MEASUREMENT AND VERIFICATION (M&V) PLAN
FOR
WAGNER FARMS ANAEROBIC DIGESTER GAS (ADG) SYSTEM
ADG 112-N

July 13, 2009

Submitted to:

New York State Energy Research and Development Authority
17 Columbia Circle
Albany, NY 12203-6399

Submitted by:

Wagner Farms
79 Garfield Road
Poestenkill, NY 14530

PROJECT PARTICIPANTS

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NYSERDA CHP Website Contractor (CHP Website Contractor)	CDH Energy Corp. Contact: Hugh Henderson. P.E. PO Box 641 Cazenovia, NY 13035 (315) 655-1063 Email: hugh@cdhenergy.com

Introduction

This plan describes the approach to monitor the performance of the anaerobic digester gas (ADG) system that will be installed on-site at Wagner Farms in Poestenkill, NY to produce biogas and electricity. Biogas will be used to drive an engine-generator to produce power that will be consumed on site. A monitoring system will be installed to measure and collect the data necessary to quantify the electric power produced by the engine-generator. The data will serve as the basis for payment of three (3) years of performance incentive payments, which Wagner Farms has applied for under a Standard Performance Contract (SPC) with NYSERDA based on a total contracted capacity of 100 kW.

ADG System Description

The digester system at the farm was designed by Genesys Biogas Inc. (now CH-Four Biogas Inc.). With the addition of the new engine-generator, the site will operate one 100 kW synchronous engine-generator system with piping and controls that are installed in a new generation and control building centrally located to the digester, electrical distribution building and main dairy barns. All the electrical loads at the farm have been consolidated into a new 3-phase electrical service in order to accommodate the generator system. The electrical system includes controls to synchronize the generator to the grid as well as a protective relay and controls to automatically isolate the farm from the utility grid in the event of a utility power outage.

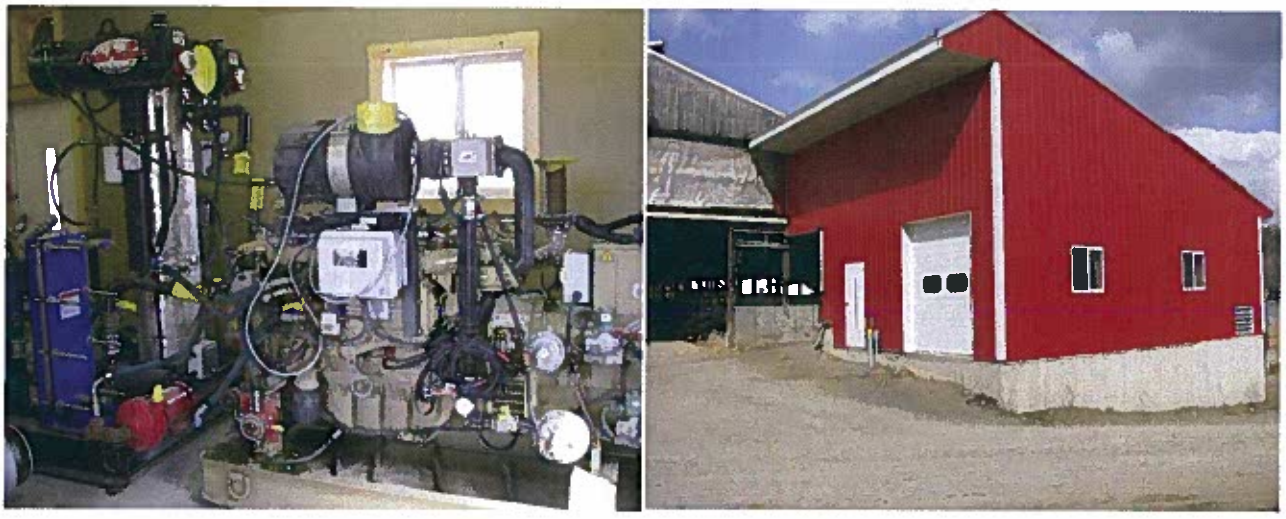

Figure 1. Photos of System Components: Partially Installed Engine Skid; Generation and Control Building.

Table 1. Biogas System at Wagner Farms

Digester	Anaerobic Digester Mixed Flow, Soft Cover, heated
Feedstock	Dairy Manure, 450 equiv cows
Engine-Generator	MAN / E 0836 LE 202 100 kW output on biogas 480 VAC, 3 phase
Biogas Conditioning	Gen Tech and Carbon Filter Receiving Skid and Genesys De-watering system
Engine Backup/startup Fuel	Propane
Heat Recovery Use	Digester heating
Additional Heat Recovery	Site Heating

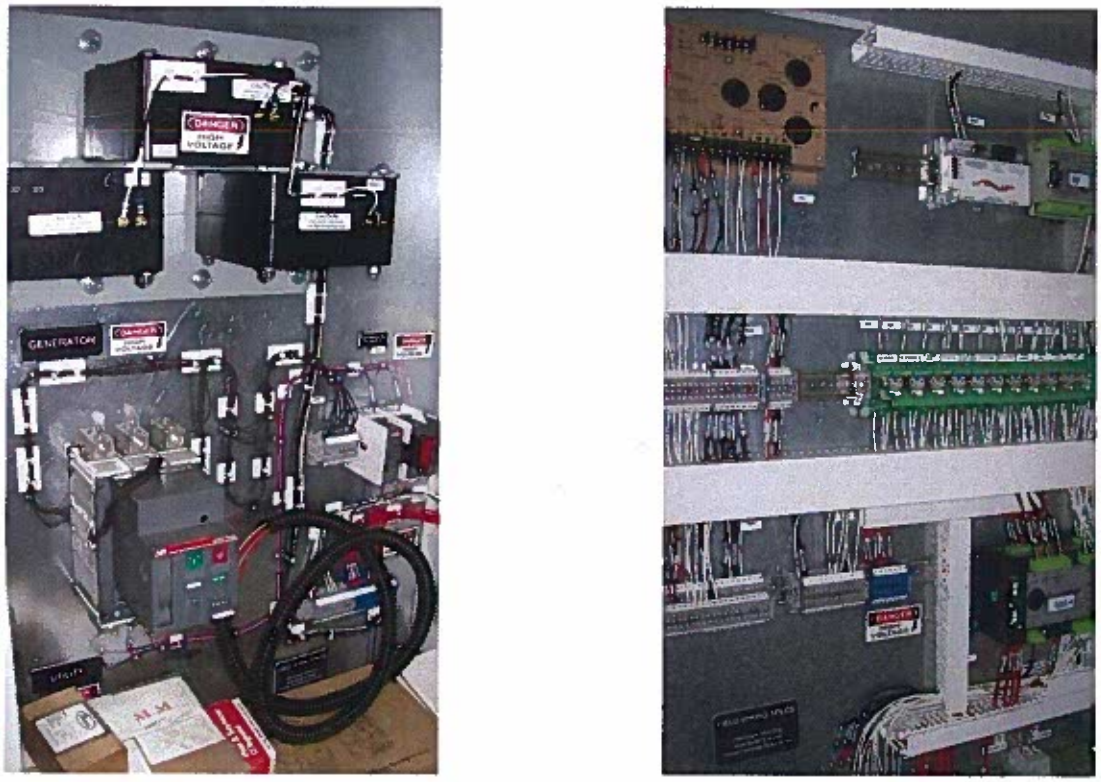

Figure 2. Photos of Electrical Panels

Figure 3 schematically shows the biogas system and engine. Biogas from the digester is either used in the engine or stored within the soft cover (membrane). The space above the liquid level in the digester provides sufficient capacity to store approximately 14,000 cu.ft. or 3 hours of fuel

reserve at relief pressure. Biogas pressure within the membrane is maintained by a pressure sensor connected to the CHP unit. The sensor throttles the engine to match biogas consumption to production and to prevent vacuum within the digester. Should the CHP unit shut down for any reason, the biogas production systems are also shut down to reduce biogas production, minimize biogas build-up, and extend the storage capabilities of the digester and flexible membrane. Biogas for the engine is de-watered in a passive cooling field and pressurized by equipment located on the biogas conditioning skid.

