

New York State Energy Research and Development Authority



**MONITORING PLAN
FOR
CHP DEMONSTRATION SITE**

August 1, 2013
Revision 0

NYSERDA AGREEMENT # 1931

**Urban Horizons Building
50 East 168th Street
Bronx, NY 10452**

Prepared For:
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1 - INTRODUCTION

This document describes the measurements, sensors, and data logging equipment proposed to quantify the performance of the Combined Heat and Power (CHP) system installed at the Urban Horizons building at 50 East 168th in the Bronx, NY.

Gut rehabbed in 1997, The Urban Horizons building was converted into apartments and commercial spaces that include WHEDCo offices, a day care center, a health care center, a commercial kitchen, and a family support and fitness center. The complex includes 132 apartments, a total of 154,750 sqft of residential space; 30,000 sqft of commercial space and 9,550 sqft of cellar and mechanical rooms.

The CHP system for the project consists of a C65 Capstone Microturbine. The system is part of an overall HVAC retrofit which will include the replacement of hydronic boilers, domestic water heaters, storage tanks and circulating pumps.

Prime Mover:	MicroTurbine
Model:	Capstone C65
Quantity:	1
Type:	gas-fired microturbine
Fuel Input:	842,000 btu/hr (HHV)
Electrical Output:	65 kW, 480 volt, 3 Phase, 60 Hz.
Recoverable Heat:	408,000 BTU/HR

The Capstone Microturbine is located on the roof, with related pumps and components located in the basement mechanical room. Also located in the basement mechanical room are the indirect water heaters and storage tanks. Hot water piping from the integrated exhaust-to-hot-water heat exchanger (ICHP heat recovery) is piped directly to the primary heating loop (boiler loop) in the basement, enabling the CHP system to serve both heating and domestic hot water systems simultaneously.

2 - MONITORING STRATEGY

A monitoring system will be installed to measure the performance of the CHP system. The system will be based around the RSP-Vue data acquisition / main controller, using an Obvius AcquiSuite A8812 Data Acquisition Server as the data collection platform. All monitoring hardware and field points are being installed by RSP. Table 1 gives an overview of all points to be monitored. Each point is listed with correspondent description, engineering unit measured and hardware model.

Data Point	Description	Units	Sensor
WT	Total Facility Power	kWh	Shark 100
WG	Net Generator Power	kWh	Veris Power Transducer H8035-0100-2
FGT	Total Facility Gas Input	ft ³	ConEd Gas Bill
FGG	Total Generator Gas Input	ft ³	Eldridge Gas Mass Flow 8720MPNH
FL	Hot Water Flow	gpm	Onicon Flow Meter F-1100
TLS	HW Loop Supply Temp	°F	Onicon Solid State Temp Sensor
TLR	HW Loop Return Temp	°F	Onicon Solid State Temp Sensor
ERT	CHP Energy Recovered	BTU	Onicon System-10 BTU Meter
SHWP	HW Circulator Pump Runtime	min	VERIS H900

Table 1. Monitored Data Points

Figure 1 displays a schematic of the location of monitored points.

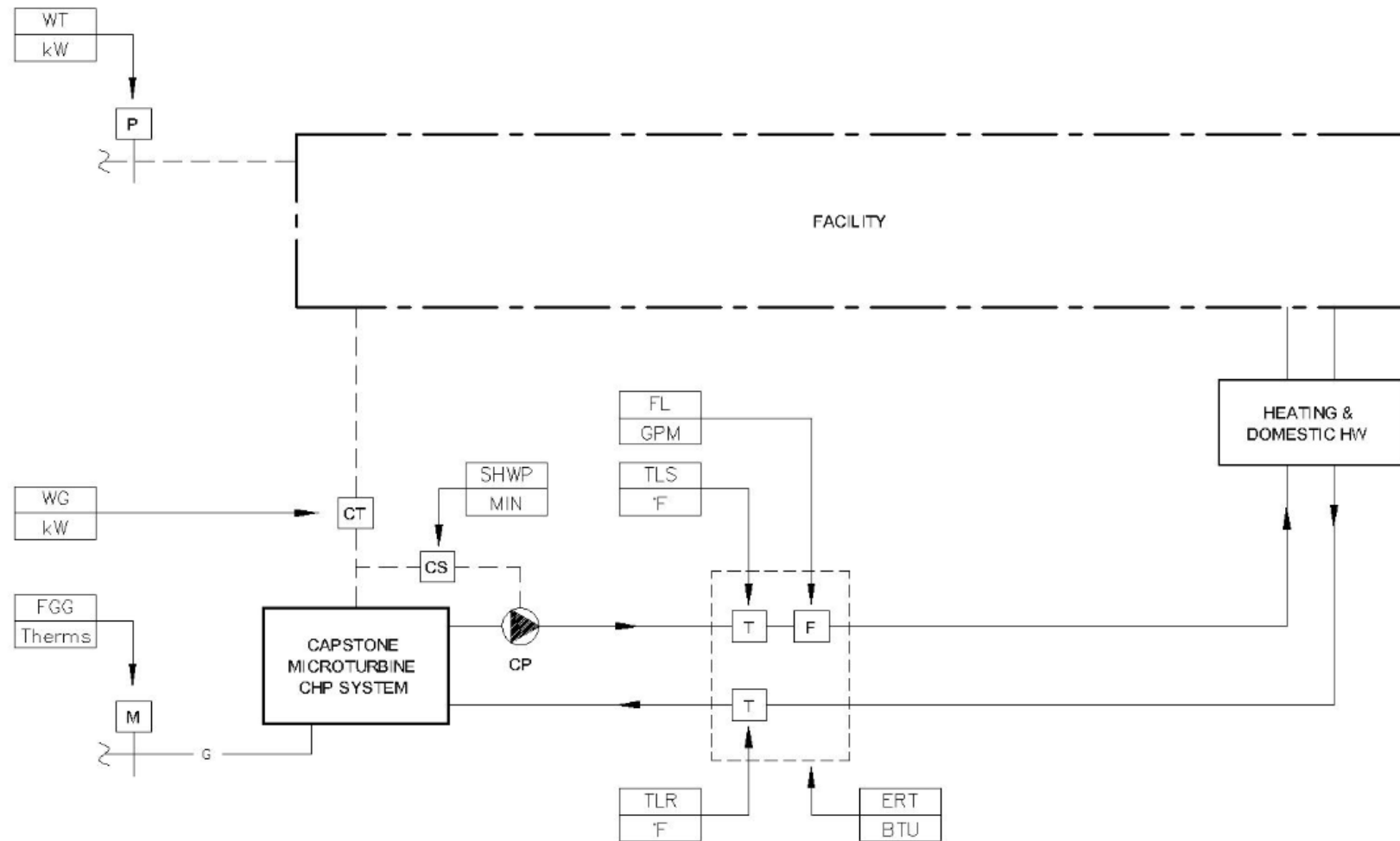


Figure 1. Monitoring Schematics

3 - MONITORING DATA POINTS

Total Facility Power [WT]

Total facility power will be monitored with a Shark 100 power meter shown in Figure 2.



Figure 2. Shark 100 Meter

Net Generator Power [WG]

Generator power will be measured with the Veris Power Transducer H8035-0100-2 shown in Figure 3.



Figure 3. Veris Enercept H8035 Transducer

Total Facility Gas Input [FGT]

Monthly natural gas consumption for the building will be collected using utility billing information from ConEd.

Total Generator Gas Input [FGG]

The total generator gas input will be gathered using an Eldridge Gas Mass Flow Meter. The meter has a model number of 8720MPNH, a length of 14" and an MNPT of 2 1/2". This device is shown in Figure 4.



Figure 4. Eldridge Gas Flow Meter

Hot Water Flow [FL]

The hot water flow will be measured using Onicon Flow Meter F-1100, a single turbine insertion flow meter. The flow rates will be utilized by the Onicon System-10 BTU Meter, described on the following page.

Turbine Energy Recovered [ERT]

The energy recovered by the CHP will be measured using Onicon System-10 BTU Meter, in combination with temperature sensors it comes with, and the aforementioned Onicon Flow Meter F-1100. This device is shown in Figure 5.



