

# InSight™


*Power Meter and Alarm Monitor*




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# IMPORTANT SAFETY INSTRUCTION

**SAVE THESE INSTRUCTIONS** - This manual contains important instructions for the InSight™ Power Meter and Alarm Monitor that must be followed during installation, operation, and maintenance of the InSight™ Power Meter and Alarm Monitor and its auxiliary equipment.

	<p style="text-align: center;"><b>WARNING</b></p> <p style="text-align: center;">OPENING ENCLOSURES EXPOSES HAZARDOUS VOLTAGES. ALWAYS REFER SERVICE TO QUALIFIED PERSONNEL ONLY.</p>
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	<p style="text-align: center;"><b>WARNING</b></p> <p>As standards, specifications, and designs are subject to change, please ask for confirmation of the information given in this publication.</p> <p>This manual is a controlled document; pages should not individually be removed from this binder.</p>
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# InSight™

## **INSTALLATION, OPERATION AND MAINTENANCE GUIDE**

INST-M001-A5  
2018-11-30

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## Warranty

Seller warrants to the Ultimate Purchaser (the purchaser who buys for use, and not for resale) that all products furnished under this order and which are manufactured by Seller will conform to final specifications, drawings, samples and other written descriptions approved in writing by Seller, and will be free from defects in materials and workmanship. These warranties shall remain in effect for a period of twelve (12) months from the date of installation or eighteen (18) months from the date of shipment, whichever occurs first. Parts replaced or repaired in the warrant period shall carry the unexpired portion of the original warranty.

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## Service and Factory Repair - Call 1 - 888 - TO - MIRUS (1 - 888 - 866 - 4787)

Direct questions about the operation, repair, or servicing of this equipment to MIRUS International Inc. Customer Support Services. Include the part number, assembly number, and serial number of the unit in any correspondence. Should you require factory service for your equipment, contact MIRUS International Inc. Customer Support Services and obtain a Return Materials Authorization (RMA) prior to shipping your unit. Never ship equipment to MIRUS International Inc. without first obtaining an RMA.

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## Revision History

Copyright ©	All rights reserved. Printed in Canada	
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This manual has been designed for ease of use and organized for easy location of information.


**How to use this manual**


To quickly find the meaning of terms used within the text, look to the Glossary.

This manual uses Note boxes to convey important information. Note boxes come in four varieties:

	<p style="text-align: center;"><b>WARNING</b></p> <p>A <b>WARNING</b> note box indicates information provided to protect the user and service personnel against safety hazards and/or possible equipment damage.</p>
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	<p style="text-align: center;"><b>CAUTION</b></p> <p>A <b>CAUTION</b> note box indicates information provided to protect the user and service personnel against possible equipment damage.</p>
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	<p style="text-align: center;"><b>IMPORTANT</b></p> <p>An <b>IMPORTANT</b> note box indicates information provided as an operating instruction or as an operating tip.</p>
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	<p style="text-align: center;"><b>NOTE</b></p> <p>A <b>NOTE</b> note box indicates information provided as an operating tip or an equipment feature.</p>
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**1**

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**Introduction**

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**1.0 Scope**

This manual provides information required for installation, operation, and maintenance of the InSight Power Meter and Alarm Monitor. Please read this manual thoroughly before installing and operating your InSight Power Meter. Retain this manual for future reference.

The manual is divided into four sections:

**Section I - Introduction**

This section introduces the InSight Power and Alarm Monitor including a general description, available options, and specifications.

**Section II - Installation**

This section describes installation of the InSight Power and Alarm Monitor, including receiving, handling, and storage procedures; prerequisites to installation; installation procedures; and start-up procedures.

**Section III - Operation**

This section presents operating information for the InSight Power and Alarm Monitor, including an overview of the system, its components, and their function; a description of the indicators and controls, and their function; and operational sequences to be followed for all conditions of normal, emergency, and maintenance operation.

**Section IV - Maintenance**

This section describes maintenance of the InSight Power and Alarm Monitor, including preventive maintenance, troubleshooting, and information about replacement parts.

A Glossary in the rear of the manual provides definitions of terms used within the text.

**1.1 System Description**

InSight™ is a highly accurate, power meter and alarm system designed to continuously monitor Mirus products such as the Lineator Advanced Universal Harmonic Filter, Onics Power Distribution units and any Ultra or Harmony transformer.

The monitoring system enhances the capability by examining its performance, gathering and processing information from its voltage, current, and temperature sensors, and controlling the operation of your system via the fully programmable I/O contacts.

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## 1.2 Typical Configurations

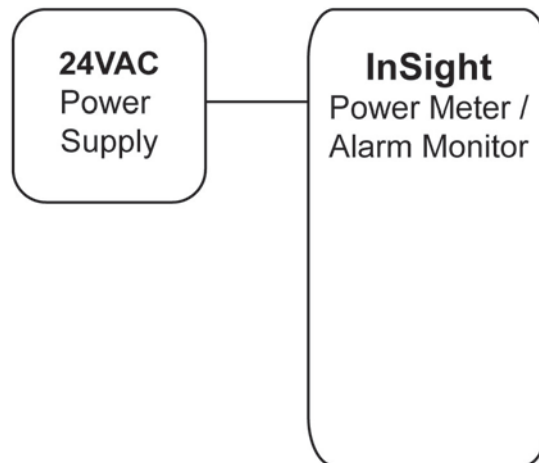
The InSight Power Monitor is supplied in various configurations. The following table describes the types of monitors available with their option code.

**POWER MONITOR :**

Option Type	Description
PM	Performance Meter
CM	Capacitor Loss Monitor
DM	Dual Monitor (Performance + Capacitor Monitoring)

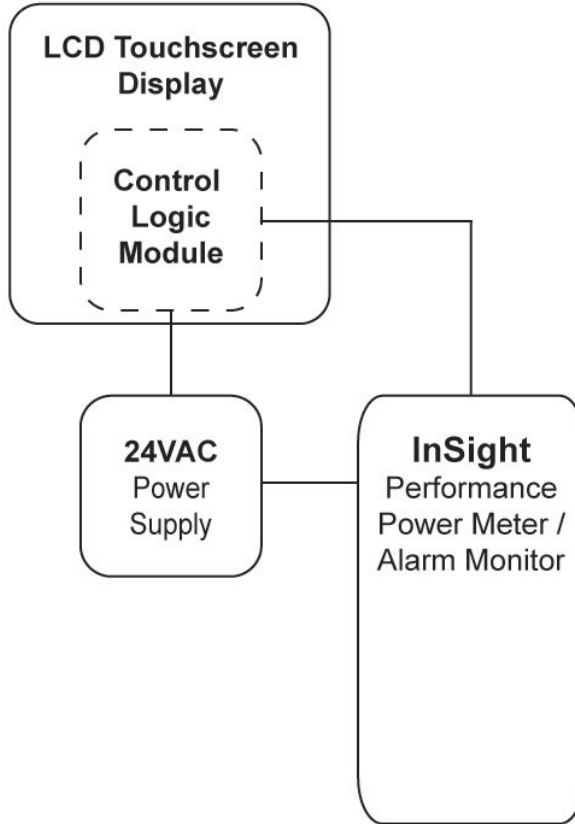
**Table 1-1 Available InSight Power Monitor Configurations**

The following diagrams display the various configurations in which the InSight Power Meter and Alarm Monitor can be applied.

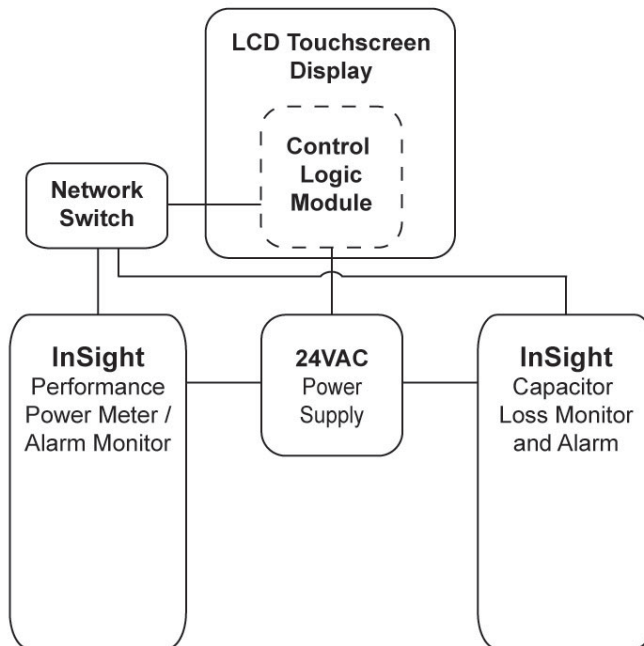


**Figure 1-1 Standalone Performance Meter**





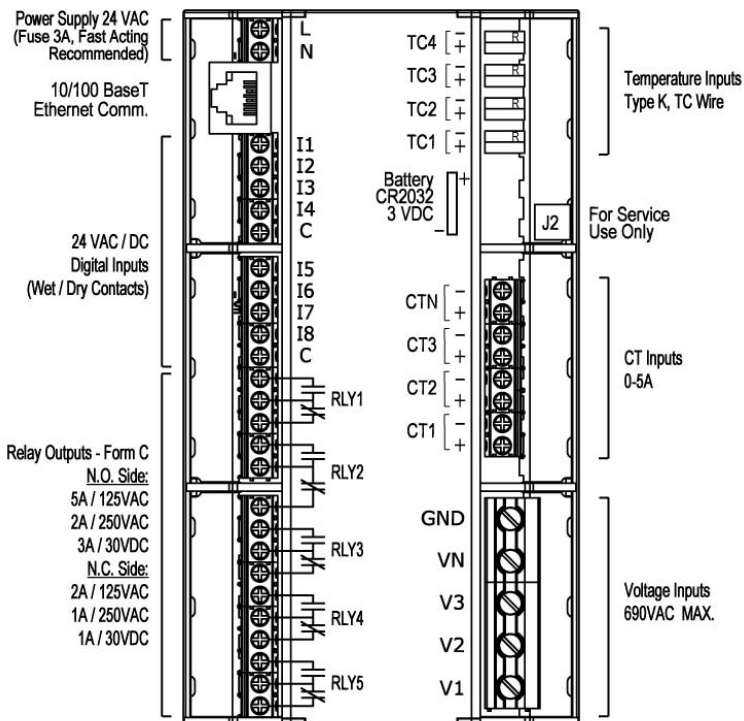
**Figure 1-2** Performance Meter or Capacitor Loss Monitor with Touchscreen Interface and Display



**Figure 1-3** Dual Performance Meter and Capacitor Loss Monitor with Touchscreen Interface and Display

## 1.3 Major Components

### Power Monitor



**Figure 1-4 InSight Power Monitor**

The power monitor is the main module for the InSight Power Meter and Alarm Monitor system. It provides all the connection terminals for voltage and current as well as temperature probes and external inputs and outputs.

InSight displays the following measurements. These measured values are accessible with an optional LCD touchscreen display or with any Browser on your personal Computer.

Voltages
3Φ RMS Voltage Wye (L-L, L-N), DELTA (L-L)
Voltage %THD Wye (L-N), DELTA (L-L)
Fundamental RMS Voltage Wye (L-N), DELTA (L-L)
Peak Voltage Wye (L-N), DELTA (L-L)
Frequency (Hz)
3Φ Average RMS Voltage Wye (L-L, L-N), DELTA (L-L)
Average Voltage %THD
Voltage Imbalance (%)

Currents
3Φ RMS Current
Current %THD
Crest Factor
Peak Current
K Factor
Neutral Current
3Φ Average RMS Current
Average Current %THD
Current Imbalance (%)
Demand Current (Amps)
Total Demand Distortion (%)

Alarms, Setpoints and I/O
Programmable for any values

Power
3Φ Active Power (kW) Total and Fundamental
3Φ Reactive Power (kVAR) Total and Fundamental
3Φ Apparent Power (kVA) Total and Fundamental
kW Demand
True Power Factor (PF)
Displacement Power Factor (dPF)

Energy
Total and Fundamental Active (kWh)
Total and Fundamental Reactive (kVARh)
Total and Fundamental Apparent (kVAh)
Total Maximum Demand (kW)

Harmonics
Phase Voltage %THD
Phase Current %THD
Phase Current K Factor
Harmonic Magnitudes
Harmonic Angles

Temperature
Four Temperature Inputs (°C)
Power Meter Internal Operating Temperature (°C)

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## 1.4 Options

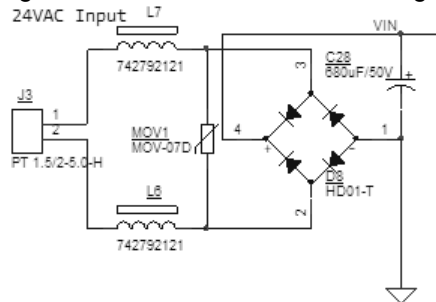
Most options must be specified at the time of the original order for factory installation. Some options can be field installed; contact your MIRUS Sales Representative for further information.

