CONTENTS

INTRODUCING THE ENERCEPT METER

The Enercept® meter is the ideal cost-effective solution for standard energy metering applications. It combines easy-to-install split-core CTs and highly accurate digital metering and communications electronics in the same package. This unique design (patent applied) eliminates the need for a separate meter enclosure or to disconnect conductors, and it greatly reduces installation costs.

There are two models of the Enercept meter: basic and enhanced. These application specific meters differ in the amount of information they report. The basic model reports power and energy, while the enhanced model provides multiple parameters, including power, demand, energy, amps, volts, power factors, and reactive power.

The Enercept meter uses the Modbus RTU 2-wire communications protocol and can be networked with POWERLOGIC® devices. Using System Manager™ software, you can present information from the Enercept meter in tabular or graphic formats, as well as generate alarms, historical logs, trends, and reports.

The Enercept meter provides ANSI C12.1 metering accuracy and is UL and cUL listed, making it ideal for many applications, including:

- Departmental costing in commercial and industrial facilities
- Real time power monitoring
- Energy management and performance contracting
- Power equipment planning
- Motor control center monitoring
- Cooling plant optimization
- Tenant submetering for commercial tenants

SAFETY PRECAUTIONS

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, BURN, OR EXPLOSION.

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.
- Turn off all power before installing or removing this device.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Before performing visual inspections, tests, or maintenance on this equipment, turn off all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, grounded, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.

Failure to observe these precautions will result in death, severe personal injury, or equipment damage.

HARDWARE DESCRIPTION

① Voltage Leads

Figures 3–6 on pages 6 and 7 show how to connect the leads to the source to be monitored. Input range is 208 to 480 V line to line.

② Mandatory Fuse Per NEC

Maximum current draw is 60 mA. Fuses providedby factory are rated 1/2 A. 200 K AIC. Replace only with fuses of same type and rating.

③ Modbus RS-485 Port

Connect to Modbus network. Figure 7 on page 8 shows how to connect RS-485 communication wires.

④ Status LED

The LED blinks green when the product is functioning normally. It blinks slowly, approximately one second on, then one second off. If the LED is red and blinking slowly, it may indicate incorrect wiring or a power factor that is less than 0.5. If the LED is red and blinking quickly, the CT's maximum current rating has been exceeded.

⑤ Address Selection Switches

Each Modbus device on a communication string must have a unique address. Set these switches before connecting the device.

NOTE: If an address is selected that conflicts with another device, both devices will be unable to communicate.

⑥ External CTs

External CTs are permanently attached and must not be disconnected or used with other meters.

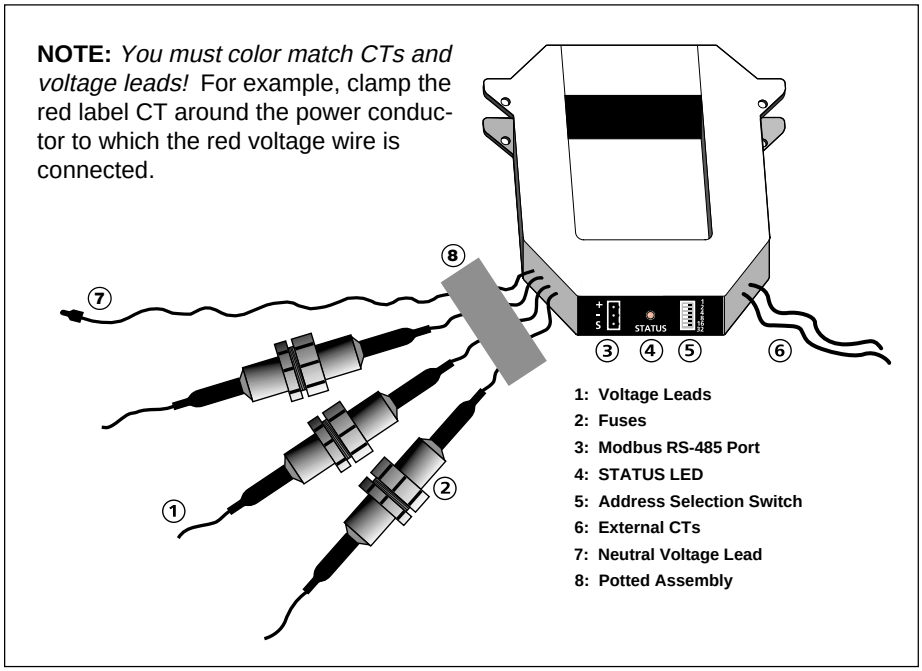

Figure 1: Diagram of typical Enercept meter

INSTALLING AND WIRING THE METER

⚠ DANGER

HAZARD OF PERSONAL INJURY OR DEATH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- Turn off all power before installing or removing the device.
- Before performing visual inspections, tests, or maintenance on this equipment, turn off all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, grounded, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.

Failure to observe these precautions will result in death, severe personal injury, or equipment damage.

