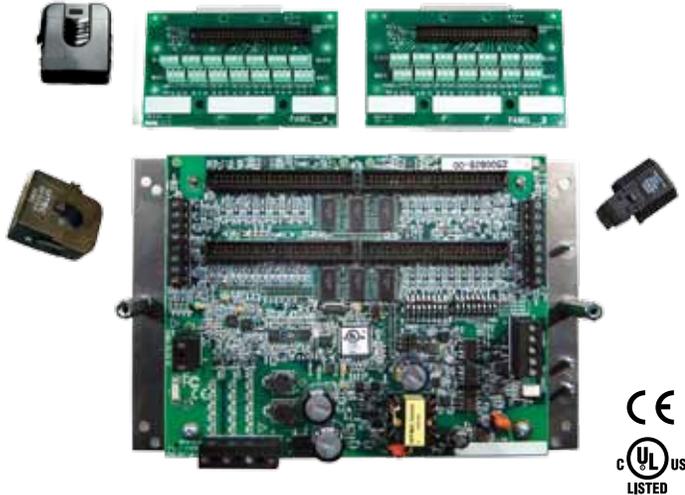


E31

E31

Panelboard Monitoring System



⚠ DANGER ⚡

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- 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.

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

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.

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. Operation of this equipment in a residential area may cause harmful interference in which case the user will be required to correct the interference at his own expense. Modifications to this product without the express authorization of Veris Industries nullify this statement.

PRODUCT IDENTIFICATION

Description	# of CTs
E31 <input type="checkbox"/>	<input type="checkbox"/>
A = Advanced board	002 = 2 adapter boards, no CTs, no cables
B = Intermediate board	004 = 4 adapter boards, no CTs, no cables
C = Basic board	42 = 2 adapter boards, 42 50A CTs, 4 ft. round ribbon cables
	84 = 4 adapter boards, 84 50A CTs, 4 ft. round ribbon cables

Installer's Specifications

Inputs:	
Input Power	90-277VAC, 50/60 Hz
Accuracy:	
Power/Energy	IEC 62053-21 Class 1, ANSI C12.1-2008
Voltage	±0.5% of reading 90-277V 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)*
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-)
Mechanical:	
Ribbon Cable Support	4 ft. (0.9 m) flat ribbon cable ships standard; up to 20 ft. (6 m) available
Environmental:	
Operating Temperature Range	0° to 60°C (32° to 140°F) (<95% RH noncondensing)
Storage Temperature Range	-40° to 70°C (-40° to 158°F)
Altitude of Operation	3000 m
Agency Approvals	UL508, EN61010

* See Configuration section for details.

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QUICK INSTALL



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

1. Disconnect and lock out power. Use a properly rated voltage sensing device to confirm power is off.
2. Mount the main acquisition board in the electrical enclosure.
3. Mount adapter boards to either DIN Rail or SNAPTRACK™.
4. Connect adapter boards to the main board via ribbon cable (sold separately).
5. Connect current transducers to the adapter boards.
6. Snap current sensors onto the conductors to be monitored. **Note: ensure that each split-core CT is closed and firmly seated.**
7. Secure wires using strain relief cable ties.
8. Configure communication and addressing parameters using DIP switches.
9. Wire RS-485 communications.
10. Connect CTs to the auxiliary inputs and connect them onto the main conductors in the enclosure (optional).
11. Wire control power and voltage taps (E31A and E31B only).
12. Download the free E3x configuration tool from www.veris.com to commission the device for operation.

OPERATION

The E31 Series Branch Current Monitor 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 E31 can monitor up to two panels.