### Power Supply

The InSight Power Meter is capable of accepting supply from a 24VAC, 24VDC or PoE when available.

- 24VAC - Control transformer rated for 50VA min.
- 24VDC - Power supply 0.42A 10W min.
- PoE - 802.3af compliant class-3, 48VDC nominal

The power supply input is designed for 24V AC and has full-bridge rectifier built in.



For 24V DC power supply connect (+) to any of the J3-1 (L) or J3-2 (N) terminal. Typically the terminal #1 is used, the one closer to the edge of the board, for connecting (+), but this is just arbitrary decision. Since the rectifier bridge is built into the circuit even reverse polarity is allowed.

The PoE (Power over Ethernet) allows a single cable to provide both data connection and power supply to the InSight Power Meter via the Ethernet port. Power sourcing equipment (PSE) such as a network Switch that provides PoE power on the Ethernet cable is required to provide power supply in this option. Otherwise use separate 24VAC power supply connected to J3 terminals.

### LCD Display Options

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#### 7 Inch [178mm] TFT LCD



Provides local display of all monitored parameters and alarm messages (HMI). The touchscreen functions as a metering display as well as a programming input device.

It is a complete touch panel computer solution comprised of a 7" TFT LCD, baseboard and processor board with Linux OS.

**3.5 Inch [89mm] LCD with Keypad**



Provides local display of all monitored parameters and alarm messages. Provides audible and visual warning signal when a warning condition is met. User input is performed through directional keypad and 'Return' button.

**Ethernet Switch**

Standard 10/100 Ethernet switch is used to network the InSight Meters and Control Logic module (HMI).

## 1.5 Model Numbering

The model number of the unit, located on the inside, can be parsed to indicate important parameters of the InSight Meter. Possible values are shown in Figure 1-8.

### InSight Model Number

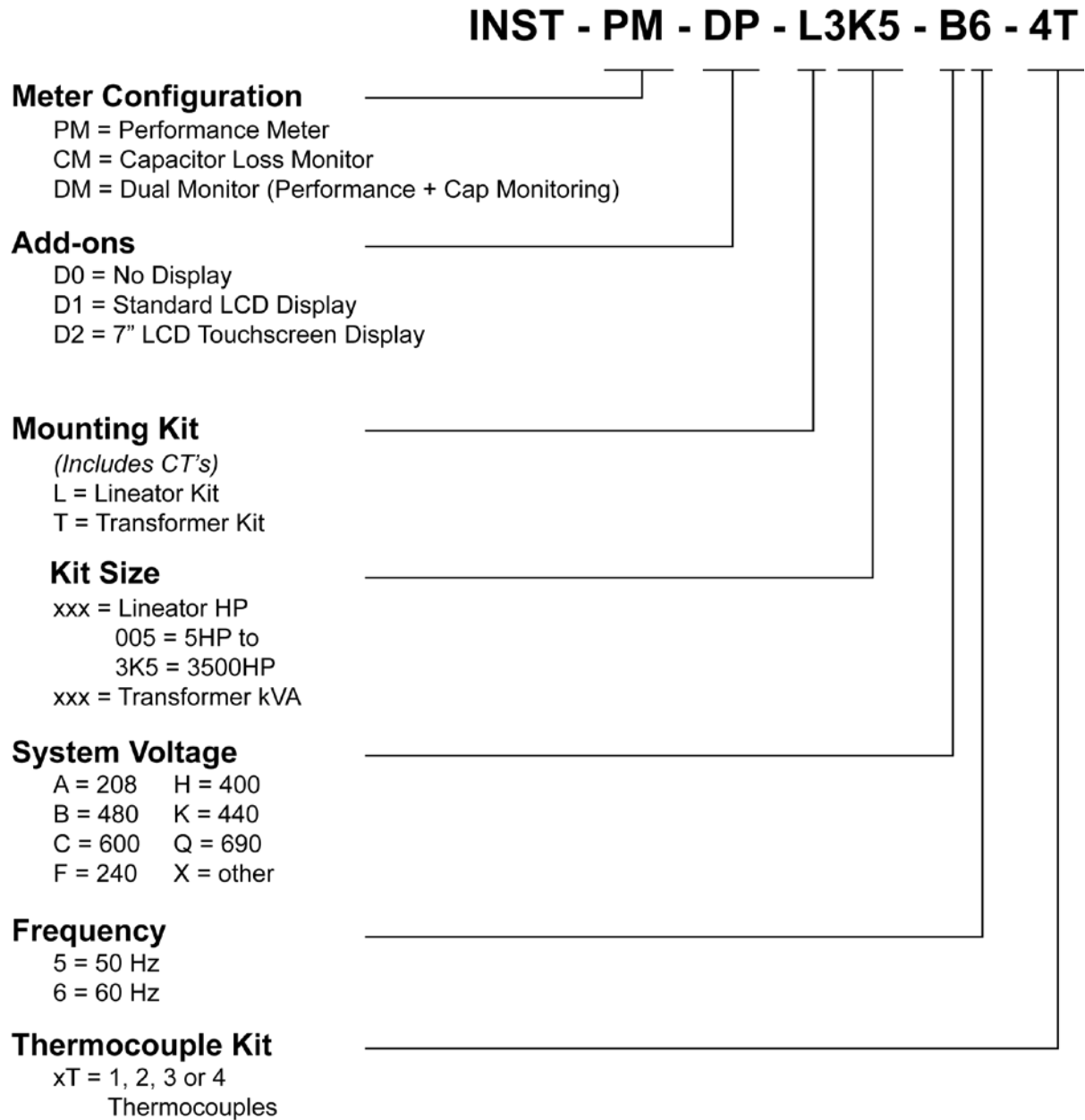


Figure 1-5 Nomenclature of InSight Power Meter

## 1.6 Specifications

### Power Supply

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Nominal	24 V AC/DC
Operating Range	15 – 30 VAC (20 – 42 VDC)
Frequency	50 / 60 Hz
Power Consumption	6 W
PoE (Power over Ethernet)	802.3af compliant class-3, 48V DC nominal

### Voltage Inputs

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Nominal full scale	10 to 690 VAC [CSA /UL], 10 to 750 VAC [IEC] (direct Ph-Ph)
Supported Connections	3-Wire Delta, 3-Wire WYE, 4-wire WYE
Fault Withstand	4490 V peak

### Current Inputs

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Class 10	5A Nominal
Burden	0.066 ohm
Fault Withstand	17 A peak

### Digital Inputs

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AC isolation test voltage	3750 V RMS for 1 min.
Voltage	24 V AC
Max. Current	20 mA
Total Power Dissipation	500 mW

### Relay Outputs

---

AC isolation test voltage	4000 V RMS for 1 min.
Max. Switching Voltage	250 V AC, 30 V DC @ 1 A
Max. Switching Current	N.O. 5A, N.C. 2A @ 125 V AC

### Accuracy

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Voltage RMS Measurement	0.2%
Current RMS Measurement	0.2%
Power	0.2%
Energy	0.2%
Harmonics	1%
Temperature	2.2°C or 0.75%

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## Specifications (continued)

### Standard Compliance

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Measurement Safety	IEC, ANSI, IEEE cCSAus, CE Mark
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### Communication

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Ethernet Protocols	10M / 100M BaseT UDP, TCP/IP, DHCP, NTP, FTP, HTTP, MODBUS TCP/IP, Telnet
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### Mechanical

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Dimensions Weight Mounting	2.4"[61mm] H x 6.37"[162mm] W x 3.54"[90mm] D 10 oz [285 g] Din Rail (International Standards DIN 46277/3)
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### Environmental

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Humidity Altitude Protection Level Enclosure Rating Storage	-25°C to 50°C    -40°C - 85°C
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## 2

## Installation

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### 2.0 Scope

This section describes installation of the InSight Power Meter and Alarm Monitor , including receiving, handling, and storage procedures, prerequisites to installation, installation procedures, and start-up procedures. For Mirus factory mounted InSight Power Meters you may skip this section and proceed to Section 3 Operation.

### 2.1 Receiving

Every effort is made to insure that the InSight Meter equipment arrives at its destination undamaged and ready for installation. Packing is designed to protect internal components. Care should be exercised to protect the equipment from impact at all times.

Before accepting the shipment from the freight carrier, inspect the exterior surfaces of shipping container(s), packaging, and equipment for damage that may have occurred during transit. If the shipping containers or equipment show evidence of damage, note the damage on the receiving document (bill of lading) prior to signing for receipt of equipment.

The equipment should be unpacked immediately after receipt, and inspected to determine if any internal damage (broken components, disconnected wiring, loose connections, etc.) has occurred. Verify that the equipment nameplate corresponds with the equipment ordered.


RECORD any external and internal damage observed for reporting to the transportation carrier. Call the carriers concerned at once for inspection, and request an inspection report. Do not contact Mirus International Inc. first – notify the carrier instead. If this precaution is not taken we cannot assist you in recovering the amount of the claim against the carrier. All claims should be as specific as possible and include purchase order (P.O.#) and serial numbers (S/N #), found on the nameplate.


A shipping label is affixed to the top of the shipping container which includes a variety of equipment and customer information, such as Purchase Order Number (P.O.#). Make certain that this information matches other shipping paper information.

Damage claims should be filed directly with the carrier. Replacements for damaged components can be ordered by calling 1-888-TO MIRUS (1-888-866-4787).

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## 2.2 Handling

	<p style="text-align: center;"><b>NOTE</b></p> <p>Refer to all the documentations furnished with the unit for any special information not outlined in this manual.</p>
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	<p style="text-align: center;"><b>WARNING</b></p> <p>Do not attempt to operate this equipment if there is evidence of shipping damage or you suspect the unit is damaged. Damaged equipment may present additional hazards to you. Contact technical support for advice before attempting to install and operate damaged equipment.</p>
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Unpack carefully; all parts and cables included with the meter system. Inspect the box carefully for loose parts before disposing of the packaging. Choose a suitable work surface for any preparation or assembly required prior to installation.

## 2.3 Storage

Although well packaged, this equipment is not suitable for storage outdoors. The equipment warranty will not be applicable if there is evidence of outdoor storage. If the equipment is to be stored indoors for any period of time, it should be stored with its protective packaging material in place. Protect the equipment at all times from excessive moisture, construction dirt, corrosive conditions and other contaminants. It is strongly suggested that the packaged protected equipment be stored in a climate-controlled environment of 0° to 40°C with a relative humidity of 0% to 95% (non-condensing). Do not, under any circumstances, stack other equipment on top of the InSight equipment whether packaged or not.

## 2.4 Prerequisite to Installation

Installation drawings are provided with each InSight Power Meter. Installation of equipment must be handled by skilled technicians and electricians familiar with the requirements of high energy electrical equipment. The installation must comply with the requirements of the National Electrical Code (CEC, NEC, ANSI/NFPA 70, latest issue) or other electrical authority having jurisdiction and with local codes and requirements as applicable. We strongly recommend contracting MIRUS Customer Support Services for start-up. Do not allow unqualified personnel to handle or operate the equipment.

### **Environmental considerations**

The InSight Power Meter is intended for use in an environment where control of temperature and humidity is provided.

