



Installation Instructions

Enercept FLEX

Compact Power and Energy Meter Uni-directional, Bi-directional for BACnet/Modbus

PN: X13690278001



X39641311001

SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

April 2021

BAS-SVX083D-EN

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1 Warnings, Cautions, and Notices

Read this manual thoroughly before operating or servicing this unit. Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe

NOTICE Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs such as HCFCs and HFCs.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified according to local rules. For the USA, the Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

2 WARNING

Proper Field Wiring and Grounding Required!
Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.

WARNING

Personal Protective Equipment (PPE) Required!
Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.
- When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labeling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.

If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.

3 WARNING

Follow EHS Policies!
Failure to follow instructions below could result in death or serious injury.

- All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.
- Non-Trane personnel should always follow local regulations.

WARNING

Hazard of Electrical Shock, Explosion, or Arc Flash!
Failure to follow these instructions could result in death or serious injury. Install the product in an appropriate electrical/fire enclosure per local regulations. Do not use the product for life or safety applications. Do not install the product in hazardous or classified locations. Do not exceed the product ratings or maximum limits. Products rated only for basic insulation must be installed on insulated conductors. Current transformer secondaries (current mode) must be shorted or connected to a burden at all times. Remove all wire scraps, tools, replace all doors, covers and protective devices before powering the equipment.

WARNING

Hazardous Voltage!
Failure to disconnect power before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized.

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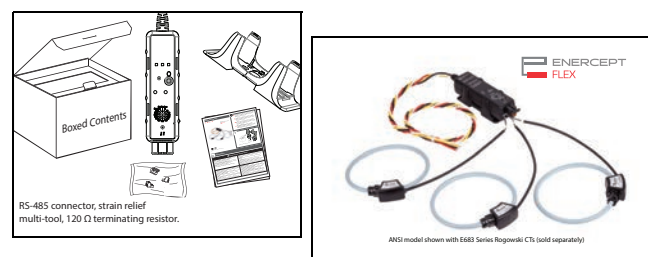
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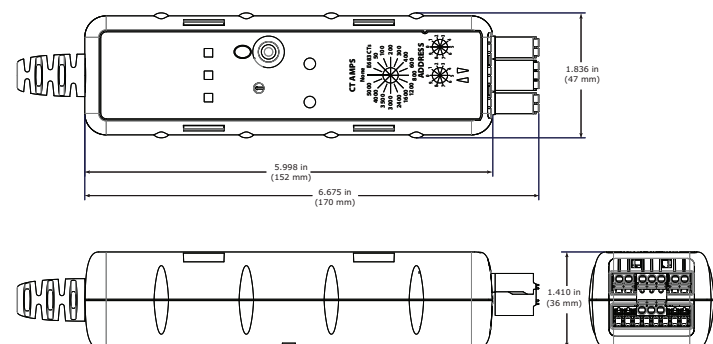
Specifications

Measurement Accuracy:	Real Power and Energy, 1/3 Volt Current Input Mode: IEC 62053-22 Class 0.2S, ANSI C12.20 0.2% Real Power and Energy, Rogowski Current Input Mode: IEC 62053-22 Class 0.5S, ANSI C12.20 0.5% Reactive Power and Energy: IEC 62053-23, Class 2, 2%
Input Voltage Characteristics:	Measured AC Voltage: Minimum 90V _{L-N} (156V _{L-L}) for stated accuracy U.L. Maximum: 480V _{L-L} (277V _{L-N}) CE Maximum: 300V _{L-N} Impedance: 2.5M _Ω _{L-N} /5M _Ω _{L-L} Frequency Range: 45 Hz to 65 Hz
Input Current Characteristics:	Measurement Input Range: 0 to 0.333 Vac (+20% over-range) Impedance: 33 k Ω
Control Power:	AC: Drawn from phase A-B Line-to-line voltage input; 4 VA maximum, 90V _{L-N} minimum U.L. Maximum: 480V _{L-L} (277V _{L-N}) CE Maximum: 300V _{L-N} Ride-through Time: 50 ms @120 Vac
Mechanical Characteristics:	IP Degree of Protection (IEC60529): IP20 Plug Size Wire (I/O communications, CT): 24 AWG to 16 AWG (0.2...1.5 mm ²) Optional Bracket, Rail Mounted: T35 (35 mm) DIN Rail per EN50022 Optional Bracket, Rail Mounted: #10 or MS screws, 2.953 in (75 mm), center-to-center
Operating Conditions:	Operating Temp: -30°C to 70°C (-22°F to 158°F) [Limited to 131°F (55°C) when used with a E683 Rogowski Rope-style CT] Storage Temp: -40° to 85°C (-40° to 185°F) Humidity Range: <95% RH (non-condensing) Altitude of Operation: 3 km maximum Pollution Degree: 2
Metering Category:	U.L.: CAT III; for distribution systems up to 277 V _{L-N} /480 Vac _{L-L} CE: CAT III; for distribution systems up to 300 V _{L-N} Dielectric Withstand: Per U.L. EN61010, EN 61010-1 Conducted/Radiated Emissions: FCC Part 15 Class A, EN61000-6-4/EN61326-1 Class A (Industrial) Conducted/Radiated Immunity: EN61000-6-2, EN61326-1 (Industrial)
Agency Approvals:	U.S./Canada (cULus): U.L. 61010-1 Europe (CE): EN61010-1