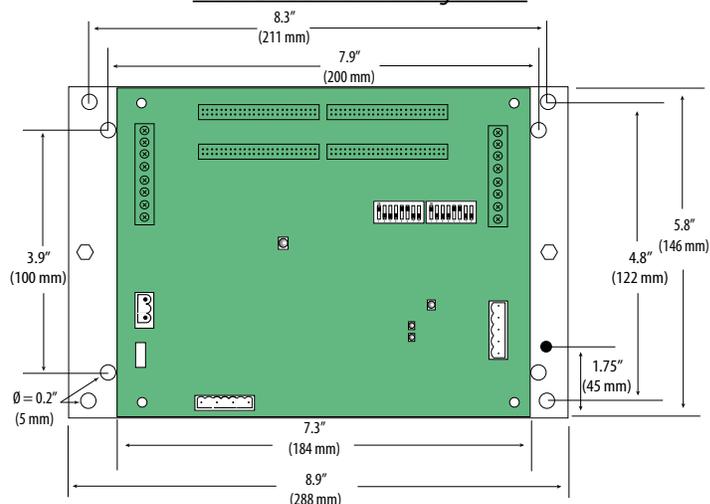
The E31 consists of a data acquisition board and up to 84 split-core current sensors (50A, 100A, or 200A), with eight auxiliary inputs. Each conductor passes through a current sensor and terminates at the breaker. Each sensor transmits the current data to the data acquisition board.

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 E31 activates the alarm indicators.

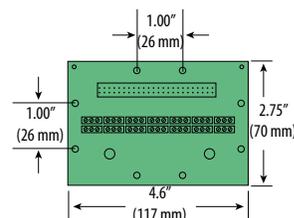
The E31A measures both current and power for the mains and branch circuits. The E31B measures both current and power for the mains, and current only in each circuit. The E31C measures current only for the mains and branch circuits.

DIMENSIONS

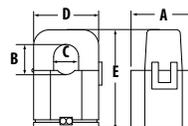
Circuit Board and Mounting Bracket



Adapter Board

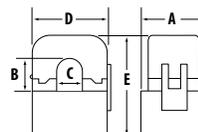


Current Sensors



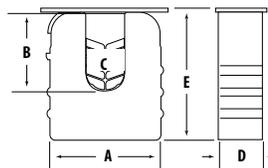
50 Amp

- 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)



100 Amp

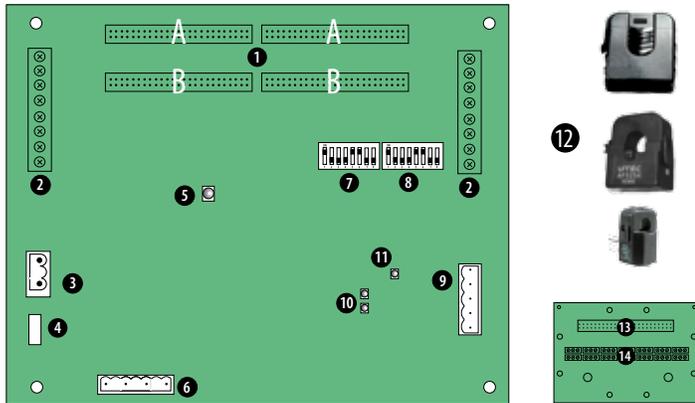
- A = 1.2" (29 mm)
- B = 0.8" (20 mm)
- C = 0.7" (16 mm)
- D = 1.6" (40 mm)
- E = 2.1" (53 mm)



200 Amp

- A = 2.6" (66 mm)
- B = 1.1" (28 mm)
- C = 0.8" (19 mm)
- D = 2.9" (74 mm)
- E = 3.5" (90 mm)

PRODUCT DIAGRAM



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 E31 models. For ribbon cable options, see Recommended Accessories on page 11.
2. **Auxiliary Inputs:** These 0.333VAC 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:** 600VAC, 500mA time lag, factory-replaceable.
5. **Alive LED:** Red/green/amber LEDs. Blink codes are on page 3.
6. **Voltage Taps:** 1, 2, or 3 phase plus neutral connections. For voltage sensing and power calculations (no voltage taps on the E31C). Voltage taps are shared by both panels.
7. **Communications Address DIP Switch:** 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- or 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 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 E31 (see Recommended Accessories on page 10). One of each style is pictured here.

