Monitoring and Analysis Plan for Aegis AGEN-75 CHP System at the 252 7th Avenue – The Chelsea Mercantile

This document describes the measurements, sensors, and data logging equipment proposed to quantify the performance of the Aegis AGEN-75 based CHP system installed at The Chelsea Mercantile in New York, NY (Figure 1). The CHP system consists of two Aegis AGEN-75 75-kW engine generator systems that produce electricity and hot water for domestic hot water and space heating.

Figure 1. 252 7th Avenue – The Chelsea Mercantile

Description of CHP System

The two 75-kW engine generators are located in boiler room in the cellar level of the building. Also located in the sub-cellar adjacent to the CHP units is a heat exchanger (HX) coupling the heat recovery loop to the buildings space heating hot water loop, a HX for the low zone DHW loop, a HX for the high zone DHW loop, a HX for the WSHP loop, and a HX for the dump radiator and cooling tower loop.

Description of Monitored Data Points

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

Table 1. Data Point List

No.	Data Point	Description	Units	Sensor	Output	Notes
1	WT1	Total Facility Power - Service #1	kW/kWh	Veris E50 C2 with MV Rope CTs	Modbus	Provided and Installed by Ageis
2	WT2	Total Facility Power - Service #2	kW/kWh	Veris E50 C2 with MV Rope CTs	Modbus	Provided and Installed by Ageis
3	WG1	Generator Power - Unit #1	kW/kWh	Veris H8035-0300-2	Modbus	Provided and Installed by Ageis
4	WG2	Generator Power - Unit #2	kW/kWh	Veris H8035-0300-2	Modbus	Provided and Installed by Ageis
5	WPAR	Parasitic Power	kW/kWh	Veris H8035-0100-2	Modbus	Provided and Installed by Ageis
6	FG	Generator Gas Use	CF	Utility pulse output from billing meter	Pulse	Provided and Installed by Ageis
7	QD	Heat Transfer Dump Radiator	Mbtu	Badger 380 BTU meter	Modbus	Provided and Installed by Ageis
8	TLR1	Supply Temperature Dump Radiator (Upstream of CT)	deg F		Modbus	Provided and Installed by Ageis
9	TLR2	Return Temperature Dump Radiator (Downstream of Rad)	deg F		Modbus	Provided and Installed by Ageis
10	FL	Flowrate CHP Loop	GPM		Modbus	Provided and Installed by Ageis
11	TLS	Supply Temperature From CHP Units	deg F	Veris TID B1 D0 10k Type II thermisor	OHMs	Provided and Installed by Ageis
12	WG	Net Generator Power	kW/kWh	-	Calculated	Provided and Installed by Ageis
13	QU	Heat Transfer Useful Loads	Mbtu	-	Calculated	Provided and Installed by Ageis
14	QDC	Heat Transfer Dump Radiator - Calculated	Mbtu	-	Calculated	Provided and Installed by Ageis

Power Meters (WT1, WT2, WG1, WG2, WPAR)

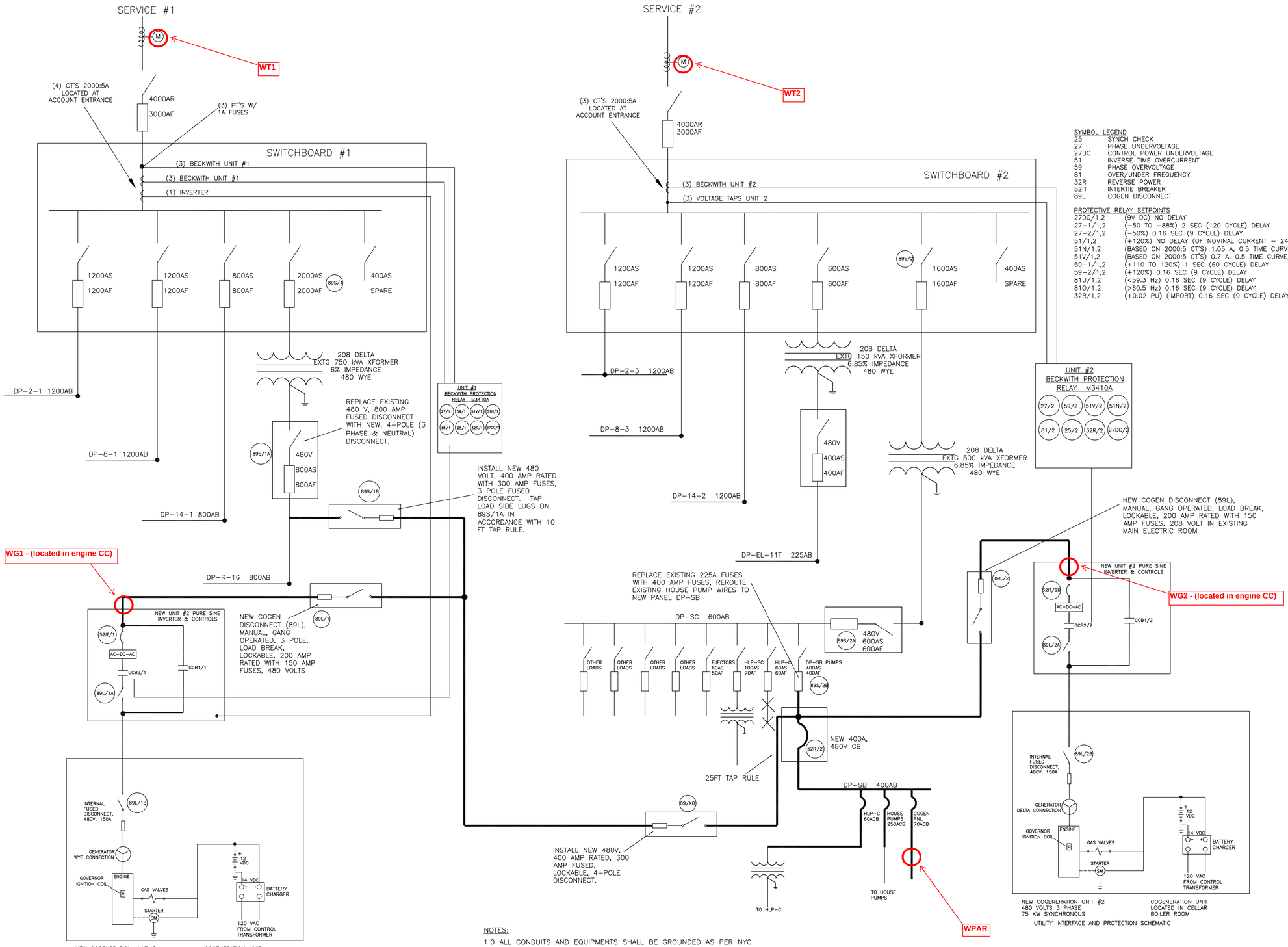
Aegis is providing two (2) power meters to monitor the total facility energy consumption (**WT1, WT2**) on the incoming bus section from the two utility services. The recommended facility power meter is a Veris Veris E50 C2 using rope CTs. The E50 meter will provide a modbus data connection to the data logger for continuous reporting of facility demand (kW) and accumulated energy consumption (kWh).

Aegis is providing two (2) power meters to monitor the output of each of the two (2) CHP units (**WG1,WG2**). The recommended generator power meter is a Veris H8035-300, which provides a modbus data connection to the data logger for continuous reporting of system power (kW) and accumulated produced energy (kWh).

Parasitic power loads (**WPAR**) for the system, typically from additional circulating pumps and the dump radiator fans, are located in Cogen Control Panels (CCPs) next to the cogen units. The recommend parasitic power meter is a Veris H8035-100, which provides a Modbus data connection to the data logger for continuous reporting of system power (kW) and accumulated produced energy (kWh).

All power meters are wired in a daisy-chain configuration on the modbus loop, requiring a continuous run of #18/2 TSP with shield between the sensors, with one return run to the data logger.

Locations of the power metering equipment are shown on the one line diagram in Figure 2.



SYMBOL LEGEND

25	SYNCH CHECK
27	PHASE UNDERVOLTAGE
27DC	CONTROL POWER UNDERVOLTAGE
51	INVERSE TIME OVERCURRENT
59	PHASE OVERVOLTAGE
81	OVER/UNDER FREQUENCY
32R	REVERSE POWER
52IT	INTERTIE BREAKER
89L	COGEN DISCONNECT

PROTECTIVE RELAY SETPOINTS

27DC/1,2	(9V DC) NO DELAY
27-1/1,2	(-50 TO -88%) 2 SEC (120 CYCLE) DELAY
27-2/1,2	(-50%) 0.16 SEC (9 CYCLE) DELAY
51/1,2	(+120%) NO DELAY (OF NOMINAL CURRENT - 248A) .05 SEC MAX CLEARING TIME
51N/1,2	(BASED ON 2000:5 CT'S) 1.05 A, 0.5 TIME CURVE, EXTREMELY INVERSE
51V/1,2	(BASED ON 2000:5 CT'S) 0.7 A, 0.5 TIME CURVE, EXTREMELY INVERSE, 85% VOLTAGE
59-1/1,2	(+110 TO 120%) 1 SEC (60 CYCLE) DELAY
59-2/1,2	(+120%) 0.16 SEC (9 CYCLE) DELAY
81U/1,2	(<59.3 Hz) 0.16 SEC (9 CYCLE) DELAY
81O/1,2	(>60.5 Hz) 0.16 SEC (9 CYCLE) DELAY
32R/1,2	(+0.02 PU) (IMPORT) 0.16 SEC (9 CYCLE) DELAY

NOTES:

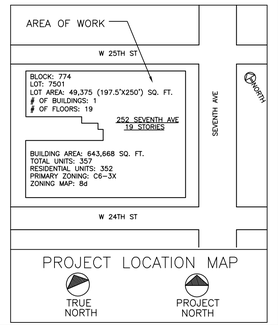
1.0 ALL CONDUITS AND EQUIPMENTS SHALL BE GROUNDED AS PER NYC ELECTRICAL CODE ART. 250.

