a few tenths of milliseconds, the slewing is not enough to compensate for the drift. Instead, a time step/jump is made and the corresponding PQZIP record is closed with the old time stamp while a new record is opened with the new stepped time. Such cases may happen if the time source (NTP Server/GPS) is unstable or when the communication link with the NTP server is inconsistent.

## Section 8. PowerQuest Analytics

### PQSCADA Suite

Innovative PQSCADA Enterprise Analysis software enables the operator to view, control, analyze, and monitor multiple measurement devices simultaneously. Data is accurately time-synchronized, within, and across **Sites**. For more details, please refer to the PQSCADA User Manual.



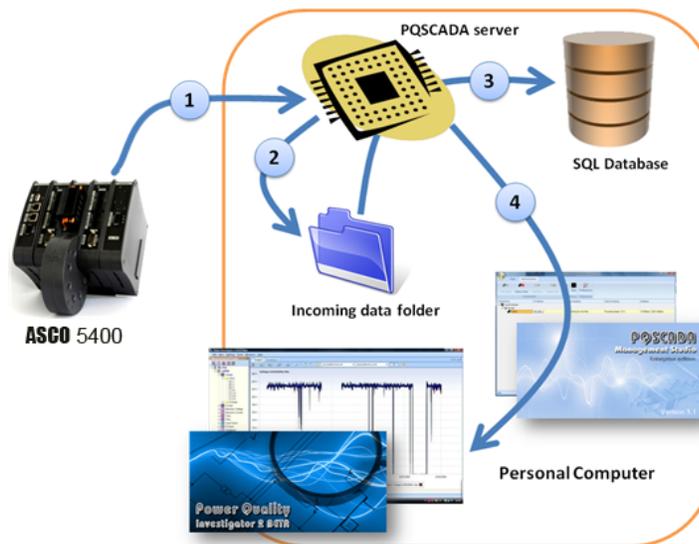
**Note: This drawing depicts the master modules initiating the communication**

The PQSCADA Enterprise System is installed on a personal computer providing unparalleled data monitoring and analysis functionality for all Power Quality Meter devices.

- **PQSCADA Management Studio:** The user interface (GUI) that is used to configure the PQSCADA Server, as well as, check status of the components.
- **PQSCADA Server:** A windows serviced based application that runs in the background even when you are not logged in. (For more details, please refer to
- **PQSCADA Server on page 117.**
- **Client Application:** ASCO Power Quality Investigator Refer to the Investigator User Guide.
- **MS SQL Storage: database engine:** An SQL Database engine used by the PQSCADA server to store and process the data.

## PQSCADA Server

The PQSCADA server is the heart of the Power Quality Meter data management and analysis system. The main functionalities of the PQSCADA server are shown in the figure above and further described below with corresponded numbering marks:



1

**Data collection (Downloading):** The PQSCADA server system is responsible for collecting all continuous data (PQZip files) from a connected device automatically. When the device is connected (wired or wirelessly) the PQSCADA server automatically checks for any new data availability using an FTP<sub>2</sub> communication protocol.

2

**Incoming Data Folder:** Placing new files into the Incoming data folder: All new PQZip files found on a connected device are copied (the original files remain on device) to a temporary location on a local hard drive “Incoming data folder”.

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<sup>2</sup> Refer to [Integrated FTP Server on page IX-1](#) for more details

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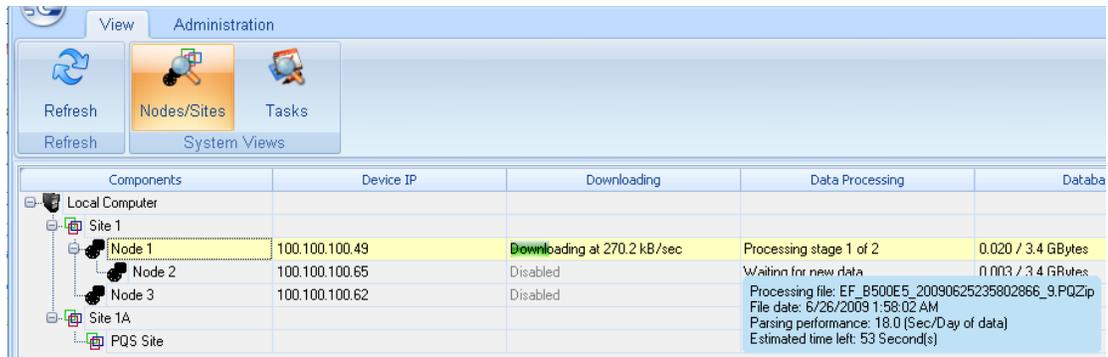
**Data processing and storage:** The next stage is data processing, in which the data is being organized for storage and quick access (Stage 1) and then a variety of electrical parameters are being calculated (Stage 2) based on the raw PQZip data. The reorganized PQZip data, as well as the calculated parameter statistics are being stored in a local SQL database. The files which have been processed and successfully inserted to the database are then removed from the Incoming folder

**Networking:** The PQSCADA server integrates a dedicated HTTP (default port 80) interface that communicates with the PQSCADA Management Studio (interactive management application) and the ASCO Power Quality Investigator (data analysis application) running on either the same or different machine.

### PQSCADA Management Studio

The PQSCADA Management Studio is an interactive tool which provides full control and monitoring of all of PQSCADA's activities.

#### Node Status



The screenshot shows the PQSCADA Management Studio interface. At the top, there are tabs for 'View' and 'Administration'. Below the tabs are buttons for 'Refresh', 'Nodes/Sites', and 'Tasks'. A 'System Views' section is also visible. The main area is a table with the following columns: Components, Device IP, Downloading, Data Processing, and Database. The table contains the following data:

Components	Device IP	Downloading	Data Processing	Database
Local Computer				
Site 1				
Node 1	100.100.100.49	Downloading at 270.2 kB/sec	Processing stage 1 of 2	0.020 / 3.4 GBytes
Node 2	100.100.100.65	Disabled	Waiting for new data	0.003 / 3.4 GBytes
Node 3	100.100.100.62	Disabled	Processing file: EF_B500E5_20090625235802866_9.PQZip File date: 6/26/2009 1:58:02 AM Parsing performance: 18.0 (Sec/Day of data) Estimated time left: 53 Second(s)	
Site 1A				
PQS Site				

The main PQSCADA Management Studio's window is a hierarchical table/grid with following columns:

- Components
- Device IP
- Downloading
- Data Processing
- Database

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## Components

The PQSCADA Suite is designed to operate and manage a virtually unlimited number of Power Quality Meter devices. The physical device is represented under the system by the term **Node**. The **Node** is the software component which represents data taken by a physical device such as the Power Quality Meter. The **SITE** is a software component which represents a group of **Nodes**. The **SERVER** is the representation of the physical machine on which the PQSCADA server application is installed.

## The Node Status Fields

### Component

Status	Description	Right Click Menu
<b>The name</b>	The given name to the node	<ul style="list-style-type: none"> <li>Refresh</li> <li>Rename</li> <li>Configure</li> <li>Delete</li> </ul>
<b>"Needs Upgrade"</b>	The node requires upgrade. Use <i>Upgrade</i> on right mouse click menu.	<ul style="list-style-type: none"> <li>Refresh</li> <li>Upgrade</li> <li>Delete</li> </ul>

### IP Address

Status	Description	Right Click Menu
<b>IP Address or host name in hyperlink format</b>	The IP Address is defined.	<ul style="list-style-type: none"> <li>Open in Explorer</li> <li>Open in FTP</li> <li>IP Setup</li> </ul>
<b>"No IP defined"</b>	No IP Address is defined, Link is disabled.	<ul style="list-style-type: none"> <li>IP Setup</li> </ul>

## Downloading

The Downloading field displays the status of the data downloading process. Below is the list of status variations.

Status	Description	Right Click Menu
<b>The name</b>	The given name to the <b>Node</b>	<ul style="list-style-type: none"> <li>Refresh</li> <li>Rename</li> <li>Configure</li> <li>Delete</li> </ul>
<b>"Needs Upgrade"</b>	The <b>Node</b> requires upgrade. Use <i>Upgrade</i> on right mouse click menu.	<ul style="list-style-type: none"> <li>Refresh</li> <li>Upgrade</li> <li>Delete</li> </ul>

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## Data Processing

The Data Processing field displays the status of the PQZip data processing engine. Below is the list of status variations could be expected on that field.

Status	Description	Right Click Menu
<b>"Disabled" in light gray color</b>	The service is disabled.	<ul style="list-style-type: none"> <li>• Folders setup</li> <li>• Define 'time of interest' interval</li> <li>• Configure service</li> <li>• Open incoming folder</li> <li>• Open 'bad files' folder</li> <li>• Open data backup folder</li> <li>• Enable</li> </ul>
<b>"Processing stage 1 of 2"</b>	Stage 1 (PQZip parsing)	<ul style="list-style-type: none"> <li>• Refresh</li> <li>• Force file parse attempt</li> <li>• Folders setup</li> <li>• Define 'time of interest' interval</li> <li>• Show/ modify data channels configurations</li> <li>• Configure service</li> <li>• Open incoming folder</li> <li>• Open 'bad files' folder</li> <li>• Open data backup folder</li> <li>• Disable</li> <li>• Recalculate data</li> </ul>
<b>"Processing stage 2 of 2" in normal colors</b>	Stage 2 (Recalculate summaries)	<ul style="list-style-type: none"> <li>• Refresh</li> <li>• Force file parse attempt</li> <li>• Folders setup</li> <li>• Define 'time of interest' interval</li> <li>• Show/ modify data channels configurations</li> <li>• Configure service</li> <li>• Open incoming folder</li> <li>• Open 'bad files' folder</li> <li>• Open data backup folder</li> <li>• Disable</li> <li>• Recalculate data</li> </ul>
<b>Bad Files Folder is full</b>	Database is full or unavailable	<ul style="list-style-type: none"> <li>• Refresh</li> <li>• Force file parse attempt</li> <li>• Folders setup</li> <li>• Define 'time of interest' interval</li> <li>• Configure service</li> <li>• Open incoming folder</li> <li>• Open 'bad files' folder</li> <li>• Open data backup folder</li> <li>• Disable</li> <li>• Recalculate data</li> </ul>

## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

Status	Description	Right Click Menu
"Waiting for new data"	Idle, no new data found in Incoming folder	<ul style="list-style-type: none"> <li>Refresh</li> <li>Force file parse attempt</li> <li>Folders setup</li> <li>Define 'time of interest' interval</li> <li>Show/ modify data channels configurations</li> <li>Configure service</li> <li>Open incoming folder</li> <li>Open 'bad files' folder</li> <li>Open data backup folder</li> <li>Disable</li> <li>Show last day log</li> <li>Recalculate data</li> </ul>
Bad Files Folder is Full	"Bad files" folder is full.	<ul style="list-style-type: none"> <li>Refresh</li> <li>Folders setup</li> <li>Define 'time of interest' interval</li> <li>Configure service</li> <li>Open incoming folder</li> <li>Open 'bad files' folder</li> <li>Open data backup folder</li> <li>Disable</li> <li>Show last day log</li> <li>Recalculate data</li> </ul>

### Database

The Database field displays the status of the Node's database. Below is the list of status variations could be expected on that field.