13. **Ribbon Cable Connection**

14. **CT Terminal Connections**

DATA OUTPUT

Monitoring at Mains	E31A	E31B	E31C
Current per phase	■	■	■
Max. current per phase	■	■	■
Current demand per phase	■	■	■
Max. current demand per phase	■	■	■
Energy (kWh), total	■	■	■
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 CODES 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

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

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 1A) or vertically (Figure 1B). 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 1A

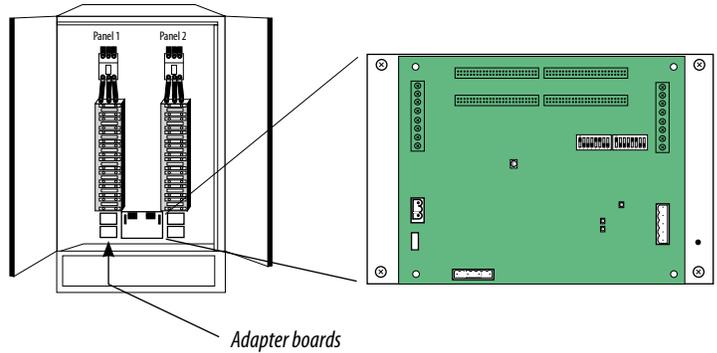
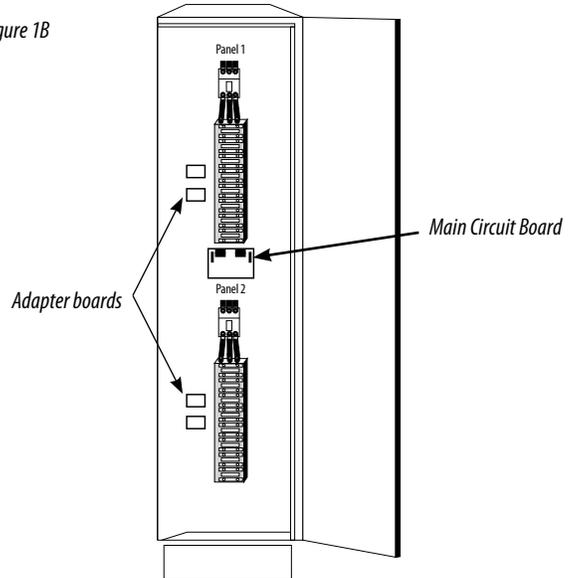


Figure 1B

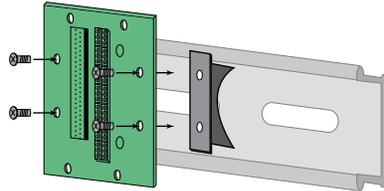


2. Mount the adapter boards to either DIN rail or SNAPTRACK.

- A. DIN Rail: Use the supplied screws to secure the plastic DIN clip to the adapter board. Affix the clip to the DIN rail (Figure 2).
- B. SNAPTRACK: Secure the SNAPTRACK to the mounting surface. Click the adapter board into place (Figure 3).

Figure 2

DIN Option 1: Vertical Mount



DIN Option 1: Horizontal Mount

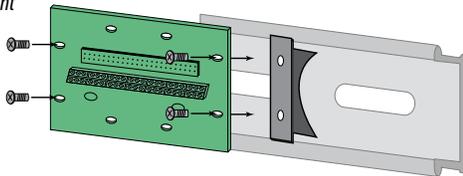
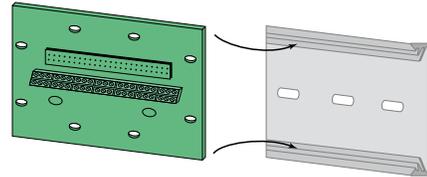