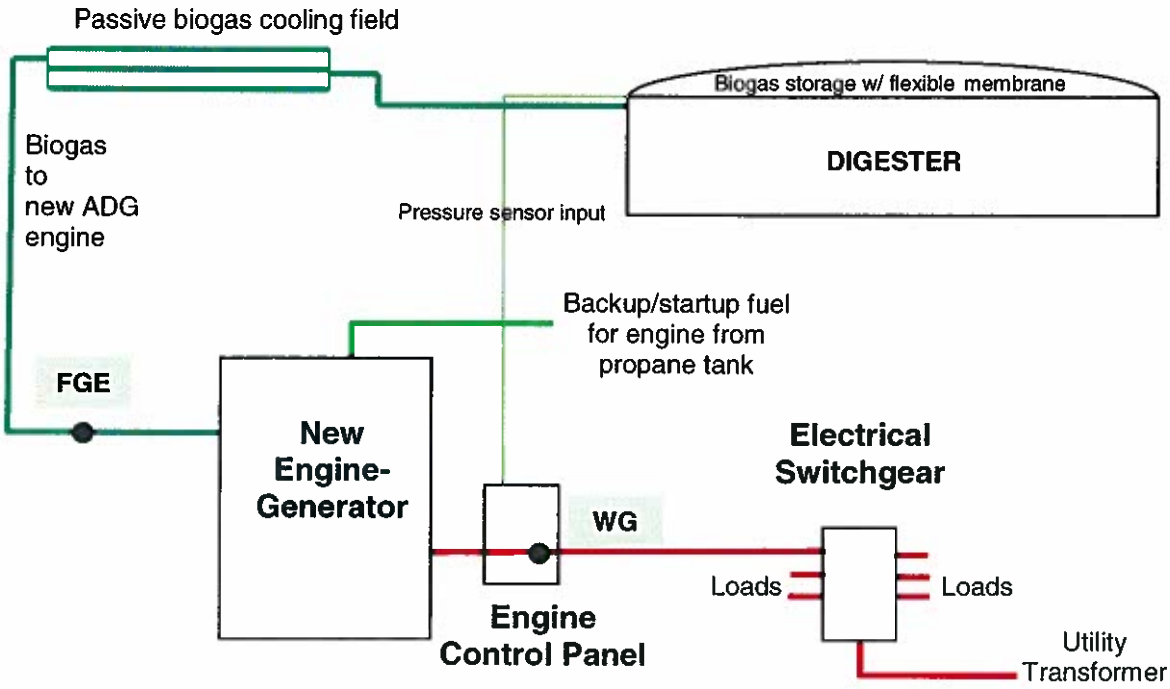

Figure 3. Schematic Biogas System

Figure 4 shows an electric schematic for the system.

Monitoring System Equipment, Installation, Operation, and Maintenance

Figure 3 also shows the locations of the two data monitoring points where system performance will be measured, i.e. a meter to measure fuel gas input to the engine generator ("FGE") and a meter to measure the kilowatts generated ("WG"). In Table 2, points following the aforementioned are monitoring points connected to an independent Programmable Logic Controller (PLC) which monitors and adjusts operating parameters of the digester and methane detection system for purposes of reducing manual intervention, optimizing biogas potential and providing operator safety. Amperage monitoring of larger motor loads provides an opportunity to

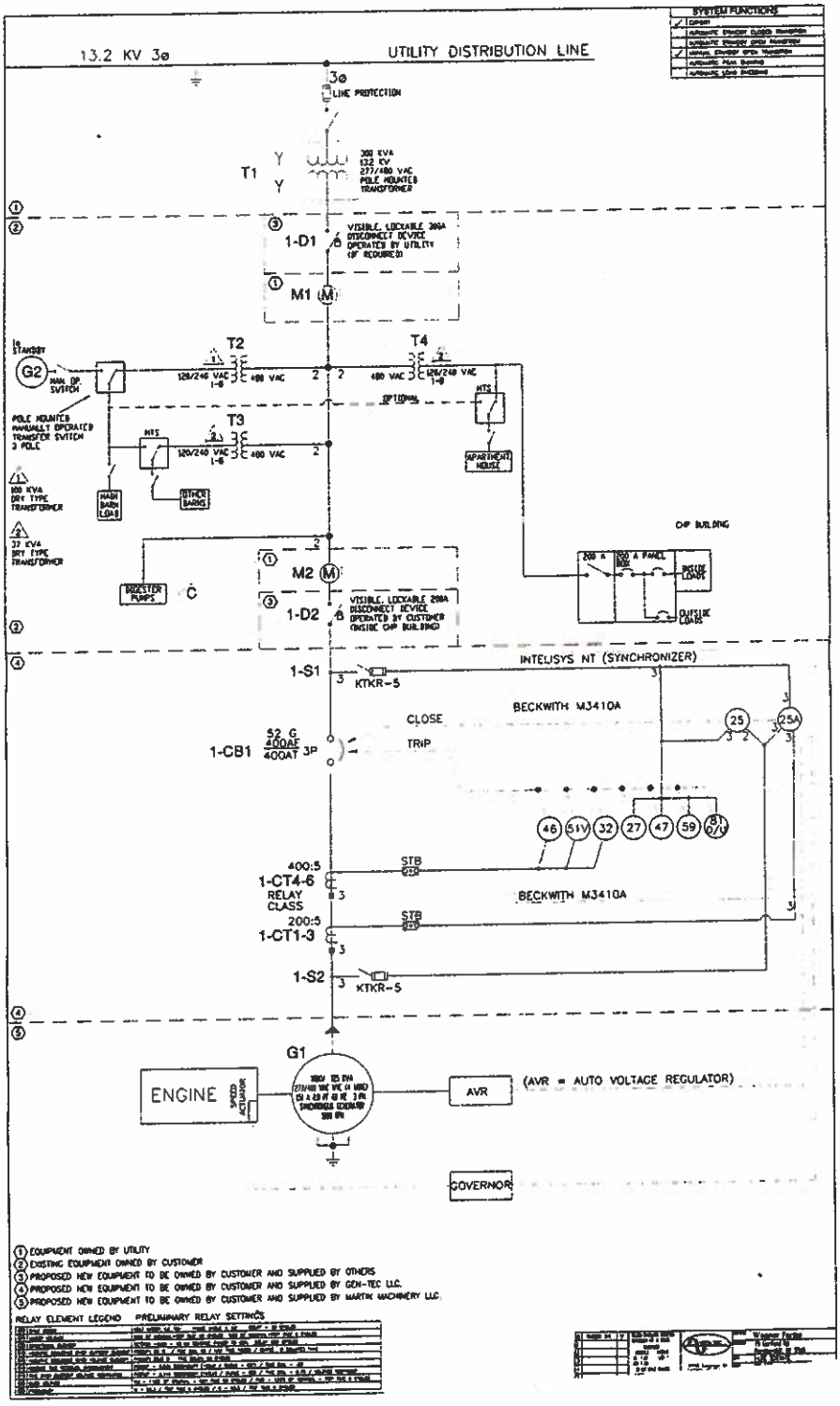

Figure 4. Electrical One-line Schematic

isolate and understand parasitic electrical loads which otherwise reduce overall biogas-to-electric system efficiency. Information on these data points is shown in Table 2.