5 Components



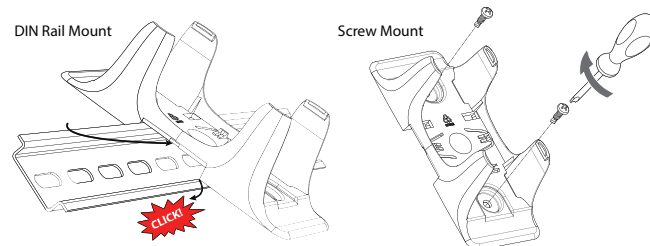
Dimensions



6 Mounting

Use one of the following two methods to mount the strap tunnel.

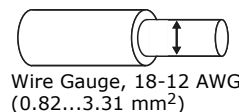
- Hook strap tunnel over top of DIN rail and push down on lower portion of strap tunnel until it snaps onto bottom of the rail.
- Secure the strap tunnel to the wall using two (2) screws.



Wiring



I1+, I1-, I2+, I2-, I3+, I3-, I4+, I4-



Wire Gauge, 18-12 AWG (0.82...3.31 mm²)

7 CT Installation Guidelines:

- Do not install on the load side of a variable frequency drive (VFD).
- To get the correct sign on bi-directional data, observe the load arrow (uni-directional data does not care).
- Ensure to correctly associate CTs with voltage inputs.
- To avoid unwanted energy accumulation, short unused CT inputs or, on communicating models, configure the correct system type to disable unused inputs.
- Insert optional strain relief tool into the two-hole opening above the RS-485 connector. Both CT and communications wires may be zip-tied to the tool for additional wire strain relief.

Symbols

Refer to the following symbols used in the wiring diagrams.

	Voltage Disconnect Switch
	Fuse <i>Note: Installer is responsible for ensuring compliance with local requirements.</i>
	Earth Ground
	Current Transducer (CT)
	Potential Transformer
	Winding
	Protection containing a voltage disconnect switch with a fuse or disconnect circuit breaker. The protection device must be rated for the available short circuit current at the connection point.

System Types

Type	Direct Connect Maximum Voltage	Type	Direct Connect Maximum Voltage
10 U.L. = ≤277 VLN IEC = ≤277 VLN		31 U.L. = ≤480 VLL IEC = ≤480 VLL	
11 U.L. = ≤277 VLL IEC = ≤400 VLL		31 U.L. ≤277 VLL IEC = ≤277 VLL	
12 U.L. = ≤240VLN/480 VLL IEC = ≤240VLN/480 VLL		40 U.L. = ≤277VLN/480 VLL IEC = ≤277VLN/480 VLL	
		40 U.L. = ≤277VLN/480 VLL IEC = ≤277VLN/480 VLL	

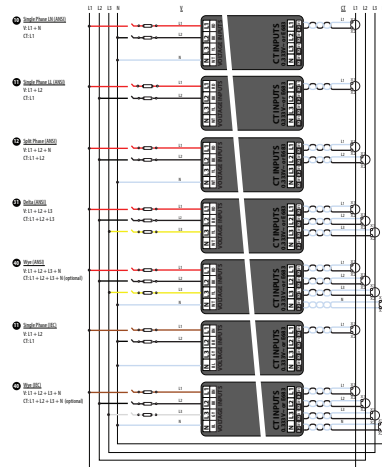
WARNING
Hazardous Voltage and Equipment Damage!
 Failure to disconnect power before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects before servicing. CT terminals are referenced to neutral on the meter and may be at elevated voltages. Do not contact meter terminals while the unit is connected. Do not connect or short other circuits to the CT terminals.