Figure 3

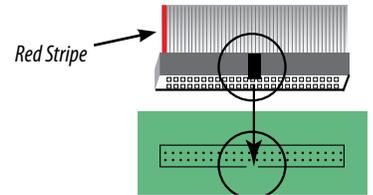
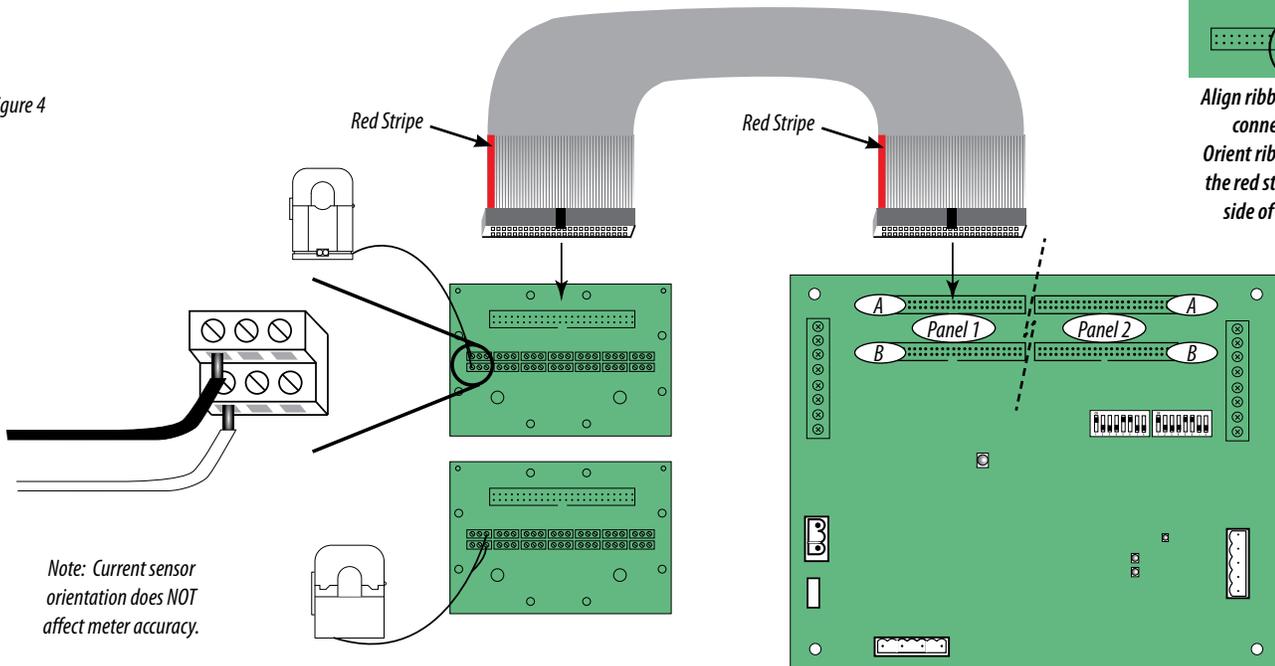


3. Connect adapter boards to the main board using ribbon cable (Figure 4). Ribbon cables are keyed to ensure proper installation. **Orient cables so that the red stripe is on the left.**

Note: Flat and round ribbon cable are available from Veris. See Recommended Accessories (page 10)

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

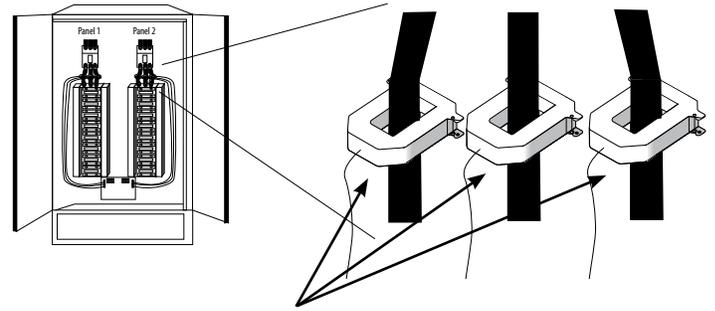
Figure 4



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

8. Configure communication and addressing parameters using DIP switches. The E31 requires two addresses, one for each set of 42 current sensors and four auxiliary inputs. See the Configuration section for more information.
9. Wire RS-485 communications (see diagrams in Wiring section).
10. Connect 0.333VAC current transducers (CTs) to the main conductors by snapping CTs around lines, observing local codes regarding bending radius (optional; Figures 9, 10).

