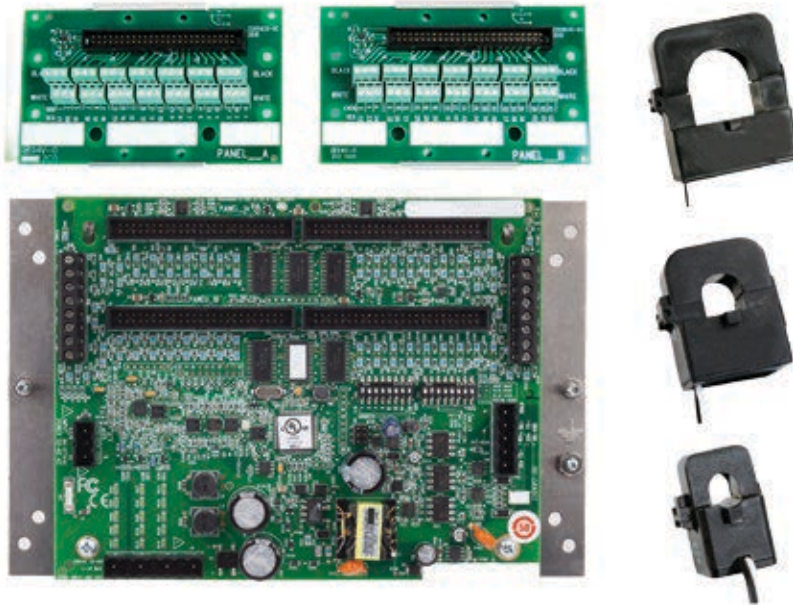


DEH-40700 Installation Instructions

ASPMETER Panelboard Monitoring System

Split Core



Safety

FCC PART 15 INFORMATION NOTE: This equipment has been tested by the manufacturer and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. This device complies with part 15 of the FCC Rules.

Operation is subject to the following two conditions:



- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

Modifications to this product without the express authorization of the manufacturer nullify this statement.

A qualified person is one who has skills and knowledge related to the construction and operation of this electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved.

NEC2011 Article 100: No responsibility is assumed by manufacturer for any consequences arising out of the use of this material.

Control system design must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and over-travel stop.

	This symbol indicates an electrical shock hazard exists.
	Documentation must be consulted where this symbol is used on the product.

DANGER: Hazard of Electric Shock, Explosion or Arc Flash
Failure to follow these instructions will result in death or serious injury.

- Follow safe electrical work practices. See NFPA 70E in the USA, or applicable local codes.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Read, understand and follow the instructions before installing this product.
- Turn off all power supplying equipment before working on or inside the equipment.
- Use a properly rated voltage sensing device to confirm power is off. **DO NOT DEPEND ON THIS PRODUCT FOR VOLTAGE INDICATION**
- Only install this product on insulated conductors.

NOTICE:

- This product is not intended for life or safety applications.
- Do not install this product in hazardous or classified locations.
- The installer is responsible for conformance to all applicable codes
- Mount this product inside a suitable fire and electrical enclosure.

WARNING: Loss of Control

Failure to follow these instructions may cause injury, death or equipment damage.

- Assure that the system will reach a safe state during and after a control path failure.
- Separate or redundant control paths must be provided for critical control functions.
- Test the effect of transmission delays or failures of communication links.
- Each implementation of equipment using communication links must be individually and thoroughly tested for proper operation before placing it in service.

For troubleshooting or service related questions, contact GE at 1-800-GE-1-STOP (1-800-431-7867).

Save These Instructions

Specifications

Inputs	
Input Power	90-277 VAC, 50/60 Hz
Accuracy	
Power/Energy	IEC 62053-21 Class 1, ANSI C12.1-2008
Voltage	±0.5% of reading 90-277 V line-to-neutral
Operation	
Sampling Frequency	2560 Hz
Update Rate	1.8 seconds (both panels)
Overload Capability	22 kAIC
Outputs	
Type	Modbus RTU™
Connection	DIP switch-selectable 2-wire or 4-wire, RS-485
Address	DIP switch-selectable address 1 to 247 (in pairs of 2) ¹
Baud Rate	DIP switch-selectable 9600, 19200, 38400
Parity	DIP switch-selectable NONE, ODD, EVEN
Communication Format	8-data-bits, 1-start-bit, 1-stop-bit
Termination	5-position depluggable connector (TX+ TX- SHIELD TX+/RX+ TX-/RX-)
Terminal Block Torque	4.4 to 5.3 in-lb (0.5 to 0.6 N-m)
Mechanical	
Ribbon Cable Support	4 ft. (0.9m) flat ribbon cable ships standard; up to 20 ft. (6m) available
Operating Conditions	
Operating Temp Range	0° to 60°C (32° to 140°F); <95% RH, non-condensing
Storage Temp Range	-40° to 70°C (-40° to 158°F)
Altitude of Operation	3000m
Compliance	
Agency Approvals	UL508 open type device, EN61010-1
Installation Category	Cat III, pollution degree 2

¹ See Configuration Section for details.

Notes:

- If ASPMETER products are used in installations with circuits higher than the product ratings, the circuits must be kept segregated per UL508A Sec. 17.5.
- 277/480VAC Wye connected (center grounded) power systems operate within the 300VAC line to neutral safety rating of the ASPMETER series, and the operational voltage limit (single-phase connection) as the line to neutral voltage is 277VAC in such power systems. Corner-grounded delta 480VAC systems would not qualify, as the actual line to earth voltage is 480VAC on each leg, exceeding the ASPMETER ratings.
- ASPMETER internal circuitry (cables and CTs) are not circuits as defined by UL508A, as they do not extend beyond the ASPMETER itself without further safety/fire isolation.