### **Mechanical considerations**

For installations within existing or new enclosures, it is recommended the InSight be Din rail mounted onto a mounting panel that is galvanized or coated to inhibit corrosion.

### **Access**

Once installed, internal access is not required for operation of the InSight Meter. For servicing and periodic inspection we recommend the unit in which it is installed be shut-down prior to accessing the equipment.

### **Cooling**

The InSight is convection cooled. Care should be taken to ensure that the air intake and exhaust areas are not obstructed for air flow.

### **Electrical considerations**

Only qualified personnel must perform installation of the InSight Power Meter. Those personnel shall follow all safety precautions and local standards and practices.

The InSight Meter during normal operation will have lethal voltages and currents present. Extreme caution must be exercised and contact with and current carrying terminals and surfaces must be avoided.

The meter and its I/O are not intended to replace primary protection devices. Use only as secondary protection.

Do not exceed the voltage that the meter can withstand. If a HIPOT/Dielectric test is required, the InSight Meter **MUST** be isolated and removed from the circuit. High voltage testing will damage electronic components within the meter.

**Mirus recommends CT Shorting blocks and fuses for voltage sensing leads. Place CTs in the shorting position when meter is removed for service.  
InSight Meter current sensing is internally grounded to GND Terminal.  
Do not ground CTs externally!**

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## 2.5 Installation Procedures

Installation procedures describe the general requirements for the InSight Meter installation. Specific requirements are described in the installation drawings shipped with your configuration.

**The steps to be followed are:**


- Placement
- Connection of input power, voltage sensing leads, CTs, I/O and communication cables plus local display when ordered.
- Start-up of the system


Installation of the InSight Meter equipment must be handled by skilled technicians and electricians familiar with the special requirements of high-energy electrical equipment. The installation must comply with the requirements of the National Electrical Code (CEC, NEC, ANSI/NFPA 70, latest issue) or other electrical authority having jurisdiction and with local codes and requirements as applicable. We strongly recommend contracting MIRUS for start-up of the InSight. Do not allow unqualified personnel to handle or operate the equipment.

### 2.5.1 Placement

Using the mechanical prerequisite information, determine the final location for the InSight Meter and any applicable options,

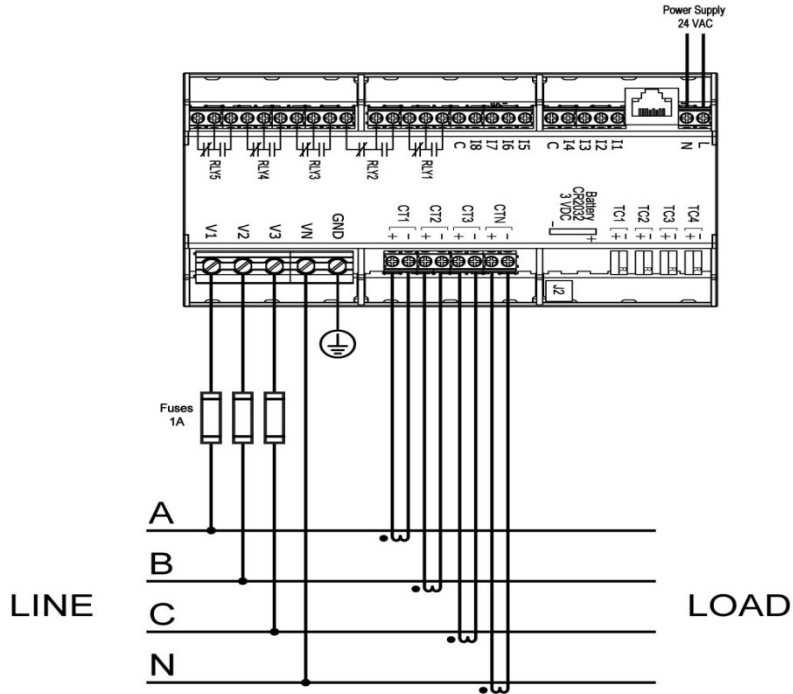
### 2.5.2 Connections

	<p style="text-align: center;"><b>WARNING</b></p> <p><b>ONLY QUALIFIED PERSONNEL SHOULD PERFORM EQUIPMENT INSTALLATION AND START-UP. LETHAL VOLTAGES ARE PRESENT DURING START-UP PROCEDURES.</b></p> <p><b>CONFIRM THAT ALL INCOMING LINE VOLTAGE, PRIMARY AND SECONDARY CIRCUITS ARE DE-ENERGIZED AND LOCKED OUT BEFORE ATTEMPTING ANY MAINTENANCE.</b></p>
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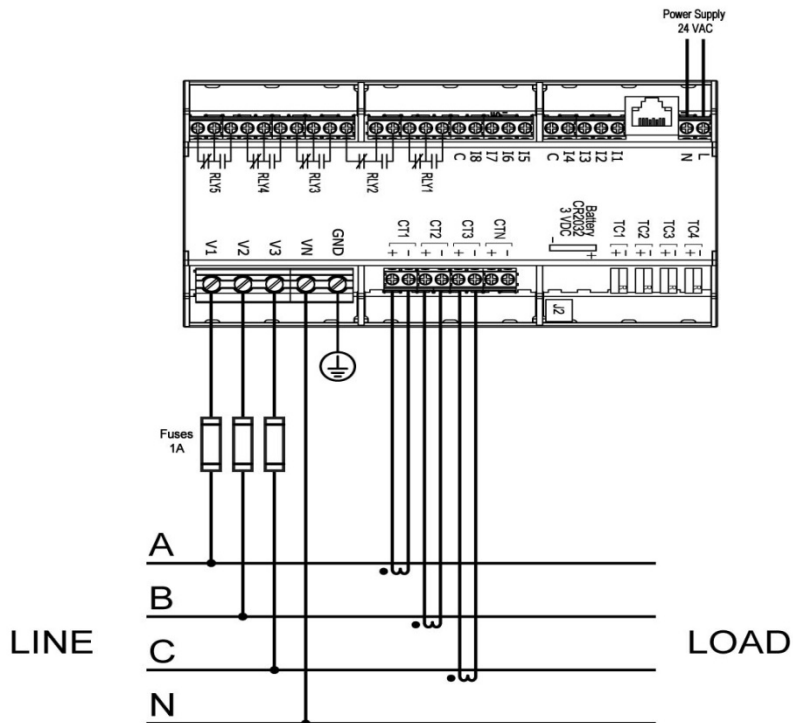
	<p style="text-align: center;"><b>CAUTION</b></p> <p><b>ALL WIRING MUST CONFORM TO NATIONAL AND LOCAL CODES. SUFFICIENT ROOM MUST BE PROVIDED FOR ROUTING ALL POWER CABLES. ALL SIGNAL CABLES MUST BE ROUTED SEPARATELY FROM POWER CABLES.</b></p>
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The following diagrams outline the various methods for connecting the InSight Power Meter. CT wire range 24-10 AWG. Power Supply and Voltage sensing leads must be insulated copper wire between the range of 26-14 AWG.

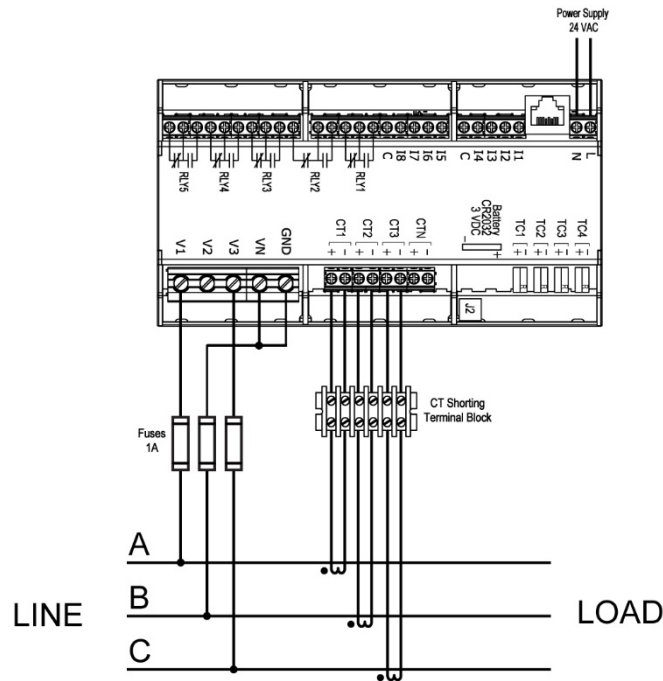
**3-Phase, 4-Wire WYE with No PTs, 4 CTs**



**3-Phase, 4-Wire WYE with No PTs, 3 CTs**

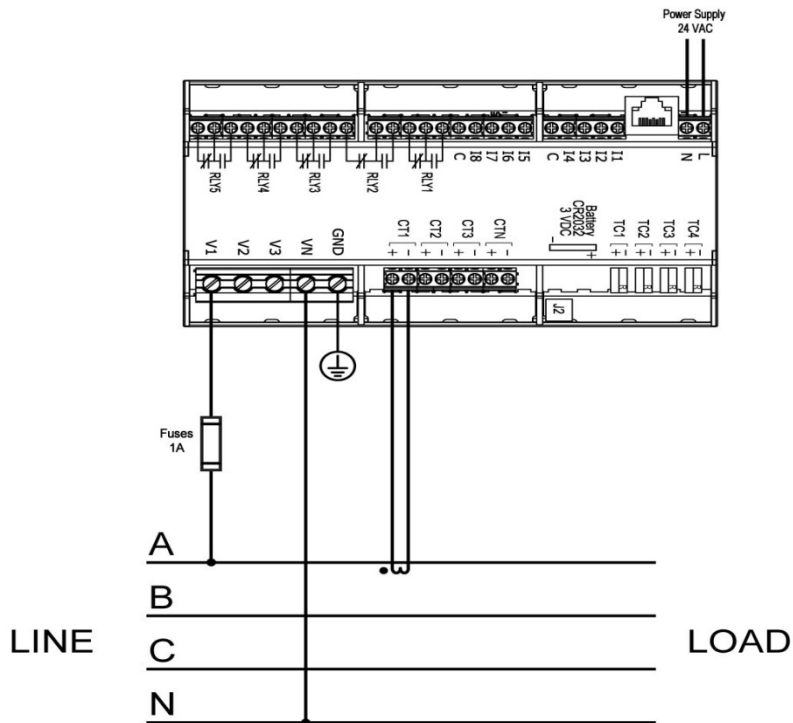


### 3-Phase, 3-Wire Delta with No PTs, 3 CTs

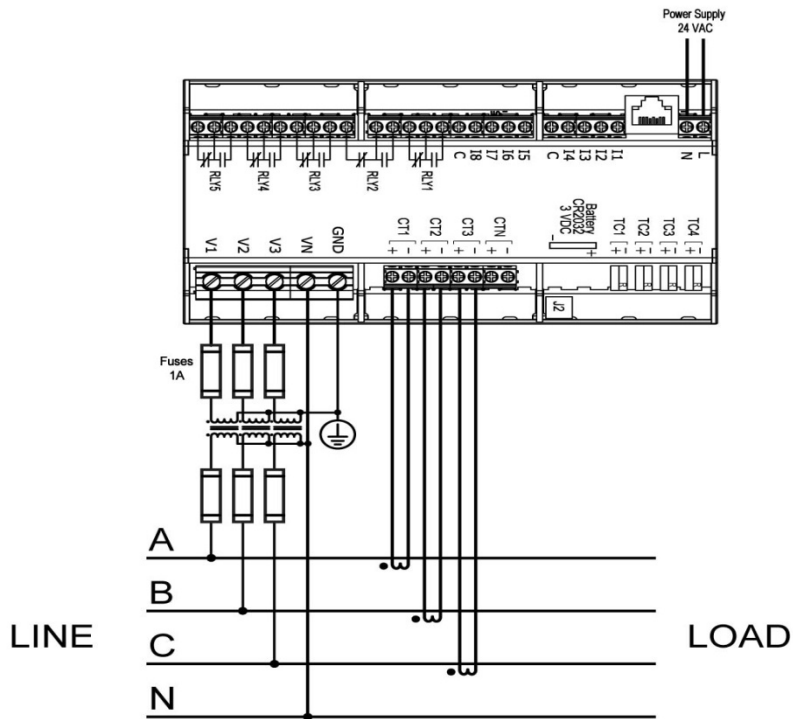


Note: In delta measurement phase-B (V2) is used for reference in voltage sensing circuit; VN and GND are jumpered together and connected to phase-B, do not ground GND terminal in this configuration.