Table 2. Monitored Points for ADG System

Point Type	Point Name	Description	Instrument	Engineering Units	Expected Range
Pulse	WG	Engine-Generator Power	Continental Control Systems Wattnode Model WNA-3Y-480-P w/ (3) CTs, 400 amp Dual Pulse Output (DPO) option with LCD display	kWh/interval	0-110 kW (0-27.5 kWh/int)
Pulse	FGE	Engine Biogas Flow	Sierra Instruments Model 640S-NAA-L06-M1-EN2-P2-V4-DD-4-MB-PULSE	ft^3/interval	0 – 25 ft^3/min (0-375 cf/int)
Digital Inputs	CH4 Alarm	Monitors gas leak	RKI Beacon 11061-0190RK-CH4	ppm	0-100% LEL
Analog input	AD Mixer	Mixer amps	Siemens	Amps	0-100 A
Analog input	AD Temp	Liquid temperature	Siemens	°F	130°F
Analog input	AD Pressure	Biogas production pressure	Siemens	In.W.C	0 – 14" w.c.
Analog input	Pit Temp.	Reception pit temperature	Siemens	°F	40-104°F
Analog input	Pump Pump	Pit pump amps	Siemens	Amps	0-50A
Analog Input	Pit Level	Reception Pit level	Migatron RPS -3000PVC	Inches	24-110"
Analog input	HW temp	Hot water supply temperature	Siemens	°F	140-180°F
Analog Input	Boost Amps	Biogas pressure booster fan	Siemens	Amps	0-20A

The electrical output of the new engine will be measured with a pulse-output power transducer (**WG**). This power transducer will include an LCD display and will be installed next to the electrical panel for the new engine by the electrical contractor. The transducer will be installed according to manufacturer requirements. The meter will have its own circuit breaker or inline fuse to provide over-current protection. Cut sheets of the power meter are attached in the Appendix.

The biogas flow to the engine will be measured by a Sierra Instruments gas meter (**FGE**) that provides pulse output proportional to the volume flow. The meter's range will be calibrated based on the actual biogas production when the digester is started up. The mass flow meter will be installed in the biogas pipe feeding the new engine in accordance with manufacturer requirements. Cut sheets of the flow meter are attached in the Appendix. The pipe will have a parallel bypass line with appropriate valves allowing for continuing use of the engine should the

meter need to be removed for cleaning or repair. A log of maintenance activities for the meter will be maintained at the site.

The lower heating value for the biogas is estimated to be 550 Btu/ft^3, based on past measurements of similar biogas. This value will be confirmed or adjusted based on weekly measurements of carbon dioxide using a Bacharach Fyrite Gas Analyzer for CO_2 range 0-60%. The biogas sample will be collected from the pipe that feeds the generator, in the Generation and Control Building. The farm manager, Peter Wagner, or delegate, will perform the CO_2 tests and log the results in the project log.

The backup/startup fuel flow (propane) will not be continuously metered at this site. However, the farm will provide the propane delivery logs and summarize them in a spreadsheet table for the Annual M&V Report in order to account for periods when the backup/startup fuel is used. The propane tank does not serve any equipment except the new engine-generator.

CDH Energy will install an Obvius AcquiLite datalogger to compile and log the data from the two monitoring points listed in Table 2. Cut sheets of the datalogger are attached in the Appendix. The datalogger will be programmed to record the totalized data for each monitoring point for each 15-minute interval. A record of all multipliers and datalogger settings will be maintained. The datalogger will be located in the electrical room next to the control panel, and will be connected to an uninterruptible power supply (UPS) to ensure the datalogger retains its settings and data in the event of a power outage. The UPS is capable of powering the data logger for at least one day. Wagner Farms will provide a dedicated phone line (or an Ethernet connection with fixed IP address) that will be used to communicate with the datalogger. The NYSERDA CHP Website Contractor (CDH Energy Corp.) will communicate with the datalogger nightly to extract monitored data from the datalogger and transfer the data to the NYSERDA CHP Website. If communications are lost, the Obvius datalogger is capable of holding at least 15 days of 15 minute interval data.

Management of Monitoring System Data

The farm will perform the following quality assurance and quality control measures to ensure the data produced from the monitoring system accurately describes system performance.

On a daily basis, the Farm Manager, or delegate, will perform inspections of the digester and engine-generator equipment and record findings into the project log.

On a weekly basis, the Farm Manager, or delegate, will perform inspections of the M&V meter installations and complete the routine maintenance on the meters, noting any abnormalities or unexpected readings. The farm will also maintain a weekly log of the cumulative power generation (kWh) from, and gas flow (cf or ft^3) to, the new engine in the event that data transfer to the NYSERDA CHP Website fails or other anomalies occur.

On a weekly basis, the farm staff will review the data stored in the NYSERDA CHP Website (chp.nyserda.org) to ensure it is consistent with their observed performance of the ADG system

and logged readings. The farm will review the data using the reporting features at the web site, including:

- Monitored Data – Plots and Graphs and
- RPS: Customer-Sited Tier Anaerobic Digester Gas-to-Electricity Program NYSERDA Incentive Program Reports

In addition, the farm staff will also setup and use the email reports that are available to help the track system performance, including:

- a periodic email report summarizing system performance and the estimated incentive,
- an email report sent out if data are not received at web site or do not pass the quality checks

The website will automatically take the data collected from the datalogger and evaluate the quality of the data for each interval using range and relational checks. The expected ranges for the sensors, which will be used for the range checks, are listed in Table 2. The relational check will compare the kWh production data and gas production data for each interval to ensure both meters always provide non-zero readings at the same time (e.g., a meter has failed). Only data that pass the range and relational quality checks are used in the incentive reports listed above. However, all hourly data are available from the NYSERDA CHP Website using the "Download (CSV file)" reporting option.

In the event of a communications or meter failure, the farm will work with CDH to resolve the issue in a few days.

If unanticipated loss of data occurs when the engine-generator continues to produce electricity, the farm will follow the procedures outlined in Exhibit D of their contract, i.e. using data from similar periods – either just before or after the outage – to replace the lost data. The farm understands that they can use this approach for up to two 36 hour periods within each 12-month performance reporting period. If more than two such data outages occur, the farm will provide information from other acceptable data sources (e.g., weekly recorded logs) to definitively determine the amount of power that was produced from biogas during the period in question.

Annual M&V Reports

The farm will prepare the Annual M&V Report, which will include a table showing the monthly kWh production biogas sent to the engine, and other data listed in Table 3. The farm may use the NYSERDA Incentive Program Reports found on the CHP website. Alternatively, they may provide their own summary of the data (using hourly CSV data downloaded from the Website) along with a narrative justifying why their data and calculations are more appropriate. The methods for calculating these values are provided below.

Table 3. Summary of Data for Annual M&V Report

Month Beginning Date	Month Ending Date	Electricity Production, $kWh_{generator}$	Biogas to Engine, CF (ft^3)	Propane Use, Gallons	Biogas LHV, (BTU/ft^3)	Biogas Energy Content, Q_{biogas} (BTU)	Propane Energy Content, $Q_{propane}$ (BTU)	Adjusted Electricity Production, $kWh_{adjusted}$

The farm will calculate monthly values for lower heating value of the biogas, and total energy content of the biogas as follows.

Monthly Biogas Lower Heating Value

The farm will use the readings of CO_2 concentration in the biogas gathered weekly to estimate the average monthly Biogas Lower Heating Value using the following equation:

$$LHV_{biogas} = LHV_{methane} \cdot (1 - F_{CO2})$$

where,

$LHV_{methane}$: lower heating value of methane (911 Btu/ft^3 at standard conditions, 60 °F and 1 atm)

F_{CO2}: fraction of biogas that is CO_2 (average of readings for each month)

Monthly Biogas Energy Content

The farm will calculate the average monthly Biogas Energy Content using the following equation:

$$Q_{biogas} = CF \cdot LHV_{biogas}$$

where,

CF: volume (ft^3) of biogas in month

Monthly Propane Energy Content

The farm will calculate the average monthly Propane Energy Content using the following equation:

$$Q_{propane} = Gallons \cdot \left[83{,}500 \frac{Btu_{LHV}}{gal} \right]$$

where,

Gallons: propane consumption in the period (gallons)

Monthly Adjusted Electricity Production

The farm will calculate the monthly adjusted electricity production using the following equation:

$$kWh_{adjusted} = kWh_{generator} \left[\frac{Q_{biogas}}{Q_{biogas} + Q_{propane}} \right]$$

where,

$kWh_{generator}$: actual electricity production

Appendix

Cut sheets for:

WattNode Meter Model WNA-3Y-480-P

Sierra Instruments Model 640S

AquiLite Data Acquisition Server – A7801-1

Continental Control Systems LLC

Pulse Output WattNode®

Home
Products >
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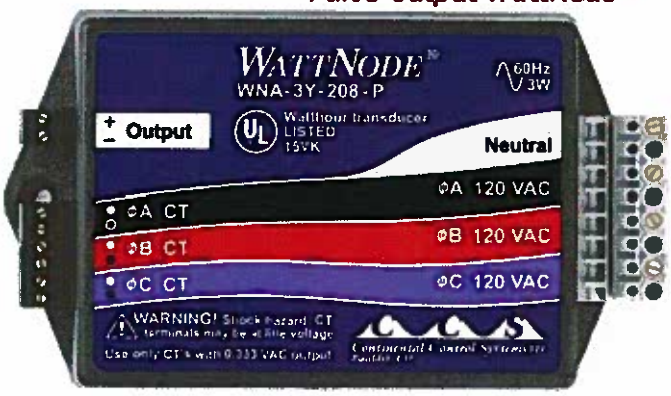
Compact, Low-Cost kWh Transducer/Submeter True RMS



Call Us Toll Free
888-928-8663
888-WATTNOD

Voice: (303)444-7422
FAX: (303)444-2903

Email:
sales@ccontrolsys.com

Continental Control Systems
3131 Indian Rd.,
Suite A
Boulder, CO 80301
USA

The Pulse Output WattNode® is a true RMS AC watt-hour transducer with pulse output (solid state relay closure) proportional to kWh consumed. The WattNode provides accurate measurement at low cost to meet your needs for sub-metering, energy management, and performance contracting applications.

Easy installation saves you time and money. The WattNode is small enough to fit entirely within a standard electrical panel and the screw terminals unplug for easy wiring.

The complete Pulse Output family measures 1, 2, or 3 phases in 2, 3, or 4 wire configurations. With voltage ratings from 120 to 600 VAC and current transformer (CT) ratings from 5 to 3000 amps, there is a WattNode combination to meet your AC power measurement requirements.

Accuracy of the WattNode is 0.5% of reading over a wide range of power factor and harmonic content. The WattNode measures true RMS power even with leading or lagging power factor and chopped or distorted waveforms. This makes the WattNode ideas for monitoring motors and pumps controlled by variable speed drives.

To assure reliability and accuracy, each WattNode is tested and calibrated by a custom, automated production system. A key part of the production system is a NIST traceable, precision voltage source that establishes the high accuracy associated with the WattNode. To assure the initial calibration accuracy is maintained, the WattNode has been designed with fixed, precision resistors, not potentiometers, in its measurement circuit.

Our safe CTs, with integral burden resistors, produce a voltage proportional to the load current. At rated current the voltage is only 0.333 VAC. Split core CTs quickly install on existing wiring and solid core CTs can prevent tampering. Bus bar CTs are available in a variety of standard sizes, plus custom designs up to 10" x 10" (254mm x 254mm) and 4000A.

The optional LCD module remotely displays energy in WH, kWh, or MWH; or power in W or kW. To protect the kWh total you can disable the front panel reset button and use a wired remote reset. The eight digit panel mount display runs for four years on a single replaceable battery.

- **Pulse output** - Compatible with energy management systems and data loggers.
- **Small size** - Can be installed in existing service panels or junction boxes.
- **Uses safe CTs** - Integral burden resistor limits the output to low voltage.
- **Line powered** - No external supply required.
- **Detachable terminal blocks** - Easy to install and remove.

- **UL Listed** - Designed and tested for safety.

SPECIFICATIONS

Measurement Configurations

- Single phase: 2 or 3 wire
- Three phase: 4 wire
- Three phase: 3 wire

Electrical

- Line powered
- FCC Class A
- Operating Voltage Range: ±20% of nominal
- Power Line Frequency: 50 or 60 Hz
- CT Input: 0 - 0.5 VAC operating, 3 VAC maximum

Pulse Output

- Square-Wave output: 50% duty cycle
- Optoisolator (phototransistor) output handles up to 50 mA at 3-35 VDC
- Fully isolated to withstand 2500 volts

Frequencies at Full Scale Power

WattNode Model	Frequency
WNA-1P-240-P	2.667 Hz
WNA-3Y-xxx-P	4.000 Hz
WNA-3D-xxx-P	2.667 Hz

Higher output frequencies are available. Call for more information.

TTL Output Option

- 0 - 5 volt TTL square-wave output - short circuit protected
- Fully isolated to withstand 1500 volts
- Specify with '-TTL' at end of model number

Accuracy

- 0.45% of reading + 0.05% of full scale through 25th harmonic

Environmental

- Operating Temperature: -30° to 60°C
- Humidity: Up to 90% RH (non-condensing)

Mechanical Click on the image for a larger view.

- Enclosure: High impact, UL rated, ABS plastic
- Size: 143mm x 85mm x 32mm (5.63" x 3.34" x 1.25")
- Connectors: Euroblock style detachable screw terminals
  - Green: 12 - 22 AWG, 600 V
  - Black: 16 - 26 AWG, 300 V

Optional LCD Display

- Display: Eight digits, each 0.43" high
- Units: Power in W or kW, Energy in WH, kWh or MWH
- Reset: Remote wire and configurable front panel button
- Enclosure: Panel mount box, 75mm x 40mm x 38.5mm (2.95" x 1.57" x 1.52")

- Battery: Lithium 2/3 A, replace every four years
- Backlit versions available
- See our LCD Display Page.

Models and Pricing

Price List

List prices for 1 piece quantities. Call for pricing on larger quantities. Effective January 1, 2009.

Model	VAC Phase to Neutral	VAC Phase to Phase	Phases	Wires	Price
WNA-1P-240-P	120	240	1	2 or 3	$170
WNA-3Y-208-P	120	208-240	3	4	$195
WNA-3Y-400-P	230	400	3	4	$195
WNA-3Y-480-P	277	480	3	4	$195
WNA-3Y-600-P	347	600	3	4	$210
WNA-3D-240-P	N/A	208-240	3	3	$195
WNA-3D-480-P	N/A	480	3	3	$210

The delta models, WNA-3D-xxx-P, are used only when neutral is not present.

Datasheet, Manuals and Application Notes

- Download a datasheet (PDF)
- Download or view the Manual: PulseWnManual.pdf
- See a list of Application Notes
- View scale factor tables Pulses per kilowatt-hour and Watt-hours per pulse.

Smart Insertion Thermal Gas Mass Flow Meter

Steel-Mass™ Model 640S

Features

- **Direct mass flow monitoring eliminates need for seperate temperature and pressure inputs**
- **Accuracy +/- 1% of reading plus 0.5% of full scale**
- **Patented Dry-sense™ technology eliminates sensor drift**
- **State-of-the-art calibration facility insures a highly accurate calibration that matches the application**
- **Field validation of meter electronics and sensor resistance verifies flow meter performance**
- **One-second response to changes in flow rate**
- **FM, CSA, PED and ATEX certified for hazardous areas**
- **CE approved**
- **high temperature option to 750F (400C) available**
- **Multipoint options available**
- **Integrated purge option available**
- **Low and high pressure hot taps available**
- **Optional MODBUS, Foundation Field BUS and Profibus PA available**

SIERRA® INSTRUMENTS
THE MASS FLOW COMPANY

ISO REGISTERED 9001

For information online...
www.sierrainstruments.com

Description

Sierra Instruments' Steel-Mass™ Model 640S smart insertion mass flow meter is designed for he toughest industrial gas flow measurement applications.

The versatile microprocessor-based transmitter integrates the functions of flow measurement, flow-range adjustment, meter validation and diagnostics, in either a probe-mounted or remote housing. Mass flow rate and totalized flow, as well as other configuration variables, are displayed on the meter's optional 2 x 12 LCD display. The programmable transmitter is easily configured via an RS-232 communication port and Sierra's Smart Interface™ software, or via the display and magnetic switches on the instrument panel.

