

Polaris 1500

User's Manual



Polaris 1500 User's Manual

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


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Safety Precautions

Please read these safety instructions before using this equipment.

For safety purposes, please observe the following when unwrapping and installing the package :

1. When opening the package, check that the contents have not been damaged during transit.
2. Check to make sure that the product model and the labeling on the outside of the packaging are consistent.
3. This product is designed for and suitable for most electrical power panels.
4. Do not install this product at the openings of ventilation ducts or near heat sources.
5. Make sure that the actual wiring conforms to the wiring diagram designated in this manual.
6. Guard against dust and water damage.
7. Make sure all power sources to be connected to the product have been shut off before installing.
8. If the equipment is used in a manner not specified by manufacturer, the protection provided by the equipment may be impaired.

	This symbol means double insulation.
	This symbol means to beware of electric shock, turn off all adjacent sources of high voltage during installation.
	This symbol means there is risk of danger.

The Polaris is a sensitive electrical equipment, care should be taken so that the maximum benefit and performance can be derived from the device.

Before cleaning or performing any maintenance on the Polaris, disconnect the device from its power source. The input voltage and current should be either turned off or disconnected.

Cleaning

Use a dry cloth or dry brush to wipe away the dust, or use in conjunction with a vacuum cleaner to suck the dust as it is being wiped away. Do not use any water or other liquid cleaning agents.

Ventilation

Check to make sure that there is sufficient space around the periphery of the Polaris to allow air to circulate. Reposition any extraneous wiring that is on the Polaris.

Maintenance

Check to make sure that the wiring contacts are tight and making good contact, tighten any terminal screws that may have loosened over time from jarring or vibration. Make sure that the wiring contact of each terminal is not touching or shorting adjacent terminals.

Repair

Do not attempt to repair the product or modify the circuitry; contact the product representative or a qualified electrical person if the product requires repair or servicing.

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1 Introduction

1.1 General Description

The Polaris 1500 meter is an electronic kilowatt-hour (kWh) meter that is designed for permanent connection to an electrical service. It is designed for single phase applications and can communicate using the Modbus/RTU protocol through its RS485 interface.

Polaris 1500 meters can be used in 1 phase 2 wire and 1 or 2 phase 3 wire configurations.

1.2 Features

- Revenue-grade accuracy
- Non-volatile memory, the stored data is maintained through power outages
- Use with DAE's dedicated split-core CTs (50~600A). Optional solid-core CTs available in 50~600A.
- Parallel up to three sets of CTs for cumulative reading

1.3 Certifications

- UL/CUL Listed, California CTEP Approved. Certified by independent test lab to exceed ANSI C12.1 national accuracy standards.

1.4 Specifications

Item	Description
Frequency	50/60 Hz
Working Voltage	Derived from A phase
Power Consumption	7VA
Measured Parameters	kWh (default), water meter pulse count (optional)
Operating Environment	-20~50°C (-4~122°F) 0~95%RH (non-condensing)
Accuracy ¹	0.5% from 1% to 100% of rated load
Weight	733g (regular terminal cover) 690g (special terminal cover ²)
Dimensions ²	W 5" x H 7.42" x D 2.24" wall-mount (regular terminal cover) W 5" x H 6.5" x D 2.24" wall-mount (special terminal cover ²)

¹ Based on DAE solid-core CT @ PF=1

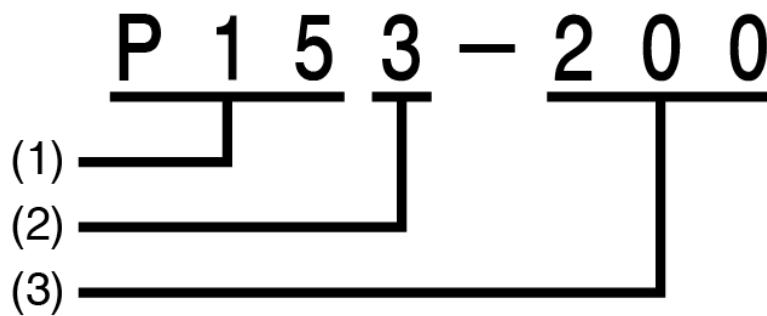
² Please see section 2.5 Conduit and Wire Ingress.

1.5 Communication

Item	Description
Interface	RS485
Protocol	Modbus/RTU
Address	1 to 254 (default is last 2 digits of serial number, 01~99=1~99, 00=100)
Baud Rate	1200, 2400, 4800, 9600 bps (default 9600 bps)
Data Format	8/n/1 (8 data bits, no parity, 1 stop bit)

1.6 Product Information

Polaris 1500 meters model No.



No.	Item	Description
(1)	Series	P15 – Polaris 1500
(2)	Configurations	3 – 1-phase, 2 wire, 120V 1- or 2-phase, 3 wire, 120/208~240V 4 – 1-phase, 2 wire, 208~240V
(3)	CT Rating	200 – 50~200A depends on CT current range 400 – 400A 600 – 600A

Water meter option

Water meter pulse input is an optional feature, which needs to be specified when ordering. The meter with water meter pulse input function will be marked on the label on the left side of the meter.

Current sensor information

Model No.	CT Type	Amp	Compatible with
CT-50S / CT-50SB	Split-core	50A	P153-200, P154-200
CT-100S / CT-100SB		100A	
CT-200S / CT-200SB		200A	
CT-400S		400A	P153-400, P154-400
CT-600S		600A	P153-600, P154-600
CT-50D3	Solid-core	50A	P153-200, P154-200
CT-200D3		200A	
CT-400D6		400A	P153-400, P154-400
CT-600D9		600A	P153-600, P154-600