To install the Enercept meter, complete the following steps:

1. Each Modbus device on a communication string must have a unique address. Before connecting the meter to the RS-485 communication wires, choose an address that is not in use, and set the switches as shown in figure 2, page 5. If the address conflicts with another device, neither device will communicate.
2. Turn off power, verify power is off with a properly rated voltage sensing device, and lock-out all power sources during installation.
3. Connect the voltage leads to the phase conductors, based on system type, as shown in figures 3–6 on pages 6 and 7. Connect the red lead to Phase A, the black lead to Phase B, and the yellow lead to Phase C.

   For 4–wire systems, remove the end cap of the white wire prior to installation. For 3–wire systems, leave the white wire capped and coiled.

   NOTE: The meter does not communicate on the network bus without power. Without power to the meter, POWERLOGIC software will report a communication error, and the Enercept Display Interface will display asterisks for that particular meter.
4. Install CTs on conductors. Each CT must be installed on the same conductor as the correspondingly colored voltage lead. (See wiring diagrams on pages 6–7.) The unit will automatically detect phase reversal, so it is not important to orient a particular side of each CT toward the load.
5. Attach the RS-485 communication wires to the terminal block as shown in figure 7, page 8. Then plug the terminal block into the red CT. (See Appendix C for additional communications information.)

   Insulate any exposed wiring. Ensure that insulation complies with local and national electrical codes.