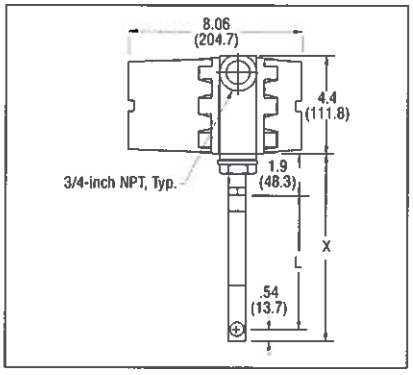
Sierra's State-of-the-art calibration facility insures that the calibration will match the application, and our patented Dry-sense™ thermal sensor insures the Model 640S will hold this calibration over time.

Sierra's Smart Interface software guides you through a procedure to fully validate instrument performance, thus field-verifying meter functionality.

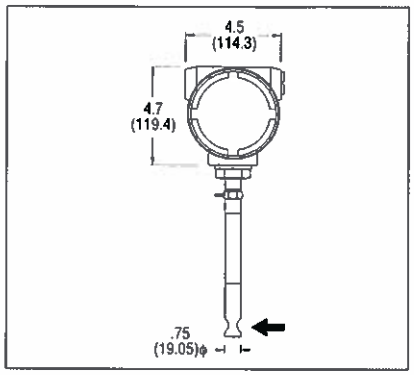
The meter is available with a variety of input power, output signal, mounting and packaging options.

Hazardous-Area Location Enclosure Dimensional Specifications

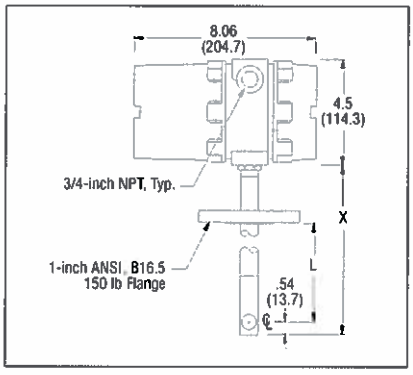
Compression Fitting–Side View (E2)



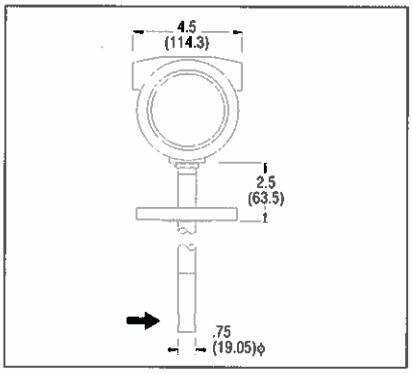
Compression Fitting–Front View (E2)



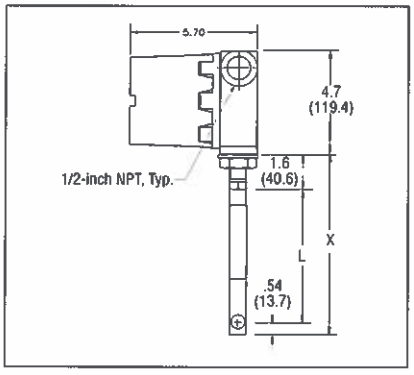
Flange Mounting–Side View (E2)



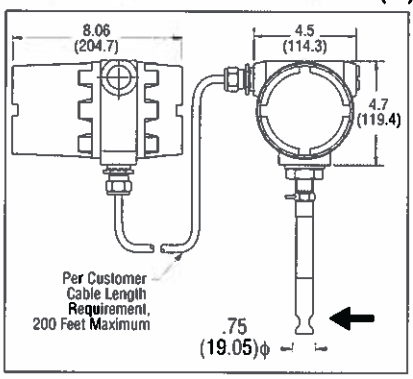
Flange Mounting–Front View (E2)



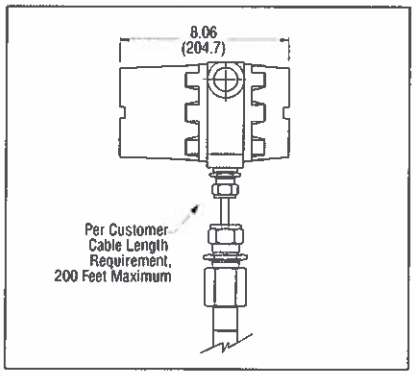
Remote Mount Junction Box–Side View (E4)



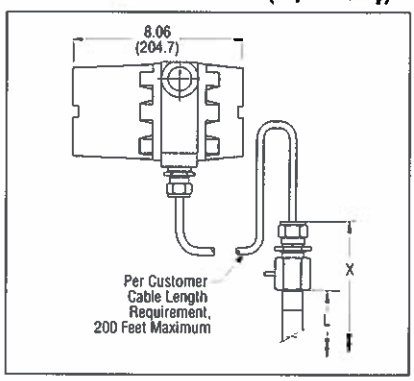
Remote Mount Junction Box–Front View (E4)



Remote Mount–Side View (E3, EEx only)



Remote Mount – Front View (E3, EEx only)



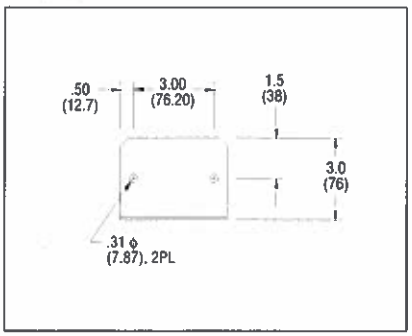
Tables

Length Chart (Compressions Fittings)		
Code	**L**	**X**
L06	6.0 (152.4)	7.5 (190.5)
L09	9.0 (228.6)	10.5 (266.7)
L13	13.0 (330.2)	14.5 (368.3)
L18	18.0 (457.2)	19.5 (495.3)
L24	24.0 (609.6)	25.5 (647.7)
L36	36.0 (914.4)	37.5 (952.5)

Length Chart (Flange Mounting)		
Code	**L**	**X**
L06	6.0 (152.4)	9.0 (228.6)
L09	9.0 (228.6)	12.0 (304.8)
L13	13.0 (330.2)	16.0 (406.4)
L18	18.0 (457.2)	21.0 (533.4)
L24	24.0 (609.6)	27.0 (685.8)
L36	36.0 (914.4)	39.0 (990.6)

Length Chart (Remote Mount Junction Box)		
Code	**L**	**X**
L06	6.0 (152.4)	7.5 (190.5)
L09	9.0 (228.6)	10.5 (266.7)
L13	13.0 (330.2)	14.5 (368.3)
L18	18.0 (457.2)	19.5 (495.3)
L24	24.0 (609.6)	25.5 (647.7)
L36	36.0 (914.4)	37.5 (952.5)

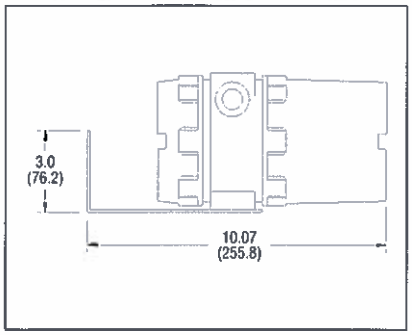
Mounting Holes for Remote Bracket



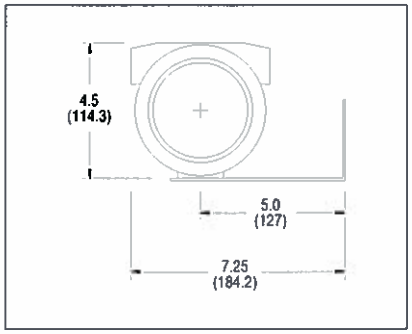
All dimensions are inches. Millimeters are in parentheses. All drawings have a +/-.25-inch (6.4 mm) tolerance. Certified drawings are available on request.