2.0 ALL WORK SHALL BE IN CONFORMANCE WITH NYC ELECTRICAL CODE ART. 705 AND ART 445.

SITE ELECTRICAL ONE-LINE DIAGRAM

SCALE: NTS

NO.	DATE	REVISION DESCRIPTION
3	3-19-12	MISC CORRECTIONS
4	5-14-12	ELECTRIC REVISIONS, MISC
5	6-5-12	REVISED GROUND SIZES



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BEPC

STATE OF NEW YORK JOHN C. BECKER 087012 LICENSED PROFESSIONAL ENGINEER

PROJECT

CHELSEA MERCANTILE
COGENERATION PROJECT
252 7TH AVENUE
NEW YORK, NY 10001

DRAWING TITLE:

ELECTRICAL
ONE-LINE DIAGRAM

DESIGN BY:	SP	DATE:	11/28/11
DRN BY:	SP	DATE:	11/29/11
CKD BY:	AHE	DATE:	11/30/11
FINAL CKD BY:	JCB	DATE:	12/02/11
SCALE:	AS NOTED	DATE:	
DWG No.		PAGE 14 OF 15	

E-005.05

PROJECT NO.

20-2477

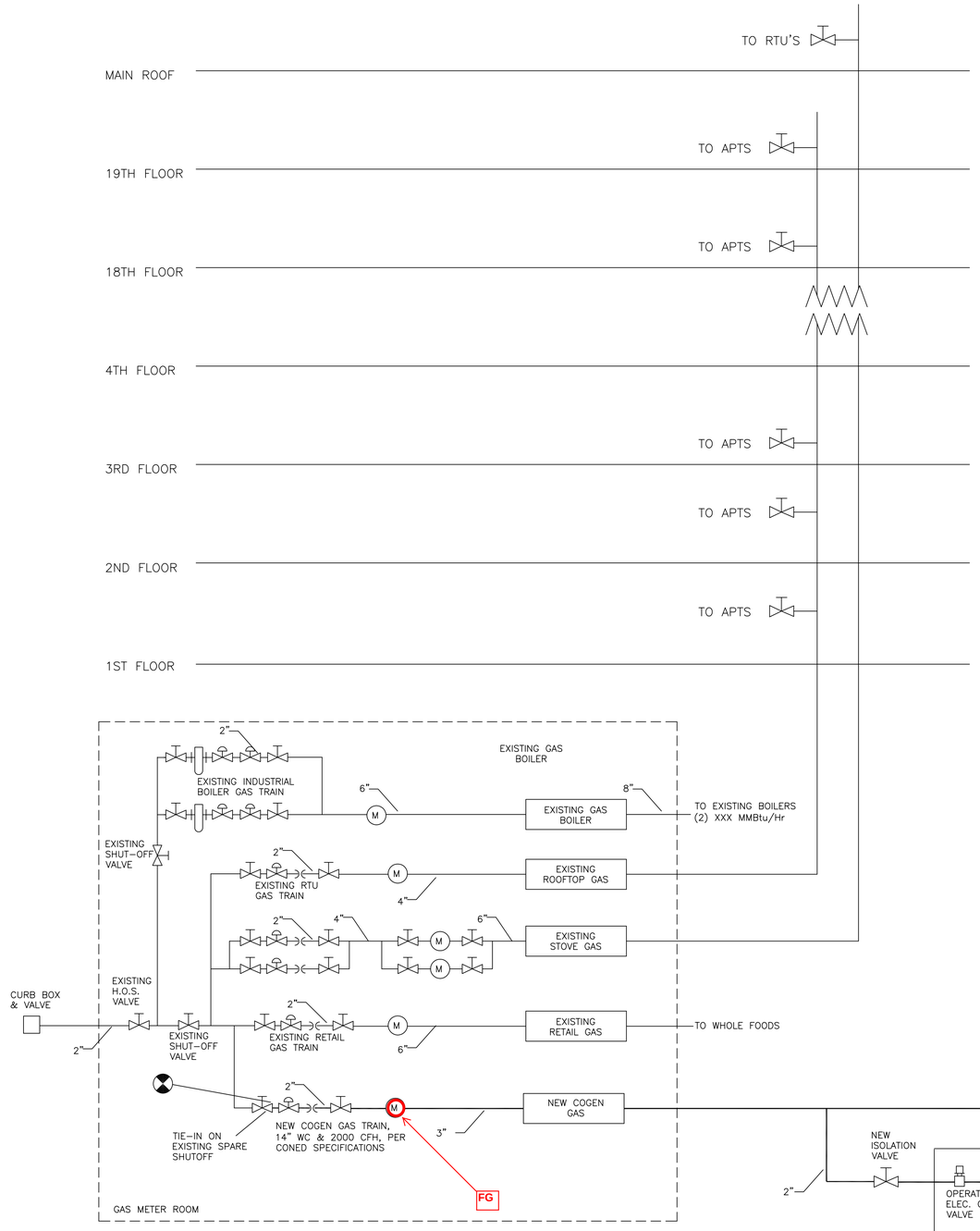
B-SCAN:

Natural Gas Flow (FG)

The natural gas meter for the CHP system is located in the cellar level in a gas metering room. The CHP system gas consumption (**FG**) will be read using a utility supplied pulse interface that provides a dry-contact switch closure for a fixed volume of gas (typically 100 CF/pulse).

The gas meter pulse output requires a dedicated twisted pair signal wire back to the CCP-1 location in the sub-cellar.

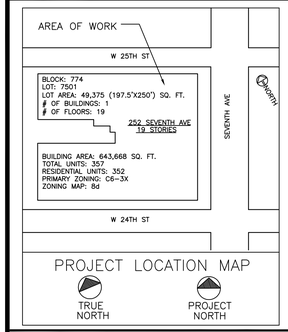
Locations of the gas metering equipment are shown on the piping diagram in Figure 3.



GAS RISER DIAGRAM

SCALE: NTS

3	3-19-12	MISC CORRECTIONS
4	5-14-12	ELECTRIC REVISIONS, MISC
5	6-5-12	REVISED GROUND SIZES



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PROJECT

CHELSEA MERCANTILE
COGENERATION PROJECT
252 7TH AVENUE
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DRAWING TITLE:

PLUMBING RISER DIAGRAM

DESIGN BY:	SP	DATE:	11/28/11
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SCALE:	AS NOTED	DATE:	
DWG No.		PAGE 9 OF 15	

P-003.05

PROJECT NO. 20-2477

B-SCAN:

Heat Recovery Calculations (QD, TLR1, TLR2, FL, TLS, QU)

The recovered heat from the CHP system is measured using one Badger 380 Btu meter and one additional temperature sensor. The Badger meter provides not only an integrated heat transfer measurement using its two onboard temperature sensors and flow meter, but also the temperature and flow readings used to compute the BTU value. Recording the flows and temperatures simultaneously with the BTU data allows for diagnosis of deviations in the heat transfer values beyond what the BTU data can provide alone.

The Badger BTU meter records the total heat transferred to the dump radiator loops (**QD**). This includes heat dissipated through the cooling towers and the standby mode radiator located in the garage. With the addition of the recovered heat loop supply temperature sensor (**TLS**), the total heat transfer to useful loads (**QU**) can be calculated using the flow and temperature reading **(FL, TLR1)** from the BTU meter.

Similar to the power meters, the BTU meter needs to be wired in a daisy-chain configuration as part of the same modbus loop, requiring a continuous run of #18/2 TSP with shield between the power meters and BTU meter, with one return run to the data logger.

Locations of the thermal metering equipment are shown on the piping diagram in Figure 4.

PUMP SCHEDULE

PUMP NO.	SERVICE	FLOW	HEAD	PUMP H.P.	PHASE	PUMP MODEL
P-1	COGEN #1	25 GPM	70 FT	3/4 HP	3 PH	BELL & GOSSETT SERIES 1535 353T
P-2	COGEN #2	25 GPM	70 FT	3/4 HP	3 PH	BELL & GOSSETT SERIES 1535 353T
P-3a & 3b	COGEN PRIMARY LOOP (REDUNDANT)	55 GPM	70 FT	1 1/2 HP	3 PH	BELL & GOSSETT SERIES 1535 355T
P-4	SPACE HEATING LOOP	50 GPM	28 FT	3/4 HP	3 PH	BELL & GOSSETT SERIES 60-615T
P-5	LOW ZONE DHW LOOP	40 GPM	15 FT	3/5 HP	1 PH	BELL & GOSSETT SERIES PL-55B
P-6	HIGH ZONE DHW LOOP	40 GPM	15 FT	3/5 HP	1 PH	BELL & GOSSETT SERIES PL-55B
P-7	WATER SOURCE HEAT PUMP LOOP	50 GPM	28 FT	3/4 HP	3 PH	BELL & GOSSETT SERIES 60-615T
P-8	DUMP LOOP	50 GPM	28 FT	3/4 HP	3 PH	BELL & GOSSETT SERIES 60-615T