Current sensor requirement

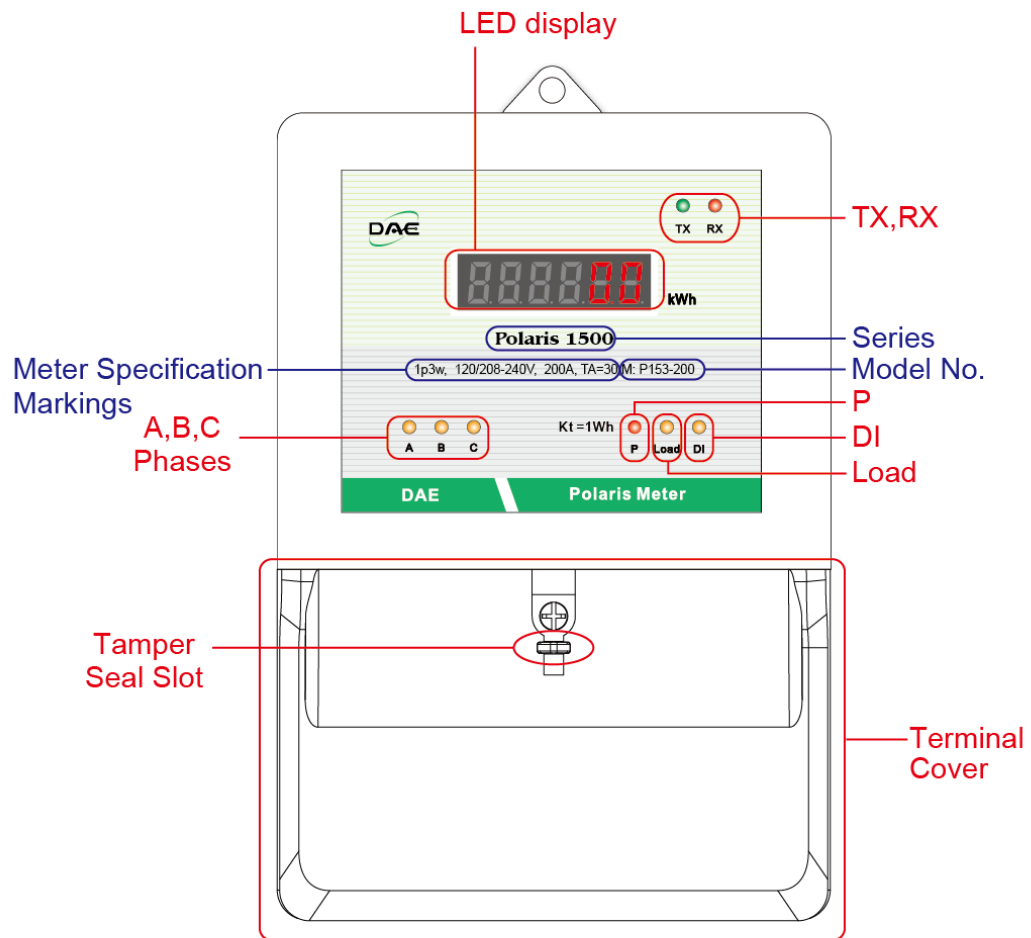
Configuration	CTs Required
1-phase, 2 wire	1 CT
1-or 2-phase, 3 wire	2 CTs

2 Installation

The Polaris is a sophisticated energy meter with multiple capabilities and functions. Before installation be sure to read and understand this section and the appropriate wiring diagrams. Installation of this device must be performed by qualified personnel according to these instructions and in conjunction with all applicable electrical codes. DAE Instrument and its representatives assumes no responsibility for any damage or injury resulting from the improper installation of this equipment.

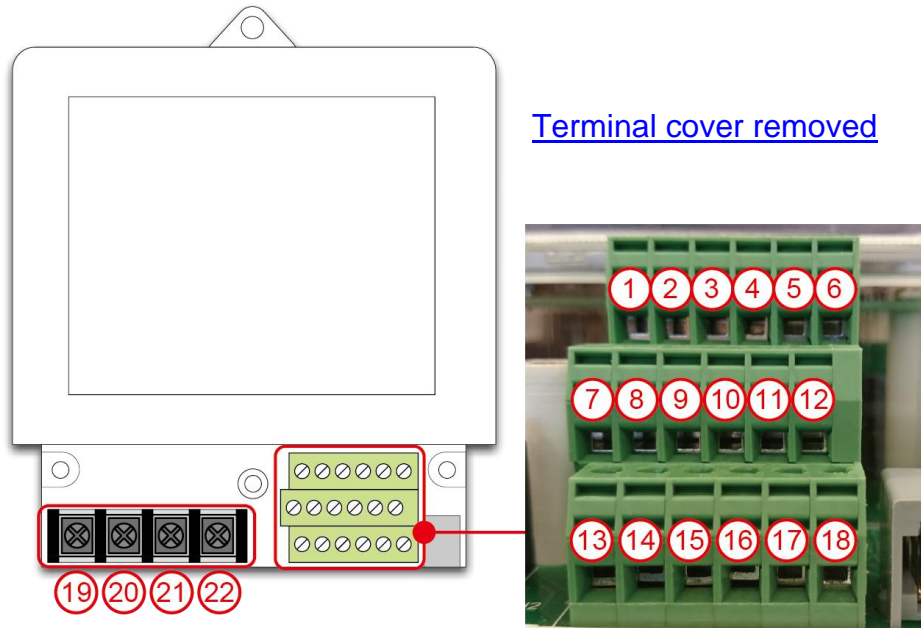
WARNING: Please make sure to read the “Safety Precautions” at the beginning of this manual before starting installation.