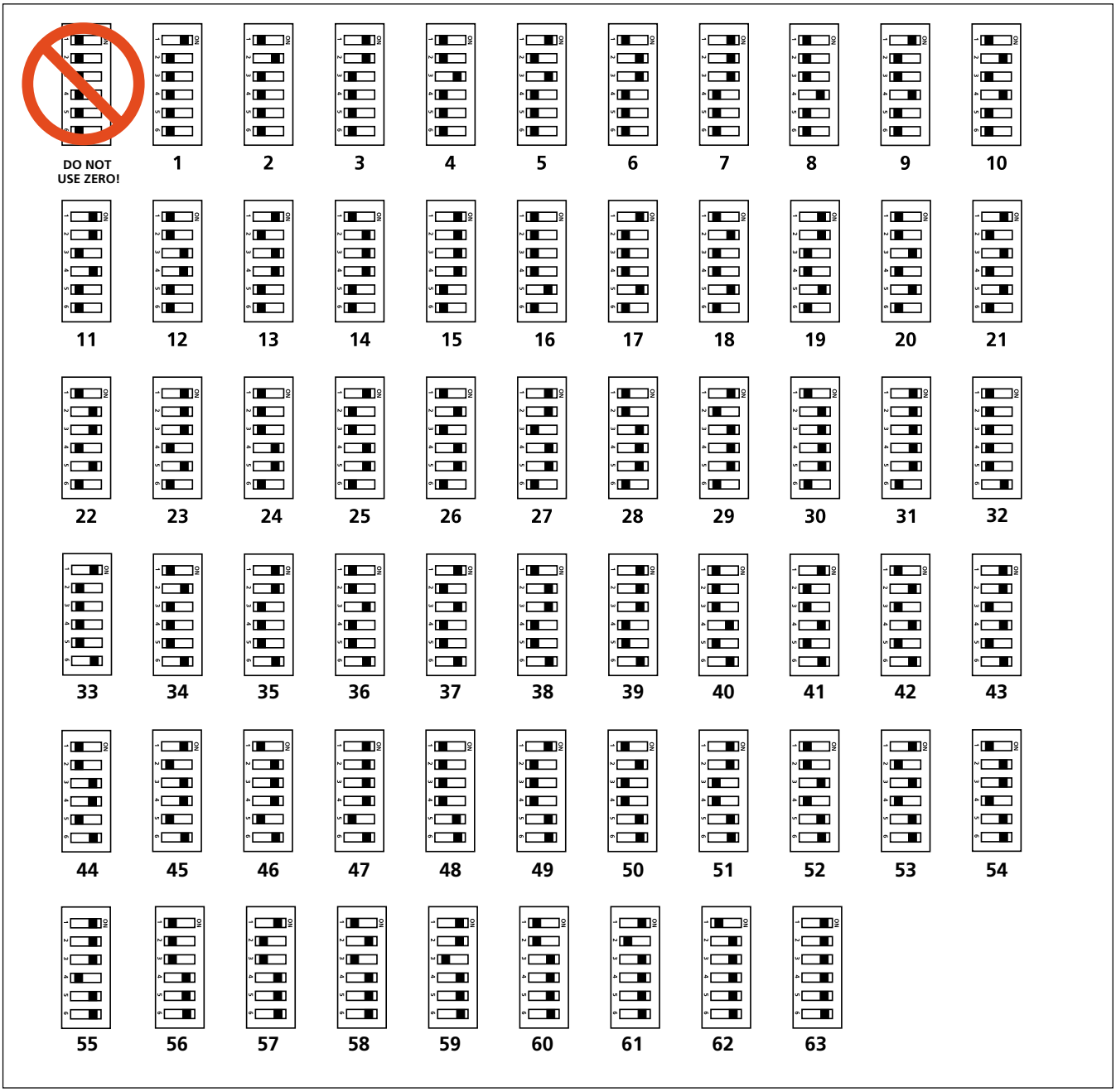

Figure 2: Address selection switches

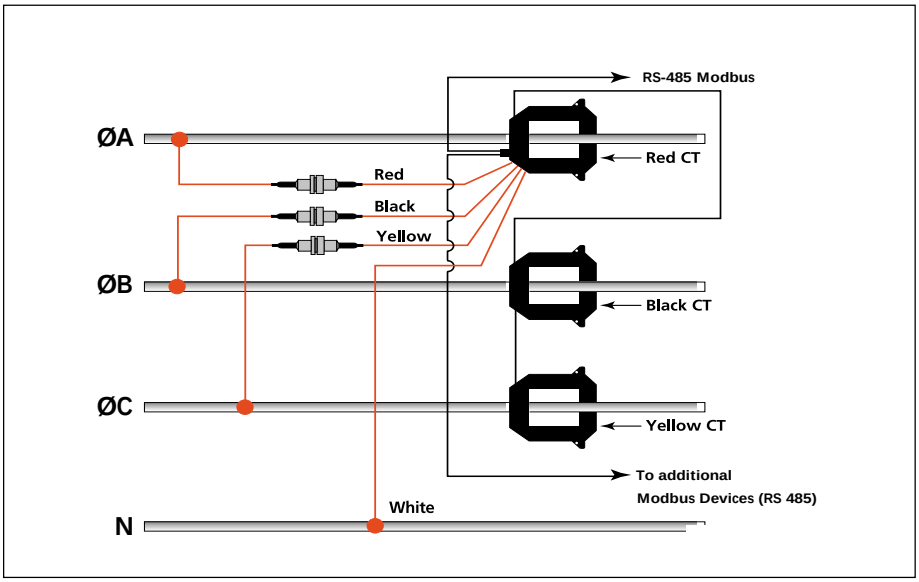

Figure 3: Typical 480 Vac max., 3Ø, 4-wire installation

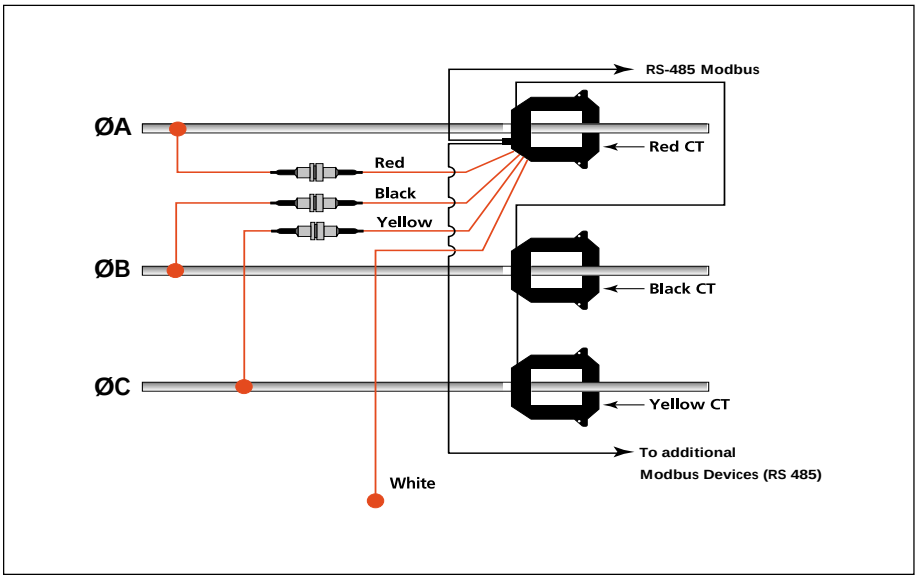

Figure 4: Typical 480 Vac max., 3Ø, 3-wire installation

CAUTION

HAZARD OF EQUIPMENT DAMAGE

When monitoring devices controlled by variable frequency drives always install the Enercept meter(s) on the line side (NEVER the load side) of the variable frequency drive.

Failure to observe this precaution will result in equipment damage.