Product Overview

The ASPMETER Panelboard Monitoring System is designed to measure the current, voltage, and energy consumption of up to 92 circuits (84 branch circuits, 2 3-phase mains, 2 neutrals) on a single board. One ASPMETER can monitor up to two panels.

The ASPMETER consists of a data acquisition board and up to 84 split-core current sensors (50A, 100A, or 200A), with eight auxiliary inputs. Each conductor passes through a current sensor and terminates at the breaker. Each sensor transmits the current data to the data acquisition board. Data is transmitted using an RS-485 Modbus protocol. Each data acquisition board requires two addresses, one for each set of 42 current sensors and four auxiliary inputs. Data is updated roughly every two seconds. As a circuit approaches the user-defined threshold, the ASPMETER activates the alarm indicators.

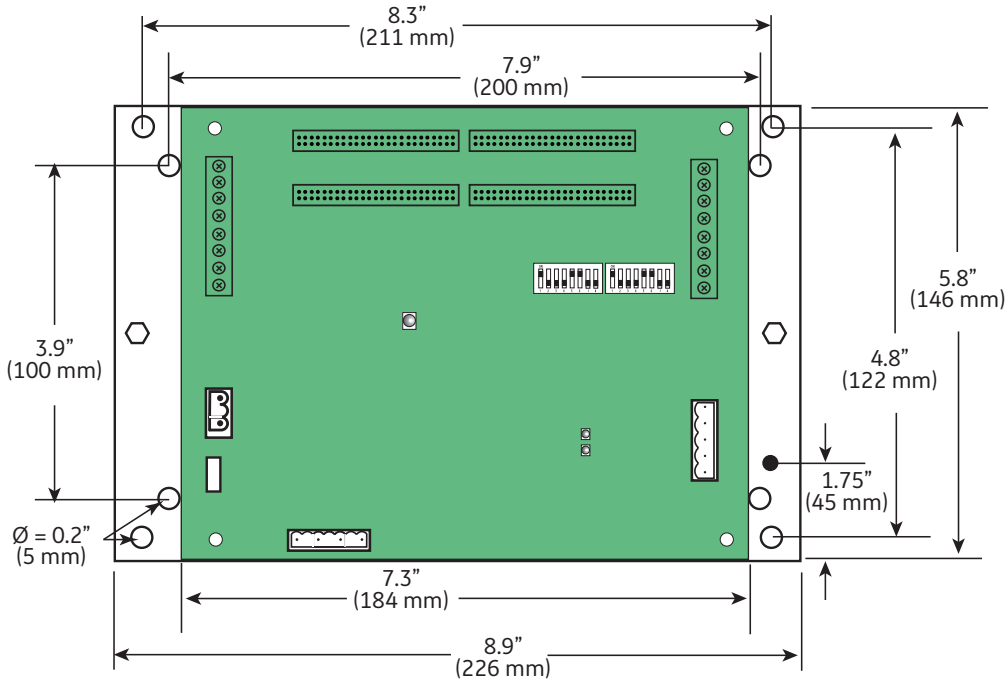
The ASPMETER-A measures both current and power for the mains and branch circuits. The ASPMETER-B measures both current and power for the mains, and current only in each circuit. The ASPMETER-C measures current only for the mains and branch circuits.

Product Identification

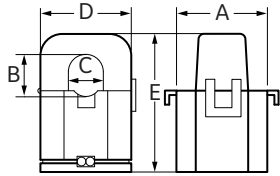
ASPMETER	Description	# of CTs
	 A = Advanced board B = Intermediate board C = Basic board	 002 = 2 adapter boards, no CTs, no cables 004 = 4 adapter boards, no CTs, no cables 42 = 2 adapter boards, (42) 50A CTs, (2) 4 ft. round ribbon cables 84 = 4 adapter boards, (84) 50A CTs, (4) 4 ft. round ribbon cables

Dimensions

Circuit Board and Mounting Bracket

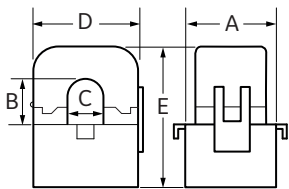


Current Sensors



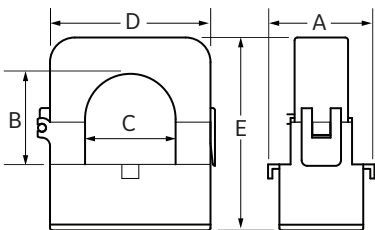
ASPCT0 50 Amp

- A = 1.0" (26 mm)
- B = 0.5" (11 mm)
- C = 0.4" (10 mm)
- D = 0.9" (23 mm)
- E = 1.6" (40 mm)



ASPCT1 100 Amp

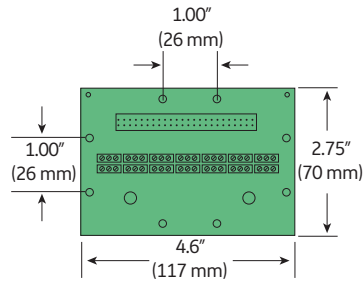
- A = 1.5" (37.5 mm)
- B = 0.6" (16 mm)
- C = 0.6" (16 mm)
- D = 1.85" (47 mm)
- E = 2.1" (53 mm)