Figure 5. Onicon System-10 BTU Meter

Data Logging Equipment

The data logging system will be based around the Obvius AcquiSuite A8812 data logger. The logger has eight analog or digital inputs on the main board, and monitoring capabilities can be extended using expansion boards. The primary sensor connection configuration for the logger is a two-wire twisted pair network that reduces the number of low voltage sensor wire runs. The logger has 32 MB of onboard RAM for data retention. The logger is equipped with both a 10/100 LAN port and an analog phone modem for remote data retrieval. The logger is displayed in Figure 6.



Figure 6. Obvius AcquiSuite Data Logger

A dynamic IP address is used by the logger to upload data every night to the CDH Energy servers.

Appendix A: Equipment Cut Sheets

SHARK[®] 100

MULTIFUNCTION POWER AND ENERGY METER

Revenue Grade

New Ethernet
TCP/IP Option

Shark[®] 100T
Transducer Only

Shark[®] 100
Meter/Transducer

Features

- 0.2% Class Energy and Demand Metering
- Measurements including Voltage, Current, Power, Frequency, Energy, etc.
- Optional KYZ Pulse and Standard IrDA Port
- Power Quality Measurements (%THD and Alarm Limits)
- V-Switch™ Technology - Field Upgrade without Removing Installed Meter
- Large Bright Red LED Display
- % of Load Bar for Analog Meter Perception
- Optional RS485 Modbus and DNP 3.0 Protocols
- Optional 100BaseT Ethernet
- Fits Both ANSI and DIN Cut-Outs
- Available in a Transducer-Only Version

Applications

- Utility Metering
- Commercial Metering
- Substations
- Industrial Metering
- Power Generation
- Campus Metering
- Submetering
- Analog Meter Replacement

Introduction

Electro Industries introduces one of the industry's highest performance revenue grade panel meters. Based on an all new platform, this low cost meter significantly outperforms other devices many times its price. This unit is perfect for new metering applications and as a simple replacement of existing analog meters. The Shark[®]

meter excels in metering energy accurately, exceeding ANSI C12.20 (0.2%) and IEC 62053-22 (0.2%) energy measurement standards. The unit utilizes high speed DSP technology with high resolution A/D conversion to provide revenue certifiable accuracy for Utility Billing, Substation Metering, Submetering and Critical Metering applications.

High Performance and Economical Pricing for High Volume Deployment

Superior Accuracy and Virtual Upgrade Switches

V-Switch™ Technology

The Shark® 100 meter is equipped with EIG’s exclusive V-Switch™ technology. This technology allows users to upgrade and add features as needed by using communication commands, even after the meter is installed.

Available V-Switches:

- V-Switch 1 – Volts and Amps Meter – Default
- V-Switch 2 – Volts, Amps, kW, kVAR, PF, kVA, Freq
- V-Switch 3 – Volts, Amps, kW, kVAR, PF, kVA, Freq, kWh, kVAh, kVARh and DNP 3.0
- V-Switch 4 – Volts, Amps, kW, kVAR, PF, kVA, Freq, kWh, kVAh, kVARh, %THD Monitoring, Limit Exceeded Alarms and DNP 3.0

Traceable Watt-Hour Test Pulse for Accuracy Verification

The Shark® 100 device is a traceable revenue meter. It contains a utility grade test pulse allowing power providers to verify and confirm that the meter is performing to its rated accuracy. This is an essential feature required of all billing grade meters.

Additional Features Include:

- Utility Block and Rolling Average Demand
- Adjustable Demand Profiles
- Max and Min Available on Most Other Parameters
- Voltage Provides Instantaneous Max and Min for Surge and Sag Limits

Advanced Communication Capability with IrDA Interface

The Shark® 100 meter provides two independent communication ports with advanced features.

Back Mounted Communication Port with KYZ Pulse

- RS485 (Option 485P) – This port allows RS485 communication using Modbus or DNP 3.0 Protocols. Baud rates are from 9,600 to 57,600.
- KYZ Pulse – In addition to the RS485, the meter also includes a KYZ pulse mapped to positive energy. This is a fixed energy pulse. Pulse values are:

Voltage Level	Class 10 Models	Class 2 Models
Below 150V	0.2505759630	0.0501151926
Above 150V	1.0023038521	0.2004607704

Optional 10/100BaseT Ethernet

Ethernet (Option INP10) – 10/100BaseT Ethernet with Modbus TCP protocol.

Measured Parameters	Accuracy % of Reading	Display Range
Voltage L-N	0.1%	0-9999 Scalable V or kV
Voltage L-L	0.1%	0-9999 V or kV Scalable
Current	0.1%	0-9999 Amps or kAmps
+/- Watts	0.2%	0-9999 Watts, kWatts, MWatts
+/-Wh	0.2%	5 to 8 Digits Programmable
+/-VARs	0.2%	0-9999 VARs, kVARs, MVARs
+/-VARh	0.2%	5 to 8 Digits Programmable
VA	0.2%	0-9999 VA, kVA, MVA
VAh	0.2%	5 to 8 Digits Programmable
PF	0.2%	+/- 0.5 to 1.0
Frequency	0.01 Hz	45 to 65 Hz
%THD	5.0%	0 to 100%
% Load Bar	1-120%	10 Digit Resolution Scalable

Note: Typical results are more accurate. Applies to 3 Element WYE and 2 Element Delta Connections. Add 0.1% of Full Scale plus 1 digit to Accuracy specs for 2.5 Element connections.

Measured Values	Real-Time	Avg	Max	Min
Voltage L-N	•		•	•
Voltage L-L	•		•	•
Current Per Phase	•	•	•	
Watts	•	•	•	•
VAR	•	•	•	•
VA	•	•	•	•
PF	•	•	•	•
+ Watt-hr	•			
-Watt-hr	•			
Watt-hr net	•			
+VAR-hr	•			
-VAR-hr	•			
VAR-hr net	•			
VA-hr	•			
Frequency	•		•	•
%THD	•		•	•
Voltage Angles	•			
Current Angles	•			
% of Load Bar	•			



Front Mounted IrDA Communication

Uniquely, the Shark® meter also has an optical IrDA port, allowing the unit to be set up and programmed using a remote laptop PC without need for a communication cable. To configure the meter, just point at it with an IrDA-equipped PC.

Rugged and Safe Voltage and Current Inputs

The Shark® 100 meter is ruggedly designed for harsh electrical applications in both high voltage and low voltage power systems. This is especially important in Power Generation, Utility Substation and Critical User applications. The structural and electrical design of this meter was developed based on the recommendations and approval of many of our utility customers.

