Monitoring and Analysis Plan for Carrier PureComfort CHP System at the New York Marriott Downtown

This document describes the measurements, sensors, and data logging equipment proposed to quantify the performance of the Carrier PureComfort CHP system installed at the New York Marriott Downtown located at 85 West Street in Manhattan. The CHP system consists of two Carrier PureComfort systems that utilize several Capstone 60 Microturbines and a Carrier exhaust fired absorption chiller on each system.

The first CHP system (System "A") uses five (5) 65 kW microturbines to produce up to 258 kW_{net} of electrical output and 161-tons of chilled water output. The second system (System "B") uses six (6) 65 kW microturbines to produce up to 308 kW_{net} of electrical output and 187-tons of chilled water output. Both chillers have the capability to act as heat exchangers during the heating season to provide 1,496 MBtu/h (System A) and 1,798 MBtu/h (System B) of hot water. Both PureComfort systems are piped in a four-pipe configuration to allow for simultaneous production of chilled water and hot water production.

Figure 1 displays the mircroturbine units for System A (typical of both systems). The equipment are located on the 4th floor setback roof, and consist of the eleven microturbines themselves, the two absorption chillers, associated exhaust ductwork, electrical distribution panels, chilled water, hot water, and natural gas piping. The chillers utilize the existing cooling tower for heat rejection, which is located on a setback roof above the CHP skid.

PureComfort Microturbines (System A) – 5 Units

Figure 1. PureComfort System Microturbines

Figure 2. PureComfort System Chillers and Cooling Tower

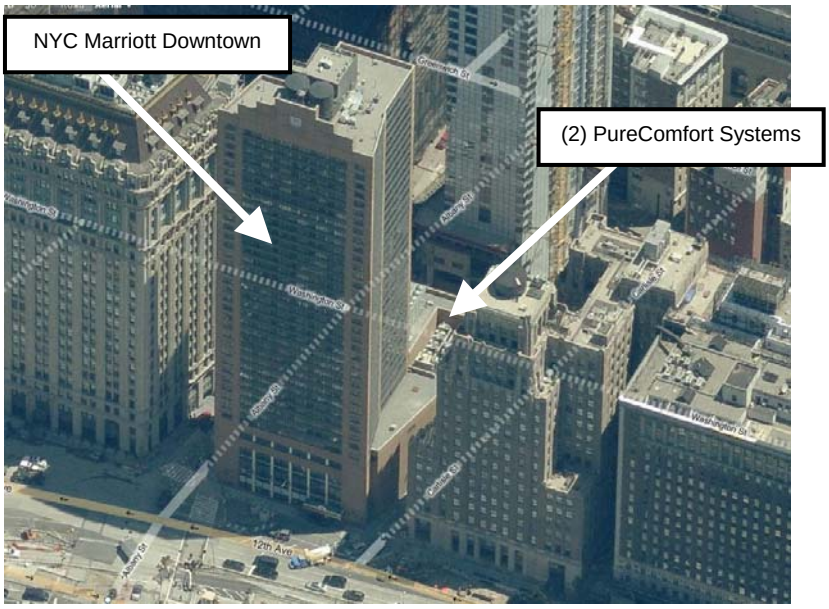


Figure 3. CHP Skid Location on Setback Roof

Description of Monitored Data Points

Table 1 lists the monitored points required to characterize the performance of the two PureComfort Systems. Each point is accompanied by the respective sensor and engineering unit measured.

Table 1. Data Point List

No.	Data Point	Description	Units	Sensor	Notes
1	WTA	Turbine Array A (1-5) Energy	kWh	Shark 100	Existing meter. Remove modbus connection from Carrier PPC and connect to datalogger
2	WTB	Turbine Array B (6-11) Energy	kWh	Shark 100	Existing meter. Remove modbus connection from Carrier PPC and connect to datalogger
3	FG	Combined Turbine Gas Flow	CFH	EPI 8800MP	Existing meter. Remove 4-20 mA signal from Carrier PPC and connect to datalogger
4	TCHWS	Chilled Water Supply Temperature	F	Veris TRAD0 10k Type II Thermistor	CDH supplied. Requires removal of insulation in mechanical room, compression surface mount, and reinsulation.
5	TCHWR	Chilled Water Return Temperature	F	Veris TRAD0 10k Type II Thermistor	CDH supplied. Requires removal of insulation in mechanical room, compression surface mount, and reinsulation.
6	THWS	Hot Water Supply Temperature	F	Veris TRAD0 10k Type II Thermistor	CDH supplied. Requires removal of insulation in mechanical room, compression surface mount, and reinsulation.
7	THWR	Hot Water Return Temperature	F	Veris TRAD0 10k Type II Thermistor	CDH supplied. Requires removal of insulation in mechanical room, compression surface mount, and reinsulation.
8	FCHW	Chilled Water Flow	GPM	SDI Insertion Flow Meter	Existing meter. Remove 4-20 mA signal from Carrier PPC and connect to datalogger
9	FHW	Chilled Water Flow	GPM	SDI Insertion Flow Meter	Existing meter. Remove 4-20 mA signal from Carrier PPC and connect to datalogger
10	SHWP	Hot Water Booster Pump Runtime	min	Veris H900	CDH supplied. Install in Pump disconnect panel adjacent to Carier PPC panel.
11	TAO	Ambient Temeprature	F	n/a	From National Weather Service website

Figure 4 displays a schematic of the location of monitored data points.

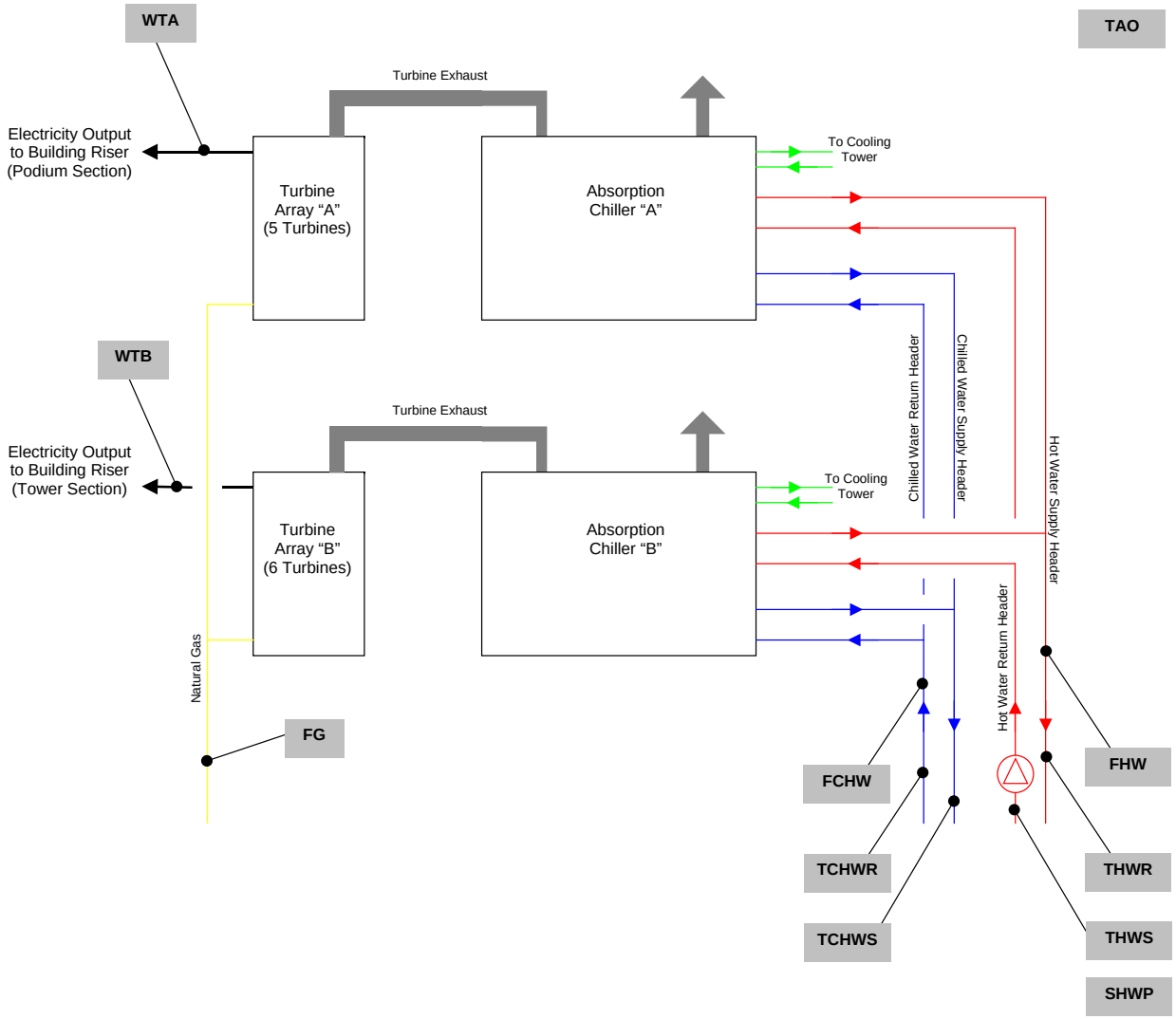
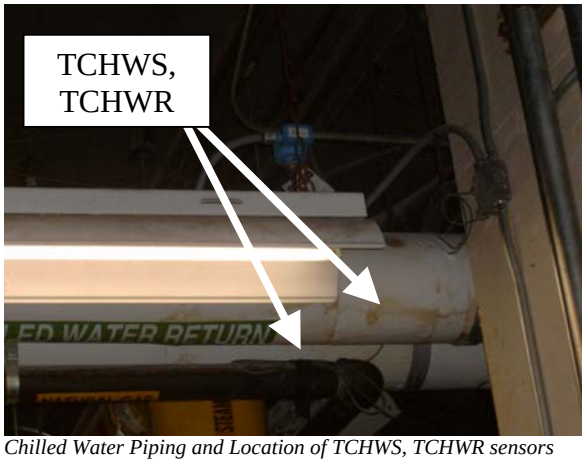


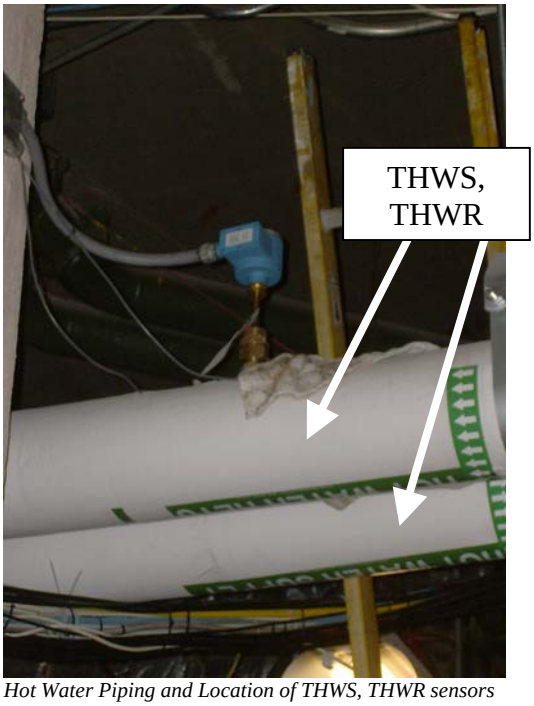
Figure 4. Location of Monitored Points on System Schematic Drawing

Temperature Sensors (TCHWS, TCHWR, THWS, THWR)

The temperature sensors will be installed on the chilled and hot water supply and return headers located in the fourth floor mechanical room above the location where the existing UTC Power RMS panel is located. These sensors will be installed as surface-mount sensors using thermal conductive paste and a large ring clamp to ensure proper contact with each piping section measured. A short section (approximately 6-inches long) of insulation will be removed where the sensor will be installed. The insulation will be replaced and sealed after installation of the sensors.