Hazardous-Area Location Enclosure Dimensional Specifications

Remote Rear Bracket Mounted Electronics



Remote Side Bracket Mounted Electronics

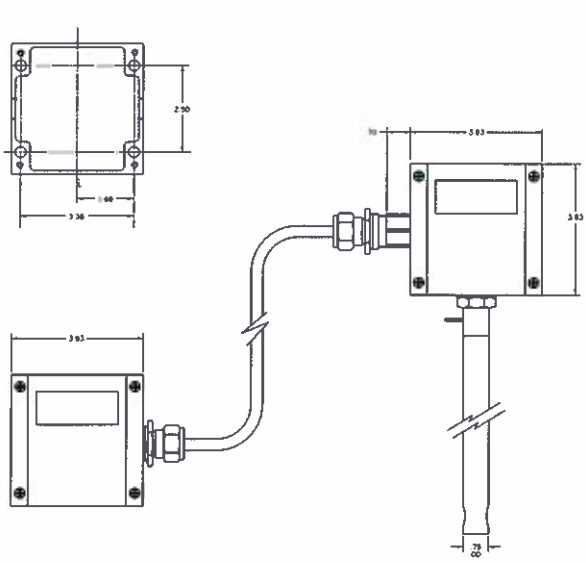


Tables

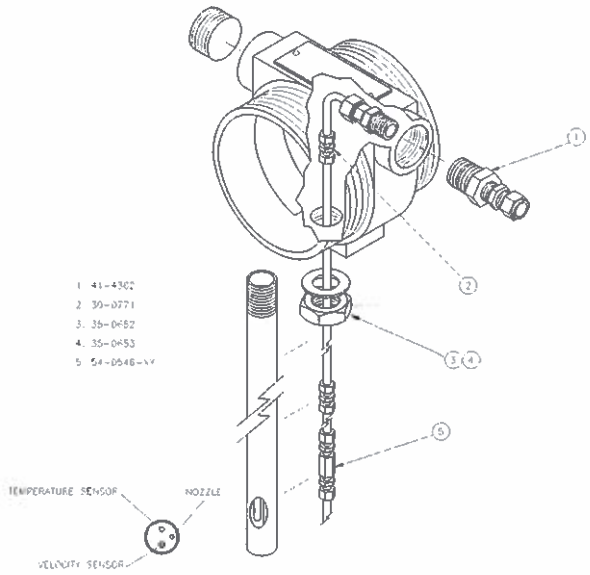
Length Chart	(NEMA 4X)	
Code	L	X
L06	6.0 (152.4)	7.25 (184.1)
L09	9.0 (228.6)	10.25 (260.3)
L13	13.0 (330.2)	14.25 (361.9)
L18	18.0 (457.2)	19.25 (488.9)
L24	24.0 (609.6)	25.25 (641.3)
L36	36.0 (980.4)	37.25 (946.1)

Dimensional Specifications

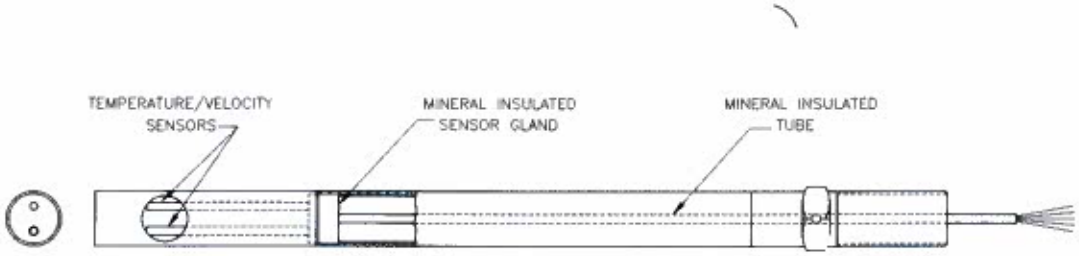
NEMA 4X Dimensional Specifications



Purge Option



High Temperature Option



All dimensions are inches. Millimeters are in parentheses. All drawings have a +/-.25-inch (6.4 mm) tolerance. Certified drawings are available on request.

Low Pressure Hot Tap to 150 psig (10 barg)

Side View

VARIABLES

L = Nominal Probe Length

D = Duct O.D.

C = Duct I.D.

T = Height of "Threadolet" or Customer Provided Weldolet

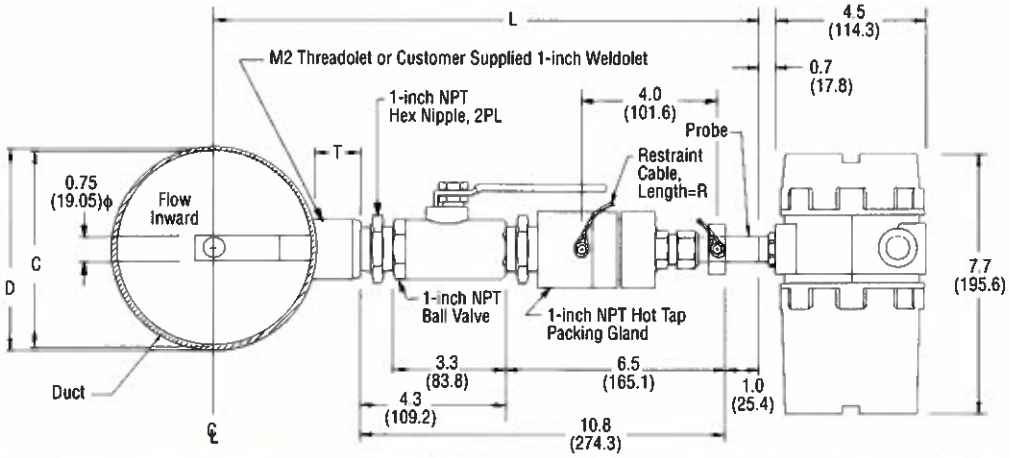
R = Restraint Cable Length

FORMULA

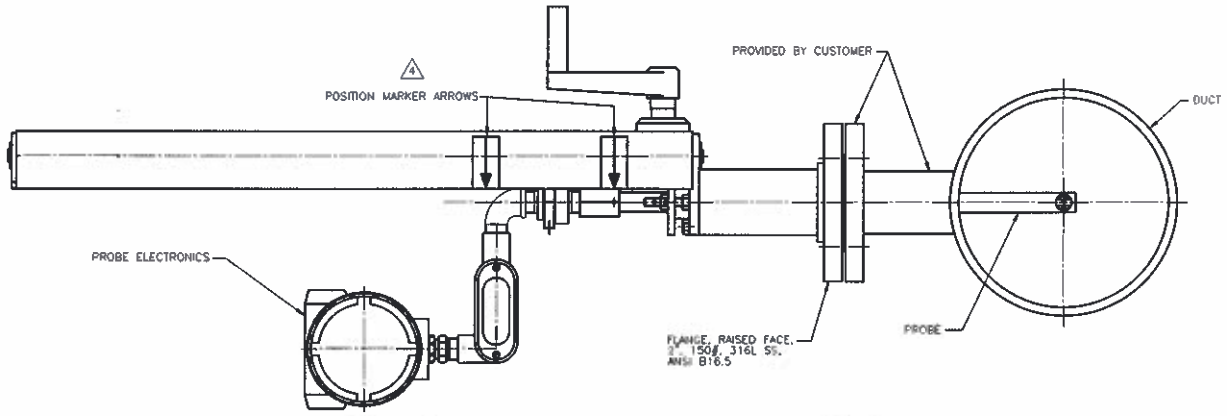
$L \geq 12 + D/2 + T$

So L must be equal or greater than 12-inches plus the height of the "Threadolet" plus half the duct O.D.

$R = D/2 + T + 8.8$



High Pressure Hot Tap to 1000 psig (70 barg)



All dimensions are inches. Millimeters are in parentheses. All drawings have a +/-.25-inch (6.4 mm) tolerance. Certified drawings are available on request.

