

ENERCEPT® H8025/8026

Networked (N2 BUS) Power Meters



US Patent No. 6,373,238



Installer's Specifications

Input Voltage	208 to 480 VAC
Number of Phases Monitored	1 or 3
Frequency	50/60 Hz
Maximum Primary Current	100/300/400/800/1600/2400 A continuous per phase
CT case isolation	600 VAC
Internal isolation	2000 VAC rms
Operating temp. range	0° to 60°C (32° to 122°F) (<95%RH, non-condensing)
Storage temp. range	-40° to 70°C (-40° to 158°F)
Accuracy	±1% of reading from 10% to 100% of the rated current*
Output Type	RS-485, 2-wire plus common
Baud Rate	9600
Protocol	N2

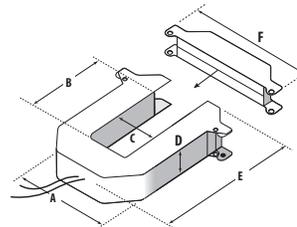
* Meter accuracy specified with conductors centered in the CT window.

QUICK INSTALL

Disconnect and lock out power before installation.

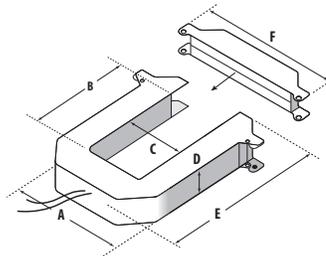
1. Set the address switches located on the bottom of the CT.
2. Connect the voltage leads to the source to be monitored.
3. Snap the CT onto the conductor (observe color matching).
4. Connect the N2 BUS wires (observe polarity).

DIMENSIONS



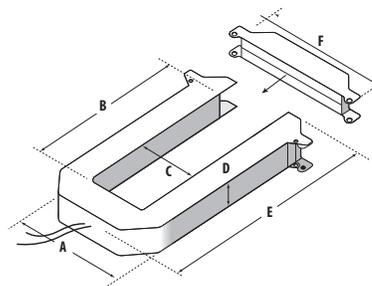
SMALL 100/300 Amp

A =	3.8" (96 mm)
B =	1.2" (30 mm)
C =	1.3" (31 mm)
D =	1.2" (30 mm)
E =	4.0" (100 mm)
F =	4.8" (121 mm)



MEDIUM 400/800 Amp

A =	4.9" (125 mm)
B =	2.9" (73 mm)
C =	2.5" (62 mm)
D =	1.2" (30 mm)
E =	5.2" (132 mm)
F =	5.9" (151 mm)



LARGE 800/1600/2400 Amp

A =	4.9" (125 mm)
B =	5.5" (139 mm)
C =	2.5" (62 mm)
D =	1.2" (30 mm)
E =	7.9" (201 mm)
F =	6.0" (151 mm)

⚠ DANGER ⚡

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

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

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

CAUTION

RISK OF EQUIPMENT DAMAGE

- Enercept meters are rated for use at 50-60Hz. Do not connect this product to circuits with high harmonic energy, such as Variable Speed Drives (a.k.a. Variable Frequency Drives, Adjustable Frequency Drives) or similar sources, as these may permanently damage the product.

Failure to follow these instructions can result in overheating and permanent equipment damage.

NOTICE

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

FCC PART 15 INFORMATION

NOTE: This equipment has been tested by the manufacturer and found to comply with the limits for a class A 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 commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Modifications to this product without the express authorization of Veris Industries nullify this statement.

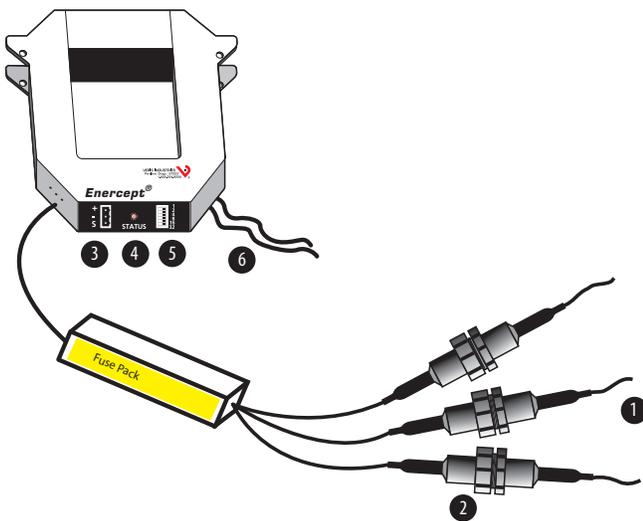
For use in a Pollution Degree 2 or better environment only. A Pollution Degree 2 environment must control conductive pollution and the possibility of condensation or high humidity. Consider the enclosure, the correct use of ventilation, thermal properties of the equipment, and the relationship with the environment. Installation category: CAT II or CAT III