Chilled Water Piping and Location of TCHWS, TCHWR sensors

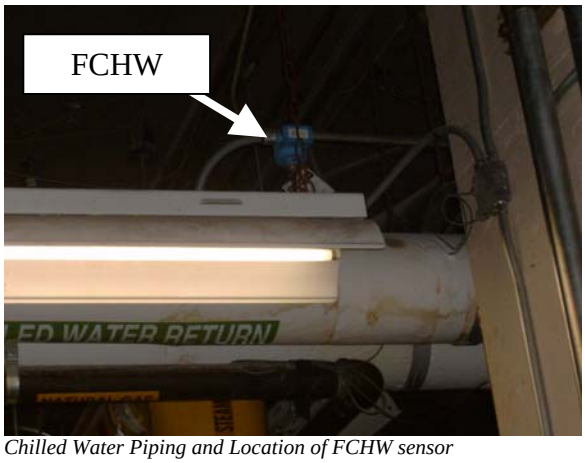


Hot Water Piping and Location of THWS, THWR sensors

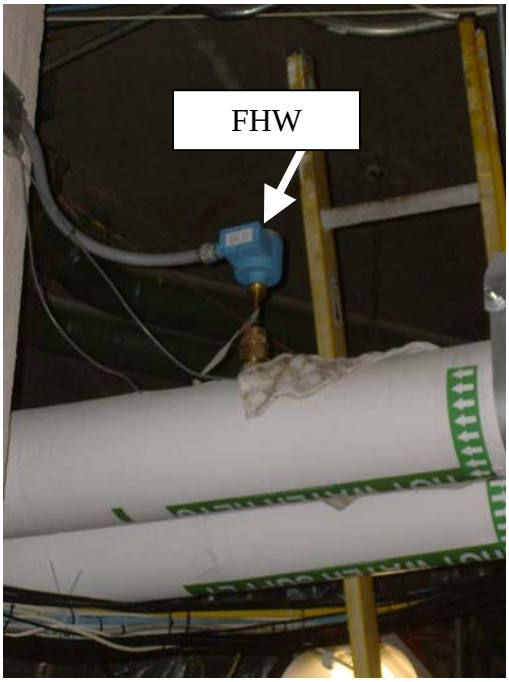
Figure 5. Loop Temperature Sensor Locations

Heat Recovery Loop Flowmeters (FCHW, FHW)

The heat recovery loop flowmeters are existing sensors located in the chilled and hot water return headers. These sensors are currently connected to the UTC Power RMS panel, but are not being used for control. We will trace the wire back to the RMS panel, disconnect the wire, and install an ACROMAG 653-T 4-20 mA signal splitter, to share the signal with the RMS panel and our data logger. The flow meters are insertion turbine meters, with a 4-20 mA output.



Chilled Water Piping and Location of FCHW sensor



Hot Water Piping and Location of FHW sensor

Figure 6. Heat Recovery Loop Sensors

Turbine Array Power Output (WTA, WTB)

The electrical output of each of the turbine arrays (System A – five turbines, System B – six turbines) is measured by two Shark 100 power transducers located at each turbine array on the CHP skid. We will trace the wire back to the RMS panel, disconnect the wire, and tie the signal directly into our data logger. It is not anticipated that the Shark 100s are used in system control (only Renewable Energy Credit (RECs) recording), and removing this signal should not adversely impact CHP system operation. The power meters are multifunction modbus power transducers that allow for multiple power or power quality measurements to be collected from a single power transducer (if desired). The power transducers are each single twisted pair RS-485 output, which must be daisy-chained together.

Figure 7. Shark 100 Power Transducer Located Each Turbine Array (typ)

Microturbine Gas Input (FG)

A hot-wire anemometer style gas meter is installed on the 3-inch gas service line in the mechanical room. We will trace the wire back to the RMS panel, disconnect the wire, and install an ACROMAG 653-T 4-20 mA signal splitter, to share the signal with the RMS panel and our data logger. The gas flow meter is a hot wire anemometer meter, with a 4-20 mA output.

Figure 8. EPI Gas Meter in Mechanical Room

Parasitic Loads (IFGB, IR)

The primary parasitic loads for the PureComfort system are the hot water booster pumps used to circulate water from the existing header to the PureComfort chillers. No additional pumps were required on the chilled water side.

The hot water pumps are located at the ceiling of the fourth floor mechanical room, but the electrical disconnects for these pumps are located adjacent to the UTC Power RMS panel. We will monitor the status of each pump using a split core current switch CT. The runtime of the pumps will be multiplied by a one-time power reading to provide the annual parasitic energy load to be removed from the PureComfort System electrical output.

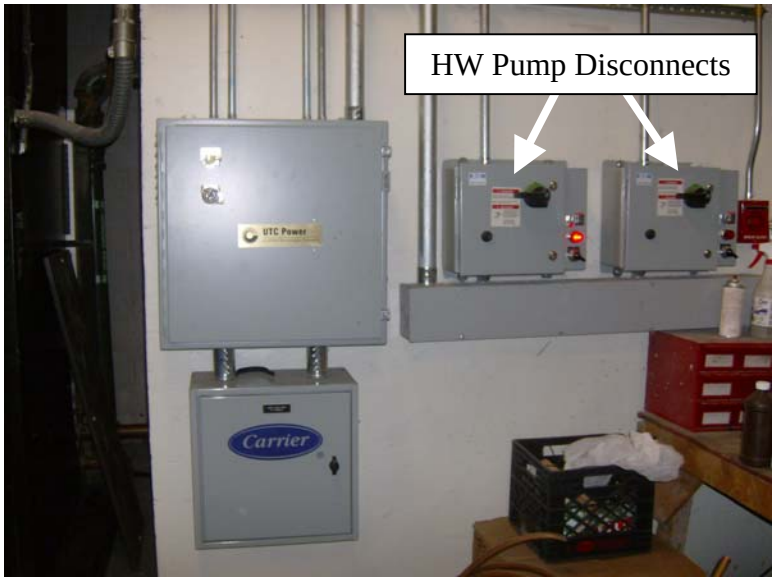


Figure 9. HW Pump Disconnects (at RMS Panel)

Figure 10. New Hot Water Booster Pumps

Data Analysis

The collected data will be used to determine the net power output of the system as well as the fuel conversion efficiency (FCE).

Peak Demand or Peak kW

The peak electric output or demand for each power reading will be taken as the average kW in a 1-minute interval, or

$$kW = \frac{kWh}{\Delta t} = \frac{kWh \text{ per interval}}{1/60 \text{ h}}$$

Heat Recovery Rates

The heat recovery rates will be calculated based on the 1-minute data recorded by the data logger. The piping arrangement at this site requires for separate heat rates to be determined with four temperature sensors and two flow readings:

Useful heat recovery cooling (**QUC**) = $K \cdot \Sigma [FCHW \cdot (TCHWS-TCHWR)] / n$

Useful heat recovery heating (**QUH**) = $K \cdot \Sigma [FHW \cdot (THWS-THWR)] / n$

Useful heat recovery total (**QU**) = QUC + QUH

The loop fluid is expected to be water and not contain glycol, (K ~ 500 Btu/h-gpm-°F). 'n' is the number of scan intervals included in each recording interval (e.g., with 1-minute data, n=60).

Parasitic Loads

The parasitic electric loads on this system consists of a hot water booster pump on the hot water return header to the PureComfort Systems.

The cooling tower, chilled water pumps, and condenser water pumps are all required to operate the existing steam absorption chiller (now used as a backup). These components are not considered parasitic loads.

The parasitic energy for the hot water booster pump will be calculated using a runtime measurement and a one-time power reading. The runtime of the pumps will be measured by current switch CTs wired in parallel, to capture the lead/lag operation of the two pumps.

Parasitic Energy (**WPAR**) = $SHWP \cdot kW_{one\text{-}time}$

Calculated Quantities

The net power output from the CHP system will be defined as the power from the microturbines minus the parasitic power. Note that for this particular site, WTA and WTB represent the net power output from the turbine arrays minus the gas boosters, and only the hot water pump power needs to be subtracted out, to calculate the fuel conversion efficiency (FCE).

The fuel conversion efficiency of the CHP system, based on the lower heating value of the fuel, will be defined as:

$$FCE = \frac{QU \cdot \Delta t + 3.412 \cdot (WG - WPAR)}{LHV_{gas} \cdot FG}$$

where:

QU	-	Useful heat recovery (Btu/h)
WG	-	Microtubine net output (kWh) (WTA+WTB)
WPAR	-	Parasitic energy (kWh)
FG	-	Generator gas consumption (Std CF)
Δt	-	1/60 for 1-minute data
LHV_{gas}	-	Lower heating value for natural gas (~905 Btu per CF).

Where

0.9 is the conversion factor between HHV and LHV

The FCE can be calculated for any time interval. When converting to daily, monthly, or annual values, each value is summed and then the following formula is applied:

$$FCE = \frac{\sum^{N} QU \cdot \Delta t + 3.412 \cdot \sum^{N} (WG - WPAR)}{LHV_{gas} \cdot \sum^{N} FG}$$

Where N is equal to the number of intervals in the period of interest.

Data Logging Equipment

The data logging system will be based around the Obvius AquiSuite 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.

Obvius AcquiSuite

Figure 11. Obvious AcquiSuite Data Logger

Each night we poll the logger via a network connection, and collect the data recorded across the day. Data are automatically loaded into the database system here at CDH Energy, where a number of automated data verification routines will identify any suspect data. Verification routines will consist of range checks, where the data are compared to a preset range of value, and data exceeding these values will be flagged; and/or relational checks, where the data are compared to the operational state of the unit for validity, such as "Are the turbines consuming gas while producing power?" Data that fails the verification routines will be checked manually by CDH personnel on a daily basis, and corrupt data will be removed from the database. We will endeavor to address data collection issues such as data logging hardware or sensor failures within 48-hours of the failure being identified.