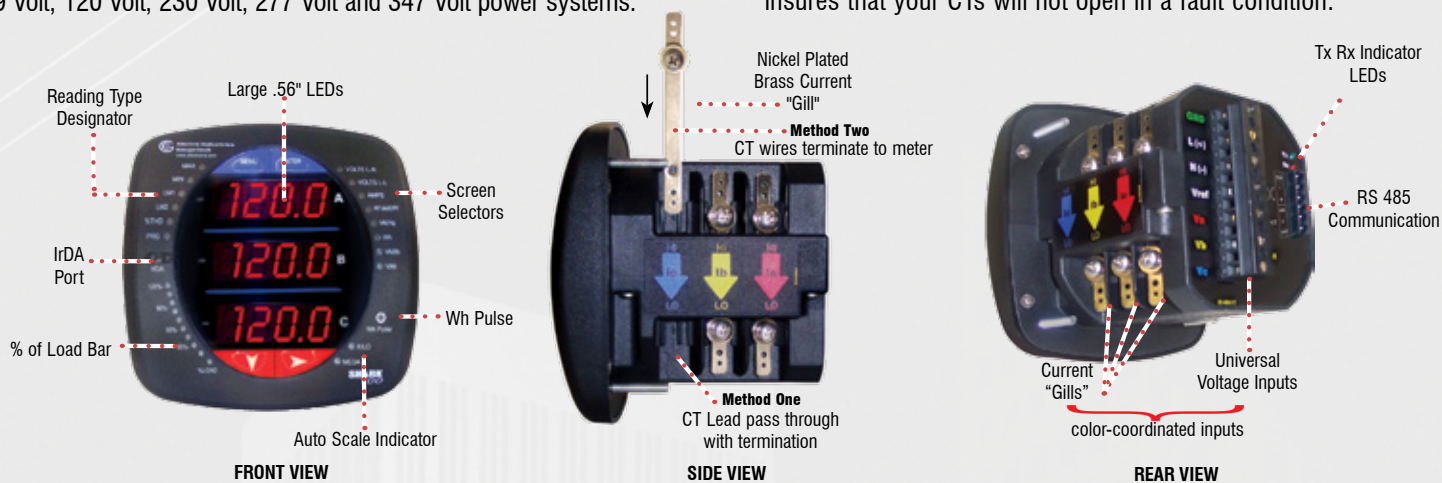
High Isolation Universal Voltage Inputs

Voltage inputs allow measurement of up to 416 Volts Line to Neutral and 721 Volts Line to Line. This insures proper meter safety when wiring directly to high voltage systems. One unit will perform to specification on 69 Volt, 120 Volt, 230 Volt, 277 Volt and 347 Volt power systems.

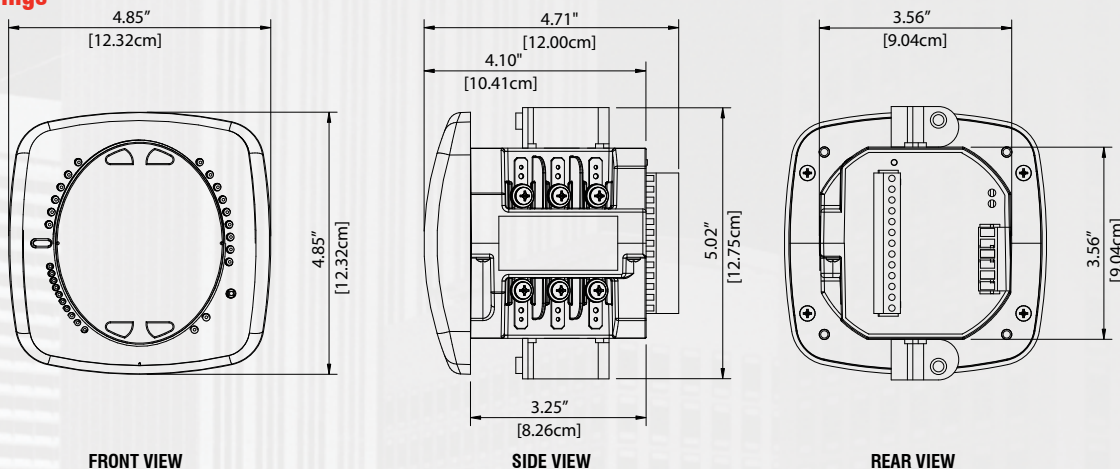
Short Circuit Safe Current Inputs

Current inputs use a unique dual input method:

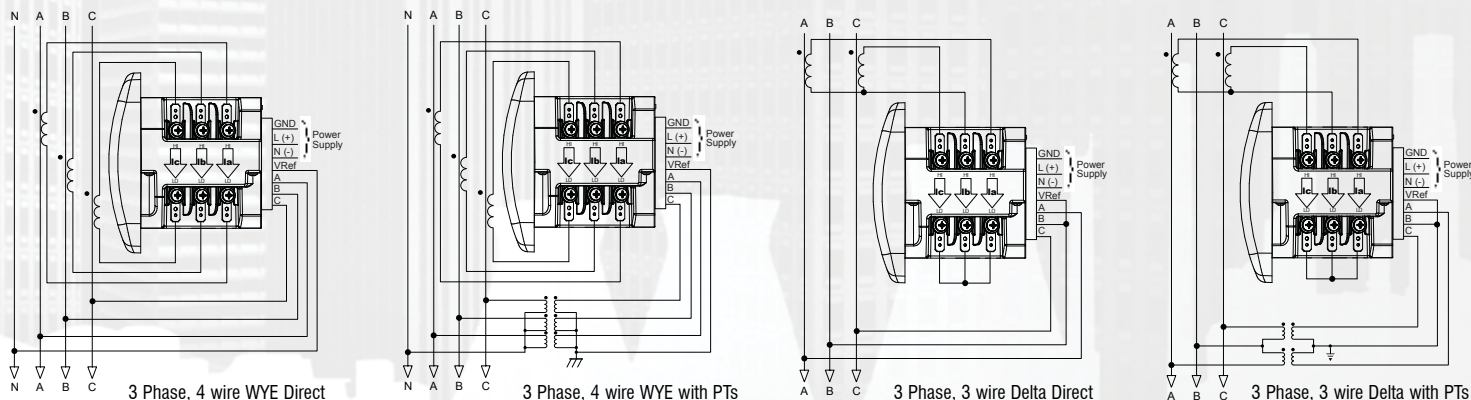
- **Method One** – CT Lead Pass Through. The CT Lead passes directly through the meter without any physical termination on the meter. This insures that the meter cannot be a point of failure on the CT circuit. This is preferable to utility users when sharing relay class CTs. No Burden is added to the secondary CT circuit.
- **Method Two** – Current “Gills.” This unit additionally provides ultra-rugged termination pass-through bars, allowing the CT leads to be terminated on the meter. The Shark® meter’s stud-based design insures that your CTs will not open in a fault condition.



Dimensional Drawings



Wiring Diagrams



Easy to Use and Install

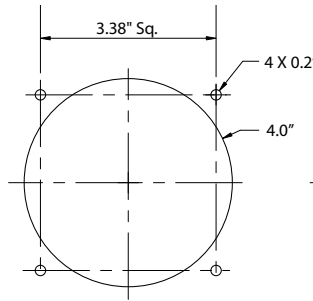
From user interface to mechanical construction, the Shark® 100 Meter was designed to be easy and intuitive, so an installer with minimal meter experience and training can easily install and use this product.

- Easy to use faceplate programming
- PC setup
- Phasor diagram showing wiring status
- Auto scroll feature
- Analog style % of Load Bar
- Shallow panel depth
- Color coordinated voltage and current inputs

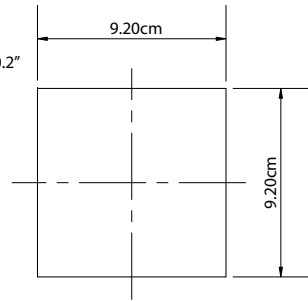
Shark® 100 meter ANSI and DIN Mounting

The unit mounts directly in an ANSI C39.1 (4" round form) or an IEC 92mm DIN square form. This is perfect for new installations and for existing panels. In new installations, simply use DIN or ANSI punches.

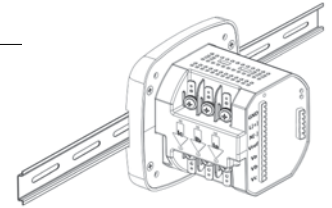
- Perfect for switchgear panel direct retrofits
- Mounts in only 4.25" panel depth
- Uses minimal panel space
- Uses standard CT or PT wiring



ANSI Mounting



DIN Mounting



Shark® 100T - DIN Rail Mounted Transducer

Specifications

Voltage Inputs

- 20-416 Volts Line To Neutral, 20-721 Volts Line to Line
- Universal Voltage Input
- Input Withstand Capability – Meets IEEE C37.90.1 (Surge Withstand Capability)
- Programmable Voltage Range to Any PT ratio
- Supports: 3 Element WYE, 2.5 Element WYE, 2 Element Delta, 4 Wire Delta Systems

- Burden: 0.36VA per phase Max at 600V, 0.014VA at 120 Volts
- Input wire gauge max (AWG 12 / 2.5mm²)

Current Inputs

- Class 10: (0 to 10) A, 5 Amp Nominal
- Class 2: (0 to 2) A, 1A Nominal Secondary
- Fault Current Withstand (at 23°C): 100 Amps for 10 Seconds, 300 Amps for 3 Seconds,

500 Amps for 1 Second

- Programmable Current to Any CT Ratio
- Burden 0.005VA per phase Max at 11Amps
- 5mA Pickup Current
- Pass through wire gauge dimension: 0.177" / 4.5mm
- Continuous current withstand: 20 Amps for screw terminated or pass through current connections

Isolation

All Inputs and Outputs are galvanically isolated to 2500 Volts AC.