OPERATION

The H8025 and H8026 three-phase power transducers monitor energy parameters from aggregate kW (real power) and kWh (consumption) to power factor per phase. Integration of electronics lowers hardware and installation costs. The sensors automatically detect phase reversal, so CT load orientation is not a concern. The CTs and meters are calibrated as a set, so it is necessary to color-match the CTs and voltage leads when installing.

With two platforms to choose from (H8025 Energy Only or H8026 Enhanced Data Stream), the applications for these devices are diverse, including aggregate billing, tenant submetering, energy management, performance contracting, demand limiting and cooling plant optimization. The 1% total system accuracy conforms to ANSI C12.1 metering standards.

PRODUCT DIAGRAM



1. Voltage Leads: input range is 208 to 480V.
2. Fuses: maximum current draw 60mA. Fuses provided by the factory are rated 1/2A, 600VAC, 200 KAIC. Replace only with fuses of the same type and rating.
3. Pulse Output connector
4. Status LED: blink codes: slow green for normal operation; slow red for incorrect wiring or low power factor (less than 0.5); fast red for max. current exceedance.
5. Pulse Rate Switches: used to set the pulse output rate.
6. External CTs: permanently attached; do not disconnect or use with other power meters.

! Color match CTs and voltage leads! Example: clamp the red labeled CT around the power conductor connected to the red voltage wire.

INSTALLATION

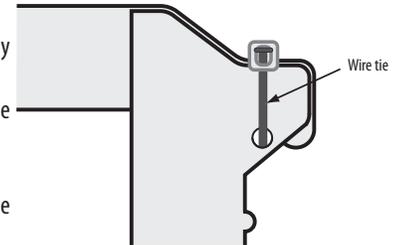
⚠️ Disconnect and lock out power before installation.

The Enercept meter, including the current transformers (CTs), voltage connection fuses, and fusepac, is permitted within electrical distribution equipment including but not limited to panelboards, switchboards, motor control centers, and transformers. Carefully review the equipment in which the Enercept meter will be installed. The following installation conditions should be considered during the installation process:

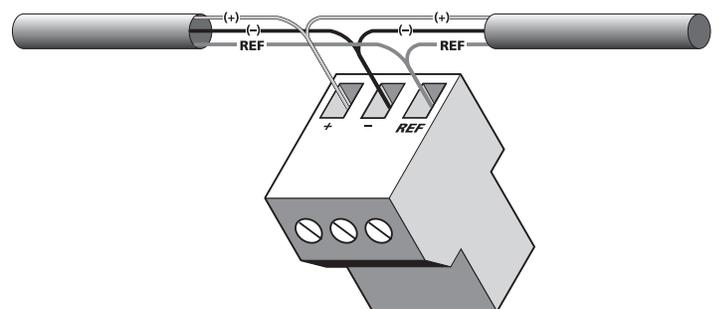
- Review the equipment enclosure for ventilation openings. Wires will cross many of these openings in a normal installation, however, do not install the Enercept where it will substantially block ventilation openings in the enclosure.
- The Enercept meter and the wiring installed within a wiring space or gutter should not exceed 75 percent cross sectional fill at the Enercept meter parts as addressed in the NEC. Improper installation of Enercept meter in the wire gutter of equipment may affect the thermal performance of the equipment.
- The arrangement of CTs within the equipment must also be considered to ensure the bending radius of conductors is not adversely affected.
- Review the arrangement and location of the CTs within the equipment. The CT must not create undue strain on the conductor. A CT may require appropriate support in order to address such a condition.

1. Choose a unique address and set the switches for that address as shown in the Address Selection Switches section. Only addresses 1 to 63 can be used.
2. Connect the voltage leads to the phase conductors, at a location that is not normally turned off. Connect voltage leads on the Line side of the conductor to ensure constant power to the meter. For a 3-phase system, connect the red lead to phase A, black to phase B, and yellow to phase C. See the Wiring section on the following page.

