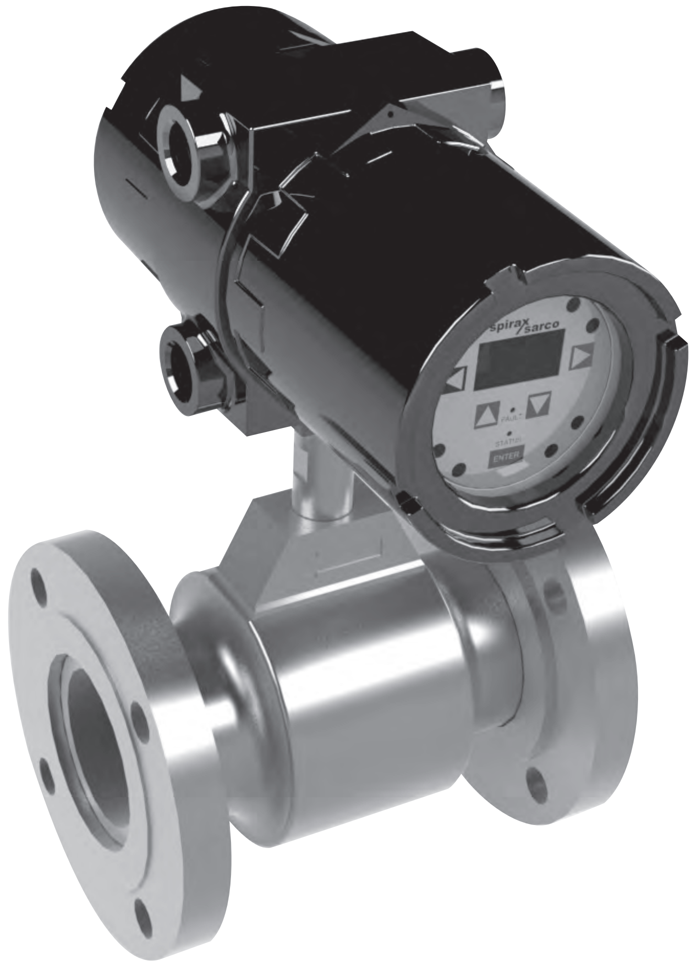
spirax sarco

INSTALLATION AND MAINTENANCE INSTRUCTIONS

IM-8-625-US February 2012

VLM10 Inline Vortex Mass Flowmeter



Contents

1. Safety information

Safe operation of this unit can only be guaranteed if it is properly installed, commissioned and maintained by a qualified person in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

Manufacturer: Spirax Sarco Inc, 2150 Miller Drive, Longmont, Colorado

The product is designed and constructed to withstand the forces encountered during normal use. Use of the product for any other purpose, or failure to install the product in accordance with these Installation and Maintenance Instructions, could cause damage to the product, will invalidate the marking, and may cause injury or fatality to personnel.

Warning

This product complies with the requirements of Electromagnetic Compatibility Directive 2004/108/EC by meeting the standards of: EN 61326: 2006 Electrical equipment for measurement, control and laboratory use EMC requirements. Immunity to industrial locations annex A -Table A1. Emissions to domestic locations Table 4. & EN55011:2007 – Radiated Emissions.

The following conditions should be avoided as they may create interference above the limits specified in EN 61326: 1997 if:

1. The product or its wiring is located near a radio transmitter.

2. Cellular telephones and mobile radios may cause interference if used within approximately 1 metre (39") of the product or its wiring. The actual separation distance necessary will vary according to the surroundings of the installation and the power of the transmitter. If this product is not used in the manner specified by this IMI, then the protection provided may be impaired.

1. 1 Intended Use

Referring to the Installation and Maintenance Instructions, nameplate and Technical Information Sheet, check that the product is suitable for the intended use / application. The product listed complies with the requirements of the European Pressure Equipment Directive 97 / 23 / EC, carries the mark when so required. The product falls within the following Pressure Equipment Directive categories:

Product **VLM10- ANSI 150**	Group 1 Gases	Group 2 Gases	Group 1 Liquids	Group 2 Liquids
sizes 25-50 mm		SEP		SEP
sizes 80-150 mm		CAT 1		SEP
sizes 200-250 mm		CAT 2		SEP

1.2 Access

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

The symbols, used on the product and in this manual, mean:

Equipment protected throughout by double insulation or reinforced insulation

Functional earth (ground) terminal, to enable product to function correctly. Not used to provide electrical safety.

Caution, risk of electric shock.

Caution, risk of danger, refer to accompanying documention.

Optically isolated current source or sink.

Caution. Electrostatic Discharge (ESD) sensitive circuit. Do not touch or handle without proper electrostatic discharge precautions

1.3 Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

1.4 Hazardous liquids or gases in the pipeline

Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider: flammable materials, substances hazardous to health, extremes of temperature.

1.5 Hazardous environment around the product

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

1.6 The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk? Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

1.7 Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labeling of closed valves. Do not assume that the system has depressurized even when the pressure gauge indicates zero.

1.8 Temperature

Allow time for temperature to normalize after isolation to avoid the danger of burns and consider whether protective clothing (including safety glasses) is required.

1.9 Tools and consumables

Before starting work ensure that you have suitable tools and / or consumables available. Use only genuine Spirax Sarco replacement parts.

1.10 Protective clothing
Consider whether you and /or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high / low temperature, radiation, noise, falling objects, and dangers to eyes and face.

1.11 Permits to work
All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions. Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety. Post 'warning notices' if necessary.

1.12 Handling
Manual handling of large and /or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

1.13 Residual hazards
In normal use the external surface of the product may be very hot. If used at the maximum permitted operating conditions the surface temperature of some products may reach temperatures of 750°F (400°C). Many products are not self-draining. Take due care when dismantling or removing the product from an installation.

1.14 Freezing
Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

1.15 Disposal
Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

2. General product information
This manual explains how to install, commission, and maintain the VLM10 Inline Vortex Flowmeters.

2.1 Product description
The VLM10 Inline Vortex flowmeter is designed to reduce the cost of flowmetering and is used as an accurate means to measure liquid, gas and steam flow rates and record total flow.

2.2 Equipment delivery and handling

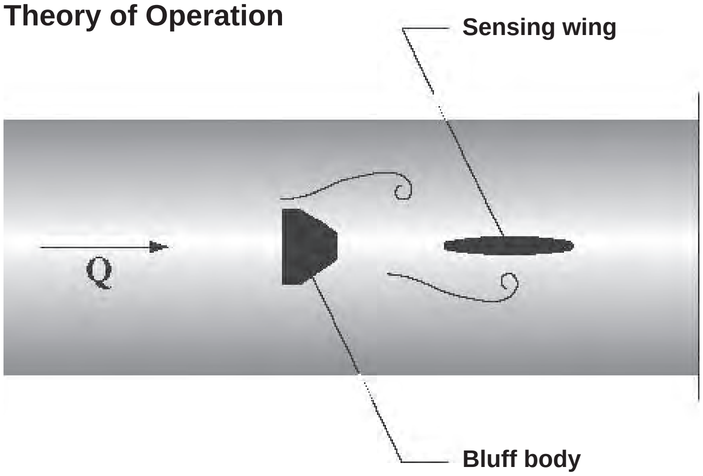
Factory shipment
Prior to shipment, the Spirax Sarco VLM10 is tested, calibrated and inspected to ensure proper operation. A packing list is sent with the shipment indicating the products sent with the order.

Receipt of shipment
Each carton should be inspected at the time of delivery for possible external damage. Document any damage found.

If it is found that some items have been damaged or are missing, notify Spirax Sarco immediately and provide full details. In addition, damage must be reported to the carrier with a request for their on-site inspection of the damaged item and its shipping carton.

Storage
If a flowmeter is to be stored prior to installation, the environmental storage conditions should be at a temperature between 32°F and 158°F (0°C and 70°C), and between 10% and 90% relative humidity (non-condensing).

Theory of Operation



Cross Sectional View of Body

The linear range of the flowmeter (where Strouhal number is constant) is for Reynolds numbers between 20,000 and 7,000,000. (The Strouhal and Reynolds numbers are dimensionless and characterize the flow conditions.) Passage of a vortex causes a slight bow of a wing placed downstream of the bluff body. The bend is measured by a piezoelectric crystal sensor in contact with the top of the wing.

The VLM10 inline vortex measures volumetric flow rate by detecting the frequency at which alternating vortices are shed from a bluff body inserted into the flow stream. These vortices are known as Von Karman vortices. The Vortex M-PhD calculates the flow velocity using the following equation:

Q = f/K

Where
Q = flow rate
f = vortex shedding frequency
K = calibration constant

Microprocessor based electronics amplify, filter, and convert the sensor input into digital or standard pulse or 4-20 outputs.

FEATURES

- Volumetric, energy, or mass flow monitoring of liquid, gas, or steam
- Removable sensor and RTD under flow conditions below 750 psig (52 bar)
- Line sizes: 1 to 12”
- Fully welded design
- Multi-variable electronics incorporate an integral RTD for compensated mass flow measurement
- 50,000 event data logger, date stamped and user selectable.
- BACnet Interface, half-duplex RS-485
- Modbus RTU, half-duplex RS-485
- Modbus TCP/IP full-duplex
- 10/100 Base T Ethernet Http Interface (Web)
- Virtual front panel display and setup wizard on a standard PC
- Industry standard 4-20 mA and frequency outputs
- Local display in various engineering and time units
- Integral or remote configurable outputs, displays and ranges