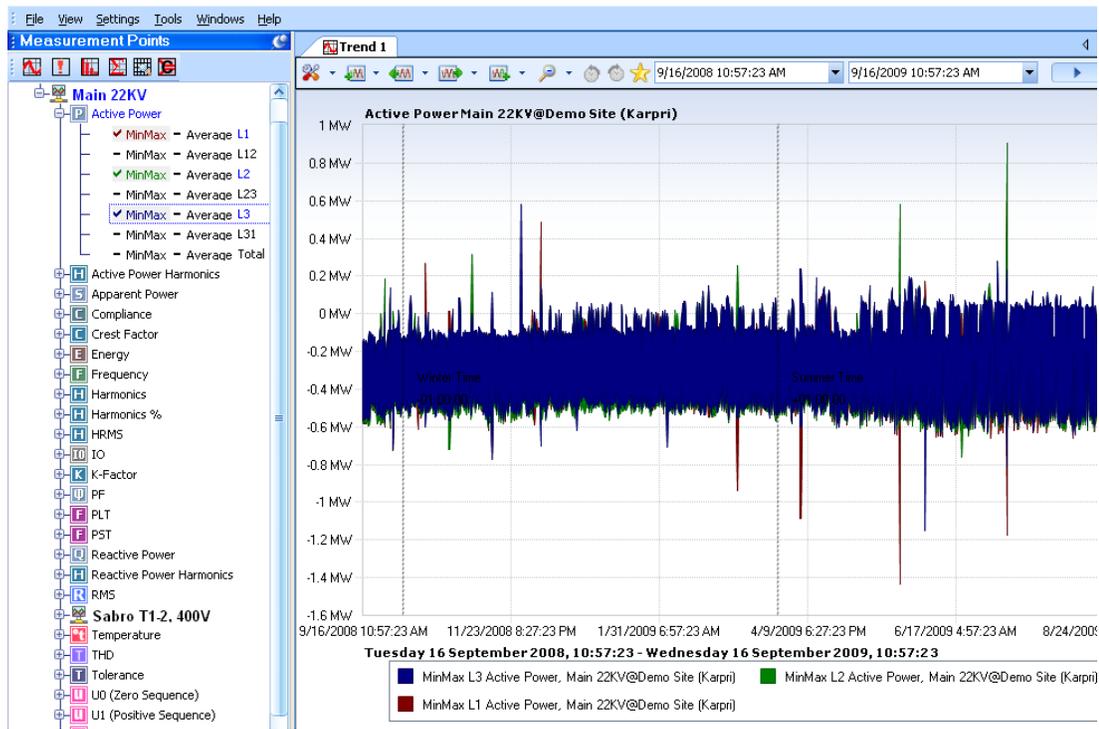
Status	Description	Right Click Menu
Login Error	Login Error. The administrative access to the database was denied. Please select Login setup option on right mouse click menu.	<ul style="list-style-type: none"> <li>Login setup</li> </ul>
Database is full	Database is full. The database size has reached its maximum state. Please resolve that issue on Size limitation setup, free more disk space or truncate unnecessary data.	<ul style="list-style-type: none"> <li>Refresh</li> <li>Login setup</li> <li>Size limitation setup</li> </ul>
XXX MB / YYY MB	Online	<ul style="list-style-type: none"> <li>Refresh</li> <li>Login setup</li> <li>Size limitation setup</li> <li>Backup</li> <li>Restore</li> <li>Delete data</li> <li>Re-index</li> <li>Import data</li> <li>Export data</li> </ul>

## ASCO Investigator

The ASCO Power Quality Investigator is an innovative tool which helps explore electrical network anomalies while investigating power quality issues with mouse-click simplicity.

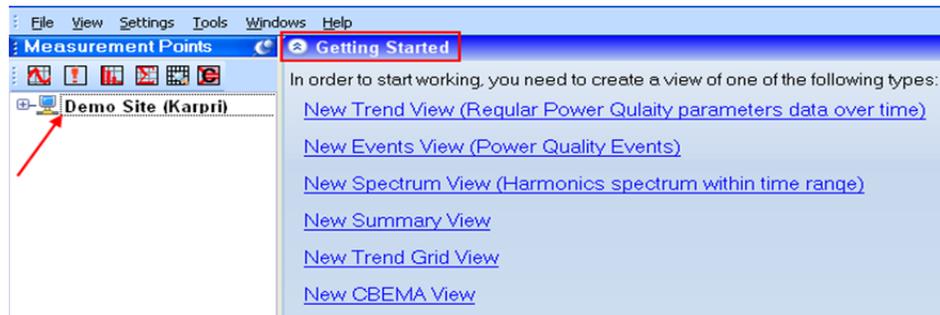
ASCO Investigator is a client application that communicates, receives, and displays data from the PQSCADA server system. The communication performed uses a standard HTTP protocol (port 80), so it is firewall friendly and can be easily used over a local LAN and/or over the Internet.

For more details, please refer to the Investigator User Manual.



## Getting Started

Initially, the Investigator application appears with a window as shown below.



### NOTICE

*The Getting Started Panel as shown above with the New view options listed is only shown the first time the application is opened.*

*In the Measurement Points panel, we have provided a link to a Demo Site Karpri complete with historical data for demonstration purposes.*

## Adding a Measurement SITE

### Automatic Scan

When the PQSCADA server application is running on the same machine, the most convenient way of adding a site is by automatically scanning for local sites functionality. This **Scan Local sites** procedure is available from the File menu. This tool makes use of UDP broadcasting on port 885 in a similar manner as the ASCO Search utility searches for Meter devices.



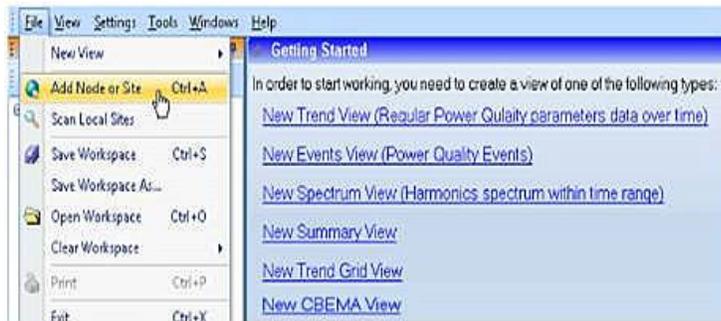
## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

However, in some situations, the tool may fail to discover local sites, due to some of the following reasons:

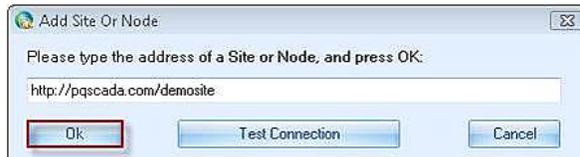
- The local firewall prohibited UDP broadcasting.
- The ASCO Search tool is running and making use already on UDP 885 port.
- The local site is down or unreachable.

If the automatic scan procedure does not provide sufficient results, it is recommended adding the SITE manually as described below.

### Adding a SITE Manually



- From the Menu Tool Bar, select **File**→**Add Node or Site** or **Ctrl+A**.
- The **Add Site or Node** window appears.

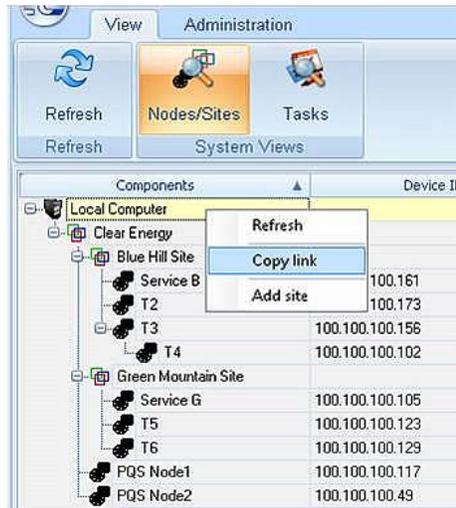


- Enter a full URL for the Site.
- Click **OK**.

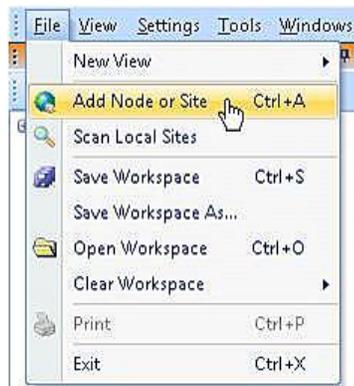
# ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

## Copying a Link

When the PQSCADA server software is running on the same computer, the site URL can be easily obtained from the PQSCADA management studio application copying a link.



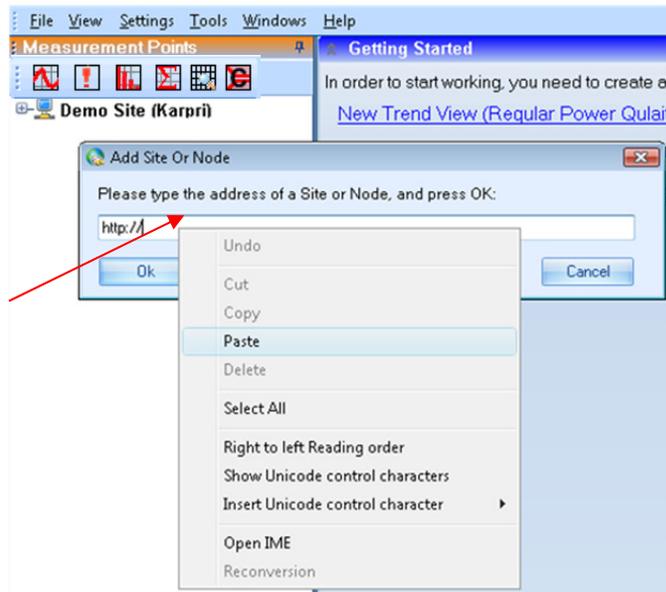
- From the main menu, right click the site. (Local Computer which contains the sites Blue Hill and Green Mountain in our example).
- Select Copy link.