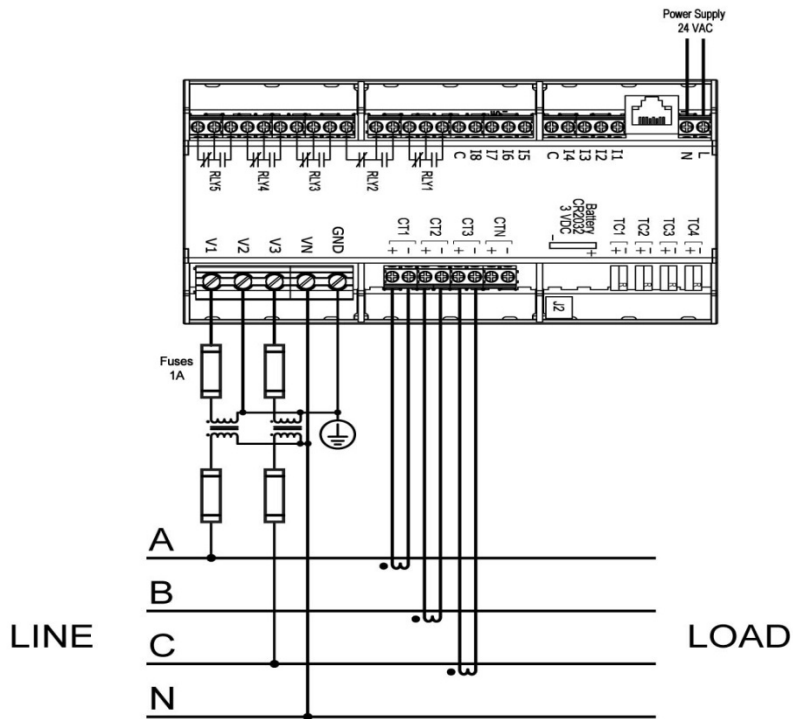
### 1-Phase, with No PTs, 1 CT



**3-Phase, 4-Wire WYE with 3 PTs, 3 CTs**



**3-Phase, 4-Wire WYE with 2 PTs, 3 CTs**



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### 2.5.3 Communication

The InSight Power Meter uses 10/100Base T Ethernet Communication. Connections between meter devices and Control Logic Module (HMI) are made with standard RJ-45 8P8C Plug with T-568A or T-568B wiring assignment.

The InSight Power Meter hosts a web server that processes requests via HTTP and deliver web pages to clients. A common web browser is required to initiate communication with the graphic user interface, retrieve, monitor, and modify information from the InSight power meter. The behavior of the web server is scripted in separate files, typically dynamic HTML documents and JSON files. Therefore no additional software has to be installed on the client computer to access full control of the InSight Power Meter.

There are the following protocols used by the InSight Power Meter: TCP/IP, DHCP, NTP, FTP, HTTP, MODBUS TCP/IP, Telnet

All InSight Power Meters are shipped with a static IP address as default. The IP addresses and networking instructions are included as a separate insert with the inserts included in each shipped item. If the installation site includes a router or a residential gateway enabled to act as a DHCP server, the meter can be set to look for an IP address from a DHCP server by following the instruction in Section 2.6.3. The DHCP server will then assign a unique IP address for the InSight Power Meter and the static IP address will be dismissed from memory.

Use a CAT 5 or better cable to connect to the InSight Power Meter.

To access the InSight power meter's web site, simply enter the meter's IP address as the URL in a web browser.

See "Operation" section for more details.

### 2.5.4 Temperature Monitoring

The InSight Power Meter is equipped with four temperature monitor inputs to monitor coil ambient or surface temperatures inside Mirus products or other equipment. The InSight is configured for use of Thermocouple Type K, TC Wire.

### 2.5.5 Digital Inputs

Eight (8) Digital Inputs are available to receive 24V DC voltage signal status from external devices and will be available as an indicator on the InSight Power Meter Display. The digital inputs are divided into two groups, each with 4 inputs. Each group has a common reference. External auxiliary power supply 24V DC required for digital inputs to detect the voltage signal. Wire size range for connections is 26-14 AWG.



## 2.5.6 Relay Outputs

When remote indication is required the InSight comes with five (5) Form C relay outputs (dry-contact). These outputs are galvanically isolated from the meter electronic circuits. The relays are fully programmable to supply indication from the InSight Power Meter. Wire size range for connections is 26-14 AWG. The relay contacts are rated as follows:

<b><u>N.O. Side</u></b>	<b><u>N.C. Side</u></b>
5A / 125VAC	2A / 125VAC
2A / 250VAC	1A / 250VAC
3A / 30VDC	1A / 30VDC

## 2.6 Startup Procedures

This section presents the procedures to be used for initial start-up of the InSight Power Meter, and the sequence to be followed any time that the system is restarted after having been shut completely down with no power applied to the system.

### 2.6.1 Checks Before Startup

Before starting the InSight Power Meter and Alarm Monitor, read this Owner's Manual thoroughly. Be certain that you fully understand the operation of the indicators, controls, and operational sequences.

Before applying power, make sure of the following:

- Upstream power circuit breaker is open.
- Voltage connected to the InSight matches the nameplate and model number.
- Equipment has been properly grounded as per wiring/measurement configuration.
- All power and control connections are properly made and are tight.
- No obstructions that might impair proper air flow.

### 2.6.2 Initial Startup

After verifying the information presented in Section 2.6.1:

- Close the upstream circuit breaker.
- Close the main circuit breaker to the equipment if available and verify circuit monitor has the proper presentation

### 2.6.3 Checks After Startup

Normal operation of the InSight Power Meter should be verified immediately after the initial start-up has been performed (STATUS LED is flashing when ready for network communication).

---

## Network communication

The static IP address that each meter ships with can be found in the documentation attached with every shipped unit. Typically the IP address is set in private network range such as 172.16.254.1 in IPv4. However, consult the network setup page to determine the factory-set IP address assigned to each InSight power meter.

If the installation site includes a router or a residential gateway enabled to act as a DHCP server, the meter can be set to look for an IP address from a DHCP server by shorting the two pins at the top of the meter and restarting the meter by toggling the power to it. This will reset the network settings to remove the factory-set static IP address and allow the local DHCP server to assign an IP address to the meter.

After resetting the network parameters to DHCP (if desired), log into the router or gateway that manages the TCP/IP settings or use 'Netscan' or 'Advanced IP Scanner' on Windows or any other IP scanning tool to find the IP address of the InSight power meter, look up the MAC address located on the right side of the enclosure of each InSight power meter to match the device with IP address.

Note that when in DHCP mode, the power meter's network settings are managed by the DHCP server. In this scenario, the InSight power meter waits for a DHCP server to assign the appropriate IP address and other network configuration information. If the DHCP server is not found the meter just runs with its last known settings and continues to look for the DHCP server.

If you have set the power meter to DHCP mode, it is possible to change back to a static IP configuration by manually assigning a static IP address to the InSight meter. See "Operation / Meter Settings and Configuration" section for details.

If choosing to use a local DHCP server to set the meter's IP address, it is necessary to have an understanding of basic TCP/IP concepts, including working knowledge of subnets to have a full understanding of the InSight power meter network communication, including DHCP.

When there is no local network connected to the InSight meter settings can be accessed using the LCD display (optional part) via the serial communication adapter. The "Comm" port is located in front of flashing LEDs. Note: the LCD screen needs the RJ11 6P6C adapter to connect to the InSight meter 6 pin connector. Contact factory for details.

If the InSight power meter appears to be on a different subnet than your PC you need to change the "Properties" for the "Internet Protocol Version 4 (TCP/IPv4)" of your Local Area Connection as required to establish proper network communication.

Make sure you change your own IP address and Subnet Mask to match IP settings of the InSight power meter.

Using a web browser of your choice (recommended Firefox or Chrome) enter the InSight IP address in the browser address bar and load the InSight web content.

## 3

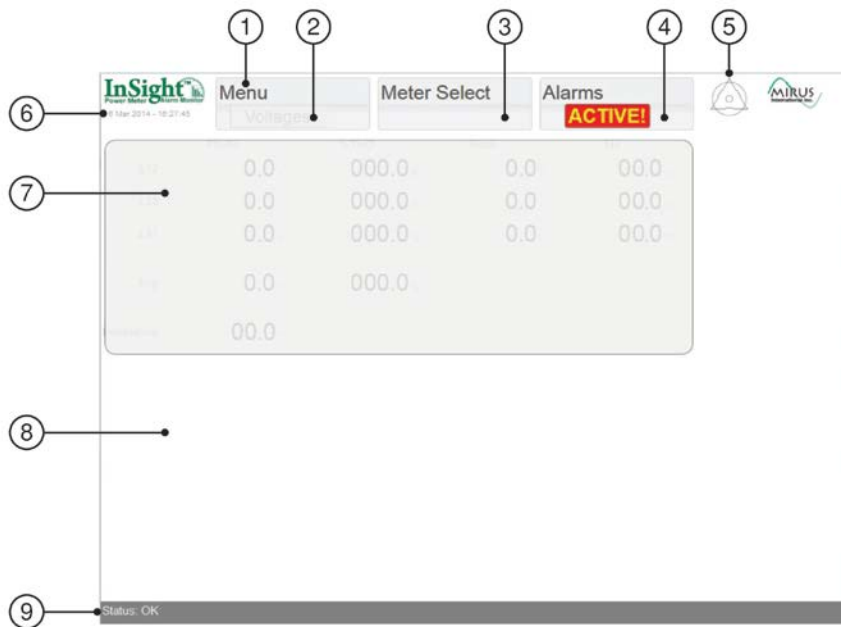
## Operation

## 3.0 Scope

This section describes how to interface with the InSight Power Meter and Alarm Monitor. This includes accessing the real-time metering data and setting parameters using a Touchscreen HMI (Human-Machine Interface) or by using a standard web browser.

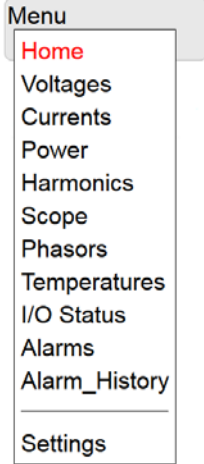
## 3.1 Browser Display Overview

When navigating InSight from your preferred web browser, the screen layout is as follows:



- |                           |  |
|---------------------------|--|
| <b>1. Menu</b>            | Provides navigation to all meter screens and settings.   |
| <b>2. Display Screen</b>  | Lists the current screen being displayed.  |
| <b>3. Meter Select</b>    | When multiple meters are connected, allows user to toggle between meters and list the current meter being displayed. |
| <b>4. Alarm Indicator</b> | If an Alarm condition is triggered the notification is provided here. To view the alarm, click this control.         |
| <b>5. Connection Type</b> | Display whether the system is a Delta or Wye configuration.  |
| <b>6. Date / Time</b>     | The current date and time is displayed here.   |
| <b>7. Main Display</b>    | The Main Display Area will display metering data for each screen that is selected.                                   |
| <b>8. Notes</b>           | This area is reserved for special notifications.   |
| <b>9. Meter Status</b>    | Provides meter and communication status.   |

### 3.2 Menu



Click on Menu button to select which meter screen to view. For setup and configuration click Settings.