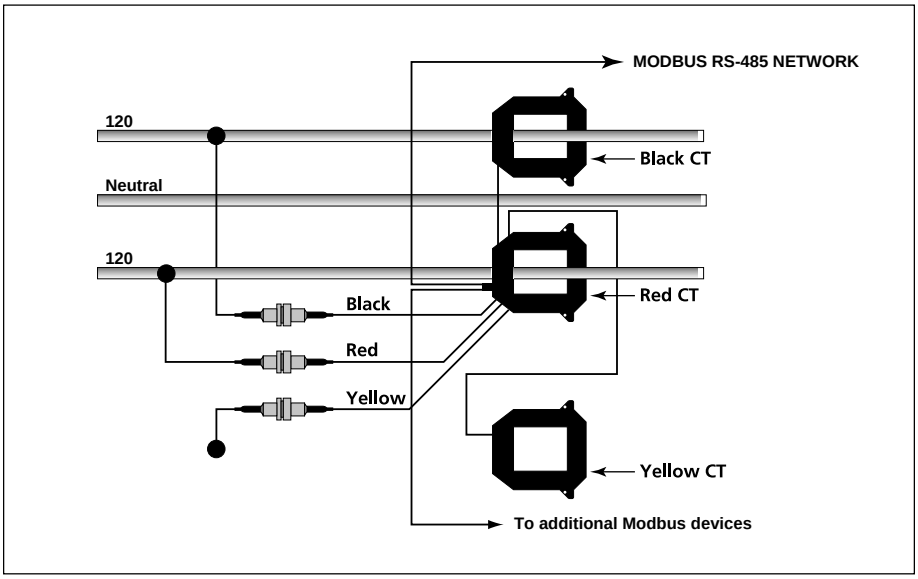

Figure 5: Typical 240/120 VAC 1Ø, 3-wire installation

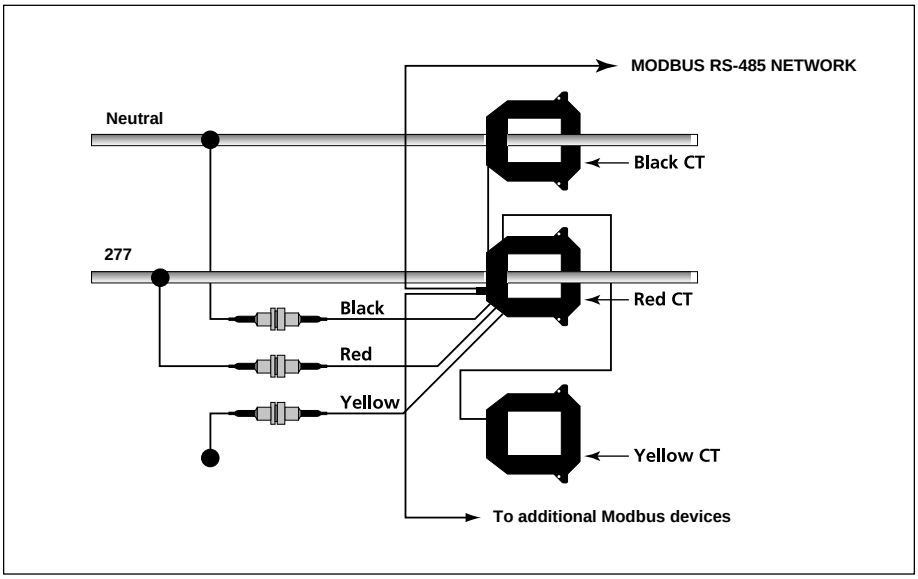

Figure 6: Typical 277 VAC 1Ø, 2-wire installation

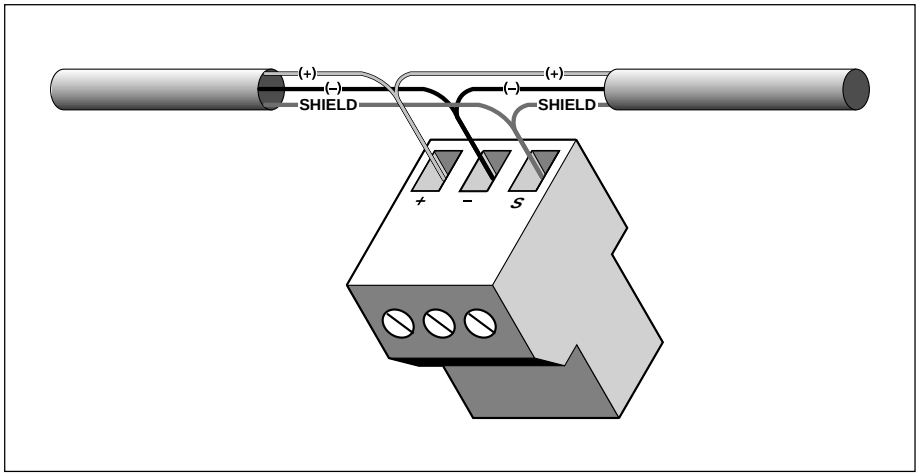

Figure 7: Wiring the RS-485 terminal block

NOTES:

1. *Do not ground the shield inside the electrical panel. Insulate all Modbus wires, including the shield, to prevent contact with high voltage conductors.*
2. *Secure the Modbus cable where it enters the electrical panel.*
3. *Connect all Modbus devices together in a daisy chain.*
4. *Use a shielded, twisted pair wire (e.g., BELDEN 1120A) or similar type wire for Modbus cables.*
5. *Up to 32 Modbus devices can be connected together on a daisy chain. Additional devices may be connected to the daisy chain if an RS-485 repeater is used.*
6. *See Appendix C for additional communications information.*

TROUBLESHOOTING

Problem: STATUS LED does not blink.