Figure 9

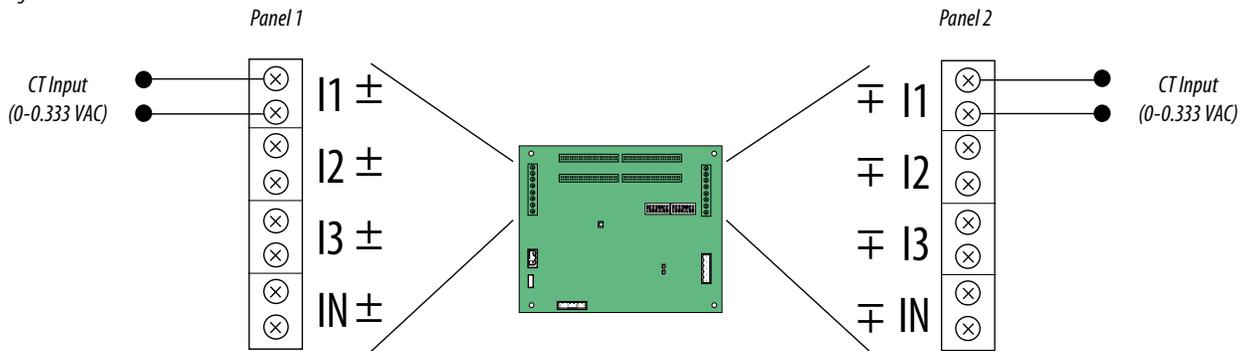


Recommended CT:

*Veris Industries H6810, H6811, H6812 Series with 0.333VAC output.
Available in 100A max. to 2400A max.*

Call a Veris sales rep if higher amperages are required.

Figure 10



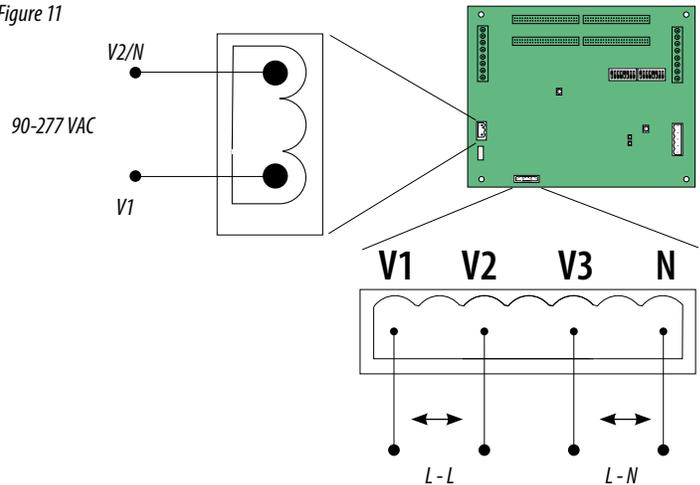
Set up Modbus registers 115-118 for CT scaling.

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 E31A and E31B, connect voltage lines to the voltage taps (Figure 11). Equip voltage lines with fuses.

Figure 11



Line to Line (L-L) Voltage: 150 to 480 VAC

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

Voltage taps are shared by both panels.

WIRING



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

1. Connect 2-wire or 4-wire Modbus RS-485 daisy chain network (Figures 12 and 13).

Figure 12

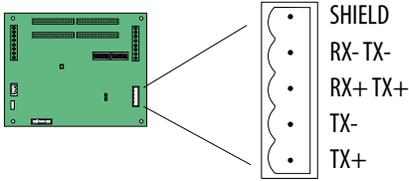


Figure 13

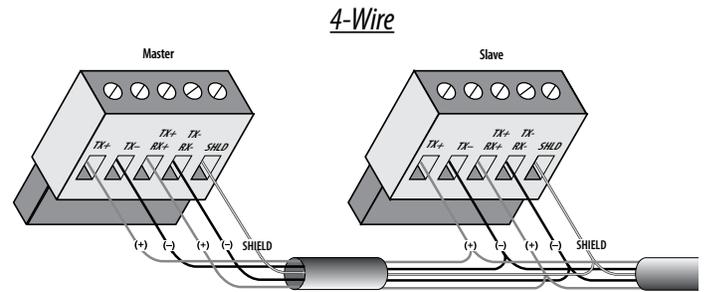
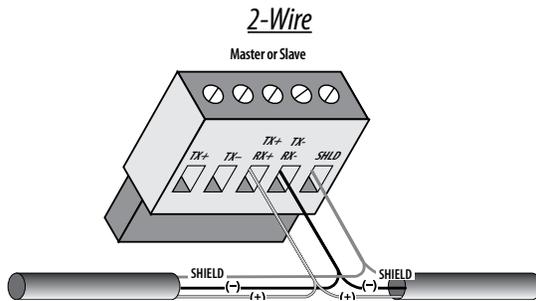


Figure 14

2. Mechanically secure the RS-485 cable where it enters the electrical panel.
3. Connect all RS-485 devices in a daisy-chain fashion, and properly terminate the chain (Figure 14).
4. Shield the RS-485 cable using twisted-pair wire, such as Belden 1120A. The cable must be voltage-rated for the installation.
5. 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 15).