CONTROL VALVE SCHEDULE

VALVE NO.	SERVICE	FLOW TYPE	SIZE	VOLTAGE	VALVE MODEL	ACTUATOR
V-1	SPACE HEATING LOOP	MIXING	2"	24 V	SCHNEIDER ELECTRIC VS2313-526-9-63	MS40-7043M MODULATING
V-2	LOW ZONE DHW LOOP	MIXING	2"	24 V	SCHNEIDER ELECTRIC VS2313-526-9-63	MS40-7043M MODULATING
V-3	HIGH ZONE DHW LOOP	MIXING	2"	24 V	SCHNEIDER ELECTRIC VS2313-526-9-63	MS40-7043M MODULATING
V-4	WATER SOURCE HEAT PUMP LOOP	MIXING	2"	24 V	SCHNEIDER ELECTRIC VS2313-526-9-63	MS40-7043M MODULATING
V-5	DUMP LOOP	MIXING	2"	24 V	SCHNEIDER ELECTRIC VA2313-526-9-67	MA40-7043M ON/OFF
V-6	STANDBY DUMP LOOP	MIXING	2"	24 V	SCHNEIDER ELECTRIC VA2313-526-9-67	MA40-7043M ON/OFF

PLATE HEAT EXCHANGER H.X.-1

DESIGN MANUFACTURER		API HEAT TRANSFER
MODEL		SBM7M-60
TYPE		BRAZED PLATE
MATERIAL		COPPER/316 STAINLESS
SERVICE		SPACE HEATING
SIDE	HOT	COLD
FLUID TYPE	WATER	WATER
FLUID FLOW	50 GPM	50 GPM
TEMP IN	220	165
TEMP OUT	176	208
PRESSURE DROP	2.09 PSI	2.06 PSI
INLET SIZE	2" NPT	2" NPT

PLATE HEAT EXCHANGER H.X.-2&3

DESIGN MANUFACTURER		API HEAT TRANSFER
MODEL		SBM7L-40
TYPE		BRAZED PLATE
MATERIAL		COPPER/316 STAINLESS
SERVICE		DOMESTIC HOT WATER
SIDE	HOT	COLD
FLUID TYPE	WATER	WATER
FLUID FLOW	50 GPM	50 GPM
TEMP IN	220	140
TEMP OUT	176	182
PRESSURE DROP	1.99 PSI	1.93 PSI
INLET SIZE	2" NPT	2" NPT

PLATE HEAT EXCHANGER H.X.-4

DESIGN MANUFACTURER		API HEAT TRANSFER
MODEL		SBM7L-40
TYPE		BRAZED PLATE
MATERIAL		COPPER/316 STAINLESS
SERVICE		WATER SOURCE HEAT PUMP
SIDE	HOT	COLD
FLUID TYPE	WATER	WATER
FLUID FLOW	50 GPM	50 GPM
TEMP IN	220 F	95 F
TEMP OUT	176 F	137 F
PRESSURE DROP	1.99 PSI	1.93 PSI
INLET SIZE	2" NPT	2" NPT

PLATE HEAT EXCHANGER H.X.-5

DESIGN MANUFACTURER		API HEAT TRANSFER
MODEL		SBM7L-40
TYPE		BRAZED PLATE
MATERIAL		COPPER/316 STAINLESS
SERVICE		DUMP LOOP
SIDE	HOT	COLD
FLUID TYPE	WATER	WATER
FLUID FLOW	50 GPM	50 GPM
TEMP IN	220 F	95 F
TEMP OUT	176 F	137 F
PRESSURE DROP	1.99 PSI	1.93 PSI
INLET SIZE	2" NPT	2" NPT

AIR COOLED RADIATOR H.X.-6

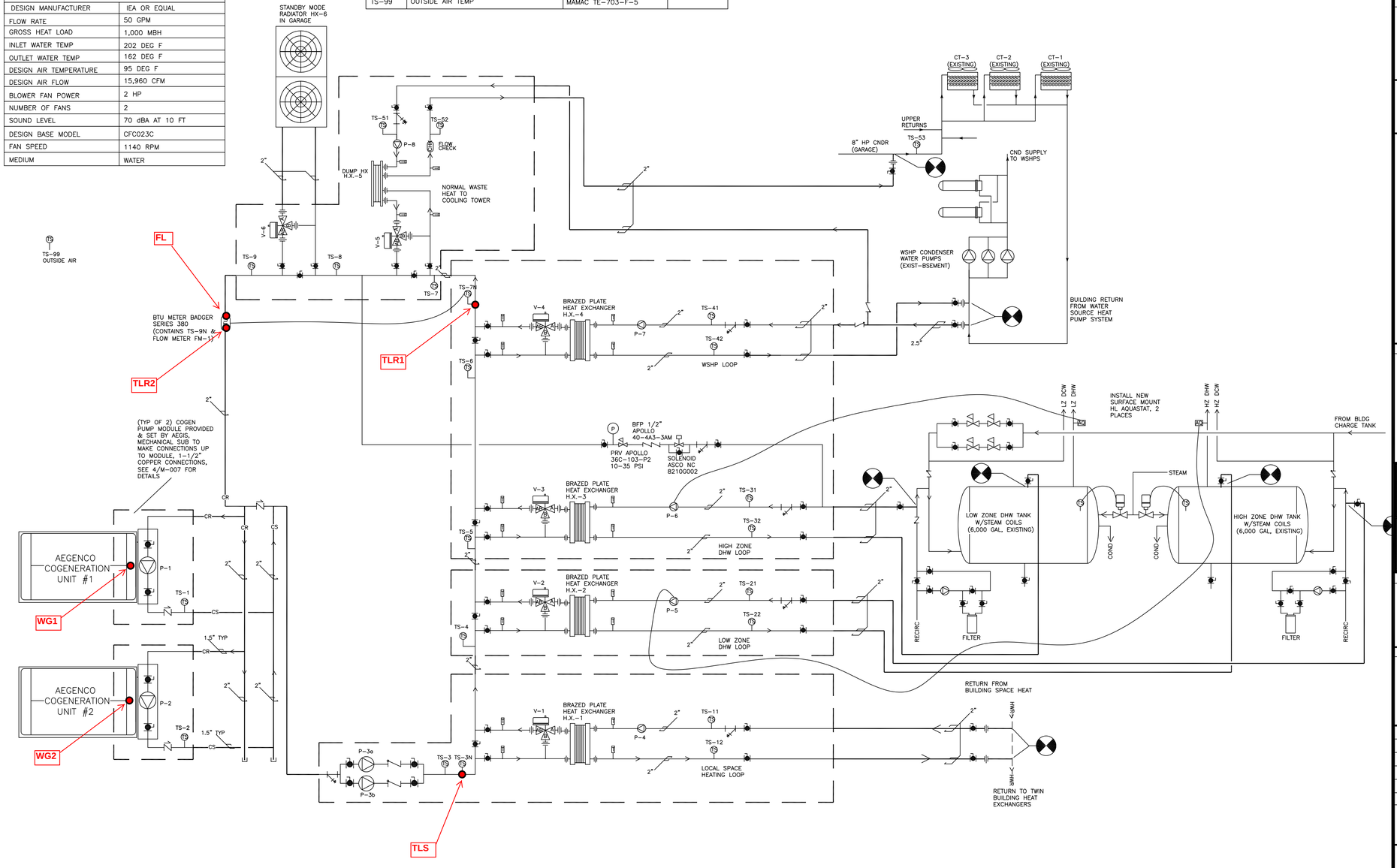
DESIGN MANUFACTURER	IEA OR EQUAL
FLOW RATE	50 GPM
GROSS HEAT LOAD	1,000 MBH
INLET WATER TEMP	202 DEG F
OUTLET WATER TEMP	162 DEG F
DESIGN AIR TEMPERATURE	95 DEG F
DESIGN AIR FLOW	15,960 CFM
BLOWER FAN POWER	2 HP
NUMBER OF FANS	2
SOUND LEVEL	70 dBA AT 10 FT
DESIGN BASE MODEL	CFC023C
FAN SPEED	1140 RPM
MEDIUM	WATER

TEMPERATURE SENSOR SCHEDULE

TS NO.	SERVICE	SENSOR MODEL NO.	WELL TYPE
TS-1	COGEN #1 SUPPLY	MAMAC TE-703-C-5A	AT-225
TS-2	COGEN #2 SUPPLY	MAMAC TE-703-C-5A	AT-225
TS-3	COGEN SUPPLY TO SPACE HX	MAMAC TE-703-C-5A	AT-225
TS-4	SUPPLY TO LZ DHW	MAMAC TE-703-C-5A	AT-225
TS-5	SUPPLY TO HZ DHW	MAMAC TE-703-C-5A	AT-225
TS-6	SUPPLY TO WATER SOURCE HP	MAMAC TE-703-C-5A	AT-225
TS-7	SUPPLY TO TOWER DUMP	MAMAC TE-703-C-5A	AT-225
TS-8	SUPPLY TO RADIATOR DUMP	MAMAC TE-703-C-5A	AT-225
TS-9	COGEN RETURN	MAMAC TE-703-C-5A	AT-225
TS-11	SPACE HEATING TO HX	MAMAC TE-703-C-5A	AT-225
TS-12	HX TO SPACE HEATING	MAMAC TE-703-C-5A	AT-225
TS-21	LOW ZONE DHW TO HX	MAMAC TE-703-C-5A	AT-225
TS-22	HX TO LOW ZONE DHW	MAMAC TE-703-C-5A	AT-225
TS-31	HIGH ZONE DHW TO HX	MAMAC TE-703-C-5A	AT-225
TS-32	HX TO HIGH ZONE DHW	MAMAC TE-703-C-5A	AT-225
TS-41	WATER SOURCE HEAT PUMP TO HX	MAMAC TE-703-C-5A	AT-225
TS-42	HX WATER SOURCE HEAT PUMP	MAMAC TE-703-C-5A	AT-225
TS-51	WATER SOURCE RETURN TO HX (DUMP)	MAMAC TE-703-C-5A	AT-225
TS-52	HX TO COOLING TOWER	MAMAC TE-703-C-5A	AT-225
TS-53	COOLING TOWER TEMP	MAMAC TE-703-C-5A	AT-225
TS-99	OUTSIDE AIR TEMP	MAMAC TE-703-F-5	