Unobstructed Flow Requirements

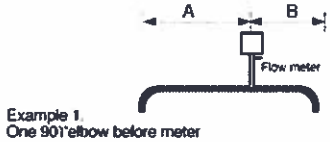
Select an installation site that will minimize possible distortion in the flow profile. Valves, elbows, control valves and other piping components may cause flow disturbances. Check your specific piping condition against the examples shown below. In order to achieve accurate and repeatable performance install the flow meter using the recommended number of straight run pipe diameters upstream and downstream of the sensor. If you cannot meet these requirements please reffer to the Flat-Trak™ Model 780S with flow conditoning plates (flow conditioning plates reduce upstream requirements to as little as 2 diameters.

Example A – Upstream (1) Requirements	
1	15D
2	20D
3	40D
4	15D
5	30D
6	40D

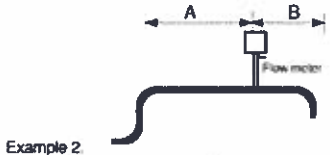
(1) Number of diameters (D) of straight pipe required between upstream disturbance and the flow meter.

Example B – Downstream (2) Requirements	
1	5D
2	5D
3	10D
4	5D
5	10D
6	5D

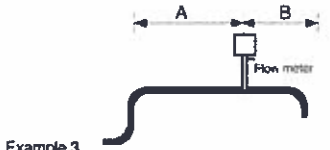
(2) Number of diameters (D) of straight pipe required downstream of the flow meter.



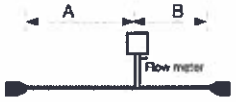
Example 1.
One 90°elbow before meter



Example 2.
Two 90°elbows before meter in one plane



Example 3.
Two 90°elbows before meter out of plane (if three 90°bends present, double recommended length)



Example 4.
Reduction before meter

Example 5.
Expansion before meter

Example 6.
Regulator or valve partially closed before meter (If valve is always wide open, base length requirements on fitting directly preceding it)

Performance Specifications

Accuracy of Point Velocity
+/- 1% of reading + 0.5% of full scale

Repeatability
+/- 0.2% of full scale

Temperature Coefficient
+/- 0.02% of reading per °F within +/- 50° F of customer specified conditions
+/- 0.03% of reading per °F within +/- 50° F to 100° F of customer specified conditions
+/- 0.04% of reading per °C within +/- 25° C of customer specified conditions
+/- 0.06% of reading per °C within +/- 25° C to 50° C of customer specified conditions

Pressure Coefficient
.02% per psi for air, consult factory for other gases

Response Time
One second to 63% of final velocity value

Operating Specifications

Gases
Most gases compatible with 316 L stainless steel

Hastalloy® available

Gas Pressure (2 limitations)
Mechanical design pressure:
Compression fittings: 500 psig (34 barg)
1-inch 150 lb flange (-40° to 250° F): 185 psig (12.8 barg)
Low Pressure Hot Tap: 150 psig (10 barg)
High Pressure Hot Tap: 1000 psig (70 barg)

Pressure Drop
Negligible for pipes three inches in diameter or larger

Gas & Ambient Temperature
Gas ..... -40° F to 350° F (-40° C to 177° C) Gas dependent. See mass flow range tables for details
Ambient ..... -40° F to 120° F (-40° C to 50° C)

Leak Integrity
5 x 10^{-9} cc/sec of helium maximum

Power Requirements
18 to 30 VDC (regulated), 625 mA maximum
100 to 240 VAC, 50/60 Hz, 15 watts maximum

High Temperature Option

Up to 750° F (400° C) air only; consult fatory for other gases

Digital Communications Options

Foundation Fieldbus (read only; flow and totalized flow)
Profibus PA (read only; flow and totalized flow)
MODBUS RTU (read/write most parameters)
RS 232 (standard; command set available)

Output Signal
Linear 0–5 VDC or 0-10 VDC, 1000 ohms minimum load resistance or
Linear 4–20 mA proportional to mass flow rate,
700 ohms maximum resistance power supply dependent
User-selectable . . Active non-galvanically separated or
Passive galvanically separated (loop power required)

Alarms
Hard contact user-adjustable high and low
Dead band adjustable with Smart Interface™ software
Relay ratings ..... Maximum 400 VDC or VAC (peak), 140 mA

Displays
Alphanumeric 2 x 12 digit backlit LCD
Adjustable variables via on-board switches (password protected) or with Smart Interface™ software
Adjustable variables. . Full scale (50 to 100 %)
Time Response (1 to 7 seconds)
Correction factor setting (0.5 to 5)
Zero and span
High and low alarm settings

Totalizer
Seven digits (9,999,999) in engineering units
Resettable by software, on-board switches or external magnet

Software
Smart Interface™ Windows®-based software
Minimum 8 MB of RAM, preferred 16 MB of RAM
RS 232 communication
Additional features. . . Alarm dead band adjustment
Zero cut-off adjustment
Linearization adjustment
Save / Load configurations
Flow meter validation

Physical Specifications

Wetted Materials
316L stainless steel

Enclosure
Hazardous-Area Location Enclosure (IP66) or NEMA 4X (IP65)
Both are powder-coated cast aluminum

Electrical Connections
Two 3/4 inch NPT. . . Hazardous-Area Location Enclosure (IP66)
One 1/2 inch NPT. . . NEMA 4X Enclosure (IP65)

Mounting (optional)
ANSI 1-inch 150 lb flange
3/4-inch tube compression fitting with 1-inch male NPT
Hot tap systems

Certifications
CE (All enclosures)
CSA (Explosion proof for Class I, Division 1, Groups B, C, D)
ATEX (II 2 GD Ex d IIC T6 ... T2
IP 66 T70 °C ... T280 °C)
FM (Explosion proof for Class I, Division 1, Groups B, C, D; dust-ignition proof for Class II, III, Division 1, Groups E, F, G)

IP66, NEMA 4X T6 -40° C to 70° C ambient

Ordering the Model 640S

640S | | | | | | | | | | |

PARENT MODEL NUMBER

640S	Steel-Mass™ Industrial Insertion Meter

AGENCY APPROVALS

NAA	Non-Agency Approved Meter
CSA	Explosion Proof for Class I, Division 1, Groups B, C, D
ATEX	II 2 GD Ex d IIC T6 ... T2 IP 66 T70 °C ... T280 °C
FM	Explosion Proof for Class I, Division 1, Groups B, C, D

PROBE LENGTH

L06	6-inches (15 cm)
L09	9-inches (23 cm)
L13	13-inches (33 cm)
L18	18-inches (46 cm)
L24	24-inches (61 cm)
L36	36-inches (92 cm)
L(in)	Special Length (Length in Inches)
L(in)-M5	Probe with 1-Inch 150 lb Flange (Length in Inches)
L(in)-M9	High Pressure Hot Tap with Retractor (Length in Inches)

MOUNTING ACCESSORIES

640S-M0	None
640S-M1	Compression Fitting (3/4-inch tube x 1-inch Male NPT)
640S-M2( )	Threadolet (3/4-inch Female NPT) Specify pipe O.D. in parentheses
640S-M3	Flat Duct Bracket (3/4-inch tube compression fitting)
640S-M4( )	Curved Duct Bracket (3/4-inch tube compression fitting) Specify duct O.D. in parentheses
640S-M8( )	Low Pressure Hot Tap. Specify duct O.D. in parentheses
640S-M15( )	Quick Removal Tap. Maximum 40 psig (2.8 barg)

ENCLOSURES

E2	Hazardous-Area Location Enclosure
E3(ft)	Remote Hazardous-Area Location Enclosure
E4(ft)	Remote Hazardous-Area Location Enclosure with Junction Box
EN2	NEMA 4X
EN4(ft)	Remote NEMA 4X with Junction Box Specify Cable Length in Parentheses Maximum 200 ft (60 m). Length in Feet Using 5ft. Increments up to 20 ft., 10 ft. Increments up to 200 ft.