2.1 Front Panel



LED display	6-digit primary LCD display for showing kWh and other parameters
TX, RX	RS485 communications transmit and receive activity indicator
A, B, C Phases	A, B, C phase voltage inputs indicator
P	Watthour test constant indicator Kt=1Wh (1000 imp/kWh)
Load	Load status indicator
DI	Water meter pulse input indicator
Terminal Cover	To cover the terminals
Series	Model series
Model No.	This specific model ordering code
Meter Specification Markings	Phase/wire, voltage, max current and test current

2.2 Terminals



Voltage input terminals

(19)	VA	Phase A voltage input
(20)	VB	Phase B voltage input
(21)	VC	Phase C voltage input
(22)	VN	Phase N voltage input

CT input terminals

(13)	CT-A +	Phase A CT + input
(14)	CT-A -	Phase A CT - input
(15)	CT-B +	Phase B CT + input
(16)	CT-B -	Phase B CT - input
(17)	CT-C +	Phase C CT + input
(18)	CT-C -	Phase C CT - input

Communication terminals

(10)	RS485 +	RS485 communication port
(11)	RS485 -	
(12)	RS485-S	

Water meter pulse input terminals (optional)

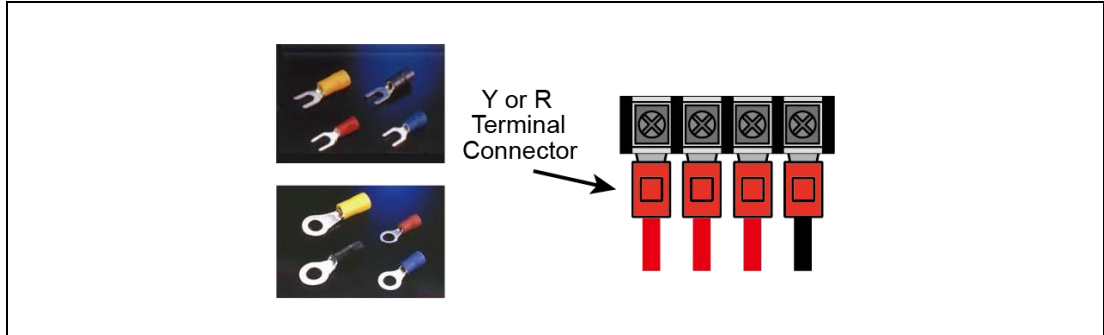
(3)	DI +	Water meter pulse input
(4)	DI -	

Other terminals (1~2, 5~9) are reserved.

Terminal detail

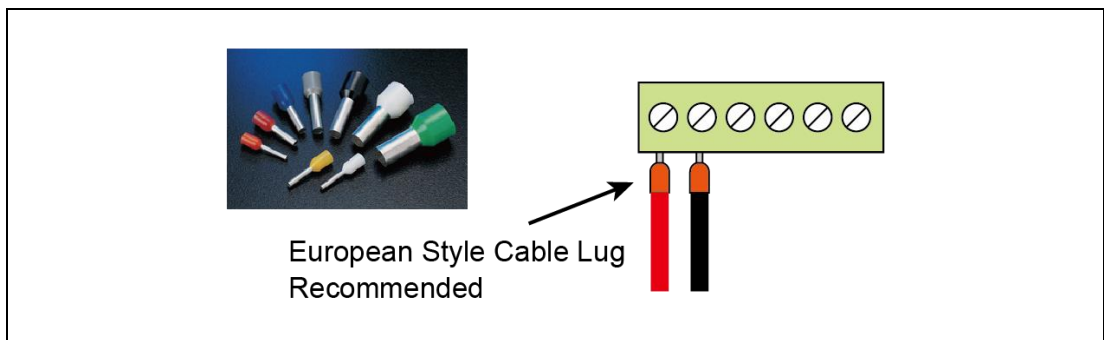
(1) Voltage input terminals

Use the proper size and wire type as per electrical regulations.



(2) Other terminals

Make sure that the wires are screwed tightly onto the terminals and making good contact.



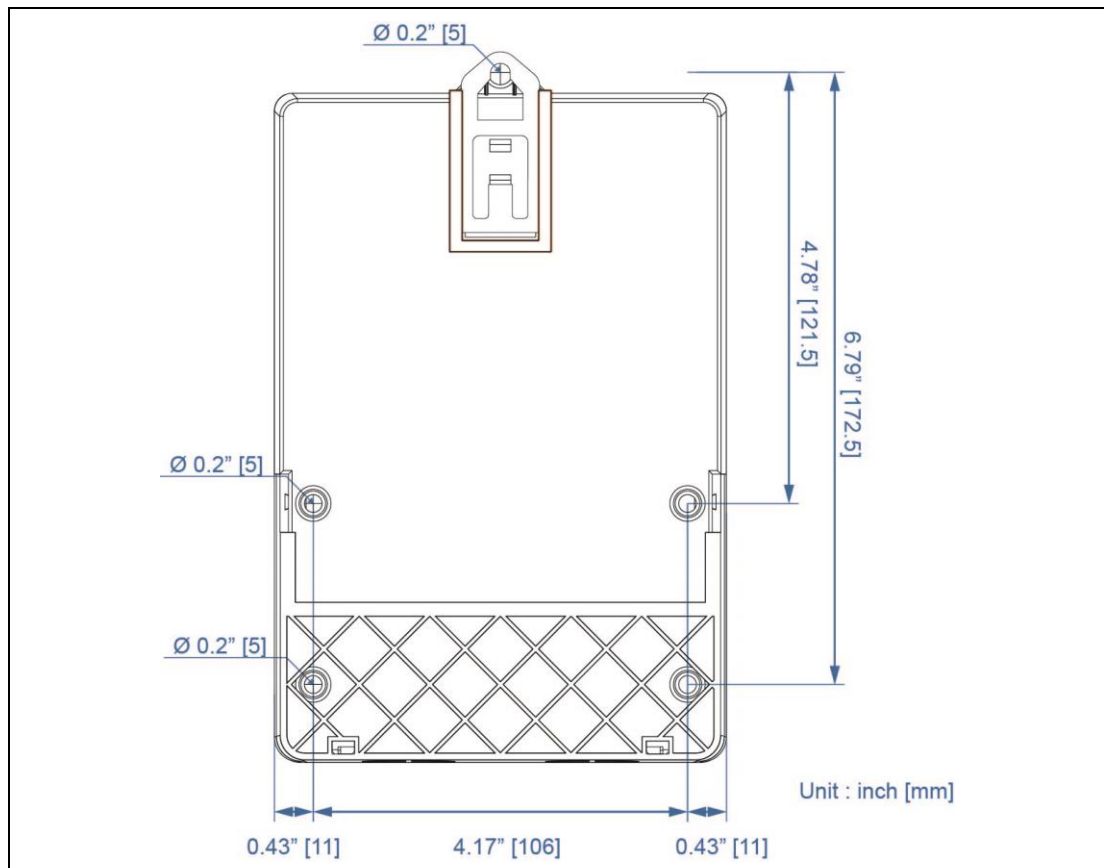
(3) Recommended wire size

Terminal type	Wire range
Voltage input	#18-22 AWG, screw torque 16 lb-inch
CT input	#14-22 AWG, screw torque 5 lb-inch
Communication	#14-22 AWG, screw torque 5 lb-inch
Water meter pulse input	#14-22 AWG, screw torque 5 lb-inch

Note : It is important to make sure to consult your local electrical codes for proper sizing requirements.