- Select **Add Node or Site** or **Ctrl+A** from the Investigator Menu Tool Bar.

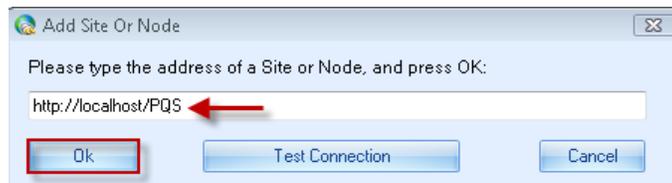
# ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

The Add Site or Node window appears.



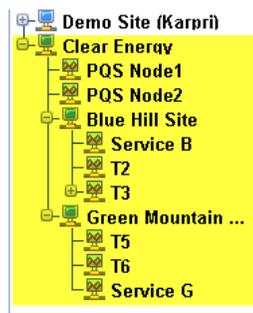
- Right click directly inside the dialog box, then select **Paste**.

The link from the Local Computer appears in the dialog box.



- i) Click **OK** to accept.

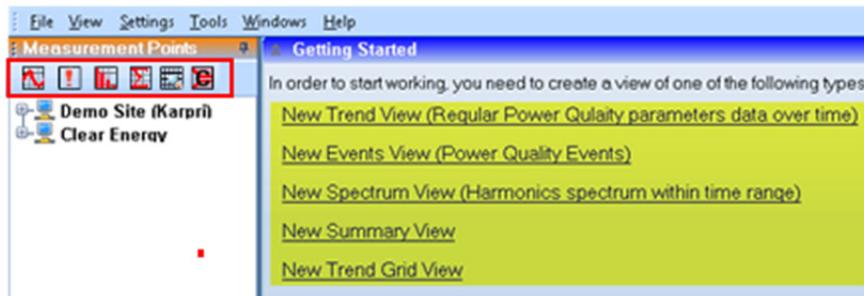
The new site appears with all sub-sites and Nodes in the Selection Tree.



# ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

## Operation

The Investigator application can present the recorded data in a number of different ways. The data presentation is referred to as a **View**. The first step in data analysis is the view selection. The View selection can be made either in the Main working panel on the right (yellow highlighting) the first time the application is opened, or with the icons in the selection tree on the left.



## View Types

The available view types, representative icons, and complete descriptions are presented in the table below. Each View type is a historical data representation of electrical and Power Quality parameters.

Icon	View Type	Description
	<b>Trend View</b>	A continuous trend graph of data parameters over time.
	<b>Events View</b>	A table of events captured/detected by the device.
	<b>Spectrum View</b>	Useful for harmonic spectrum representation including voltages, current, and power anomalies.
	<b>Summary View</b>	Displays summary information over a defined period of time, including maximum, minimum, and true mathematical averages of any parameter over a time span defined by the user.
	<b>Trend Grid View</b>	Similar to the trend view, but with a grid/table style display.
	<b>CBEMA View</b>	The CBEMA (Computer and Business Equipment Manufacturers' Association) is a power quality graph that plots the depth or deviation of voltage dips and overvoltage on the x-axis and the duration on the y-axis.

# ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

## Multi-View

The ASCO Investigator is a multi-view application, which means that you can open and operate a number of views of any type simultaneously. When a view(s) (Trend 2 and Events 2) in our example) are created, they appear as a blank screen and are docked as a tab in the working area as below.

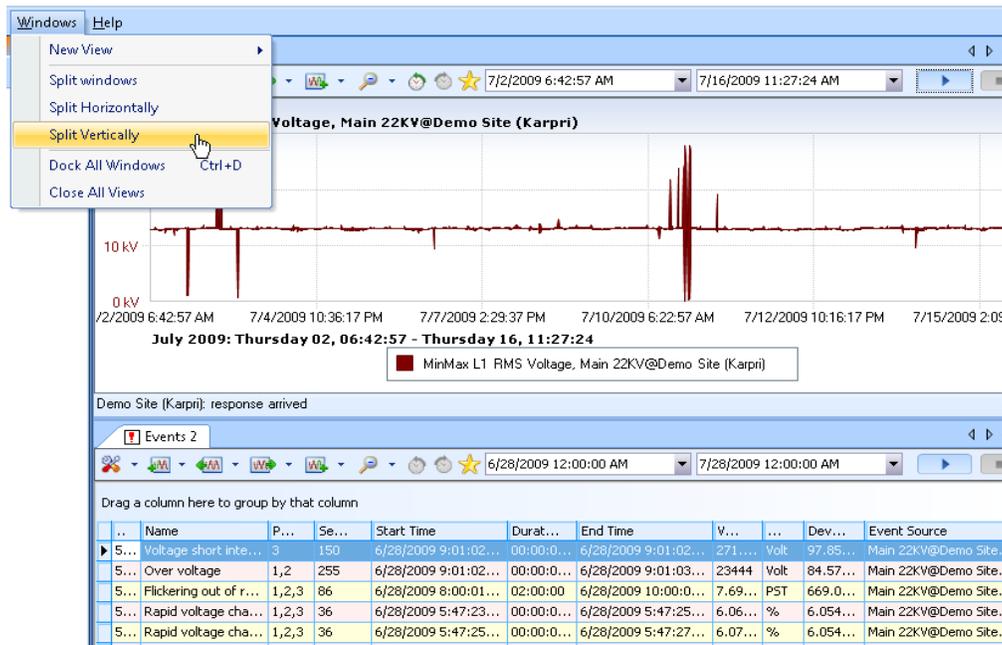


Each view can have its own parameters and time span, so it is possible to display different parameters or different time spans simultaneously using a number of views. In our example, the **MinMax for L1** is the chosen parameter and the time span is consistent for all views.

To display multiple views, you can split the window or drag and drop the view into the working area. (The split option may be more suitable for 2 views)

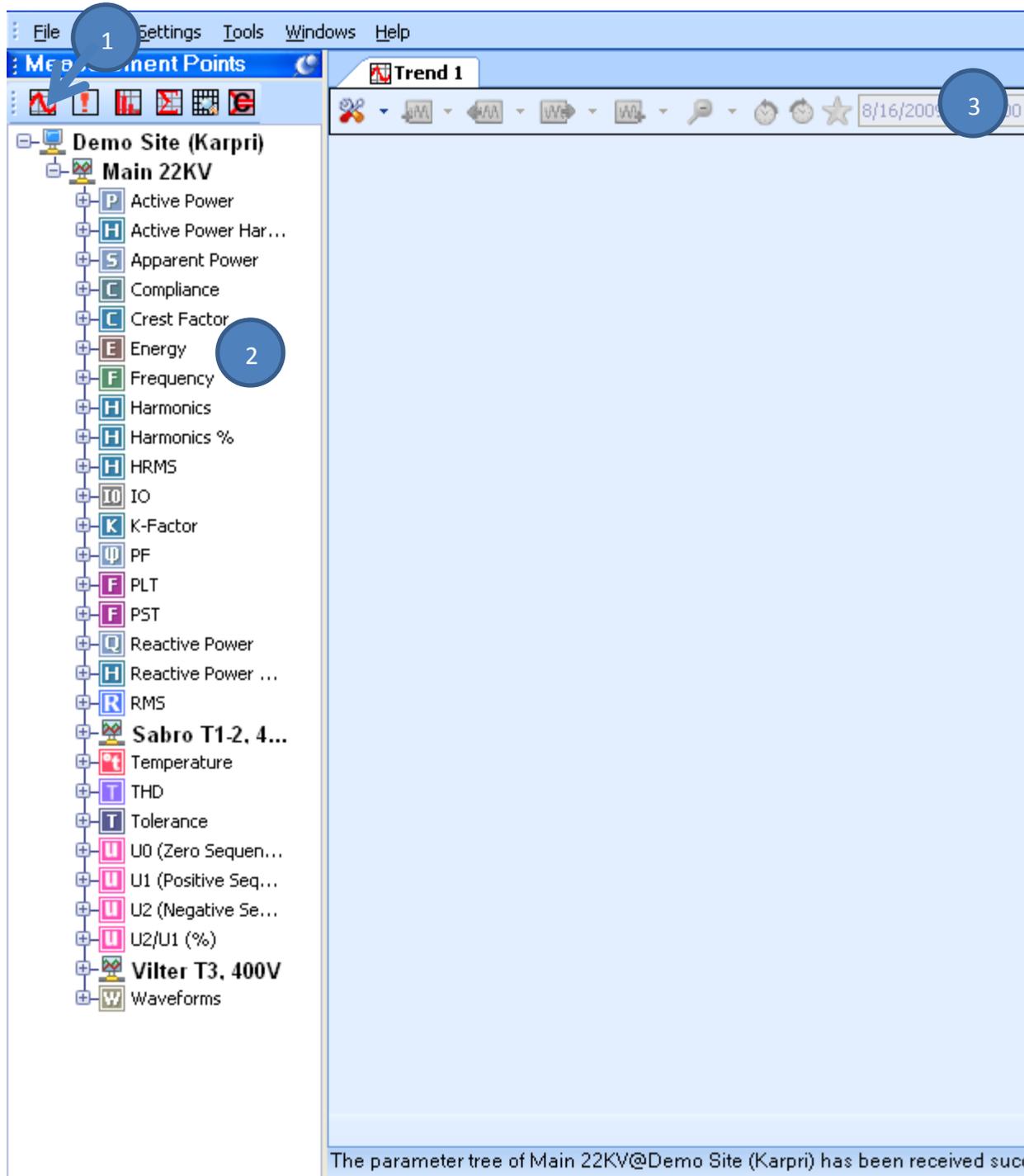
### To split the windows:

- From the main menu, right click windows, then select **Split Vertically** (for our example the vertical split will be easier for the same time range)