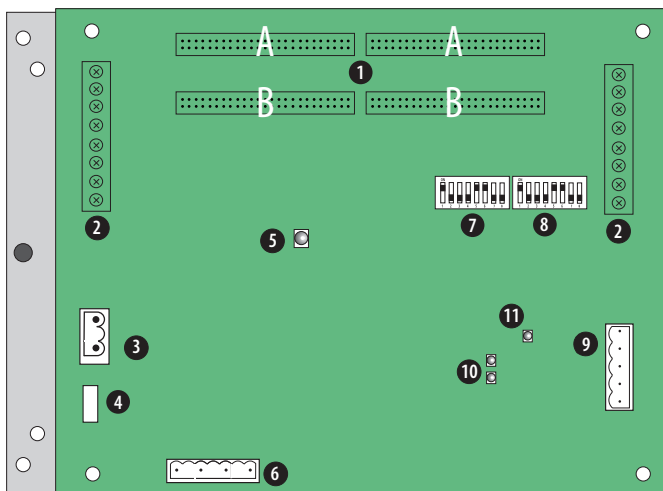
ASPCT3 200 Amp

- A = 1.5" (39 mm)
- B = 1.25" (32 mm)
- C = 1.25" (32 mm)
- D = 2.5" (64 mm)
- E = 2.8" (71 mm)

Adapter Board



Product Diagrams



1. **50-Pin Ribbon Cable Connectors:** Ribbon cables attach here for easy connection of adapter boards to the data acquisition board. The two connectors on the left are for panelboard 1; the two on the right are for panelboard 2.
NOTE: Connect Adapter Boards A and B to the correct ribbon cable connectors for each panel. The top connector is for Adapter Board A, and the bottom connector is for Adapter Board B.
NOTE: Ribbon Cable is not included with all ASPMETER models. For ribbon cable options, see Recommended Accessories on page 14.
2. **Auxiliary Inputs:** These 0.333 VAC inputs are used for monitoring the main breaker or other high amperage source. Inputs on the left are for panelboard 1; inputs on the right are for panelboard 2.
3. **Control (Mains) Power Connection:** Easy 2-wire 90-277 VAC 50/60 Hz connection.
4. **Control Power Fuse:** 600 VAC, 500 mA time lag, factory-replaceable.
5. **Alive LED:** Red/green/amber LEDs. Blink codes are on page 5.
6. **Voltage Taps:** 1, 2, or 3 phase plus neutral connections. For voltage sensing and power calculations (no voltage taps on the ASPMETER-C). Voltage taps are shared by both panels.
7. **Communications Address DIP Switches:** Each Modbus device must have a unique address. Switches are binary weighted. Left-most switch has a value of 1; right-most switch has a value of 128.
NOTE: Switches set the address for panel 1; panel 2 is automatically set to (Panel 1 address + 1). See Configuration section for details.

8. **Communications Settings DIP Switch:** Configures baud rate, parity, 2/4 wire communications.
9. **RS-485 Connection:** Used for Modbus serial communications. The Universal plug accommodates 2 or 4 wire connections.
10. **RS-485 LEDs:** The RX LED (closest to DIP switches) indicates the RS-485 is receiving information; the TX LED (farthest from DIP switches) indicates transmission of information.
11. **Power LED:** Indicates power to main board.
12. **Branch Current Sensors:** Each split-core current sensor is capable of monitoring conductors rated up to a maximum of 50, 100, or 200 amps. Up to 84 sensors can be purchased with the ASPMETER (see Recommended Accessories on page 14). One of each style is pictured here.
13. **Ribbon Cable Connectors**
14. **CT Terminal Connectors**

Data Output

Monitoring at Mains	ASPMETER-A	ASPMETER-B	ASPMETER-C
Current per phase	✓	✓	✓
Max. current per phase	✓	✓	✓
Current demand per phase	✓	✓	✓
Max. current demand per phase	✓	✓	✓
Energy (kWh) per phase	✓	✓	
Real Power (kW) per phase	✓	✓	
Apparent Power (kVA)	✓	✓	
Power factor total *	✓	✓	
Power factor per phase	✓	✓	
Voltage - L-L and average of 3 phases	✓	✓	
Voltage - L-N and average of 3 phases	✓	✓	
Voltage - L-N and per phase	✓	✓	
Frequency (phase A)	✓	✓	
Monitoring at Branch Circuit			
Current	✓	✓	✓
Max. current	✓	✓	✓
Current demand	✓	✓	✓
Max. current demand	✓	✓	✓
Real power (kW)	✓		
Real power (kW) demand	✓		
Real power (kW) demand max.	✓		
Energy (kWh) per circuit	✓		
Power factor	✓		
Apparent Power (kVA)	✓		
Modbus Alarms			
Voltage over/under	✓	✓	
Current over/under	✓	✓	✓

* Based on a 3-phase breaker rotation.

Blink Code for Status LED

Color and Pattern	Status Description
Green, once per second	Normal operation
Amber, once per second	Volts or Amps clipping
Amber, twice per second	Invalid firmware image
Red, solid or blink	Diagnostic event detected

Split-Core CT Accuracy


Description	Split-Core CT		
	50A	100A	200A
Voltage rating	300 VAC	300 VAC (CE), 600 VAC (UL)	300 VAC (CE), 600 VAC (UL)
Accuracy	±1%	±0.5%	±1%
Temperature	0° to 60°C		
Agency	UL508 recognized, EN61010-1		

Commissioning

1. Install according to instructions in Mechanical Installation.
2. Provide control power to panel.
3. Configure installation mode using Modbus Register 6.
4. Configure CT scaling.
5. Configure alarms.
6. Configure demand.

Download the free Configuration Tool “NetConfig” from www.veris.com/modbus_downloads.aspx to commission the E3x for operation.

Wiring



Power must be disconnected and locked out before making any wiring connections.

Connect 2-wire or 4-wire Modbus RS-485 daisy chain network (Figures 1 and 2).

Figure 1.