3. Snap the CT onto the conductor. Connect CTs to the correspondingly colored voltage lead. If the application can exceed 20 times the rated CT current, use wire ties to secure the I-bar to the CT housing. This CT automatically detects phase reversal, so CT load orientation is not important.



4. Remove the terminal block and attach the N2 BUS. Observe (+), (-), and Ref polarity. Insulate any exposed wiring. When installing multiple meters, attach all N2 Bus connectors to the network trunk cable, and then connect individual meters



5. Set up Metasys (see Metasys Setup section).
6. Check power reading (these calculations are approximations only).

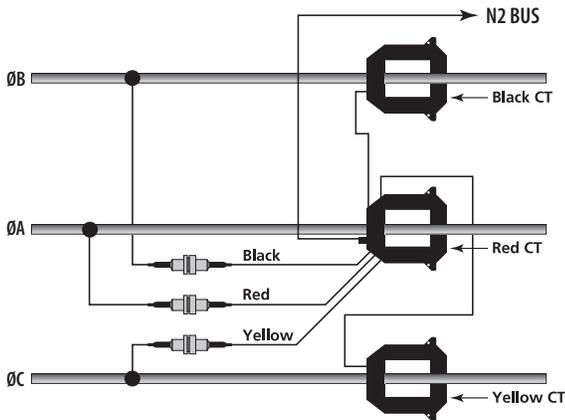
Expected power:

$$kW = \text{Volts} \times \text{Amps} \times 1.732 \times \text{PF} / 1000$$

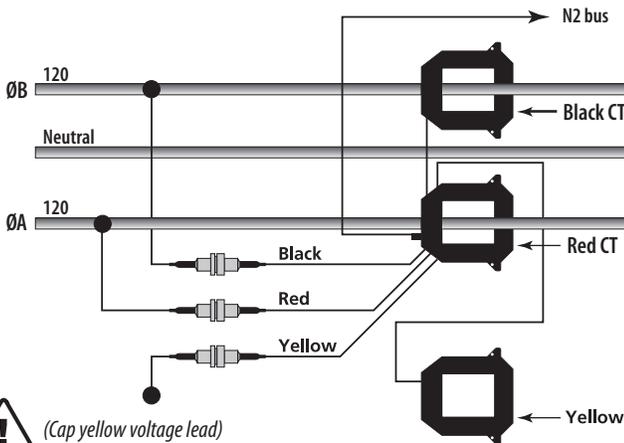
$$kW = \text{Horsepower} \times 0.746$$

WIRING

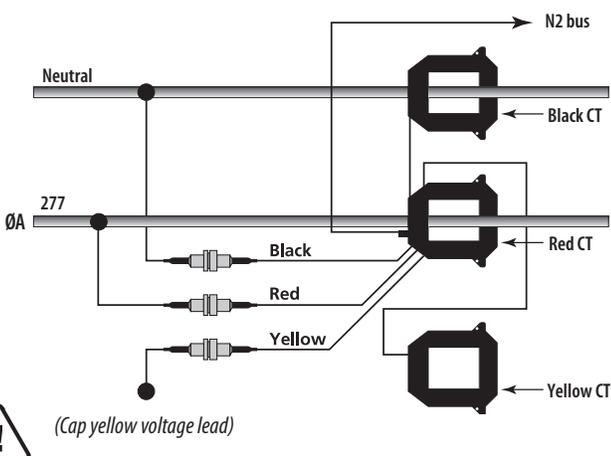
Typical 208/480 VAC 3Ø, 3, 4 Wire Installation



Typical 240/120 VAC 1Ø, 3 Wire Installation



Typical 277 VAC 1Ø, 2 Wire Installation



Note: The meter cannot communicate on the N2 bus without power. Therefore, it is best to connect the voltage leads ahead of switching devices.

NOTES

1. DO NOT GROUND THE N2 BUS REFERENCE INSIDE THE ELECTRICAL PANEL. All N2 lines, including the shield, should be insulated to prevent accidental contact with high voltage conductors.
2. The N2 BUS cable should be mechanically secured where it enters the electrical panel.
3. All N2 BUS devices should be connected together in a daisy-chain fashion.
4. The N2 BUS cable should be shielded twisted pair wire BELDEN 1120A or similar.