Environmental Rating

Storage: (-20 to +70)° C
 Operating: (-20 to +70)° C
 Humidity: to 95% RH Non-Condensing
 Faceplate Rating: NEMA12 (Water Resistant)
 Mounting Gasket Included

Sensing Method

- RMS
 - Sampling at 400+ Samples per Cycle on all channels measured readings simultaneously
 - Harmonic %THD (% of Total Harmonic Distortion)
- ### Update Rate
- Watts, VAR and VA every 6 cycles
 - All other parameters every 60 cycles

Power Supply

- Option D2:
- (90 to 265) Volts AC and (100 to 370) Volts DC. Universal AC/DC Supply

Option D:

- 18-60VDC
- Burden: 10VA max.

Communication Format

- 2 Com Ports (Back and Faceplate)
 - RS485 Port (Through Backplate)
 - IrDA (Through Faceplate)

- 10/100BaseT Ethernet Modbus TCP (INP10)
- Com Port Baud Rate: (9,600 to 57,600)
- Com Port Address: 0-247
- 8 Bit, No parity
- Modbus RTU, ASCII or DNP 3.0 Protocols

KYZ Pulse

- Type Form A
- On Resistance: 23-35 Ohm
- Peak Voltage: 350 VDC
- Continuous Load Current: 120 mA
- Peak Load Current: 350mA (10ms)
- Off Stat Leakage Current @ 350VDC: 1 mA
- Opto-Isolation: 3750V (60Hz, 1min)

Dimensions and Shipping

- Weight: 2 lbs
- Basic Unit: H4.85 x W4.85 x L4.25

- Shark100 – mounts in 92mm DIN and ANSI C39.1 4" Round Cut-outs
- Shark100T-DIN rail mounted transducer
- Shipping Container Dimensions: 6" cube

Meter Accuracy

- See page 2

Compliance:

- IEC62053-22 (0.2% Accuracy)
- ANSI C12.20 (0.2% Accuracy)
- ANSI (IEEE) C37.90.1 Surge Withstand
- ANSI C62.41 (Burst)
- EN61000-6-2 - Immunity for Industrial Environments: 2005
- EN61000-6-4 - Emission Standards for Industrial Environments: 2007
- EN61326-1 - EMC Requirements: 2006

Ordering Information: To order, please fill out ordering guide:

Option Numbers:	Model	Frequency	Current Class	V-Switch Pack	Power Supply	COM	Mounting (Shark100 Only)
Example: Shark 100	-	60	10	V2	D2	X	X
	Shark100 (Meter/Transducer)	50 50 Hz System	10 5 Amp Secondary	V1 Default V-Switch Volts / Amps	D2 (90-265)VAC or (100-370)VDC	X No Com	X ANSI Mounting
	Shark100T (Transducer Only)	60 60 Hz System	2 1 Amp Secondary	V2 Above with Power & Freq	D 18-60V DC	485P RS485 + Pulse (Standard in Shark® 100T Transducer)	DIN DIN Mounting Brackets
				V3 Above with DNP 3.0 and Energy Counters		INP10 10/100BaseT + Pulse	
				V4 Above with %THD & Limits			

Additional Accessories

Communication Converters

- 9PINC – RS232 Cable
- CAB6490 - USB to IrDA Adapter
- Unicom 2500 - RS485 to RS232 Converter

- Unicom 2500-F – RS485 to RS232 to Fiber Optic Converter
- Modem Manager, Model # MM1 – RS485 to RS232 Converter for Modem Communication

Compliance Documents

- Certificate of Calibration, Part # CCal – This provides Certificate of Calibration with NIST traceable Test Data.



Electro Industries/GaugeTech

1800 Shames Drive • Westbury, NY 11590

1-877-EIMETER (1-877-346-3837) Tel: 516-334-0870 • Fax: 516-338-4741 • E-Mail: sales@electroind.com • www.electroind.com

ENERCEPT® H8035/H8036

Networked Power Transducer (Modbus RTU)



US Patent No. 6,373,238



⚠ 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

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	Modbus RTU

* 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 Modbus wires (observe polarity).

PRODUCT IDENTIFICATION

*Modbus Enhanced Data Stream Power Transducers**

MODEL	MAX. AMPS	CT SIZE
H8036-0100-2	100	SMALL
H8036-0300-2	300	SMALL
H8036-0400-3	400	MEDIUM
H8036-0800-3	800	MEDIUM
H8036-0800-4	800	LARGE
H8036-1600-4	1600	LARGE
H8036-2400-4	2400	LARGE

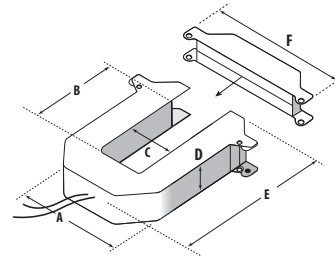
*H8036 models work with H8920-1 LON nodes

*Modbus Basic Power Transducers**

MODEL	MAX. AMPS	CT SIZE
H8035-0100-2	100	SMALL
H8035-0300-2	300	SMALL
H8035-0400-3	400	MEDIUM
H8035-0800-3	800	MEDIUM
H8035-0800-4	800	LARGE
H8035-1600-4	1600	LARGE
H8035-2400-4	2400	LARGE

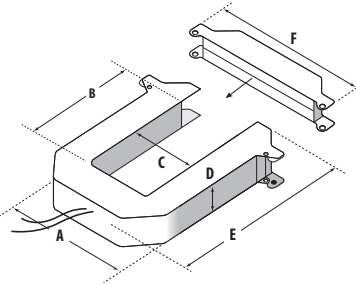
*H8035 models work with H8920-5 LON nodes

DIMENSIONS



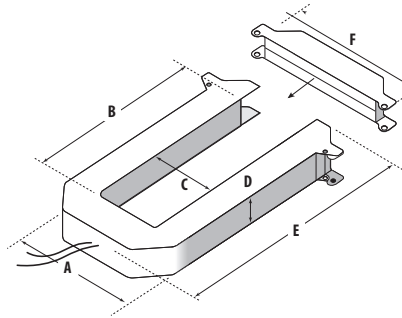
SMALL
100/300 Amp

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

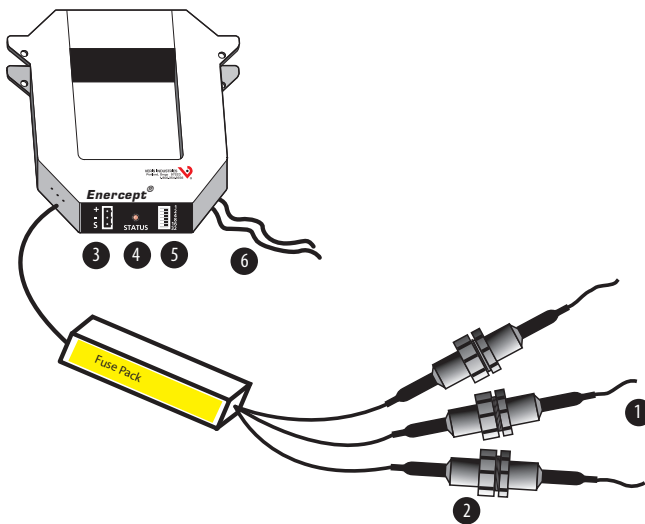
A =	4.9" (125 mm)
B =	5.5" (139 mm)
C =	2.5" (62 mm)
D =	1.2" (30 mm)
E =	7.9" (201 mm)
F =	6.0" (151 mm)

OPERATION

The H8035 and H8036 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 electronics are calibrated as a set, so it is necessary to color-match the CTs and voltage leads when installing. These devices monitor up to 63 loads at a time on a single RS-485 drop.