## Creating Views

Generally, the operation can be simplified as a 4 stage process:

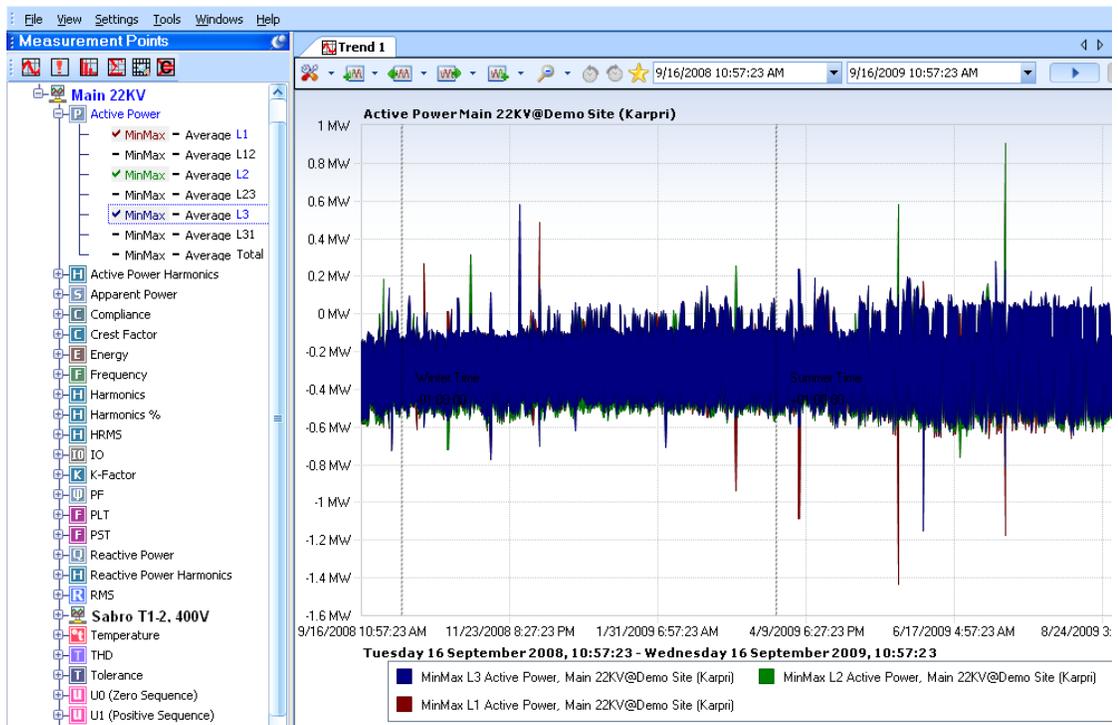


# ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

- 1 Select the view
- 2 Select the parameters
- 3 Select the time span
- 4 Press the query  button and receive the data

## Sample View

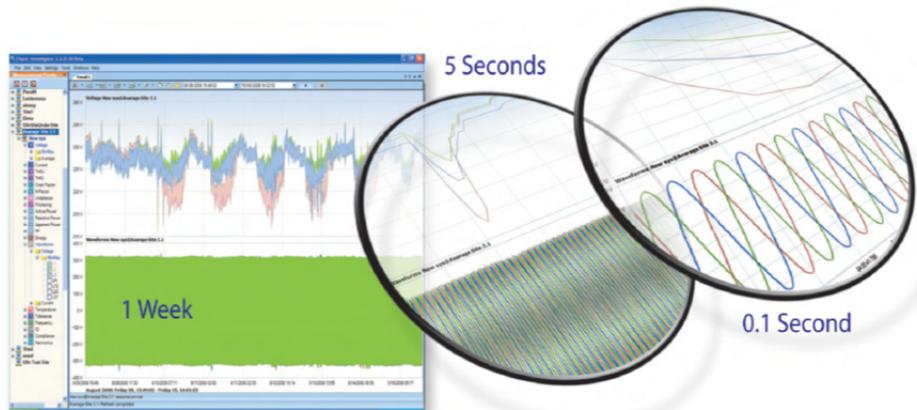
A Trend View (below) for Min/Max Voltages (L1, L2, and L3) for the previous year.



# ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

## Zooming In/Out

You can add/remove parameters any time and choose any time intervals. The data can be further zoomed in and out using a mouse from/to any time resolution.



## ASCO Search Utility

The ASCO Search Utility is a small, yet powerful tool that allows searching for multiple Power Quality Meter device IP addresses sharing the same local LAN. The ASCO Search makes use of UDP broadcasting, sending a “*please respond*” broadcast request to all devices on the LAN and displaying the resultant list of all devices responding to it.

### Obtaining the Search Utility

ASCO Search is a small program which does not require installation and is available free by contacting <https://support.ascopower.com> or dialing 1-800-800-ASCO(2726) in North America or dial +1 973-360-3600 when International.

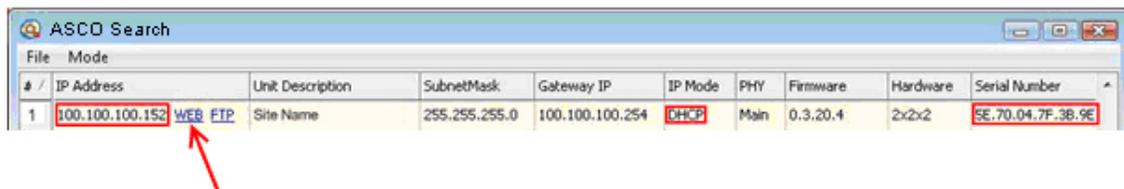
Or, found on the Power Quality Meter disk.

Since the program is small and does not require installation, it is recommended copying it and operating it directly from the computer Desktop. (please refer to [Download the ASCO Search software on page 20](#))

### Operation

Initially, the program may trigger a verification warning similar to the one below. You may proceed by clicking **Run**.

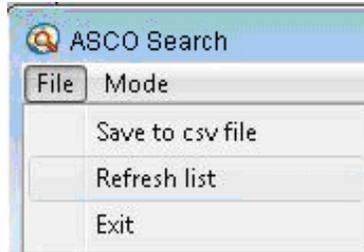
By clicking **Run**, a scan procedure is initiated; the **ASCO Search** utility appears as a grid displaying all Power Quality Meter devices found on the intranet network. In our example we are only showing only one device.



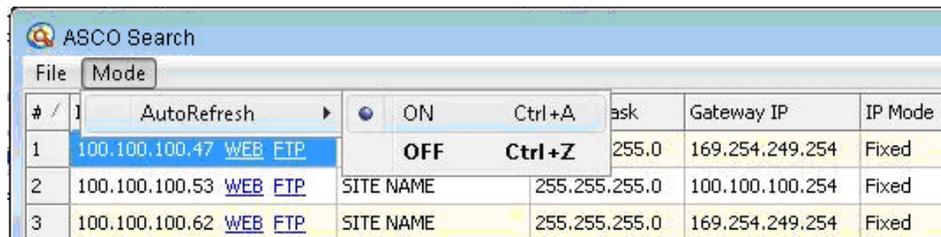
#	IP Address	Unit Description	SubnetMask	Gateway IP	IP Mode	PHY	Firmware	Hardware	Serial Number
1	100.100.100.152	WEB FTP	255.255.255.0	100.100.100.254	DHCP	Main	0.3.20.4	2x2x2	SE.70.04.7F.3B.9E

# ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

Once open, the scan procedure can be manually prompted by using the **File**→**Refresh List** menu as shown below.



As an alternative, the scan procedure can be configured to automatically refresh each second. This can be done by setting the **Mode**→**AutoRefresh** to **ON**. The default state is OFF.

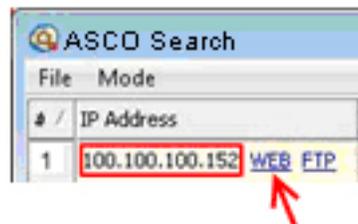


The ASCO Search list shows a variety of important information about every Power Quality Meter device found on network; most of it is helpful to identify devices. However, probably the most important information is the IP address of each device. This allows the initiation of WEB, FTP, or Telnet session with the device.

## Limitations

The ASCO Search utility can operate only as one single instance at a time, since it uses a single and fixed UDP port. When more than one instance is running at the same time – only the first one will operate correctly, the rest will show no devices.

## Launching WEB or FTP Session



## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

The WEB and FTP hyperlink buttons on the right of the IP Address string launch WEB or FTP sessions directly from the ASCO Search window.

---

### **NOTICE**

*It is recommended that you define MS Internet Explorer© 7 as the default internet browser application. I.E. 8 may be used in the “compatibility view” mode.*

---

### New Device Indication



File	Mode									
14	100.100.100.144	<a href="#">WEB</a> <a href="#">FTP</a>	SITE NAME	255.255.255.0	169.254.249.254	Fixed	Main	0.3.60.9	3x2x2x1	5E.70.07.B4.E5.9D
15	100.100.100.152	<a href="#">WEB</a> <a href="#">FTP</a>	SITE NAME	255.255.255.0	100.100.100.254	DHCP	Main	0.3.60.6	2x2x2	5E.70.04.7F.3B.9E
16	100.100.100.153	<a href="#">WEB</a> <a href="#">FTP</a>	Elspec CU	255.255.255.0	100.100.100.254	DHCP	Main	0.3.50.12	2x2x2	5E.70.04.7F.36.80

Every new device – one that wasn't found on the previous refresh is marked in green.

### Restoring Factory Defaults

The device can be forced to restore the factory default network configuration through a left mouse button double click anywhere on a specific device record except at the [WEB](#) or [FTP](#) links.

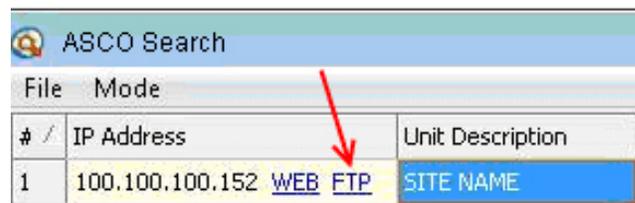


Please allow a couple of minutes for a change to take effect as the device will automatically reboot, restoring factory default settings upon pressing the **Yes** button.