2-Wire Example

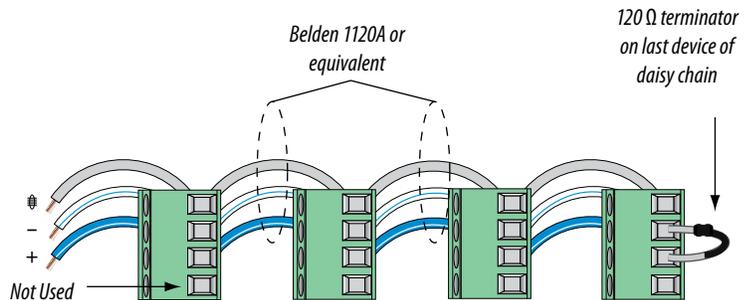
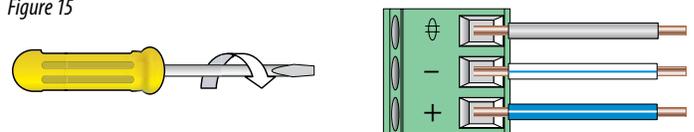


Figure 15



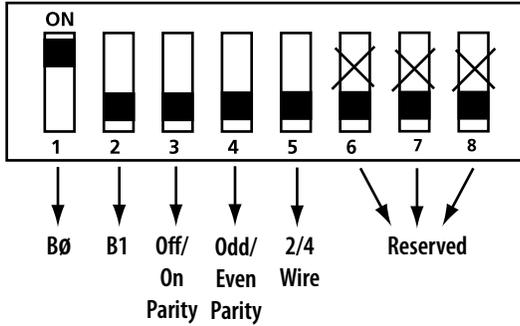
WARNING: After wiring the RS-485 cable, remove all scraps of wire or foil shield from the electrical panel. Wire scraps coming into contact with high voltage conductors could be DANGEROUS!

CONFIGURATION

1. Communications Configuration: Communications parameters for the E31 series are field selectable for your convenience. Please see the Product Diagram section (page 2) for selector location. The following parameters are configurable:

- Baud Rate: 9600, 19200, 38400
- Parity On or Off
- Parity: odd or even
- Wiring: 2 or 4

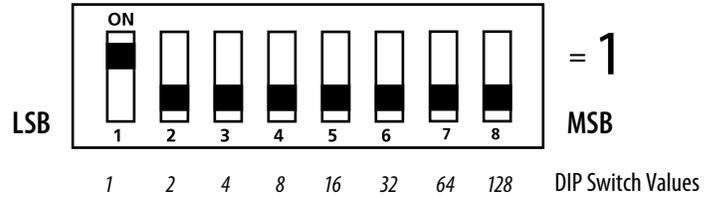
Example: 2-wire 19200 Baud No Parity



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

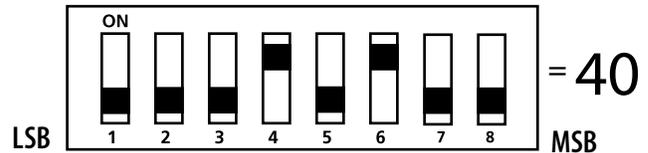
2. Address Configuration: Each Modbus device on a single network must have a unique address. Set the switch block to assign a unique address before the device is connected to the Modbus RS-485 network. If an address is selected that conflicts with another device, neither device will be able to communicate.