All data collected will be converted to hourly data in a comma delimited CSV format consistent with the requirements for inclusion into the NYSERDA integrated data system website.

All sensors are scanned on the order of once per second, and these samples will be combined into 1-minute averages (for analog data) and totals (for digital data). The logger has sufficient memory to hold up to 30-days of data without overwriting the logger memory.

All data logging equipment is installed in a fiberglass NEMA Type 1 enclosure to be mounted inside the mechanical room, near the existing Carrier RMS panel, providing 110 VAC and internet connectivity.

Figure 12. Existing UTC Power RMS Panel and Proposed Data Logger Location

Other Monitoring Requirements

The use of the existing field installed sensors assumes that these sensors are not used for control of the PureComfort systems, and multipliers and offsets for the existing sensors are available or can be readily determined.

The data logger will require a connection to the Internet. A dedicated static IP address is desired, but not required. If a dynamic IP address is used, the logger will upload data every night to the CDH Energy servers, but we will not be able to access the logger for remote configuration purposes. As a fall back position, we can install a phone-switching module, and share the analog phone connection in the RMS panel. The phone will only be used for remote configuration of the data logger. Data collection will still require the networked Internet connection for timely delivery of the monitored data.

All low voltage signal wiring will not be installed in conduit. Cable runs will be neat and secured to existing conduit.

Sensor Selection

Cut sheets for the data logging equipment and sensors are attached.

Sensor Verification

To be completed upon installation of data logger.

System Energy Flows

To be completed upon installation of data logger.

Data Collection Status

To be completed upon installation of data logger.

APPENDIX A – Data Logger and Sensor Cut Sheets

A8812 AcquiSuite DR™ Data Acquisition Server

Description

Obvius, the leader in cost effective data acquisition and wireless metering solutions introduces the all-new A8812-x AcquiSuite DR™ data acquisition server, providing high performance and low cost for:

- Demand response programs
- Benchmarking building operations performance
- Verification of energy savings and utility costs
- Cost allocation to departments or tenants
- Internet based supervisory control outputs

The system combines the flexibility of choosing LAN, modem or cellular communication paths with the lowest total installed cost for logging building data such as:

- Electrical, gas and water usage and costs
- Indoor and outdoor temperatures
- Pressure, humidity, CO2
- Industry standard pulse or analog inputs

AcquiSuite™ brings "plug and play" capability to the data acquisition market, dramatically reducing the time and training required to put a typical building on line. In most applications, the installation can be done by the building engineer or contractor in less than 2 hours. The system automatically detects and configures Modbus devices in just seconds reducing installation time and costs.

Applications

- Demand response program control and reporting
- Cost allocation to tenants and third parties
- Measurement & verification of energy savings
- Data center branch circuit monitoring
- Monitoring performance of building systems (e.g., chillers, boilers, fans)

Easy installation saves time and money

- Simple "plug and play" connectivity to standard Modbus meters minimizes installation time and costs
- "Flex" I/O inputs provide easy connections for analog, pulse and resistance sensors
- Integrated relay outputs allow supervisory control from any location for load shedding or local generation
- Integrated web server provides setup and configuration using any industry standard web browser (i.e., Netscape™ or Internet Explorer™)

AcquiSuite Framework lets users add Modbus devices

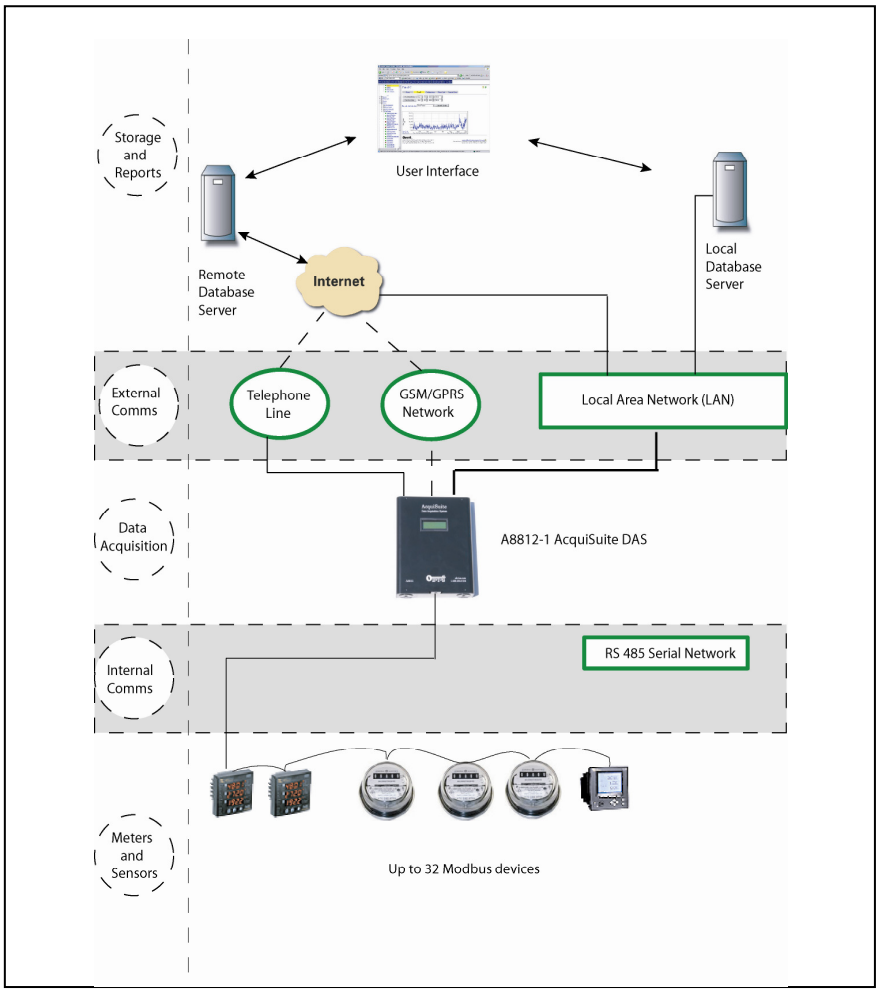
- Allows users a simple means to add Modbus devices not supported by AcquiSuite plug and play drivers
- Driver templates can be stored and shared with multiple AcquiSuites
- Simple web-based interface makes the process easy

Internet display of key building parameters

- Buildingmanageronline.com™ allows authorized users to see building performance data in an easy to use graphical format
- BMO site provides storage, display and downloads of historical data in a secure SQL database
- Users can be notified of alarm conditions in any or all monitored points
- Open protocols provide connectivity to any energy management or building automation software

Flexible communications and wireless connectivity

- All data is stored at the site in nonvolatile memory, insuring protection of valuable information in the event of power loss
- Optional on-board ModHopper (R9120-x) for wireless RS 485 communications (consult factory)
- A8812-1 provides two communication options: Local Area Network (LAN) or phone line
- A8812-GSM replaces the standard phone modem with a GSM/GPRS modem for cellular data transfer



SPECIFICATIONS

Processor	Main processor: ARM 9 ; I/O co-processor: ARM 7
Operating System	Linux 2.6
Flash ROM	16 MB NOR Flash (expandable with USB memory device)
Memory	32 MB RAM
LED	8x pulse input, 4 modem activity, Modbus TX/RX, power status
Console	2 x 16 LCD character, two buttons
LAN	10/100, Auto crossover detection
Modem (phone)	V.34 bis, 33,600 bps **(Part number A8812-1)**
Modem (cellular)	GSM/GPRS Class10, 85 kbps **(Part number A8812-GSM)**
Protocols	Modbus/RTU, Modbus/TCP, TCP/IP, PPP, HTTP/HTML, FTP,SNMP, SMTP, XML
Power Supply	24 VDC, included
Serial Port	RS-485 Modbus
Approvals	CE; FCC Part 15, Class A
USB port	USB memory expansion port
Power Requirement	110-120VAC
Interval recording	User selectable 1-60 minutes. Default 15 minute interval.
Outputs	2x, Dry contact 30 VDC, 150 mA max
Inputs	8x, user selectable:

- 0-10 V - Min/Max/Ave/Instantaneous
- 4-20 mA - Min/Max/Ave/Instantaneous
- Pulse- Consumption, Rate
- Resistance - Min/Max/Ave/Instantaneous
- Runtime - Runtime, Status

CE

Isolated Transmitters

650T Units Multi-Channel, Two-Wire Transmitters

DC Current Input

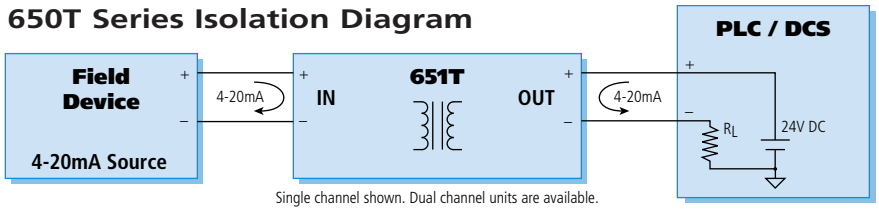
Models
651T: Single I/O channel
652T: Dual I/O channel
653T: Single input, dual output (splitter)

Input / Output Ranges
4 to 20mA DC input
4 to 20mA DC output

Power Requirement
12 to 50V DC (loop-powered)
Two-wire transmitter

Approvals
CE marked. UL, cUL listed
Class I, Division 2, Groups A, B, C, D.

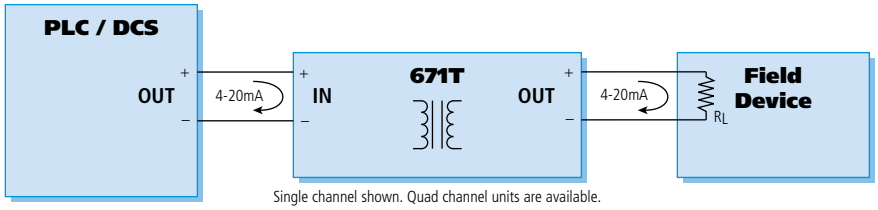
650T Series Isolation Diagram



Single channel shown. Dual channel units are available.

Note: 650T series transmitters are for two-wire transmitter interfaces (sinks current).
For application notes using 650T Transmitters, refer to Page 138.

670T Series Isolation Diagram



Single channel shown. Quad channel units are available.

Note: 670T series transmitters are for output resistive loads only (sources current).
For more information on the 670T Transmitter, refer to Page 136. Application notes are on Page 138.