## Section 9. Integrated FTP Server

FTP is a file transfer protocol for exchanging and manipulating files over a TCP computer network. The Power Quality Meter uses an integrated FTP server providing the most convenient computer network standard interface to the generated PQZip files and auto generated reports. The PQSCADA software system makes use of the FTP server interface by automatically downloading PQZip files. The same protocol may be used to manually download the PQZip files.

One of the easiest ways to launch an FTP session, which allows the user to access the Power Quality Meter internal memory, is by using the **ASCO Search** utility Refer to [Launching WEB or FTP Session on page 133](#).



ASCO Search			
File	Mode		
# /	IP Address		Unit Description
1	100.100.100.152	<a href="#">WEB</a> <a href="#">FTP</a>	SITE NAME

Another way is by typing [ftp://\[device ip address\]/](#) in the Windows Internet Explorer or Windows Explorer address field.



## Login

When initiated from ASCO Search utility, this page will probably appear as shown above. On manual operation it will most likely require a user name and password like:

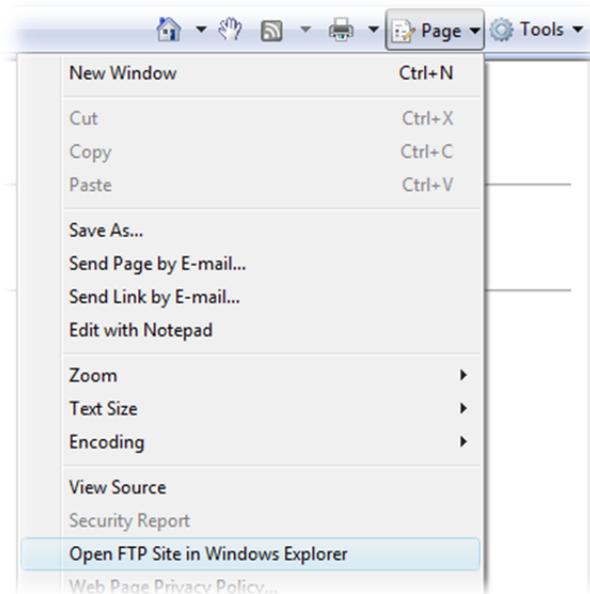


If so, type:

- User name: **ASCO**
- Password: **ASCOASCO**

It is recommended to open the folder in Windows Explorer rather than Internet Explorer, since the latter may have some issues related to file operations.

To switch from Internet Explorer to the Windows Explorer, press the **Page** button and select **Open FTP Site in Windows Explorer**.



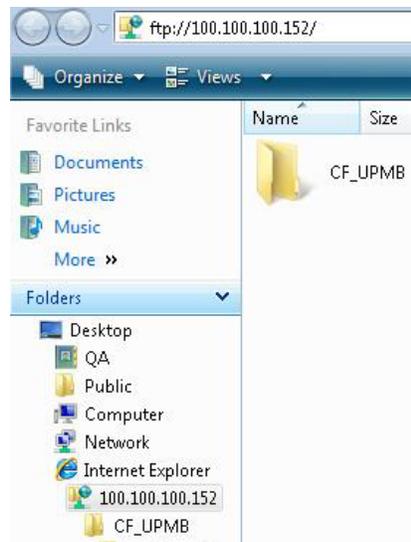
This will probably require typing a password again:

It is recommended to mark the **Save password** checkbox if you prefer skipping that procedure the next time.

## System limitations

The Power Quality Meter's integrated FTP server is limited by design to handle up to four concurrent FTP connections. Any connection while another four are still active will be denied. Connection which is idle for more than two minutes will be closed automatically.

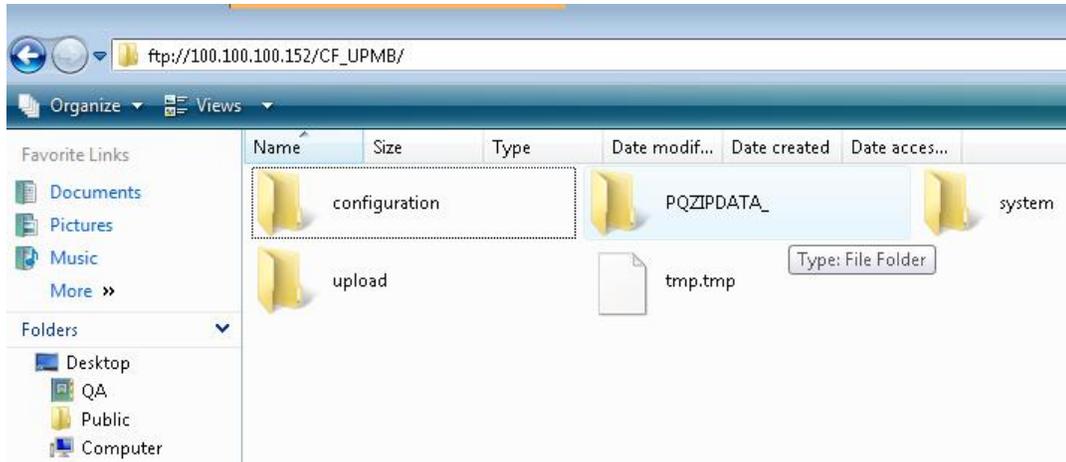
## The File Structure



The root directory of the Power Quality Meter FTP server appears as CF\_UPMB which points to the main storage memory drive.

## PQZip Files

The PQZip Files are located under PQZIPDATA\_ folder

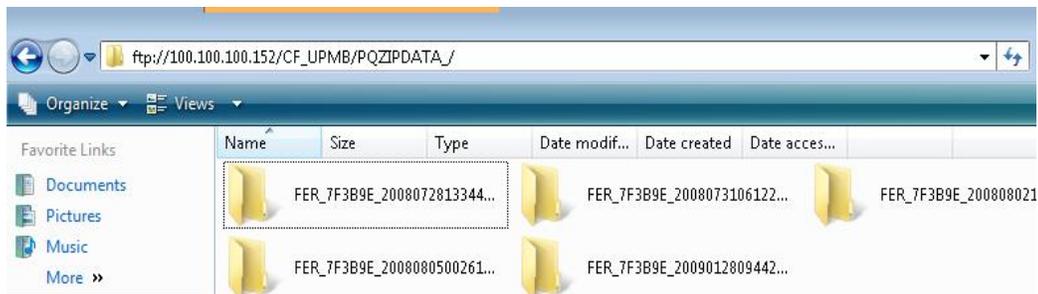


The PQZip files are organized under PQZip folders. The folder names are constructed as:

### **FER\_A\_B\_C**

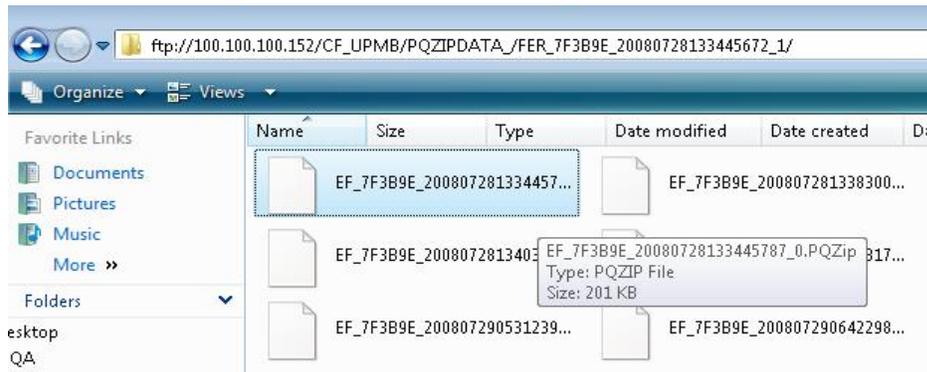
Where:

- **A:** Device serial number
- **B:** The date and time the folder was created. The format is:  
**YYYYMMDDHHmmSSmmm**  
where **YYYY** = Year, **MM** = Month, **DD** = Day, **HH** = hour, **mm** – Minutes, **SS** = seconds, **mmm** = milliseconds
- **C:** Sequential index of the folder. The index value is started with “1” on the very first PQZip session initialization and incrementing on every new folder creation. When the value reaches 999 it resets to a “1” on with the next folder.



## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

The PQZip folders normally contain no more than 50 PQZip files.



The PQZip files can be further recognized by a “PQZip” or “PQ” file extensions. The “PQZip” extension files are “closed” and ready for download while the “PQ” means that the file is still in a process. The “PQ” file remains open until an event occurs or the file capacity is reached. There is always one open PQZip file that can be viewed by the file name on the Web interface at the **Configuration→ PQZipRecording** page. In order to view the open file, the PQZip must be **Enabled**.

The PQZip file names are organized as:

### **EF\_A\_B\_C**

**Where:**

- **A:** Device serial number
- **B:** The date and time the folder was created. The format is:  
**YYYYMMDDHHmmSSmmm**  
where **YYYY** = Year, **MM** = Month, **DD** = Day, **HH** = hour, **mm** – Minutes, **SS** = seconds, **mmm** = milliseconds
- **C:** Sequential index inside the folder. The index value is started with “1” on the first file created in the folder and increments sequentially with the next files in the same folder.

---

### **NOTICE**

*The Date and Time used to construct PQZip folder and file names are in UTC time format!*

---

## Section 10. Integrated Telnet server

Telecommunications Network (Telnet) is a text-only (non-GUI) user command protocol terminal emulation program for TCP/IP networks such as the internet or a LAN. A Telnet client is often used to connect to a Telnet server in order to diagnose problems without specialized client software. The Power Quality Meter device comes enabled from the factory capable of being used as a Telnet server. In much the same way that we can enter the device through the Web as a GUI interface or FTP to transfer files, ASCO supports the use of a Telnet connection in order to perform specific high level administrative functions that are not accessible through other interfaces.

### Telnet Client Application

The standard Telnet Client Application is available as part of a Windows operation system. The client can be accessed using a command line interface.