COGENERATION SCHEDULE (2 UNITS)

DESIGN MANUFACTURER	AEGENCO
FUEL	NATURAL GAS
FUEL INPUT	930 SCFH
GAS PRESSURE	10-14" WC
THERMAL OUTPUT	523 MBH
ELECTRICAL OUTPUT	75 KW
POWER GENERATOR	SYNCHRONOUS
VOLTAGE	120/208 3PH
ACOUSTIC LEVEL	70dba @ 20ft
VIBRATION ISOLATION	YES
CONTROLS	MICROPROCESSOR BASED
UNIT WEIGHT	3050 LBS
MODEL	TP-75LES
AVG INLET TEMP	170 DEG F
AVG OUTLET TEMP	220 DEG F
DIMENSIONS	46"W x 89"L x 49"H



COGENERATION HVAC SCHEDULES

SCALE: NTS

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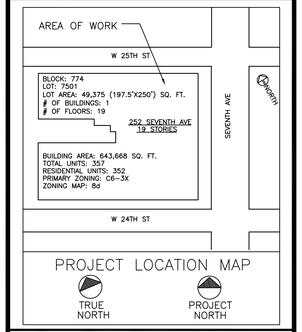

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PROJECT

CHELSEA MERCANTILE COGENERATION PROJECT
252 7TH AVENUE
NEW YORK, NY 10001

DRAWING TITLE:

HVAC SCHEDULES/ MECHANICAL FLOW DIAGRAM

DESIGN BY:	SP	DATE:	11/28/11
DRN BY:	SP	DATE:	11/29/11
CKD BY:	AHE	DATE:	11/30/11
FINAL CKD BY:	JCB	DATE:	12/02/11
SCALE: AS NOTED		DATE:	
DWG No.		PAGE 3 OF 15	

M-001.05

PROJECT NO.
20-2477

B-SCAN:

Data Logger Location and Communication

The data logger will be installed adjacent to the Aegis CCP control panel in the cellar level, and will utilize a port on the router (DHCP or Static IP to be provided by Aegis). Inside the Aegis communication panel is a 110 VAC outlet that will be utilized for datalogger power.

The modbus communication loop will be configured for the following modbus slave address on each device.

Table 2. Modbus Communication Loop Device Numbers

Data Point	Sensor	Modbus Device Number
WT1	Veris E50 C2 with MV Rope CTs	1
WT2	Veris E50 C2 with MV Rope CTs	2
WG1	Veris H8035-0300-2	3
WG2	Veris H8035-0300-2	4
WPAR	Veris H8035-0100-2	5
QD, TLR1, TLR2, FL	Badger 380	6

The modbus communication loop is shown schematically in Figure 5. (will be added once the site is visited and floors and exact locations are known for the various meters)

[PDF DRAWING]

Figure 5. Modbus Loop Wiring Diagram

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 metering arrangement at this site allows for useful heat and rejected heat to be calculated using one flow measurement and three temperature measurments:

Useful heat recovery (**QU**) = $K \cdot \Sigma [FL \cdot (TLS-TLR1)] / n$

Dumped heat recovery (**QHD**) = $K \cdot \Sigma [FL \cdot (TLR1-TLR2)] / n$

Or

Dumped heat recovery (**QHD**) = QL2 (From BTU Meter)

The loop fluid is expected to be glycol water mixture, (K ~ 480 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 consist of 9 circulation pumps (two pumps are redundant) and two dump radiator fans. The loads are able to all be measured with one power transducer in the CCP.

Parasitic Energy (**WPAR**) = $\Sigma WPAR / n$

Calculated Quantities

The net power output from the CHP system will be defined as the power from the engine generators minus the parasitic power.

WG = WG1 + WG2 - WPAR

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

$$FCE = \frac{QU \cdot \Delta t + 3{,}412 \cdot WG}{LHV_{gas} \cdot FG}$$

where:

	QU	-	Useful heat recovery (Btu/h)
	WG	-	Engine generator gross output (kWh) (WG1+WG2)
	FG	-	Generator gas consumption (Std CF)
	Δt	-	1/60 for 1-minute data
	LHV_{gas}	-	Lower heating value for natural gas (~920 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:

$$FCE = \frac{\sum^{N} QU \cdot \Delta t + 3{,}412 \cdot \sum^{N} WG}{LHV_{gas} \cdot \sum^{N} FG}$$

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 6. 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 engines 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 cellar mechanical room, near the existing Aegis control panel, providing 110 VAC and internet connectivity.

Other Monitoring Requirements

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.

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 performed at monitoring system installation.

System Energy Flows

System energy and thermal flows documented in data analysis section.

Data Collection Status

To be provided at monitoring system commissioning.

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

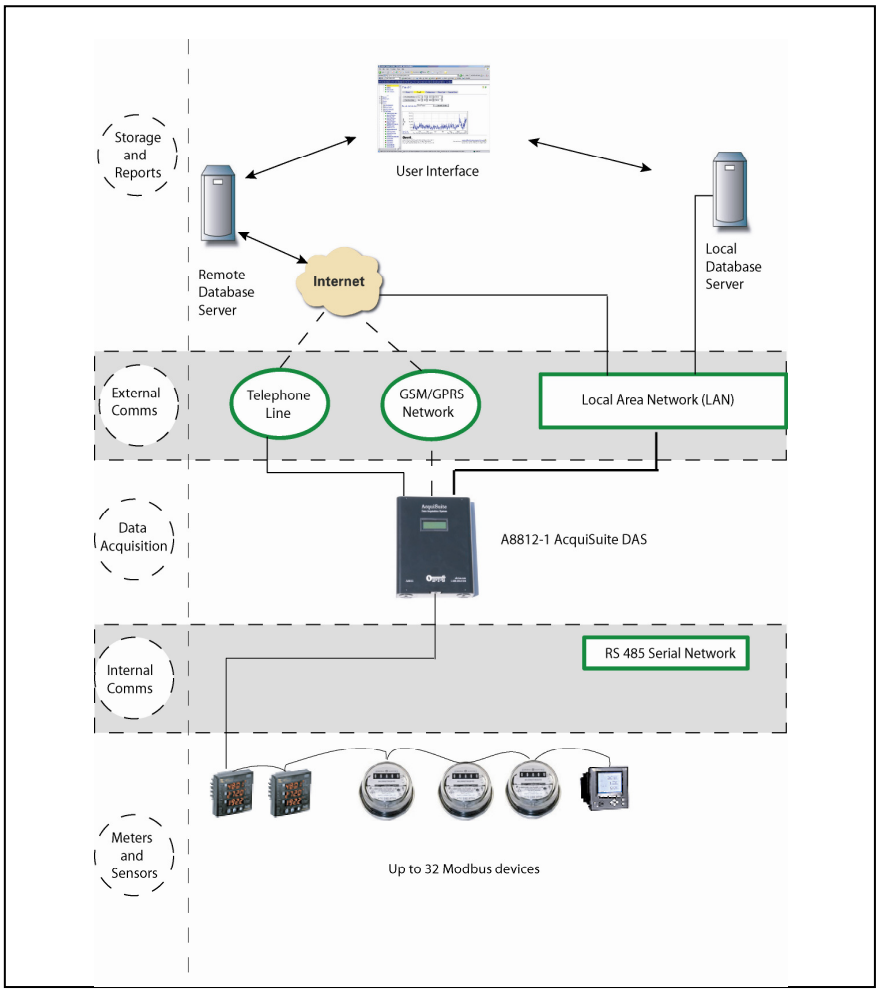
- Allows users a simple means to add Modbus devices not supported by AcquiSuite plug and play drivers
- Driver templates can be stored and shared with multiple AcquiSuites
- Simple web-based interface makes the process easy

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

Enhanced Power and Energy Meter

Versatile Energy Monitoring Solution

E5x

5 Year Warranty

APPLICATIONS

- Energy monitoring in building automation systems
- Renewable energy
- Energy management
- Commercial submetering
- Industrial monitoring
- Cost allocation

FEATURES

All Models: A compact solution for panelboard monitoring

- DIN rail mounting option...easy installation
- ANSI 12.20 0.5% accuracy, IEC 62053-22 Class 0.5S...great for cost allocation
- Real energy output and phase loss alarm output on E50Bx and E5xCx models...one device serves multiple applications
- 90-600 VAC...application versatility with fewer models to stock
- Bright backlit LCD...easy visibility in dark enclosures
- Data logging capability (E5xC3 and E50H5)...safeguard during power failures
- Compatible with CTs from 5A to 32000A...wide range of service types
- User-enabled password protection...protect from tampering
- System integration via Modbus (E5xCx) or BACnet MS/TP (E50H5)...convenient compatibility with existing systems
- Native BACnet MS/TP support with serial rates up to 115.2 kbaud (E50H5)

E51 Models: An essential solution for Solar and other renewable energy applications

- Bi-directional metering (4-quadrant)...allows net metering
- Data logging capability (E51C3)...ensures long term data retrieval
- CSI approved
- Includes SunSpec compliant common and meter register blocks

DESCRIPTION

The **E5x Series** DIN Rail Meter combines exceptional performance and easy installation to deliver a cost-effective solution for power monitoring applications. The E5x can be installed on standard DIN rail or surface mounted as needed. Pulse output and phase alarms provide additional versatility. The Modbus and BACnet output options offer added flexibility for system integration. The data logging capability (E5xC3 and E50H5) protects data in the event of a power failure. Modbus, pulse output, and phase alarms are all provided to suit a wide variety of applications.