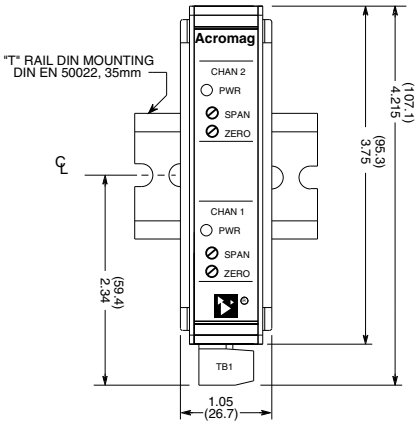
Description

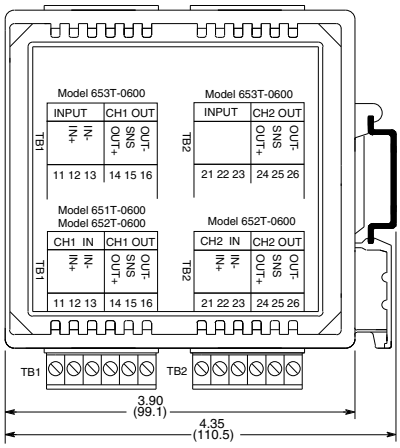
These units receive 4-20mA process current inputs and provide isolated 4-20mA output signals. Each channel operates independently and is isolated from the others to prevent interaction between channels.

For easy troubleshooting, each unit has LEDs and diagnostic test points. Power LEDs help identify output open loop conditions. The precision 10 ohm sense resistor enables monitoring of the output signal without disturbing field wiring.

Special Features

- Two channels in a single unit saves space and reduces costs.
- Signal splitter model (653T) provides two identical outputs from one input signal.
- Galvanic isolation eliminates ground loops, reduces noise, and blocks transient signals.
- Independent channels prevent signal interaction and offer spares for later use.
- Power LEDs provide a visual indication of operational process loops.
- Excellent accuracy and stability ensure reliable operation in noisy environments.





NOTE: ALL DIMENSION ARE IN INCHES (MILLIMETERS)

Performance

Reference Test Conditions
Input/Output current: 4 to 20mA; output load 500 ohms; 77°F (25°C).

Input range
4 to 20mA input (each channel).

Input burden
Voltage drop (651T, 652T): Less than 1.5V, typical (75 ohm equivalent).
Voltage drop (653T): Less than 3.0V, typical (150 ohm equivalent).

Output range
4-20mA DC output (each channel).
$R_L = (P_{SUPPLY}-12V) / 0.02$

Output compliance
$P_{SUPPLY} = 12V + (0.02 \times R_{LOAD})$

Output limiting
Outputs are limited to 36mA.

Output ripple
Less than ±0.1% of the maximum output span.

Accuracy
±0.1% of output span. Error includes the combined effects of isolator repeatability, hysteresis, terminal point linearity and adjustment resolution.

Ambient temperature effect
Less than ±0.006% of input span per °F (±0.01% per °C) over the ambient temperature range for reference test conditions. This specification includes the combined effects of zero and span over temperature.

Calibration
Two 15-turn potentiometers (zero and span) per channel, accessible from front of the unit.

Bandwidth
-3dB at 4.5Hz, typical.

Response time
For a step input, the output reaches 98% of output span in 15mS, typical.

Noise rejection
Common mode: 100dB at 60Hz, typical.
Normal mode: -5dB at 60Hz, 100 ohm source, typical.

Diagnostics
LED power indicator: Off for output open loop detection, power, or load compliance problem.

Field test points: An internal 10 ohm sense resistor provides test points for monitoring the output signal current during field maintenance.

Environmental

Ambient Temperature
Operating: -25 to 70°C (-13 to 158F).
Storage: -40 to 85°C (-40 to 185°F).

Relative Humidity
5 to 95%.

Power Requirement
12 to 50V DC for each output channel.

Isolation
Inputs, outputs, and individual channels are isolated from each other for common-mode voltages up to 250V AC, or 354V DC off ground, on a continuous basis (will withstand 1500V AC dielectric strength test for one minute without breakdown).

Radiated Field Immunity (RFI)
Complies with EN61000-4-3 Level 3 (10V/m, 30 to 1000MHz) and European Norm EN50082-1.

Electromagnetic Field Immunity (EMI)
Less than ±0.25% of output span effect under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Surge Immunity
Complies with EN61000-4-5 Level 3 (2KV) and European Norm EN50082-1.

Electrical Fast Transient (EFT)
Complies with EN61000-4-4 Level 3 (2KV) and European Norm EN50082-1.

Electrostatic Discharge (ESD)
Complies with EN61000-4-2 Level 3 (8KV air, 4KV direct to the enclosure port) and European Norm EN50082-1.

Radiated Emissions
Meets or exceeds European Norm EN50081-1 for Class B equipment.

Approvals
CE marked
UL listed (UL508 and UL1604).
cUL listed (C22.2, 142-M1987 and 213-M1987).
Hazardous Locations: Class I: Div. 2; Groups A, B, C, D

Physical

Enclosure
Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)
Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards
Military grade FR-4 epoxy glass circuit board.

Dimensions
1.05W x 4.68H x 4.35D inches.
26.7W x 95.3H x 110.5D millimeters.

Shipping Weight
1 pound (0.45 Kg) packed.

Ordering Information

Models
651T-0600
Single channel 2-wire transmitter

652T-0600
Dual channel 2-wire transmitter

653T-0600
Single input with dual isolated output transmitter

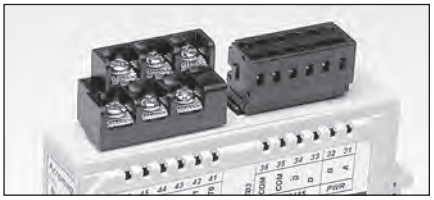
Accessories (see Page 142)
PS5R-D24
Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

TBK-B01
Optional terminal block kit, barrier strip style, 2 pcs.

TBK-S01
Optional terminal block kit, spring clamp style, 2 pcs.

DIN RAIL 3.0
DIN RAIL 16.7
DIN rail strip, Type T, 3 inches (75mm) or 16.7 inches (425mm)

20RM-16-DIN
19" rack-mount kit with DIN rail.
Holds sixteen 650T transmitters.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.

Accessories

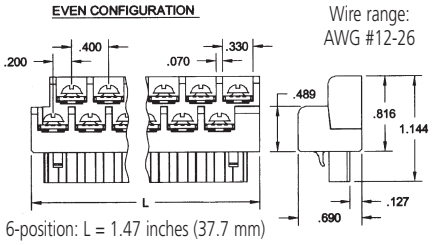
Terminal Blocks

Barrier strip (left) and spring clamp (right).

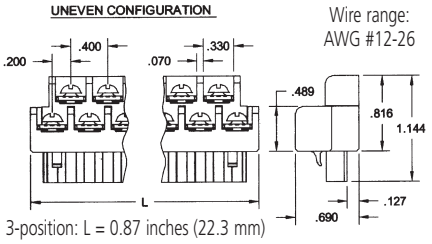
Ordering Information

See individual I/O modules for compatibility.

Barrier Strip Terminal Blocks



6-position: L = 1.47 inches (37.7 mm)



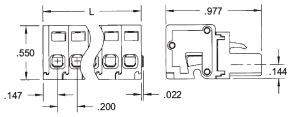
3-position: L = 0.87 inches (22.3 mm)

TBK-B01
Terminal block kit, two 6-position pieces

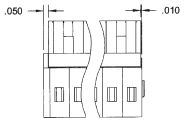
TBK-B02
Terminal block kit, four 6-position pieces

TBK-B03
Terminal block kit, one 3-position and three 6-position pieces

Spring Clamp Terminal Blocks



Wire range:
AWG #12-26



3-position:
L = 0.66 inches (16.9 mm)

6-position:
L = 1.26 inches (32.3 mm)

TBK-S01
Terminal block kit, two 6-position pieces

TBK-S02
Terminal block kit, four 6-position pieces

TBK-S03
Terminal block kit, one 3-position and three 6-position pieces

Mounting Hardware

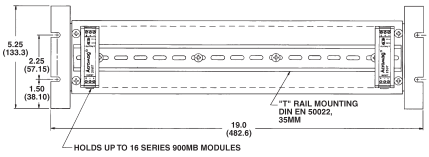
DIN-Rail Mounting

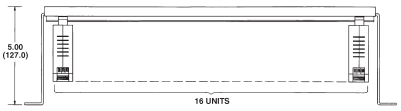
For your convenience, Acromag offers several mounting accessories to simplify your system installation. Our 19" rack-mount kit provides a clean solution for mounting your I/O modules and a power supply. Or you can buy precut DIN rail strips for mounting on any flat surface.

Ordering Information

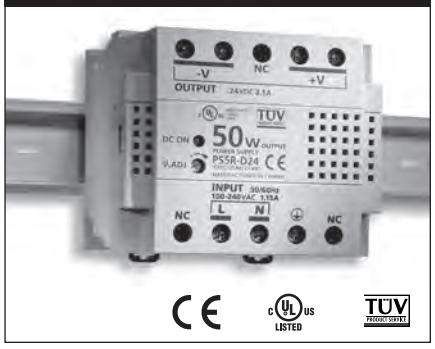
20RM-16-DIN
19" rack-mount kit with DIN rail.

DIN RAIL 3.0
DIN RAIL 16.7
DIN rail strip, Type T, 3 inches (75mm) or 16.7 inches (425mm)





Power Supplies



50W Supply

Input Power Requirement
85 to 264V AC or 105 to 370V DC

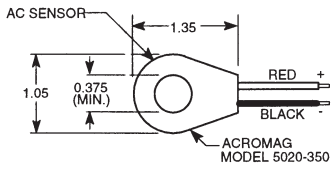
Output
24V DC, 2.1A (50W)

Ordering Information

PS5R-D24
Universal 50W power supply

See Power Supplies on Page 199 for other models and more information.

AC Current Sensor



Ordering Information

5020-350
AC current sensor (See page 205)

SHARK®100

MULTIFUNCTION POWER AND ENERGY METER

Revenue Grade

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 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 100 BaseT 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 687 (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

Electro Industries/GaugeTech

c UL us LISTED ELECTRICAL & ELECTRONIC MEASURING & TEST EQUIP. 22CZ

ISO 9001 : 2000 REGISTERED FIRM

www.electroind.com

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

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.

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

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	•			

Advanced Communication Capability with IrDA Interface

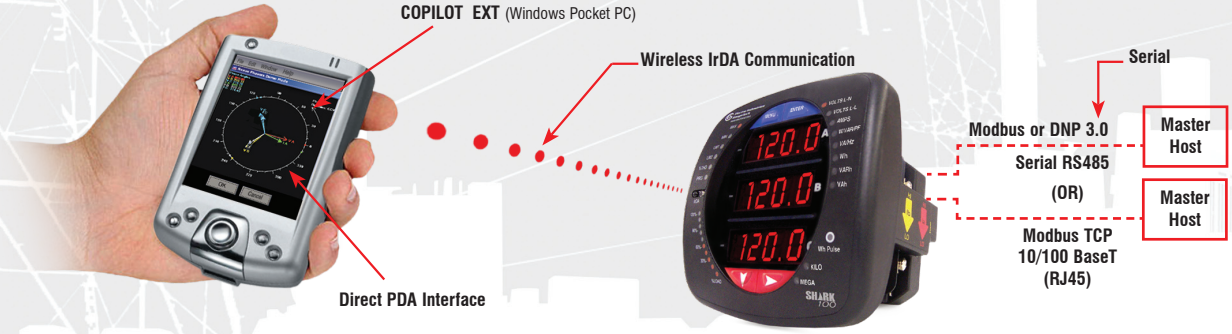
The Shark® 100 meter provides two independent communication ports with advanced features.