### 3.3 Browser Display Screens

#### Voltages

- Phase to phase - RMS Volts
- %THD
- Peak Volts
- Frequency (Hz)
- Avg. Ph-Ph Volts
- Avg. %THD
- % Voltage Imbalance
  
- Phase to neutral - RMS Volts
- Avg. Ph-N Volts
- % Voltage Imbalance

	Ph-Ph	Non.	Ph-N	%THD	Fund RMS	Peak	Fz	Hg Nom.	
L12	497.0 <sub>v</sub>	72.0 <sub>%</sub>	L1	287.5 <sub>v</sub>	2.1 <sub>%</sub>	287.3 <sub>v</sub>	404.2 <sub>v</sub>	60.0 <sub>Hz</sub>	100.0 <sub>%</sub>
L23	497.8 <sub>v</sub>	72.1 <sub>%</sub>	L2	286.5 <sub>v</sub>	1.9 <sub>%</sub>	286.6 <sub>v</sub>	401.1 <sub>v</sub>	60.0 <sub>Hz</sub>	100.0 <sub>%</sub>
L31	499.5 <sub>v</sub>	72.4 <sub>%</sub>	L3	288.1 <sub>v</sub>	1.8 <sub>%</sub>	288.1 <sub>v</sub>	404.3 <sub>v</sub>	60.0 <sub>Hz</sub>	100.0 <sub>%</sub>
Avg	497.9 <sub>v</sub>			287.5 <sub>v</sub>	2.0 <sub>%</sub>				
Imb.	0.3 <sub>%</sub>			0.3 <sub>%</sub>					

#### Currents

- Phase - Amps
- %THD
- Crest Factor
- Peak Amps
- K Factor
- Avg. Phase Current
- Avg. %THD
- % Current Imbalance
  
- Neutral - Amps
  
- Demand - Current Demand (A)  
(Ability to Reset when logged in)
- %TDD

	Current	Non.	%THD	Fund RMS	Peak	Crest Factor	K Factor	Max
L1	23.5 <sub>A</sub>	2.2 <sub>%</sub>	6.0 <sub>%</sub>	23.4 <sub>A</sub>	34.2 <sub>A</sub>	1.456	1.11	23.5
L2	23.6 <sub>A</sub>	2.2 <sub>%</sub>	5.1 <sub>%</sub>	23.5 <sub>A</sub>	34.8 <sub>A</sub>	1.477	1.07	23.6
L3	23.7 <sub>A</sub>	2.3 <sub>%</sub>	5.2 <sub>%</sub>	23.7 <sub>A</sub>	34.8 <sub>A</sub>	1.449	1.08	23.7
N	0.1 <sub>A</sub>							0.1
Avg	23.5 <sub>A</sub>			5.4 <sub>%</sub>				
Imbalance	0.6 <sub>%</sub>							
%	23.6 <sub>A</sub>			TDD	5.4 <sub>%</sub>			

**Power**

- Total**
- Active Power (kW)
  - Reactive Power (kVAR)
  - Apparent Power (kVA)
  - True Power Factor (Pf)
  - kW Demand (kW<sub>D</sub>)  
(Ability to Reset when logged in)

- Fundamental**
- Active Power (kW)
  - Reactive Power (kVAR)
  - Apparent Power (kVA)
  - Displacement Power Factor (dPf)

InSight		Menu Power	Meter Select Solo	Alarms CLEAR	MARUS
	Active	Total	Apparent	True PF	
L1	0.0 kW	-6.7 kVAR	6.7 kVA	-0.00	
L2	-0.1 kW	-6.7 kVAR	6.8 kVA	-0.01	
L3	0.0 kW	-6.8 kVAR	6.8 kVA	-0.00	
Total	-0.1 kW	-20.2 kVAR	20.2 kVA	-0.01	
	Active	Fundamental	Apparent	dPF	
L1	0.0 kW	-6.7 kVAR	6.7 kVA	-0.00	
L2	-0.1 kW	-6.7 kVAR	6.7 kVA	-0.01	
L3	0.0 kW	-6.8 kVAR	6.8 kVA	0.00	
Total	-0.1 kW	-20.2 kVAR	20.2 kVA	-0.00	

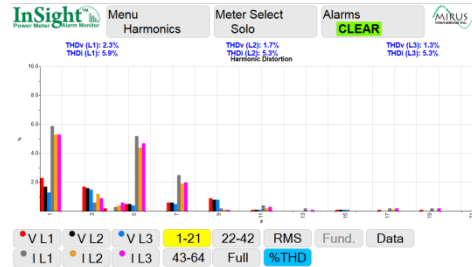
Status: OK IP: ... | Wiring type | Frequency: 60 Hz | Firmware: 411

**Harmonics**

- Phase**
- Voltage %THD
  - Current %THD

- RMS**
- Fundamental

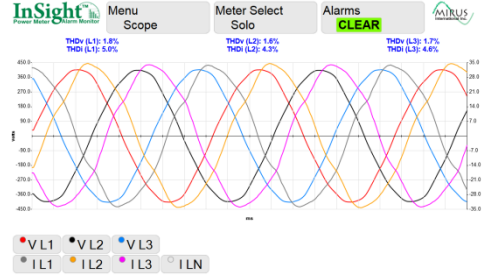
- Range Select**
- Harmonic # 1 – 21
  - Harmonic # 22 – 42
  - Harmonic # 43 – 64
  - Harmonic # 1 – 64



Status: OK IP: ... | Wiring type | Frequency: 60 Hz | Firmware: 411

## Scope

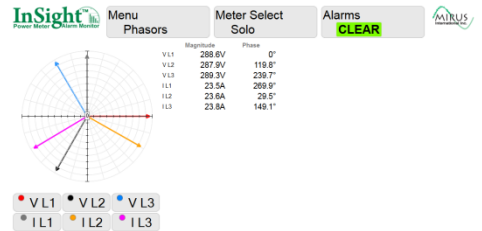
- Phase - Volts
- Current
  
- Neutral - Current



Status: OK IP: ... | Wiring: wye | Frequency: 60 Hz | Firmware: 411

## Phasors

- Phase - Volts
- Current



Status: OK IP: ... | Wiring: wye | Frequency: 60 Hz | Firmware: 411

## Temperatures

- Thermocouple - T1 – T4
- 3 Alarm Setpoints
  
- Power Meter - Internal Temperature

Temperature	Alarm Limit 1	Alarm Limit 2	Alarm Limit 3
Top Coils	28.9 °C	111.0 °C	170.0 °C
Bottom Coils	29.2 °C	170.0 °C	200.0 °C
Capacitors	29.3 °C	70.0 °C	100.0 °C
Inlet Ambient	28.7 °C	45.0 °C	100.0 °C
Power Meter	29.8 °C		

Status: OK IP: ... | Wiring: wye | Frequency: 60 Hz | Firmware: 411

## I/O Status

- Digital Inputs - D1 – D8
  
- Relay Outputs - RLY1 – RLY5
  
- Input Expressions - IE0 – IE16  
(Programmable)
  
- Output Expressions - OUT1 – OUT3  
(Programmable)

Input	INPUT EXPRESSIONS	OUTPUT EXPRESSIONS
D1	ALRM_OV	ALM_CLEAR
D2	ALRM_VIBS	ALM_CLEAR
D3	ALRM_OI	ALM_CLEAR
D4	ALRM_PHS	ALM_CLEAR
D5	ALRM_LMBAL	ALM_CLEAR
D6		ALM_CLEAR
D7		ALM_CLEAR
D8		ALM_CLEAR
IE0	TC1_LIM_1 + TC2_LIM_1 + TC3_LIM_1	
IE1		
IE2		
IE3		
IE4		
IE5		
IE6		
IE7		
IE8		
IE9		
IE10		
IE11		
IE12		
IE13		
IE14		
IE15		
IE16		

Status: OK IP: ... | Wiring: wye | Frequency: 60 Hz | Firmware: 411

## Alarms

Programmable for any Meter values.  
Displays programmed setpoints and present values.

When no Alarm conditions are active, Alarm Status will indicate CLEAR.

The screenshot shows the InSight Alarms menu with the status 'CLEAR'. The menu includes various alarm parameters with their limits and present values.

Name	Limit	Present value(s)
V RMS Max	490 V	287.6
I RMS Max	1000 A	23.6
Frequency (Hz)	50.00 Hz	59.981
Capacitance Min	1995 uF	217.7
V THD Max	400.0%	1.9%
I THD Max	400.0%	4.3%
V Imbalance Max	3.0%	0.2%
I Imbalance Max	8.0%	0.5%
Overvoltage	585.0 V	405.7
Overcurrent	5275.0 A	35.2
Undervoltage	8.0 V	405.7
Phase Loss		
Phase Sequence		
Temperature Max	Measured	Limit 1: 110.0, Limit 2: 170.0, Limit 3: 200.0
		28.4, 45.0, 45.0, 100.0

When Alarm conditions are active, Alarm Status will indicate ACTIVE. The values in Alarm state will be colored in Red.

The screenshot shows the InSight Alarms menu with the status 'ACTIVE!'. The values for several parameters are highlighted in red, indicating they are out of range.

Name	Limit	Present value(s)
V RMS Max	V L1, V L2, V L3	V
I RMS Max	A L1, A L2, A L3	A
Frequency (Hz)	Hz L1, Hz L2, Hz L3	Hz
Capacitance Min	uF L1, uF L2, uF L3	uF
V THD Max	% L1, % L2, % L3	%
I THD Max	% L1, % L2, % L3	%
V Imbalance Max	% L1	%
I Imbalance Max	% L1	%
Overvoltage	V L1, V L2, V L3	V
Overcurrent	A L1, A L2, A L3	A
Undervoltage	V L1, V L2, V L3	V
Phase Loss		
Phase Sequence		
Temperature Max	T1: Limit 1: Not set, Limit 2: Not set, Limit 3: undefined	T1: Limit 1: Not set, Limit 2: Not set, Limit 3: undefined

## Alarms History

The screenshot shows the InSight Alarms History menu. It displays a list of historical alarm events with their names, limits, and present values.

Name	Limit	Present value(s)
V RMS Max	490 V	0.1
I RMS Max	1000 A	0.1
Frequency (Hz)	50.00 Hz	61.402
Capacitance Min	1995 uF	1200.7
V THD Max	400.0%	400%
I THD Max	400.0%	400%
V Imbalance Max	3.0%	6.1%
I Imbalance Max	8.0%	0.4%
Overvoltage	585.0 V	0.0
Overcurrent	5275.0 A	0.0
Undervoltage	8.0 V	0.0
Phase Loss		
Phase Sequence		
Temperature Max	Measured	Limit 1: 110.0, Limit 2: 170.0, Limit 3: 200.0
		28.5, 28.4, 70.0, 70.0, 100.0, 28.0, 45.0, 45.0, 100.0

### 3.4 Meter Settings and Configuration

Click Menu/Settings to open the meter Configuration page. The page content is protected and requires authentication to view and make any changes.

When prompted for a username and password, enter the following credentials:

User: **mirus**; password: **insight**  
(Alternatively used user: **lpc**; password: **escherlogic**)

#### Configuration

Once the Configuration page loads, set the following parameters:

- Meter Wiring mode [Delta, Wye]
- Supply Frequency [50, 60 Hz]
- Nominal Voltage [690V, 600V, 480V, 440V, 400V, 208V/240V, Unset]
- Nominal Current [Value]
- Nominal Power [Value]
- Nominal Capacitance [Value]
- Current Transformers Ratio
- Potential Transformers Ratio

After all changes are done click 'Memorize ALL changes'

The screenshot shows the 'Configuration' page in the InSight web interface. It features a navigation bar with 'Labels', 'Alarm limits', 'Network', and 'Configuration' (highlighted in green). Below the navigation bar, there are sections for 'Measured Voltages' and 'Measured Currents'. The 'Measured Voltages' section shows L1, L2, and L3 voltage readings (e.g., 0.205, 0.275, 0.200) and an 'Installed PT Voltage Ratio' of 1. The 'Measured Currents' section shows L1, L2, L3, and N current readings (e.g., 0.072, 0.072, 0.072, 0.074) and an 'Installed CT Amps Ratio' of 200. There are also sections for 'Meter installation settings', 'Meter accumulator resets', and 'Nominal Voltage' and 'Nominal Current' settings. A 'Save network settings' button is visible at the bottom left.