Approvals

- CE- EU EMC Directive 89-336-EEC; EN55EN 5008-1

Pending approvals –

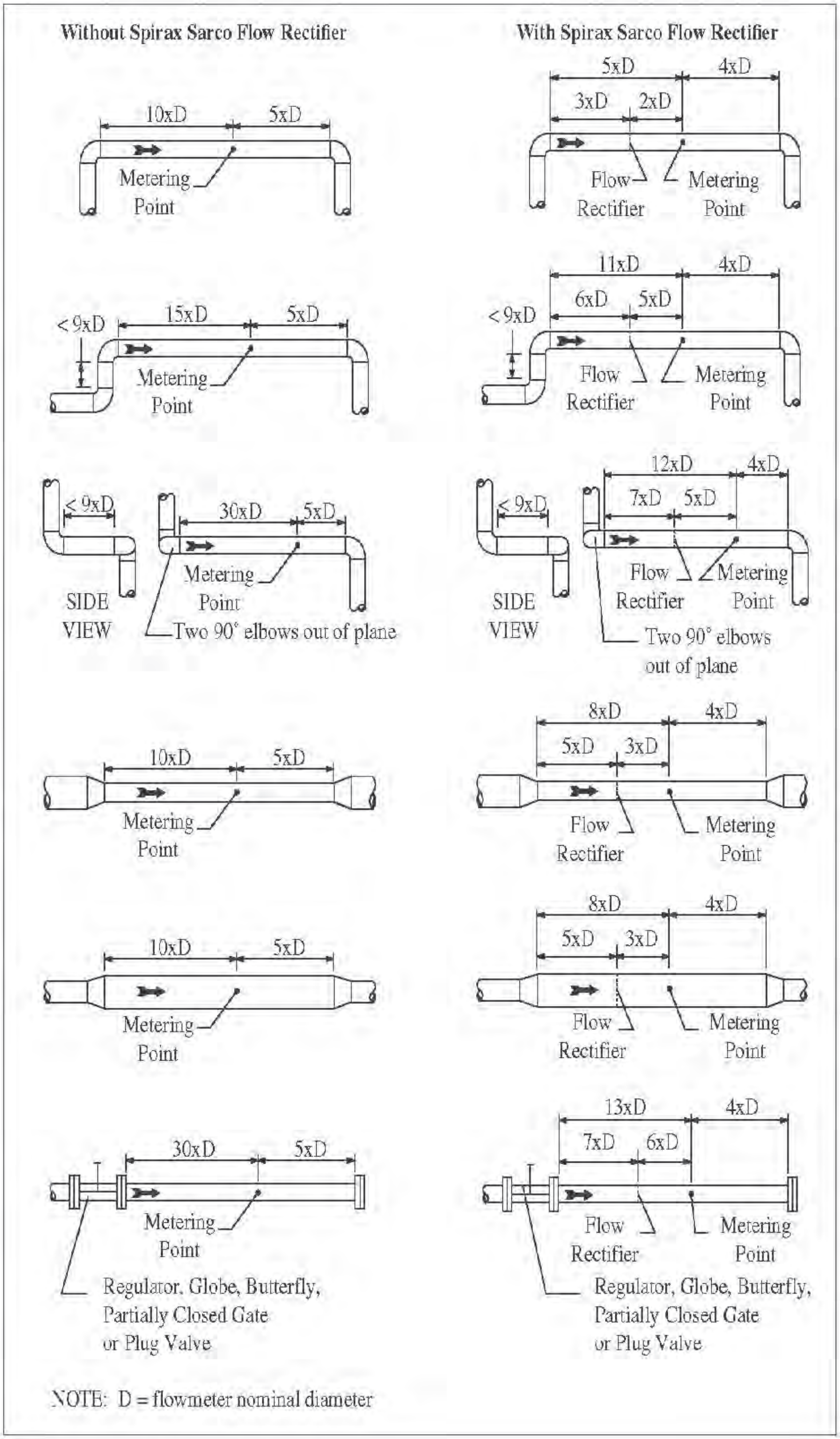
- Class I, Division II, Groups B, C, and D; and Dust-ignition Proof for Class II, Division III, Groups F, and G hazardous (classified) location ns.
- CSA approval – Class I, Division I, Groups B, C, and D; Dust-ignition Proof for Class II, Division I, Groups F, and G; and Class III hazardous locations.

3. Mechanical Installation

PIPING

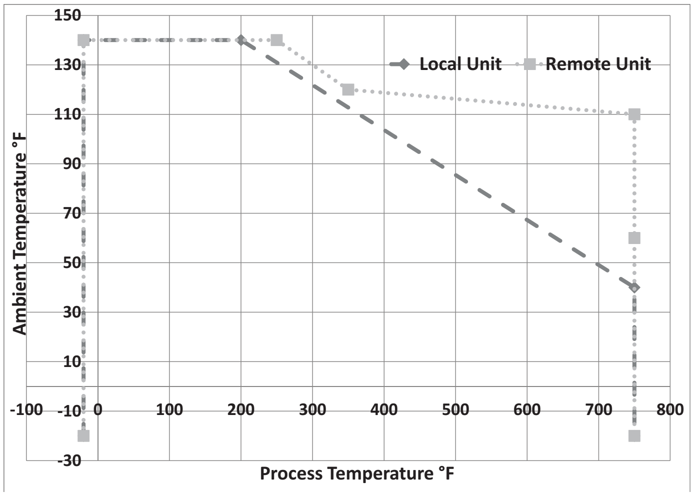
Straight Run Requirements

Note: the straight run of piping must have the same nominal diameter as the meter.



Integral/ Remote Mounting

Sensor and electronics can be mounted either as an integral unit or the electronics can be remotely mounted from the sensor. For integral mounting, the process (medium) and the ambient temperature must be less than the value defined by the dashed line shown on the **Ambient vs. Process Temperature** graph.

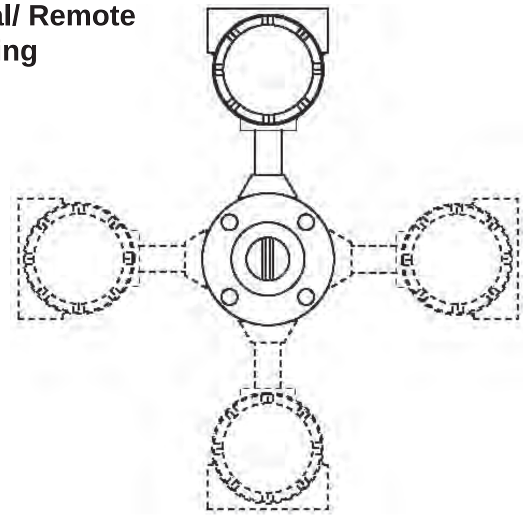


Ambient vs. Process Temperature Table

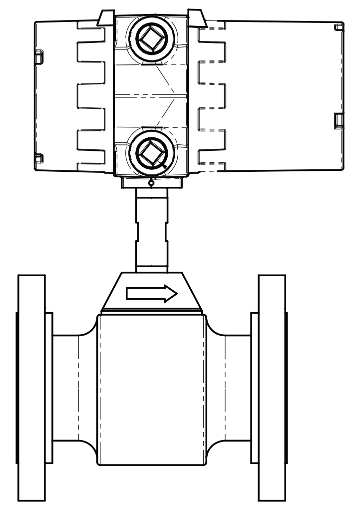
If remote electronics are used, the combination of ambient and process temperature must be lower than the dotted line shown on the Ambient vs. Process Temperature graph. It is recommended to shield the electronics from the high temperature of the piping system with thermal insulation blankets. The thermal insulation blankets should not cover the meter's stem or electronics enclosure. The VLM10 electronics do not need to be mounted above the sensor, they can be mounted in any orientation.

The display is rotatable in 90 degree increments to allow for easy reading of the local display.

Integral/ Remote Mounting

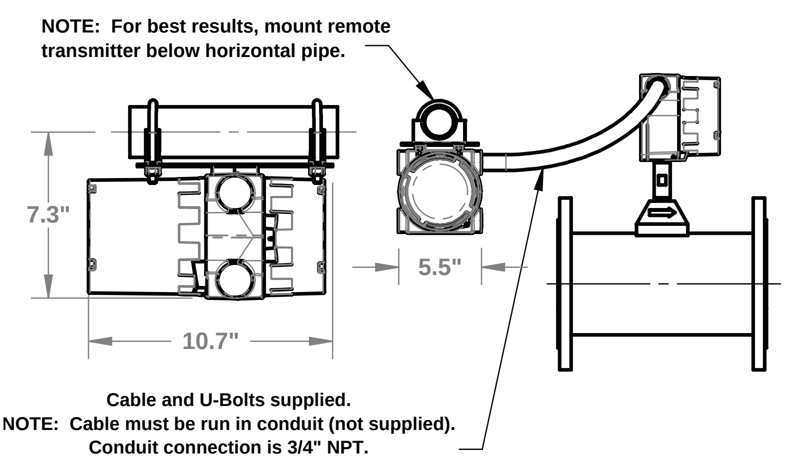


Integral Electronics

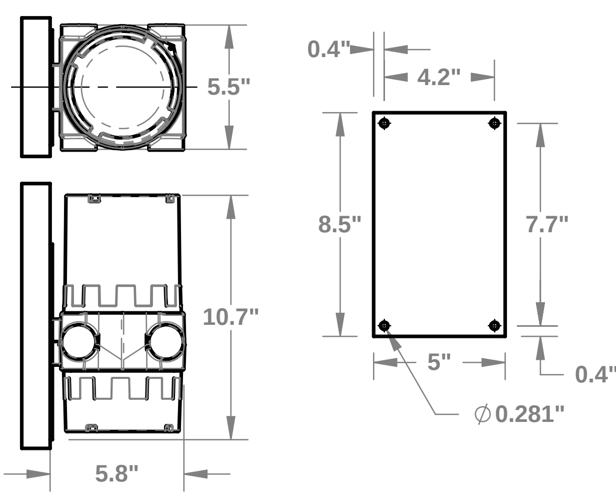


Remote Mount Electronics

Pipe Mount Electronics



Wall Mount Electronics



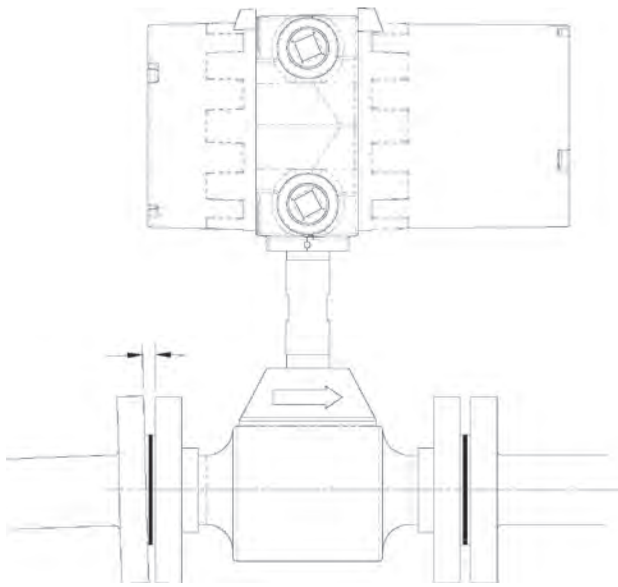
Sensor and electronics can be mounted as one (Integral) unit. When the process and ambient temperature exceeds the dotted line of the Ambient vs. Process Temperature, remote mounting of the electronics is necessary. When remote mounting the electronics, determine the ambient and process temperature do not exceed the dashed values shown on the graph. There are two options for remote mounting, pipe or wall. The distance between sensor and the electronics must not exceed 150'. If remote mounting is ordered, mounting clamps and plate, and 50' of cable is supplied (100' or 150' of cable can be ordered as an option).