WARNING: After wiring the N2 BUS cable, remove all scraps of wire or foil shield from the electrical panel. This could be DANGEROUS if wire scraps come into contact with high voltage wires!

OUTPUT

H8025

AC-1: kWh, consumption

BO-1: Reset kWh

AI-1: kW, real power

H8026

AC-1: kWh, consumption

BO-1: Reset kWh

BO-2: Reset min./max./avg.

AI-1: kWh, consumption

AI-2: kW, real power

AI-3: VAR, reactive power

AI-4: VA, apparent power

AI-5: Power factor

AI-6: Average real power

AI-7: Minimum real power

AI-8: Maximum real power

AI-9: Voltage, line-to-line

AI-10: Voltage, line-to-neutral

AI-11: Amps, average current

AI-12: kW, real power ØA

AI-13: kW, real power ØB

AI-14: kW, real power ØC

AI-15: Power factor ØA

AI-16: Power factor ØB

AI-17: Power factor ØC

AI-18: Voltage, ØA to ØB

AI-19: Voltage, ØB to ØC

AI-20: Voltage, ØA to ØC

AI-21: Voltage, ØA to Neutral

AI-22: Voltage, ØB to Neutral

AI-23: Voltage, ØC to Neutral

AI-24: Amps, Current ØA

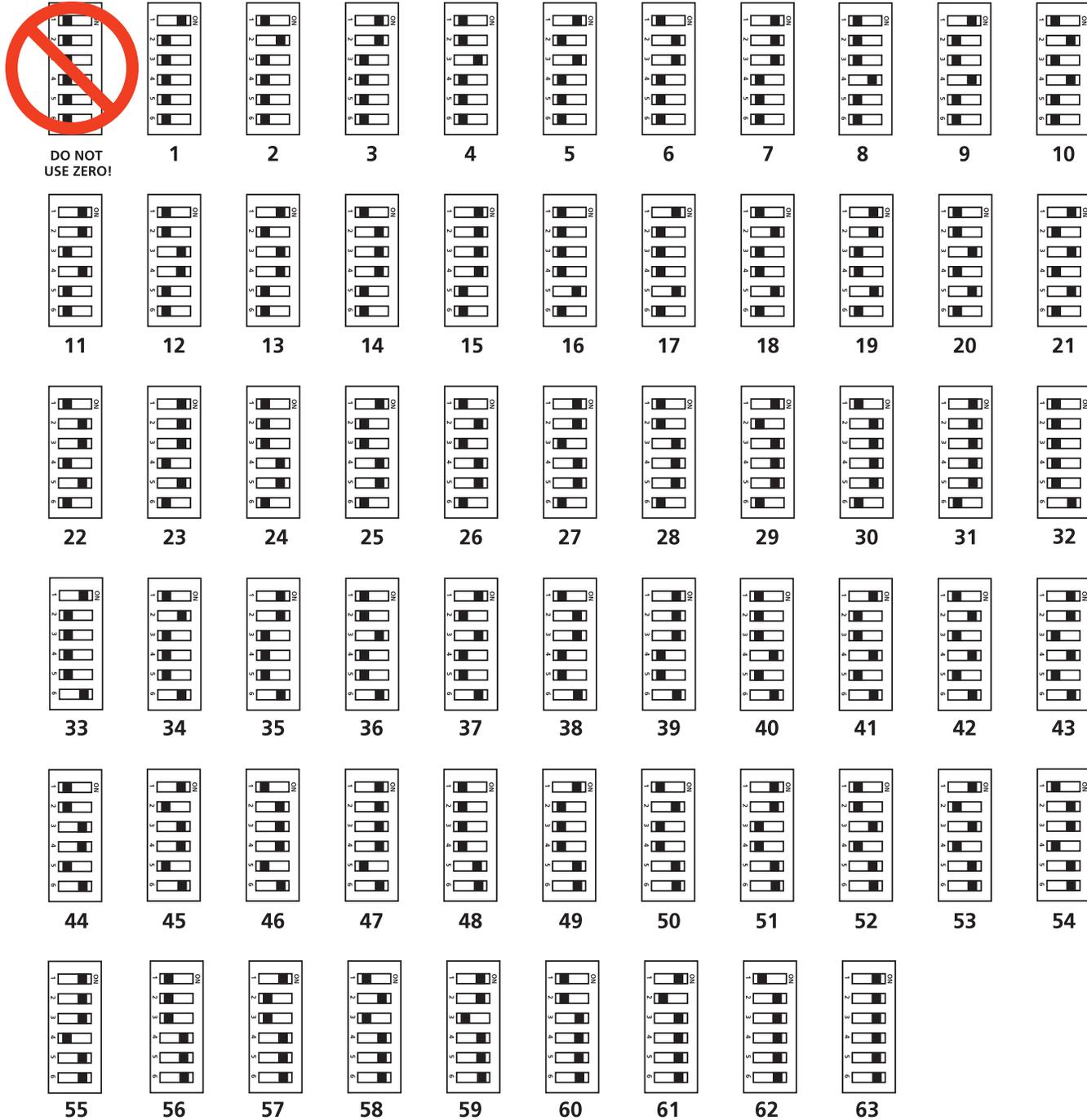
AI-25: Amps, Current ØB

AI-26: Amps, Current ØC

ADDRESS SELECTION SWITCHES

Each device on the N2 BUS must have a unique address. These switches must be set to assign a unique address before the device is connected to the N2 BUS. If an address is selected which conflicts with another device on the N2 BUS, both devices will be unable to communicate.

When setting the N2 BUS address, choose an address number which is not in use. Only N2 addresses in the range of 1 to 63 may be used. Set the switches for the selected address by following the diagram below. This address will be required when adding the meter to Metasys®.



POINT MAP FOR H8025, N2 PROTOCOL

NPT	NPA	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	1	kWh, kW*	Consumption (accumulation)	100A: 0.0025 kWh/count 300A: 0.01 kWh/count 400A: 0.01 kWh/count 800A: 0.02 kWh/count 1600A: 0.04 kWh/count 2400A: 0.08 kWh/count	Intended for use as an accumulator (ACM) type. It should not be read as a binary status.
AI	1	kWh	Consumption	100A: 0 to 10737418.24 2400A: 0 to 343597383.7	Allows direct view of kWh accumulator as an AI point. For large values, BI-1 is more precise.
AI	2	kW	Real Power	100A: 0 to 83.1 2400A: 0 to 1995.3	