Additional pulse inputs on E50H5 provide an easy way to incorporate simple flow sensors to track gas, water, steam, or other energy forms using a BACnet system in addition to full monitoring of electrical energy.

The E51 models add a bi-directional monitoring feature designed expressly for renewable energy applications, allowing measurement of power imported from the utility grid as well as power exported from the renewable energy source (e.g. solar panels). In this way, a facility administrator track all energy data, ensuring accuracy in billing and crediting.

SPECIFICATIONS

Inputs:

Control Power, AC	50/60 Hz; 5VA max.; 90V min.; UL Maximums: 600V_{L-L} (347V_{L-N}); CE Maximums: 300V_{L-N} (520V_{L-L})
Control Power, DC	3W max.; UL and CE: 125 to 300VDC (external DC current limiting required)
Voltage Input	UL: 90 V_{L-N} to 600 V_{L-L}; CE: 90 V_{L-N} to 300 V_{L-L}
Current Input	
Scaling	5 A to 32,000 A
Input Range	0 to 0.333 V or 0 to 1 V (selectable)
Pulse Inputs (E50H5 only)	Two sets of contact inputs to pulse accumulators

Accuracy:

Real Power and Energy	0.5% (ANSI C12.20, IEC 62053-22 Class 0.5S)

Outputs:

All Models (except E50H5)	Real Energy Pulse: N.O. static; Alarm contacts: N.C. static
E50Bx	Reactive energy pulse 30 VAC/DC
E5xCx	RS-485 2-wire Modbus RTU (1200 baud to 38.4 kbaud)
E50H5	RS-485 2-wire BACnet MS/TP (9600 baud to 115.2 kbaud)

Mechanical:

Mounting	DIN Rail or 3-point screw mount

Environmental:

Operating Temperature Range	-30° to 70°C (-22° to 158°F)
Storage Temperature Range	-40° to 85°C (-40° to 185°F)
Humidity Range	<95% RH noncondensing

UL listed, CE, California CSI Solar, ANSI C12.20

POWER/ENERGY MONITORING

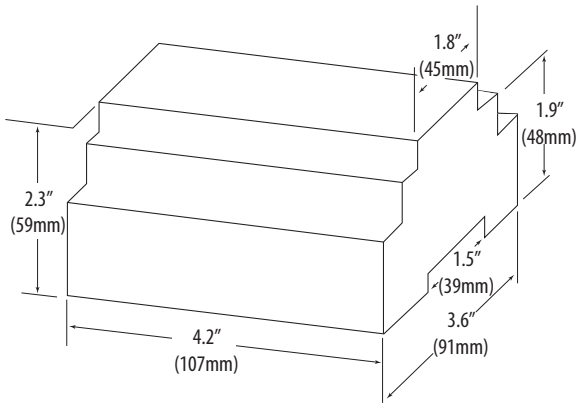
ORDERING INFORMATION

SunSpec alliance — E51 only

E51 only

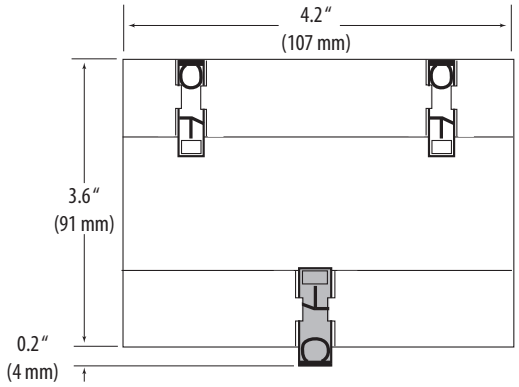
	E50B1	E50C2	E50C3	E50H5	E51C2	E51C3
Measurement Capability - Full Data Set						
Bi-directional Energy Measurements					●	●
Power (3-phase total and per phase) - Real (kW), Reactive (kVAR), and Apparent (kVA)	●	●	●	●	●	●
Power Factor: 3-phase average and per phase	●	●	●	●	●	●
Present Power Demand - Real (kW), Reactive (kVAR), and Apparent (kVA)	●	●	●	●	●	●
Import and Export totals of Present Power Demand - Real (kW), Reactive (kVAR), and Apparent (kVA)					●	●
Peak Power Demand - Real (kW), Reactive (kVAR), and Apparent (kVA)	●	●	●	●	●	●
Current: (3-phase average and per phase)	●	●	●	●	●	●
Voltage - Line-Line and Line-Neutral: (3-phase average and per phase)	●	●	●	●	●	●
Frequency	●	●	●	●	●	●
Accumulated Energy - Real (kWh), Reactive (kVARh), and Apparent (kVAh)	●	●	●	●		
Import and Export Accumulators of Real and Apparent Energy					●	●
Reactive Energy Accumulators by Quadrant (3-phase total and per phase)					●	●
Configurable Demand Subinterval	●	●	●	●	●	●
Demand Interval Configuration: Fixed or Rolling Block	●	●	●	●	●	●
Demand Interval Configuration: External Sync to Comms		●	●	●	●	●
Data Logging (store up to 60 days at 15-minute interval):						
Data Logging - 10 16-Bit Configurable (can include Date/Time) Data Buffers			●			●
Data Logging - 3 Timestamped 32-Bit Configurable Data Buffers				●		
Outputs:						
Alarm Output (N.C.)	●	●	●		●	●
1 Pulse Output (N.O.)		●	●		●	●
2 Pulse Outputs (N.O.)	●					
RS-485 Serial (Modbus RTU Protocol)		●	●		●	●
RS-485 Serial (BACnet MS/TP Protocol)				●		
Inputs:						
2 Pulse Contact Accumulator Inputs				●		

DIMENSIONAL DRAWING

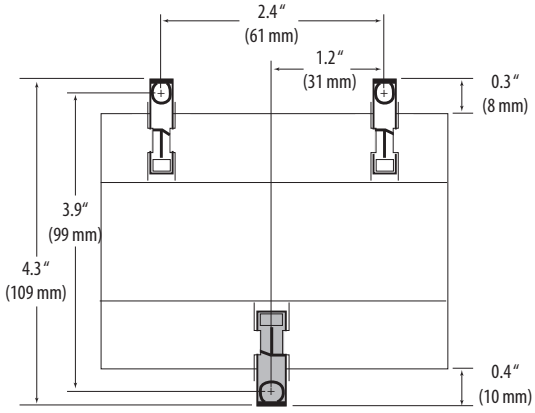


MOUNTING DIAGRAMS

DIN Mount Configuration



Wall Mount Configutation



ACCESSORIES

NEMA4 enclosure (AE010) with locking mechanism (AE011) (pictured)
Fuse Kits with hi-interrupt capability AC Fuses (AH02, AH03, AH04)
Split-core and solid-core CTs (H681x, UCT, SCT)
Replacement mounting clips (AE004)
DIN Rail (AV01)
DIN Rail Stop Clips (AV02)
Terminating Resistor (AH22)

POWER/ENERGY MONITORING

Enercept® Networked Power Transducers (Modbus® RTU)

Integral Monitoring Solution Eliminates The Need For Separate Enclosures

H8035

U.S. Patent No. 6,373,238

5 Year Warranty

APPLICATIONS

- Energy managing & performance contracting
- Monitoring for commercial tenants
- Activity-based costing in commercial and industrial facilities
- Real-time power monitoring

FEATURES

The world's most cost-effective power transducer

- Monitor energy parameters (kW, kWh, kVAR, PF, Amps, Volts) at up to 63 locations on a single RS-485 network...greatly reduces wiring time and cost
- Fast split-core installation eliminates the need to remove conductors...saves time and labor
- Precision electronics and current transformers in a single package...reduces the number of installed components...huge labor savings
- Smart electronics eliminate CT orientation concerns...fast trouble-free installation

High accuracy

- ±1% total system accuracy, (10% to 100% of CT rating)

DESCRIPTION

The **Enercept H8035/8036** are innovative three-phase networked (Modbus RTU) power transducers that combine measurement electronics and high accuracy industrial grade CTs in a single package. The need for external electrical enclosures is eliminated, greatly reducing installation time and cost.

There are two application-specific platforms to choose from. The Basic Enercept energy transducers (H8035) are ideal for applications where only kW and kWh are required. The Enercept Enhanced power transducers (H8036) output 26 variables including kW, kWh, volts, amps, and power factor, making them ideal for monitoring and diagnostics.

Color-coordination between voltage leads and CTs makes phase matching easy. Additionally, the Enercept automatically detects and compensates for phase reversal, eliminating the concern of CT load orientation. Up to 63 Enercepts can be daisy-chained on a single RS-485 network.