INPUT POWER

P2	18–30 VDC
P3	100–240 VAC (Not Available on EN Enclosures)

OUTPUT SIGNAL

V1	0–5 VDC, Linear
V3	0–10 VDC, Linear
V4	4–20 mA, Linear

DISPLAY

NR	No Readout
DD	Digital Display

GAS CODE

0	Air
1	Argon
2	CO_2
3	Chlorine (Correlation)
4	Digester
5	Digester (Correlation)
6	Helium
7	Hydrogen
8	CH_4
9	CH_4 (Correlation)
10	Nitrogen
11	Oxygen (Correlation)
12	Propane
13	Propane (Correlation)
99	Other

OPTION 1 (DIGITAL COMMUNICATIONS)

PULSE	Pulse (not avail. w/ E2-NR)
MB	MODBUS (not avail. w/ P3)
FF	Foundation Fieldbus (E2/P2 only)
PB	Profibus (E2/P2 only)

OPTION 2 (PURGE)

PURGE	Includes valve, tube and purge nozzle.

OPTION 3 (HIGH TEMPERATURE)

HT	To 750 F (400 C); Requires E4, EN4 remote option.

OPTION 4 (CERTIFICATES)

PT	Pressure Test Certificate
CC	Certificate of Conformance
NC	NACE Certificate
MC	Materials Certificate
NC	NACE Certificate

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SIERRA INSTRUMENTS, EUROPE • Bijlmansweid 2 • 1934RE Egmond aan den Hoef • The Netherlands • +31 72 5071400 • Fax: +31 72 5071401

A7801-1 AcquiLite Data Acquisition Server

DESCRIPTION
The AcquiLite™ data acquisition server is the perfect "do-it-yourself" solution for:

- Web-enabling new and existing electricity, gas and water meters
- Verification of energy savings and utility costs
- Cost allocation to departments or tenants

The server combines the flexibility of Ethernet LAN, WAN or modem communications with the lowest total installed cost for logging building data such as:

- Electrical usage and costs
- Natural gas usage and costs
- Water usage and costs
- Combine KWH and KVARH pulse inputs to calculate power factor

AcquiLite™ 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 building engineer or contractor can do the installation in less than 2 hours. The server scales to accept any pulse input.

After installation, data from the connected devices is time stamped and stored in nonvolatile memory on user selected intervals. This interval data is stored at the local site until the nextscheduled upload to the SQL database server.

Using the built-in modem or Ethernet port, data is sent via either the network or phone lines to the Building Manager Online™ server (or to other third party software providers).
At the BMO site, the newly gathered data is combined with historical information that is available to authorized users from anywhere in the world using standard browsers and the Internet. No additional software is required to develop customized views of operational and energy data from one or more buildings.

Applications

- Web-enabling of energy information from new and existing meters from local or remote sites
- Submetering tenants or departments
- Verification of utility usage and charges
- Developing load profiles for energy purchases
- Cost allocation of energy usage

Easy installation saves time and money

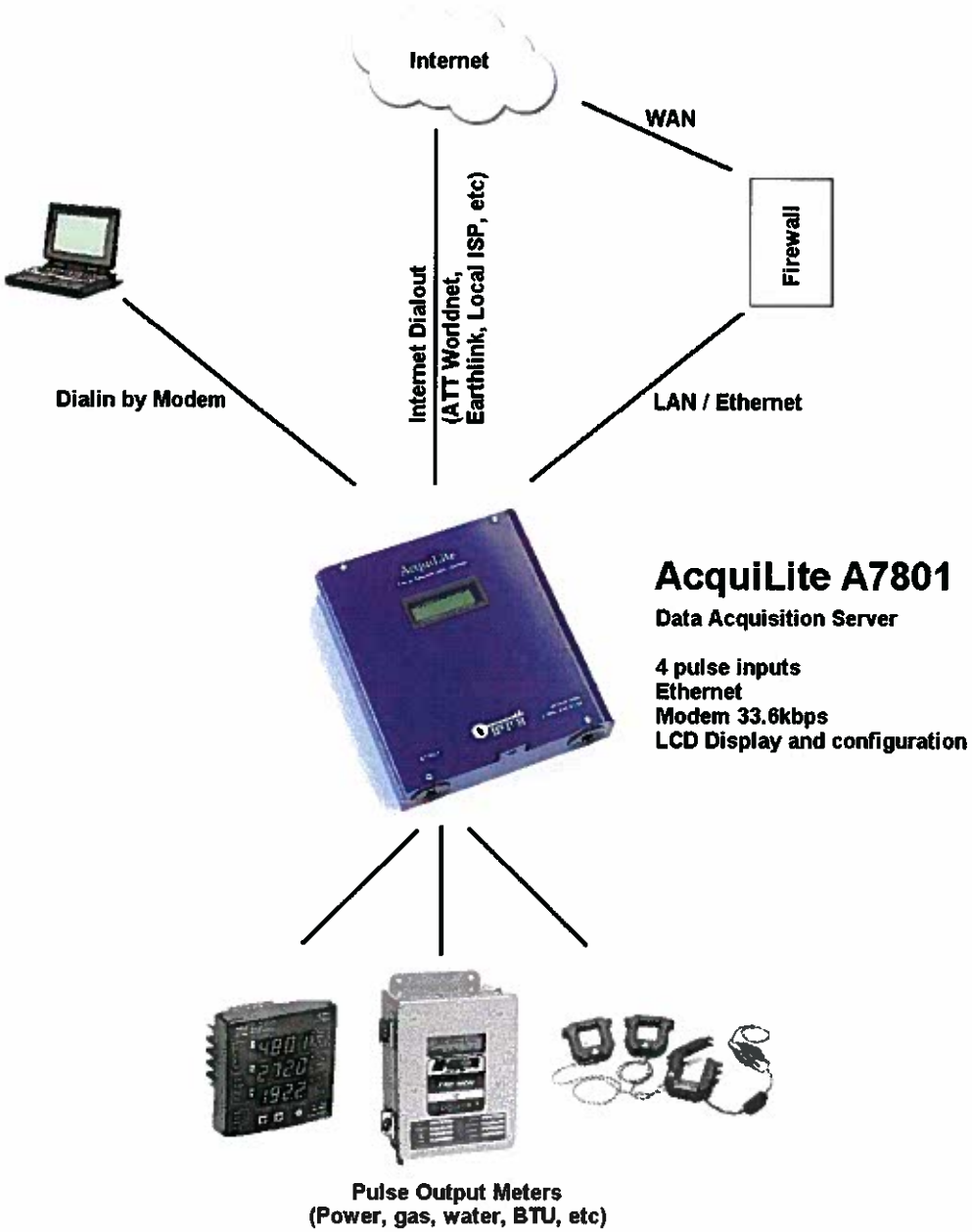
- Simple "plug and play" connectivity means that the system can be installed and configured in minutes
- Industry standard pulse inputs allow the user to gather a wide range of energy information
- AcquiLite hardware and software is designed to provide data in flexible, industry standard formats for databases, spreadsheets, etc.
- Uploads of "near real-time" information on a local LAN provide immediate response to problems
- Convenient LCD display provides ease of installation and troubleshooting without the need for a laptop or special software
- Integrated web server provides setup and configuration using any industry standard web browser (i.e., Netscape™ or Internet Explorer™)

Internet display of key building parameters

- Buildingmanageronline.com™ allows authorized users to see building performance data in an easy to use graphical format

Secure data and flexible comunications

- All data is stored at the site in nonvolatile memory , insuring protection of data in case of power loss
- Wide range of communication options via the modem and Ethernet ports
- Password protection provides security for confidential information
- AcquiLite provides the flexibility to connect to existing meters
- TCP/IP protocols permit easy interface of collected data to spreadsheets, databases, text files, etc.



Specifications:

Processor	R2000 - 8bit embedded cpu, 22Mhz.
Memory	512K flash, 512k sram.
LED	4x pulse input, 4x modem activity, power, alive, ethernet
Console	2 x 16 LCD, two pushbuttons
Communications:	33,600 bps modem, 10base-T half duplex Ethernet
Protocols	TCP/IP, PPP, HTTP/HTML, NTP
Power Requirement	110-120VAC Transformer included, 9VDC, Class2 transformer
Pulse Inputs	4x dry contact (consumption/rate/min/max)
Utility sync input	1x dry contact.
Size	8" x 9.25" x 2.5"

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website: http://www.obvius.com