Solution: Check fuses and voltage connections. STATUS LED should blink regardless of CTs, Modbus connections, and DIP switch settings.

Problem: Status LED does not blink, and the unit is wired on the load side of an adjustable frequency drive.

Solution: The unit's thermal fuse within the potted assembly has done its job. The unit must not be installed on the load side of an adjustable frequency drive. Please review Caution notice on page 6.

Problem: Enercept meter interferes with another Modbus device on the communication string.

Solution: Set DIP switches to a Modbus address which is not in use.

Problem: Readings seem highly inaccurate.

Solution:

- Check that each CT is installed on the conductor with the corresponding color voltage input lead attached. In most cases, incorrect wiring will cause the STATUS LED to blink RED (slowly). However, a power factor lower than 0.5 could cause the LED to blink this way, even if the unit is installed properly.
- It does not matter which side of the CTs face toward the load.
- Check actual current with a clamp-on ammeter.

  Expected power is:

  kW = Volts x Amps x 1.732 x PF ÷ 1000

  kW = Horsepower x .746

  PF is usually 0.7 to 0.95, depending on the nature of the load.
- Compare this to the kW.
- If current is below 1–2% of full scale maximum for the CT, an Enercept meter with a smaller CT rating is probably needed.

Problem: Meter is off-line when load is switched off.

Solution: The Enercept meter cannot communicate without voltage.

Problem: STATUS LED blinks red.

Solution:

- If the LED blinks quickly, approximately 5 blinks in 2 seconds, the CT used is too small. A larger CT current rating is required.
- If the LED blinks slowly (approximately 1 blink in two seconds), the CTs are not installed on the correct conductors, or the load's power factor is less than 0.5. The meter can measure these low power factors, but few loads normally operate at such a low power factor.

APPENDIX A—SPECIFICATIONS

Specifications for Basic Enercept Meter

Input primary voltage	208 to 480 Vac line to line
Number of phases monitored	One or Three
Frequency	50/60 Hz
Maximum primary current	2400 amps cont. per phase
AIC rating	100,000 kAIC
Internal isolation	2000 Vac rms
Case insulation	600 Vac
Temperature range	0 to 60° C
Humidity range	0–95 % non-condensing
Accuracy†	±1.0 %
Communications	RS-485, 2 wire plus shield, 9600 Baud, no parity
Protocol	Modbus RTU
Data for output	Energy, kWH
	Real Power, kW, total
Current transformer	Split core, 100, 300, 400, 800, 1600, or 2400 amps

Specifications for Enhanced Enercept Meter

Input primary voltage	208 to 480 Vac line to line
Number of phases monitored	One or Three
Frequency	50/60 Hz.
Maximum primary current	2400 amps cont. per phase
AIC rating	100,000 kAIC
Internal isolation	2000 Vac rms
Case insulation	600 Vac
Temperature range	0 to 60° C
Humidity range	0–95 % non-condensing
Accuracy†	±1.0 %
Communications	RS-485, 2-wire plus shield, 9600 Baud, no parity
Protocol	Modbus RTU
Data for output	Energy, kWh
	Real Power, kW, per phase and total
	Demand, kWD
	Reactive Power, kVAR
	Apparent Power, kVA
	Power Factor, per phase and total
	Current, A, per phase and average
	Voltage, V, L-N, per phase and average
	Voltage, V,L-L, per phase and average
Current transformer	Split core, 100, 300, 400, 800, 1600, or 2400 amps

