INSTALLATION INSTRUCTIONS

ReliaGear™ lighting panelboard — AMP1 integrated power and energy meter

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AMP1
Safety

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

Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

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

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

NEC 2011 Article 100: No responsibility is assumed by manufacturer for any consequences arising out of the use of this material. Control system design must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and over-travel stop.

This symbol indicates an electrical shock hazard exists.

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

DANGER: Hazard of electric shock, explosion or arc flash: Failure to follow these instructions will result in death or serious injury.

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

WARNING: Loss of control

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

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.

AMP1
Specifications

Measurement accuracy	
Real power/energy	IEC 62053-22 Class 0.2S, ANSI C12.20 0.2%
Reactive power/energy	IEC 62053-23 Class 2, 2%
Current	0.4% (+0.015% per °C deviation from 25°C) from 5% to 100% of range; 0.8% (+0.015% per °C deviation from 25°C) from 1% to 5% of range
Voltage	0.4% (+0.015% per °C deviation from 25°C) from 90 V_{L-N} to 600 V AC $_{L-L}$
Sample rate	2520 samples per second
Data update rate	1 second
Type of measurement	True RMS up to the 21st harmonic 60 Hz; one- to three-phase AC system
Input voltage	
Measured AC	Minimum 90 V L-N (156V L-L) for stated accuracy UL maximum: 600 V_{L-L} (347 V_{L-N}) CE maximum: 300 V_{L-N}
Metering over-range	+20%
Impedance	2.5 MΩ $_{L-N}$ /5 MΩ $_{L-L}$
Frequency	45 to 65 Hz
Input current	
CT scaling	Primary: Adjustable from 5 A to 32,000 A
Measured input range	0 to 0.333 V AC or 0 to 1.0 V AC (+20% over-range)
Impedance	10.6 kΩ (1/3 V mode) or 32.1 kΩ (1 V mode)
Control power	
AC	Maximum 5 V; Minimum 90 V UL maximum = 600 V_{L-L} (347 V_{L-N}) CE maximum = 300 V_{L-N}
DC[1]	3 W maximum; UL and CE = 125 to 300 V DC
Ride-through	100 msec at 120 V AC
Input	
Pulse	Solid-state or mechanical contacts (currents less than 1 mA); 2 pulse inputs
Minimum pulse width	20 msec
Output	
RS-485 port	2-wire, 1200 to 38400 baud, Modbus RTU
Mechanical	
Weight	0.62 lb. (0.28 kg)
IP degree of protection (IEC 60529)	IP40 front display; IP20 meter
Display characteristics	Back-lit blue LCD
Terminal block screw torque	0.37 ft./lb. (0.5 N-m) nominal; 0.44 ft./lb/ (06. N-m) maximum
Terminal block wire size	24 to 14 AWG (0.2 to 2.1 mm^2)
Rail	T35 (35 mm) DIN rail per EN50022

Environmental	
Operating temp. range	-30° to 70 °C (-22° to 158 °F)
Storage temp. range	-40° to 85 °C (-40° to 185 °F)
Humidity range	<95% RH (noncondensing)
Altitude of operation	3000 m maximum
Metering	
North America	CAT III; for distribution systems up to 347 V_{L-N}/600 V AC $_{L-L}$
CE	CAT III; for distribution systems up to 300 V_{L-N}
Dielectric withstand	Per UL 508; EN61010
Conducted and radiated emissions	FCC part 15 Class B; EN55011/EN61000 Class B (residential and light industrial)
Conducted and radiated immunity	EN61000 Class A (heavy industrial)
Compliance	
Agency approvals	
US and Canada (cULus)	UL 508 open-type device / CSA 22.2 No. 14-05
Europe (CE)	EN61010-1:2001

[1] External DC current limiting is required; see fuse recommendations.

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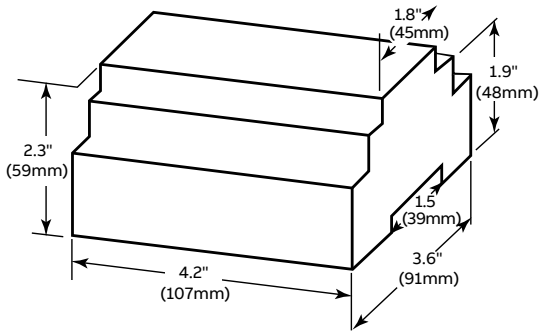
Product identification

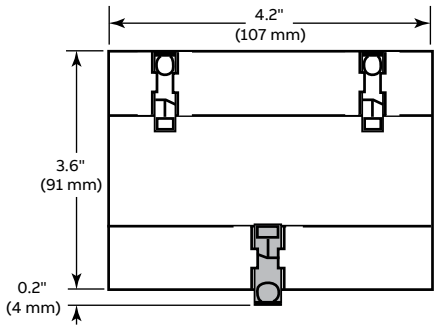
Description	
AMP1H5	BACnet MS/TP protocol output; Modbus full data set, data logging; pulse input (2 pulses)

Dimensions



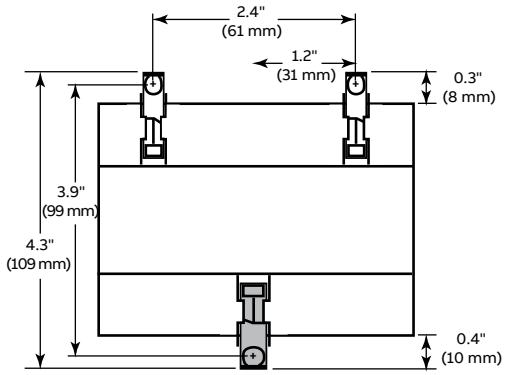
DIN mount configuration

Bottom view



Screw mount configuration

Bottom view



Product overview

The AMP1H5 DIN rail power meter provides a solution for measuring energy data with a single device. Inputs include control power, CT and 3-phase voltage. The meter supports BACnet MS/TP protocol and has data logging capability and two pulse contact inputs. The LCD screen on the faceplate allows instant output viewing.

The meter is housed in a plastic enclosure suitable for installation on T35 DIN rail according to EN50022. It can be mounted in any orientation over the entire ambient temperature range, either on a DIN rail or in a panel. The AMP1H5 meter is not sensitive to CT orientation to reduce installation errors.

Data output

Full data set (FDS)

- Power (kW)
- Energy (kWh)
- Configurable for CT and PT ratios, system type and passwords
- Diagnostic alerts
- Current: 3-phase average
- Volts: 3-phase average
- Current: by phase
- Volts: by phase line-line and line-neutral
- Power: real, reactive and apparent 3-phase total and per phase
- Power factor: 3-phase average and per phase
- Frequency
- Power demand: most recent and peak
- Demand configuration: fixed, rolling block and external sync (Modbus only)
- Real-time clock: uses BACnet time synchronization services

Data logging — includes all FDS outputs, plus:

- Three BACnet Log_Events: each buffer holds 5760 time-stamped 32-bit entries (user configures which three data points are stored in these buffers)
- User-configurable logging interval (when configured for a 15-minute interval, each buffer holds 60 days of data)
- Continuous and single-shot logging modes: user selectable

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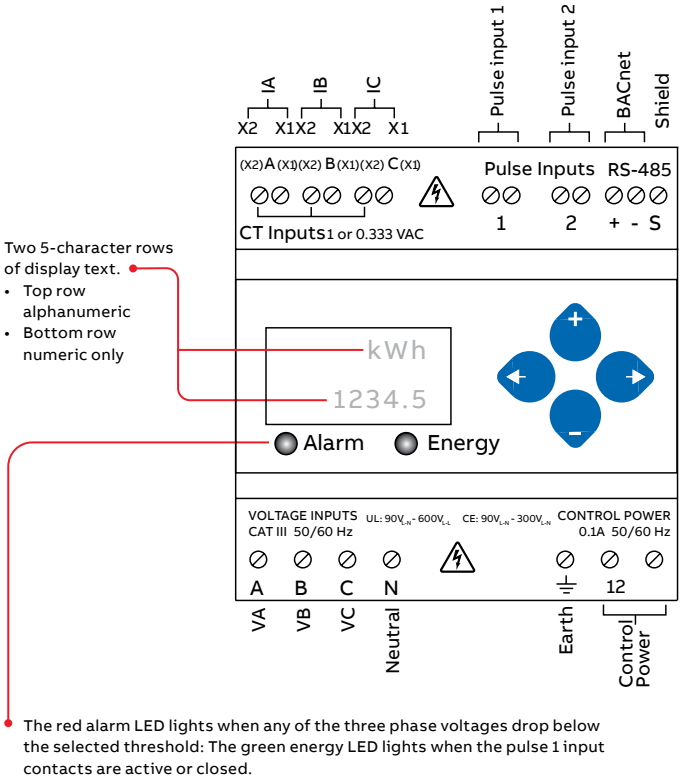
Product diagram and wiring diagram symbols



To avoid distortion, use parallel wires for control power and voltage inputs. The following symbols are used in the wiring diagrams on the following pages.

Symbol	Description
	Voltage disconnect switch
	Fuse (Installer is responsible for ensuring compliance with local requirements. No fuses are included with the meter.)
	Earth ground
	Current transducer
	Potential transformer
	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.

CAUTION: RISK OF EQUIPMENT DAMAGE

- This product is designed only for use with 1 V or 0.33 V current transducers (CTs).
- DO NOT USE CURRENT OUTPUT (e.g., 5 A) CTs ON THIS PRODUCT.
- Failure to follow these instructions can result in overheating and permanent equipment damage.

AMP1
Wiring

WARNING: RISK OF ELECTRIC SHOCK OR PERMANENT EQUIPMENT DAMAGE
Failure to follow these instructions will result in death or serious injury.
CT negative terminals are referenced to the meter's neutral and may be at elevated voltages.
- Do not contact meter terminals while unit is connected.
- Do not connect or short other circuits to the CT terminals.