2.3 Mounting Procedure

- (1) The Polaris is wall-mounted, drill the screw holes according to the diagram below.
- (2) Place the Polaris flat against the wall making sure that the mounting holes are aligned with the screw holes.
- (3) Secure the Polaris using the screws through the mount holes.



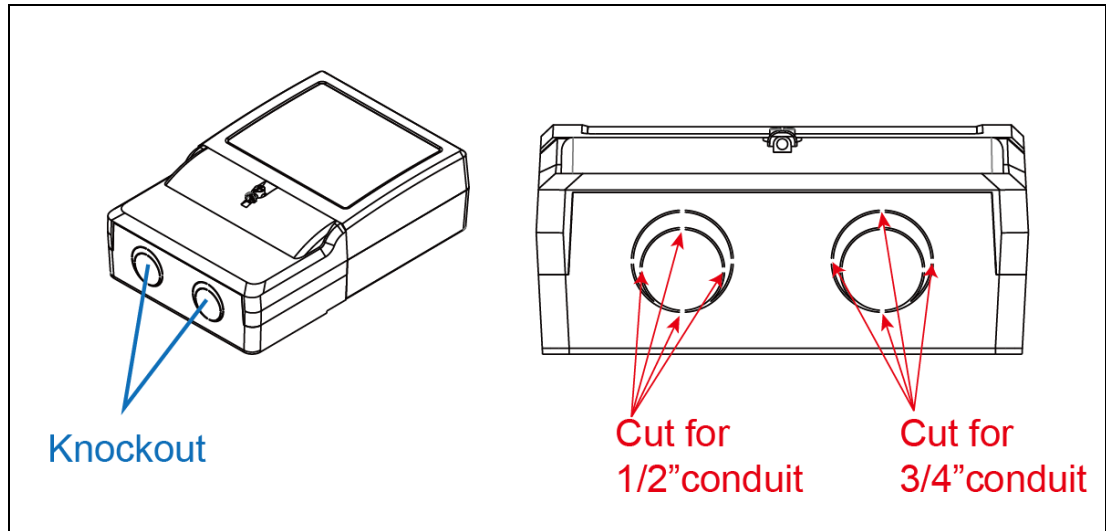
2.4 Before Installation

- (1) Check that the ratings and specifications of the model to be installed is suitable for its intended application.
- (2) Verify that the dedicated CT being used is compatible with the type of Polaris. Note that the Polaris cannot be directly used with non-DAE dedicated CTs.
- (3) Verify that the current rating of the dedicated CT being used is suitable for its intended load.
- (4) Make sure to turn off all power sources to the Polaris and any adjacent power sources before performing the installation.

2.5 Conduit and Wire Ingress

(1) Regular terminal cover

Each Polaris meter has two knockouts at the bottom. Both knockouts can be cut open for either 1/2" or 3/4" conduit. For voltage and CT wirings, cut open the knockout for 3/4" conduit. For the RS485 communication cable, cut open the knockout for 1/2" conduit. Avoid placing both the communication and power cables in the same conduit to avoid interference.



Note : Please use UL certified cables and conduits.

(2) Special terminal cover

An alternate terminal cover is also available (purchased separately) for use when the meter is to be installed within an enclosure. The voltage and CT wires will enter the meter through the rear opening of the terminal cover.



2.6 Meter Installation

- (1) Attach the dedicated CTs to the CT terminal with their appropriate phases.
- (2) Connect the phase A voltage terminal of the Polaris to the corresponding power source with an intermediate fuse.
- (3) Connect the voltage terminals of the Polaris to their corresponding phase voltages. (* Use 18 to 22 AWG, 600V wire for the voltage terminals.)
- (4) Assemble the CTs onto the corresponding conductors being measured making sure that the direction and orientation of the CTs with wiring are consistent. With solid core CTs, the wire must be threaded through the CT, which would necessitate disconnecting the wire from the load. With split core CTs and clamp type CTs, the CT can be opened and clipped or clamped onto the conductor without the need to disconnect the wiring to the load.

2.7 CT Installation

The Polaris can only make use of the dedicated CTs provided by DAE. There are two types of dedicated CTs as shown in the following descriptions.

- (1) Split-core CT installation

Load side



Step 1. Open the split-core CT



Step 2. Lay the load wire inside the opening



Step 3. Snap close the split-core CT

Meter side

Connect the CT white wire to the CT+ terminal on the meter, and the CT black wire to the CT– terminal on the meter. Please refer to section 2.2 on Terminals.



(2) Solid-core CT installation

Load side

With solid core CTs, the wire must be threaded through the CT, which would necessitate disconnecting the wire from the load.