† Meter accuracy specified with conductors centered in CT window

APPENDIX B—DIMENSIONAL DRAWINGS

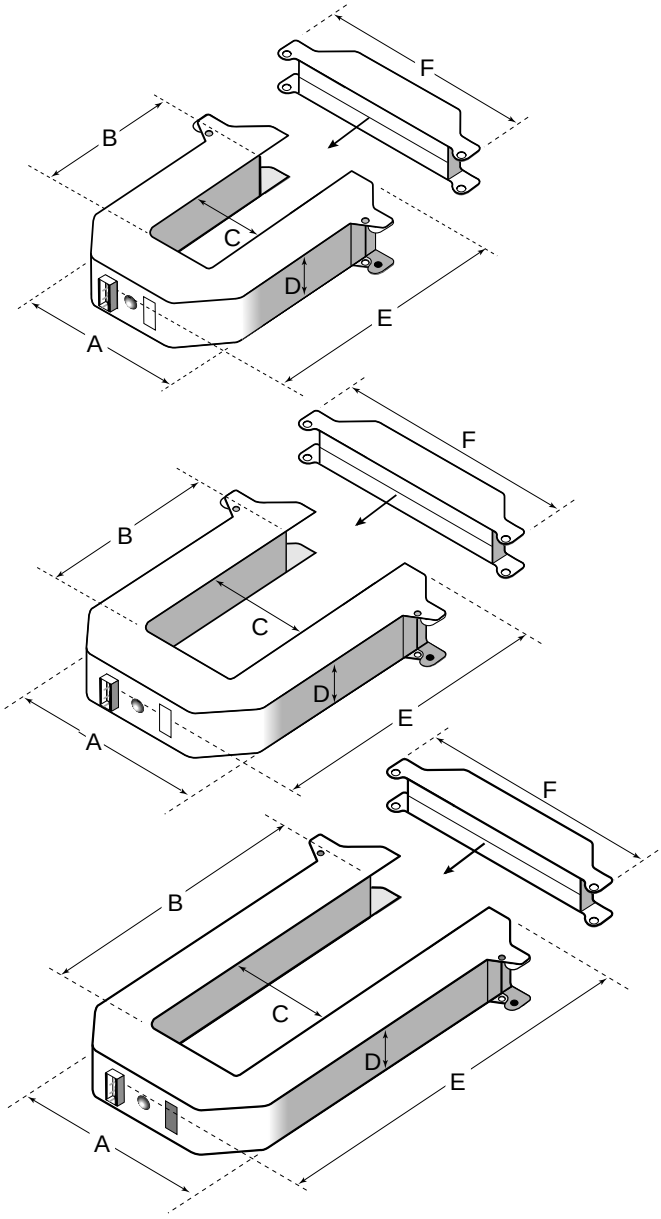

Figure 8: Enercept meter dimensions

SMALL 100 Amp 300 Amp	MEDIUM 400 Amp 800 Amp	LARGE 800 Amp 1600 Amp 2400 Amp
A = 3.75" (95 mm)	A = 4.90" (124 mm)	A = 4.90" (124 mm)
B = 1.51" (38 mm)	B = 2.89" (73 mm)	B = 5.50" (140 mm)
C = 1.25" (32 mm)	C = 2.45" (62 mm)	C = 2.45" (62 mm)
D = 1.13" (29 mm)	D = 1.13" (124 mm)	D = 1.13" (29 mm)
E = 3.91" (99 mm)	E = 5.20" (124 mm)	E = 7.88" (200 mm)
F = 4.75" (121 mm)	F = 5.91" (150 mm)	F = 5.92" (150 mm)

APPENDIX C—COMMUNICATIONS

CONNECTING TO A PC's SERIAL PORT

Enercept meters can be connected to a serial communications port on a personal computer (see figure 9). To do this, connect the meters to an RS-232 to RS-422/RS-485 converter, which is connected to the personal computer. Square D offers a converter for this purpose (P/N 3050 2W485C).

Connect up to 32 2-wire Modbus devices. See "Length of the Communications Link" below for limitations on the length of the daisy-chain. Terminate the last device on the daisy-chain. See "Terminating the Communications Link" on page 14.

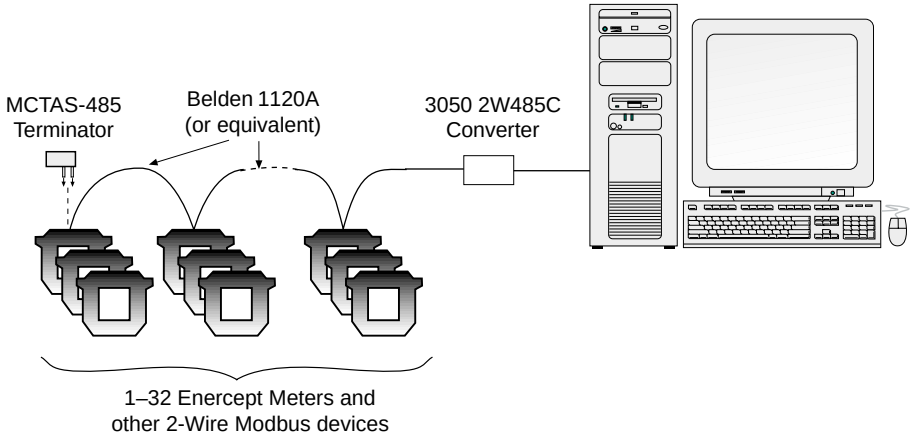

Figure 9: Enercept meters connected to a PC's serial port.

LENGTH OF THE COMMUNICATIONS LINK

The length of the communications link—that is, the total length of the communications cable from the personal computer or interface to the last device on the daisy-chain—depends on the number of devices on the daisy-chain. For a daisy-chain with 1–16 devices operating at 9600 baud, the maximum length is 10,000 ft. (3,048 m). For a daisy-chain with 17–32 devices, the maximum length is 4,000 ft. (1,219 m).

DAISY-CHAINING DEVICES

Each Enercept meter has a 3-position plug-in RS-485 terminal block (figure 11) for connection to a 2-wire Modbus communications link. On the Enercept meter, the communications connections are labeled +, –, and S (shield). To create the communications link, daisy-chain devices using a twisted, shielded pair wire such as Belden 1120A.