Figure 1.
1-phase, line to neutral, 2-wire system, 1 CT
USE SYSTEM TYPE 10 (1L + 1n)

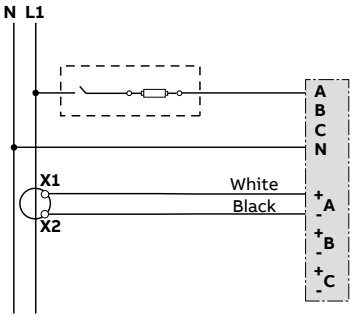


Figure 2.
1-phase, line to line, 2-wire system, 1 CT
USE SYSTEM TYPE 11 (2L)

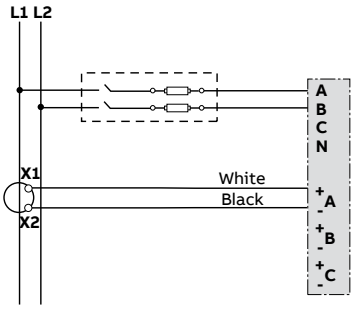


Figure 3.
1-phase, direct voltage, 2-wire system connection, 2 CT
USE SYSTEM TYPE 12 (2L + 1n)

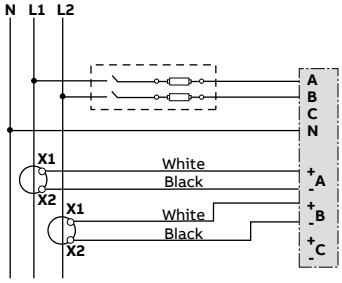


Figure 4.
3-phase, 3-wire system connection, CT, no PT
USE SYSTEM TYPE 31 (3L)

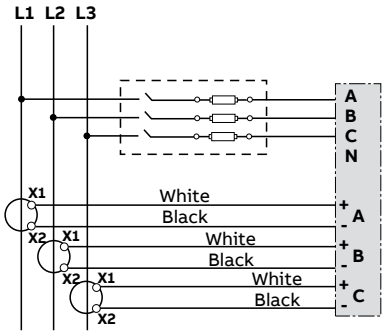


Figure 5.
3-phase, 4-wire, wye direct voltage input connection, 3 CT
USE SYSTEM TYPE 40 (3L + 1n)

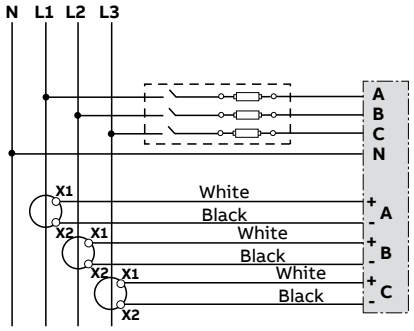
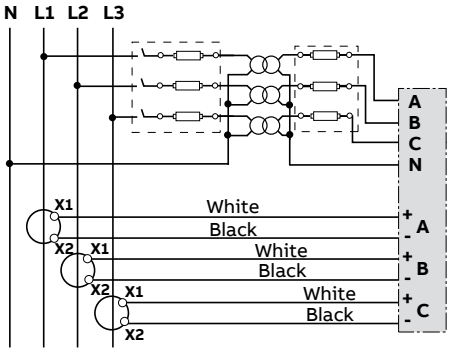


Figure 6.
3-phase, 4-wire, wye connection, 3 CT, 3 PT
USE SYSTEM TYPE 40 (3L + 1n)



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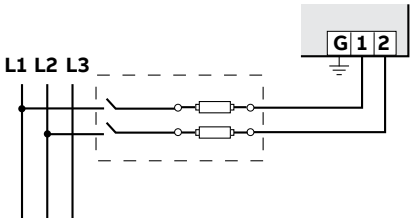
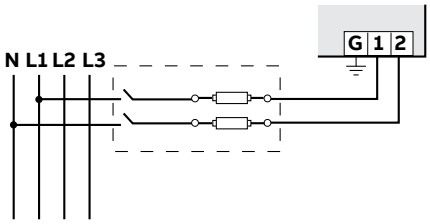
Control power

Direct connect control power, line to line



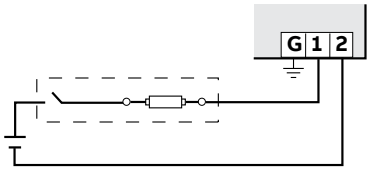
Line to line from 90 V AC to 600 V AC (UL) (520 V AC for CE). In UL installations ,the lines may be floating (such as a delta). If any lines are tied to an earth (such as a corner-grounded delta), see the line to neutral installation limits. In CE compliant installations, the lines must be neutral (earth) referenced at less than 300 V AC_{L-N}.

Direct connect control power, line to neutral



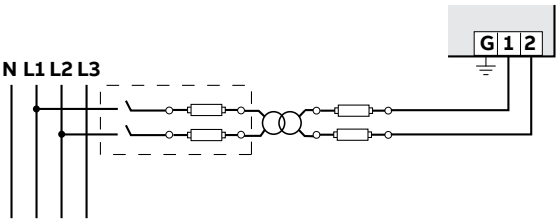
Line to neutral from 90 V AC to 347 V AC (UL) or 300 V AC (CE).

Direct connect control power (DC control power)



DC control power from 125 V DC to 300 V DC (UL and CE max.)

Control power transformer (CPT) connection



The control power transformer may be wired $_{L-N}$ or $_{L-L}$. Output to meet meter input requirements.

Fuse recommendations

Keep the fuses close to the power source (obey local and national code requirements).

Use the following criteria to select fuses and circuit breakers:

- Select current interrupt capacity based on the installation category and fault current capability.
- Select overcurrent protection with a time delay.
- Use a voltage rating sufficient for the input voltage applied.
- Provide overcurrent protection and disconnecting means to protect the wiring. For DC installations, provide external circuit protection. Suggested: 0.5 A, time-delay fuses rated for DC operation at or above the supply voltage.
- Use the earth connection for electromagnetic compatibility (EMC), not a protective earth ground.

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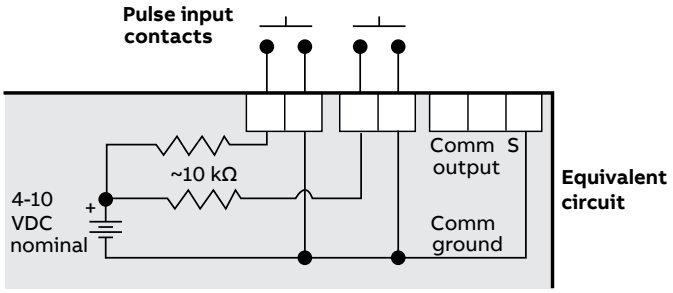
Pulse contact inputs and user interface menu abbreviations

The AMP1H5 has two inputs with pulse accumulators for solid-state or mechanical contacts in other sensors, such as water or gas flow meters. These inputs are isolated from the measured circuits and referenced to the communication signal ground. Use with contacts that do not require current to remove oxidation.



The user can set the display mode to IEC or IEEE notation in the SETUP menu.

Main menu

IEC	IEEE	Description
D	D	Demand
MAX	M	Maximum demand
P	W	Present real power
Q	VAR	Present reactive power
S	VA	Present apparent power
A	A	Amps
UAB, UBC, UAC	VAB, VBC, VAC	Voltage line to line
V	VLN	Voltage line to neutral
PF	PF	Power factor
U	VLL	Voltage line to line
HZ	HZ	Frequency
KSh	KVAh	Accumulated apparent energy
KQh	KVARh	Accumulated reactive energy
KPh	KWh	Accumulated real energy
PLOSS	PLOSS	Phase loss
LOWPF	LOWPF	Low power factor error
F ERR	F ERR	Frequency error
I OVR	I OVR	Over current
V OVR	V OVR	Over voltage
PULSE	PULSE	kWh pulse output overrun (configuration error)
_PHASE	_PHASE	Summary data for 1, 2 or 3 active phases
ALERT	ALERT	Diagnostic alert status
INFO	INFO	Unit information
MODEL	MODEL	Model number
OS	OS	Operating system
RS	RS	Reset system
SN	SN	Serial number
RESET	RESET	Reset data
PASWD	PASWD	Enter reset or setup password
ENERG	ENERG	Reset energy accumulators
DEMND	DEMND	Reset demand maximums

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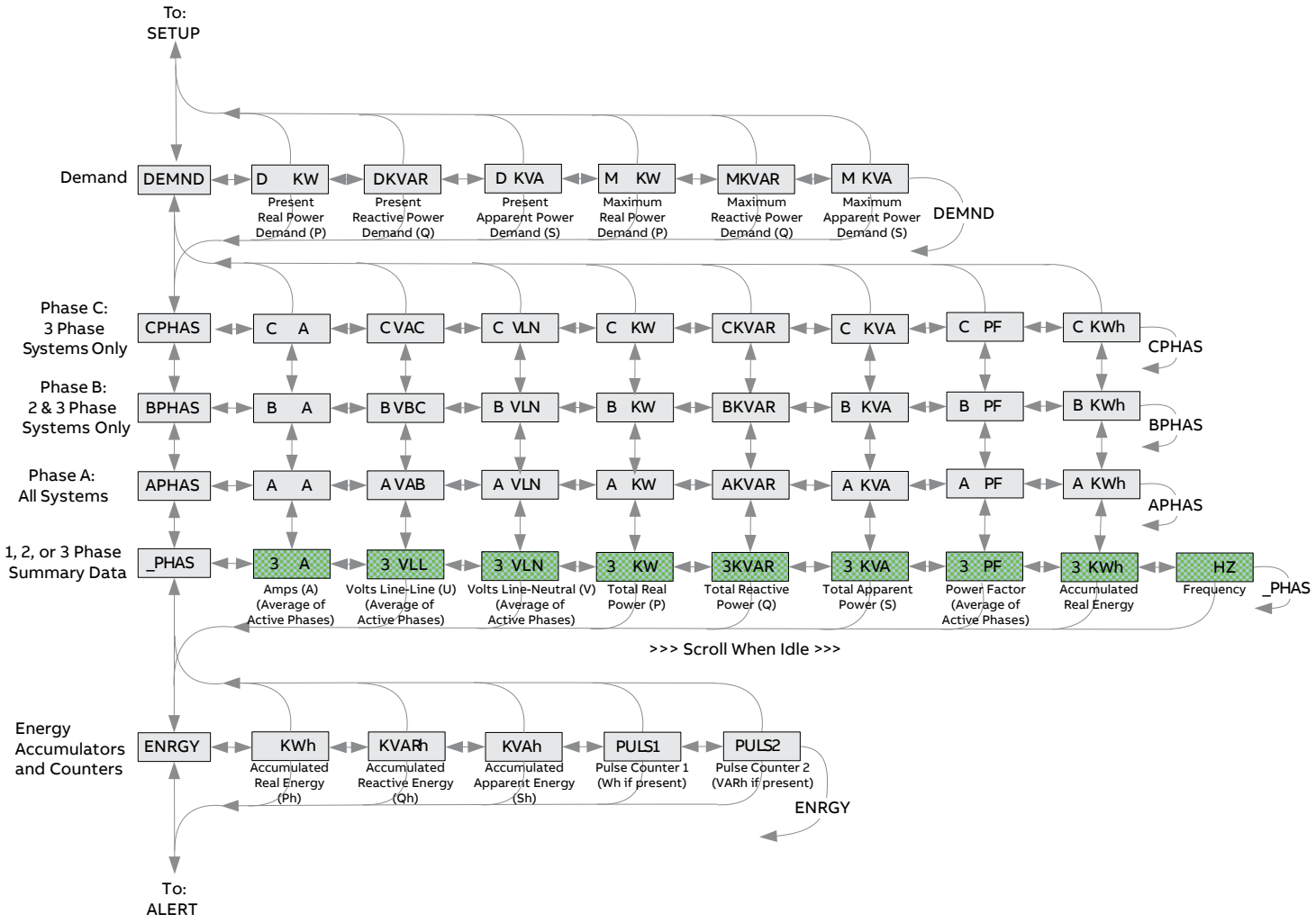
User interface for data configuration