With two platforms to choose from (H8035 Energy Only or H8036 Enhanced Data Stream), the applications for these devices are diverse, including aggregate billing, tenant monitoring, energy management, performance contracting, demand limiting and cooling plant optimization.

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. **Modbus 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 maximum current exceedance.
5. **Modbus address switches:** Used to set the pulse output rate.
6. **External CTs:** Permanently attached; do not disconnect or use with other power transducers.



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:

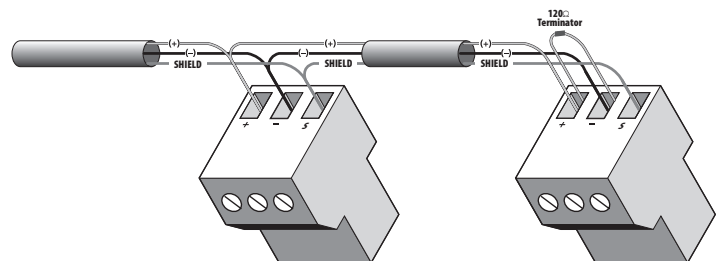
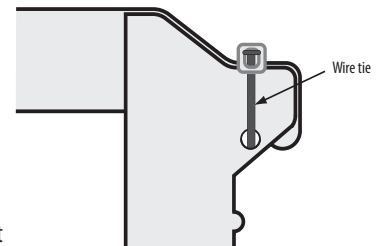
- Review the equipment enclosure for ventilation openings. Wires will cross many of these openings in a normal installation, however, do not install the Enercept where it will substantially block ventilation openings in the enclosure.
- The Enercept meter and the wiring installed within a wiring space 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 Enercept. 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.

ADDRESS



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 RS-485 wires. Observe (+), (-), and Shield polarity. Insulate any exposed wiring.



5. For information regarding software setup, see the Modbus protocol specifications available at www.veris.com/Modbus/.

6. Check power reading (these calculations are approximations only).

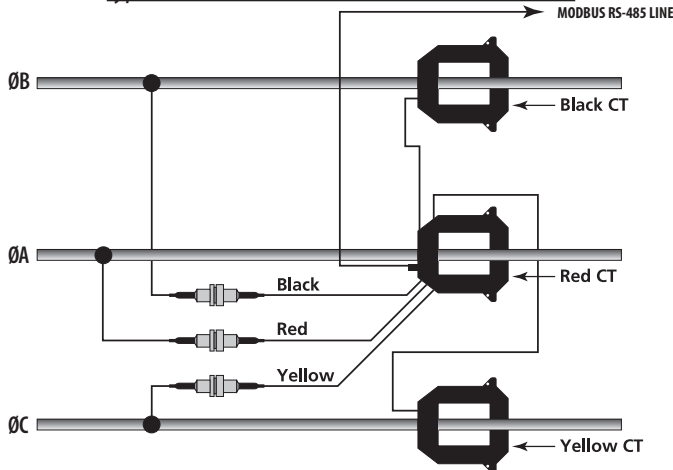
Expected power:

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

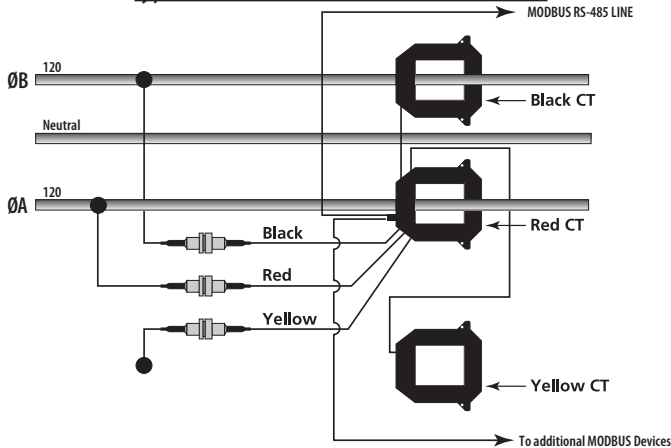
$$kW = \text{Horsepower} \times 0.746$$

WIRING

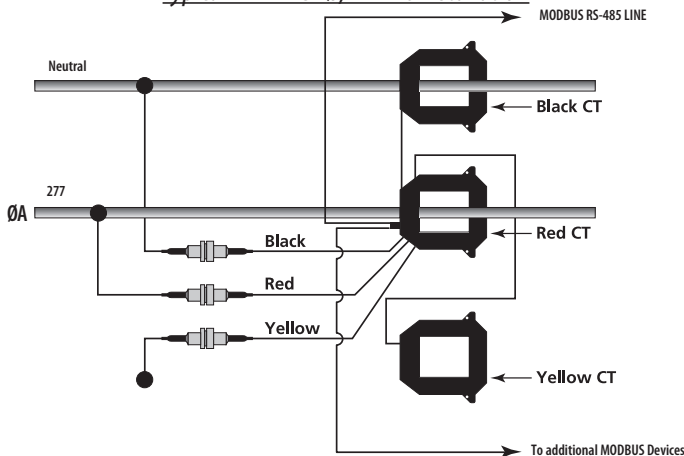
Typical 208/480 VAC 3Ø, 3- or 4- Wire Installation



Typical 240/120 VAC 1Ø, 3-Wire Installation



Typical 277 VAC 1Ø, 2-Wire Installation



NOTES

1. DO NOT GROUND THE SHIELD INSIDE THE ELECTRICAL PANEL. All Modbus wires, including the shield, should be insulated to prevent accidental contact with high voltage conductors.
2. The Modbus cable should be mechanically secured where it enters the electrical panel.
3. All Modbus devices should be connected together in a daisy-chain fashion. The first and last devices in the chain should have a 120Ω terminating resistor between (+) and (-).
4. The Modbus cable should be shielded twisted pair wire BELDEN 1120A or similar.



WARNING: After wiring, 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

H8035

kWh, consumption
Reset kWh
kW, demand

H8036

kWh, consumption
kW, real power
VAR, reactive power
VA, apparent power
Power factor
Average real power
Minimum real power
Maximum real power
Voltage, line-to-line
Voltage, line-to-neutral
Amps, average current
kW, real power ØA
kW, real power ØB
kW, real power ØC
Power factor ØA
Power factor ØB
Power factor ØC
Voltage, ØA to ØB
Voltage, ØB to ØC
Voltage, ØA to ØC
Voltage, ØA to Neutral
Voltage, ØB to Neutral
Voltage, ØC to Neutral
Amps, Current ØA
Amps, Current ØB
Amps, Current ØC

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

Eldridge Products, Inc.

Gas Mass Flow Measurement & Control Instrumentation

Master-Touch™



Series

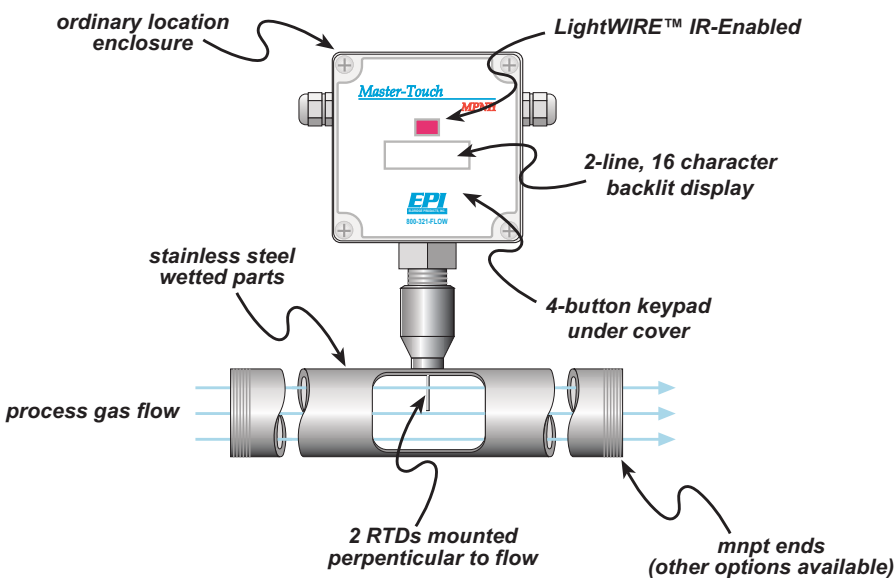
8600MPNH-8700MPNH
Flowmeters

CE



Eldridge Products' proprietary thermal mass flow sensors use two ratiometrically-matched, reference-grade platinum Resistance Temperature Detectors (RTDs). The platinum sensing element wire is wound on a ceramic base, given a thin protective glass coating, and encapsulated in a 316 Stainless Steel sheath or, if specified, a Hastelloy C sheath. The sensor assembly is large, rugged, and relatively insensitive to dirt buildup.