#### Network Settings

##### DHCP or static IP

- IP address
- Net Mask
- Gateway
- Primary DNS
- Secondary DNS
- FTP address
- FTP port
- Log server

##### Network configuration File/Reset

- [Memorize network settings]
- [Restart Network]

##### Device reboot

- [password required]
- Enter the reboot password '1234' and click 'Reboot'

##### Time settings

- SNTP server:
- Time zone offset:

The screenshot shows the 'Network Settings' page in the InSight web interface. It features a navigation bar with 'Labels', 'Alarm limits', 'Network' (highlighted in green), and 'Configuration'. Below the navigation bar, there are sections for 'Network settings' and 'Time settings'. The 'Network settings' section includes options for 'DHCP Client' and 'Static IP', with fields for 'Our IP', 'Net Mask', 'Gateway', 'Primary DNS', 'Secondary DNS', 'FTP Address', 'FTP Port', and 'Log Server'. The 'Time settings' section includes fields for 'SNTP Server' and 'Time Zone Offset'. There are also sections for 'Network Configuration File/Reset' and 'Device reboot'. A 'Save network settings' button is visible at the bottom left.



## Alarm Limits

### Temperature Limits Electrical Limits

Click Network to display present values

Input	°C	Limit 1	Limit 2	Limit 3	End
TC1	24.1	90.0	170.0	200.0	End
TC2	34.7	90.0	170.0	300.0	End
TC3	37.1	90.0	170.0	300.0	End
TC4	37.4	90.0	20.0	90.0	End

Refresh Apply Temperature Limits Save Temperature Limits

**Electrical Limits**

	Value	Enable?	Time delay
V RMS	225.900	<input checked="" type="checkbox"/>	2.00 SEC
I RMS warning	0.000	<input type="checkbox"/>	2.00 SEC
I RMS alarm	200.000	<input checked="" type="checkbox"/>	2.00 SEC
V imbalance	0.0	<input checked="" type="checkbox"/>	2.00 SEC
Frequency	0.000	<input type="checkbox"/>	2.00 SEC
Capacitance	0.0	<input type="checkbox"/>	2.00 SEC
V THD	5.0	<input checked="" type="checkbox"/>	2.00 SEC
I THD	00.0	<input type="checkbox"/>	2.00 SEC
Overvoltage	1020.000	<input checked="" type="checkbox"/>	2.00 SEC
Overcurrent	1145.000	<input checked="" type="checkbox"/>	2.00 SEC
Sag	0.000	<input type="checkbox"/>	2.00 SEC
Phase loss		<input type="checkbox"/>	2.00 SEC
Ph Sequence		<input type="checkbox"/>	2.00 SEC
Temperature [°]		<input checked="" type="checkbox"/>	2.00 SEC

Refresh Apply Electrical Limits Save Electrical Limits

Changes are not permanent until you 'Save' or 'Apply' changes in the meter memory.  
Hide/Show All Changes

## Labels

### Digital Inputs Input Expressions Outputs Temperature inputs labels

Click Network to display present values

Digital Inputs	Input Expressions	Outputs	Temperature inputs labels
DI1 [a1]	IE1 [a1]	RLY1 [a1]	TC1 [a1]
DI2 [a2]	IE2 [a2]	RLY2 [a2]	TC2 [a2]
DI3 [a3]	IE3 [a3]	RLY3 [a3]	TC3 [a3]
DI4 [a4]	IE4 [a4]	RLY4 [a4]	TC4 [a4]
DI5 [a5]	IE5 [a5]	RLY5 [a5]	
DI6 [a6]	IE6 [a6]	OUT1 [a1]	
DI7 [a7]	IE7 [a7]	OUT2 [a2]	
DI8 [a8]	IE8 [a8]	OUT3 [a3]	
DI9 [a9]	IE9 [a9]		
DI10 [a10]	IE10 [a10]		
DI11 [a11]	IE11 [a11]		
DI12 [a12]	IE12 [a12]		
DI13 [a13]	IE13 [a13]		
DI14 [a14]	IE14 [a14]		
DI15 [a15]	IE15 [a15]		
DI16 [a16]	IE16 [a16]		

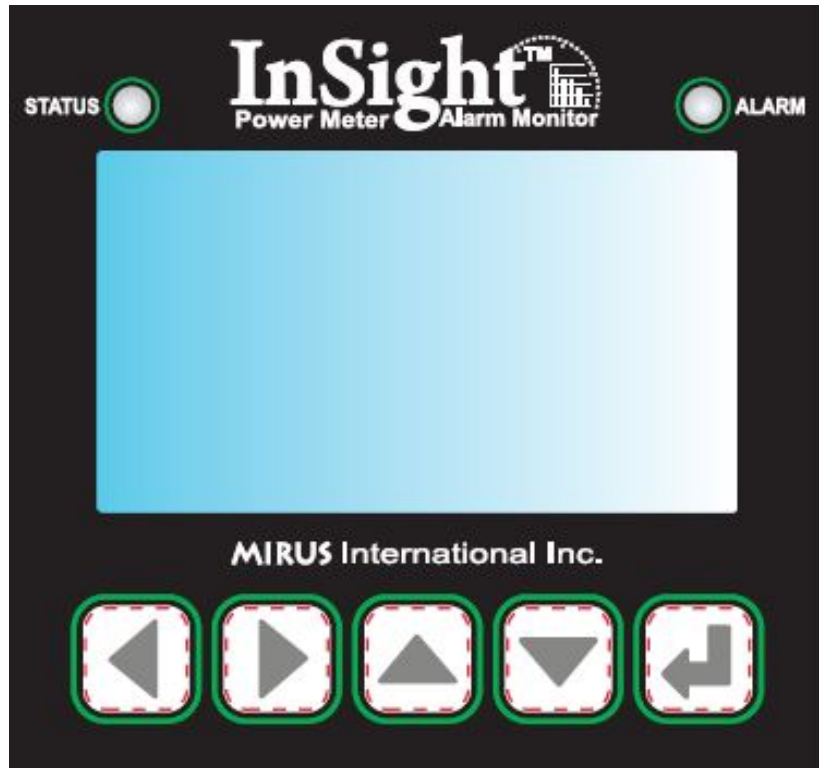
Apply Labels

Changes are not permanent until you 'Save' or 'Apply' changes in the meter memory.  
Hide/Show All Changes

The alarm limits can also be set on the local display by scrolling through all of the measurement screens until you reach the 'Alarm Limits' screen. Any changes made on this screen will be saved to the meter and will be viewable on the web browser screen as shown above.

---

### 3.5 Local Display Screen Overview



Press the up and down arrows to navigate through the different measurement screens. Measurement screens include Voltage, Current, Power Factor, Temperature, Harmonics Spectrum, Scope, Phasors, and meter I/O status.

Press the right button to navigate to the date and time screen.

When an alarm is active, the 'Alarms' screen will automatically appear. At the bottom of the screen, the alarm conditions that are causing the alarm will cycle. In the middle of the screen, a button to silence the alarm buzzer can be clicked by pressing the down arrow followed by the Return key.

When the alarm is silenced, the 'Alarm' LED at the top right will stay red but the screen will switch to the 'Alarm History' page. The historical alarm conditions can be cycled through by clicking on the 'Prev' and 'Next' buttons. The date and time stamp will indicate when the alarm occurred.

When in the 'Alarm History' screen, the down button takes you to the measurements screens.

### 3.6 The 7" High Performance Mountable Panel PC with Linux



The optional 7 Inch [178mm] TFT LCD is a complete touch panel computer solution providing human machine interface (HMI) comprised of a 7" TFT LCD, baseboard and computer-on-module. It features full Linux operating system providing a gateway to one (option PM-D2 or CM-D2) or two (DM-D2) InSight Power Meters allowing for local graphic user interface directly on the monitored equipment i.e. the Lineator™.

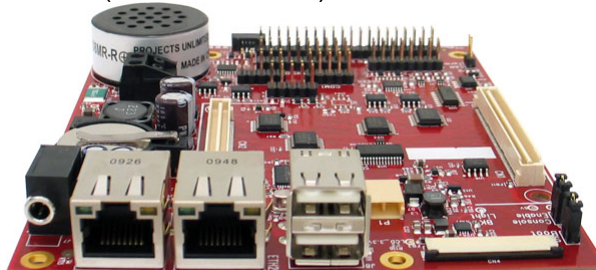
It accepts 5-28VDC input on the power terminal block connector.



The software image includes an initial filesystem which boots immediately after the power is applied and the kernel is loaded.

After the initial splash screen the graphic user interface appears on the screen. Graphics and text is displayed on a WVGA 800x480 RGB TFT touch panel

The baseboard features two Ethernet ports 10/100 first (ETH0), next to the 3.5mm audio port, is used for communication with client network and second (ETH1) for communication with the InSight power meters (internal network).



---

Similar to the basic InSight power meter the network is configured for the DHCP as default settings.

Network settings could be changed on customer request by editing `/etc/network/interfaces` in the Linux system via SSH session.

Note that network settings will affect the communication with individual InSight power meters therefore it is allowed only at the factory or by trained Mirus representative. Besides the user name and password credentials are required for remote connections via SSH.

This board optionally supports 802.11 through the WIFI module. Consult factory for support.

The baseboard also includes two USB 2.0 ports labelled J8 for additional peripherals such as keyboards, mice, wifi adapters, etc. However they are typically not used in customer applications, since some uncommon devices may require a kernel recompile.

---

## 4

## Advanced Functions

---

### 4.0 Scope

The InSight Power Meter contains advanced metering tools and is able to measure a multitude of power, energy and power quality parameters. Most of the advanced functions are accessible directly from the meter user interface as every meter comes with a powerful software that helps access the information. This chapter introduces advanced functions and raw measurements access to help with custom software development and meter integration into bigger systems.

### 4.1 Measurements

The InSight Power Meter supports HTTP protocol and has a Web Server function making the InSight meter accessible through Ethernet anytime and from anywhere.

The Ethernet module supports all major web browsers

The IP address the InSight meter needs to be known prior to accessing measurements data.

Users enter the correct IP address of the InSight meter in the address bar of the web browser. This provides access to data and settings.

The following measurement tabs are provided by the InSight meter:

Home, Voltages, Currents, Power, Energy, Harmonics, Scope, Phasors, Temperatures, I/O Status, Alarms, Alarm\_History

In case the user wishes to develop his own customized web server or integrate the meter into a bigger systems all measurements data are available from the meter by means of the **Modbus TCP protocol** (see Appendix A, for data address table) or direct access to each measurement tab using the appropriate **JSON** file.

JSON is a lightweight data-interchange text format and it is easy to read and write. It is completely language independent but uses conventions that are familiar to programmers of many languages including C++, C#, Java, JavaScript, Python and many others.

Therefore it is ideal for data-exchange and natural for JavaScript to use.

To access raw data from a page use the same file name for the JSON file format as referred by the user interface tab name i.e. for Voltages use the voltages.json file.

Example: <http://192.168.1.237/voltages.json>

<http://192.168.1.237/currents.json>

<http://192.168.1.237/power.json>

etc...

Data is refreshed each time this page is requested by the web browser.

### 4.2 CGI Web Pages

The InSight Power Meter provides hardware information by means of the following CGI pages:

/cgi-bin/system.cgi - shows all system threads and active system timers.

/cgi-bin/sockets.cgi – shows all TCP and UDP sockets and their status

/cgi-bin/freeze.cgi – shows the entire logged contents of the meter alarm history captured as freeze frames

/cgi-bin/serialhome.cgi – shows host info and basic network settings

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### 4.3 Telnet Session

Although it is not recommended for basic data and settings the InSight Power Meter can be accessed via interactive text-oriented communication facility using a telnet session.

Since all information and settings are available using graphic user interface and other means i.e. JSON files, it is not recommended to use text-oriented Telnet session for InSight meter communication.

A proprietary Etag commands are used for text based data-exchange between the host and the InSight meter.

Contact factory for support

# 5


# Maintenance

## 5.0 Scope

This section describes maintenance of the InSight, including preventive maintenance, troubleshooting, and information about replacement parts.