1. Type **cmd** in a **run/search** field on windows Vista or **Start>Run** in Windows XP, then press **Enter**.

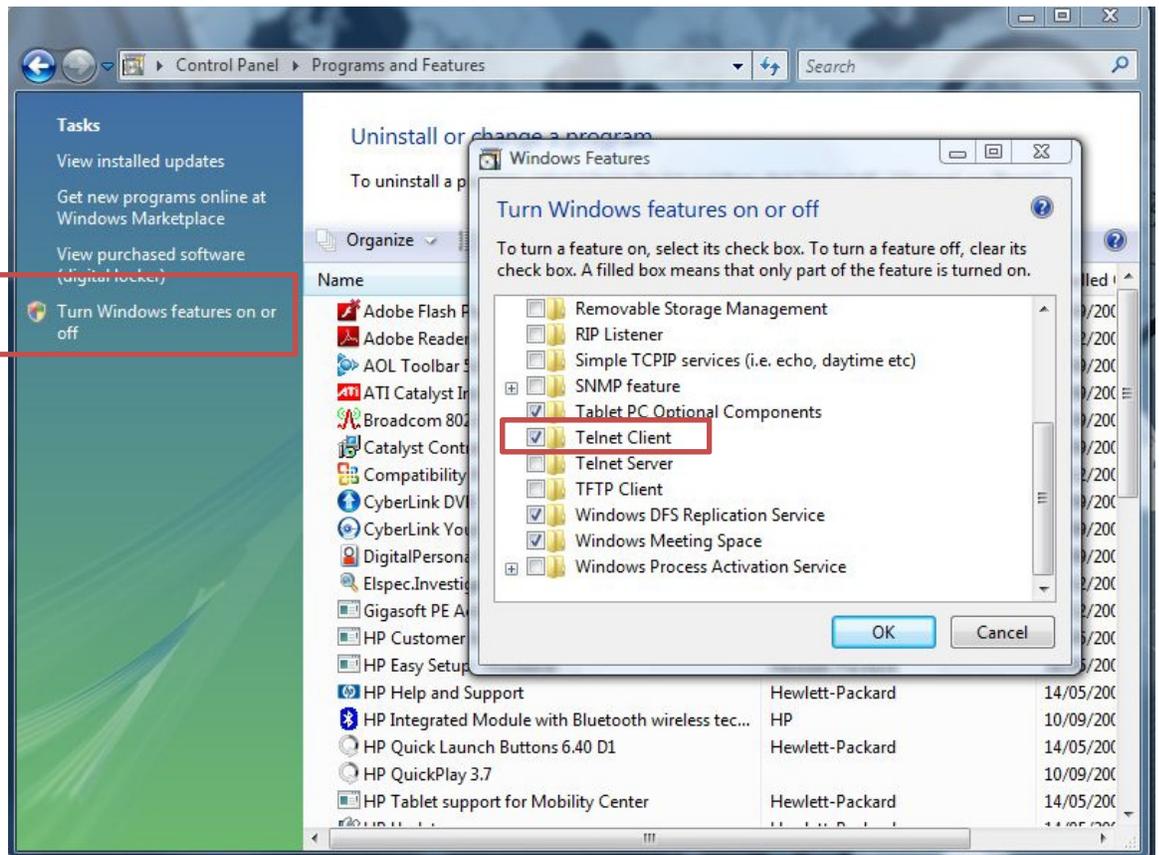


2. On the command prompt type **telnet**, then press **Enter**.

#### In case of an error as follows:

The Telnet client is probably not installed on the computer. To enable/install it.

1. From the Control Panel, Launch Programs and Features, then turn Windows features on or off.

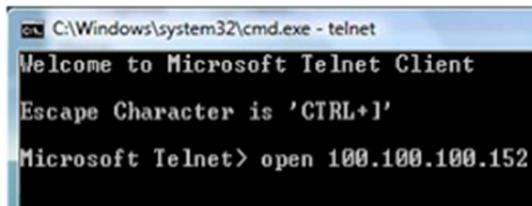


3. Select **Telnet client** on the list.
4. Click **OK**.

## Establishing a Telnet Session

To establish a Telnet Session:

1. Type **open [device IP]** on the telnet command line.



The login line appears.

2. Use login name: **ASCO** (all cap letters)

## ASCO 5400 SERIES POWER QUALITY METER OPERATOR'S MANUAL

3. And password: **ASCOASCO**

When the prompt “→” appears, the telnet session is ready for use.

---

**NOTICE**

*All Telnet commands and operations are case sensitive!*

---

## Section 11. How to....?

### Establish Automatic Web Login

#### Parameters

- “pass” – login password i.e. 123/1234/12345
- “lang” – login language index, which is language index in “Language” list, starting zero.
- “page” – page to go directly to, just as filename in the page url, i.e. mon\_sum.asp is the default starting page.

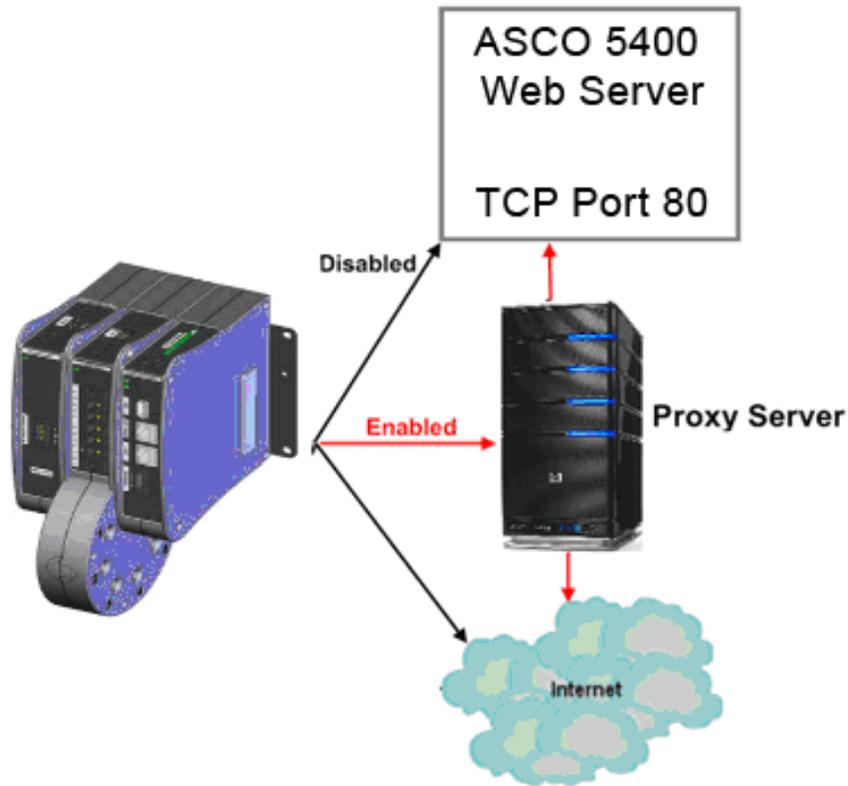
#### Example

- [http://100.100.100.58/login.asp?pass=12345&page=srvc\\_set\\_evt.asp](http://100.100.100.58/login.asp?pass=12345&page=srvc_set_evt.asp)  
logs you into a unit as an administrator directly into “Events Setup” page.
- <http://100.100.100.58/loginlite.asp?lang=1>  
logs you into light Russian interface.
- If the parameter has no/wrong/illegal value – default is used (except for wrong password).

#### Defaults

- Language is English.
- Page is MONITORING/Summary.
- Password is the one written in password field.
- To use the desired language, count it's index in the “Language” drop-down menu at Login page, starting zero and add it as a parameter.
- To use the “page” feature, copy the filename of desired page and add it as a parameter.

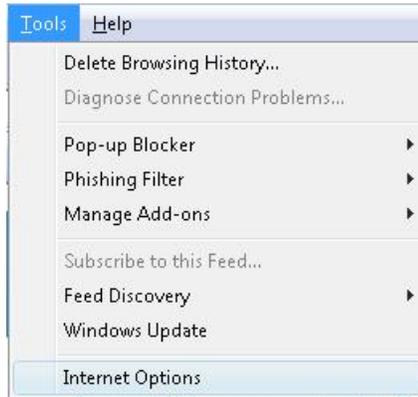
## Disable Proxy Server in Internet Explorer



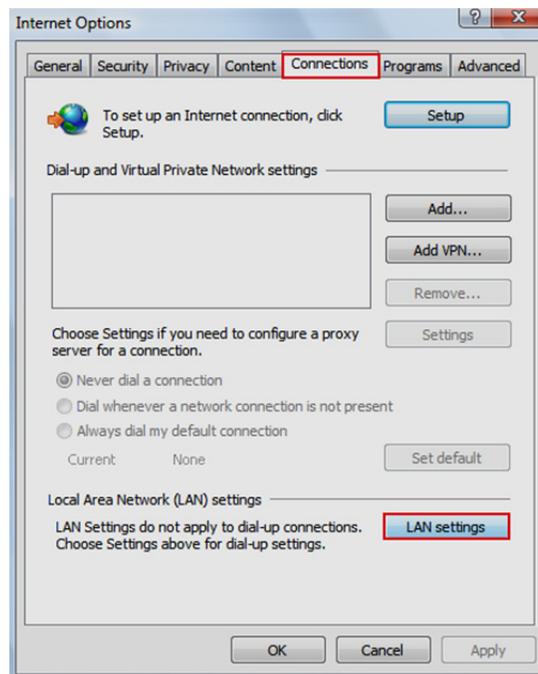
A Proxy Server is a computer or application that functions as an intermediary between a web browser (such as Internet Explorer) and the Internet or Web Server. Originally proxy servers were designed to help improve web performance by storing a collection cache of frequently used web pages. With the advent of much faster connection speeds to the Internet, proxy servers are now primarily used in corporate networks to help improve security by filtering out some web content and malicious software.

Using a web browser, you connect to the Power Quality Meter's web server through HTTP in much the same way you connect to the Internet. To view the web server of the device or embedded router, access to TCP Port 80 is required. Depending on the configuration of your LAN, (please consult your Network Administrator), you may (not) have permissions set to allow direct access to Port 80 on the Power Quality Meter device. In such cases, it may be necessary to disable the proxy server in Internet Explorer.