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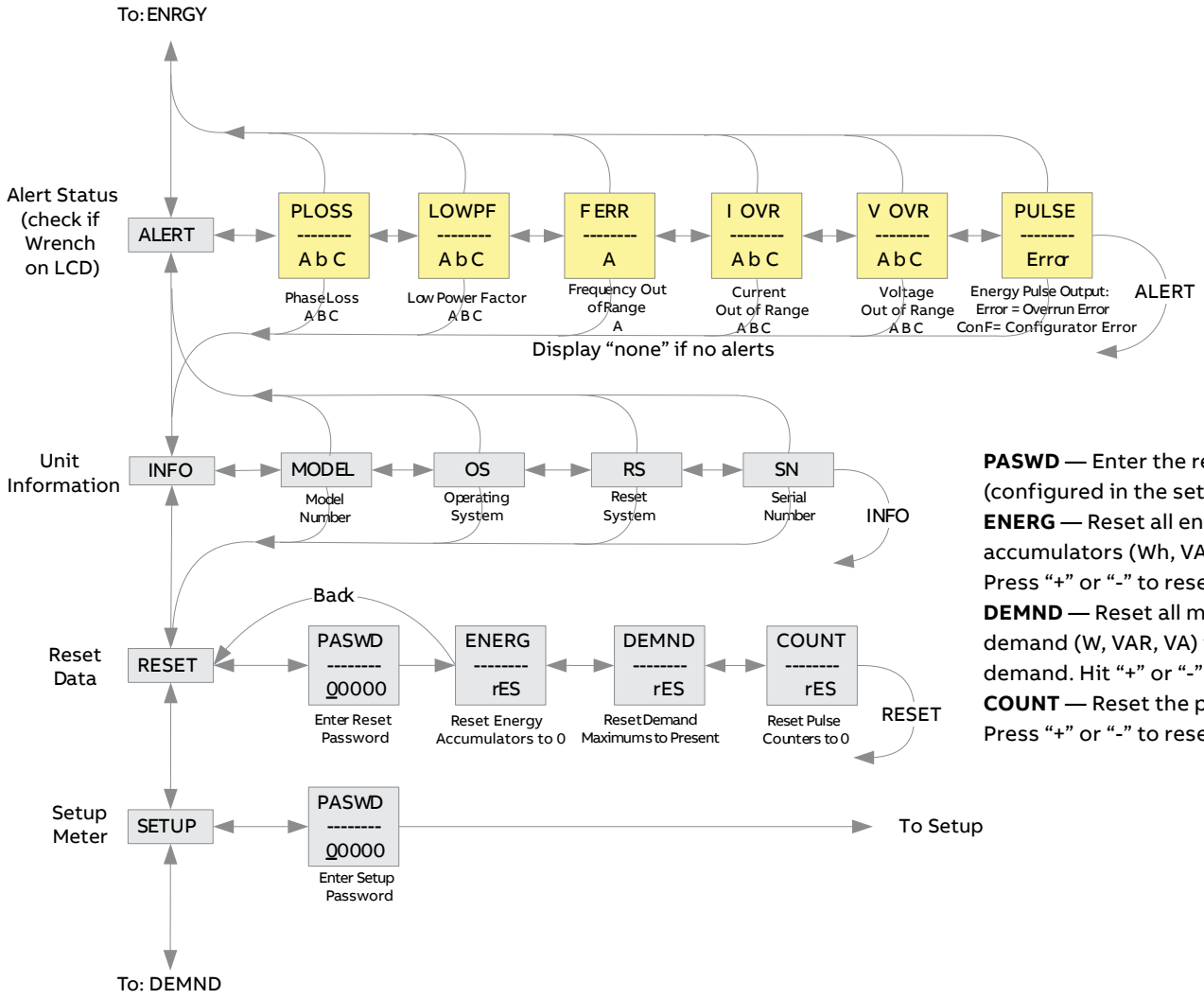
Alert/reset information



PASWD — Enter the reset password (configured in the setup menu).
ENERG — Reset all energy accumulators (Wh, VARh, VAh) to 0. Press "+" or "-" to reset.
DEMND — Reset all maximum demand (W, VAR, VA) to the present demand. Hit "+" or "-" to reset.
COUNT — Reset the pulse counters. Press "+" or "-" to reset.

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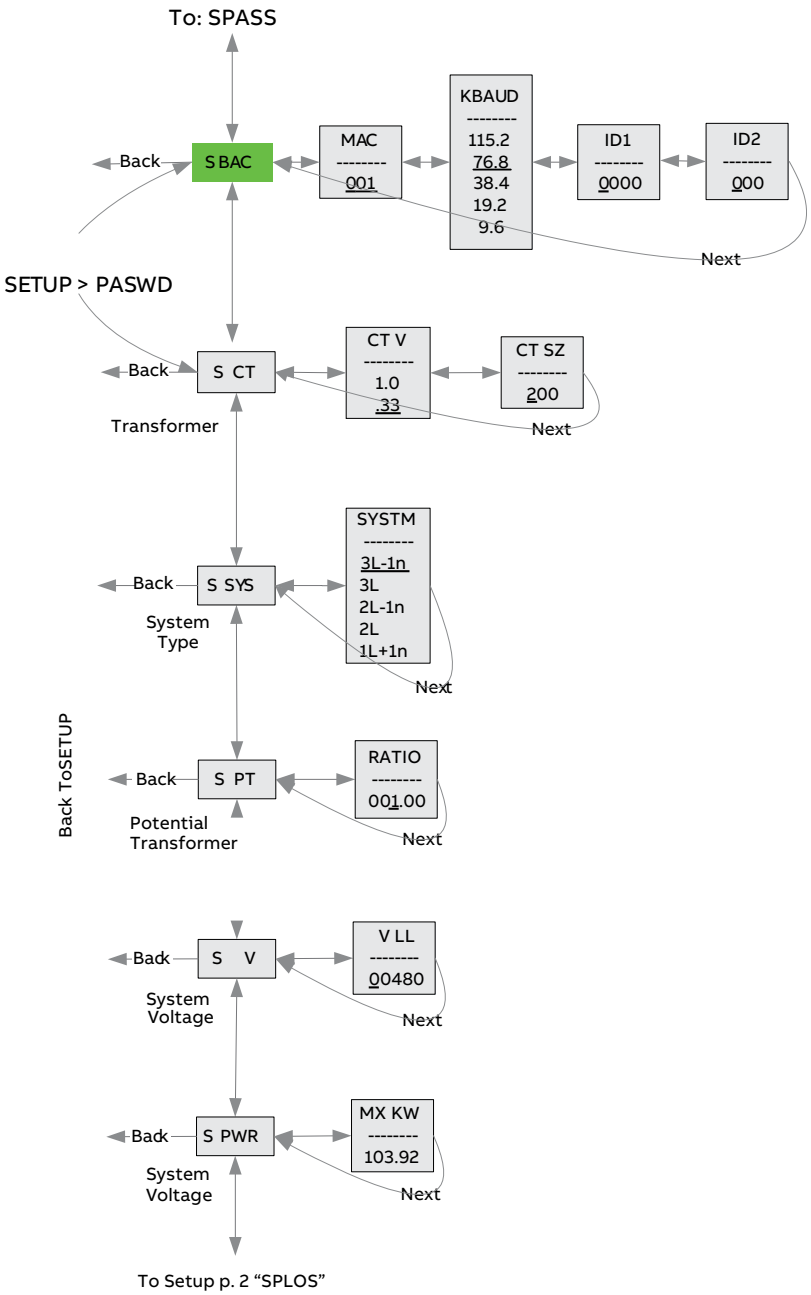
User interface for setup



Note: Bold is the default.

Set communication parameters:
ADDR — BACnet MS/TP MAC address: 0–127.
+ increments the selected (blinking) digit.
- selects the digit to the left.
BAUD — Baud tate: 9600 – 115200 baud
BACnet ID: These two screens set the 7-digit BACnet device ID. Screen ID1 is the most significant 4 digits and ID2 the least significant 3 digits. This is in the range of 0–4,194,302.

Set current transducer:
CT V — CT input voltage: + or - for 1.0 or 0.33 V.
CT SZ — CT size: in amps. Maximum is 32000 A.

Set system configuration:
SYSTM: + or - to step through the following system type options:

System	Reg 130	CTs	Description
3L-1n	40	3	Wye three-phase: A, B, and C with neutral (default).
3L	31	3	Delta three-phase: A, B and C; no neutral.
2L-1n	12	2 S	Single split-phase: A and B with neutral.
2L	11	1	Single-phase: A and B; no neutral.
1L-1n	10	1	Single-phase: A to neutral.

Set potential transformer ratio:
RATIO — Potential transformer step down is RATIO: 1. Default is 1:1 (no PT installed). See install for wiring diagrams. This value must be set before the system voltage (if used).

Set system voltage:
V LL — The nominal line-to-line voltage for the system. This is used by the meter to calculate the theoretical maximum system power, and as the reference voltage for setting the phase loss threshold. Maximum is 32000 volts. For system type 1+N (10), this is a line-to-neutral voltage, indicated by “V LN.” Note: The meter will reject settings that are not within the meter’s operating range when divided by the PT ratio.

System power:
MX KW — The theoretical maximum system power is calculated by the meter from the system voltage, CT size and system type. Power factor is assumed to be unity. The value of system power is used to determine which combinations of pulse weight and duration are valid and will keep up with the maximum power the meter will see. This value is read-only.