Flange Style

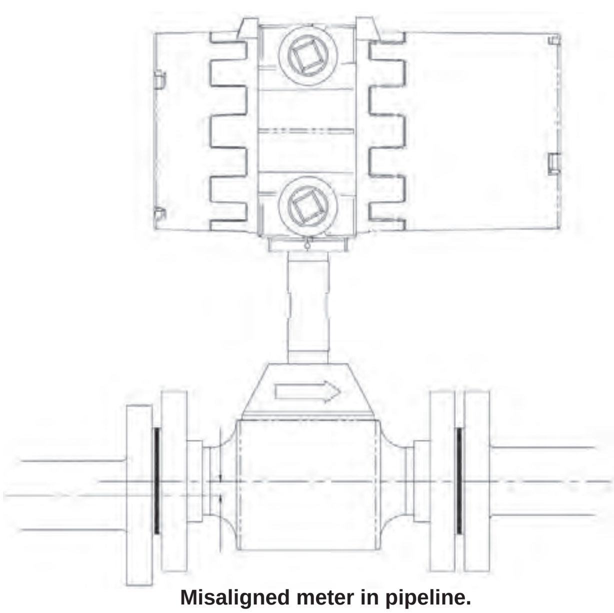
Pipe supports are recommended if mechanical vibration is present. Pipe supports should follow industry standard piping practices. Install the meter with the flow arrow on the meter body in the direction of flow.

Align the bolt holes of each set of mating flanges. The bolt holes should be directly opposite each other in order to minimize any stress on the flowmeter body. Snug all bolts prior to final tightening.

The VLM10 can be used in systems using pipe I.D.'s ≤ schedule 80 pipe. The schedule of the mating pipe must be ≥ the internal diameter of the flowmeter. Weldneck flanges and self-centering gaskets are recommended for optimum performance, and gaskets should *not* be allowed to protrude into the flow stream.



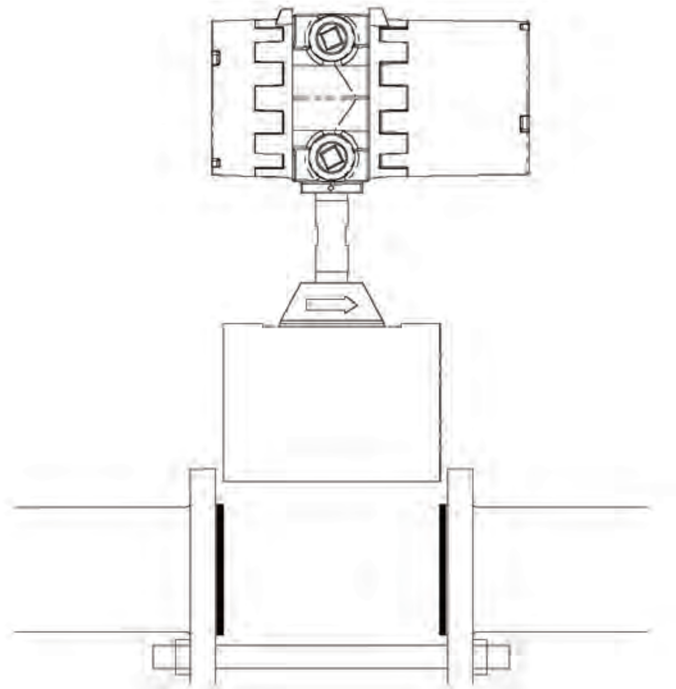
Tilt caused by uneven tightening of bolts.
Tighten bolts in a staggered fashion to avoid tilt.



Misaligned meter in pipeline.

Wafer Style

Tighten the bolts until snug; the bolts should be snug enough to hold the meter, yet loose enough to allow movement. Align the upstream end of the flowmeter by measuring from the outside edge of the flowmeter body to the outside diameter of the flange at several points. Adjust the position of the meter body until these measurements are within 1/16'' of each other for meter sizes 2'' and less, and 1/8'' for larger sizes. Repeat for the downstream end of the meter. The alignment of the inlet to the meter is more critical than the outlet; i.e., if the piping system is warped such that both ends cannot be aligned, sacrifice the downstream alignment. Tighten all bolts.



Place meter body between flanges; see that gaskets don't protrude into the bore. Install bolts.

VLM10 Dimensions and Weights

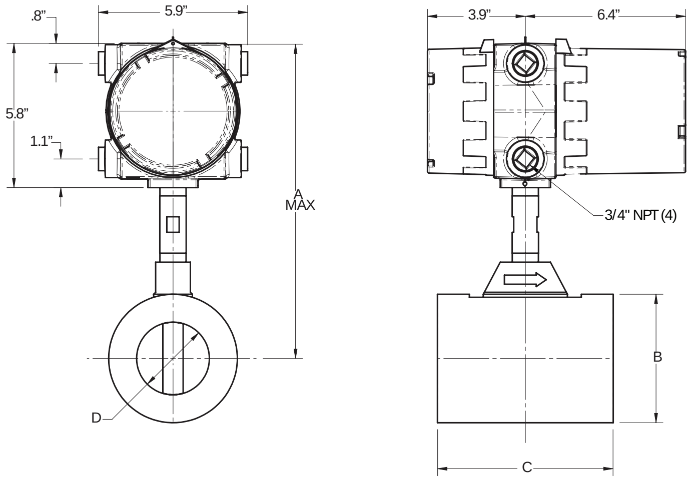


Figure 4. Dimensions: Wafer Connection Type, Integral Mounting.

Wafer Connection

Wafer connection is available in stainless steel sizes 1–3" only. The schedule of the mating pipe's internal diameter ≥ dimension "D".

Size (in)	A (in)	B (in)	C (in)	D (in)	Approx Wt (lb)
1	11.4	3.3	4.1	0.957	13
1.5	11.1	3.1	4.1	1.500	14
2	11.4	3.6	5.0	1.939	17
3	12.1	5.0	7.0	2.900	32

Table 6. Weights & Dimensions: Wafer

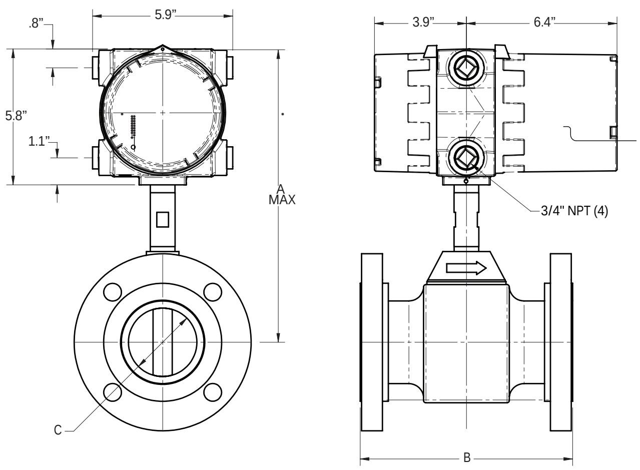


Figure 6. Dimensions: Flange Connection, Integral Mounting.

all in inches	A	B	C				Approx. Wt.(lb)		
			Stainless Steel		Carbon Steel				
size			150# 300#	600#	150# 300#	600#	150#	300#	600#
1	11.3	7.6	0.957	0.957	N/A	N/A	18	20	20
1.5	11.3	8.1	1.500	1.500	N/A	N/A	22	28	28
2	13.0	8.5	1.939	1.939	N/A	N/A	31	36	36
3	14.4	9.0	2.900	2.900	N/A	N/A	51	60	60
4	14.9	9.5	3.826	3.826	N/A	N/A	55	72	99
6	15.9	13.6	5.761	5.761	5.761	5.761	92	116	140
8	16.9	18.5	7.625	7.625	7.625	7.625	144	182	220
10	18.0	18.5	10.020	N/A	10.020	N/A	180	260	N/A
12	19.0	18.5	12.000	N/A	11.938	N/A	265	365	N/A

Table 7. Weights & Dimensions: Flange.

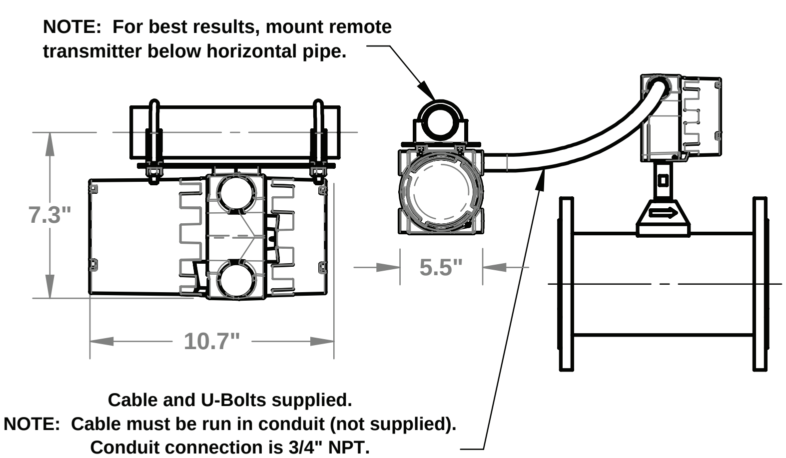
Notes:
1. The schedule of the mating pipe's internal diameter > dimension 'C'.
2. N/A = Not Available.

Approximate Weight (lb)				
size (in)	150# Flange	300# Flange	600# Flange	Wafer
1	24	26	26	19
1.5	28	34	34	20
2	37	42	42	23
3	57	66	66	38
4	72	89	105	N/A
6	98	122	146	N/A
8	150	188	226	N/A
10	186	266	N/A	N/A
12	271	371	N/A	N/A

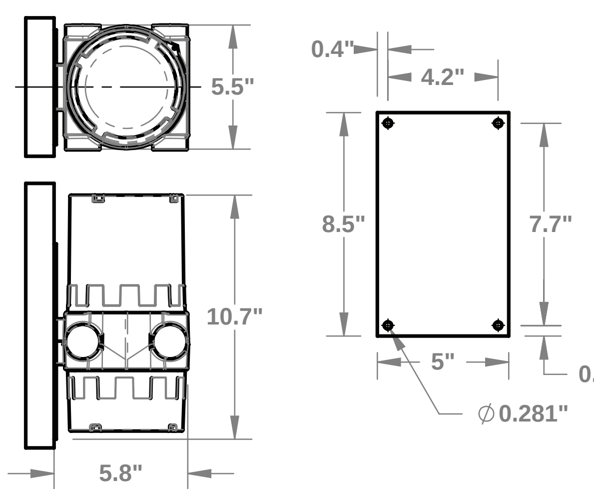
Figure 5. Dimensions weights: Remote Mounting

Remote Mount Electronics

Pipe Mount Electronics



Wall Mount Electronics



4. Electrical Installation

The VLM10 vortex meter electronics provide a variety of interfaces to communicate with the meter. Each interface is provided with a discrete connector on the terminal board to simplify wiring of the meter. Available interfaces include Ethernet, RS-485, pulse output, two relay outputs, three 4-20mA current loop outputs, two 4-20mA current loop inputs, and an additional RS-485 link for remote mount communications.

The VLM10 vortex meter electronics amplify and convert the raw sensor signals into a number of different analog output signals. Available outputs are:

- Pulse Output
  - Generates pulses based on internal totalizer increments.
  - Adjustable pulse width and polarity.
- 4-20mA Current Loop Output
  - Volumetric, mass, energy flow values, pressure, temperature.
  - 4-20mA outputs provide 2500Vrms electrical isolation.