A forced null Wheatstone Bridge preferentially heats one RTD. The second RTD acts as a temperature reference by taking on the temperature of the flowing gas. The resistance ratios are maintained through the Wheatstone Bridge to compensate for the dynamic changes in process temperature. By maintaining a constant temperature difference between the RTDs, EPI can measure the amount of heat dissipated by the flowing gas. As heat is dissipated, more power is used to maintain the constant temperature. The power demand is directly proportional to the gas mass flow rate, allowing our sensors to measure the gas molecular rate of flow without further compensation for outside effects. EPI's standard flow sensors can respond to flow velocities as low as 15 feet per minute and as high as 45,000 feet per minute for most gases. Consult our factory or a local sales representative for details.



INLINE style thermal mass flowmeters include a flow section that is usually specified to match the user's flow conduit and is then plumbed directly into the process line. This design has the sensing elements mounted directly in the flow section for exposure to the process gas. Our Inline style thermal mass flowmeters are available in sizes from 1/4" pipe through 4" pipe and are provided with threaded male NPT ends as the standard mounting style. Optional end mounting styles may be specified, such as tube ends, tube end fittings, butt weld ends, flanged end configurations, etc. as required. Pipe sizes in excess of 4" require insertion style thermal mass flow meters.

INTEGRAL style thermal mass flowmeters have all of the electrical components and connections located within one enclosure. The enclosure is NEMA 4X for non-hazardous environments. The enclosure is mounted directly to the inline flow section or to the insertion probe assembly at the point of measurement.



TYPICAL APPLICATIONS FOR MASTER-TOUCH™ FLOWMETERS:

AUTOMOTIVE INDUSTRY Compressed Air monitoring * Natural Gas consumption * Powder paint air flow * Paint booth/paint oven ventilation

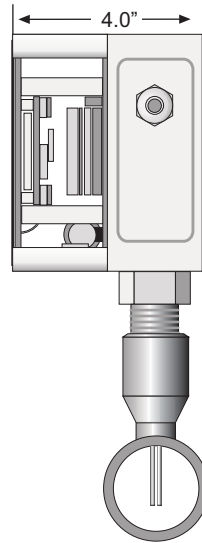
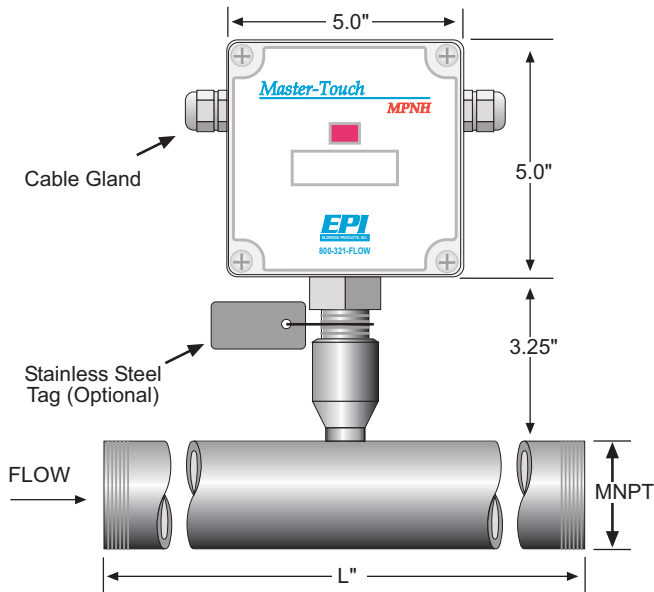
UTILITY SERVICES Stack or Flue Gas * Wastewater aeration * Ventilation systems * Digester Gas * Gas flows * Nitrogen purge * Combustion air * Boiler inlet air

FOOD PROCESSING Drying air * Ventilation systems * Boiler inlet air * Exhaust gas * Process control * Compressor lines * HVAC Air balancing * Duct flows * Energy conservation * Fume hoods * Cleanrooms * Laminar flow benches

LABORATORY AND R & D Flow research * Biomedical studies * University studies * Toxicology studies * Energy studies * Industrial Hygiene * Occupational Safety * Experimentation

PETROLEUM & GAS INDUSTRIES Custody transfer * Landfill Gas recovery * Flare Gas measurement * Gas mixing * Gas quality studies * Leak testing

RAW MATERIALS INDUSTRIES Pulp & Paper mills * Mining * Semiconductor manufacturing * Chemical processing * Primary metals * Plastics & synthetics



Model Number	MNPT	Length
8636MPNH	1/4"	6"
8649MPNH	3/8"	6"
8659MPNH	1/2"	7"
8669MPNH	3/4"	7"
8689MPNH	1"	8"
8710MPNH	1 1/4"	10"
8712MPNH	1 1/2"	14"
8716MPNH	2"	14"
8720MPNH	2 1/2"	14"
8724MPNH	3" Flanged	14"
8732MPNH	4" Flanged	14"

SPECIFICATIONS

Linear signal output	0–5 VDC & 4–20 mA
Signal Interface	RS232 & RS485 Modbus RTU
Accuracy, including linearity (Ref.: 21°C)*	± [1% of Reading + (.5% + .02%/°C of Full Scale)]
Repeatability	±0.2% of Full Scale
Sensor response time	1 second
Turn down ratio	100:1 minimum
Electronics temperature range	-40°–85°C (-40°–185°F)
Gas temperature range**	-40°–200°C (-40°–392°F), extended range available
Gas pressure effect	Negligible over ± 20% of absolute calibration pressure
Pressure rating maximum	500 PSI Std., > 500 PSI special
Input power requirement	24VDC @ 250mA 115 VAC 50/60 Hz optional 230 VAC 50/60 Hz optional
Flow Transmitter power requirements	5 watts maximum
Flow Transmitter enclosure	NEMA 4X, ABS plastic with clear polycarbonate cover, 5" x 5" x 4"
Wetted materials	316 Stainless Steel (Hastelloy optional)
Standard temperature & pressure (STP)	70°F & 29.92" Hg (Air .075 lb./cubic foot)
NIST traceable calibration	Standard

APPROVALS

MPNH Series for use in Ordinary (Non-Hazardous) area locations: Type 4X, IP66

* The accuracy specification applies to the instrument only. EPI is not responsible for measurement errors due to flow profile irregularities caused by installation piping configurations, corrosion on inner pipe surfaces, valve placement, etc.

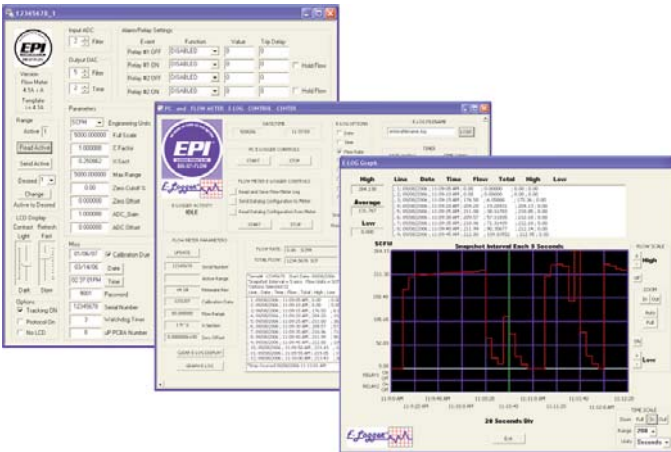
**SSM option required for 66°–200°C (150°–392°F)

ACCESSORIES



Light **WIRE™**

The LightWIRE™ Communicator I modules transmit and receive signals from LightWIREIR-Enabled flowmeters. When connected to a RS232 or USB port on a PC or laptop running EPI Communicator software, the LightWIRE Communicator I module replaces the three-wire cable for communications with an IR-Enabled Master-Touch™ flowmeter. The LightWIRE Communicator II hand-held module is a substitute for the keypad/display assembly of IR-Enabled Master-Touch™ flowmeters. Access all of the flowmeters functions without removing the flowmeter's enclosure cover with the Communicator II module.