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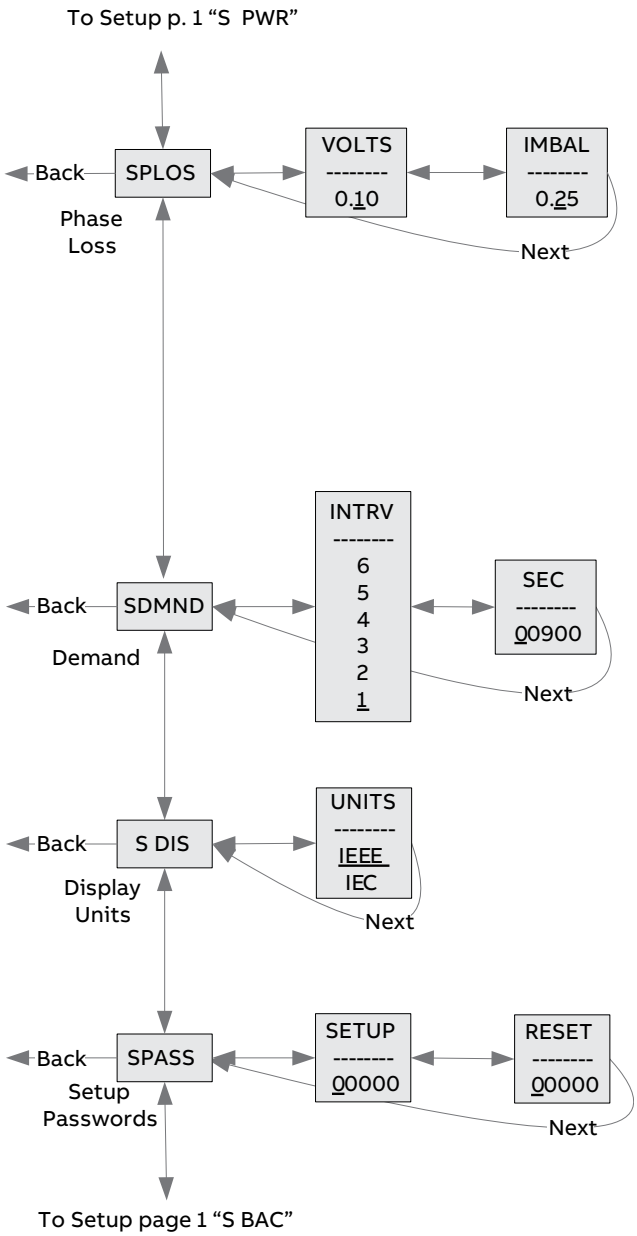
User interface for setup



Set phase loss:
VOLTS — phase loss voltage: The fraction of the system voltage below which phase loss alarm is on. For system types with neutral, the line to neutral voltage is also calculated and tested. If the system voltage is 600 and the reaction is set to 0.10, then the phase loss threshold will be 60 volts.
IMBAL — phase loss imbalance: The fractional difference in line to line voltages above which phase loss alarm is on. For system types with neutral, the line to neutral voltages are also tested. For system types 1+N (10) and 2 (11), imbalance is not tested.

Set demand interval:
INTRV — The number of sub-intervals (1 to 6) in a demand interval. Default is 1 (block demand).
SEC — Sub-interval length in seconds. Default is 900 (15 minutes). Set to 0 for external sync-to-comms.

Set display units: +/- to switch between:
IEEE — VLL VLN W VAR VA units.
IEC — U V P Q S units.

Set passwords:
SETUP — The password to enter the setup menu.
RESET — The password to enter the reset menu.

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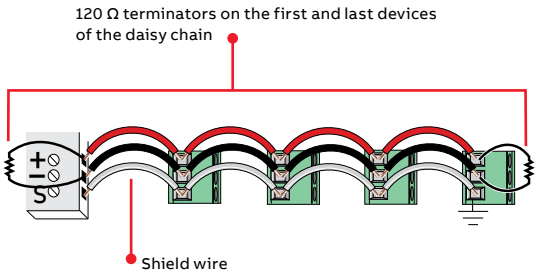
RS-485 communications and display screen diagram

Daisy chaining devices to the power meter
The RS-485 slave port allows the power meter to be connected in a daisy chain with up to 63 2-wire devices.



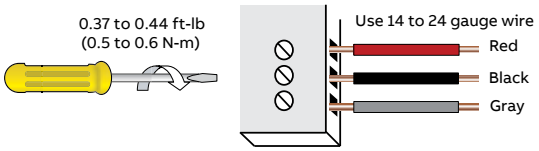
Notes:

- The terminal's voltage and current ratings are compliant with the requirements of the EIA RS-485 communications standard.
- The RS-485 transceivers are ¼ unit load or less.
- RS-485+ has a 47 kΩ pull-up to +5 V, 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).

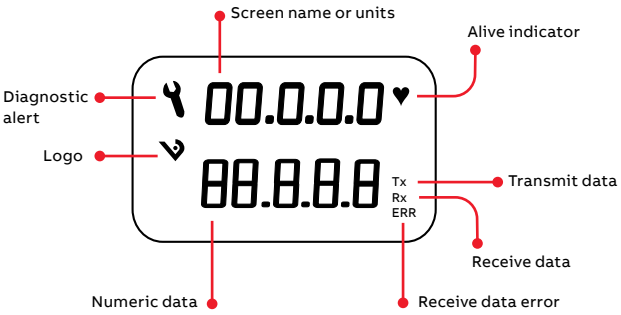
For all terminals on AMP1 series meters

- When tightening terminals, apply the correct torque: 0.37-0.44 ft·lb (0.5-0.6 N·m).
- Use 14–24 AWG (2.1–0.2 mm^2) wire.

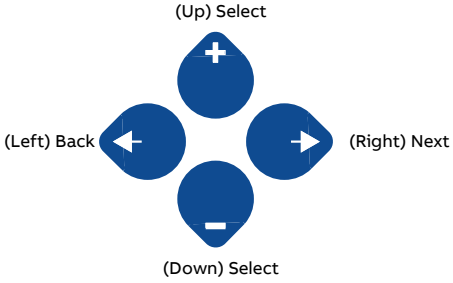
Display screen diagram



LCD screen



Buttons



AMP1
Quick setup

To enter BACnet communication parameters
These instructions assume the meter is set to factory defaults. If it has been previously configured, all optional values should be checked.

1. Press ⊕ or ⊖ repeatedly until **SETUP** screen appears.
2. Press ▶ to get to the **PASWD** screen.
3. Press ▶ to move through the digits. Use the ⊕ or ⊖ buttons to enter your password (the default is 00000). Exit the screen to the right.
4. Use ⊕ or ⊖ buttons to select the parameter to configure.
5. If the unit has an RS-485 interface, the first setup screen is **S COM** (set communications).
   a. Press ▶ to go to the **ADDR** screen and through the address digits. Use ⊕ or ⊖ to select the Modbus address.
   b. Press ▶ to accept the value and go to the **BAUD** screen. Use ⊕ or ⊖ to select the baud rate.
   c. Press ▶ to go to the **PAR** screen. Use ⊕ or ⊖ to select the parity.
   d. Press ▶ to go back to the **S COM** screen.
6. Press ⊖ to go to the **S CT** (set current transducer) setup screen. If this unit does not have an RS-485 port, this will be the first screen.
   a. Press ▶ to go to the **CT V** screen. Use ⊕ or ⊖ to select the voltage mode current transducer output voltage.
   b. Press ▶ to go to the **CT SZ** screen and through the digits. Use ⊕ or ⊖ to select the CT size in amps.
   c. Press ▶ to accept the value and go back to the **S CT** screen.
7. Press ⊖ to go to the **S SYS** (set system) setup screen.
   a. Press ▶ to go to the **SYSTM** screen. Use ⊕ or ⊖ to select the system type (see wiring diagrams).
   b. Press ▶ to go back to the **S SYS** screen.
8. (Optional) Press ⊖ to go to the **S PT** (set potential transformer) screen. If PTs are not used, skip this step.
   a. Press ▶ to go to the **RATIO** screen and through the digits. Use the ⊕ or ⊖ buttons to select the potential transformer step-down ratio.
   b. Press ▶ to go back to the **S PT** screen.
9. Press ⊖ to go to the **S V** (set system voltage) screen.
   a. Press ▶ to go to the VLL (or VLN if system is 1L-1N) screen and through the digits. Use the ⊕ or ⊖ buttons to select the line to line system voltage.
   b. Press ▶ to go back to the **S V** screen.
10. Use the ◀ button to exit the setup screen and then **SETUP**.
11. Check that the wrench is not displayed on the LCD.
    a. If the wrench is displayed, use the ⊕ or ⊖ buttons to find the **ALERT** screen.
    b. Press ▶ to go through the screens to see which alert is on.

For full setup instructions, see the configuration instructions.

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BACnet default settings and programming information

Setting	Default value[1]	BACnet object
Setup password	00000	–
Reset password	00000	–
System type	40 (3 + N) Wye	AV2
CT primary ratio	200 A	AV3
CT secondary ratio	0.33 V	AV4
PT ratio	1:1 (none)	AV5
System voltage	480 V L-L	AV6
Max. theoretical power	Calculated from AV2, AV3, AV5 and AV6 (with all default settings, this would be 103.92 kW)	AI45
Display mode	1 (IEEE)	AV7
Phase loss threshold	10% of system voltage	AV8
Phase loss threshold	25% phase to phase Imbalance	AV9
Demand: number of sub-intervals per interval	1 (block mode)	AV10
Demand: sub-interval length	900 sec (15 min) (AV11 default value is 90000 [1/100 seconds])	AV11
BACnet MAC address	001	–
BACnet MS/TP baud rate	76800 baud	–
BACnet MS/TP Max_Master	127	Device
BACnet Device_ID	Pseudo-random value from 1,000,000 to 3,097,151	Device
BACnet device location	Installed location not yet identified	Device
Trend_Log object 1 Log_Device_Object Property	AI1 (real energy)	TL1
Trend_Log object 2 Log_Device_Object Property	AI27 (reactive energy)	TL2
Trend_Log object 3 Log_Device_Object_Property	AI34 (total real present demand)	TL3

[1] Default values are preset at the factory. Once changed, there is no way to automatically reset defaults. They must be restored individually. The baud rate and MAC address are set through the user-interface screens, and the others are set by re-writing each object (see BACnet programming information section, next page).

The AMP1H5 is programmable via BACnet protocol and can easily be connected to a BACnet MS/TP network using an off-the-shelf BACnet router. It uses five types of BACnet objects. A standard PICS (below) describes the required characteristics of the BACnet implementation, but this additional descriptive context may be helpful to the integrator.

In addition to the required properties, the device object uses some optional properties to support other functionality — time synchronization (primarily used for data/trend logging on the device) and description and location properties to simplify installation and maintenance. Configure all of the meter's functions, other than data logging and writable device properties, by writing the Present_Value of the 11 Analog_Value objects. These values (except for the configuration register, AV1, which always returns zero when read) are all readable and stored in nonvolatile memory so that they are retained if power to the device is interrupted.

Data values other than log information and alerts are all accessed by reading the Present_Value of the 52 Analog_Input objects. Most of these values are instantaneous readings of measured service parameters. Some of them, (AI1, AI26, AI27, AI37–AI45, AI47, AI50,AI51) represent accumulated values and are stored in nonvolatile memory as well. If power to the device is interrupted, these values are retained, but no additional information accumulates until the device completes its re-initialization.