Wiring, Single Phase

Refer to the following diagram for fuse selection, voltage connection, and disconnection.
Note: Neutral (N) may be clipped and capped if not needed. Meter control power is derived from voltage between phases L1 and L2. The meter will not operate when using only phase L1 and N.

Fuse Recommendations

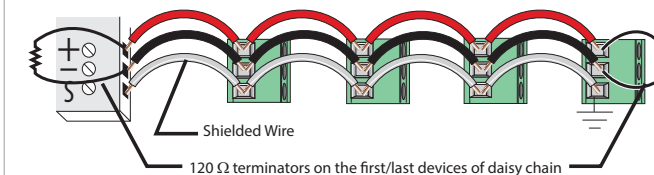
- Keep the fuses close to the power source.
 For selecting fuses and circuit breakers, use the following criteria:
- Select current interrupt capacity based on the installation category and fault current capability.
 - Select over-current protection with a time delay.
 - Use a voltage rating sufficient for the input voltage applied.
 - Provide over-current protection and disconnecting means to protect the wiring. For AC installations, use Trane AH04 (X13651691001) or equivalent. For DC installations, provide external circuit protection.
 - Suggested: 0.5A, time delay fuses rated for DC operation at or above the supply voltage.
 - Use the earth connection (G) for electromagnetic compatibility (EMC), not a protective earth ground.



RS-485 Communication

The meter listens on the RS-485 bus to determine the baud rate, parity, and protocol and then configures itself to match (auto-baud and auto-protocol). This typically takes a dozen packet receptions. When the meter is listening to determine the baud rate and protocol, the Rx LED will flash yellow. If the meter is power-cycled when the meter has been communicating in Modbus RTU mode, it will remember the baud rate, parity, and Modbus protocol when power is restored. If the meter is power-cycled when communicating in BACnet® TP mode, it will come up in listen mode. If the meter sees numerous CRC or framing errors, it will return to the listening mode (Rx LED flashing yellow).

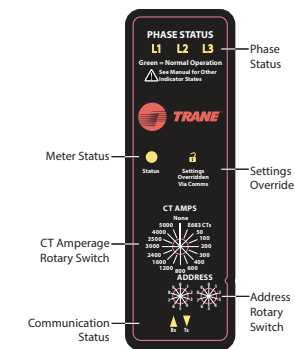
Below shows a daisy chain of devices to the power meter. The RS-485 secondary port allows the power meter to be connected in a daisy chain with up to 63, 2-wire devices.



- Notes:
- The voltage and current ratings on the terminals are compliant with the requirements of the EIA RS-485 communications standard.
 - The RS-485 transceivers are 1/4 unit load or less.
 - RS-485+ has a 47 kΩ pull up to +5V, and RS-485- has a 47 kΩ pull down to Shield (RS-485 signal ground).
 - Wire the RS-485 Bus as a daisy chain from device-to-device, without any stubs. Use 120 Ω termination resistors at each end of the bus (not included).
 - Shield is not internally connected to Earth Ground.
 - Connect Shield to Earth Ground somewhere on the RS-485 bus (only at one point).

- For all terminals on E20 meters:
- When tightening terminals, apply the correct torque: 0.37-0.44 ft-lb (0.5-0.6 N-m).
 - Use 14-24 gauge (2.1-0.2 mm²) wire.

Meter Interface



Interface Readouts

Meter Status	Readout
	Normal operation.
	Error condition.
	Firmware download mode.
Setting Override	Readout
	Meter operating normally and parameters are set on meter front panel
	One or more to the meter interface controls (rotary dials) has been overridden through communications. The rotary dial settings on the meter no longer accurate.

Communication Status

	Meter has received a valid frame.
	Meter is in automatic baud mode and has not yet locked onto a baud rate, parity, and protocol.
	Meter has received a communication error (typically bad CRC or framing error).
	Meter is transmitting.

Phase Status (Bi-directional applications only)

The number of blinks between pauses indicates the Power Factor in tenths. A blink count of 7 would be a Power factor of approximately 0.70 (in the range of 0.65 and 0.75). The length of a blink can also indicate that a CT has been installed incorrectly. If two phases have a long blink and one phase has a short blink and power is being pulled from the grid, this indicates that a CT on the phase with the short blink is likely installed backwards.

- Blink .75 second; power is being imported (for example, taken from the grid).
- Blink .25 second; power is being exported (for example, sent to the grid).