E-logger™

The E-Logger™ module of the free EPICommunicator™ software is a fully functional, PC-based data logger that works in conjunction with Master-Touch™ flowmeters which have v4.1A or higher software. The user can select from a set of categories for the data collection, the time interval for each data "snapshot" and, if necessary, programmed start and stop times. The data is stored on either the flowmeter or a PC. E-Logger will also graph the data, and it provides tools for analysis of the data. Data files stored on a PC can be accessed by most common spreadsheet applications.

LIMITED WARRANTY

Eldridge Products, Inc. (EPI) warrants its products to be free from defects in materials and workmanship for one year from the date of factory shipment. If there is a defect, the purchaser must notify EPI of the defect within the warranty period. Upon receipt of the defective product, EPI will either repair or replace the defective product at its sole option and at no cost to the purchaser. EPI MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AS TO THE PRODUCTS. EPI MAKES NO WARRANTY THAT THE GOODS SOLD TO ANY PURCHASER ARE FIT FOR ANY PARTICULAR PURPOSE. FURTHERMORE, EPI MAKES NO WARRANTY OF MERCHANTABILITY WITH RESPECT TO ANY PRODUCTS SOLD TO ANY PURCHASERS. There are no other warranties that extend beyond the description on any brochure or price quote.

LIMITED ACCEPTANCE

Acceptance of any offer is limited to its terms. Acceptances or confirmations that state additional or differing terms from this price quote shall be operative as acceptances, but all additional or differing terms shall be deemed material alterations within the meaning of Commercial Code Section 2207(2)(b), and notice of objection to them pursuant to Commercial Code Section 2207(2)(c) is hereby given. The laws of the State of California govern this contract and venue is Monterey County. Risk of loss passes F.O.B. EPI factory. Payment due in full in US Dollars within credit terms granted from factory shipment. Additional fees shall include interest on unpaid balances that are outstanding for more than granted credit terms, plus all collection costs and attorneys' fees incurred in collecting any outstanding balance. Any and all additional or differing terms do not become part of the contract between EPI and any purchaser. The terms of any offer are expressly limited to the terms detailed in any product brochure or price quote. Any modification to any of the terms of this offer must be in writing and must be signed by an officer of EPI.



Eldridge Products, Inc.

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• **SYSTEM-10 BTU METER** •



DESCRIPTION

The System-10 BTU Meter provides highly accurate thermal energy measurement in chilled water, hot water and condenser water systems based on signal inputs from two matched temperature sensors (included) and any of ONICON's insertion or inline flow meters (ordered separately). The basic model provides local indication of energy, flow and temperature data through an alphanumeric display. An isolated solid state dry contact is provided for energy total. Optional analog outputs and network communications are also available.

APPLICATIONS

Chilled water, hot water and condenser water systems for:

- Commercial office tenant billing
- Central plant monitoring
- University campus monitoring
- Institutional energy cost allocation
- Performance/efficiency evaluations
- Performance contracting energy monitoring

FEATURES

Simple Installation and Commissioning - Factory programmed and ready for use upon delivery. All process data and programming functions are accessible via front panel display and keypad.

Single Source Responsibility - One manufacturer is responsible for every aspect of the energy measurement process, ensuring component compatibility and overall system accuracy.

N.I.S.T. Traceable Calibration with Certification - Each BTU measurement system is individually calibrated using application specific flow and temperature data and is provided with calibration certifications.

Precision Solid State Temperature Sensors - Custom calibrated and matched to an accuracy better than $\pm 0.15^\circ$ F over calibrated range.

Highly Accurate Flow Meters - Insertion turbine and inline turbine flow meters are accurate to within $\pm 0.5\%$ of rate at the calibrated typical flow rate and within $\pm 2\%$ of rate over an extended 50:1 turndown range (0.4 - 20 ft/s).

Complete Installation Package - All mechanical installation hardware, color coded interconnecting cabling and installation instructions are provided to ensure error-free installation and accurate system performance.

Serial Communications - Optional communications card provides complete energy, flow and temperature data to the control system through a single network connection, reducing installation costs.

ORDERING INFORMATION

The System-10 BTU Meter is sold complete with temperature sensors and standard thermowells. Flow Meters are purchased separately.

ITEM #	DESCRIPTION
SYSTEM-10	System-10 BTU Meter
SYSTEM-10-OPT1	Add for 6" and larger pipes
SYSTEM-10-OPT2	Add for 2.5" - 3" copper tube
SYSTEM-10-OPT3	Add for 4" copper tube
SYSTEM-10-OPT4	Upgrade to outdoor thermowells (pair)
SYSTEM-10-OPT5	Upgrade to hot tap thermowells (pair)
SYSTEM-10-OPT8	High temperature sensors (over 200° F)
SYSTEM-10-OPT9	Add one analog output
SYSTEM-10-OPT10	Add four analog outputs
Choose from the following flow meters & installation kits:	
F-1100	Single Turbine Insertion Flow Meter (1¼"-72")
F-1200	Dual Turbine Insertion Flow Meter (2½"-72")
FB-1200	Bi-Directional Insertion Flow Meter (2½"-72")
F-1300	Inline Turbine Flow Meter (¾" - 1")
F-STD-INSTL1	Std. install kit for 1¼" - 72" steel pipe
F-HTAP-INSTL2	Hot tap install kit for 1¼" - 72" steel pipe
(refer to catalog for additional install kits)	



SYSTEM-10 BTU METER SPECIFICATIONS

CALIBRATION

Flow meter and temperature sensors are individually calibrated, followed by a complete system calibration. Field commissioning is also available.

ACCURACY

Differential temperature accuracy $\pm 0.15^\circ\text{F}$ over calibrated range
 Computing nonlinearity within $\pm 0.05\%$

PROGRAMMING

Factory programmed for specific application
 Field programmable via front panel interface

MEMORY

Non-volatile EEPROM memory retains all program parameters and totalized values in the event of power loss.

DISPLAY

Alphanumeric LCD displays total energy, total flow, energy rate, flow rate, supply temperature and return temperature
 Alpha: 16 character, 0.2" high; Numeric: 6 digit, 0.4" high

OUTPUT SIGNALS

Standard:

Isolated solid state dry contact for energy total
 Contact rating: 100 mA, 50V
 Contact duration: 0.5, 1, 2, or 6 sec

Optional:

Analog Output(s) (4-20 mA, 0-10 V or 0-5 V):
 One or four analog output(s) available for flow rate, energy rate, supply/return temps, or delta-T.
 Serial Communications: BACnet MS/TP, LONWORKS, JCI-N2 or Siemens P1. Contact factory for availability of additional communications protocols.

LIQUID FLOW SIGNAL INPUT

0-15 V pulse output from any ONICON flow meter.

TEMPERATURE SENSORS

Solid state sensors are custom calibrated using N.I.S.T. traceable temperature standards.
 Current based signal (mA) is unaffected by wire length.

TEMPERATURE RANGE

Liquid temperature range: 32° to 200°F
 Optional liquid temperature range: 122° to 302°F
 Ambient temperature range: 40° to 120°F

MECHANICAL

ELECTRONICS ENCLOSURE:

Standard: Steel NEMA 13, wall mount, 8"x10"x4"
 Optional: NEMA 4 (not UL listed)
 Approximate weight: 12 lbs.