Alerts are used to indicate conditions of potential concern to the installer or the system, such as input voltage or current on any phase that exceeds the meter's measurement range, phase voltage below the phase loss threshold set by the user or power factor below 0.5 on any phase. Alerts are accessible individually by reading the Present_Value of the 15 Binary_Input objects or as a group by reading the Present_Value of Analog_Input object 52. Alerts are not latched and do not generate events to system. They indicate presence of these conditions at the time they are read, but the device does not latch and store them until they are read (if the condition changes before they are read, the alert will go away).

All Analog_Value, Analog_Input, and Binary_Input objects implement the reliability property and use it to indicate that the Present_Value properties are functional, valid and current. For complete assurance, check the reliabilty property for a No_Fault_Detected status before reading the Present_Value of any AV, AI or BI objects.

The AMP1H5 data logging capability is implemented using three Trend_Log objects. These are described in more detail in the section on data logging.

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BACnet programming information (cont.)

BACnet protocol implementation conformance statement (PICS)
Date: January 1, 2013
Vendor name: GE Industrial Solutions
Product name: AMP1H5 energy meter
Product model number: AMP1H5
Applications software version: 1
Firmware revision: x.xxx
BACnet protocol revision: 4
Product description: 3-phase electrical energy meter

BACnet standardized device profile (Annex L): BACnet Application-specific controller (B-ASC)

List all BACnet interoperability building blocks supported (Annex K): DS-RP-B, DS-RPM-B, DS-WP-B, DM-DDB-B, DM-DOB-B, DM-DCC-B, T-VMT-I-B, DM-TS-B

Segmentation capability: Segmentation not supported

Standard object types supported: No dynamic creation or deletion supported; no proprietary properties or object types

1. Device object
Optional properties supported
- Max_Master, Max_Info_Frames, Description, Location, Local_Time, Local_Date

Writable properties
- Object_Identifier, Object_Name, Max_Master, Location

Property range restrictions
- Object_Identifier – May only write values from 1 to 4,193,999
- Location (limited to 64 characters); Max_Master – May only write values from 1 to 127

2. Analog_input objects
Optional properties supported
- Description, reliability
- No writable properties

3. Analog_value objects
Optional properties supported
- Description, reliability
- Writable properties : only the Present_Value is writable
- Property range restrictions
  - AV1: May only write 30078, 21211, 21212 and 16498
  - AV2: May only write 10, 11, 12, 31 and 40
  - AV3: May only write values from 5 to 32000
  - AV4: May only write values 1 and 3
  - AV5: May only write values from 0.01 to 320.0
  - AV6: May only write values such that AV6/AV5 is from 82 to 660 (absolute range is 82–32000). To ensure AV6 accepts/rejects the proper values, set AV5 first.
  - AV7: May only write values 0 and 1
  - AV8: May only write values from 1 to 99
  - AV9: May only write values from 1 to 99
  - AV10: May only write values from 1 to 6
  - AV11: May only write the value 0 or a value from 1000 to 3276700 in multiples of 100. The Record_Count of the Trend_Logs (TL1 to TL3) is reset when this object is written.

4. Binary_input objects
Optional properties supported
- Description, reliability
- No writable properties

5. Trend_log objects
Optional properties supported
- Description
- Writable properties
  - Log_Enable, Start_Time, Stop_Time, Log_DeviceObject-Property, Log_Interval, Stop_When_Full, Record_Count
- Property range restrictions
  - Log_DeviceObjectProperty: May only be set to the Present_Value of local objects AI1 through AI44 (only the Present_Value of objects AI1 through AI44 may be logged)
  - Log_Interval: May only write the value 0 or values from 1000 to 3276700 in multiples of 100

Data link layer options: BMS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800, 115200

Device address binding: Static device binding is not supported (no client functionality is included)

Networking options: None

Character sets supported: ANSI X3.4

Legend
The following table lists the addresses assigned.

R/W	R=read only; R/W=read from either int or float formats, write only to integer format.
NV	Value is stored in non-volatile memory. The value will still be available if the meter experiences a power loss and reset.
Units	Lists the physical units that a register holds.

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Device object

Property	R/W	NV	Value returned	Additional information
Object_Identifier	R/W	NV	Device<n>	n is the 7-digit ID # set in the ID1 and ID2 setup screens on the meter. The BACnet device ID is a decimal number from 1 to 4,193,999 that can be entered or viewed on the user screens or through this property. The default value set at the factory is a pseudo-random number from 1,000,000 to 3,097,151 to reduce the likelihood of conflicts if multiple units are installed using their default IDs.
Object_Type	R	NV	Device (8)	–
Object_Name	R	NV	GE AMP1xx Series Energy Meter - S/N: <serial number>	–
Vendor_Name	R	NV	GE Industrial Solutions	–
Vendor_Identifier	R	NV	276	–
Model_Name	R	NV	AMP1H5 Energy Meter	–
Firmware_Revision	R	NV	<Current Revision #>	“xyyy”. This is the BACnet processor firmware version in the format <xyyy>, with an implied decimal point between the first two digits (x.yyy).
Application_Software_ Version	R	NV	<Current version #>	“RS= xyyy, OS=xyyy, BACnet Gateway=xyyy”. The format <xyyy> has an implied decimal point between the first two digits (x.yyy).
Location	R/W	NV	<Location>	Limited to 64 characters — Default value is “Installed location not yet identified”
Description	R	NV	GE AMP1H5 Energy Meter S/N: <serial number>	–
Protocol_Version	R	NV	1	BACnet Protocol Version 1
Protocol_Revsion	R	NV	4	BACnet Protocol Revision 4
Local_Date	R	–	Date	Set via BACnet time synchronization only — reverts to Jan 1, 2000 if control power drops.
Local_Time	R	–	Time	Set via BACnet time synchronization only — reverts to 12:00:00 AM if control power drops.
Segmentation_Supported	R	NV	NO_SEGMENTATION (3)	Segmentation is not supported.
Max_Master	R/W	NV	1–127 (factory default is 127)	Highest possible MAC address for master nodes on the local MS/TP network.
Max_Info_Frames	R	NV	1	Maximum number of information frames allowed before passing the MS/TP token.
Max_APDU_Length_Accepted	R	NV	480	–
APDU_Timeout	R	NV	60000	–
Number_of_APDU_Retries	R	NV	0	–
System_Status	R	NV	Operational (0)	–
Protocol_Sevices_Supported	R	NV	0b00000000000010110100000000000000	–
011110000	R	NV		–
Protocol_Object_Types_ Supported	R	NV	0b10110000100000000000010000000000	–
Object_List	R	NV	DE1,AI1,AI2,AI3,AI4,AI5,AI6,AI7,AI8,AI9,AI10,AI11, AI12, AI13,AI14,AI15,AI16,AI17,AI18,AI19,AI20,AI21, AI22,AI23, AI24,AI25,AI26,AI27,AI28,AI29,AI30, AI31,AI32,AI33,AI34,AI35,AI36,AI37,AI38,AI39,AI40 ,AI41,AI42 ,AI43,AI44,AI45,AI46,AI47,AI48,AI49, AI50,AI51,AI52,AV1,AV2,AV3,AV4,AV5,AV6,AV7,AV8 ,AV9,AV10,AV11,BI1,BI2,BI3,BI4,BI5, BI6,BI7,BI8,BI9 ,BI10,BI11,BI12,BI13,BI14,BI15,TL1,TL2,TL3	–
Device_Address_Binding	R	NV	{}	–
Database_Revsion	R		0	–

AMP1

Analog_value objects

Use the Present_Value property of the Analog_Value object for all writable variables in the meter other than those used specifically for BACnet configuration or time synchronization (in the device object) or data logging (in the Trend_Log objects).

Values are checked when written, and errors are returned for invalid entries. This table describes how the meter uses those variables, what values are valid and what their defaults are. When writing values to the Present_Value properties of Analog_Value BACnet objects, there is a delay of up to about two seconds to validate and store the new value. An immediate read of the same property before that delay has elapsed can return the prior value (even if the new value was accepted). To read a value immediately after writing it, check the reliability property first. When it reports a No_Fault_Detected status, the Present_Value of the object is current.

These objects support the description and reliability object properties and all required Analog_Value object properties, but Present_Value is the only writable property.

No.	Name	Description	R/W	NV	Units	Range	Factory default value	Additional information
AV1	Config	Configuration	R/W	–	n/a	n/a	Always returns "0" when read	Command register: – Write 30078 (0x757E) to clear all energy accumulators to 0 (all). – Write 21211 (0x52DB) to begin new demand sub-interval calculation cycle and log another data value on Trend_Log objects TL1-TL3 (when the meter is in Manual "Sync-to Comms" mode). This takes effect at the end of the next 1-second calculation cycle. Write no more frequently than every 10 seconds. – Write 21212 (0x52DC) to reset maximum demand values to present demand values. Takes effect at the end of the next 1-second calculation cycle. Write no more frequently than every 10 seconds. – Write 16498 (0x4072) to clear pulse counters to 0.
AV2	System_ Type	System type	R/W	NV	n/a	40, 31, 12, 11, 10	40	System_Type: – Write 10 for single-phase: A + N – Write 11 for single-phase: A + B – Write 12 for split-phase: A + B + N – Write 31 for 3-phase Á: A + B + C, no N – Write 40 for 3-phase Y: A + B + C + N
AV3	CT_Ratio_ Primary	CT ratio – primary	R/W	NV	Amps	5–32000	200	Current transducer size — Primary current range (Default is set for 100 A CTs)
AV4	CT_Ratio_ Secondary	CT ratio – secondary	R/W	NV	1/Volts	1, 3	3	Current transducer type — Secondary interface – Enter 1 for CTs with 1 V outputs (default) – Enter 3 for CTs with 1/3 V outputs
AV5	PT_Ratio	PT ratio	R/W	NV	Value	0.01–320.0	1	Potential transformer ratio — The default is 1.00 (1:1), which is no PT attached. Set this value before setting the system voltage (below).
AV6	System_ Voltage	System voltage	R/W	NV	Volts	From 82 (times the PT_Ratio in AV5) to 660 (times the PT_ Ratio in AV5 — absolute limits are 82–32000)	480	System voltage — This voltage is line to line unless in system type 10 (in object AV2), in which case it is line to neutral. This value is used by the meter to calculate the full-scale power for the analog outputs and pulse configuration (see below), and as full scale for phase loss (in object AV8). Do not set the meter to voltages outside the range of 82–660 volts times the PT ratio in object AV5.
AV7	Display_Units	Display units	R/W	NV	n/a	0, 1	1	Display units: 0 = IEC (U, V, P, Q, S), 1 = IEEE (default: VLL, VLN, W, VAR, VA)
AV8	Phase_Loss_ Voltage_ Threshold	Phase loss voltage threshold	R/W	NV	Percent	1–99	10	Phase loss voltage threshold in percent of system voltage (in object AV6). Default is 10 (10%). Any phase (as configured in AV2) whose level drops below this threshold triggers a phase loss alert — i.e., if the system voltage is set to 480 V L-L, the L-N voltage for each phase should be 277 V. When the threshold is set to 10%, if any phase drops more than 10% below 277 V, (less than 249 V), or if any L-L voltage drops more than 10% below 480 V (less than 432 V) the corresponding phase loss alarm bit will be true.
AV9	Phase_ Loss_ Imbalance_ Threshold	Phase loss imbalance threshold	R/W	NV	Percent	1–99	25	Phase loss imbalance threshold in percent. Default is 25% phase to phase difference. For a 3-phase Y (3 + N) system type (40 in object AV2), both line to neutral and line to line voltages are tested. In a 3-phase A system type (31 in object AV2), only line to line voltages are examined. In a single split-phase (2 + N) system type (12 in object AV2), only the line to neutral voltages are compared.
AV10	Subintervals	Number of sub-intervals per demand interval	R/W	NV		1–6	1	Number of sub-intervals per demand interval. Sets the number of sub-intervals that make a single demand interval. For block demand, set this to 1. Default is 1. When sub-interval length (in object AV11) is set to 0 (sync-to-comms mode), the meter ignores this value.
AV11	Subinterval_ Length	Sub-interval length	R/W	NV	Hundreths of a second	0, 10–32767	90000	Sub-interval length in hundredths of a second. For sync-to-comms mode, which allows manual triggering of demand intervals and the logging of another Trend_ Log record, set this value to 0 and write 21211 to the reset register (object AV1) each time the sub-interval must be externally reset. Default is 90000 (15 minutes). This variable is tied directly to the Log_Interval property of all three Trend_Log objects (their value is always the same as this one). Changing any of these four properties changes all of them.