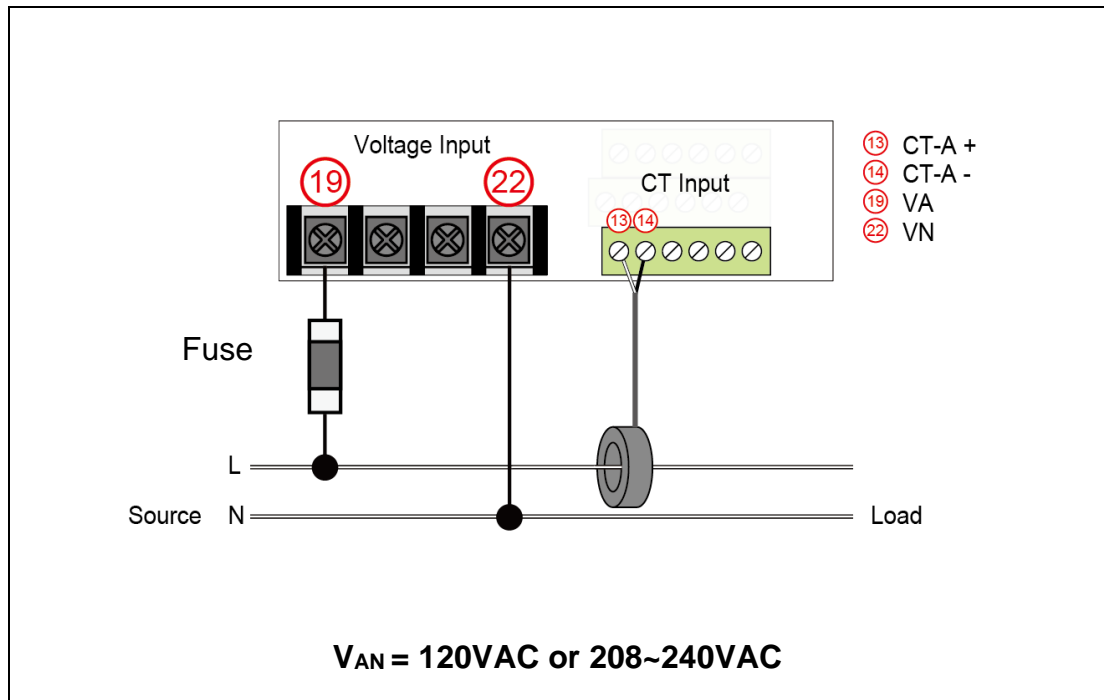


Meter side

Connect the CT white wire to the CT+ terminal on the meter, and the CT black wire to the CT– terminal on the meter. Please refer to section 2.2 on Terminals.

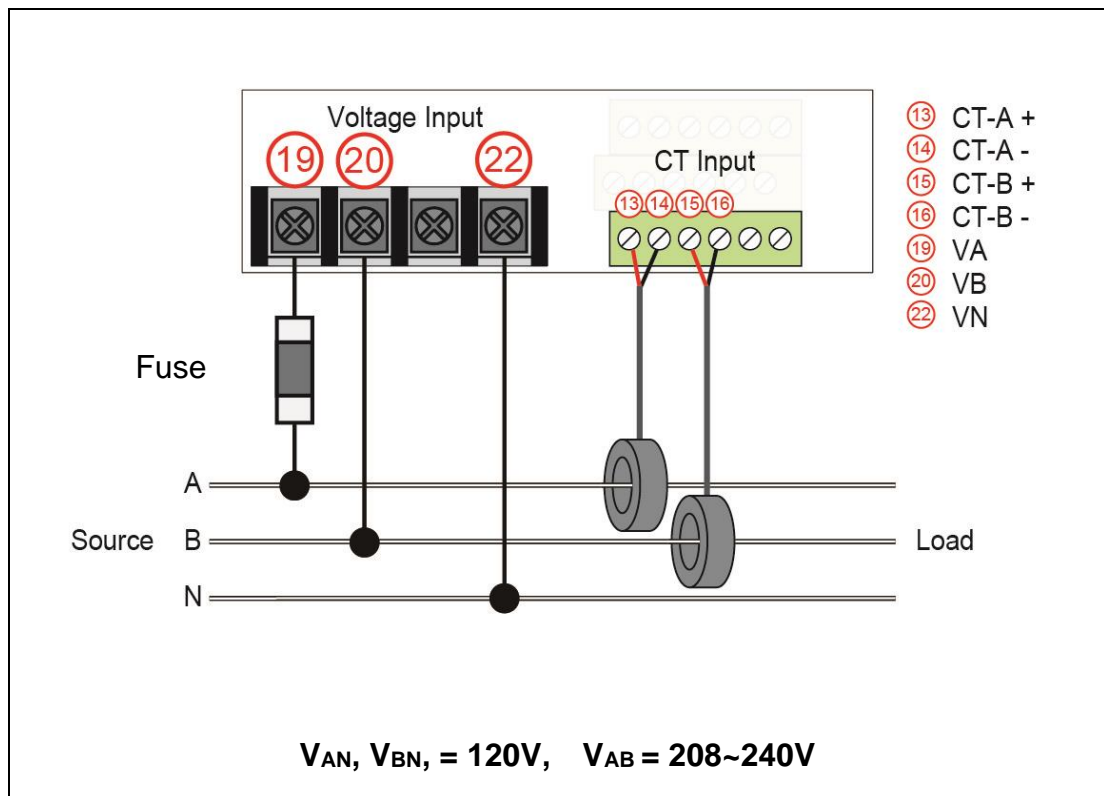
2.8 Wiring Diagram

(1) 1-phase, 2 wire



Note : Please install a fuse for each voltage input. (Except the phase N)