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 9600 to 57.6k.
- Ethernet (Option INP10) – 10/100 BaseT Ethernet with Modbus TCP protocol.
- 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:
  K(h) at Test Volts less than 150V=0.0501151926
  K(h) at Test Volts more than 150V=0.2004607704

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 PDA or remote laptop without need for a communication cable. To configure the meter, just point at it with an IrDA-equipped PC or PDA. COPILOT EXT is a Windows Pocket PC software package that allows you to easily configure the Shark® 100 meter and poll readings.



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
- PDA setup using IrDA port
- Phasor diagram showing wiring status
- Auto scroll feature
- Analog style % of Load Bar
- Shallow panel depth
- Color coordinated voltage and current inputs

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

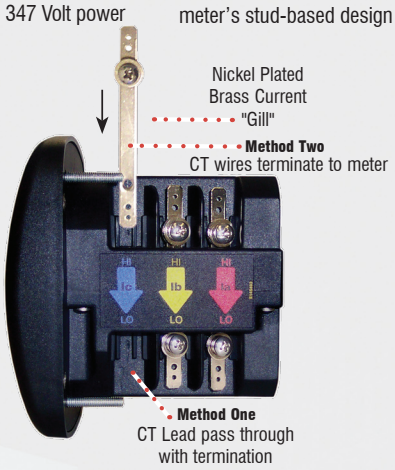
Voltage inputs allow measurement of up to 416 Volts Line to Neutral and 721 Volts Line to Line. This insures proper meter safety when wiring directly to high voltage systems. One unit will perform to specification on 69 Volt, 120 Volt, 230 Volt, 277 Volt and 347 Volt power systems.

Short Circuit Safe Current Inputs

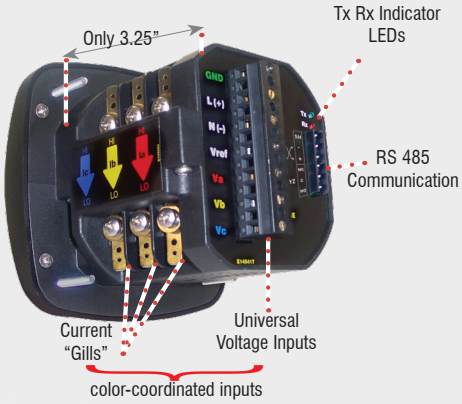
Current inputs use a unique dual input method:

- **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.

FRONT VIEW

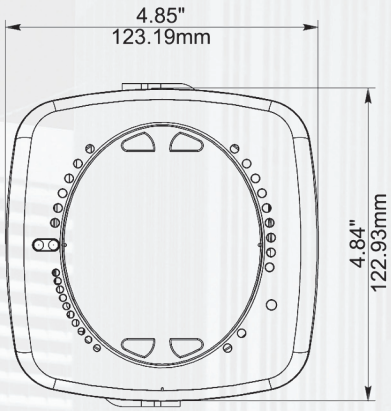


SIDE VIEW

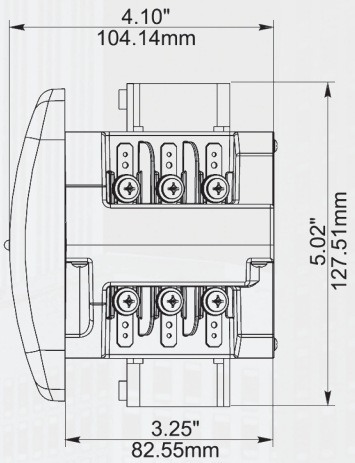


REAR VIEW

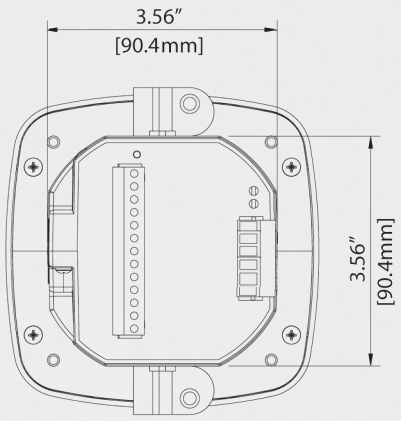
Dimensional Drawings



FRONT VIEW

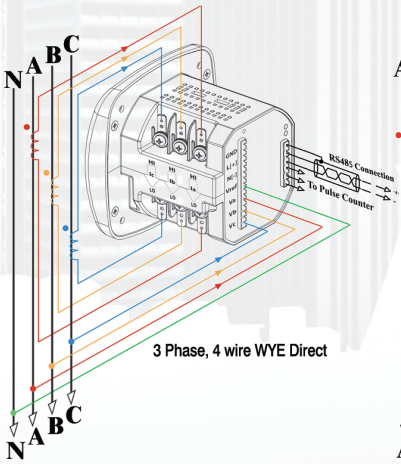


SIDE VIEW

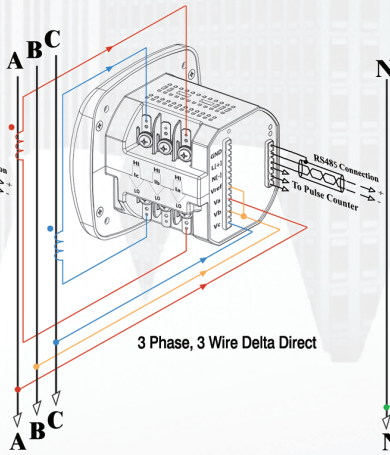


REAR VIEW

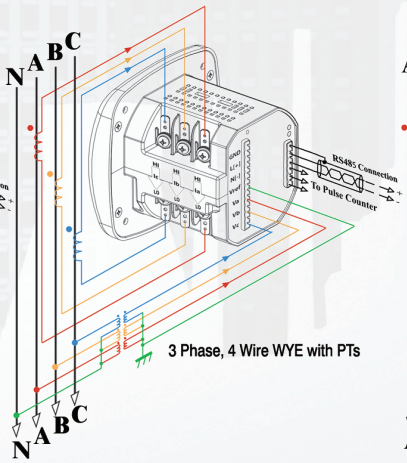
Wiring Diagrams



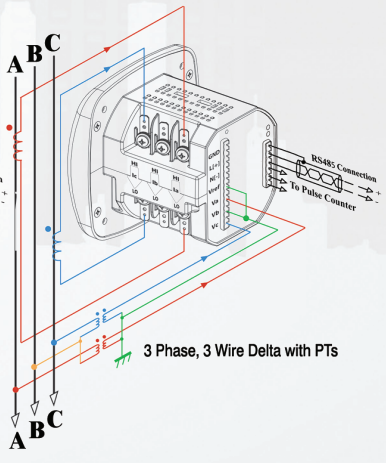
3 Phase, 4 wire WYE Direct



3 Phase, 3 Wire Delta Direct



3 Phase, 4 Wire WYE with PTs



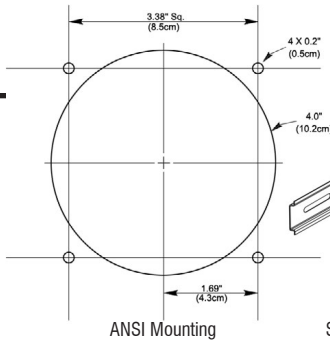
3 Phase, 3 Wire Delta with PTs

SHARK®100 METER

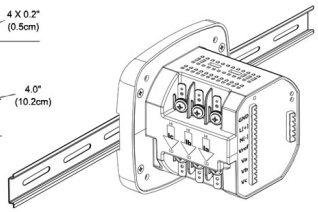
Shark® 100 meter ANSI and DIN Mounting

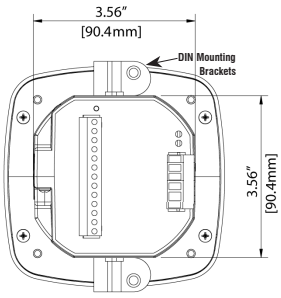
The unit mounts directly in an ANSI C39.1 (4" round form) or an IEC 92 mm DIN square form. This is perfect for new installations and for existing panels. In new installations, simply use DIN or ANSI punches. For existing panels, pull out old analog meters and replace them with the Shark® 100 meter. The meter uses standard voltage and current inputs so that CT and PT wiring does not need to be replaced.

- Perfect for switch gear panel direct retrofits panel
- Uses minimal panel space
- Mounts in only 3.5" panel depth



ANSI Mounting


Shark® 100T - DIN Rail Mounted Transducer



DIN Mounting

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 / 2.5mm^2)

Current Inputs
- Class 10: (0 to10) A, 5 Amp Nominal
- Class 2: (0 to 2) A, 1A Nominal Secondary
- Fault Current Withstand: 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: (-40 to +85)° 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-100msec
- All other parameters-1second

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 Face Plate)
- RS485 Port (Through Back Plate)
- 10/100 BaseT Ethernet Modbus TCP (INP10)
- IrDA (Through Faceplate)
- Com Port Baud Rate: (9600 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: 23-35W
- 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 W4.82 x L4.25
- Shark100 – mounts in 92mm DIN and ANSI C39.4" Round Cut-outs
- Shark100T-DIN rail mounted transducer
- Shipping Container Dimensions: 6" cube

Meter Accuracy
- See page 2

Compliance:
- IEC687 (0.2% Accuracy)
- ANSI C12.20 (0.2% Accuracy)
- ANSI (IEEE) C37.90.1 Surge Withstand
- ANSI C62.41 (Burst)
- IEC1000-4-2 – ESD
- IEC1000-4-3 – Radiated Immunity
- IEC1000-4-4 – Fast Transient
- IEC1000-4-5 – Surge Immunity

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

	Model		Frequency		Current Class		V-Switch Pack		Power Supply		COM		Mounting *(Shark100 Only)*
Option Numbers:		-		-		-		-		-		-	
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 Energy Counters						
							V4 Above with %THD & Limits				**INP10** 10/100 BaseT + Pulse		

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) • **E-Mail:** sales@electroind.com
Tel: 516-334-0870 • **Web Site:** www.electroind.com • **Fax:** 516-338-4741

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Eldridge Products, Inc.