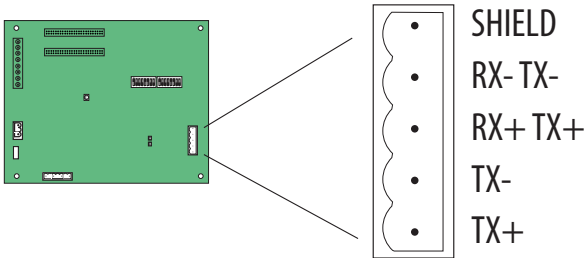
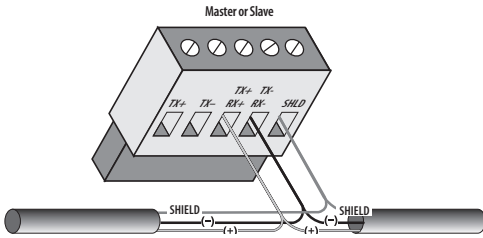
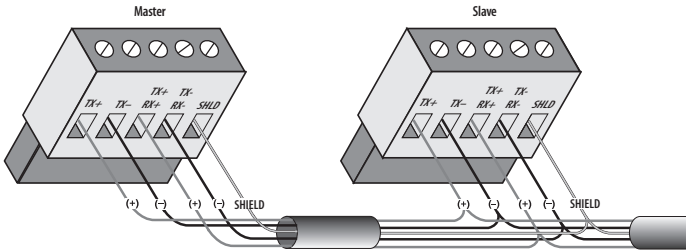


Figure 2.

2-wire



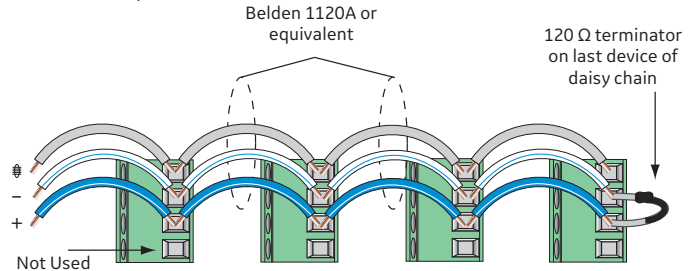
4-wire



1. Mechanically secure the RS-485 cable where it enters the electrical panel.
2. Connect all RS-485 devices in a daisy-chain fashion, and properly terminate the chain (Figure 3).

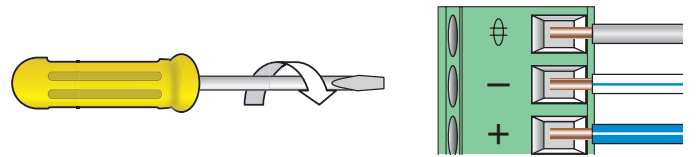
Figure 3.


2-wire example



3. Shield the RS-485 cable using twisted-pair wire, such as Belden 1120A. The cable must be voltage-rated for the installation.
4. When tightening terminals, ensure that the correct torque is applied: 0.5 to 0.6 N·m (0.37 to 0.44 ft·lb) for connectors on main board, 0.22 to 0.26 N·m (0.16 to 0.19 ft·lb) for connectors on adapter boards (Figure 4).

Figure 4.





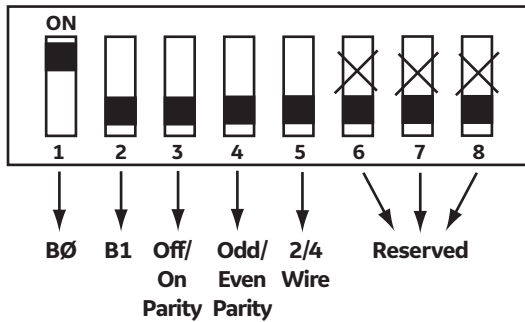
WARNING: After wiring the RS-485 cable, remove all scraps of wire or foil shield from the electrical panel. Wire scraps coming into contact with high voltage conductors could be DANGEROUS!

Configuration

1. **Communications Configuration:** Communications parameters for the ASPMETER series are field selectable for your convenience. Please see the Product Diagrams section (page 5) for selector location. The following parameters are configurable:

- Baud Rate: 9600, 19200, 38400
- Parity On or Off
- Parity: odd or even
- Wiring: two or four

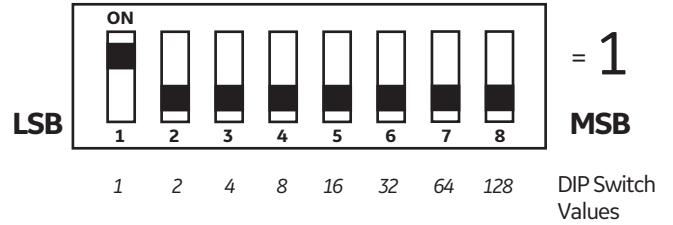
Example: 2-wire 19200 Baud, no parity (default only)



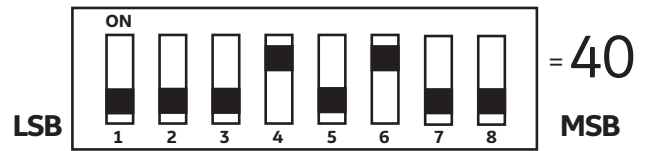
1	2	3	4	5	6	7	8	
Off	Off				X	X	X	9600
On	Off				X	X	X	19200
Off	On				X	X	X	38400
On	On				X	X	X	Reserved
		Off	Off		X	X	X	No Parity
		On	Off		X	X	X	Odd Parity
		Off	On		X	X	X	No Parity
		On	On		X	X	X	Even Parity
				On	X	X	X	4-wire RS-485
				Off	X	X	X	2-wire RS-485

2. **Address Configuration:** Each Modbus device on a single network must have a unique address. Set the switch block to assign a unique address before the device is connected to the Modbus RS-485 network. If an address is selected which conflicts with another device, neither device will be able to communicate.