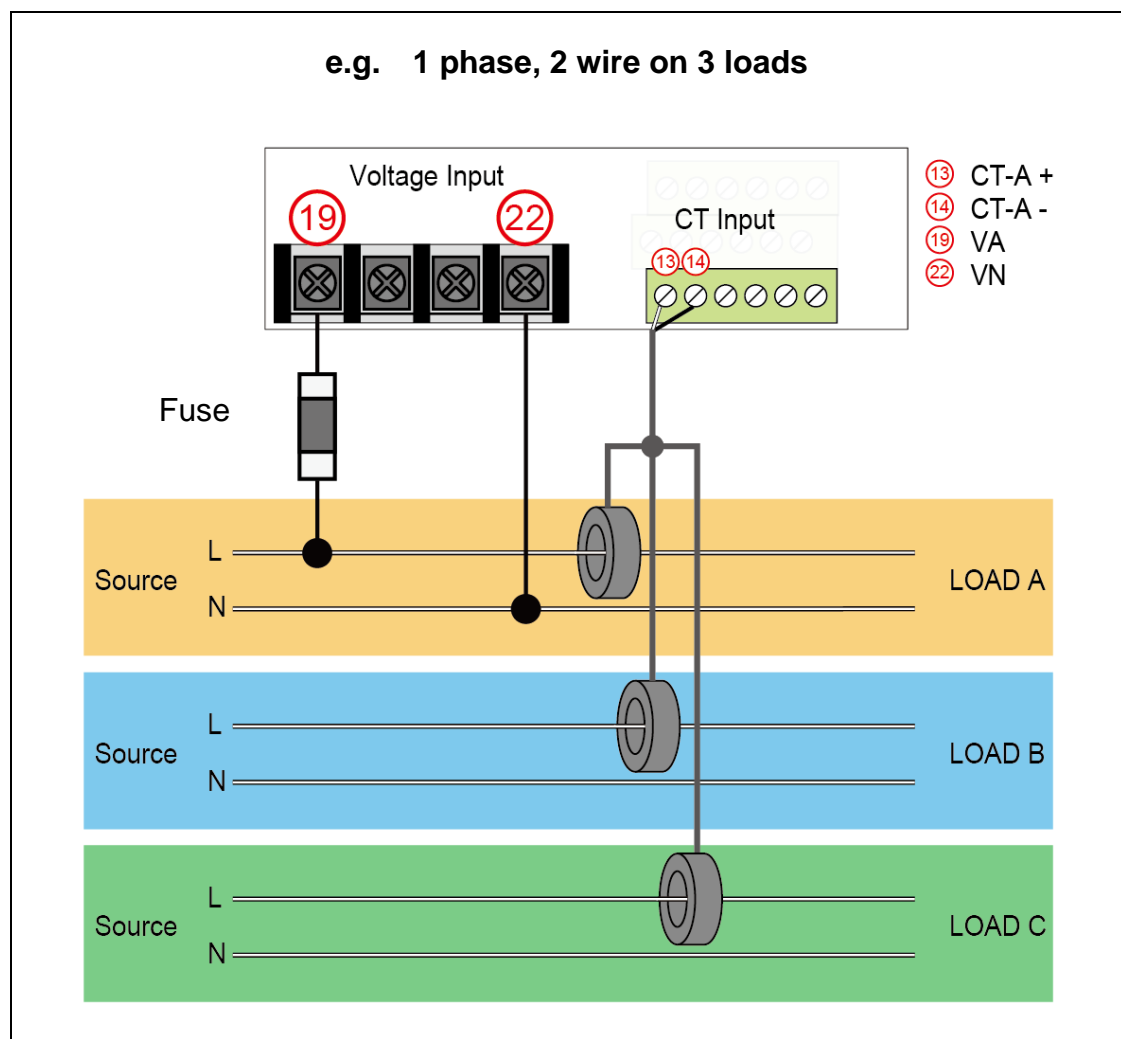
(2) 1- or 2-phase, 3 wire



Note : Please install a fuse for each voltage input. (Except the phase N)

2.9 Measuring Multiple Loads with One Meter

- (1) The loads must be the same configuration and come from the same power source.
- (2) Each meter can accept 3 loads at most, each load needs to have its own set of CTs and each CT must be of the same rating.
- (3) The load wires threaded through the CTs must be in the same direction. Each of the CTs for the same phase on different loads must be connected to the correct polarity (CT white wire to the CT+ terminal on the meter, and the CT black wire to the CT- terminal on the meter)



2.10 Power Supply

The power supply of the Polaris is derived from the phase A voltage. To provide additional protection for the Polaris, a fuse should be placed between the Polaris and the power source as shown in each of the electrical wiring diagrams.