Flow information is also available in digital format. The available interfaces are:

- BACnet Interface
  - Half-duplex RS-485
- Modbus RTU
  - Half-duplex RS-485
- Modbus TCP/IP
  - Full-duplex, 10/100 BaseT Ethernet
- Http Interface (Web)
  - Virtual front panel display using Windows Explorer or Mozilla Firefox on a standard PC

Relay Outputs

The VLM10 vortex meter electronics provide two single-pole, double-throw relays. Each relay has a common terminal, a normally-open terminal, and a normally-closed terminal. Also provided are two 4-20mA current loop inputs for connection to external transducers. Refer to Figure 1, for a diagram of all available I/O.

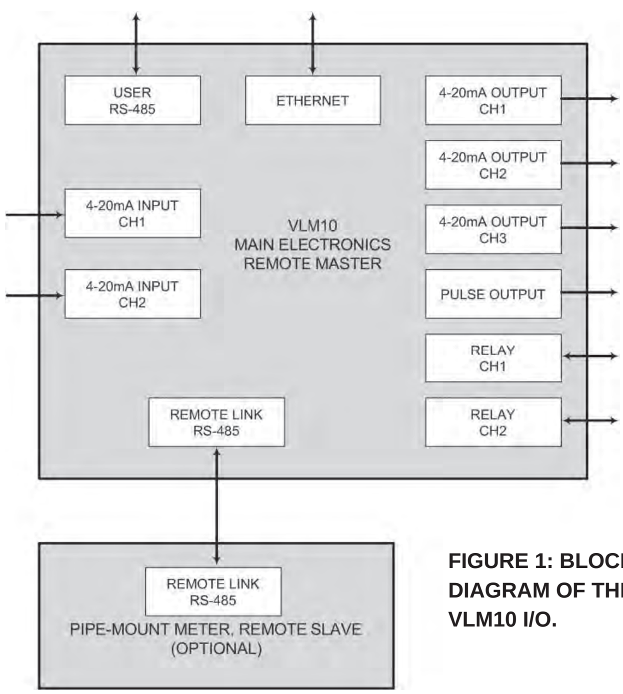


FIGURE 1: BLOCK DIAGRAM OF THE VLM10 I/O.

Maximum Ratings

Stresses above those listed under Maximum Ratings may cause permanent damage to the VLM10 meter.

TABLE 1: MAXIMUM RATINGS

PARAMETER	MAX. RATING
V+ to V-, +24VDC Supply Input	0V to +32V DC
V+ to V-, Remote Slave Electronics Supply	0V to +32V DC
I4-20,IN, 4-20mA Input Current	24mA DC max
V4-20,OUT, 4-20mA Output Loop Voltage	+28V DC max
P4-20,OUT, 4-20mA Output Power Rating	600mW max
IRELAY, Continuous Relay Current	60mA DC max
VRELAY, Relay Blocking Voltage	175V DC max
PRELAY, Relay Power Rating	400mW max
IPULSE, Continuous Pulse Output Relay Current	650mA DC max
IPULSE,PK, Peak Pulse Output Relay Current	2A max, 100ms
VPULSE, Pulse Output Blocking Voltage	50V AC max
PPULSE, Pulse Output Power Rating	350mW max

Recommended Operation Conditions

The following table defines the normal operating conditions of the VLM10 meter.

TABLE 2: RECOMMENDED OPERATING CONDITIONS

PARAMETER	MIN	TYP	MAX
V+ to V-, +24VDC Supply Input	+10VDC	+24VDC	+28VDC
DC Power Supply – Current Output	3A DC1	-	-
V+ to V-, Remote Slave Electronics Supply	+10VDC	+24VDC	+28VDC
I4-20,IN, 4-20mA Input Current Range	3.5mA	-	20.5mA
4-20mA Input Accuracy, %Full-Scale Error	-	-	0.1%
4-20mA Input Voltage Drop	-	-	+7VDC
4-20mA Output Galvanic Isolation	-	-	1kV$_{rms}$
V4-20,OUT, 4-20mA Output Loop Voltage			
Load Resistance < 200Ω	+12VDC	+24VDC	+28VDC
Load Resistance > 200Ω	+14VDC	+24VDC	+28VDC
V4-20,OUT, 4-20mA Output Current Range	3.5mA ± 5%	-	21mA
4-20mA Output Accuracy, %Full-Scale Error	-	-	0.1%
4-20mA Output Load Resistance	0Ω	-	350Ω[2]
4-20mA Output Galvanic Isolation	-	-	1kV$_{rms}$[3]
VRELAY, Relay Operating Voltage	+3V	+24V	-[4]
IRELAY, Continuous Relay Current	-	12mA	-[4]
Relay Galvanic Isolation	-	-	1kV$_{rms}$[3]
VPULSE, Pulse Output Operating Voltage	+3V	+24V	-[4]
IPULSE, Continuous Pulse Output Current	-	12mA	-[4]
Pulse Output Galvanic Isolation	-	-	1kV$_{rms}$[3]
RS-485 Resistive Load	54Ω	120Ω ± 10%	132Ω

1.In order to guarantee that the fuse on-board the VLM10 electronics will blow under fault conditions, a minimum supply current is specified. When selecting a power supply, be sure to follow the minimum current output specification.

2. To drive the maximum resistive load on the 4-20mA outputs, a minimum loop supply voltage of +14VDC is required.

3. The galvanic isolation is across the circuit under test and the VLM10 supply reference; and across the circuit under test and chassis. If the on-board supply is used to bias an isolated circuit, the galvanic isolation is defeated, which means there is no galvanic isolation.

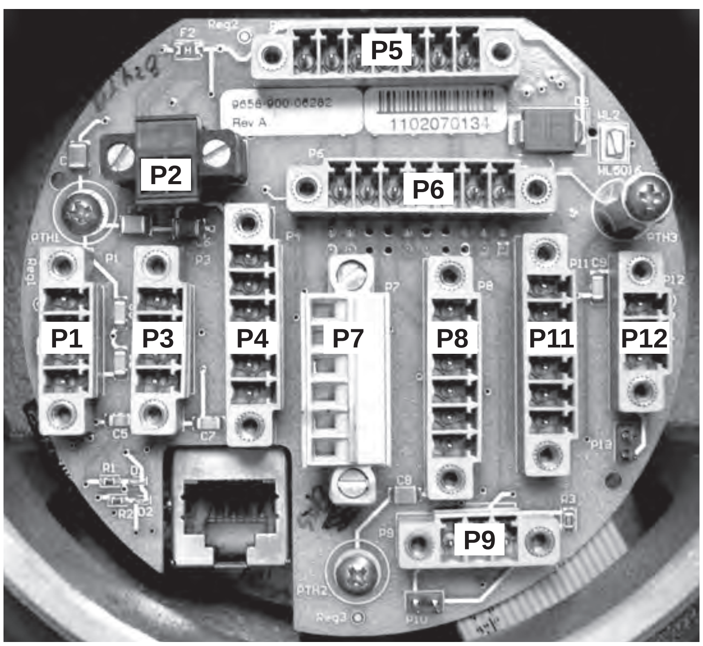
4. See Maximum Ratings table.

Terminal Board and Electronics Enclosure

All VLM10 electronics are housed in a cast aluminum electronics enclosure. The electronics enclosure is rated for Class I, Div II environments.

Connection of user wiring is made on the terminal board. To access the terminal board, remove the back cover on the electronics enclosure. The terminal board provides pluggable, screw-terminal connectors to simplify wiring. Before wiring, be sure to turn-off power to the VLM10 meter and all interfaces connecting to the meter. ESD safe procedures must be followed to avoid damage to the electronics. Refer to Figure 2 for a diagram of the terminal board.

FIGURE 2: VLM10 TERMINAL BOARD DIAGRAM



Connector Pinouts

Each pluggable, screw-terminal connector on the terminal board is dedicated to a user accessible circuit. Table 2 defines the mapping of connectors to circuits.

For all pluggable screw-terminals, pin #1 is indicated on the printed circuit board by the location of the reference designator, which is adjacent to pin #1.

TABLE 2: MAPPING OF CONNECTORS TO CIRCUITS

Connector Reference Designator	Circuit
P2	DC Supply Input
P1	Relay Channel 1
P3	Relay Channel 2
P7	Pulse Output
P5	4-20mA Input Channel 1
P6	4-20mA Input Channel 2
P4	4-20mA Output Channel 1
P8	4-20mA Output Channel 2
P11	4-20mA Output Channel 3
P9	User RS-485
P12	Remote Link RS-485
P10	User RS-485 Termination Jumper
P13	Remote Link RS-485 Termination Jumper

P2: DC SUPPLY INPUT CONNECTOR

PIN #	SIGNAL
1	V(-) INPUT, DC SUPPLY REFERENCE
2	V(+) INPUT, DC SUPPLY POSITIVE

P1: RELAY CHANNEL 1

PIN #	SIGNAL
1	NORMALLY-OPEN
2	COMMON
3	NORMALLY-CLOSED
4	*{NOT USED}*

P3: RELAY CHANNEL 2

PIN #	SIGNAL
1	NORMALLY-OPEN
2	COMMON
3	NORMALLY-CLOSED
4	*{NOT USED}*

P7: PULSE OUTPUT

PIN #	SIGNAL
1	PULSE CONTACT 1
2	PULSE CONTACT 2
3	*{NOT USED}*
4	*{NOT USED}*
5	V(+) OUTPUT (NON-ISOLATED)
6	V(-) OUTPUT (NON-ISOLATED)

P5: 4-20mA INPUT CHANNEL 1

PIN #	SIGNAL
1	IN(+), 4-20mA INPUT POSITIVE
2	IN(-), 4-20mA INPUT NEGATIVE
3	*{NOT USED}*
4	*{NOT USED}*
5	*{NOT USED}*
6	V(+) OUTPUT (NON-ISOLATED)
7	V(-) OUTPUT (NON-ISOLATED)

P6: 4-20mA INPUT CHANNEL 2

PIN #	SIGNAL
1	IN(+), 4-20mA INPUT POSITIVE
2	IN(-), 4-20mA INPUT NEGATIVE
3	*{NOT USED}*
4	*{NOT USED}*
5	*{NOT USED}*
6	V(+) OUTPUT (NON-ISOLATED)
7	V(-) OUTPUT (NON-ISOLATED)

P4: 4-20mA OUTPUT CHANNEL 1

PIN #	SIGNAL
1	OUT(+), 4-20mA OUTPUT POSITIVE
2	OUT(-), 4-20mA OUTPUT NEGATIVE
3	*{NOT USED}*
4	*{NOT USED}*
5	V(+) OUTPUT (NON-ISOLATED)
6	V(-) OUTPUT (NON-ISOLATED)

P8: 4-20mA OUTPUT CHANNEL 2

PIN #	SIGNAL
1	OUT(+), 4-20mA OUTPUT POSITIVE
2	OUT(-), 4-20mA OUTPUT NEGATIVE
3	*{NOT USED}*
4	*{NOT USED}*
5	V(+) OUTPUT (NON-ISOLATED)
6	V(-) OUTPUT (NON-ISOLATED)

P11: 4-20mA OUTPUT CHANNEL 3

PIN #	SIGNAL
1	OUT(+), 4-20mA OUTPUT POSITIVE
2	OUT(-), 4-20mA OUTPUT NEGATIVE
3	{NOT USED}
4	{NOT USED}
5	V(+) OUTPUT (NON-ISOLATED)
6	V(-) OUTPUT (NON-ISOLATED)

P9: USER RS-485

PIN #	SIGNAL
1	RS-485(+) POSITIVE
2	RS-485(-) NEGATIVE
3	RS-485 SHIELD TERMINATION

P12: REMOTE LINK RS-485

PIN #	SIGNAL
1	RS-485(+) POSITIVE
2	RS-485(-) NEGATIVE
3	RS-485 REFERENCE

Wiring Recommendations

Before wiring, be sure to turn-off power to the VLM10 meter and all interfaces connecting to the meter. Proper wiring is essential to achieving satisfactory performance and reliability. The following is recommended:

1. Use shielded wire, for example, Belden 82641 or Belden 9451P, for 4-20mA current loops, especially in noisy electrical environments.