POWER/ENERGY MONITORING

SPECIFICATIONS

Inputs:

Voltage Input	208 to 480VAC, 50/60 Hz RMS †(††)
Current Input	Up to 2400A continuous per phase †

Accuracy:

System Accuracy	±1% of reading from 10% to 100% of the rated current of the CTs, accomplished by matching the CTs with electronics and calibrating them as a system

Outputs:

Type	Modbus RTU**(*)
Baud Rate	9600, 8N1 format
Connection	RS-485, 2-wire + shield

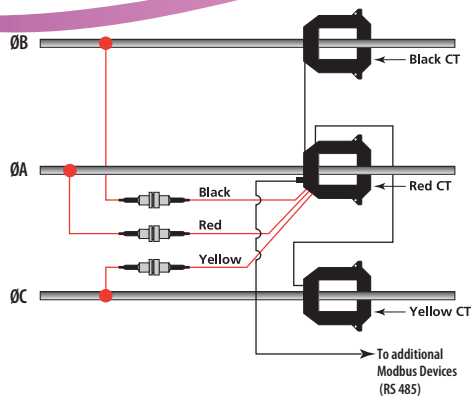
Environmental:

Operating Temperature Range	0° to 60°C (32° F to 140°F), 50°C (122°F) for 2400A
Humidity Range	0 - 95% non-condensing

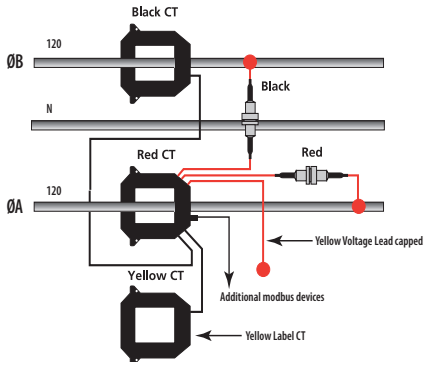
UL, approved for California CSI Solar applications (check the CSI Solar website for model numbers)
*** Detailed protocol specifications are available at: http://www.veris.com/modbus*
** Other protocols available. Please consult factory.*
† Contact factory to interface for voltages above 480VAC or current above 2400 Amps.
†† Do not apply 600V Class current transformers to circuits having a phase-to-phase voltage greater than 600V, unless adequate additional insulation is applied between the primary conductor and the current transformers. Veris assumes no responsibility for damage of equipment or personal injury caused by products operated on circuits above their published ratings.

APPLICATION/WIRING EXAMPLES

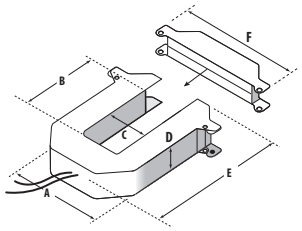
208 or 480VAC 3Ø, Installation



240VAC 1Ø, 3-Wire Installation

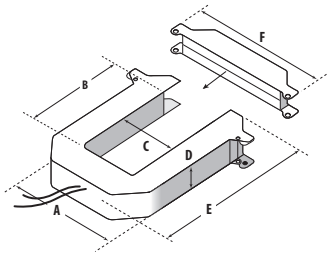


DIMENSIONAL DRAWINGS



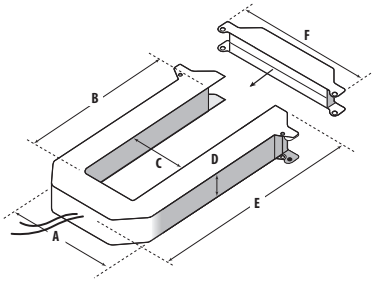
SMALL
100/300 Amp

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)

DATA OUTPUTS

H8035
kWh
kW

H8036
kWh, Consumption
kW, Real Power
kVAR, Reactive Power
kVA, Apparent Power
Power Factor
Average Real Power
Minimum Real Power
Maximum Real Power
Voltage, L-L
Voltage, L-N*
Amps, Average Current
kW, Real Power ØA*
kW, Real Power ØB*
kW, Real Power ØC*

** Based on derived neutral voltage.*

ORDERING INFORMATION

LISTED 44XJ UL 508 C UL US E212445

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*

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

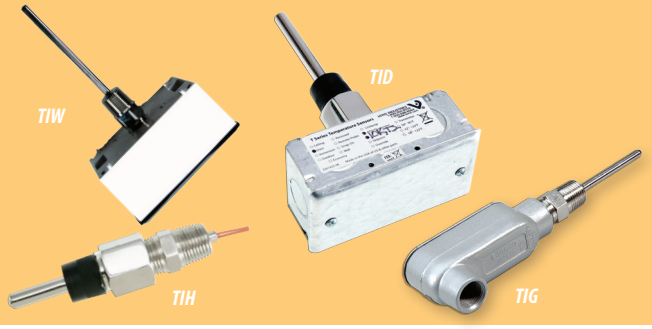
**H8036 models work with H8920-1 LON nodes*

ACCESSORIES

CT Mounting brackets (AH06)
H8920 Series LON nodes

Immersion Temperature Sensors

Corrosion Resistant Stainless Steel Probe



DESCRIPTION

These immersion probe type temperature sensors are both highly accurate and cost effective. Installation could not be easier. The sensor is encased in a corrosion-resistant stainless steel probe for durability, with a choice of service entry body, indoor junction box, or threaded enclosures. A variety of RTD or thermistor sensor options and probe lengths are available for maximum application versatility.

FEATURES

- Cost-effective high accuracy thermistors/RTDs
- Corrosion resistant stainless steel probe design...durable
- 1/2" NPT threads standard...ease of selection
- Variety of enclosures include duct mount, service entry body, threaded, and water resistant to fit your application
- Thermowells available...enables easy servicing

APPLICATIONS

- Tanks
- Pipes
- Chillers

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	10k Type 2	10k Type 3
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	±0.1°C 20/70°C	±0.1°C
	0.0385 curve	0.0385 curve	0/70°C	0/70°C	-50/150°C	0/70°C	-20/70°C	0/70°C	0/70°C	Factory	Factory	Factory	±0.2°C 0/20°C	0/70°C
Temp. Response*	PTC	PTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC
													High Accuracy	

*PTC: Positive Temperature Coefficient
*NTC: Negative Temperature Coefficient

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 NTC	20k "D"	100k	10k Type 2	10k Type 3
-50	-58	80.306	803.06	154,464	205,800	692,700	454,910	672,300	-	441,200	1,267,600	-	-	692,700	454,910
-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	344,700	245,089
-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	180,100	137,307
-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	98,320	79,729
-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	55,790	47,843
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	32,770	29,588
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	19,930	18,813
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	12,500	12,272
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	10,000	10,000
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	8,055	8,195
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	5,323	5,593
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	3,599	3,894
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	2,486	2,763
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	1,753	1,994
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	1,258	1,462
90	194	134.707	1347.07	207.4	-	919	1,088	917	915	1,084	1,833	1,542	9,164	919	1,088
100	212	138.506	1385.06	153.8	-	682	821	679	678	816.8	1,356	1,134	6,792	682	821
110	230	142.293	1422.93	115.8	-	513	628	511	509	623.6	1,016	816	5,108	513	628
120	248	146.068	1460.68	88.3	-	392	486	389	388	481.8	770	606	3,894	392	486
130	266	149.832	1498.32	68.3	-	303	380	301	299	376.4	591	456	3,006	303	380
Sensor Codes		B	C	E	F	D	H	J	S	R	M	U	T	W	Y

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

SPECIFICATIONS

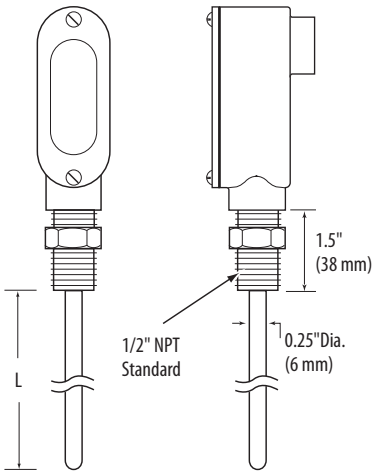
5 Year Warranty

Wiring	22 AWG; 2-wire: RTD Thermistor, 4-20mA; 3-wire: Voltage output models
Probe	Stainless Steel
Test Pressure	200 psi
Linitemp:	
Input Power	5 to 30VDC
Output	1µA/°C or 10mV/°C
Operating Temperature	-25° to 105°C (-13° to 221°F)
Resistive:	
RTD/Thermistor	See table, above
Accuracy:	
Calibration Error	1.5°C (2.7°F) typical; 2.5°C (4.5°F) max. at 25°C (77°F)*
Error over Temperature	1.8°C (3.24°F) typical; 3.0°C (5.4°F) max. over 0° to 70°C (32° to 158°F) range; 2.0°C (3.6°F) typical, 3.5°C (6.3°F) max. over -25° to 105°C (-13° to 221°F) range

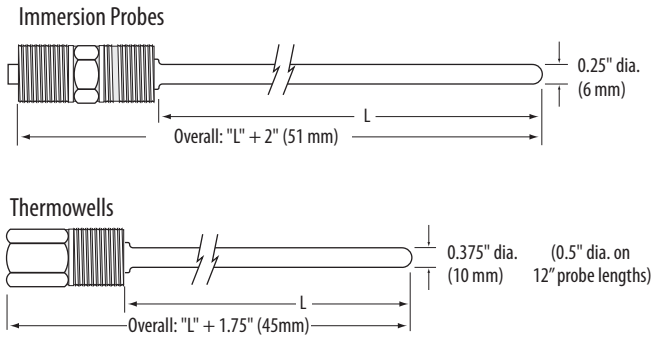
Room temperature error documented on each unit.