BO	1		Reset kWh	0 = NA 1 = Reset kWh	Resets the kWh accumulator to zero. The value will return to "off." **
ADI	1		Preset kWh, LSW	-32768 to 32767	Allows the lower 16 bits of the kWh accumulator to be preset
ADI	2		Preset kWh, MSW	-32768 to 32767	Allows the upper 16 bits of the kWh accumulator to be preset

* kWh when displayed in "analog consumption units," kW when displayed in "analog units."

** Do not define BO-1 as auto-restorable. If they are defined in a Metasys CS object or in Companion, they should be commanded to 0 after commanding to 1 to avoid unintentional reset.

Only BO-1, BO-2, ADI-1, and ADI-2 are capable of being commanded or overridden.

Phase A corresponds to the red lead, Phase B to the black lead, and Phase C to the yellow.

METASYS SETUP

H8025

1. Define a hardware object: Type "N2 Device", Device type: "VND"
2. Add kWh Accumulator (Consumption) Point: Directly map BI point 1 to an accumulator (ACM) object at Metasys. Refer to the Range/Value column in the point map (page 5) for the "pulse constant" which corresponds to the CT size used. The correct pulse constant must be used to obtain accurate data. The "Rate Constant" should be "Hour".
3. Add kW (Instantaneous Demand) Point Directly map AI point 2 to an Analog Object: Do not use alarm or warning limits (see below). Alternatively, the CS model file H8025.DDL may be used.
4. Add kWh AI Point (optional): Directly map AI point 1 to an analog object. Do not use alarm warning limits. Alternatively, the CS model file H8025.DDL may be used. This AI point provides direct kWh accumulation display.

H8026

1. Define a hardware object: Type "N2 Device", Device type: "VND"
2. Add kWh Accumulator (Consumption) Point: Directly map BI point 1 to an accumulator (ACM) object at Metasys. Refer to the Range/Value column in the point map (page 6) for the "pulse constant" which corresponds to the CT size used. The correct pulse constant must be used to obtain accurate data. The "Rate Constant" should be "Hour".
3. Compile the CS model file (H8026.DDL) to add the CS models for the H8026 to your Metasys database: Type "DDL H8026".
4. Add CS Object using the model "H8026A": This allows access to the first 16 AI points.
5. Add CS Object using the model "H8026B": This allows access to the remaining AI points.