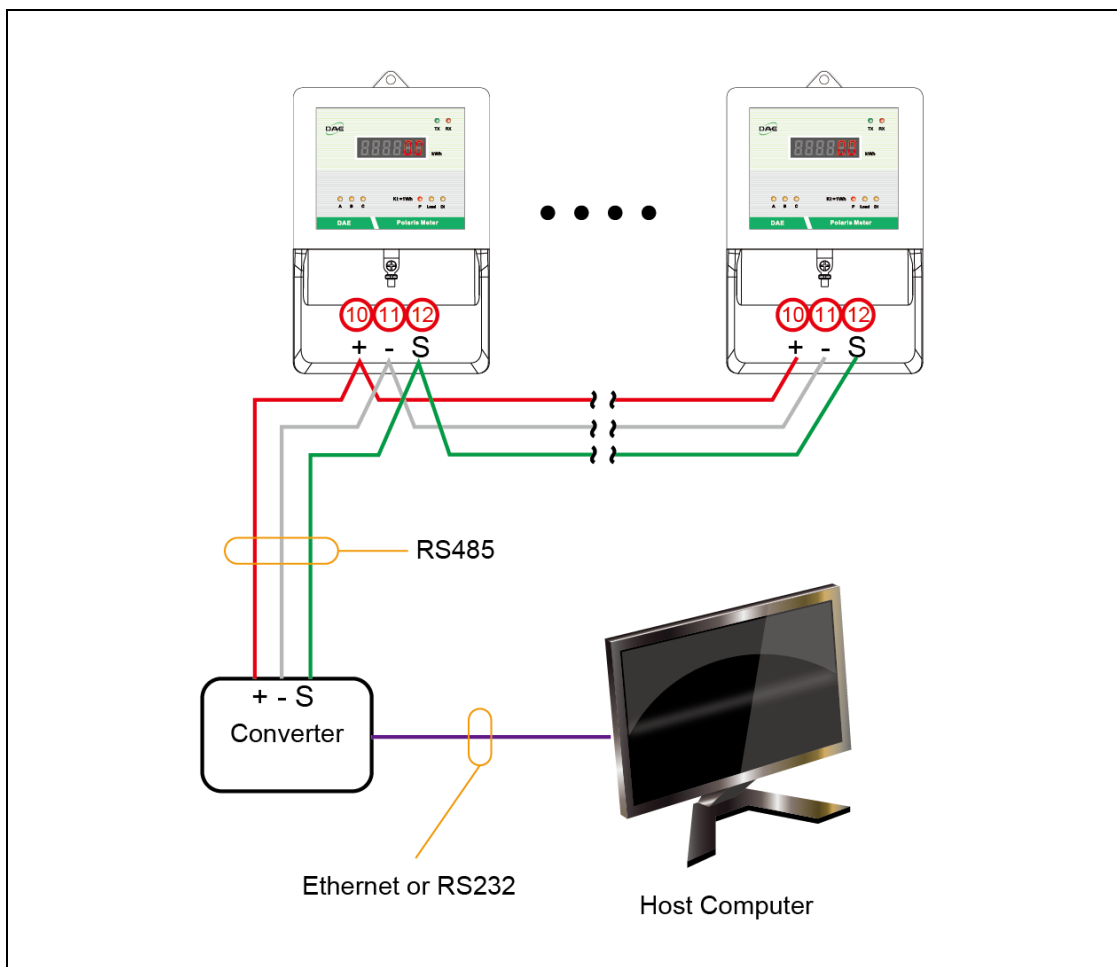
2.11 RS485 Installation

The meter can be optionally equipped with an RS485 communication port. This port can be used for connecting with PC for remote reading.

Multiple Polaris units can be connected to the same RS485 network. All the positive terminals are to be connected together using the same conductor, and all the negative terminals are to be connected together to the same wire. The shielding wire should be grounded to the panel or enclosure.

When connecting as a network, the RS485 wires should be daisy chained as shown in the diagram, it should not be branched off or looped.

Since most modern computers have no built in RS485, a converter is necessary to convert the RS485 signals into something the host computer can understand. Typically this converter can either be an RS485 to RS232 converter, with the host computer needing to have built in RS232 port or expansion card; or for some computers with no expansion such as a notebook computer, an alternative would be to use a commercially available RS485 to Ethernet converter.


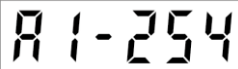

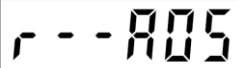


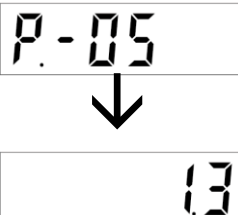


3 Display

The Polaris 1500 meter normally displays the kWh reading, but if a water meter feature is enabled, the display will toggle between the kWh (Page 5, **P.-05**) and pulse count of the water meter (Page 9, **P.-09**).

3.1 Startup Display

The power up sequence of the Polaris shows the following information on the display:

#	Display Shows	Example	Description	Range
1	8.8.8.8.8.8.		LED display test	---
2	A1- xxx		Device address ³	1~254
3	b1- xx		Baud rate ⁴	96=9600bps 48=4800bps 24=2400bps 12=1200bps
4	r-- xxx		Firmware version	Varies
5	1500 ab		Polaris type and function	(1) 1500 = Polaris 1500 (2) a = w (with water meter) a = n/a (without water meter) (3) b = n/a (P15 x -200) b = 4 (P15 x -400) b = 6 (P15 x -600)
6	8.8.8.8.8.8.		LED display test	---
7	P.-05 ↓ xxxxx.x		Page 5 Energy (kWh)	0~99,999.9 kWh

³ The default device address is the last 2 digits of the serial number.

⁴ The default baud rate is 9600 bps.

4 Modbus Reference

4.1 Data Format

Bits	8
Parity	None
Stop bit	1

4.2 Function Code

Function Code	Description	Code Definition
3	Read Data	Read Holding Registers
16	Write Data	Write Multiple Register

4.3 Register Table

All numerical values are in decimal including Register Address.

Register Address	Size	Description	Read/Write	Range	Unit
5	1 word	Address ⁵ high : not used low : address	Read/Write	1~254	---
127	1 word	Baud rate ⁶	Read/Write	0 = 9600 1 = 4800 2 = 2400 3 = 1200	bps
278	2 words	Phase A Active Energy (EPA)	Read/Write	0~9,999,999	0.01 kWh
279					
280	2 words	Phase B Active Energy (EPB)	Read/Write		
281					
282	2 words	Phase C Active Energy (EPC)	Read/Write		
283					
307	2 words	Total Active Energy (EP)	Read Only	0~9,999,999	0.01 kWh
308					
64000	32 words	Device Information, Model Name and Firmware Version	Read Only	ASCII string	---

⁵ The default Modbus address is the last 2 digits of the serial number, or 100 if 00.

⁶ The default baud rate is 9600 bps.

5 Troubleshooting

The Polaris meters are fully calibrated and tested during production. The Polaris meters should work normally if installed properly by correctly following our installation guide. If the meter has any problem, please consider the following troubleshooting procedures.

Problems or Symptoms	Possible Causes and Solutions
The LED does not light up.	<ul style="list-style-type: none"> (a) Check that the voltage input terminal wiring are connected properly. (b) Check that the fuse and circuit breaker are neither blown nor tripped, respectively. (c) Check to make sure that power is being supplied from the power source to the voltage input. (d) Check that the power source voltage is within the rated power supply. (e) Check to make sure that the enclosure or terminals are not damaged.
kWh value is not incrementing.	<ul style="list-style-type: none"> (a) Check that CT wiring to the terminals. (b) Check to make sure that the measured circuit corresponds to its phase. (c) Check to make sure that the power is on for the load circuit being measured. (d) Check the fuse or circuit breaker. (e) Check to make sure that only the L wire passes through the CT. If the N wire is also passing through then remove it from the CT. (f) The CT may be damaged or defective, swap it with another CT for a cross check. If defective or damaged, replace the CT.

Problems or Symptoms	Possible Causes and Solutions
Any Voltage input indicators do not light up.	<p>(a) Check to make sure that the voltage input terminal wiring is connected properly.</p> <p>(b) Check the voltage input terminals are not damaged.</p>
The accumulation of kWh does not match total consumption.	<p>(a) Check to make sure the voltage input is continuously 24 hours/day.</p> <p>(b) Check the CT wiring direction on load and polarity on meters if parallel 2 or 3 CTs for any phase. When parallel 2 or 3 CTs, the wiring direction and polarity must be the same.</p>

6 Frequently Asked Questions

Q. Why is the kWh value of a new Polaris meter not zero?

A. Each Polaris meter must proceed a loading test with a calibration exam before put in stock. The kWh value exists to make sure this unit passes the calibration exam.