3. The E31 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 E31 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:

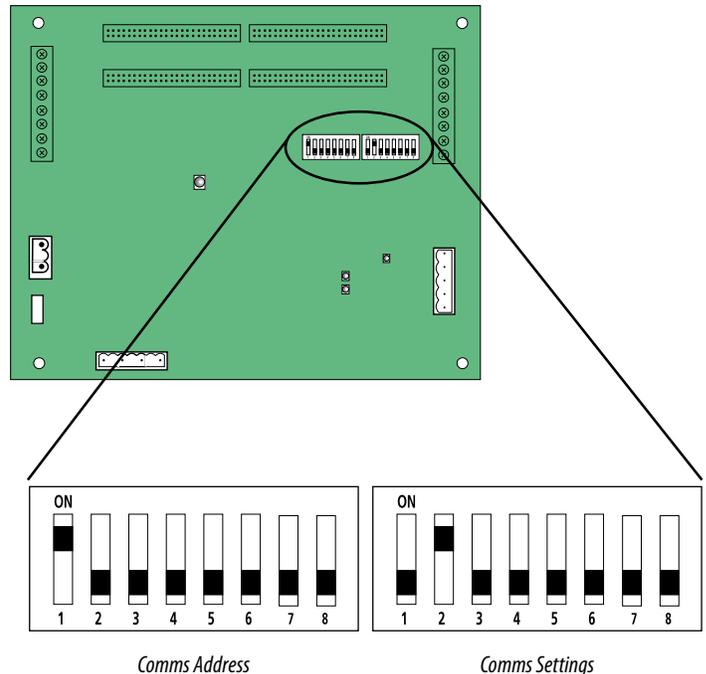


Switch number 4 has an ON Value of 8 and switch number 6 has an ON Value of 32. (8 + 32 = 40). Therefore, the address for Panel 1 is 40, and the address for Panel 2 is 41.

See the Address Setup section (page 9) for a pictorial listing of the first 63 switch positions.

DEFAULT DIP SWITCH SETTINGS

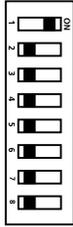
The E31 includes two DIP switches, as shown below. Switches are shown in their default positions.



ADDRESS SETUP



DO NOT
USE ZERO



1



2



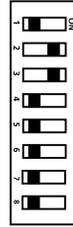
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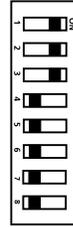
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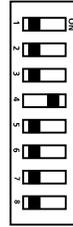
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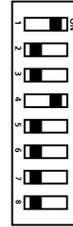
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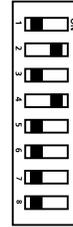
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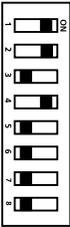
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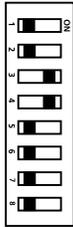
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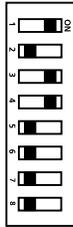
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11



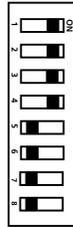
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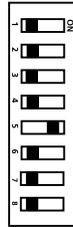
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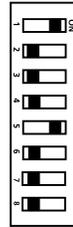
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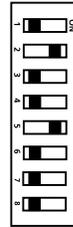
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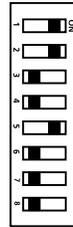
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17



18



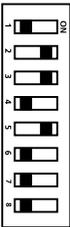
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22



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24



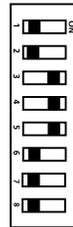
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26



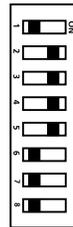
27



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29



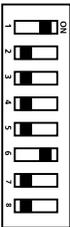
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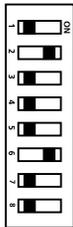
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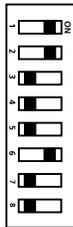
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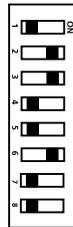
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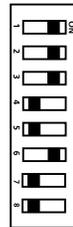
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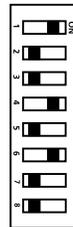
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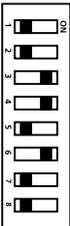
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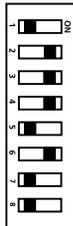
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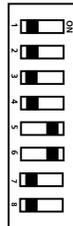
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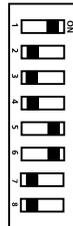
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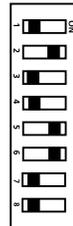
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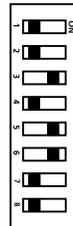
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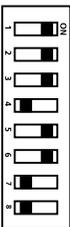
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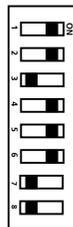
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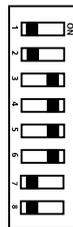
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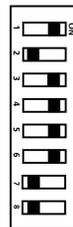
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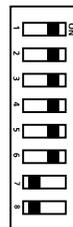
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COMMISSIONING

1. Reconnect power to the panel.
2. Configure installation mode using Modbus Register 6.
3. Configure CT scaling.
4. Configure alarms.
5. Configure demand.