Gas Mass Flow Measurement & Control Instrumentation

Master-Touch™

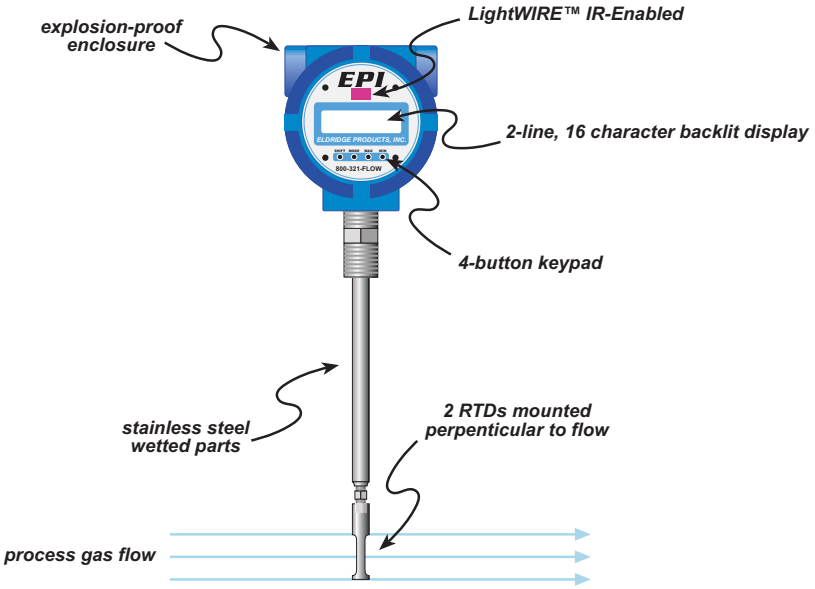
Series 8800MP Flowmeters

CE SA SA C US Ex

ELDRIDGE PRODUCTS, INC.
EPI™
www.epiflow.com
800-321-FLOW

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.



INSERTION style thermal mass flowmeters include a sensor probe assembly that is inserted into the process gas flow conduit to allow the process gas to flow across the flow sensing elements. Our insertion style flowmeters are available with 1/2", 3/4", or 1" OD probes and may be installed with pipe fitting connections or user-supplied bored through tube fittings. Tube fittings and ball valve retractor assemblies, with or without a mounting flange, are also available from the factory as options. The tube length must be specified upon ordering. Standard lengths range from a minimum of 6" to a maximum of 36". For other probe diameters and lengths, please consult the factory.

INTEGRAL style thermal mass flow meters have all of the electrical components and connections located within one enclosure. The enclosure is explosion-proof cast aluminum NEMA 4X. 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

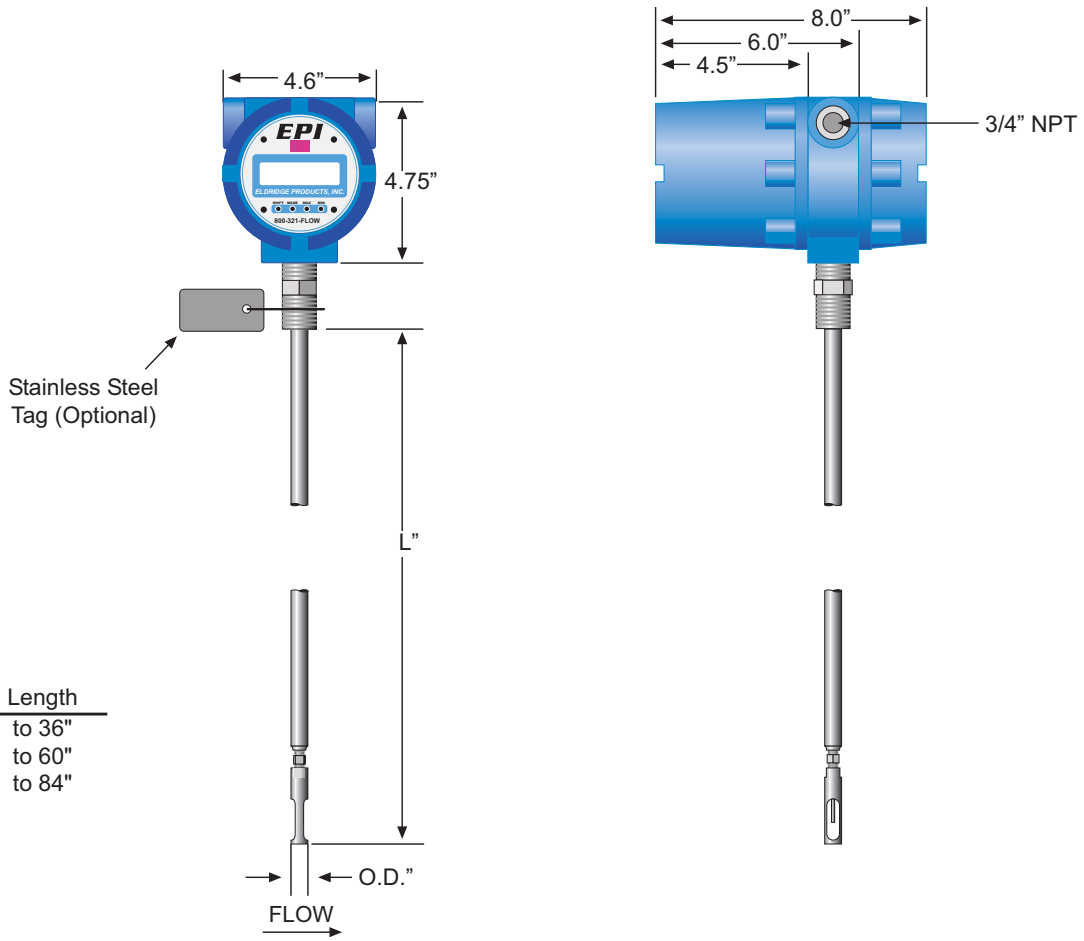
UTILITY SERVICES Stack or Flue Gas * Wastewater aeration * Ventilation systems * Digester Gas * Gas flows * Nitrogen purge * Combustion air * Boiler inlet air

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	O.D.	Length
8840MP	1/2"	to 36"
8860MP	3/4"	to 60"
8880MP	1"	to 84"

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
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

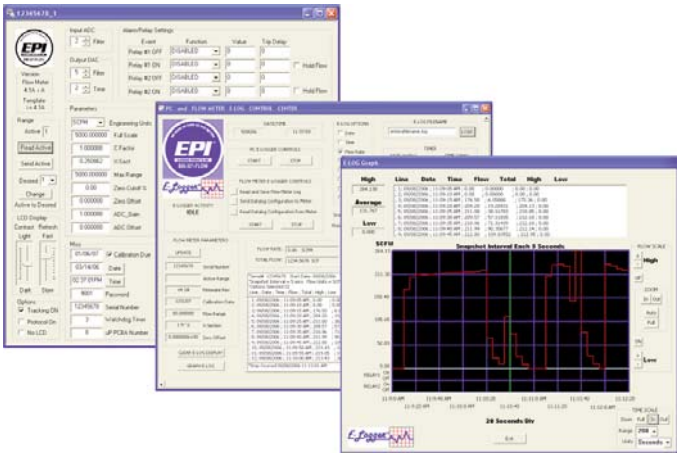
MP Series Flow Transmitter — For use in hazardous area locations: Class I Division 1 Groups B, C and D; Class II E, F and G; Class III; Type 4X; Ex d IIB + H2; AEx d IIB + H2, IP66; EEx d IIB + H2, IP66; T2 (consult factory for T3 or T4).
Certified to US requirements; Certified to Canadian requirements
Certified to European ATEX requirements

* 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.

** Consult factory for options required for 66°–200°C (150°–392°F)

ACCESSORIES

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.



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.
2700 Garden Road, Building A, Monterey, CA 93940
TF: 800.321.FLOW (3569) PH: 831.647.7777 FX: 831.648.7780
www.epiflow.com — sales@epiflow.com

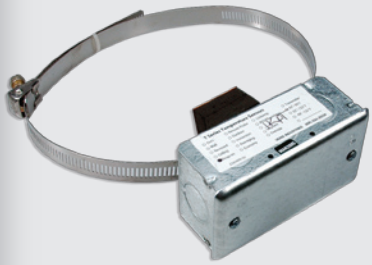
HIGH ACCURACY SPECIALTY SENSORS

5 Year Warranty

TA

Averages the temperature across the duct

TB



Pipe clamps secure sensor to the pipe, a copper sensing plate is used for fast response

TRA

Stainless steel remote probe, designed for high accuracy

Specialty Temperature Sensors

The **TA Series** averages the temperature read across the entire length of its copper tubing, making it an ideal product for duct temperature measurements.

The **TB** strap-on sensor uses a clamp to secure the unit to a pipe, and a copper sensing plate for fast temperature response. The TB is perfect for secondary measurement of water temperature typical in retrofit applications. All TB Series temperature sensors include a steel mounting box for wire termination and easy conduit connection.

The **TRA Series** stainless steel remote probe is designed for high accuracy in remote temperature sensing applications. These units can be used in numerous refrigeration applications, or they can be mounted on pipes for chilled or heated water temperature sensing. All TRA Series temperature sensors are easily installed and include a durable stainless steel sensing probe and a two-wire twisted pair wire with strain relief.

TA Averaging Sensor

- Temperature averaging sensors average the temperature across the duct in 6', 12', or 24' (1.8m, 3.6m, or 7.3m) lengths
- Copper tubing enhances response time

TB Pipe Surface Sensor

- Secondary measurement of water temperature... ideal for retrofit applications
- Pipe clamps allow for easy installation on pipes up to 12" in diameter

TRA Probe Sensor

- Durable stainless steel sensing probe

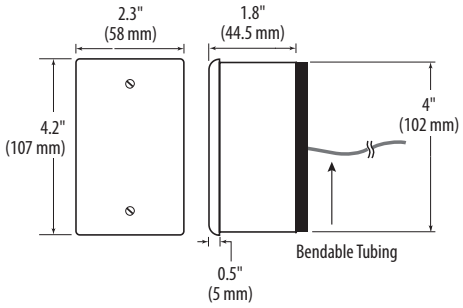
SPECIFICATIONS

Wiring		22AWG; 2-wire:RTD/Thermistor
Linitemp:		
Input Power		5 to 30VDC
Output		1µA/°C or 10mV/°C
Operating Temperature		-25° to 105°C (-13° to 221°F)
Accuracy	Calibration Error:	1.5°C (35°F) typical; 2.5°C (37°F) max. at 25°C (77°F)*
	Error over Temperature:	1.8°C typical (35°F); 3.0°C (34°F) max. over 0° to 70°C (32° to 158°F) range
		2.0°C (35°F) typical, 3.5°C (38°F) max. over -25° to 105°C (-13° to 221°F) range