To disable the proxy server:

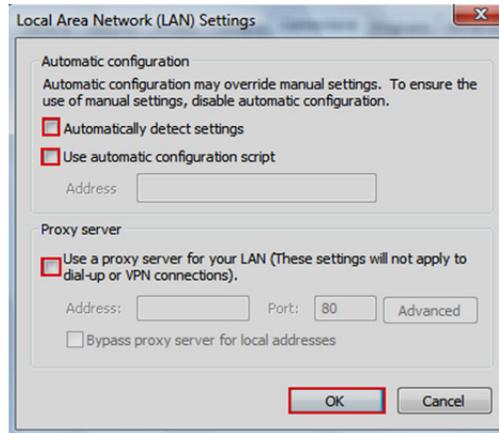


1. From the main IE main window, select **Tools**→**Internet Options**.  
**The Internet Options window appears.**



2. Select **Connection**→**LAN settings**.  
The LAN Settings dialog box appears.

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3. Uncheck all pick boxes.
4. Click **OK**.
5. Press **F5** to refresh the browser window.

The Login screen appears.

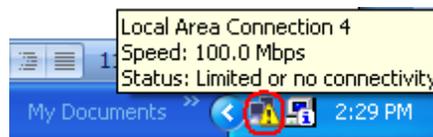
## Establish a Direct Connection

The following steps describe how to connect to the unit for the first time using a direct connection.

### To connect to the network for the first time:

- Disconnect the network cable linking your PC/Laptop to the server network.
- Using the same cable (RJ45 LAN Network Cable), connect to the port marked **LAN1** on the Power Quality Meter.
- The green link-LED of the LAN1 connector begins to flash as Windows begins communicating with the unit.
- Wait for about 2 minutes as the Windows operating system reverts to the default **"No Server" IP** configuration.

When this is completed, the **"Local Area Connection Status"** icon in the **"Quick Start"** tray will change to "Limited or no connectivity".



- Connect to the instrument by entering the IP address manually or by using the **Automatic Search Utility**.

---

### **NOTICE**

*There is no need to connect the PC directly to the Power Quality Meter if they both are connected to the same LAN.*

---

## Enter IP Manually

If you are unable to automatically set your IP address, you need to manually enter an IP.

### To enter an IP manually:

1. Open Internet Explorer or any Internet browser.
2. Type **169.254.249.247** into the address bar.
3. Click **Enter**.

**NOTICE**

*If the ASCO WEB page did not appear, then the IP configuration on the PC must be changed. Contact your system administrator for an available IP address in your network.*

---

## Change the IP Configuration

If you are unable to manually configure your IP consider the following:

- The Power Quality Meter is programmed before leaving the factory with a default Internet protocol (IP) address of **169.254.249.247** and a default subnet mask of **255.255.0.0**.
  - This default configuration typically fits the default network configuration used by the Windows operating system when no DHCP network server is detected.
  - Windows operating systems use a default IP address in the range of **169.254.X.X** when no network server is found and the IP settings on the PC side are on automatic (not fixed). This default configuration allows inter-connection with Power Quality Meter WEB interface without any prior configuration on the PC side.
  - If the default configuration of the PC has been changed, no connection will take place, since the Power Quality Meter cannot find the PC.
- 

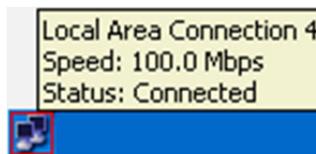
**NOTICE**

*The purpose of the following configuration change is to allow for one-time communication with the Power Quality Meter for the purpose of parameter setup. Carefully record all changed parameters in order to return your PC to its original network parameters.*

---

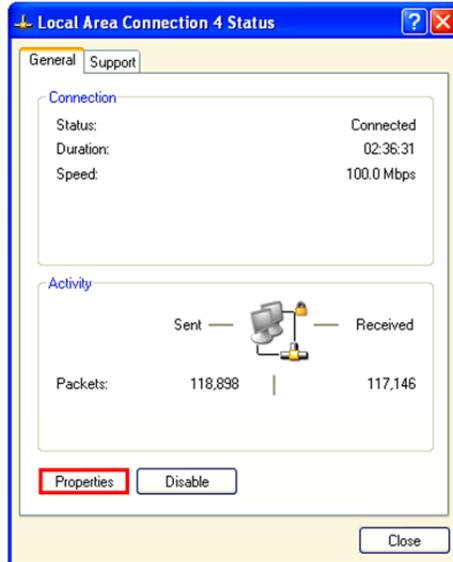
**To change the IP configuration:**

1. To open the Control Panel, click the network icon  in the bottom tray.



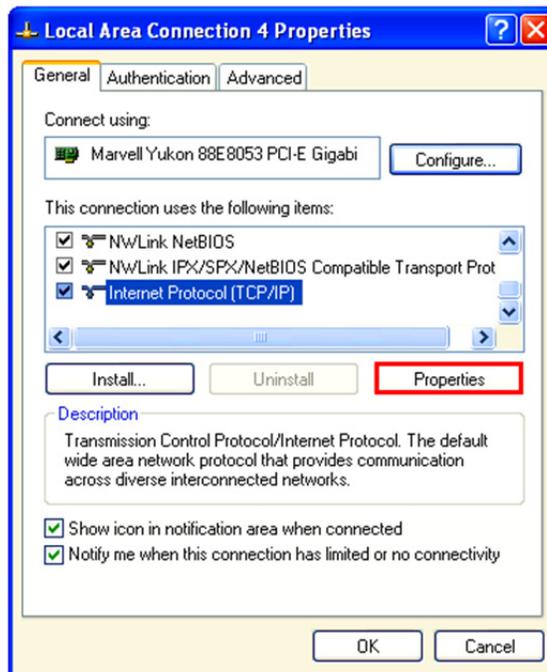
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The LAN Status Window appears.



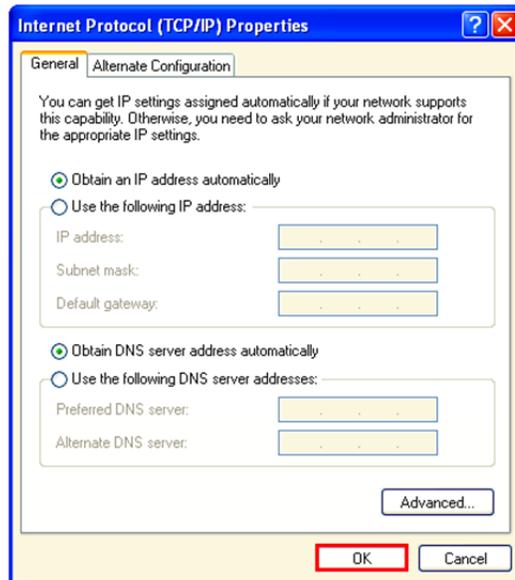
2. Click Properties.

The LAN Properties window appears



3. Select **Internet Protocol (TCP/IP)**, then Click Properties.

The TCP/IP Properties box will appear.



4. Select Obtain an IP address automatically.
5. Select Obtain DNS server address automatically.
6. Click **OK** to accept

## Section 12. Appendices

### Appendix A: Troubleshooting

Problem	Description	Solution
Red led constant on	PQZip is inactive.	Active the PQZip
	Flash parameter corrupted	Restart the unit.
	DSP module communication failure	<ul style="list-style-type: none"> <li>Unplug the unit and wait for power down</li> <li>Power up the unit again.</li> </ul>
	Initialization error – DSP communication, PQZip or the event module failed on initialization	<ul style="list-style-type: none"> <li>Unplug the unit and wait for power down</li> <li>Power up the unit again.</li> </ul>
	ASCO 5401 LCD failed to initialize	<ul style="list-style-type: none"> <li>Unplug the unit and wait for power down</li> <li>Power up the unit again.</li> </ul>
Red led blinks	Warning: Connection problem with the EASCO 5401	Restart the unit
	Warning: Logger corrupted	<ul style="list-style-type: none"> <li>Erase Log</li> <li>Restart the unit</li> </ul>
Green led blinks and does not stop after a minute	Application stuck in initialization phase.	Contact support
Unable to access web interface	Browser may be incorrectly configured for direct or remote access to the network.	If the problem continues, see solutions for Unable to communicate.
Unable to communicate with the unit	The unit is not responding to network communication.	<ul style="list-style-type: none"> <li>Run ASCOSearch for trying to locate the unit. See if the network configuration is correct</li> <li>Open shell window (Start→Run→cmd) and Run→ping &lt;Unit IP&gt;.</li> <li>Restart the unit.</li> <li>Unplug the network cable and attach to the back of the unit</li> </ul>
OPC: Group items return error while reading from the unit	Possible incorrect parameters	Check if all the parameters in the group are valid in the current power configuration.

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Problem	Description	Solution
<b>ModBus Communication over serial RS485 fails</b>	<b>Connection problem</b>	<b>Check serial connection</b> <ul style="list-style-type: none"> <li>• <b>Wiring</b></li> <li>• <b>Bit rate</b></li> <li>• <b>ModBus address</b></li> </ul> <b>Check client configuration</b> <ul style="list-style-type: none"> <li>• <b>Each parameter returns a 32bit floating value.</b></li> <li>• <b>The parameter ids are incremented by one.</b></li> </ul>
<b>GPS Module is connected but NO Time SYNC status</b>	<b>Verification</b>	<b>Check time synchronization source:</b> <ul style="list-style-type: none"> <li>• <b>Should be on GPS or Auto.</b></li> </ul> <b>GPS page:</b> <ul style="list-style-type: none"> <li>• <b>Check the information there is valid.</b></li> <li>• <b>If nothing displayed, check the power source of the gps and the wiring.</b></li> </ul> <b>Verify PPS/IRIG Signal state and check connection to IRIG pin</b>

## Appendix B: Modbus

The MODBUS Protocol is a messaging structure often used in industrial automation to establish master-slave communication between intelligent devices. There are several versions of the protocol including ASCII, RTU, and Ethernet. The ASCO 5400 supports the MODBUS RTU version. Using the web interface, you can define a MODBUS protocol configuration for a 5400 device. Configuration for the MODBUS protocol involves setting general configuration items including communication configuration (such as baud rate, full or half duplex and address), word order, identifier values, and other miscellaneous configurations. The MODBUS message that is sent from the master to the slave contains the address of the slave, the command function, such as “read register”, the data, and a check sum. The 5400 implementation can be used with any Modbus Master application that supports integer 32-bit element types.

### To configure the 5400 for Modbus communication protocol:

1. Connect the Master computer to the 5400 unit through the serial port (RS485/422).
2. Enter the unit's web interface as administrator (Password 12345)
3. Enter Configuration → Serial Ports.

The following screen appears.