2. Select the proper wire gauge. 20-24 AWG stranded wire is recommended. For Ethernet and Modbus RTU CAT5, Cat 5e, or Cat 6 type cable is recommended, such as Belden 1624P.

Warning: Do not exceed maximum wiring distances for the various interfaces. Refer to the following table for maximum recommended wiring distances.

Interface	Recommended Cable	Maximum Cable Length
RS485	Belden 9841	4000 feet (1220 m)
4-20mA Current Loop	Belden 9451P	1000 feet (304 m)
Pulse Out	Belden 82842	1000 feet (304 m)
Ethernet	Belden 1624P or 7929A	328 feet (100 m)
Relay Out	Belden 8334	1000 feet (304 m)
Remote Head	Belden 8334	150 feet (50 m)

Hum and Noise

Although the VLM10 is designed to operate reliably in industrial environments, some precautions should be followed to minimize interference on the meter. It is recommended that the VLM10 meter be powered using an Omron S8VM-10024CD or S8VM-10024C DC power supply to achieve the best noise performance.

The maximum run length for the 4-20mA current loop input sensors and RS-485 may be reduced due to noise and noise pickup along the cable. The use of properly grounded shielded twisted pair (STP) cable helps to limit the effects of interference in most cases.

Cables should be run inside grounded conduit anytime these signals must be pulled near welders, motor drives, arc furnaces or other noisy electrical equipment in order to provide additional shielding.

For noise immunity, while using the user RS-485 link, AC termination to chassis is provided on-board the VLM10 electronics for the RS-485 cable shield. It is recommended to terminate the cable shield at both ends. At the VLM10 electronics, terminate the RS-485 cable shield to the shield termination terminal, P9 pin 3, which is AC coupled to chassis. The DC galvanic isolation provided by the AC shield termination is rated to 1kV peak. At the other end of the user RS-485 cable, terminate the shield directly to earth. This will improve performance in noisy environments, and the AC coupling will block low-frequency currents commonly seen in ground loops.

Ground Loops

Ground loops may interfere with signal transmission by superimposing unwanted signals on the desired signals. This may be prevented by correctly connecting the cable shields. Metal or plastic pipelines determine the shield to be used.

Metal pipelines are usually earth grounded. Thus, the cable shield should not be connected at the flow meter. The shield should be connected to a specific instrument earth ground at the control panel.

Plastic pipelines require the transmitter electronics enclosure be connected to an earth ground. To do this, connect the electronics enclosure to earth ground by attaching a cable or braid form earth ground to the external ground lug on the electronics enclosure. Alternatively, connect the signal cable shields to the electronics enclosure via one of the terminal board mounting screws.

Remote Mount Option

The remote mount option allows the main VLM10 electronics, remote master, to be mounted at a distance from the VLM10 meter at the pipe, remote slave. The main electronics may be separated from the meter by up to 30m (100 ft.) of wiring. Proposed mounting locations should be reviewed and wiring runs measured prior to installation. Failure to observe the maximum wiring lengths can prevent the meter from operating correctly and may void the warranty.

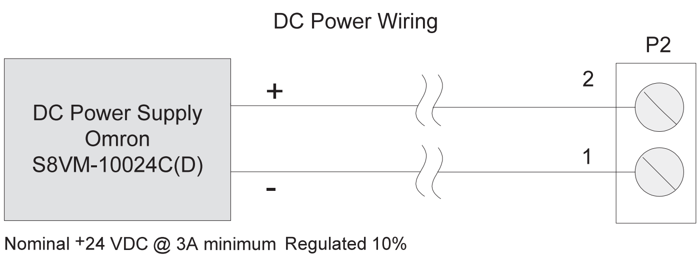
In the Remote Mount situation, the shields from the interface cable should be connected to earth ground at the main electronics terminal board. A pigtail from the shields can then be screwed down onto a standoff that extends up from the terminal board mounting hole. Do not terminate any other cable shields to chassis at the main electronics enclosure.

Wiring the Meter

DC Power

The VLM10 meter is powered by an external DC power supply as shown in Figure 3. Use 18 to 22 gauge wire between the DC supply and the VLM10 meter. It is recommended to use an Omron S8VM-10024CD or S8VM-10024C +24V DC power supply to supply power to the VLM10 meter and achieve the best noise performance.

FIGURE 3: VLM10 DC POWER SUPPLY WIRING EXAMPLE



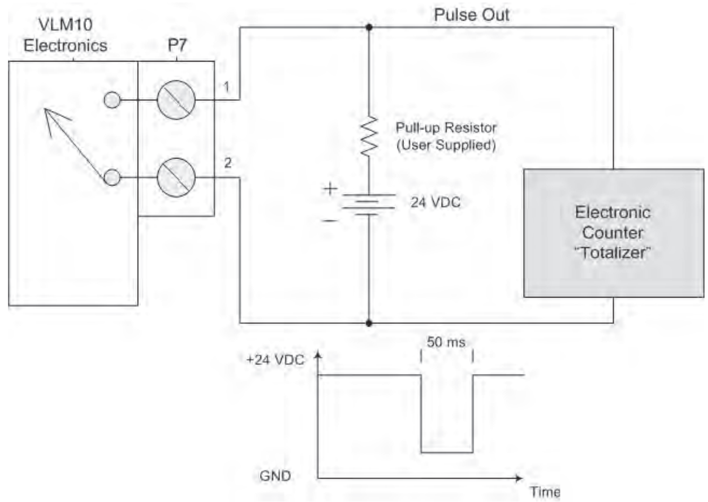
Pulse-Out

The pulse output provided by the VLM10 meter is implemented with a solid-state relay. The relay has two contacts. When the relay is closed, a contact closure is formed permitting the flow of current. When the relay is open, no current is permitted to flow.

The maximum pulse output relay current must not be exceeded. A current limiting resistor is required to limit current through the relay. A 2k, 0.5W resistor is recommended on a +24V supply. The pulse output is galvanically isolated from the DC supply reference and chassis inside the VLM10 electronics. If the on-board supply is used to bias this circuit, the electrical isolation will be defeated. The on-board supply positive is available on pin 5 of P7 and its reference is available on pin 6 of P7.

Figure 4 shows an example of wiring the pulse output circuit to an external totalizer using an external supply

FIGURE 4: VLM10 PULSE OUTPUT WIRING EXAMPLE



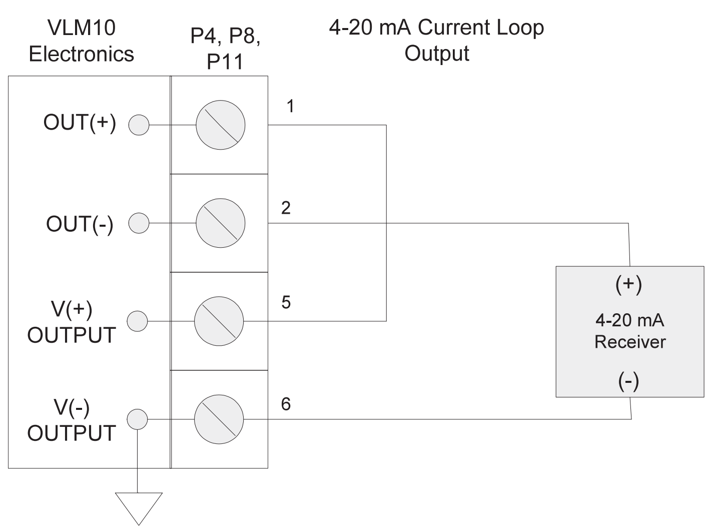
4-20mA Current Loop Outputs

The VLM10 meter provides up to three 4-20mA output channels. These are 2-wire current loop connections that regulate current through the loop based on a flow parameter and scale. Each 4-20mA output is galvanically isolated from the DC supply reference and chassis. If the on-board supply is used to power these circuits, the electrical isolation will be defeated.

Figure 5 illustrates the use of the on-board supply to power a 4-20mA current loop. The 4-20mA output, OUT (+), is connected to the V (+) OUTPUT terminal. The 4-20mA output, OUT (-) is connected to the 4-20mA receiver positive input terminal. The receiver return current should complete the loop and connect to the V (-) OUTPUT terminal.

Alternatively, an external supply can be used to supply loop power by replacing the connections to the V (+) OUTPUT and V (-) OUTPUT terminals with an external supply.

FIGURE 5: VLM10 4-20mA OUTPUT WIRING EXAMPLE



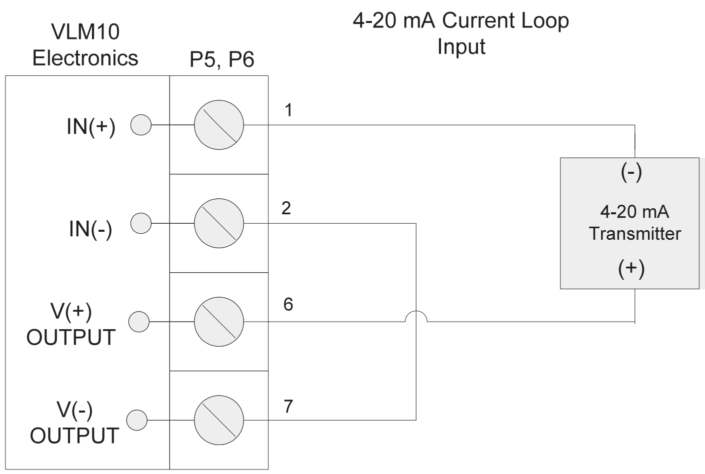
4-20mA Current Loop Inputs

The VLM10 meter provides up to two 4-20mA input channels. These are 2-wire current loop connections that measure the current flowing through the loop. Each 4-20mA input is galvanically isolated from the DC supply reference and chassis. If the on-board supply is used to power this circuit, the electrical isolation will be defeated.