NOTE: Enercept meters communicate via 2-wire RS-485 communications with no parity. POWERLOGIC circuit monitors and power meters communicate via 4-wire RS-485 communications with even parity. You can add Enercept meters to a POWERLOGIC communications link using a 4-wire to 2-wire converter (see figure 10). Square D offers an Enercept Network Adapter (3020 ENA485) and an Enercept Display Interface (3020 EDI32), either of which can be used to add Enercept meters to a POWERLOGIC network. Refer to the instructions with the ENA and EDI for additional information.

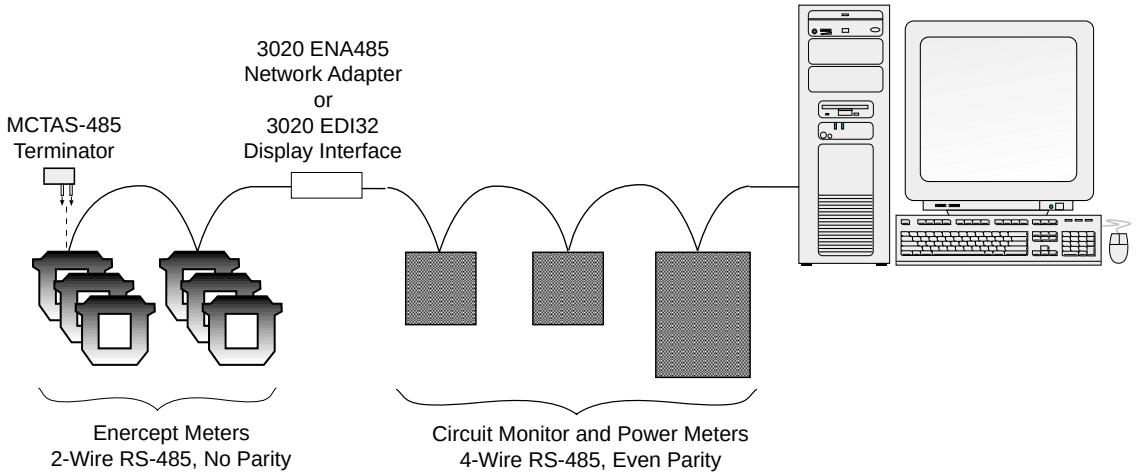

Figure 10: Enercept meters added to a 4-wire communications link with an Enercept Network Adapter or an Enercept Display Interface.

To daisy-chain an Enercept meter to another Enercept meter or 2-wire Modbus device, do the following:

1. Strip back the cable sheath 2” (51 mm) on each end of the cable, and strip back the insulation 0.25” (6 mm) from the end of each wire.
2. Wire the + terminal of the Enercept meter to the + terminal of the next device, wire the – terminal to the – terminal, and wire shield to shield (see figure 11).

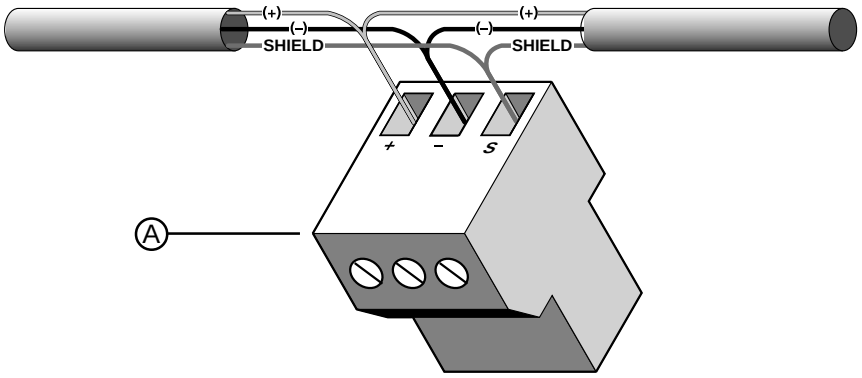

Figure 11: Connecting communications wires to the RS-485 terminal block

TERMINATING THE COMMUNICATIONS LINK

To ensure reliable communications, terminate the last device on the RS-232 communications link (see figures 9 and 10). If an Enercept meter is the last device on the communications link, terminate it as follows:

1. Using a wire clipper, clip off two of the four wires on the MCTAS-485 terminator (figure 12, B). It does not matter whether you clip the left pair or right pair.

2. Insert the two remaining wires into the + and – holes on the Enercept meter's removable RS-485 terminal block (figure 12, A).
3. Using a small flat blade screwdriver, tighten the connector's screws.
4. Plug the communications connector into the communications port of the last meter on the daisy-chain.