RS-485 / RS-422				
Bitrate	Data bits	Parity	Stop bits	Flow
19200	8 bit	None		Full
Serial mode				ModBus slave addr
MODBUS RTU (SLAVE)				159

4. Enter the appropriate values for Bitrate, Flow, and Slave address. (for an explanation of each parameter see **RS485/422 on page 85**.)
5. Select **Modbus RTU (slave)** for the Serial Mode.

*Make sure that the same communication values are used both for the 5400 MODBUS RTU configuration and for the Master MODBUS interface.*

**NOTICE**

*If you are changing the configuration of the RS-485/RS-422 interface from working with a modem to working as a MODBUS RTU (SLAVE) [“Serial mode” = PPP -> “Serial mode” = MODBUS RTU (SLAVE)], then it is necessary to Restart the device*

6. When finished, click **Apply changes** Apply changes to confirm.
7. To restart the device, enter **Configuration**→**Device Info**



8. Click **Restart Unit** if required.

The unit is now ready to be configured using the Modbus protocol. For a complete listing of Modbus parameters, please contact CustomerCare@ASCO.com or dial 1-800-800-ASCO(2726) in North America or dial +1 973-360-3600 when International

Parameter	R/W	Hex Code	Decimal	Address	Type ([Size])
<b>Cycle by Cycle Measurements</b>					
PRM_CODE_DSP_FREQUENCY		100	256	40256	IEEE Float
PRM_CODE_VN_THD		101	257	40257	IEEE Float
PRM_CODE_V1_THD		102	258	40258	IEEE Float
PRM_CODE_V2_THD		103	259	40259	IEEE Float
PRM_CODE_V3_THD		104	260	40260	IEEE Float
PRM_CODE_V12_THD		105	261	40261	IEEE Float
PRM_CODE_V23_THD		106	262	40262	IEEE Float
PRM_CODE_V31_THD		107	263	40263	IEEE Float
PRM_CODE_IN_THD		108	264	40264	IEEE Float
PRM_CODE_I1_THD		109	265	40265	IEEE Float

## Appendix C: Integrated OPC Server

### General

OPC (Open Connectivity, formerly OLE for Process Control) is an industry standard based on Microsoft's OLE/COM technology for communicating to numerous data sources, either devices on the factory floor, or a database in a control room.

In other words, OPC is a common way for applications to access data from any data source.

OPC brings the value that comes with the use of standards, including reduced training costs, reduced custom development costs, and lower long-term maintenance costs. By design, OPC-compliant products work seamlessly with one another. With this plug-and-play approach, off-the-shelf components can be brought together efficiently to solve immediate requirements. With OPC, system integration in a heterogeneous computing environment becomes simple.

### The Current Client Application Architecture

All of the OPC Specifications are based on the OPC Client/Server model. Client/Server describes the relationship between two computer applications in which one application, the OPC client, makes a service request from another application, the OPC Server, which fulfills the request.

- An OPC Server is a software application that has been written to one of the OPC specifications. An OPC Server will respond to requests, and provide data to one or more OPC Clients in a standard, consistent manner. Any compliant OPC Client can interface with, and request data from any complaint OPC Server, regardless of the vendor, or the underlying system providing the data.
- An OPC Server provides a set of standard interfaces, properties and methods, such that any OPC Client can connect/disconnect, obtain information on what data is available, and read/write data in a standard manner.

**Further information on OPC can be found at [OPC Foundation](#).**

## Types of Services

The primary OPC Specifications, OPC Data Access (OPC DA) which are also based on the Client/Server model.

---

### **NOTICE**

*Online Data Access: The efficient reading and writing of data between an application and a device flexibly and efficiently. Alarm and Event Handling: The mechanisms for OPC Clients to be notified of the occurrence of specified events and alarm conditions*  
*Historical Data Access: The reading, processing and editing of data of a historian engine.*

---

## The ASCO Power Quality Meter and Its Embedded OPC Server

The ASCO Power Quality Meter uses built-in TCP/IP based fast Ethernet ports (2 ports for 5450 and 5490 and 1 port for 5410) for communications purposes.

The three most useful protocols that are used are the http (Hyper Text Transfer Protocol), ftp (File Transfer Protocol) and OPC (Open Connectivity). Http is the standard website protocol. Ftp is the Internet's standard file transfer protocol and it is used to fetch PQZIP files from the Power Quality Meter to the server.

The embedded OPC Server provided by the ASCO Power Quality Meter unit supports [\*OPC Data Access Custom Interface Standard Specification version 2.05a\*](#).

The Power Quality Meter embedded OPC Server includes all available data and there is no need to setup anything rather than the device IP address.

## Power Quality Meter OPC Server Parameters

The ASCO Power Quality Meter OPC Server provides a standard way to access real-time data from the device. The following is the list of parameters, calculated based on the standards IEC 61000-4-30 – Testing and measurement techniques – Power quality measurement methods:

- **RMS Group values** comprising line voltages and phase voltages, line current and phase currents plus neutral voltage and current.
- **Total Harmonic Distortion Group values** comprising line voltages, phase voltages, phase currents, and neutral voltage and current.
- **K-Factor values** comprising line and phase currents

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- **Crest Factor values** comprising line voltages, phase voltages, phase currents, and neutral voltage and current
- **RMS values**, comprising line voltages, phase voltages, phase currents, neutral voltage and current, and average line and phase voltages and phase currents
- **Power Factor values**, comprising power factor per phase, neutral and total power factor.
- **Apparent Power values** comprising apparent power per phase, neutral and total.
- **Reactive Power values** comprising reactive power per phase, neutral and total.
- **Active Power values** comprising active power per phase, neutral and total.
- **Total Harmonic Distortion values** comprising line voltages, phase voltages, phase currents, and neutral voltage and current.

OPC parameters are Power Quality Meter memory resource consumers. Addition of parameters in the embedded OPC interface will be evaluated upon specific customer request.

---

### **NOTICE**

*RMS Group values and THD Group values are calculated according to the definitions of IEC 61000-4-7, Testing and measurement techniques.*

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### **Using Power Quality Meter OPC Server with 3rd Party OPC Client Applications**

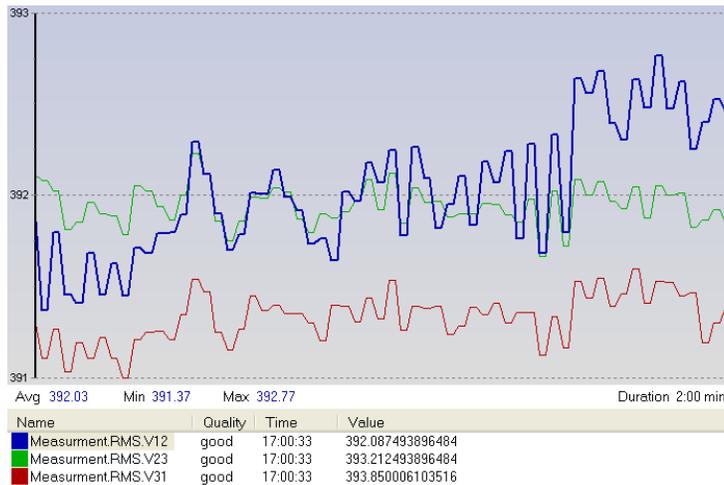
There are several third party OPC Client applications in the market. One of them is [dOPC Explorer](#) from **Kassl GmbH** which is a free (for non commercial use) program to read/write OPC Items from/to OPC DA servers.

**dOPC Explorer** is an easy to use OPC diagnostic and communication tool that enables you to connect to the ASCO Power Quality Meter OPC DA server.

With dOPC Explorer you can browse for different Power Quality Meter OPC DA servers connected to the same network, browse for OPC items, read item properties and create different OPC groups.

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With the embedded Trend Graph you can view the change of data compared to the time in the following figure.



By using the 'Trend Graph' option the interface can also show you the *Average*, *Minimum* and *Maximum* value per parameter per screen.

### **NOTICE**

*The implemented OPC Server does not support Microsoft's changes made in Windows XP Service Pack 2 DCOM interface. In case you are using Windows XP with Service Pack 2 you should configure the client computer as described in the [Using OPC via DCOM with Microsoft Windows XP Service Pack 2](#).*

### Appendix of URL links

The following are URL link references from the text.

OPC Foundation

<http://www.opcfoundation.org/>

OPC Data Access Custom Interface Standard Specification version 2.05a

<http://www.opcfoundation.org/DownloadFile.aspx?CM=3&RI=66&CN=KEY&CI=274&CU=17>

DOPC Explorer

<http://www.kassl.de/opc/explorer.shtml>

Using OPC via DCOM with Microsoft Windows XP Service Pack 2

<http://opcfoundation.org/Archive/72e9fbfa-6a89-4ef2-9b6d-3f746fd7eb05/Using%20OPC%20via%20DCOM%20with%20XP%20SP2%20v1.10.pdf>

## Appendix D: DNP3

DNP3 (Distributed Network Protocol) is a set of communication protocols used between components in systems. It is very commonly used in SCADA systems, primarily for communications between a master station and Remote terminal unit.

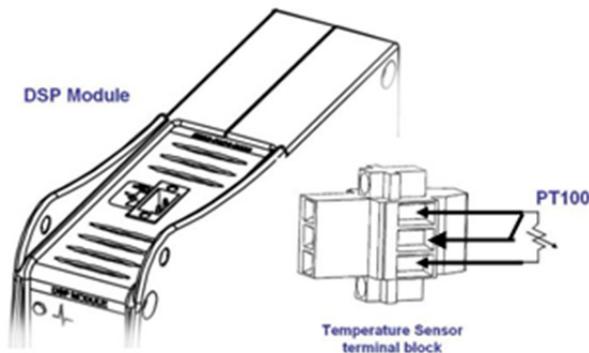
We support the following.

- Object 30 –measurement information (For further information please contact <https://support.ascopower.com> or dial 1-800-800-ASCO(2726) in North America or dial +1 973-360-3600 when International
- Object 0 – Device information.

## Appendix E: Temperature Connection

To attach the temperature connections:

1. Remove the Temperature Sensor Terminal block provided with the ASCO Power Quality Meter package.
2. Attach lugged ends of wires to the terminal block using a properly sized screw driver.



4. Insert the terminal block into the DSP module.
5. Verify the correct polarity on the connector.

---

### **NOTICE**

*There are a total of three wires; two for the PT leads and one (the center) that is used to compensate for the cable length.*

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