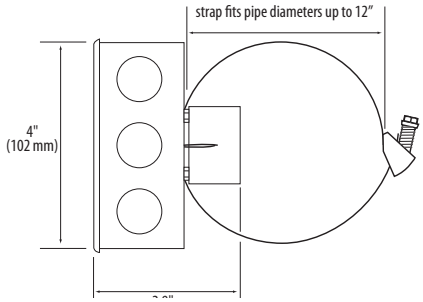
**Room temperature error documented on each unit.*

DIMENSIONAL DRAWINGS

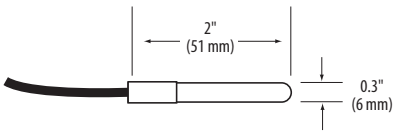
TA Model



TB Model



TRA Model



Class	Pt RTD		THERMISTOR								
Type	**100 Ohm**	**1000 Ohm**	**2.2k**	**3k**	**10k** Type 2	**10k** Type 3	**10k** Dale	**10k** 3A221	**10k** "G" US	**20k**	**20k** "D"	**100k**
Accuracy	±0.3°C	±0.3°C	±0.2°C	±0.2°C	±1.0°C	±0.2°C	±0.2°C	±1.1°C	±0.2°C	Consult	Consult	Consult
	0.0385 curve	0.0385 curve	0/70°C	0/70°C	-50/150°C	0/50°C	-20/70°C	0/70°C	0/70°C	Factory	Factory	Factory
Temp. Response*	PTC	PTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC

*PTC: Positive Temperature Coefficient

*NTC: Negative Temperature Coefficient

To compute Linitemp Temperature:
2-Wire version (1µA/°C)
µA reading - 273.15=Temperature in °C
3-Wire version (10mV/°C)
mV reading/10 - 273.15 = Temperature in °C

STANDARD RTD AND THERMISTOR VALUES (Ohms Ω)

°C	°F	100 Ohm	1000 Ohm	2.2k	3k	10k Type 2	10k Type 3	10k Dale	10k 3A221	10k "G" US	20k	20k "D"	100k
-50	-58	80.306	803.06	154,464	205,800	692,700	454,910	672,300	-	441,200	1,267,600	-	-
-40	-40	84.271	842.71	77,081	102,690	344,700	245,089	337,200	333,562	239,700	643,800	803,200	3,366,000
-30	-22	88.222	882.22	40,330	53,730	180,100	137,307	177,200	176,081	135,300	342,000	412,800	1,770,000
-20	-4	92.160	921.60	22,032	29,346	98,320	79,729	97,130	96,807	78,910	189,080	220,600	971,200
-10	14	96.086	960.86	12,519	16,674	55,790	47,843	55,340	55,252	47,540	108,380	122,400	553,400
0	32	100.000	1000.00	7,373	9,822	32,770	29,588	32,660	32,639	29,490	64,160	70,200	326,600
10	50	103.903	1039.03	4,487	5,976	19,930	18,813	19,900	19,901	18,780	39,440	41,600	199,000
20	68	107.794	1077.94	2,814	3,750	12,500	12,272	12,490	12,493	12,260	24,920	25,340	124,900
25	77	109.735	1097.35	2,252	3,000	10,000	10,000	10,000	10,000	10,000	20,000	20,000	100,000
30	86	111.673	1116.73	1,814	2,417	8,055	8,195	8,056	8,055	8,194	16,144	15,884	80,580
40	104	115.541	1155.41	1,199	1,598	5,323	5,593	5,326	5,324	5,592	10,696	10,210	53,260
50	122	119.397	1193.97	811.5	1,081	3,599	3,894	3,602	3,600	3,893	7,234	6,718	36,020
60	140	123.242	1232.42	561.0	747	2,486	2,763	2,489	2,486	2,760	4,992	4,518	24,880
70	158	127.075	1270.75	395.5	527	1,753	1,994	1,753	1,751	1,990	3,512	3,100	17,510
80	176	130.897	1308.97	284.0	378	1,258	1,462	1,258	1,255	1,458	2,516	2,168	12,560
90	194	134.707	1347.07	207.4	-	919	1,088	917	915	1,084	1,833	1,542	9,164
100	212	138.506	1385.06	153.8	-	682	821	679	678	816.8	1,356	1,134	6,792
110	230	142.293	1422.93	115.8	-	513	628	511	509	623.6	1,016	816	5,108
120	248	146.068	1460.68	88.3	-	392	486	389	388	481.8	770	606	3,894
130	266	149.832	1498.32	68.3	-	303	380	301	299	376.4	591	456	3,006

ORDERING INFORMATION

Strap-on Brackets

TB □

A = 2 1/2" max. diameter
D = 8" max. diameter
E = 12" max. diameter

TRA *Remote Probe*

Sensor Type □

B = 100R platinum, RTD
C = 1k platinum, RTD
D = 10k T2, Thermistor
E = 2.2k, Thermistor
F = 3k, Thermistor
G = 10k CPC, Thermistor
H = 10k T3, Thermistor
J = 10k Dale, Thermistor
K = 10k w/11k shunt, Thermistor
M = 20k NTC, Thermistor
N = 1800 ohm, Thermistor
P = 10mV/°C, Linitemp
R = 10k US, Thermistor
S = 10k 3A 221, Thermistor
T = 100k, Thermistor
U = 20k "D", Thermistor

Cal Certificate □

0 = None
1 = 1 point Cal validation
2 = 2 point Cal validation

Examples:

TB [D] [C] [2]

TRA [F] [1]

TA

Probe Length □

***M** = 6' (1.8m)
H = 12' (3.6m)
J = 24' (7.3m)

Sensor Type □

B = 100R platinum, RTD
C = 1k platinum, RTD
D = 10k, T2, Thermistor
H = 10k, T3, Thermistor
J = 10k, Dale, Thermistor
M = 20k, NTC
N = 1800 ohm, Thermistor
P = 10mV/C, Linitemp
R = 10k US, Thermistor

Cal Certificate □

0 = None
1 = 1 point Cal validation
2 = 2 point Cal validation

Example:

TA [H] [C] [2]

**Available with sensor types J,N,P*

NOTE: For 4-20mA transmitter output, order sensor with the 100Ω platinum RTD and accessory AA10xx. See page 209.

FLOW SENSOR WITH INTEGRAL FLOW TRANSMITTER
SDI SERIES

DESCRIPTION

The **SDI Series Flow Sensor with Integral Flow Transmitter** is Data Industrial's latest product in their dependable line of flow meters for liquids. The direct insertion models are available in either brass or stainless steel material and can be installed or removed in piping systems that are not pressurized. The hot tap stainless steel models include an isolation valve and mounting hardware that enables flow meter installation and removal while the piping system is pressurized; system shutdown is unnecessary. Hot tap stainless steel models are also available for bidirectional flow measurement.

The four-blade impeller is rugged and non-fouling and requires no custom calibration. The **SDI Series** is available with a frequency output, analog output, and scaled-pulse output and the display is optional. Stainless steel models are available with a PEEK (polyetheretherketone) tip for high (up to 300°F) fluid temperatures, or a PPS (polyphenylene sulfide) tip for more moderate fluid temperatures.

FEATURES

- ***Direct insertion or hot tap installation***
- ***Fits pipe sizes 1.5" to 36"+ (3.8 to 91+ cm)***
- ***Mounts in 1" NPT tap, weld-on or pipe saddle***
- ***1% accuracy***
- ***Low pressure drop***
- ***Optional 8 character 3/8" (0.95 cm) LCD***
- ***NEMA 4X enclosure standard***
- ***Bidirectional models available***
- ***Field programmable with optional software***

SPECIFICATIONS

Operating voltage	8-35 VDC
Output impedance	750Ω @ 24 VDC
Accuracy	±1% of flow rate
Max pressure	
Stainless steel	1000 psig (6895 kPa)
Brass	600 psig (4137 kPa)
Max fluid temp	300°F (149°C) (PEEK tip) 180°F (82°C) (PPS tip)
Ambient temp range	14° to150°F (20° to 65°C)
Design flow range	0.3 to 20 fps (.09 to 6.1 mps)
Display	One-line eight-character 3/8" (0.95 cm) LCD
Pressure drop	0.5 psig (3.45 kPa) or less
Enclosure	NEMA 4X, polypropylene with Viton-sealed dacrylic cover
Electrical connection	Screw terminals with 1/2" (1.27 cm) conduit connection
O-Ring	Viton (standard)
Shaft	Tungsten carbide (standard)
Impeller	Stainless steel (standard)
Bearing	Torlon (standard)
Warranty	1 year

SDI Insertion

ORDERING INFORMATION

MODEL	DESCRIPTION
SDI	Flow sensor with integral transmitter
	MATERIAL
0D1N	Stainless steel insertion w/PPS tip for 1.5" to 10" pipes
0D2N	Stainless steel insertion w/PPS tip for 12"" to 36" pipes
0D3N	Stainless steel insertion w/PPS tip for 36"+ pipes
1D1N	Brass insertion w/PPS tip for 1.5" to 10" pipes
1D2N	Brass insertion w/PPS tip for 12" to 36" pipes
1D3N	Brass insertion w/PPS tip for 36"+ pipes
2D1N	Stainless steel insertion w/PEEK tip for 1.5" to 10" pipes
2D2N	Stainless steel insertion w/PEEK tip for 12" to 36" pipes
2D3N	Stainless steel insertion w/PEEK tip for 36"+ pipes
0H1N	Stainless steel hot tap w/PPS tip for 1.5" to 10" pipes
0H2N	Stainless steel hot tap w/PPS tip for 12" to 36" pipes
0H3N	Stainless steel hot tap w/PPS tip for 36"+ pipes
2H1N	Stainless steel hot tap w/PEEK tip for 1.5" to 10" pipes
2H2N	Stainless steel hot tap w/PEEK tip for 12" to 36" pipes
2H3N	Stainless steel hot tap w/PEEK tip for 36"+ pipes
	OUTPUT
0	Standard frequency pulse
1	4-20 mA
2	Scaled pulse
5	Bidirectional, 4-20 mA + direction (hot tap, PPS tip only)
6	Bidirectional, scaled pulse (hot tap, PPS tip only)
	DISPLAY
0	No display
1	LCD option (not available with output option 0)
	CONSTRUCTION
0200	Viton O-ring, Carbide shaft, stainless steel impeller, Torlon bearing (std)
1200	EPDM O-ring, Carbide shaft, stainless steel impeller, Torlon bearing

SDI | 2D1N | 1 | 1 | 0200

Example: SDI2D1N11200 Flow sensor with integral transmitter, stainless steel insertion with PEEK tip, 4-20 mA output, display, standard construction.

RELATED PRODUCTS

A-SDI	**Programming kit**
A-1027	**Hot tap adapter nipple**
8132030	**Ball valve for hot tap installation (required)**

PROGRAMMABLE ANALOG FLOW TRANSMITTER
MODEL 310

DESCRIPTION

The **Model 310 Programmable Analog Flow Transmitter** is a loop-powered device that converts the signal from a 200 or 4000 Series flow sensor into a linear 4-20 mA signal. An integral, adjustable electronic filter dampens the analog output for smooth, stable operation. The microprocessor-based **Model 310** is configured from a computer, allowing it to be ordered pre-configured, or it can be field-configured. One Model A301-20 programming kit will configure all **Model 310** transmitters.