SPECIAL METASYS SETUP OPTIONS

Setting Alarm or Warning Limits

The H8025 and H8026 do not support alarm and warning status reporting for AI points. If alarm and/or warning limits are required, first define a CS object. Then map an AD object to each CS object AI point value attribute. However, alarm and warning limits may be used with the accumulator point.

Resetting the kWh Accumulator

Point BO-1 resets the kWh accumulator when commanded to "1." This point will automatically return to "0" immediately after the kWh accumulator is reset. Map BO-1 directly to a BO object defined with the auto restore flag set to "N." This will prevent an accidental kWh reset if the meter goes off-line and returns. Do not define BO-1 with a CS Model, as this would automatically set the auto restore flag to "Y."

Using Multipliers to Scale Data Points

In high voltage installations where the meter is powered by a potential transformer, the data must be multiplied by the ratio of the transformer used. Most of these applications use pre-installed 5 Amp output current transformers, with the 5 Amp line wrapped many times through the H8025/H8026 meter. Two multipliers exist, one for the voltage, and one for the effective current ratio. For example, a 300:5 amp CT is pre-installed and the 5 Amp loop is wound 20 times onto the H8026 meter; effective

current ratio would be 3. If a 20:1 potential transformer is used, then voltage points would need to be multiplied by 20, current points would need to be multiplied by 3, and power points would need to be multiplied by 60. Power factor points do not use multipliers.

The kWh accumulator may be multiplied by changing the "pulse constant." To apply multipliers to AI points, use a GPL process to do the math and write the multiplied value to a pseudo-point.

Displaying kWh

Use totalization to display kWh values. When displayed normally, the accumulator will show kW instead of kWh. The kW value associated with the accumulator should agree with AI-2, but it will respond slowly as Metasys® counts kWh over a period of time to compute kW. Alternatively, AI-1 provides a direct view of the accumulated kWh. For large values, BI-1 will provide better precision than AI-1.

Presetting the kWh Accumulator

In some cases it may be necessary to preset the kWh accumulator to a specific value by writing to ADI-1 and ADI-2. To computing the values to write to these points:

1. Divide the desired kWh value by the kWh/count constant that corresponds to the CT size of the meter (see the point map), and round off to the nearest whole number. This is the "raw count."
2. Divide the raw count by 65536 and round down to the nearest whole number.
3. If the value was greater than 32767, subtract 65536. This is the value to write to ADI-2.
4. Take the raw count, divide by 65536, subtract out the integer portion, leaving only the part to the right of the decimal point, and then multiply by 65536.
5. If the value was greater than 32767, subtract 65536. This is the value to write to ADI-1.

Both points should be written when there is no power (AI-1 reads zero) to prevent the values from changing unexpectedly as they are written.

Using the Avg/Min/Max Points (H8026)

The Average Real Power (AI-5), Minimum Real Power (AI-6), and Maximum Real Power (AI-7) points measure their respective data during a period of time. They begin after BO-2 is commanded to "1." A typical usage would be to read these points at a regular interval, such as every 15 minutes, and then command BO-2 immediately after reading them. Map BO-2 directly to a BO object defined with the auto restore flag set to "N."

METASYS MODEL FILES

H8025.DDL

Veris H8025, Energy Meter

@MODEL+

CSMODEL "H8025","VND"

AITITLE "Analog Inputs"

BOTITLE "Binary Outputs"

ADTITLE "Analog Data Points"

CSAI "AI1",N,N,"CONSUMPT","kWH"

CSAI "AI2",N,N,"POWER","kW"

* These two points can be used to preset the kwh accumulator.

* Normally the kwh accumulator only needs to be reset to zero,

* which can be accomplished using B01. Computing the values

* to write to these points is not simple. In most applications,

* the exact value of the accumulator is not important because

* totalization is used to obtain useful kWH data.

* CSAD "ADI1",Y,N,"PRESET_L","kWH"

* CSAD "ADI2",Y,N,"PRESET_H","kWH"

* The following BO point should be mapped directly to a BO object

* defined with the auto retore flag set to 'N'.

* CSBO "B01",N,N,"RES_kWH","n/a","reset"

These files may be downloaded from:

<http://www.veris.com/hawkeye/revb/h8025.ddl>

<http://www.veris.com/hawkeye/revb/h8026.ddl>

H8026.DDL

* Veris H8026, Energy Meter, Enhanced Data Stream

* This file contains two CS models to access all of the AI points

* in the H8026. Two models are required because there are more

* than 16 AI points.