Q. What is the meaning of $Kt = 1Wh$?

A. It means 1000 pulses will be output for every kWh. Another way of saying it is that 1 pulse is output for every Watt. The P indicator will flash once for every Watt consumed.

Q. Does the Polaris meters come with its own CTs? Can I make use of my own CTs?

A. The Polaris meters are sold with the CTs included which cannot be used direct connects. The Polaris 1500 meters use DAE's dedicated CTs and can accept neither regular 5A output CTs nor dedicated CTs from other suppliers. The CT input of the Polaris can only accept milli-amps which matches DAE's dedicated CTs. Connecting a regular 5A output CT directly will thus damage the Polaris meters.

Q. Can the CT lead wire be extended?

A. Yes, the CT lead wire can be extended up to 2000 feet. An example of a suitable cable would be the 7958A or the 7957A from Belden cables. It is important to make sure to consult your local electrical codes for proper sizing requirements.

Q. Can a single CT be used to monitor multiple circuits?

A. It is possible to do so if the different circuits share the same phase and power source. The L wire for each circuit must go through the CT in the same direction, and the current rating of the CT in must be higher than the total amperage for all the circuits to be measured.

Q. Can a single Polaris be used to monitor two different sub panels?

A. It is possible if the two sub panels have the same power source. If the two sub panels do not share the same power source, then two separate Polaris must be used.

Q. For those with only a single meter, is there a driver or software available to remotely read the meter?

A. DAE provides the Modbus protocol, but the user must provide for the software or purchase DAE's EnergyLink400 auto-metering software.

Q. Can the wires for both the measured voltage and the communication be placed within the same conduit?

A. No, it is not recommended as the communication is sensitive to noise and interference. They should each be placed in their own conduits separately.

Q. How to connect to a host computer that doesn't have an RS485 communication port?

A. If the host computer only has an Ethernet port, then use an RS485 to Ethernet converter.

Q. There is no communication or the communication is unstable between the Polaris 1500 meters and the host computer.

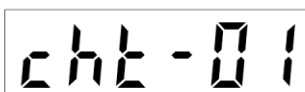
A. (1) Make sure that the network does not form a tree or star topology and that there are no loops.
(2) Check that the converter has its parameters set up properly.

- (3) Make sure that the baud rate set for meters and the Ethernet converter are the same.
- (4) Make sure that each of the meter on the same bus has its own unique device address.
- (5) Make sure that the polarities for the RS485 wiring are correct for all the Polaris meters and the Ethernet converters. All positive terminals must be connected together, and all negative terminals must be connected together.
- (6) Make sure that the total length of any single RS485 bus segment is less than 1000 meters (3281 feet), a segment is defined to be one without any intervening repeaters.
- (7) Make sure that there are no more than 32 devices on a single RS485 bus segment.

Q. What will happen if the polarities are reversed for each of the following: CT and communication?

- A. (1) The Polaris only considers the absolute value of the current and disregards the direction; thus, the current and energy values can only be positive. However, we still recommended that the CTs be connected with the correct wiring orientation.
- (2) The communication cable is polarity sensitive. RS485 requires that all positive terminals are connected together, and all negative terminals are connected together, reversing any one on any single device will cause the entire RS485 bus to collapse and all communication will fail. If the polarity to any one device is inconsistent with the rest, simply reverse the polarities and the communication should be restored.

Q. What does Polaris message “cht-01” mean?

The image shows a digital display with the text "cht-01" in a monospaced, digital font. The characters are black on a white background, and the display is enclosed in a thin black rectangular border.

- A. It means that the circuit currently being measured has a power factor that is less than 0.5. This is not normal behavior and could be caused by having the phases reversed (voltage and current phases are not properly matched), or there may be some run-down equipment that are in need of repair or replacement. Check to make sure that the voltage and current inputs are matched properly, if they are, they check the condition of equipment on the circuit being measured.

Q. I have checked and followed all the troubleshooting guidelines but my problem is still not resolved; what should I do?

- A. Contact our technical support by phone or email before concluding that the unit is faulty and removing it. Our technical support team will help to diagnose your problem and provide advice on potential fixes. Please see Section 8, **Supplementary Information**, for our contact info.

7 Warranty and Return Policy

7.1 Warranty

The warranty is effective for a period of five years from the date of shipment. The buyer must inform DAE of the defect within 80 days after the defect is experienced or found. DAE's responsibility is limited to repair, replacement, or refund, any of which may be selected by DAE in its sole discretion. DAE reserves the right to substitute functionally equivalent new or serviceable used parts.

This warranty covers only defects from normal use and does not include the damage due to improper installation, improper maintenance, misuse, neglect, water damage, acts of nature, tornadoes, any alterations or repairs that are not DAE.

DAE's liability to the Customer from the sale of DAE's products, whether such liability is asserted on the basis of contract, tort or otherwise, shall not exceed the purchase price paid by Customer for the products claimed.

7.2 Return Policy

All returned material must be in good, "as new" and in salable condition. A 20% restocking fee is charged on all RMA's.

Products may not be returned if more than 80 days have elapsed since the shipment date from DAE.

Buyer must notify DAE and request a Returned Material Authorization Number (RMA Number) and state the specific reason for return. Unauthorized returns will not be accepted. When requesting an RMA Number please supply the following information:

- (1) Distributor name and address
- (2) Model number of meter

- (3) Original purchase order number
- (4) Reason for return

All paperwork and boxes must be marked with an RMA number issued by DAE. All authorized returned materials must be shipped freight prepaid to DAE. DAE is not responsible for uninsured packages or packages lost by your carrier.

RMA's are only valid for 30 days. The buyer will be responsible for all return shipping costs and customs duties.

8 Supplementary Information

Please add fuses to the voltage input to protect damage from a short circuit.

Our contact information

US Website: www.DAEcontrols.com

US Email: info@DAEcontrols.com

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