Figure 6 illustrates the use of the on-board supply to power a 4-20mA current loop. The V (+) OUTPUT terminal is connected to the positive input of a 4-20mA transmitter. The 4-20mA input, IN (+), is connected to the negative side of the 4-20mA transmitter. Current is passed measured and passed through the 4-20mA input channel and then returned to the V (-) OUTPUT terminal.

Alternatively, an external supply can be used to supply loop power by replacing the connections to the V (+) OUTPUT and V (-) OUTPUT terminals with an external supply.

FIGURE 6: VLM10 4-20mA INPUT WIRING EXAMPLE

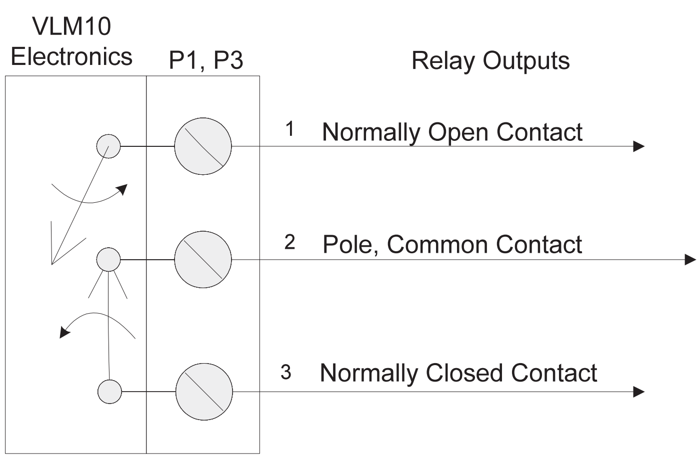


Relay Output

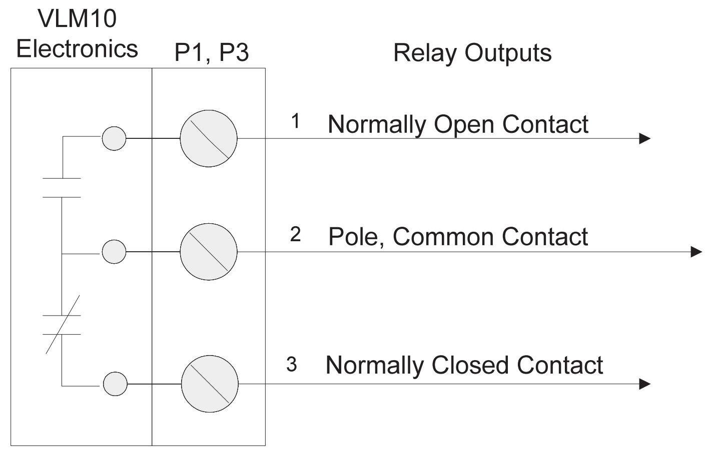
The VLM10 meter provides up to two single-pole double-throw relay channels. These channels are implemented using solid-state relays, each with a common, normally-closed and normally-open contact. Each relay channel is galvanically isolated from the DC supply reference and chassis. If the on-board supply is used to bias this circuit, the electrical isolation will be defeated.

Figure 7 illustrates the function of each relay channel with its corresponding pin-out.

FIGURE 7: VLM10 RELAY CIRCUITRY



An alternate view of the relay contacts is shown below:



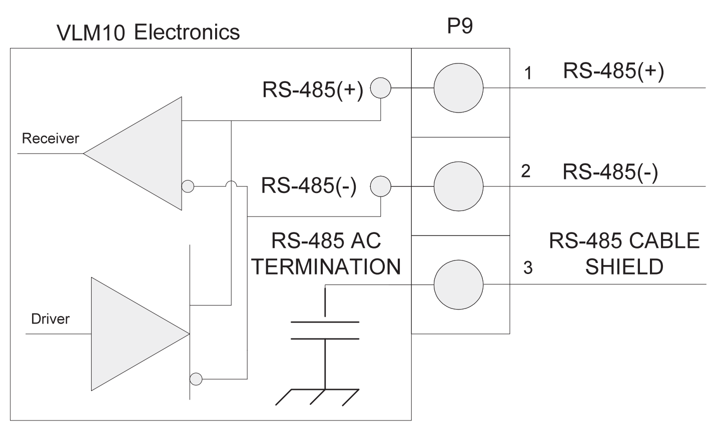
User RS-485 Communications

The VLM10 meter provides a 2-wire, half-duplex, RS-485 communications channel that can be used as a Modbus RTU or BACnet interface. This RS-485 channel is galvanically isolated from the DC supply reference and chassis.

For noise immunity, while using the user RS-485 link, AC termination to chassis is provided on-board the VLM10 electronics for the RS-485 cable shield. It is recommended to terminate the cable shield at both ends. At the VLM10 electronics, terminate the RS-485 cable shield to the shield termination terminal, P9 pin 3, which is AC coupled to chassis. The DC galvanic isolation provided by the AC shield termination is rated to 1kV peak. At the other end of the user RS-485 cable, terminate the shield directly to earth. This will improve performance in noisy environments, and the AC coupling will block low-frequency currents commonly seen in ground loops. Note: the VLM10 electronics enclosure must be connected to earth ground for effective termination.

The RS-485 bus requires 120Ω termination. If the bus is not terminated, it is possible to terminate the RS-485 bus with 120Ω by populating jumper P10 on the terminal board. When P10 is populated with a jumper, 120Ω is placed across RS-485(+) to RS-485(-). When P10 is open, not populated, there is no resistance placed across RS-485(+) to RS-485(-) and termination is required elsewhere. Figure 8 illustrates the RS-485 driver and pin-out.

FIGURE 8: VLM10 USER RS-485 CIRCUITRY AND CONNECTOR PINOUT



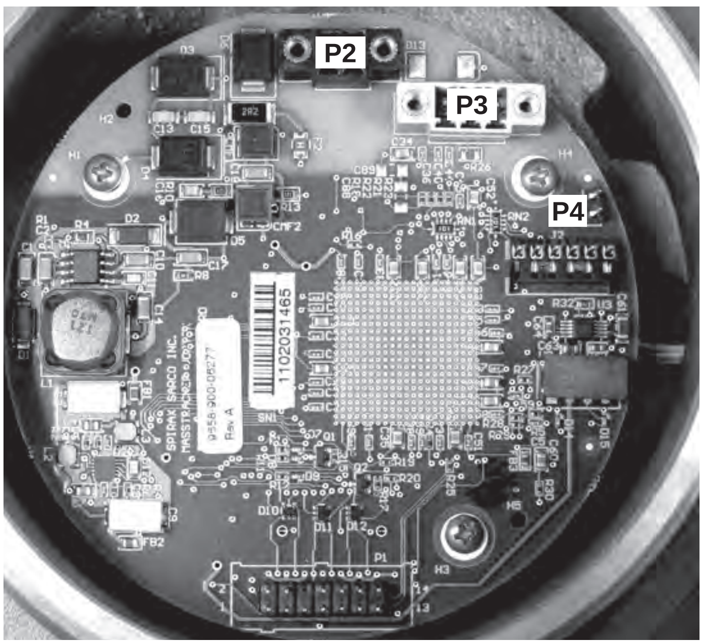
Ethernet

The Ethernet connection is standard 10/100 BaseT. Shielded twisted pair (STP) cable of category 5 or greater is recommended. The termination is a standard RJ45 jack accessible through the cut-out in the terminal board, and can be connected to with readily available shielded Ethernet cables or patch cords.

Remote Mount Electronics

Connection of the remote slave, pipe-mount wiring is made on the remote slave electronics terminal board. To access the remote slave terminal board, remove the cover on the remote electronics enclosure. The remote slave terminal board provides two, pluggable screw-terminal connectors to simplify wiring. Before wiring, be sure to turn-off power to the VLM10 meter, remote slave electronics and all interfaces connecting to the meter. ESD safe procedures must be followed to avoid damage to the electronics. Refer to Figure 9 for a diagram of the remote slave terminal board.

FIGURE 9: VLM10 REMOTE SLAVE, PIPE-MOUNT TERMINAL BOARD DIAGRAM



Remote Slave Connector Pinouts

Table 3 defines the mapping of connectors on the remote slave terminal board.

For all pluggable screw-terminals, pin #1 is indicated on the printed circuit board by the location of the reference designator, which is adjacent to pin #1.

TABLE 3: MAPPING OF CONNECTORS TO CIRCUITS AT REMOTE SLAVE

CONNECTOR REFERENCE DESIGNATOR	CIRCUIT
P2	DC SUPPLY INPUT
P3	RS-485 REMOTE LINK
P4	RS-485 TERMINATION JUMPER

P2: REMOTE SLAVE - DC SUPPLY INPUT CONNECTOR

PIN #	SIGNAL
1	V(-) INPUT, DC SUPPLY REFERENCE
2	V(+) INPUT, DC SUPPLY POSITIVE

P3: REMOTE SLAVE - RS-485 LINK

PIN #	SIGNAL
1	RS-485(+) POSITIVE
2	RS-485(-) NEGATIVE
3	RS-485 REFERENCE

Remote Link RS-485 Communications

The VLM10 meter provides a 2-wire, half-duplex, RS-485 communications channel that is intended exclusively for remote mount communications between the remote master (main electronics enclosure) and the remote slave (pipe mount meter). This RS-485 channel is galvanically isolated from the DC supply reference and chassis at both the remote master and remote slave electronics.

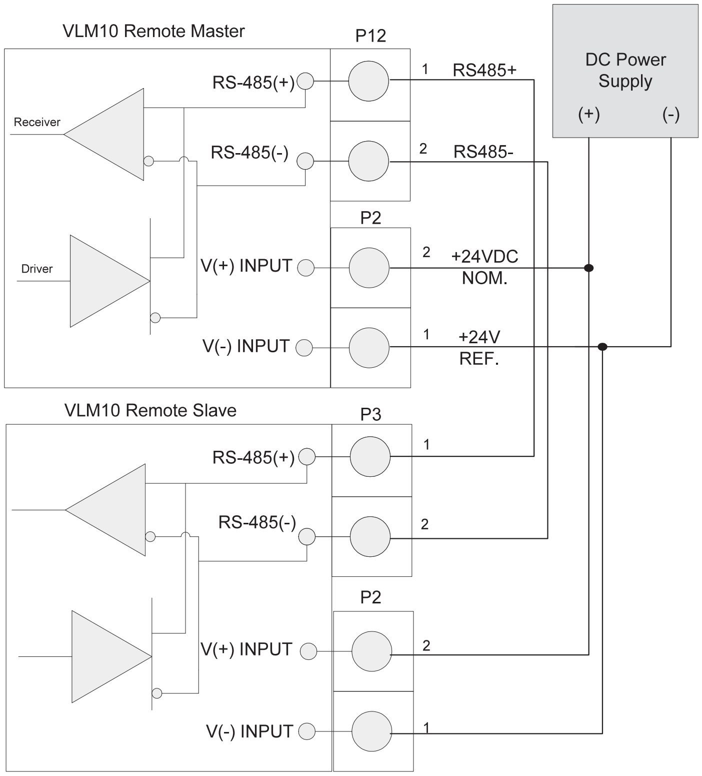
The RS-485 bus requires 120Ω termination. By default, the remote slave electronics comes from the factory pre-terminated with 120Ω termination. This is accomplished by populated the jumper P4 on the remote slave terminal board.