	Power factor greater than 0.70.
	Power factor less than 0.70, but greater than 0.50.
	Power factor is less than 0.50.

Troubleshooting

Problem	Cause	Solution
LEDs do not light.	Meter is not receiving adequate power.	<ul style="list-style-type: none"> Verify that the meter has the required voltage between phase A and B voltage inputs. Verify the Status LED is blinking green. Check the fusing.
Data returned from the meter is inaccurate.	Incorrect setup values.	<ul style="list-style-type: none"> Verify that the CT size entered on the CT Amps rotary control is correct. On communicating meters, check the power meter setup parameters (CT and PT ratings, system type, etc.). See the Configuration Tool, Modbus Point Map or BACnet Objects List.
	Incorrect voltage inputs.	Check power meter voltage input terminals to verify adequate voltage and correct phase connections.
	Power meter is wired improperly.	<ul style="list-style-type: none"> Check all CTs and PTs to verify correct connection to the same service, PT polarity, and adequate powering. Check that the CT and voltage inputs are properly associated (Phase A voltage is connected to the Phase A CT, etc.).
Cannot communicate with power meter from a remote computer.	Power meter address is incorrect.	Verify that the meter is correctly addressed on the address rotary controls (see the Wiring section for more information).
	Baud rate is not supported.	Verify that the baud rate used on the bus is supported by the meter (see "RS-485" on page 10). If the meter cannot determine which baud rate is being used, it will stay in auto-baud mode, blinking amber on the Rx LED.
	Protocol is not supported.	Verify that the protocol used on the bus is supported by the meter (see "User Interface" on page 11). The meter supports Modbus and BACnet TP protocol
	Communication lines are improperly connected.	<ul style="list-style-type: none"> Verify the power meter communications connections (see "RS-485" on page 10). Verify the terminating resistors are properly installed on both ends of a chain of units. Units in the middle of a chain should not have a terminator. Verify biasing resistors are installed on a single place on the bus. Verify the shield ground is connected between all units. Verify the shield ground is connected to earth at a single point on the bus.

Meter Initial Setup

Incorrect CT polarity (bi-directional applications only)	CT orientation incorrectly installed toward the load.	The user sets bits to invert the polarity of individual CT inputs (see Modbus register 4174). Inverting the CT polarity changes the sign (direction of energy flow) of real (active) power (in watts) reported for that phase in the bi-directional data set. It will also change the lead or lag indication reported by the sign of reactive power (VAR) in the bi-directional data set
Incorrect voltage to CT orientation.	The phase CT is not on the same wire that is connected to voltage input for that phase. The reported real (active) power will be inaccurately low and the reactive power high, resulting in a low Power Factor warning or alarm (see LED section and Error Bitmap Modbus register 4196).	The CT inputs may be re-assigned to different phases (see Modbus registers 4175 to 4177). Both the power and energy calculations in the uni- and bi-directional data sets will be rendered inaccurate by incorrect voltage-to-CT association. Note that the order of the phases does not affect the total energy calculated for the circuit, so it is not necessary to fix phase order, just voltage-to-CT association to obtain a correct power and energy calculation

Meter Initial Setup

- Use the CT Amperage Rotary Switch to select the rating (in amps) of the 1/3-volt CTs or the E683 Rogowski rope-style CTs to be attached to the meter. If the correct size is not on the list, use the next higher value, or a precise value may be configured over the communications port (if equipped).
- Use the Address Rotary Switches to configure the meter to an address in the range of 1 to 99 for Modbus or 0 to 99 for BACnet® (MAC) that is unique on the bus. The left rotary is the most significant digit, and the right is the least significant.
- Insert the long end of the strain relief tool (shown below) into the rotary pots and turn to the desired setting. Advanced Configuration Options Download the configuration tool or configure yourself using the Modbus Point Map and BACnet Object List. All available at www.trane.com



China RoHS Compliance Information

Part Name	Hazardous Substances					
	Pb	Hg	Cd	Cr, VI	PBB	PBDE
Electronic	X ^(a)	O ^(b)	O	O	O	O

(a) X indicates that concentration of hazardous substance in at least one of the homogeneous materials used for this part is above the limit as stipulated in GB/T 26572.
 (b) O indicates that the concentration of hazardous substance in all of the homogeneous materials for this part is below the limit as stipulated in GB/T 26572.

Additional Resources

- Enercept FLEX Compact Power and Energy Meter Product Data Sheet, BAS-PRD034.
- Quick Installation Guide, Z207411-0A 0217.



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