AMP1

Analog_input objects

Use the Present_Value property of the Analog_Input objects for all read-only numeric variables in the meter other than those used specifically for device configuration (in the device object) or data logging (in the Trend_Log objects).

These objects support the description and reliability object properties and all required Analog_Input object properties. None of them are writable. The values that are not instantaneous (i.e., accumulated energy, max. demand, pulse input counts) are non-volatile. They are not updated while control power is inactive, but their past values are retained when power is restored.

For complete assurance, check the reliability property for a No_ Fault_Detected status before reading the Present_Value. If the line voltage or input frequency of the system being monitored falls out of the supported range, the corresponding alert bits (BI1–BI7) are set and the reliability property of any values that cannot be accurately measured under those conditions returns Unreliable_Other.

No.	Name	Description	R/W	NV	Units	Range	Additional information
AV1	Energy	Real energy consumption	R	NV	kWh	0–3.4+E38	–
AV2	kW_Total	Total real power	R	–	kW	0–Max_Power (AI45)	–
AV3	kVAR_Total	Total reactive power	R	–	kVAR	0–Max_Power (AI45)	–
AV4	kVA_Total	Total apparent power	R	–	kVA	0–Max_Power (AI45)	–
AV5	PF_Total	Total power factor	R	–	Power factor	0.00–1.00	1.00 for 100%
AV6	Volts_LL_Avg	Voltage L-L average	R	–	Volts	–	–
AV7	Volts_LN_Avg	Voltage L-N average	R	–	Volts	–	–
AV8	Current_Avg	Current average	R	–	Amps	–	–
AV9	kW_A	Real power phase A	R	–	kW	0–Max_Power (AI45)	–
AV10	kW_B	Real power phase B	R	–	kW	0–Max_Power (AI45)	–
AV11	kW_C	Real power phase C	R	–	kW	0–Max_Power (AI45)	–
AI12	PF_A	Power factor phase A	R	–	Power factor	0.00–1.00	1.00 for 100%
AI13	PF_B	Power factor phase B	R	–	Power factor	0.00–1.00	1.00 for 100%
AI14	PF_C	Power factor phase C	R	–	Power factor	0.00–1.00	1.00 for 100%
AI15	Volts_AB	Votlage phase A-B	R	–	Volts	–	–
AI16	Volts_BC	Voltage phase B-C	R	–	Volts	–	–
AI17	Volts_AC	Voltage phase A-C	R	–	Volts	–	–
AI18	Volts_AN	Voltage phase A-N	R	–	Volts	–	–
AI19	Volts_BN	Voltage phase B-N	R	–	Volts	–	–
AI20	Volts_CN	Voltage phase C-N	R	–	Volts	–	–
AI21	Current_A	Current phase A	R	–	Amps	–	–
AI22	Current_B	Current phase B	R	–	Amps	–	–
AI23	Current_C	Current phase C	R	–	Amps	–	–
AI24	Reserved_AI24	Reserved	R	–	n/a	–	Returns QNAN or any value.
AI25	Frequency	Frequency	R	–	Hz	45.0–65.0	Returns QNAN if frequency is out of range (or no voltage input present on phase A).
AI26	kVAh	Apparent energy consumption	R	NV	kVAh	0–3.4+E38	The UNITS property of object AI26 reports that these units are kWh because there is no unit type in the BACnet standard for kVAh.
AI27	kVARh	Reactive energy consumption	R	NV	kVARh	0–3.4+E38	The UNITS property of object AI27 reports that these units are kWh because there is no unit type in the BACnet standard for kVARh.
AI28	kVA_A	Apparent power phase A	R	–	kVA	0–Max_Power (AI45)	–
AI29	kVA_B	Apparent power phase B	R	–	kVA	0–Max_Power (AI45)	–
AI30	kVA_C	Apparent power phase C	R	–	kVA	0–Max_Power (AI45)	–
AI31	KVAR_A	Reactive power phase A	R	–	kVAR	0–Max_Power (AI45)	–
AI32	KVAR_B	Reactive power phase B	R	–	kVAR	0–Max_Power (AI45)	–
AI33	KVAR_C	Reactive power phase C	R	–	kVAR	0–Max_Power (AI45)	–
AI34	KW_Present_Demand	Total real power present demand	R	–	kW	0–Max_Power (AI45)	–

table continued on next page

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Analog_input objects (cont.)

No.	Name	Description	R/W	NV	Units	Range	Additional information
AI35	KVAR_Present_Demand	Total reactive power present demand	R	–	kVAR	0–Max_Power (AI45)	–
AI36	KVA_Present_Demand	Total apparent power present demand	R	–	kVA	0–Max_Power (AI45)	–
AI37	KW_Max_Demand	Total real power maximum demand	R	NV	kW	0–Max_Power (AI45)	This retains the largest value measured for total real power demand (AI34) for any single demand interval since the max demand was last explicitly reset via AV1 (this is also reset when the demand interval is changed).
AI38	KVAR_Max_Demand	Total reactive power maximum demand	R	NV	kVAR	0–Max_Power (AI45)	This retains the largest value measured for total reactive power demand (AI35) for any single demand interval since the max demand was last explicitly reset via AV1 (this is also reset when the demand interval is changed).
AI39	KVA_Max_Demand	Total apparent power maximum demand	R	NV	kVA	0–Max_Power (AI45)	This retains the largest value measured for total apparent power demand (AI36) for any single demand interval since the max demand was last explicitly reset via AV1 (this is also reset when the demand interval is changed).
AI40	Pulse_Count_1	Pulse count #1	R	NV	#	0–4294967040	Running count of contact closures on Pulse1 input since last reset. Write 16498 (0x4072) to the Present_Value property of Analog_Value object AV1 to reset both pulse counters to 0.
AI41	Pulse_Count_2	Pulse count #2	R	NV	#	0–4294967040	Running count of contact closures on Pulse2 input since last reset. Write 16498 (0x4072) to the Present_Value property of Analog_Value object AV1 to reset both pulse counters to 0.
AI42	KWH_A	Real energy consumption phase A	R	NV	kWh	0–3.4+E38	–
AI43	KWH_B	Real energy consumption phase B	R	NV	kWh	0–3.4+E38	–
AI44	KWH_C	Real energy consumption phase C	R	NV	kWh	0–3.4+E38	–
AI45	Max_Power	Theoretical maximum system power	R	NV	kW	0–1.84467e19	Theoretical maximum system power — This is the theoretical maximum power the meter expects to see on a service. It is calculated by the meter from the system type (in object AV2), CT size (in object AV3) and system voltage (in object AV6). Power factor is assumed to be unity. The register is updated when the user changes any of these parameters.
AI46	Reserved_AI46	Reserved	R	–	–	0	Returns QNAN or any value.
AI47	Energy Resets	Count of energy accumulator resets	R	NV	–	0–32767	Running count of how many times the energy counter has been reset.
AI48	Reserved_AI48	Reserved	R	–	–	0	Returns QNAN or any value.
AI49	Reserved_AI49	Reserved	R	–	–	0	Returns QNAN or any value.
AI50	Power Up Count	Power up counter	R	NV	–	0–32767	Running count of product power-up cycles (control power).
AI51	Output Config	Output configuration	R	NV	–	0–15	Returns “0”
AI52	Reserved_AI52	Alert summary register	R	–	–	0–32767	This contains a decimal value that represents the status of all Binary_Object alert values in one number that can be read without having to access multiple objects. It is a decimal representation of a 15-bit hexadecimal value produced by combining the 15 alert bits into one number, where the bit value of Object BI1 is the least significant bit and BI15 is the most significant bit.

AMP1

Binary_input objects

Use the Present_Value properties of the Binary_Input objects as alerts for conditions of potential concern regarding to the system measurement. These values are dynamic and are not latched, so if the condition is resolved, the alert will go inactive whether or not it has been read.

These objects support the description and reliability object properties and all required Binary_Input object properties. None of them are writable. For complete assurance, check the reliability property for a No_Fault_Detected status before reading the Present_Value.

To test the meter's alert status, read the Present_Value of each of the Binary_Input objects representing the alert bits of interest, or read the Present_Value of AI52, which combines all 15 bits into a single decimal value. AI52 represents the status of all Binary_Object alert values in one number that can be read without having to access multiple objects. The bit value of object BI1 is the least significant bit and BI15 is the most significant bit.