DIMENSIONAL DRAWINGS

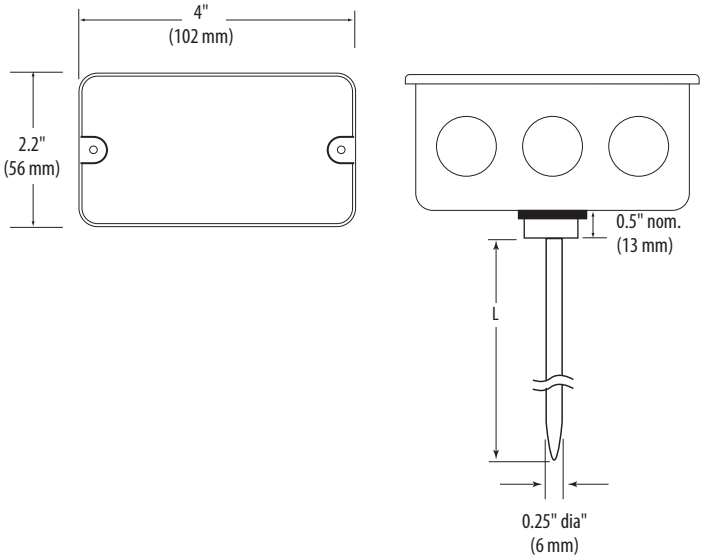
TIG Model



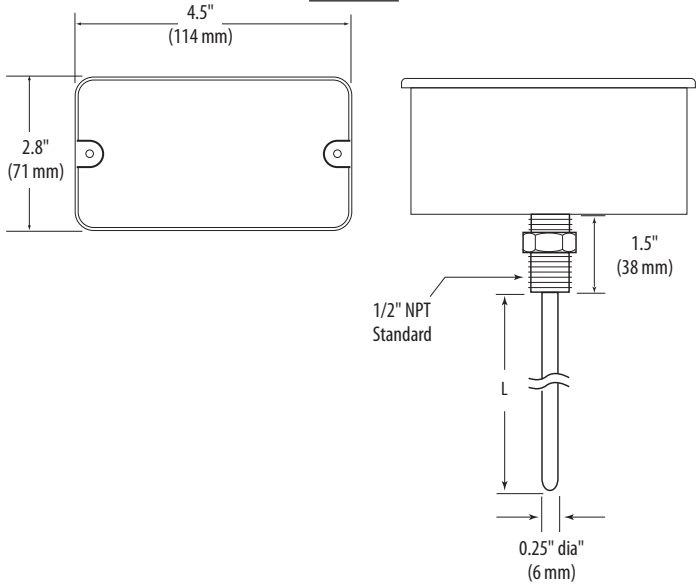
TIH Model



TID Model



TIW Model



ORDERING INFORMATION

	Enclosure	Immersion Probe Length "L"	Thermowell	Sensor Type	OPTIONS: Cal Certificate	OPTIONS: Threads
TI	☐	☐	☐	☐	☐	☐
	D = Duct **G** = Service Entry Body **H** = Threaded NPT Only **W** = Water resistant housing	**A** = 2 1/2" (64mm) **B** = 4" (102mm) **C** = 6" (152mm) **D** = 8" (203mm) **E** = 12" (305mm)	**0** = None **1** = Add Thermowell	**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 3A221, Thermistor **T** = 100k, Thermistor **U** = 20k "D", Thermistor **W** = 10k T2 high accuracy, Thermistor **Y** = 10k T3 high accuracy, Thermistor **Z** = 10k E1, Thermistor	**0** = None **1** = 1 point Cal validation **2** = 2 point Cal validation	**Blank** = NPT **A** = BSPT **B** = DIN 2999

NOTE:
For 4-20mA transmitter output, order any TI with the 100Ω platinum RTD and accessory AA10xx

Thermowell Sizing

Probe Length	Thermowell Length
A (2 1/2") (64mm)	1 1/2" (38mm)
B (4") (102mm)	3" (76mm)
C (6") (152mm)	5" (127mm)
D (8") (203mm)	7" (178mm)
E (12") (305mm)	11" (279mm)

Example:

TI	D	B	1	D	2	A

ACCESSORIES

Thermowells (AA22, AA24, AA25, AA33)

AA24

Badger Meter

Series 380 Impeller

380CS/HS

OVERVIEW

The Badger Meter Series 380 Btu Systems provide a low cost system for metering cold or hot systems. The 380CS/HS can accurately measure flow and temperature differential to compute energy. Utilizing either BACnet or Modbus RS-485 communications protocols or a scaled pulse output, the Btu Meter can interface with many existing control systems.

The rugged design incorporates an impeller flow sensor and two temperature probes. One temperature probe is conveniently mounted directly in the flow sensor tee. The second temperature probe is placed on either the supply or the return line depending on ease of installation for the application. These minimal connections help simplify installation and save time.

The main advantage of the Series 380 Btu meters is the cost savings over other systems offered on the market today. The integration of flow and temperature sensors provide a single solution for metering. With this system it will be possible to meter energy where it hasn't been cost effective before.

Commissioning of this meter can be completed in the field via a computer connection. Setup includes energy measurement units, measurement method, communication protocol, pulse output control, fluid density, and specific heat parameters.

RS-485 Configuration

All Series 380 Btu meters are equipped with BACnet and Modbus protocols as a standard feature. The protocol of choice can be selected and setup in the field at the users discretion. These common protocols allow for quick and easy commissioning while gaining valuable application data beyond energy total. Information such as Flow Rate, Flow Total, Energy Rate, Energy Total, Temp 1, Temp 2, and Delta T can all be transmitted on the RS-485 connection.

Scaled Pulse Output

If the RS-485 is not required for the application, a simple scaled pulse output is available. This output would represent energy total and can be set in various units of measure. This output is an open drain scaled pulse output that is compatible with a variety of PLCs, counters and also the Badger Meter 350 wireless system. This ensures the unit is easily compatible with most inputs.

MECHANICAL

Mass — Less than 13 lbs.

ELECTRICAL

Inputs

Power	12-35 VDC 12-28 VAC	
Communication	Modbus RTU BACnet MSTP	

Output

Scaled Pulse	Open drain 0.01 Hz min. to 100 Hz max.

MATERIALS

Housing	Polycarbonate
Flow Sensor	PEEK
Potting Material	Polyurethane
Tee Material	Brass

SENSOR BODY SIZES

Tee Sizes 3/4", 1", 1 1/4", 1 1/2", and 2"

ENVIRONMENTAL

Fluid Temp.	-4°F to 140°F (-20°C to 60°C) - chilled 40°F to 260°F (4°C to 125°C) - hot
Ambient Temp.	-4°F to 149°F (-20°C to 65°C)

ACCURACY

± 2% of flow rate within flow range
± 0.5% repeatability
RTD meets IEC751 Class B

FLOW RANGE

1 - 15ft./sec

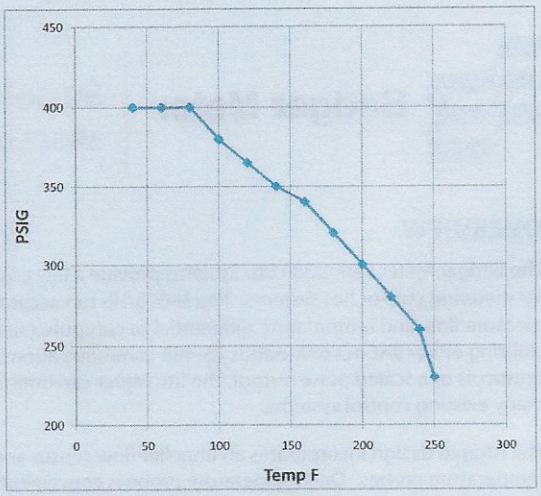
Diameter (Inches)	380 Btu Meter Flow Range (GPM)		
0.75	1.65	to	24.69
1	2.70	to	40.48
1.25	4.66	to	69.93
1.5	6.35	to	95.18
2	10.49	to	157.34

This chart is based on ASME/ANSI B36.10 Welded and Seamless Wrought Steel Pipe and ASME/ANSI B36.19 Stainless Steel Pipe