## 5.1 Preventive Maintenance

The technician or electrician performing preventive maintenance on the InSight Power Meter must read this manual thoroughly and be familiar with the power quality metering equipment.

	<p><b>IMPORTANT</b></p> <p>Isolate and de-energize the equipment for all maintenance operations.</p>
---	--

- a. Ensure that the equipment is clean and free of loose dust, dirt, and debris.
- b. Inspect the air intake and exhaust plates and clean as required. Verify that air flows freely through the equipment. Clean the air intake and exhaust plates with a vacuum cleaner.
- c. Verify that all system monitoring functions operate properly.

### Calibration

The InSight monitoring package is intended to be used for indication purposes only. Each meter is calibrated before shipment but Mirus does not guarantee accuracy to within any specific standards and does not recommend use of this meter as a validation device without performing third part calibration.

Consult Mirus Customer Support to obtain a calibration procedure if using the InSight meter as a validation device for an extended period of time.

## 5.2 Troubleshooting

The following is a list of the most frequent problems, their most likely cause, and the possible solutions in the form of actions to be taken. In the event that the suggested solution does not solve the problem, call MIRUS International Inc. Customer Support Services for assistance.

### A. InSight has no input power

Cause #1: No building power to the InSight  
Action: Restore building power

Cause #2: Blown Fuses.  
Action: Check and replace blown fuses.

---

Cause #3: The Power Supply is faulty.  
Action: Have a qualified technician check the wiring continuity between the power supply input and the building input power panel.

**B. No display on LCD**

Cause #1: Blown Fuse in Logic Controller.  
Action: Check and replace blown fuse.

Cause #2: Wiring fault.  
Action: Have a qualified technician check for wiring continuity between Logic Controller and LCD and communication cable between InSight Meter and Logic Controller.

Cause #3: Defective LCD display.  
Action: Replace LCD Panel.

Cause #4: Faulty Logic Controller.  
Action: Replace Logic Controller.

**C. Incorrect Meter readings**

Cause #1: CT's not wired correctly.  
Action: Check CT wiring and phase direction.

Cause #2: PT's not wired correctly, or PT fuse blown.  
Action: Check PT wiring as per diagrams issued with equipment.  
Check all associated fuses and replace blown fuses.

Cause #3: Meter not configured correctly.  
Action: Login to meter and check all configuration parameters.



## A

## Appendix

## A.0 MODBUS IMPLEMENTATION

Function Code	Register Address (16-bit)	Description	Comment
43	MEI 14	read device ID, obj ID: 0,1,2,3,4.	
<b>Function Codes 01/05/15:</b>			
<b>Relays status:</b>			
1	0	relay #1	(must have force bit ON to control)
1	1	relay #2	(must have force bit ON to control)
1	2	relay #3	(must have force bit ON to control)
1	3	relay #4	(must have force bit ON to control)
1	4	relay #5	(must have force bit ON to control)
1	5	logic output bit: 5	
1	6	logic output bit: 6	
1	7	logic output bit: 7	
<b>Logic Coils status:</b>			
1	14	coil bits used for boolean engine input	address 14-29
1	15	coil bits used for boolean engine input	
1	16	coil bits used for boolean engine input	
1	17	coil bits used for boolean engine input	
1	18	coil bits used for boolean engine input	
1	19	coil bits used for boolean engine input	
1	20	coil bits used for boolean engine input	
1	21	coil bits used for boolean engine input	
1	22	coil bits used for boolean engine input	
1	23	coil bits used for boolean engine input	
1	24	coil bits used for boolean engine input	
1	25	coil bits used for boolean engine input	
1	26	coil bits used for boolean engine input	

Function Code	Register Address (16-bit)	Description	Comment
1	27	coil bits used for boolean engine input	
1	28	coil bits used for boolean engine input	
1	29	coil bits used for boolean engine input	
<b>Function Code 02 (Read Discrete Inputs):</b>			
<b>Discrete Inputs Status:</b>			
2	100	24VAC digital input #1	
2	101	24VAC digital input #2	
2	102	24VAC digital input #3	
2	103	24VAC digital input #4	
2	104	24VAC digital input #5	
2	105	24VAC digital input #6	
2	106	24VAC digital input #7	
2	107	24VAC digital input #8	
<b>Boolean Engine Expressions status:</b>			
2	116	mapped input array for boolean engine	
2	117	mapped input array for boolean engine	
2	118	mapped input array for boolean engine	
2	119	mapped input array for boolean engine	
2	120	mapped input array for boolean engine	
2	121	mapped input array for boolean engine	
2	122	mapped input array for boolean engine	
2	123	mapped input array for boolean engine	
2	124	mapped input array for boolean engine	
2	125	mapped input array for boolean engine	
2	126	mapped input array for boolean engine	
2	127	mapped input array for boolean engine	
2	128	mapped input array for boolean engine	
2	129	mapped input array for boolean engine	
2	130	mapped input array for boolean engine	
2	131	mapped input array for boolean engine	

Function Code	Register Address (16-bit)	Description	Comment
<b>Function Code 03/06/16 (Read Holding Registers):</b>			
<b>Digital Signal Processor STATUS1 register (32-bit):</b>			
3	10	(32-bit) DSP Control state MSB	
3	11	(32-bit) DSP Control state LSB	
3	12	(32-bit) DSP Control flags MSB	
3	13	(32-bit) DSP Control flags LSB	
<b>PCB Thermistor Temperature value (deg.C. X 10):</b>			
3	100	(16-bit) C/J temperature	
<b>Thermocouples Temperature values (deg.C. X 10):</b>			
3	101	(16-bit) T/C temp. #1	
3	102	(16-bit) T/C temp. #2	
3	103	(16-bit) T/C temp. #3	
3	104	(16-bit) T/C temp. #4	
<b>Thermocouples Temperature Limit values:</b>			
3	105	(16-bit) T/C temp. #1 Limit 1	
3	106	(16-bit) T/C temp. #2 Limit 1	
3	107	(16-bit) T/C temp. #3 Limit 1	
3	108	(16-bit) T/C temp. #4 Limit 1	
3	109	(16-bit) T/C temp. #1 Limit 2	
3	110	(16-bit) T/C temp. #2 Limit 2	
3	111	(16-bit) T/C temp. #3 Limit 2	
3	112	(16-bit) T/C temp. #4 Limit 2	
3	113	(16-bit) T/C temp. #1 Limit 3	
3	114	(16-bit) T/C temp. #2 Limit 3	
3	115	(16-bit) T/C temp. #3 Limit 3	
3	116	(16-bit) T/C temp. #4 Limit 3	
<b>Measured RMS values (32-bit):</b>			
<b>NOTE: 32-bit values are stored as two 16-bit words with big-endian storage (most significant value is stored first).</b>			
3	200	(32-bit) MSB, AIRMS	Phase A current rms value.
	201	(32-bit) LSB, AIRMS	Phase A current rms value.
	202	(32-bit) MSB, AVRMS	Phase A voltage rms value
	203	(32-bit) LSB, AVRMS	Phase A voltage rms value
	204	(32-bit) MSB, BIRMS	Phase B current rms value
	205	(32-bit) LSB, BIRMS	Phase B current rms value
	206	(32-bit) MSB, BVRMS	Phase B voltage rms value.
	207	(32-bit) LSB, BVMRS	Phase B voltage rms value.
	208	(32-bit) MSB, CIRMS	Phase C current rms value
	209	(32-bit) LSB, CIRMS	Phase C current rms value
	210	(32-bit) MSB, CVRMS	Phase C voltage rms value.
	211	(32-bit) LSB, CVRMS	Phase C voltage rms value.
	212	(32-bit) MSB, NIRMS	Neutral current rms value
	213	(32-bit) LSB, NIRMS	Neutral current rms value
	214	(32-bit) MSB, ISUM	Sum of IAWV, IBWV and ICWV registers
	215	(32-bit) LSB, ISUM	Sum of IAWV, IBWV and ICWV registers

Function Code	Register Address (16-bit)	Description	Comment
<b>Function Code 03/06/16 (Read Holding Registers):</b>			
<b>Measured Peak Values (24-bit):</b>			
3	216	(32-bit) MSB, IPEAK	Current peak register.
	217	(32-bit) LSB, IPEAK	Current peak register.
	218	(32-bit) MSB, VPEAK	Voltage peak register.
	219	(32-bit) LSB, VPEAK	Voltage peak register.
<b>Power Quality Registers (32-bit) values:</b>			
3	220	(32-bit) MSB, AIMAV	Phase A current mean absolute value
	221	(32-bit) LSB, AIMAV	Phase A current mean absolute value
	222	(32-bit) MSB, BIMAV	Phase B current mean absolute value
	223	(32-bit) LSB, BIMAV	Phase B current mean absolute value
	224	(32-bit) MSB, CIMAV	Phase C current mean absolute value
	225	(32-bit) LSB, CIMAV	Phase C current mean absolute value
	226	(32-bit) MSB, AWATT	Phase A total active power
	227	(32-bit) LSB, AWATT	Phase A total active power
	228	(32-bit) MSB, BWATT	Phase B total active power
	229	(32-bit) LSB, BWATT	Phase B total active power
	230	(32-bit) MSB, CWATT	Phase C total active power
	231	(32-bit) LSB, CWATT	Phase C total active power
	232	(32-bit) MSB, AVA	Phase A total apparent power
	233	(32-bit) LSB, AVA	Phase A total apparent power
	234	(32-bit) MSB, BVA	Phase B total apparent power
	235	(32-bit) LSB, BVA	Phase B total apparent power
	236	(32-bit) MSB, CVA	Phase C total apparent power
	237	(32-bit) LSB, CVA	Phase C total apparent power

Function Code	Register Address (16-bit)	Description	Comment
<b>Function Codes 03/06/16:</b>			
<b>Power Quality Register (16-bit) values:</b>			
3	250	(16-bit) PHSTATUS	Phase peak register
3	251	(16-bit) ANGLE0	Time Delay 0
	252	(16-bit) ANGLE1	Time Delay 1
	253	(16-bit) ANGLE2	Time Delay 2
<p>The diagram illustrates three phase waveforms labeled PHASE A, PHASE B, and PHASE C. PHASE A is a solid line, PHASE B is a dashed line, and PHASE C is a dotted line. Vertical lines mark the zero-crossing points for each phase. Horizontal double-headed arrows below the x-axis indicate the time delays: ANGLE0 is the delay from the start of PHASE A to the start of PHASE B; ANGLE1 is the delay from the start of PHASE B to the start of PHASE C; and ANGLE2 is the delay from the start of PHASE A to the start of PHASE C.</p>			
3	254	(16-bit) PHNOLOAD	Phase no load register
	255	(16-bit) PHSIGN	Power sign register
	256	(16-bit) APF	Phase A power factor x 1000
	257	(16-bit) BPF	Phase B power factor x 1000
	258	(16-bit) CPF	Phase C power factor x 1000
	259	(16-bit) APERIOD	Phase A period converted Frequency Hz x 100
	260	(16-bit) BPERIOD	Phase B period converted Frequency Hz x 100
	261	(16-bit) CPERIOD	Phase C period converted Frequency Hz x 100