No.	Name	Description	R/W	Range	Additional information
BI1	Volts_Error_A	Voltage out of range phase A	R	0=INACTIVE, 1=ACTIVE	Phase A input voltage exceeds meter's measurement range.
BI2	Volts_Error_B	Voltage out of range phase B	R	0=INACTIVE, 1=ACTIVE	Phase B input voltage exceeds meter's measurement range.
BI3	Volts_Error_C	Voltage out of range phase C	R	0=INACTIVE, 1=ACTIVE	Phase C input voltage exceeds meter's measurement range.
BI4	Current_Error_A	Current out of range phase A	R	0=INACTIVE, 1=ACTIVE	Phase A current out of range.
BI5	Current_Error_A	Current out of range phase B	R	0=INACTIVE, 1=ACTIVE	Phase B current out of range.
BI6	Current_Error_A	Current out of range phase C	R	0=INACTIVE, 1=ACTIVE	Phase C current out of range.
BI7	Frequency_Error	Frequency error	R	0=INACTIVE, 1=ACTIVE	Phase A frequency out of range.
BI8	Reserved_BI8	Reserved	R	0=INACTIVE, 1=ACTIVE	Returns "INACTIVE"
BI9	Phase_Loss_A	Phase loss phase A	R	0=INACTIVE, 1=ACTIVE	Phase loss — Phase A voltage dropped below the phase loss threshold set by user.
BI10	Phase_Loss_B	Phase loss phase B	R	0=INACTIVE, 1=ACTIVE	Phase loss — Phase B voltage dropped below the phase loss threshold set by user.
BI11	Phase_Loss_C	Phase loss phase C	R	0=INACTIVE, 1=ACTIVE	Phase loss — Phase C voltage dropped below the phase loss threshold set by user.
BI12	Power_Factor_A	Low power factor phase A	R	0=INACTIVE, 1=ACTIVE	Phase A power factor less than 50% (commonly due to mis-wiring of CTs/PTs to meter).
BI13	Power_Factor_B	Low power factor phase B	R	0=INACTIVE, 1=ACTIVE	Phase B power factor less than 50% (commonly due to mis-wiring of CTs/PTs to meter).
BI14	Power_Factor_C	Low power factor phase C	R	0=INACTIVE, 1=ACTIVE	Phase C power factor less than 50% (commonly due to mis-wiring of CTs/PTs to meter).
BI15	RTC_Reset	RTC reset	R	0=INACTIVE, 1=ACTIVE	Real-time clock reset. This goes active when the meter is powered after an interruption (since it does not use a battery backup). It indicates that the real-time clock has re-initialized to a default setting (00:00:00:00 on Jan 1, 2000) and should not be relied upon. The clock runs, and the meter will operate and even log data, but the date and time will not be correct until a Time_ Synchronization occurs.

AMP1
Data logging

The AMP1H5 includes a data logging feature that records three meter parameters, accessible via BACnet using Trend_Log objects. All three Trend_Log objects use shared data logging resources in the meter, so all three are controlled in unison. All writable properties other than Log_Device_Property_ Object are common to all three Trend_Log obects. Changes to these properties (Log_Enable, Start_Time, Stop_Time, Log_ Interval, Stop_When_Full or Record Count) for any one of the objects will be reflected in the corresponding property of all three objects. The Log_Interval property is also common with the Demand_Subinterval (Present_Value of AV11) since logging records are updated synchronously with demand calculations.

Default settings cause logging to begin immediately with 15-minute intervals and no stop time. When full, the buffer wraps and overwrites the oldest data first (unless the Stop_ When_ Full property is used).

Configuration
Use Log_Device_Object_Property to select the meter parameter to log with each object. Set this property to point to Present_Value property of any of the Analog_Input objects. The default values for the Log_Device_Object_Property of the three Trend_Log objects are set as follows:
- TL1 = Real energy consumption (AI1 Present_Value)
- TL2 = Reactive energy consumption (AI27 Present_Value)
- TL3 = Total real power present demand (AI34 Present_Value)

The Log_Interval (and demand sub-interval) can be set from 10 seconds to 32767 seconds (values of 1000 to 3276700). The sub-interval timer, which determines how often the meter's demand accumulators are updated, also triggers writing to the Trend_Log log buffers. Use the Log_Interval property to set the data logging time sub-interval in units of hundredths of a second (0.01 seconds). The default sub-interval is 15 minutes (a value of 90000 in the Log_Interval property). The Buffer_Length is fixed at 5760, so at a 15-minute interval setting, the buffers hold 60 days' data.

Use the Stop_When_Full property to select either single-shot (Stop_When_Full = TRUE) or continuous mode (Stop_When_ Full = FALSE) for data logging. The default mode is continuous. In single-shot mode, the meter records data only until the buffer is full. Data for this time period is kept, but newer energy information is lost. In continuous mode, the meter continues to record energy data as long as the meter is operating. The buffer can only hold 5760 entries at one time, however; so when the number of records exceeds 5760, the oldest entry is deleted to make room for the newest.

To start data logging with any of the three Trend_Log objects, set the Log_Enable property to TRUE or set the Start_Time and Stop_Time properties appropriately and wait for logging to commence at Start_Time.

By default, the Record_Count property of the Trend_Log objects is initialized to zero.

Reading data
Access logged data with corresponding timestamps via the Log_Buffer property of the Trend_Log object using the BACnet ReadRange service. The AMP1H5 supports both the "by position" and "by sequence number" modes of the ReadRange service, but not the "by time" mode.

AMP1

Trend_log objects

Trend_log properties used	R/W	Units	Additional information
Object_Name	R	Trend_Log_<n>	Where n is 1–3 (there are three instances of Trend_Log objects available).
Description	R	Trend_Log <n>	Where n is 1–3 (there are three instances of Trend_Log objects available).
Log_Enable	W	Binary	Set this to TRUE to enable logging or FALSE to disable logging. The default is TRUE. The value is set to FALSE internally if logging stops for other reasons (i.e., buffer is full).
Start_Time	W	Date/time	Sets the date/time when data logging will start (if Log_enable is TRUE). Set to a date/time earlier than the Local_Date/Local_Time properites of the device object and set Log_Enable TRUE to start logging immediately.
Stop_Time	W	Date/time	Sets the date/time when data logging will STOP (if still running). Stop_Time will be ignored if “”wildcard”” values are used in any of the fields.
Log_Device_Object_ Property	W	BACnetDeviceObject PropertyReference	Set (point) this to the Present_Value of any of objects AI1 through AI49 to establish which parameter to log. Default values are: TL1 = Real energy consumption (array of AI1 Present_Value) TL2 = Reactive energy consumption (array of AI27 Present_Value) TL3 = Total real power present demand (array of AI34 Present_Value)
Log_Interval	W	0.01 seconds	Logging period in hundredths of a second. Default is 90000 (15-minute intervals); minimum value is 1000 (10 seconds). This property can also be set to zero, which will change all three Trend_Logs and the demand calculation to a manual mode (sometimes referred to as “sync to comms.” In manual mode, the demand interval is updated and another record is logged upon a manual command, which is issued by writing the value 21211 to the Present_Value of object AV1.
Stop_When_Full	W	Binary	Set this to TRUE to stop logging when the buffer is full (single-shot mode) or FALSE to continue when full (wrap and overwrite oldest data entries).
Buffer_Size	R	5760	Length of buffer (# of records).
Log_Buffer	R	List of BACnetLongRecord	Contains the data values logged, with timestamps.
Record_Count	W	Unsigned 32-bit integer	This is an integer count of how many records logged since the Trend_Log objects were last reset. Writing a zero to this property resets the logs of all three objects. This value defaults to zero, but by default, logging will start automatically at 15-minute intervals.
Total_Record_Count	R	Unsigned 32-bit integer	This is an integer count of how many records logged since the Trend_Log objects were created (the factory state of the meter). This count is unaffected by resetting the record count or by power failures.
Event_State	R	Binary	–

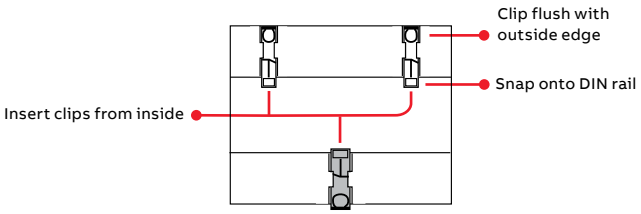
AMP1
Installation

Disconnect power prior to installation.
Reinstall any covers that are displaced during installation before powering the unit.
Mount the meter in an appropriate electrical enclosure near equipment to be monitored.
Do not install on the load side of a variable frequency drive (VFD).

DIN rail mounting

1. Attach mounting clips to the underside of the housing by sliding them into the slots from the inside. The stopping pegs must face the housing, and the outside edge of the clip must be flush with the outside edge of the housing.
2. Snap the clips onto the DIN rail. See diagram of the underside of the meter (figure 7).
3. To prevent horizontal shifting across the DIN rail, use two end stop clips.

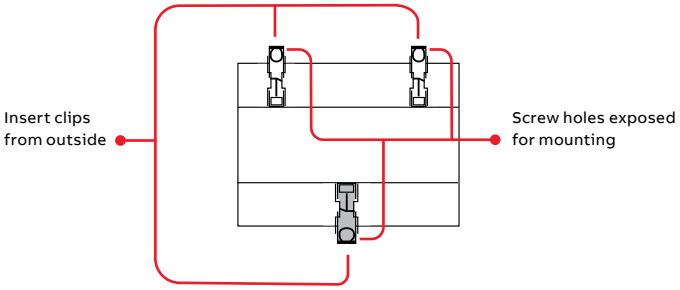
Figure 7.
DIN rail mounting



Screw mounting

1. Attach the mounting clips to the underside of the housing by sliding them into the slots from the outside. The stopping pegs must face the housing, and the screw hole must be exposed on the outside of the housing.
2. Use three #8 screws (not supplied) to mount the meter to the back of the enclosure. See diagram of the underside of the meter (figure 8).

Figure 8.
Screw mounting



AMP1

Supported system types

CAUTION: Risk of equipment damage
- This product is designed only for use with 1 V or 0.33 V current transducers (CTs).
- DO NOT USE CURRENT OUTPUT (e.g., 5 A) CTs ON THIS PRODUCT.
- Failure to follow these instructions can result in overheating and permanent equipment damage.

The AMP1H5 power meter has a number of different possible system wiring configurations (see wiring diagrams, page 6). To configure the meter, set the system type via the user interface or by writing the Present_Value of AV2 with the system type value in the table below. The system type tells the meter which of its current and voltage inputs are valid, which are to be ignored and if neutral is connected. Setting the correct system type prevents unwanted energy accumulation on unused inputs, selects the formula to calculate the theoretical maximum system power and determines which phase loss algorithm is to be used. The phase loss algorithm is configured as a percent of the line-to-line system voltage (except when in system type 10) and also calculates the expected line to neutral voltages for system types that have neutral (12 and 40).

Values that are not valid in a particular system type will display as “----” on the user interface or as QNAN in the BACnet objects.