3. The ASPMETER uses two logical addresses. Panel 1 uses the base address as set on the DIP switches, and Panel 2 uses this base address + 1. Address the ASPMETER as any whole number between and including 1-246. Each unit is equipped with a set of 8 DIP switches for addressing. See below.



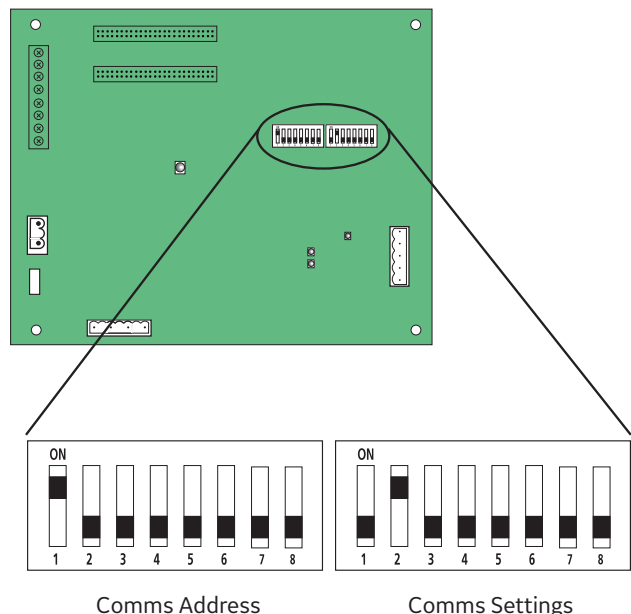
4. To determine an address, simply add the values of any switch that is on. For example:



Switch number 4 has an ON Value of 8 and switch number 6 has an ON Value of 32. (8 + 32 = 40). Therefore, the address for Panel 1 is 40 and the address for Panel 2 is 41. See the Address Setup section (page 9) for a pictorial listing of the first 63 switch positions.

Default DIP Switch Settings

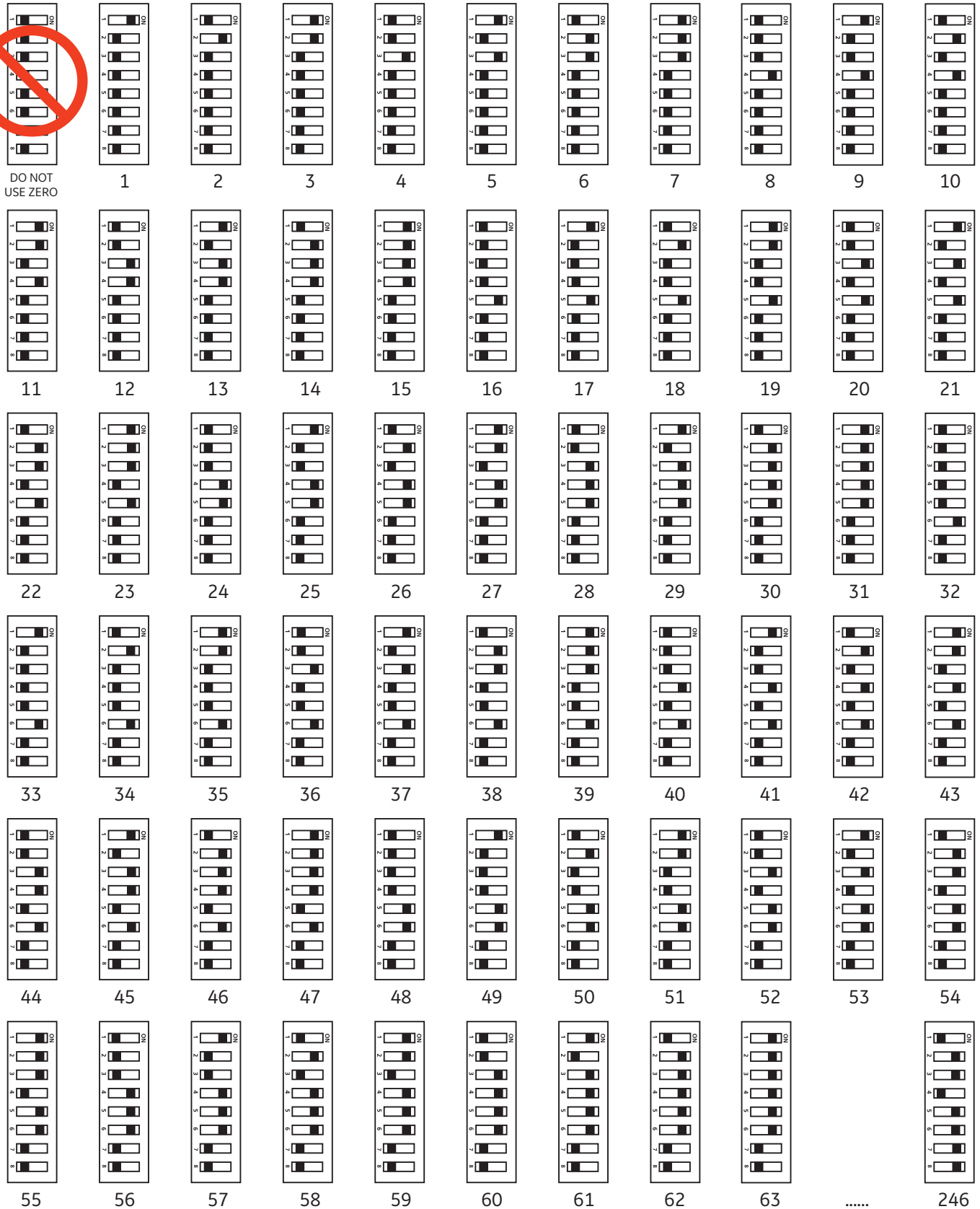
The ASPMETER includes two DIP switches, as shown below. Switches are shown in their default positions.