In addition to RS-485 communications, power must be supplied to the remote slave electronics. The remote slave electronics have the same DC power requirements as the remote master electronics. It is recommended to power the remote slave electronics by wiring in parallel with the DC power supply used to supply power to the remote master (main electronics). This can be accomplished by using an adapter that connects between the DC power supply, remote master terminal board and the remote slave cable; or by twisting wires from the DC power supply together with wires from the remote cable and inserting them into the power connector on the remote master terminal board. Screw terminals can also be used to wire the DC power to the remote master and remote slave electronics in parallel.

It is recommended to use one cable to wire power and RS-485 between the remote master and remote slave electronics. See the recommended cables section above.

Refer to Figure 10 for a wiring diagram that illustrates the proper connection of the remote electronics.

FIGURE 10: VLM10 REMOTE ELECTRONICS WIRING DIAGRAM



Ethernet

The Ethernet connection is standard 10/100 Base T. Shielded twisted pair (STP) cable of category 5 or greater is recommended. The termination is a standard RJ45 jack accessible through the cut-out in the terminal board, and can be connected to with readily available shielded Ethernet cables or patch cords.

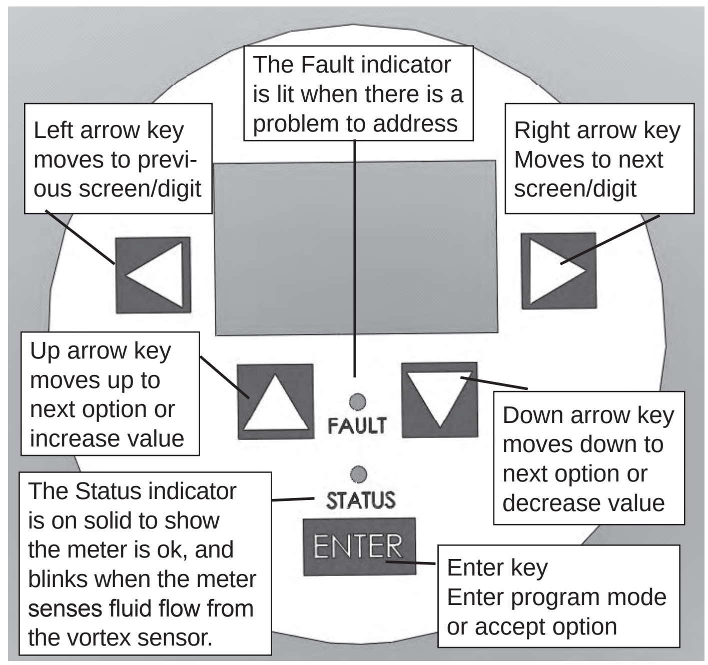
5. VLM10 Front Panel Interface

This chapter describes the VLM10 front panel interface.

The front panel consists of a display and 5 keypads. The keypads are actuated only by the presence of a magnetic field. A magnetic wand is included with each meter to activate the keypads. Each keypad has a green LED behind it. When the keypad senses the magnetic wand over it, a green LED behind the keypad will turn on.

NOTE: Holding the wand over a key will not actuate the key – the key LED must turn on, and then off to be sensed as a valid key press by the meter.

Use the up and down arrow keys to select (highlight) an option from the display menus. When the desired option is selected, pressing the enter key or right arrow key enters the next menu. To go back to a previous menu, press the left arrow key.

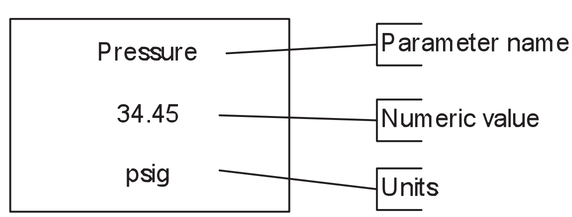


Run Mode

The Front Panel interface has 2 operating modes: Run and Programming. After power-up, the meter enters Run mode. In this mode, individual flow data is displayed on separate screens.

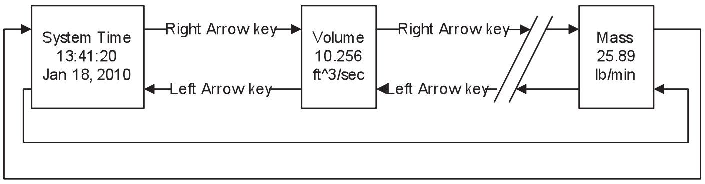
Each screen has the same format. The top line describes the measurement name, the middle line is the numerical value of the measurement, and the bottom line contains the measurement units.

Run Mode Screen



The user can select which screens are displayed from the Set Display Options menu in Programming mode.

Run mode cycles through each screen automatically, pausing for 5 seconds between screens. It is also possible to use the left or right arrow keys to move between screens.



When the front panel has not detected any key activity for 10 minutes, it turns off the display and enters "sleep" mode. In sleep mode, the display will turn on for 15 seconds every 5 minutes. Pressing any of the arrow keys will exit the display sleep mode. The meter will still calculate flow parameters, and the fault and status LED indicators will still be active in display sleep mode.

A yellow indicator (FAULT) on the front panel turns on when a fault is detected. A fault screen will also display for 5 seconds with a description of the latest fault. To clear the fault the user must enter Programming mode and select the View/Clear Faults menu.
A green indicator (STATUS) on the front panel blinks fast to indicate the unit senses fluid flow. The STATUS indicator blinks slowly when the meter detects no flow.

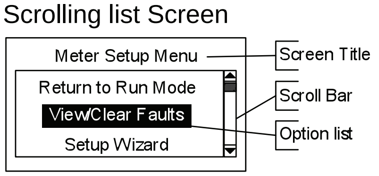
Program Mode

To enter Program mode, the user must tap the Enter key with the magnetic wand 5 times. When the unit enters program mode, the Meter Setup menu will appear.

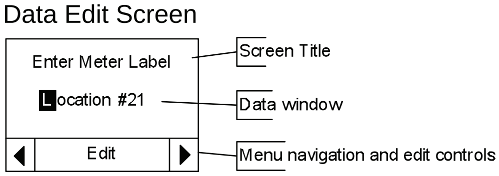
In Program mode, there are two different types of displays. The first type is a scrollable list of selectable menu items. When the desired item is selected, pressing the right arrow or enter key goes deeper into the menu. A vertical slider bar located on the right side of the screen shows the relative position of the cursor in the list.

The second type contains a display window and a bottom line for viewing or editing operations. The bottom line has 3 selectable fields, a left arrow, text, and a right arrow. Selecting the left arrow and pressing enter returns to the previous screen. Selecting the right arrow and pressing enter proceeds to the next screen. The text field tells the user what action can be performed at this screen.

Scrolling list Screen



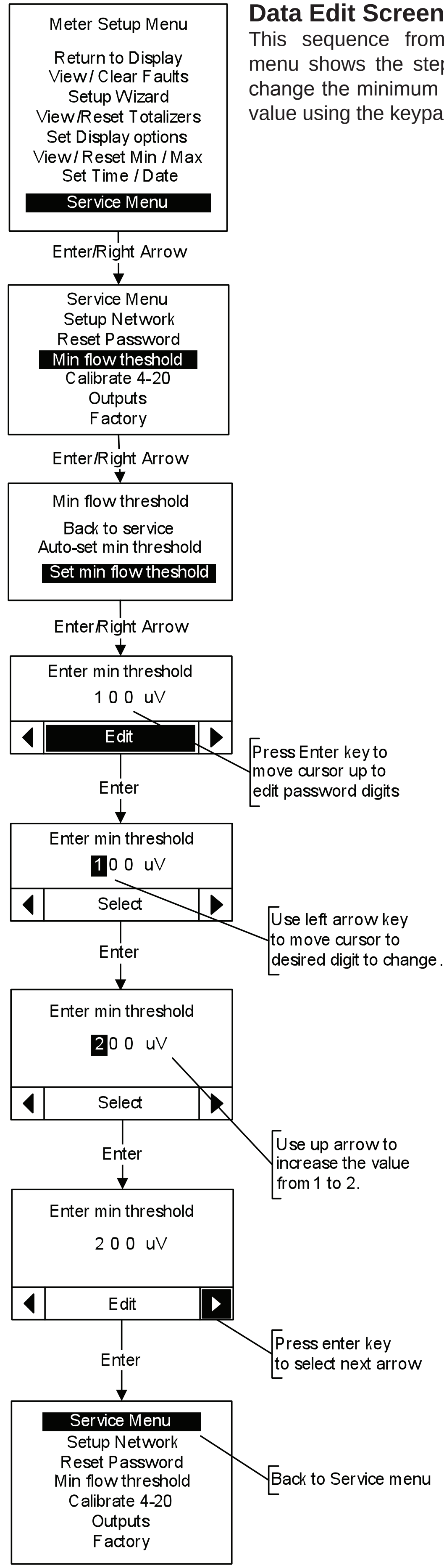
Data Edit Screen



NOTE: If the meter does not detect a key press for 5 minutes, it will revert back to Run mode.

Data Edit Screen example

This sequence from the Service menu shows the steps required to change the minimum flow threshold value using the keypad.

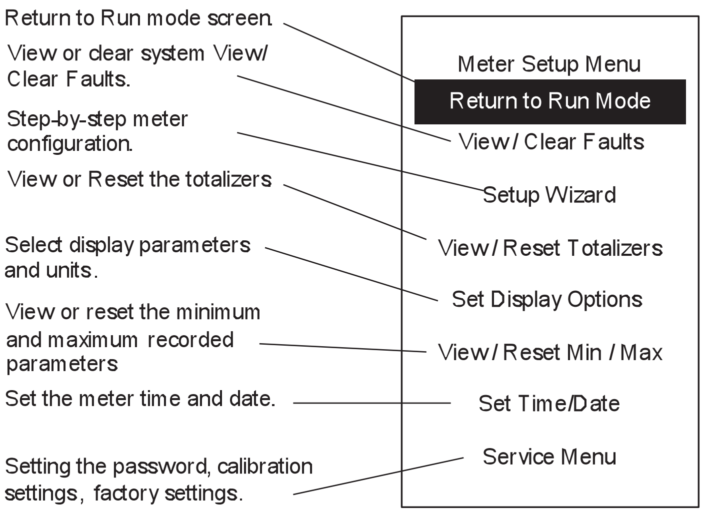


Program Mode Menus

The Meter Setup Menu is the first menu in Programming Mode. To access one of the sub-menus, select the menu using the up or down arrow keys and then press the enter or right arrow key.

The sub-menus are described below in the sequence in which they appear in the Main Menu.

The user can return to Run mode by selecting the "Return to Run Mode" item.