TEMPERATURE THERMOWELLS:

Standard: $\frac{1}{2}$ " NPT brass thermowells (length varies with pipe size) with junction box
 Note: 6" pipes and larger require SS thermowell option
 Optional:

- $\frac{1}{2}$ " NPT stainless steel thermowells
- Outdoor junction box with thermal isolation
- Hot tap thermowells with isolation valves are available in plated brass or stainless steel

ELECTRICAL

INPUT POWER*:

Standard: 24 VAC 50/60 Hz, 300 mA
 Optional: 120 VAC 50/60 Hz, 200 mA
 230 VAC, 50 Hz, 150 mA

*Based on Btu meters configured for network connection without the optional analog outputs

INTERNAL SUPPLY:

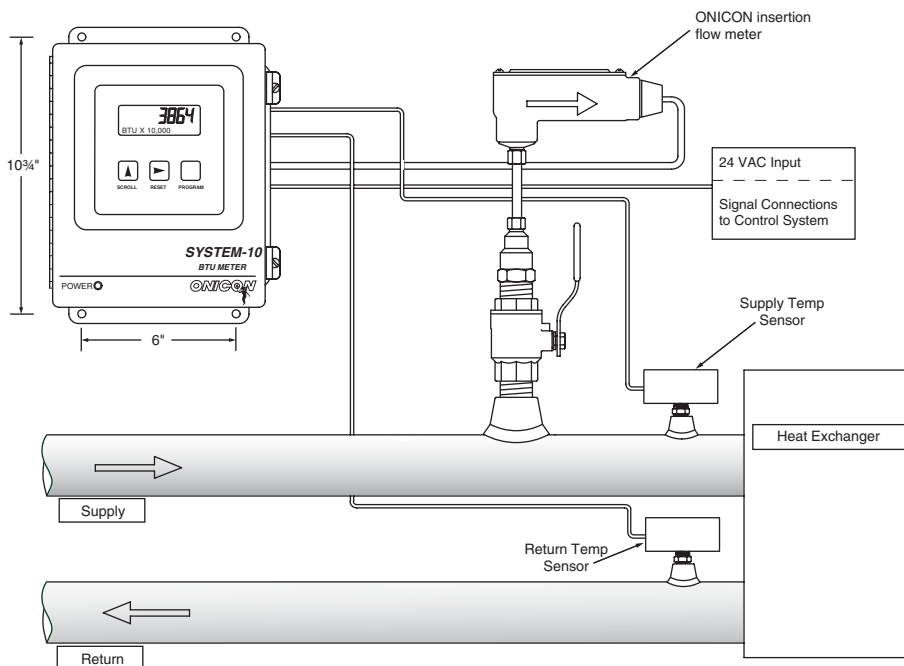
Provides 24 VDC at 200 mA to electronics and flow meter

WIRING:

Temperature signals: Use 18 - 22 ga twisted shielded pair
 Flow signals: Use 18 - 22 ga - see flow meter specification sheet for number of conductors

NOTE: Specifications are subject to change without notice.

TYPICAL SYSTEM-10 INSTALLATION





Energy Information Made Obvius



AcquiSuite

Data Acquisition Server

ACQUISUITE A8812-1 AND A8812-GSM

Obvius' AcquiSuite is an intelligent, flexible data acquisition server allowing users to collect energy data from meters and environmental sensors. Designed to connect to IP-based applications such as enterprise energy management, demand response and smart grid programs, the AcquiSuite server lets you connect thousands of energy points, benchmark energy usage and reduce energy costs.

DATA COLLECTION

The AcquiSuite collects and logs data from connected (wired or wireless) devices based on user selected intervals. Data from downstream devices are time stamped and stored locally in non-volatile memory until the next scheduled upload or manual download. Using an integrated modem or Ethernet (LAN) connection you can push or pull data via HTTP, XML, FTP or any custom protocol utilizing our AcquiSuite Module to build your own application, including integrated cellular communication options.

INSTALLATION & FEATURES

No software is required. Easily access information through ANY web browser. The AcquiSuite has eight integrated flex I/O inputs. Each field selectable input can measure resistive, analog (4/20mA / 0-10V) and standard pulse / KYZ pulse output devices. This simplifies installation for basic projects monitoring electric, gas or water meters. There are several additional features including alarming, SNMP Traps, network configuration, wireless diagnostics, security provisions, alarm relays and backlit LCD. Our integrated meter driver library is designed to speed up installation and lower integration costs through "plug-and-play" connectivity.

COMPATIBILITY

The AcquiSuite is compatible with nearly any front-end software platform allowing customers to use a variety of reporting tools; whether it's a local server or an enterprise wide reporting suite. Obvius offers a free utility for automated .CSV file downloads or an affordable hosted solution for \$195.00 annually (unlimited data storage).

PARTNERS

Obvius' outstanding integration and software partners supplement our products and services to ensure you receive the very best energy monitoring solution.

APPLICATIONS

- Utility submetering (electricity, gas, water, etc.)
- Measurement and verification (M&V)
- Reduce energy costs
- Access energy information from local or remote sites
- Benchmark building energy usage
- View "real time" performance data
- Track energy use and peak demand for Demand Response programs
- Monitor performance of critical systems (lighting, HVAC, PDUs, inverters, etc.)
- Alarm notification for data points above or below target levels (including SNMP Traps)
- Monitor renewable energy performance and production
- Create load profiles for energy purchases
- Push or pull meter data to energy dashboards, kiosks and software applications
- LEED / Energy Star certification

ABOUT OBVIUS

Obvius manufactures data acquisition and wireless connectivity products specifically for energy management. We deliver cost-effective, reliable hardware designed to speed up installation. Our products are based on an open architecture allowing our customers to collect and log energy information from virtually any meter or sensor. The ability to support multiple communication options provides remote access to all your energy information. Founded in 2003, Obvius is located in Hillsboro, Oregon. We serve a global clientele and continue to drive innovation by simplifying data collection.

SOLUTIONS

- Data Acquisition
- Wireless Communication
- Meters & Sensors
- Custom Packaged Solutions
- Integration & Software Partners

HEADQUARTERS

Hillsboro, Oregon

CONTACT US

sales@obvius.com

AcquiSuite A8812

Obvius helps customers collect and distribute energy information. Users can begin with one best-of-breed product that satisfies a requirement, or incorporate several products and services for a complete energy management solution.

Specifications

Processor	ARM9 embedded CPU, ARM7 IO co-processor
Operating System	Linux 2.6
Memory	32 MB RAM
Flash ROM	16 MB NOR Flash (expandable with USB memory device)
Interval Recording	1 to 60 minutes, user selectable
LEDs	8x input, 4 modem activity, Modbus TX/RX, power, system, IO status
Console	2 x 16 LCD character, two push buttons

Power

North America	110-120VAC, 60Hz, primary
CE/Europe	100-240VAC, 50-60Hz, primary (interchangeable plug adapters optional)
Power Supply	24VDC, 1A, class 2 wall brick transformer included

Communication

Protocols	Modbus/RTU, Modbus/TCP, TCP/IP, PPP, HTTP/HTML, FTP, NTP, XML, SNMP-Trap
LAN	RJ45 10/100 Ethernet, full half duplex, auto polarity
Modem	V.34 bis, 33,600 bps (A8812-1 only)
Cellular	GSM/GPRS Cellular (A8812-GSM only)
USB	USB expansion port

Inputs

Serial Port	RS-485 Modbus, supports up to 32 external devices (expandable)
I/O	8x Flex IO inputs with user selectable modes: voltage, current, resistance, pulse and status

Outputs

Relays	2x, dry contact 30 VDC, 150 mA max
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Physical

Weight	5lbs (2.3kg)
Size	8" x 9.25" x 2.5" (203mm x 235mm x 64mm)

Environment

North America	0 to 50C, 0-90% RH, non-condensing
CE/Europe	5 to 40C, 0-90% RH, non-condensing

Codes and Standards

FCC CFR 47 Part 15, Class A, EN 61000, EN 61326, CE

Additional Notes

NEMA enclosures available upon request

Manufactured in the USA



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