Address Setup



DO NOT
USE ZERO



Mechanical Installation



Observe precautions for handling static sensitive devices to avoid damage to the circuitry that is not covered under the factory warranty.



Disconnect power to the electrical panel and lock it out.

1. Install the acquisition board mounting bracket in the panel using screws and bolts provided. Panels can be oriented side-by-side (Figure 5A) or vertically (Figure 5B). A grounding connection is located on the mounting bracket, near the lower right corner. Use this stud to ground the bracket when mounting on a non-conductive surface.

Figure 5A.

Side-by-side

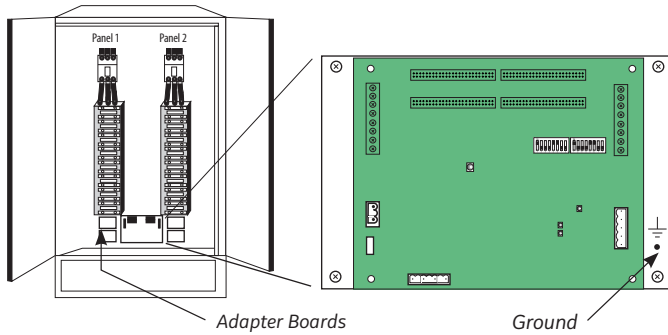
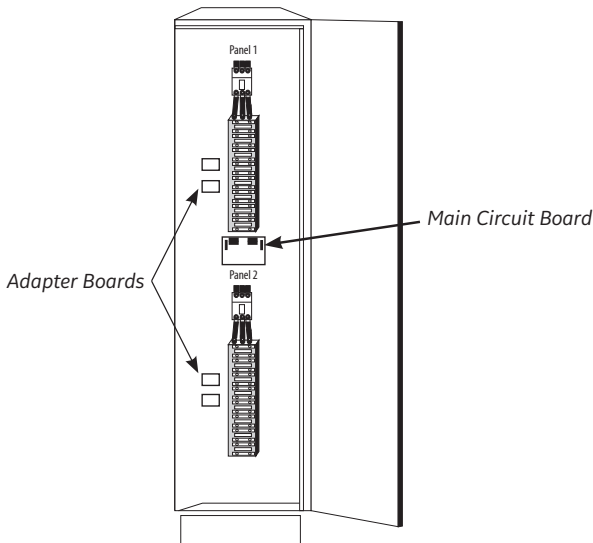


Figure 5B.

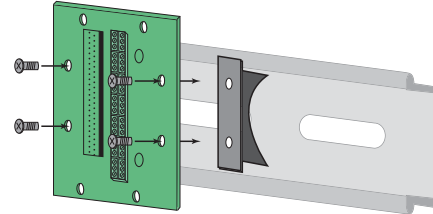
Vertically



2. Mount the adapter boards to either DIN rail or SNAPTRACK.
 - **DIN Rail:** Use the supplied screws to secure the plastic DIN clip to the adapter board. Affix the clip to the DIN rail (Figure 6).
 - **SNAPTRACK:** Secure the SNAPTRACK to the mounting surface. Click the adapter board into place (Figure 7).

Figure 6.

DIN Option - Vertical Mount



DIN Option - Horizontal Mount

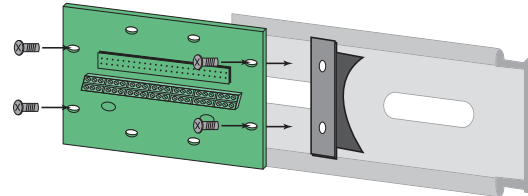
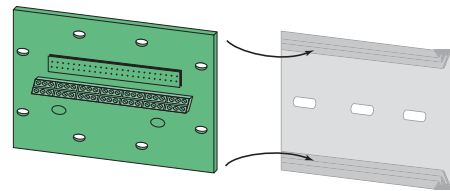


Figure 7.

SNAPTRACK



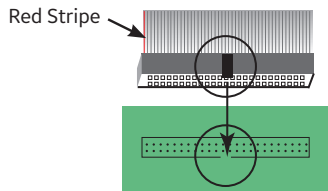
3. Connect adapter boards to the main board using ribbon cable (Figure 8). Ribbon cables are keyed to ensure proper installation.

Orient cables so that the red stripe is on the left.

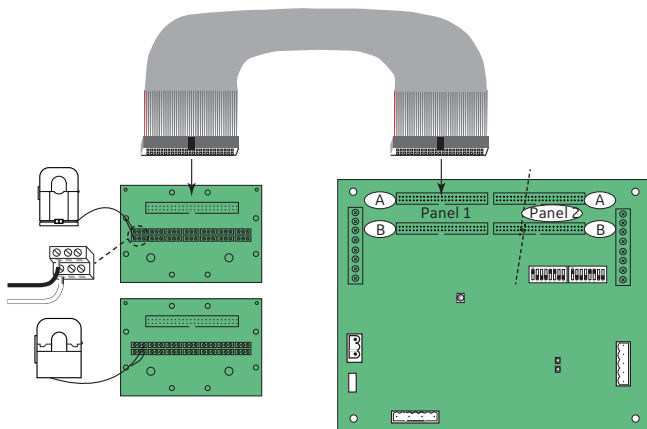
NOTE: Flat and round ribbon cable are available. See Recommended Accessories.