Download the free E3x configuration tool from www.veris.com to commission the device for operation.

RECOMMENDED ACCESSORIES

Part ID	Description
CBL008	Flat ribbon cable, 50 x 28 AWG, 1.5 ft. (0.45 m)
CBL016	Flat ribbon cable, 50 x 28 AWG, 4 ft. (1.2 m)
CBL017	Flat ribbon cable, 50 x 28 AWG, 5 ft. (1.5 m)
CBL018	Flat ribbon cable, 50 x 28 AWG, 6 ft. (1.8 m)
CBL019	Flat ribbon cable, 50 x 28 AWG, 8 ft. (2.4 m)
CBL020	Flat ribbon cable, 50 x 28 AWG, 10 ft. (3.0 m)
CBL021	Flat ribbon cable, 50 x 28 AWG, 20 ft. (6.1 m)
CBL022	Round ribbon cable, 50 x 28 AWG, 4 ft. (1.2 m)
CBL023	Round ribbon cable, 50 x 28 AWG, 10 ft. (3 m)
CBL024	Round ribbon cable, 50 x 28 AWG, 20 ft. (6 m)
CBL025	Flat ribbon cable, 50 x 28 AWG, 2 m
CBL026	Flat ribbon cable, 50 x 28 AWG, 4 m
CBL027	Flat ribbon cable, 50 x 28 AWG, 6 m
CBL031	Round ribbon cable, 50 x 28 AWG, 1.5 ft. (0.45 m)
CBL032	Round ribbon cable, 50 x 28 AWG, 2.5 ft. (0.76 m)
E31CT0	Six-pack 50 A CT, 6 ft. (1.8 m) lead
E31CT0R20	Six-pack 50 A CT, 20 ft. (6 m) lead
E31CT1	Six-pack 100 A CT, 6 ft. (1.8 m) lead
E31CT1R20	Six-pack 100 A CT, 20 ft. (6 m) lead
E31CT3	Single 200A CT, 6ft (1.8m) lead
E31CT3R20	Single 200A CT, 20ft (6m) lead
E31CTDB	2 E31 Adapter boards
AE001	E3x MCB Cover
AV01	Veris DIN Rail

SAFETY

If Veris E31 products are used in installations with circuits higher than the product ratings, the circuits must be kept segregated per UL508A Sec. 17.5.

Note: 277/480VAC Wye connected (center grounded) power systems operate within the 300VAC line to neutral safety rating of the E3x 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 E3x ratings.

Note: E3x internal circuitry (cables and CTs) are not circuits as defined by UL508A, as they do not extend beyond the E3x itself without further safety/fire isolation.

UL listed under standard 508 as an "open type device."

Maximum ambient air temperature for use is 60°C.

Installation category: CAT III

The E31 Series must be installed in an appropriate electrical and fire enclosure per local regulations.

For use in a Pollution Degree 2 or better environment only.

A Pollution Degree 2 environment must control conductive pollution and the possibility of condensation or high humidity. Consideration must be given to the enclosure, the correct use of ventilation, thermal properties of the equipment and the relationship with the environment.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the device may be impaired.

IEC/EN 61010-1 



This symbol indicates an electrical shock hazard exists.



Documentation must be consulted where this symbol is used on the product.

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 the split-core size 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.
E3x Config Tool returns Modbus error on read/write	<ul style="list-style-type: none"> • Verify using the latest release of E3x Config Tool as older versions may not support all features in current product firmware. Latest version is available on our website http://www.veris.com/modbus.aspx

CHINA ROHS COMPLIANCE INFORMATION (EFUP TABLE)

部件名称	产品中有毒有害物质或元素的名称及含量Substances					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
电子线路板	X	0	0	0	0	0
0 = 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。 X = 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求。						
Z000057-0A						