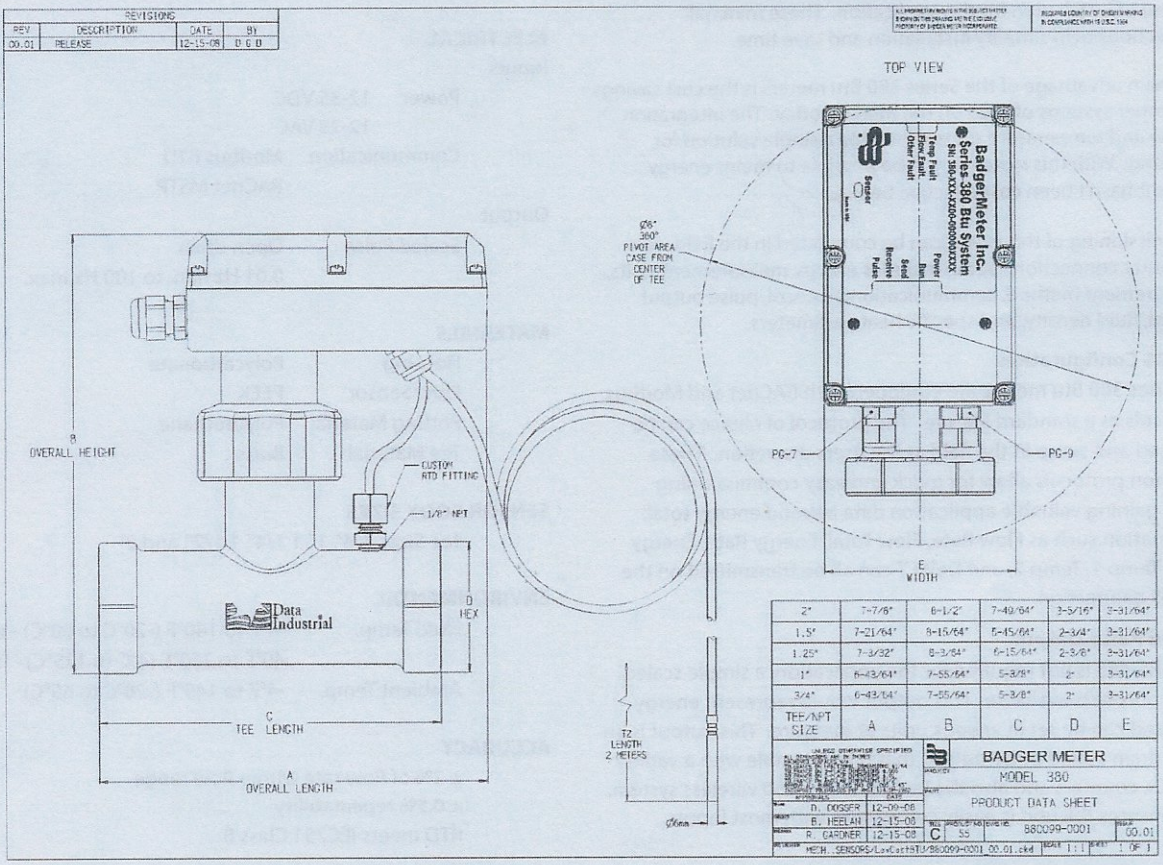
Technical Brief

Badger® Series 380 BTU System Ordering Matrix

	380	0	7	0	0	0	-	1	2	0	0
Type											
CS - Cold Service		0									
HS - Hot Service		1									
Size											
0.75"			07								
1"			10								
1.25"			12								
1.5"			15								
2"			20								
Electronic Housing											
Polycarbonate				0							
Output											
Scaled Pulse and RS-485 (Modbus and BACnet)					0						
Display											
N/A						0					
O-Ring											
EPDM (CS - Cold Service)								1			
Aflas® (HS - Hot Service)								2			
Shaft											
Tungsten Carbide [Standard]									2		
Impeller											
Stainless Steel										0	
Bearing											
Torlon® (CS - Cold Service)											0
Ketron® (HS - Hot Service)											2



*Max. Temp. 250°F 230 PSIG
Unit can be used to -20°F @ 400 PSIG



TEE/NPT SIZE	A	B	C	D	E
2"	7-7/8"	8-1/2"	7-49/64"	3-5/16"	3-31/64"
1.5"	7-21/64"	8-15/64"	5-45/64"	2-3/4"	3-31/64"
1.25"	7-3/32"	8-3/64"	6-15/64"	2-3/8"	3-31/64"
1"	6-43/64"	7-55/64"	5-3/8"	2"	3-31/64"
3/4"	6-43/64"	7-55/64"	5-3/8"	2"	3-31/64"

BADGER METER
MODEL 380
PRODUCT DATA SHEET
880099-0001
00.01

Data Industrial®

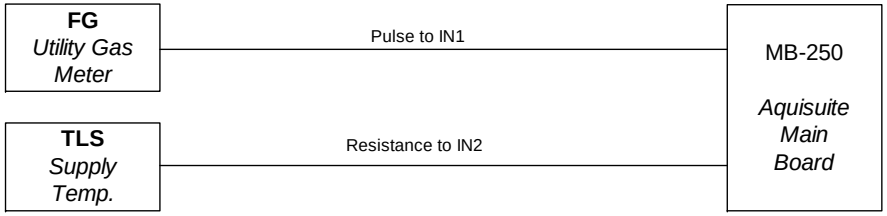
Please see our website at www.badgermeter.com for specific contacts.

Due to continuous research, product improvements and enhancements, Badger Meter reserves the right to change product or system specifications without notice, except to the extent an outstanding contractual obligation exists.

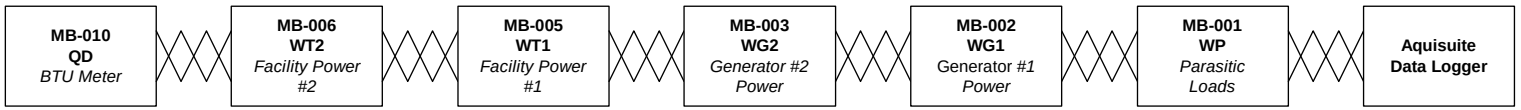
Badger Meter | P.O. Box 245036, Milwaukee, Wisconsin 53224-9536
800-876-3837 | infocentral@badgermeter.com | www.badgermeter.com

APPENDIX B – Data Logger Wiring Diagrams

Main Board Wiring



Modbus 485 Wiring



Aquisuite IP Info

IP Address: 207.38.241.83

Addendum – Chelsea Mercantile

252 7th Avenue
New York, New York

Site Contact
Sean Pringle
Aegis Energy Services, Inc.
413-536-1156
SPringle@aegisenergyservices.com

Ask for access to boiler room, located in sub basement, at the front desk.

- CDH was on site June 25, 2013 to install and configure the Obvius datalogger, terminate power meter wiring, and terminate BTU meter wiring.
- CDH was on site October 2, 2013 to terminate gas meter wiring and to configure the total facility power meters.
- CDH was on site October 30, 2013 to verify metering.

IP Info

External IP: 206.71.237.148:4081

Summary

Aegis purchased and installed the metering and ran wires while CDH energy purchased and installed the data logger. CDH also terminated meter wiring.

Monitored Data Points

Data Point	Description	Units	Sensor	Output	Notes
WT1	Total Facility Power - Service #1	kW/kWh	Veris E50 C2 with MV Rope CTs	Modbus	Provided and Installed by Ageis
WT2	Total Facility Power - Service #2	kW/kWh	Veris E50 C2 with MV Rope CTs	Modbus	Provided and Installed by Ageis
WG1	Generator Power - Unit #1	kW/kWh	Veris H8035-0300-2	Modbus	Provided and Installed by Ageis
WG2	Generator Power - Unit #2	kW/kWh	Veris H8035-0300-2	Modbus	Provided and Installed by Ageis
WG	Net Cogen Output (Unit #1 & #2)	kW/kWh	-	Calculated	Provided and Installed by Ageis
WPAR	Parasitic Power	kW/kWh	Veris H8035-0100-2	Modbus	Provided and Installed by Ageis
FG	Generator Gas Use	CF	Utility pulse output from billing meter	Pulse	Provided and Installed by Ageis
QD	Heat Transfer Dump Radiator	Mbtu	Badger 380 BTU meter	Modbus	Provided and Installed by Ageis
TLR1	Supply Temperature Dump Radiator (Upstream of CT)	deg F		Modbus	Provided and Installed by Ageis
TLR2	Return Temperature Dump Radiator (Downstream of Rad)	deg F		Modbus	Provided and Installed by Ageis
FL	Flowrate CHP Loop	GPM		Modbus	Provided and Installed by Ageis
TLS	Supply Temperature From CHP Units	deg F	Veris TID B1 D0 10k Type II thermisor	OHMs	Provided and Installed by Ageis
WG	Net Generator Power	kW/kWh	-	Calculated	Provided and Installed by Ageis
QU	Heat Transfer Useful Loads	Mbtu	-	Calculated	Provided and Installed by Ageis
QDC	Heat Transfer Dump Radiator - Calculated	Mbtu	-	Calculated	Provided and Installed by Ageis

Procedure

- Hot water loop flow (FL) was verified using a Portaflow ultrasonic flowmeter, mounted on a straight section of the return piping.

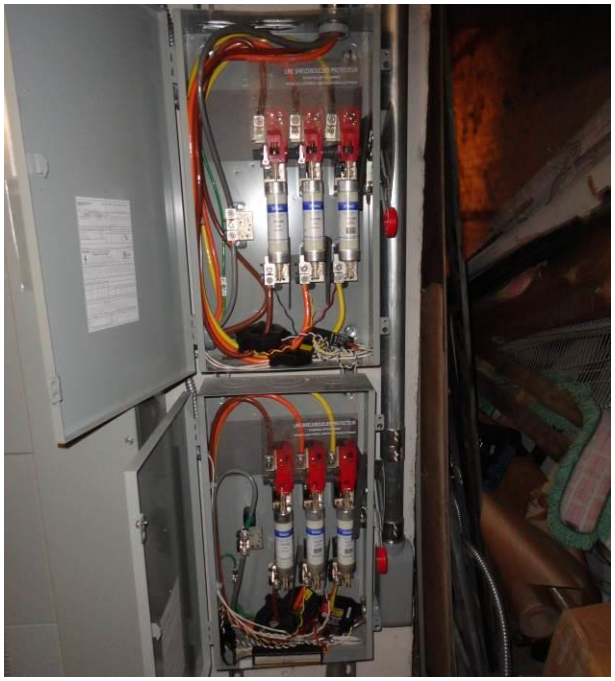
Verification – October 30, 2013

Recovered Heat Loop Flow:

Portaflow (gpm)	Obvius (gpm)
54.4	55.9

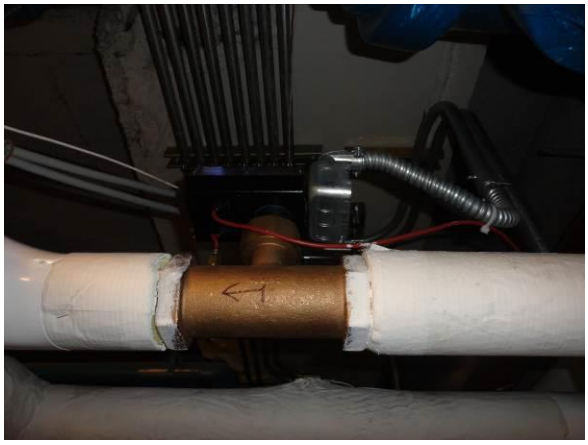
Site Photos

One of two (2) installed cogen units.



Power meters for generator #1 and generator #2 (WG1, WG2)

Total facility power meters (WT1, WT2)



Recovered heat loop BTU meter.

CDH datalogger and enclosure.

Utility provided gas meter and demarcation point.