NEW!

310-00

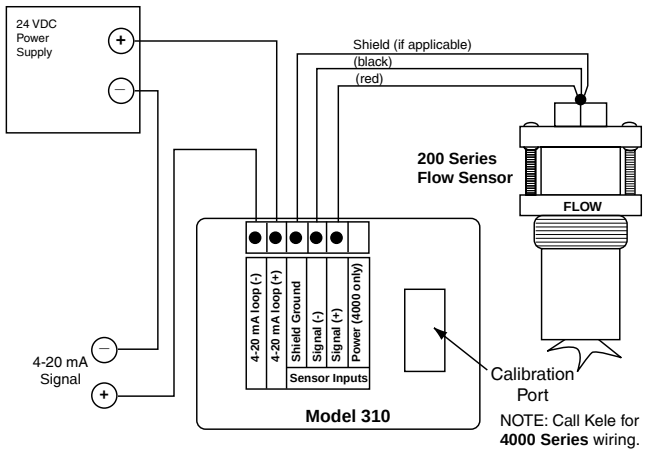
FEATURES

- ***4-20 mA loop powered***
- ***Compact size***
- ***Computer programmable***
- ***Electronic signal dampening***

SPECIFICATIONS

Power requirements	
Loop input voltage	9-35 VDC
Max loop resistance	750Ω @ 24 VDC
Accuracy	0.1% FS
Input frequency	0-1 kHz
Output response time	Varies with filter, typically 1 sec 10% to 90% step response
Operating temp	32° to 158°F (0° to 70°C)
Dimensions	1.75"H x 3.65"W x 1.0"D (4.4 x 9.3 x 2.5 cm)
Warranty	1 year

WIRING



NOTE: Call Kele for **4000 Series** wiring.

ORDERING INFORMATION

MODEL	DESCRIPTION
310	Programmable analog flow transmitter
	MOUNTING
00	Transmitter only
01	Transmitter in NEMA 4X enclosure
02	Transmitter in metal enclosure
03	Transmitter in plastic enclosure
04	Transmitter with DIN rail mount
	OPTIONS
XR	Pre-configured option

310 – 00 – XR ***Example:*** **310-00-XR** Preconfigured programmable analog flow transmitter for field mounting

For preconfigured flow sensors, specify pipe size, schedule, and maximum flow rate at time of order.

RELATED PRODUCTS

A301-20 **Programming kit (cable and software)**

SPLIT-CORE & SOLID-CORE GO/NO GO CURRENT SWITCHES

5 Year Warranty

H300

Micro-housing, install anywhere
US Patent No. 7,193,428; other patents pending

H600

Lowest turn-on current in the industry, only 150mA
US Patent No. 7,193,428

H800/H800NC/H800HV

Mini housing with adjustable mounting bracket for easy installation
US Patent No. 7,193,428

H900

Standard housing for larger conductors

Current Switches: Fixed Trip Point

Hawkeye x00 go/no go current switches provide a cost-effective solution for monitoring status on unit vents, exhaust fans, recirculation pumps, and other fixed loads where belt loss is not a concern.

Veris has applied new technology to the H300, H600, and H800 models to achieve impressive improvement in turn-on levels. The Hawkeye H300 and H600 now have the lowest turn-on current in the industry at a mere 150mA!

APPLICATIONS

- Monitoring on/off status of electrical loads
- Monitoring direct-drive units, exhaust fans, and other fixed loads
- Verifying lighting run times

On/off status for direct-drive fans, pumps, and process motors

- More reliable for status than relays across auxiliary contacts
- Ideal for direct-drive units, unit vents, fan coil units, exhaust fans, and other fixed loads
- Great for lighting status–less expensive than 277V relays
- Low 0.15A turn-on (H300 and H600)...ideal for small exhaust fans (not intended to detect belt loss)
- Removable mounting bracket provides installation flexibility
- Bracket on H900 can be installed in three different configurations

Monitor status of fans, pumps, motors & other electrical loads

- Split-core H300, H600, and H900 for fast retrofit installation
- Mini solid-core H800 and micro split-core H300 fit in tight enclosures...saves valuable panel space
- 100% solid-state, no moving parts to fail
- Polarity insensitive output
- 5-year limited warranty

CURRENT SENSING THE ULTIMATE PROOF OF FLOW

Maximize Reliability
Minimize Installed Cost

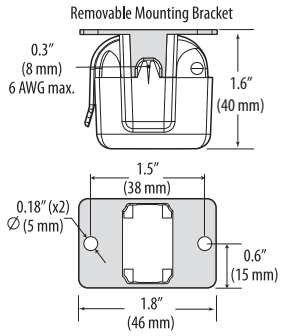
SPECIFICATIONS

Sensor Power (N.O. Models)	Induced from monitored current
Insulation Class	600VAC RMS (UL), 300VAC RMS (CE)
Frequency Range	50/60 Hz
Temperature Range	**H800, H800NC, H300, H900:** -15° to 60°C (5° to 140°F) **H600:** -15° to 40°C (5° to 104°F) (to 200A); -15° to 60°C (5° to 140°F) (to 150A) **H800HV:** -40° to 50°C (-40° to 122°F) (to 200A); -40° to 75°C (-40° to 167°F) (to 100A, & 0.25A output)
Humidity Range	10-90% RH, non-condensing
Sensor Power (N.C. Models)	5-30VDC, permanently connected
Off State Leakage (N.C. Models)	34µA@5VDC, 200µA@30VDC
On State Voltage Drop (N.C. Models)	1.9VDC (max.) @0.1A
Terminal Block Maximum Wire Size	14 AWG (16 AWG for H300)
Terminal Block Torque (nominal)	4 in-lbs (7 in-lbs for H300)
Agency Approvals	UL 508 open device listing CE:EN61010-1:2001-02, CAT III, deg. 2, basic insulation

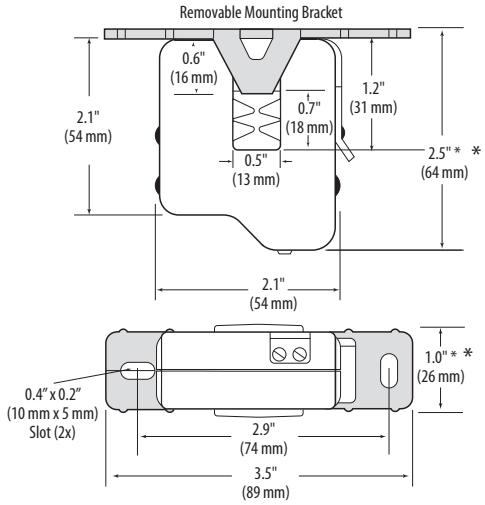
Do not use the LED status indicators as evidence of applied voltage.
For applications requiring double or reinforced insulation, please contact the factory.

DIMENSIONAL DRAWINGS

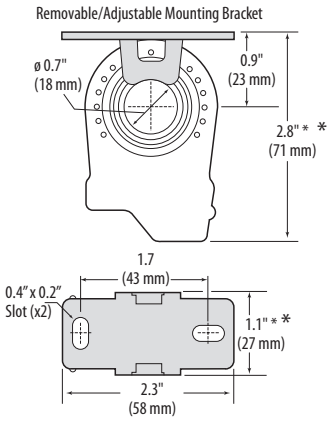
H300



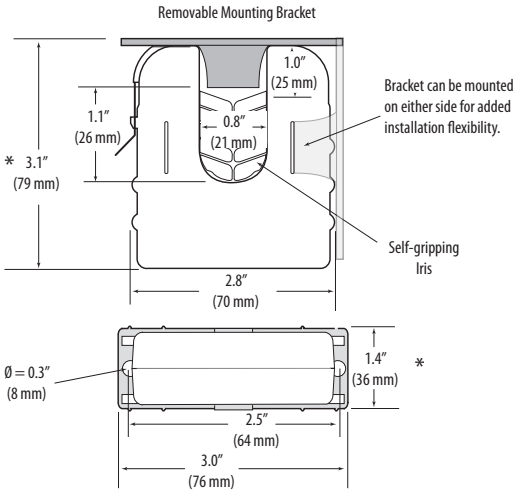
H600



H800, H800HV, H800NC



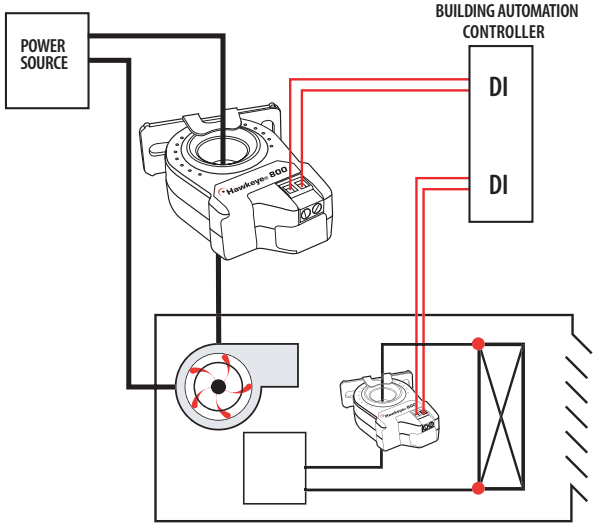
H900



** Terminal block may extend up to 1/8" over the height dimensions shown.*

APPLICATION/WIRING EXAMPLE

Unit Vent Heater Control



ORDERING INFORMATION

MODEL	AMPERAGE RANGE	STATUS OUTPUT (max.)	TRIP POINT	HOUSING	UL	CE	RoHS
H300	0.15 - 60A	N.O. 1.0A@30VAC/DC	0.15A or less	Split-core	●	● [2]	●
H600	0.15 - 200A	N.O. 1.0A@30VAC/DC	0.15A or less	Split-core	● [1]	●	●
H800	0.25 -200A	N.O. 1.0A@30VAC/DC	0.25A or less	Solid-core	● [1]	●	●
H800NC	0.5 - 200A	N.C. 0.1A@30VDC	0.5A or less	Solid-core	● [1]		
H800HV	0.75 - 200A	N.O. 0.5A@250VAC/DC	0.75A or less	Solid-core	● [3]		
H900	1.5 - 200A	N.O. 1.0A@30VAC/DC	1.5A or less	Split-core	●	●	

[1] *Listed for use on 75°C insulated conductors.*
[2] *Product provides functional insulation only.*
[3] *Listed for use on 90°C insulated conductors.*

ACCESSORIES

DIN Rail Clip Set, DIN Rail, and DIN Stop Clip...see page 219.

APPENDIX B – Data Logger Wiring Diagrams

To be completed upon installation of data logger.