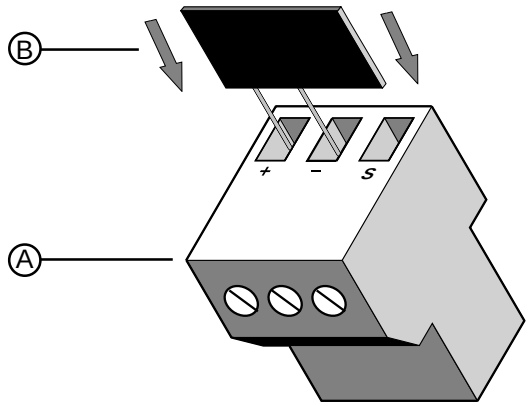

Figure 12: Installing the MCTAS-485 terminator.

USING ENERCEPT METERS WITH POWERLOGIC SYSTEM MANAGER SOFTWARE (SMS)

The Enercept Meter Device Support Install is available for SMS 3.1 and newer versions. This device support provides communications setup and viewing capabilities within tables, meters, bar charts, and trending.

The following rules apply when using Enercept in an SMS system:

1. When using the Enercept meter on the same daisy chain as the device using POWERLOGIC protocol (circuit monitors and power meters), address 16 must not be used for the Enercept meters, and address 0 or 1 must not be used for the POWERLOGIC protocol devices.
2. POWERLOGIC circuit monitors on the same daisy chain as Enercept meters must have firmware version17.008 or above.
3. The Enercept meter provides an unsigned value for power factor.

   Since the "Instantaneous Readings" table recognizes only a signed register for power factor, the value for Enercept meters will be shown as "N/A." An "Enercept Power Factor Summary" table is available.
4. To reset kWHRS or Peak Demand (kWD), go to Read/Write Registers (Control > Diagnostics > Read/Write Registers).

   To reset kWh, choose the Enercept meter that you want to reset. Input register #39 and a value of 2. Then click on the "Write" button. To reset peak demand, input register #39 and a value of 4. Then click on the "Write" button.

APPENDIX D—REGISTER LIST

Enercept Meter Enhanced Version, 3020 Exxx Point Map:

Configuration Registers:

Register	Description
36	System Type. 20 = Single Phase, 2 Wire 21 = Single Phase, 3 Wire 30 = Three Phase Delta 40 = Three Phase Wye
37	Sub-Interval Length. Sets the length of a sub-interval. Value is the number of seconds times 5 (for example, 15 minutes is 4500). For sync-to-comms, set this to zero.
38	Number of sub-intervals per demand interval. Sets the number of sub-intervals that make a single demand interval. Legal values are 1 to 6. For block demand, set this to 1.
39	Command (bit mapped). bit 0 (mask 1) = Begin new demand sub-interval bit 1 (mask 2) = Clear kWH accumulator bit 2 (mask 3) = Reset peak demand

Floating-point Register	Description	Units
257–258	Energy Consumption	kWH
261–262	Real Power	kW
263–264	Reactive Power	kVAr
265–266	Apparent Power	kVA
267–268	Total Power Factor	
269–270	Voltage, line to line, average of 3	Volts
271–272	Voltage, line to neutral, average of 3	Volts
273–274	Current, average of 3	Amps
275–276	Real Power, phase A	kW
277–278	Real Power, phase B	kW
279–280	Real Power, phase C	kW
281–282	Power Factor, phase A	
283–284	Power Factor, phase B	
285–286	Power Factor, phase C	
287–288	Voltage, phase A-B	Volts

289–290	Voltage, phase B-C	Volts
291–292	Voltage, phase A-C	Volts
293–294	Voltage, phase A-N	Volts
295–296	Voltage, phase B-N	Volts
297–298	Voltage, phase C-N	Volts
299–300	Current, phase A	Amps
301–302	Current, phase B	Amps
303–304	Current, phase C	Amps
305–306	Present Demand Sub-Interval	kW
307–308	Minimum demand	kW
309–310	Maximum demand	kW
311–312	Present Demand	kW
313–314	Peak Demand	kW
317–318	CT Size (100, 300, etc.)	Amps
319–320	Count of KWH resets	
321–322	Count of Peak Demand Resets	
323–324	Count of Sub Intervals	
325–326	Count of number readings in present sub-interval	

Enercept Meter Basic Version, 3020 Bxxx Point Map:

The Basic Version is the “energy-only” version of the meter, which provides only energy consumption and real power.

Configuration Registers:

Register	Description
39	Command (bit mapped) bit 1 (mask 2) = Clear kWH accumulator

Floating-point Register	Description
257–258	Energy Consumption, kWH.
261–263	Real Power, kW
317–318	CT Size
319–320	Count of KWH resets

Bulletin No. 63230-216-200/A1
6/2000

Instruction Bulletin

PowerLogic®

Enercept® Meter

Class 3020

SQUARE D

NOTICE

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.


The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE: Electrical equipment should be installed, operated, serviced, and maintained by qualified electrical personnel. This document is not intended as an instruction manual for untrained persons.

FCC NOTICE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designated to provide reasonable protection against harmful interference when the equipment is operated in a commercial 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 is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.