@MODEL+

CSMODEL "H8026A","VND"

AITITLE "Analog Inputs"

BOTITLE "Binary Outputs"

ADTITLE "Analog Data Points"

CSAI "AI1",N,N,"CONSUMPT","kWH"

CSAI "AI2",N,N,"POWER","kW"

CSAI "AI3",N,N,"REACTPOWER","kVAR"

CSAI "AI4",N,N,"APP_POWER","kVA"

CSAI "AI5",N,N,"POW_FACT",">#"

CSAI "AI6",N,N,"AVE_PWR","kW"

CSAI "AI7",N,N,"MIN_PWR","kW"

CSAI "AI8",N,N,"MAX_PWR","kW"

CSAI "AI9",N,N,"VOLT_L-L","Volts"

CSAI "AI10",N,N,"VOLT_L-N","Volts"

CSAI "AI11",N,N,"CURRENT","Amps"

* These two points can be used to preset the kwh accumulator.

* Normally the kwh accumulator only needs to be reset to zero,

* which can be accomplished using B01. Computing the values

* to write to these points is not simple. In most applications,

* the exact value of the accumulator is not important because

* totalization is used to obtain useful kWH data.

* CSAD "ADI1",Y,N,"PRESET_L","kWH"

* CSAD "ADI2",Y,N,"PRESET_H","kWH"

* The following BO points should be mapped directly to BO objects

* defined with the auto retore flag set to 'N'.

* CSBO "B01",N,N,"RES_kWH","n/a","reset"

* CSBO "B02",N,N,"RES_AVG","n/a","reset"

CSMODEL "H8026B","VND"

AITITLE "Analog Inputs"

CSAI "AI12",N,N,"POWER-A","kW"

CSAI "AI13",N,N,"POWER-B","kW"

CSAI "AI14",N,N,"POWER-C","kW"

CSAI "AI15",N,N,"PF_PH-A",">#"

CSAI "AI16",N,N,"PF_PH-B",">#"

CSAI "AI17",N,N,"PF_PH-C",">#"

CSAI "AI18",N,N,"VOLT_A-B","Volts"

CSAI "AI19",N,N,"VOLT_B-C","Volts"

CSAI "AI20",N,N,"VOLT_A-C","Volts"

CSAI "AI21",N,N,"VOLT_A-N","Volts"

CSAI "AI22",N,N,"VOLT_B-N","Volts"

CSAI "AI23",N,N,"VOLT_C-N","Volts"

CSAI "AI24",N,N,"CURRENTA","Amps"

CSAI "AI25",N,N,"CURRENTB","Amps"

CSAI "AI26",N,N,"CURRENTC","Amps"

TROUBLESHOOTING

Problem	Solution
Status LED does not blink	Check fuses and voltage connections. Status LED should blink regardless of CTs, N2 BUS connections, and DIP switch setting.
Power meter interferes with another device on the N2 BUS	Set DIP switches to a different N2 address not in use.
Readings seem highly inaccurate.	<ul style="list-style-type: none"> • Check that each CT is installed on the conductor with the corresponding color voltage input lead attached. In most cases, incorrect wiring will cause the STATUS LED to blink RED (slowly). However, a power factor lower than 0.5 could cause the LED to blink this way, even if the unit is installed properly. • It does not matter which side of the CT faces towards the load. • If current is below 7% of full scale maximum for the CT, use a smaller CT or wrap each wire through the CT multiple times • Check current with an amp-clamp. <p>Expected power: $kW = Volts \times Amps \times 1.732 \times PF / 1000$ $kW = Horsepower \times 0.746$ PF is usually 0.7 to 0.95, depending on the load.</p>
Meter goes offline when load is switched off.	Voltage leads must be connected on the Line side of the conductor. The power meter cannot communicate on the N2 BUS without voltage.
Status LED blinks red.	<ul style="list-style-type: none"> • If the LED blinks quickly (i.e., about 5 blinks in two seconds), then the CT rating is too low. • If the LED blinks slowly (i.e., about 1 blink in two seconds) the CTs are not installed on the correct conductors, or the power factor is less than 0.5. The meter can accurately measure these low PFs, but few loads operate normally at such a low power factor.