	CTs		Voltage connections			System type		Phase loss measurements			Wiring diagram number
Number of wires	Qty	ID	Qty	ID	Type	BACnet object AV2	User interface: SETUP>S SYS	VLL	VLN	Balance	
Single-phase wiring											
2	1	A	2	A, N	L-N	10	1L + 1n	–	AN	–	1
2	1	A	2	A, B	L-L	11	2L	AB	–	–	2
3	2	A, B	3	A, B, N	L-L with N	12	2L + 1n	AB	AN, BN	AN-BN	3
Three-phase wiring											
3	3	A, B, C	3	A, B, C	Delta	31	3L	AB, BC, CA		AB-BC-CA	4
4	3	A, B, C	4	A, B, C, N	Grounded Wye	40	3L + 1n	AB, BC, CA	AN, BN, CN	AN-BN-CN and AB-BC-CA	5, 6

AMP1
Troubleshooting

Problem	Cause	Solution
The maintenance wrench icon appears in the power meter display.	There is a problem with the inputs to the power meter.	• See the alert sub-menu or the diagnostic alert BACnet Binary_Input objects.
The display is blank after applying control power to the meter.	The meter is not receiving adequate power.	• Verify that the meter control power is receiving the required voltage. • Verify that the heart icon is blinking. • Check the fuse.
The data displayed is inaccurate.	Incorrect setup values.	• Verify the values entered for power meter setup parameters (CT and PT ratings, system type, etc.). See the setup section.
	Incorrect voltage inputs.	• Check power meter voltage input terminals to verify adequate voltage.
	Power meter is wired improperly.	• Check all CTs and PTs to verify correct connection to the same service, PT polarity and adequate powering. See the wiring diagrams section for more information.
Cannot communicate with power meter from a remote personal computer.	Power meter address is incorrect.	• Verify that the meter is correctly addressed (see setup section).
	Power meter baud rate is incorrect.	• Verify that the baud rate of the meter matches that of all other devices on its communications link (see setup section).
	Communications lines are improperly connected.	• Verify the power meter communications connections (see the communications section). • 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 the shield ground is connected between all units.

AMP1N4

Enclosure for AMP1 series energy meters with swing panel kit

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

Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

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

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

NEC 2011 Article 100: No responsibility is assumed by manufacturer for any consequences arising out of the use of this material.

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

This symbol indicates an electrical shock hazard exists.

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

DANGER: Hazard of electric shock, explosion or arc flash. Failure to follow these instructions will result in death or serious injury.

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

NOTICE:

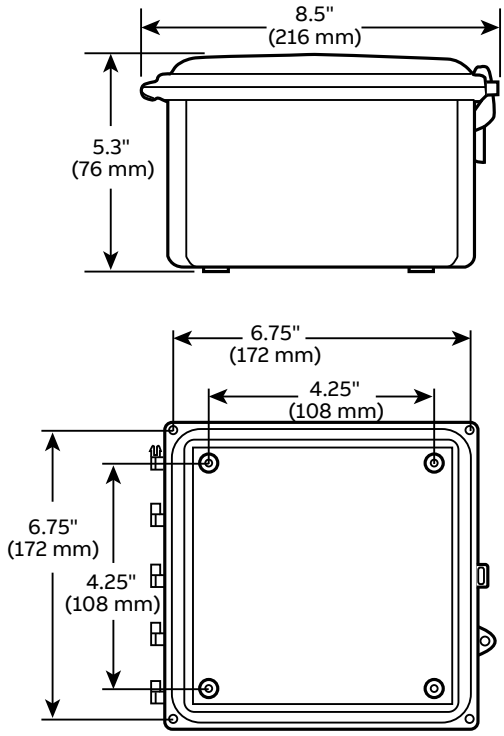
- This product is not intended for life or safety applications.
- Do not install this product in hazardous or classified locations.
- The installer is responsible for conformance to all applicable codes.
- Mount this product inside a suitable fire and electrical enclosure.

AMP1N4

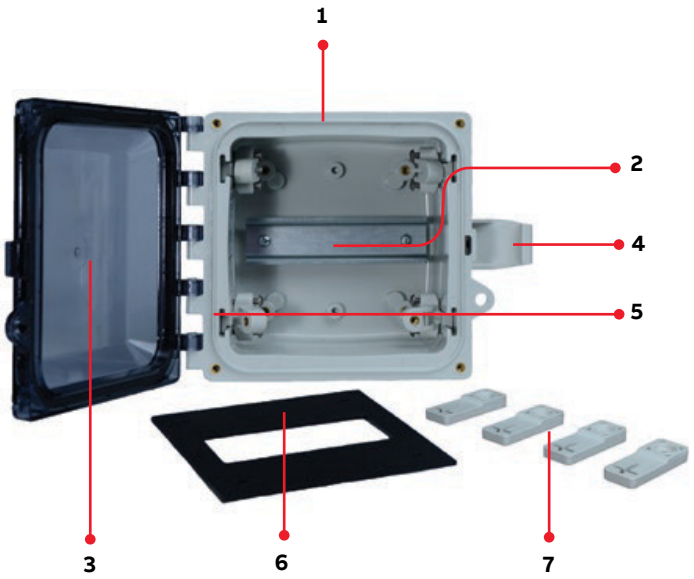
Product overview

The AMP1N4 enclosure offers a mounting option for AMP1 series energy meters that helps protect from tampering and the elements. The enclosure is equipped with DIN rail mounting hardware for easy installation and a NEMA 4X rating for durability. The swing panel kit and multiple locking options provide additional security from unwanted tampering.

Dimensions



Product components



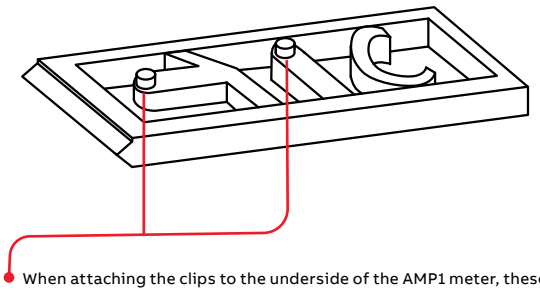
1. Enclosure
2. DIN rail
3. Hinged lid
4. Clasp
5. Brackets for swing panel cover
6. Swing panel cover
7. Mounting feet

(Hardware not pictured)

AMP1N4
Installation

1. **Install DIN rail clips to the back of the AMP1 meter**
   The AMP1 meter is shipped with a set of three DIN rail clips included. Insert these clips into the slots on the back of the housing from the middle, moving outward. Stopping pegs must face the underside of the housing. Push the clips into place until there is an audible click.

   DIN rail clip (included with AMP1 meter)

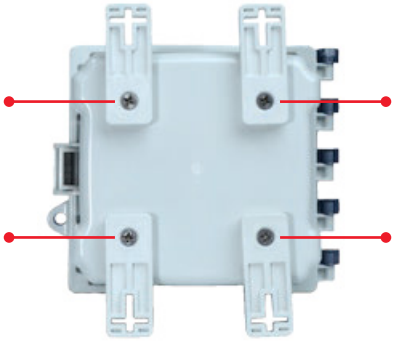


When attaching the clips to the underside of the AMP1 meter, these stopping pegs must face inward toward the meter housing. Set pegs into the available slots on the meter, with the beveled side of the clip facing toward the center of the meter.

When all clips are in place, the white clips must be flush with the top edge of the housing, and the black clip must protrude slightly past the bottom edge.

2. **Mount the AMP1N4 enclosure to a wall or panel**
   Cut holes in the enclosure for wire conduit connections prior to installing the meter in the enclosure. After running the wiring, seal all holes properly to maintain the enclosure rating. If using metallic conduit, bonding between the conduit connections is not automatic and must be provided as part of the installation.

   To prevent component damage or a future malfunction, take care to protect the equipment from drill chips, filings and other contaminants when making the wire entry holes and mounting the enclosure.

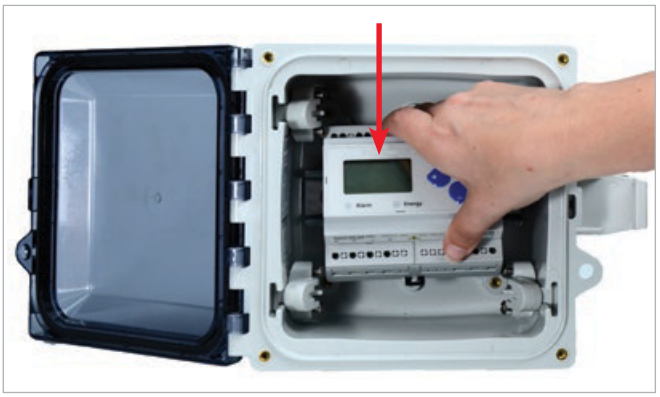


Use the included mounting hardware to attach the mounting feet to the enclosure. Then mount the enclosure to the wall or panel using either a 4-point or 2-point configuration (hardware for mounting to the wall/panel is provided by the installer). The 4-point configuration is shown here. For a 2-point configuration, mount the feet as shown, but rotate the bottom feet 180° so they are flush against the back of the enclosure.

AMP1N4
Installation

3. **Install the AMP1 meter onto DIN rail inside the AMP1N4**
   Run meter wiring through the holes drilled previously. Wire the meter according to the instructions in the meter installation guide.

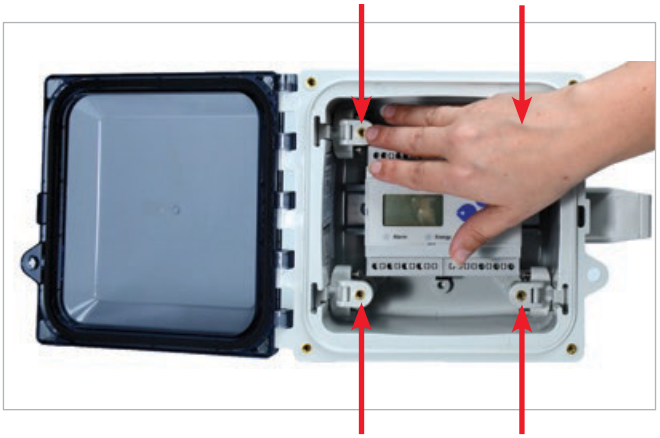
   Push the top of the meter onto the DIN rail.



   Push the bottom of the meter onto the DIN rail until you hear an audible click.

   If necessary, remove the meter from the DIN rail using a flat screwdriver to pry out the bottom (black) clip while lifting out the bottom of the meter.

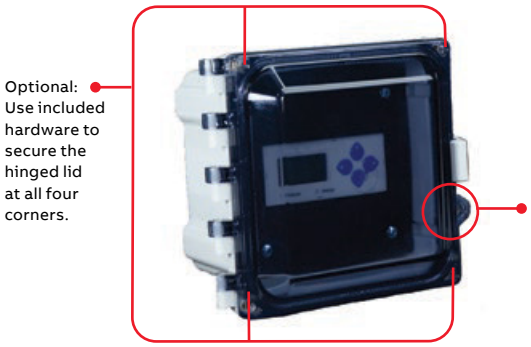
   Lower the four brackets so that the swing panel cover can be attached using the enclosed hardware.



AMP1N4
Installation

Close the hinged lid and secure the clasp to close.

Screws are provided to secure the hinged lid. Local codes may require this step to prevent opening by unauthorized persons if a locking mechanism is not used. For added security, the installer may attach a locking mechanism.



Notes

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