4. Connect current sensors to the terminals on the adapter boards (Figure 8).

Figure 8.



Align ribbon cable key with connector keyhole. Orient ribbon cable so that the red stripe is on the left side of the connector.

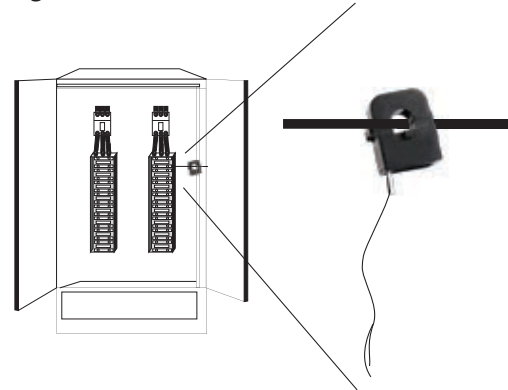


If the signed power factor feature is NOT enabled, then the current sensor orientation does not affect meter behavior. If this feature IS enabled, orient the current sensors so that the arrow points toward the load for proper operation.

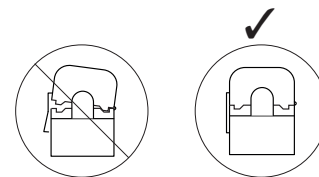
5. Install the current sensors onto the conductors to be monitored (Figure 9). Sensors can be mounted facing either direction; orientation does not affect meter accuracy.

NOTE: Clean split-core contacts before closing. The hinge can detach, allowing the base and the top to separate for easier cleaning and installation

Figure 9.



The 50 A CT accepts a maximum #2 AWG (0.384" O.D.) wire with THHN insulation. The 100A CT accepts a maximum 3/0 AWG (0.584" O.D.) wire with THHN insulation. The 200A CT accepts a maximum of 350 MCM wire with THHN insulation. Use this gauge wire or smaller for each circuit.



Close CTs until the clasp clicks into place to ensure that contact surfaces are firmly seated.

6. Plastic cable ties are included with the product for strain relief. Insert the strain relief device into one of the available holes on the adapter board (Figure 10A). Gather all current sensor wires connected to that adapter board and secure the cable tie around them (Figure 10B).

Figure 10A.

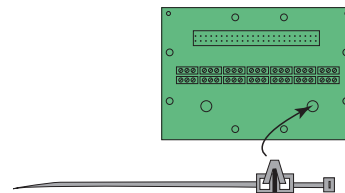
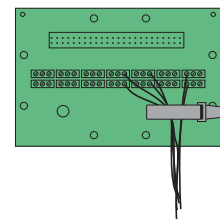
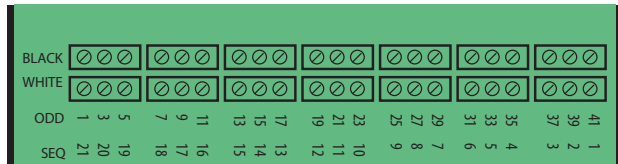


Figure 10B.



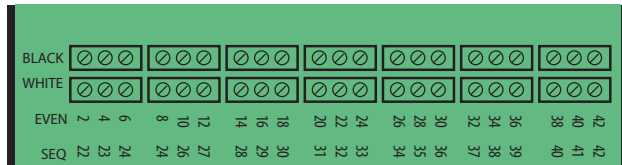
- The adapter boards are silk screened with two rows of numbers. For applications that require odd/even branch circuit numbering, use the row designated ODD or EVEN. For applications that require sequential numbering, use the number row marked SEQ (Figures 11 and 12).

Figure 11.



Numbering - Adapter Board A:

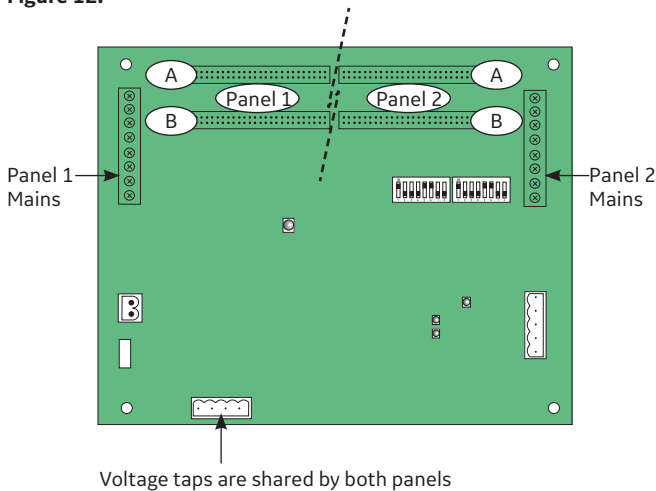
ODD	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41
SEQ	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1



Numbering - Adapter Board B:

EVEN	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
SEQ	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42

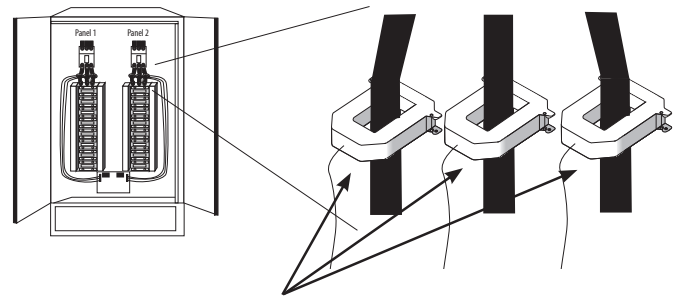
Figure 12.