Function Code	Register Address (16-bit)	Description	Comment
<b>Function Codes 03/06/16:</b>			
<b>Energy Registers (32-bit) values:</b>			
3	300	(32-bit) MSB, AWATTHR	Phase A total active energy accumulation
3	301	(32-bit) LSB, AWATTHR	Phase A total active energy accumulation
3	302	(32-bit) MSB, BWATTHR	Phase B total active energy accumulation
3	303	(32-bit) LSB, BWATTHR	Phase B total active energy accumulation
3	304	(32-bit) MSB, CWATTHR	Phase C total active energy accumulation
3	305	(32-bit) LSB, CWATTHR	Phase C total active energy accumulation
3	306	(32-bit) MSB, AFWATTHR	Phase A fundamental active energy accumulation
3	307	(32-bit) LSB, AFWATTHR	Phase A fundamental active energy accumulation
3	308	(32-bit) MSB, BFWATTHR	Phase B fundamental active energy accumulation
3	309	(32-bit) LSB, BFWATTHR	Phase B fundamental active energy accumulation
3	310	(32-bit) MSB, CFWATTHR	Phase C fundamental active energy accumulation
3	311	(32-bit) LSB, CFWATTHR	Phase C fundamental active energy accumulation
3	312	(32-bit) MSB, AFVARHR	Phase A fundamental reactive energy accumulation
3	313	(32-bit) LSB, AFVARHR	Phase A fundamental reactive energy accumulation
3	314	(32-bit) MSB, BFVARHR	Phase B fundamental reactive energy accumulation
3	315	(32-bit) LSB, BFVARHR	Phase B fundamental reactive energy accumulation
3	316	(32-bit) MSB, CFVARHR	Phase C fundamental reactive energy accumulation
3	317	(32-bit) LSB, CFVARHR	Phase C fundamental reactive energy accumulation
3	318	(32-bit) MSB, AVAHR	Phase A total apparent energy accumulation
3	319	(32-bit) LSB, AVAHR	Phase A total apparent energy accumulation
3	320	(32-bit) MSB, BVAHR	Phase B total apparent energy accumulation
3	321	(32-bit) LSB, BVAHR	Phase B total apparent energy accumulation
3	322	(32-bit) MSB, CVAHR	Phase C total apparent energy accumulation
3	323	(32-bit) LSB, CVAHR	Phase C total apparent energy accumulation

Function Code	Register Address (16-bit)	Description	Comment
<b>Function Codes 03/06/16:</b>			
<b>Alarm Limits (32-bit) values:</b>			
3	400	(32-bit) MSB, Overvoltage	Overvoltage
3	401	(32-bit) LSB, Overvoltage	Overvoltage
3	402	(32-bit) MSB, Overcurrent	
3	403	(32-bit) LSB, Overcurrent	
3	404	(32-bit) MSB, Voltage Sag	
3	405	(32-bit) LSB, Voltage Sag	
3	406	(32-bit) MSB, IRMS Warning	
3	407	(32-bit) LSB, IRMS Warning	
3	408	(32-bit) MSB, VRMS Alarm	
3	409	(32-bit) LSB, VRMS Alarm	
3	410	(32-bit) MSB, IRMS Alarm	
3	411	(32-bit) LSB, IRMS Alarm	
3	412	(32-bit) MSB, Frequency tolerance	
3	413	(32-bit) LSB, Frequency tolerance	
3	414	(32-bit) MSB, Low Capacitance Threshold	
3	415	(32-bit) LSB, Low Capacitance Threshold	
3	416	(32-bit) MSB, VTHD Limit	
3	417	(32-bit) LSB, VTHD Limit	
3	418	(32-bit) MSB, ITHD Limit	
3	419	(32-bit) LSB, ITHD Limit	
<b>Unbalance Limits (32-bit) values:</b>			
3	440	(32-bit) MSB, Voltage Unbalance Limit	
	441	(32-bit) LSB, Voltage Unbalance Limit	
3	442	(32-bit) MSB, Current Unbalance Limit	
	443	(32-bit) LSB, Current Unbalance Limit	
<b>TDD (32-bit) values:</b>			
3	450	(32-bit) MSB, Total Demand Distortion (TDD)	
	451	(32-bit) LSB, Total Demand Distortion (TDD)	
<b>Voltage Peak (32-bit) values:</b>			
3	460	(32-bit) MSB, VPEAK-A	Phase A Voltage peak value
	461	(32-bit) LSB, VPEAK-A	Phase A Voltage peak value
3	462	(32-bit) MSB, VPEAK-B	Phase B Voltage peak value
	463	(32-bit) LSB, VPEAK-B	Phase B Voltage peak value
3	464	(32-bit) MSB, VPEAK-C	Phase C Voltage peak value
	465	(32-bit) LSB, VPEAK-C	Phase C Voltage peak value

Function Code	Register Address (16-bit)	Description	Comment
<b>Function Codes 03/06/16:</b>			
<b>Current Peak (32-bit) values:</b>			
3	470	(32-bit) MSB, IPEAK-A	Phase A Current peak value
3	471	(32-bit) LSB, IPEAK-A	Phase A Current peak value
3	472	(32-bit) MSB, IPEAK-B	Phase B Current peak value
3	473	(32-bit) LSB, IPEAK-B	Phase B Current peak value
3	474	(32-bit) MSB, IPEAK-C	Phase C Current peak value
3	475	(32-bit) LSB, IPEAK-C	Phase C Current peak value
<b>Crest Factor (32-bit) values:</b>			
3	480	(32-bit) LSB, CF-A	Phase A Crest Factor value
3	481	(32-bit) MSB, CF-A	Phase A Crest Factor value
3	482	(32-bit) LSB, CF-B	Phase B Crest Factor value
3	483	(32-bit) MSB, CF-B	Phase B Crest Factor value
3	484	(32-bit) LSB, CF-C	Phase C Crest Factor value
3	485	(32-bit) MSB, CF-C	Phase C Crest Factor value
<b>K-Factor (32-bit) values:</b>			
3	490	(32-bit) LSB, K-Factor-A	Phase A K-Factor value
3	491	(32-bit) MSB, K-Factor-A	Phase A K-Factor value
3	492	(32-bit) LSB, K-Factor-B	Phase B K-Factor value
3	493	(32-bit) MSB, K-Factor-B	Phase B K-Factor value
3	494	(32-bit) LSB, K-Factor-C	Phase C K-Factor value
3	495	(32-bit) MSB, K-Factor-C	Phase C K-Factor value
<b>Capacitance (32-bit) values:</b>			
3	500	(32-bit) LSB, CAP-A-uF	Phase A Capacitance uF value
3	501	(32-bit) MSB, CAP-A-uF	Phase A Capacitance uF value
3	502	(32-bit) LSB, CAP-B-uF	Phase B Capacitance uF value
3	503	(32-bit) MSB, CAP-B-uF	Phase B Capacitance uF value
3	504	(32-bit) LSB, CAP-C-uF	Phase C Capacitance uF value
3	505	(32-bit) MSB, CAP-C-uF	Phase C Capacitance uF value
3	506	(32-bit) MSB, CAP-nom-uF	Nominal Capacitance uF value
3	507	(32-bit) MSB, CAP-nom-uF	Nominal Capacitance uF value
<b>Fundamental components data (32-bit):</b>			
3	900, 901	(32-bit) MSB/LSB, AFVRMS	Phase A Fundamental Voltage RMS value
3	902, 903	(32-bit) MSB/LSB, AFIRMS	Phase A Fundamental Current RMS value
3	904, 905	(32-bit) MSB/LSB, AFWATT	Phase A Fundamental Watts
	906, 907	(32-bit) MSB/LSB, AFVAR	Phase A Fundamental VAR
3	908, 909	(32-bit) MSB/LSB, AFVA	Phase A Fundamental VA
3	910, 911	(32-bit) MSB/LSB, AFPPF	Phase A Fundamental Power Factor
3	912, 913	(32-bit) MSB/LSB, AVTHD	Phase A Voltage THD
	914, 915	(32-bit) MSB/LSB, AITHD	Phase A Current THD



Function Code	Register Address (16-bit)	Description	Comment
<b>Function Codes 03/06/16:</b>			
<b>Fundamental components data (32-bit):</b>			
3	920, 921	(32-bit) MSB/LSB, BFVRMS	Phase B Fundamental Voltage RMS value
3	922, 923	(32-bit) MSB/LSB, BFIRMS	Phase B Fundamental Current RMS value
3	924, 925	(32-bit) MSB/LSB, BFWATT	Phase B Fundamental Watts
	926, 927	(32-bit) MSB/LSB, BFVAR	Phase B Fundamental VAR
3	928, 929	(32-bit) MSB/LSB, BFVA	Phase B Fundamental VA
3	930, 931	(32-bit) MSB/LSB, BFPF	Phase B Fundamental Power Factor
3	932, 933	(32-bit) MSB/LSB, BVTHD	Phase B Voltage THD
	934, 935	(32-bit) MSB/LSB, BITHD	Phase B Current THD
3	940, 941	(32-bit) MSB/LSB, CFVRMS	Phase C Fundamental Voltage RMS value
3	942, 943	(32-bit) MSB/LSB, CFIRMS	Phase C Fundamental Current RMS value
3	944, 945	(32-bit) MSB/LSB, CFWATT	Phase C Fundamental Watts
	946, 947	(32-bit) MSB/LSB, CFVAR	Phase C Fundamental VAR
3	948, 949	(32-bit) MSB/LSB, CFVA	Phase C Fundamental VA
3	950, 951	(32-bit) MSB/LSB, CFPF	Phase C Fundamental Power Factor
3	952, 953	(32-bit) MSB/LSB, CVTHD	Phase C Voltage THD
	954, 955	(32-bit) MSB/LSB, CITHD	Phase C Current THD
<b>Harmonic measurements RMS (32-bit) arrays:</b>			
Read limit of max. 256 bytes on one request including header			
3	1000-1125:	(32-bit) VA harmonic bins 1-63	Max.62 bins can be read at a time
	1150-1275:	(32-bit) VB harmonic bins 1-63	
	1300-1425:	(32-bit) VC harmonic bins 1-63	
	1450-1575	IA	
	1600-1725	IB	
	1750-1875	IC	
<b>Harmonic distortion (%) (32-bit) arrays:</b>			
3	2000-2125	(32-bit) VA harmonic distortion bins 1-63	
	2150-2275	VB	
	2300-2425	VC	
	2450-2575	IA	
	2600-2725	IB	
	2750-2875	IC	
<b>Phasors data (32-bit):</b>			
3	4000, 4001	(32-bit) MSB/LSB, VA Mag	Phase A Voltage Magnitude
3	4002, 4003	(32-bit) MSB/LSB, VB Mag	Phase B Voltage Magnitude
3	4004, 4005	(32-bit) MSB/LSB, VC Mag	Phase C Voltage Magnitude
3	4006, 4007	(32-bit) MSB/LSB, VA Angle	Phase A Voltage Phase Angle
3	4008, 4009	(32-bit) MSB/LSB, VB Angle	Phase B Voltage Phase Angle
3	4010, 4011	(32-bit) MSB/LSB, VC Angle	Phase C Voltage Phase Angle

Function Code	Register Address (16-bit)	Description	Comment
<b>Function Codes 03/06/16:</b>			
<b>Phasors data (32-bit):</b>			
3	4012, 4013	(32-bit) MSB/LSB, IA Mag	Phase A Current Magnitude
3	4014, 4015	(32-bit) MSB/LSB, IB Mag	Phase B Current Magnitude
3	4016, 4017	(32-bit) MSB/LSB, IC Mag	Phase C Current Magnitude
3	4018, 4019	(32-bit) MSB/LSB, IA Angle	Phase A Current Phase Angle
3	4020, 4021	(32-bit) MSB/LSB, IB Angle	Phase B Current Phase Angle
3	4022, 4023	(32-bit) MSB/LSB, IC Angle	Phase C Current Phase Angle
3	5900-5901	(32-bit) scope update interval	Interval value in seconds
<b>Scope data (registers holding an array of 2240, 32-bit, values):</b>			
	6000-10479	'scope data (IA[0], IB[0], IC[0], IN[0], VA[0], VB[0], VC[0], IA[1], IB[1], etc,....)	





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## Warranty Registration

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### WARRANTY CARD

**Send this to:**

**By Mail:** MIRUS International Inc., 31 Sun Pac Blvd., Brampton, Ontario Canada L6S 5P6  
**or Fax:** 905-494-1140 **or Email:** mirus@mirusinternational.com

Model No.: \_\_\_\_\_ Serial No.: \_\_\_\_\_

Date of Purchase: \_\_\_\_\_

Company Name: \_\_\_\_\_

Contact Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_ Ext.: \_\_\_\_\_

E-mail: \_\_\_\_\_

My signature below acknowledges that I have read, fully understand, and accept the limited warranty agreement as listed on page iv of this manual.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Must return within 30 days after delivery. Please keep copy of this for your records.

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Mirus International Inc. 1-888 TO MIRUS (1-888-866-4787) mirusinternational.com

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