Panel 1 uses base Modbus address as set by DIP switches.
Panel 2 uses base + 1 Modbus address as set by DIP switches.

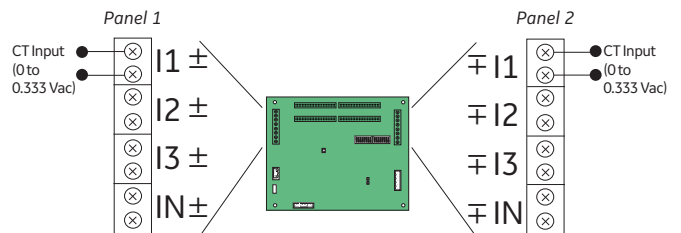
- Configure communication and addressing parameters using DIP switches. The ASPMETER requires two addresses, one for each set of 42 current sensors and four auxiliary inputs. See the Configuration section for more information.
- Wire RS-485 communications (see diagrams in Wiring section).
- Connect 0.333VAC current transducers (CTs) to the main conductors by snapping CTs around lines, observing local codes regarding bending radius (optional; Figures 13 and 14).

Figure 13.



Recommended CT: AMP1 Series available in 100A max. to 2000A max. Contact your local GE sales rep for recommended CTs amperages or if higher amperages are required.

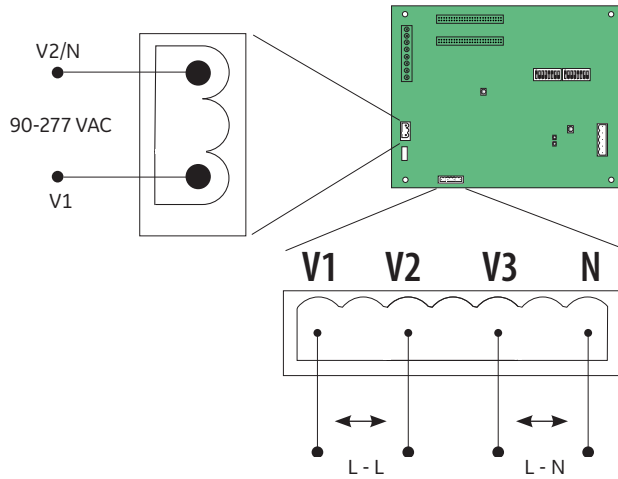
Figure 14.



Set up Modbus registers 115-118 for CT scaling.
Use base + 1 address for Panel 2 setup.
NOTE: (+) represents black, (-) represents white

11. Connect 2-wire 90-277VAC power to main power terminals. Observe polarity. For the ASPMETER-A and ASPMETER-B, connect voltage lines to the voltage taps (Figure 15). Equip voltage lines with fuses.

Figure 15.



Line to Line (L-L) Voltage: 150 to 480 VAC
 Line to Neutral (L-N) voltage: 90 to 277 VAC

Recommended Accessories

Catalog Number	Description
ASPCT0	Six-pack 50 A CT, 6 ft. (1.8 m) lead
ASPCT1	Six-pack 100 A CT, 6 ft. (1.8 m) lead
ASPCT2	Single 200A CT, 6ft (1.8m) lead

Troubleshooting

Problem	Solution
Product is not communicating over Modbus daisy chain	<ul style="list-style-type: none"> • Check the unit Modbus address to ensure that each device on the daisy chain has a unique address. • Check Parity. • Check the communications wiring. • Check that the daisy chain is properly terminated.
RX LED is solid	<ul style="list-style-type: none"> • Check for reversed polarity on Modbus comms. • Check for sufficient biasing on the Modbus bus. Modbus physical specification calls for 450-650 Ω biasing. This is usually provided by the master.
The main board has a fast flashing amber light	<ul style="list-style-type: none"> • Verify ribbon cable connectors are inserted in the correct orientation. • If cables are correct, reset main board to re-initialize product.
The main board has a slow flashing amber light	<ul style="list-style-type: none"> • One or more channels is clipping. This can be caused by a signal greater than 100 A or 277 V L-N, or by a signal with high THD near the gain stage switching points (1.5 A and 10 A).
The main board has a flashing green light	<ul style="list-style-type: none"> • Everything is wired properly and the main board has power.
The main board is a flashing or solid red light	<ul style="list-style-type: none"> • Light may be red briefly while device powers up. • If light is red for more the 60 sec. device has encountered a diagnostic event. Contact technical support.
Split-core product is reading zero for some values	<ul style="list-style-type: none"> • Device was unable to read split-core adapter boards on power up. Verify adapter boards are connected. • Verify ribbon cable connectors are inserted in the correct orientation. • Reset main board to re-initialize product.
Power factor reading is not as expected	<ul style="list-style-type: none"> • Verify voltage taps are connected in appropriate phase rotation. • Verify phase rotation of breakers (firmware rev. 1.012 or higher allows for custom rotation if needed).
Current reading is not as expected, or reading is on different CT number than expected	<ul style="list-style-type: none"> • Verify ribbon cable is fully seated and in the correct orientation.
Current is reading zero, even when small currents are still flowing through circuit	<ul style="list-style-type: none"> • The product cuts off at 50 mA, and will set the reporting register to 0 mA for currents near or below this range.
Configuration Tool "NetConfig" returns Modbus error on read/write	<ul style="list-style-type: none"> • Verify using the latest release of Configuration Tool "NetConfig" as older versions may not support all features in current product firmware. Latest version is available on the website http://www.veris.com/modbus_downloads.aspx

For troubleshooting or service related questions, contact GE at 1-800-GE-1-STOP (1-800-431-7867).



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