The following pages show how to navigate the sub-menus. To make this process simple and clear, duplicate paths through the menus are not shown, and the scrolling list screens are not shown with the scroll bar or navigation fields.

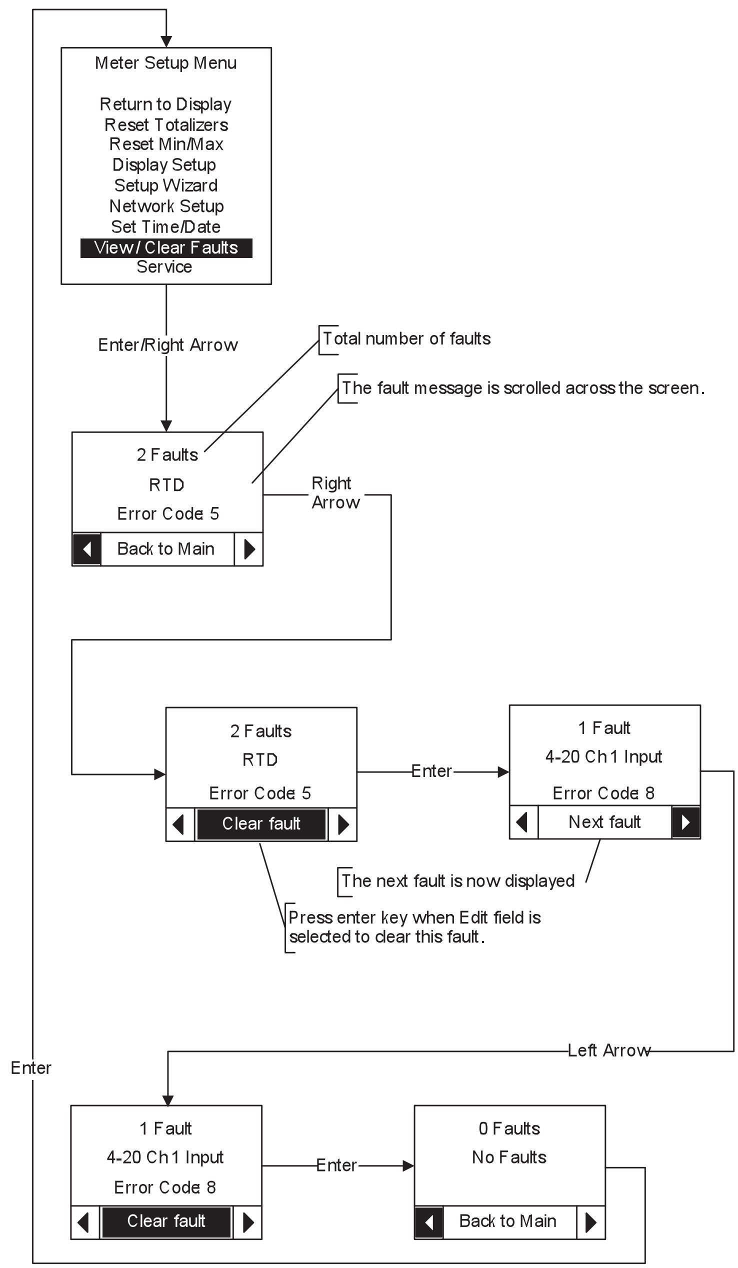
View / Clear Faults

In this menu the user can view and/or clear the meter faults. Each fault has a code number and a message that describes the details of the fault.

A list of faults is stored in memory. Some faults are "latched" which means they must be cleared from the list by the user.

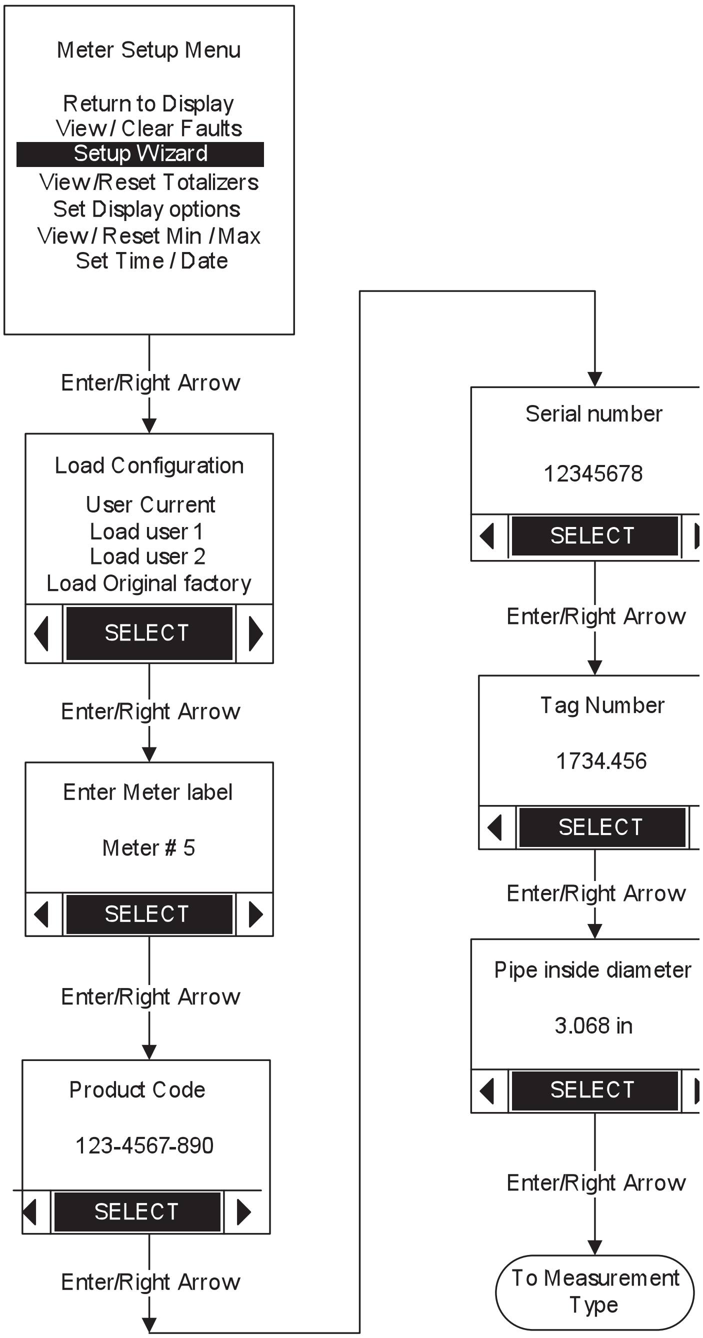
The fault indicator on the front panel will turn on if any faults are detected, and will not turn off until all faults have been corrected and cleared from the list.

If a fault condition is occurring continuously, the fault will not clear until the cause of the fault is corrected.



Setup Wizard (General settings)

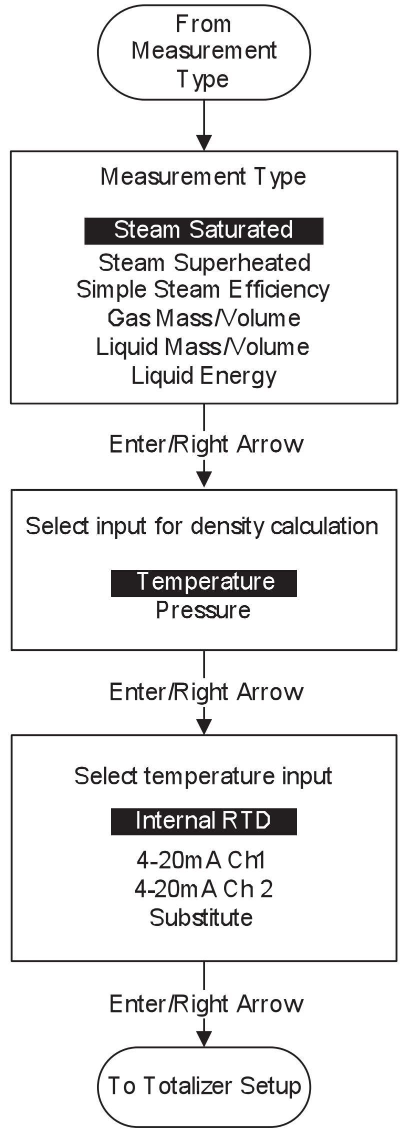
This menu assists the user in setting up the meter. This menu starts by asking the user to select one of 4 configurations. If the meter is to be run in a single configuration, it is best to load the User Current configuration and save it back to the Current configuration at the end of the setup wizard. The Original factory configuration cannot be over-written. The following screens let the user enter a Meter label and tag number – the Product code, serial number, and Pipe inside diameter are not editable by the user.



Setup Wizard (Measurement type)

This menu lets the user select the type of measurement and configure the sensor inputs.

Shown below is a sequence to configure the meter for measuring saturated steam.



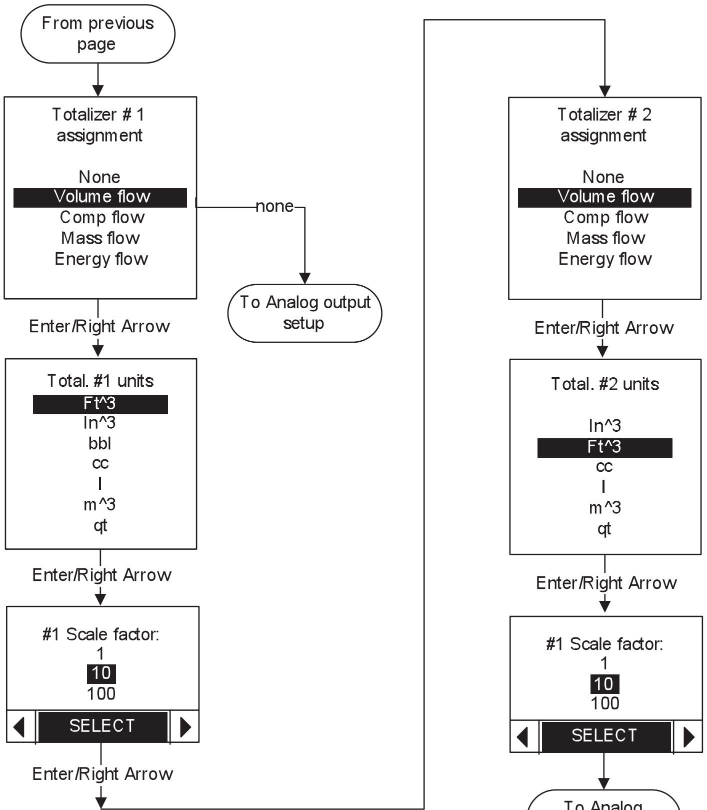
If Saturated Steam is selected, the meter can use either Temperature or Pressure to calculate the steam density using the saturated steam tables.

By selecting Temperature and the Internal RTD a separate transmitter is not required to calculate the steam density.

Simple Steam Efficiency measurement type calculates steam system energy use by measuring steam flow, temperature (with internal RTD), and return temperature of condensate.

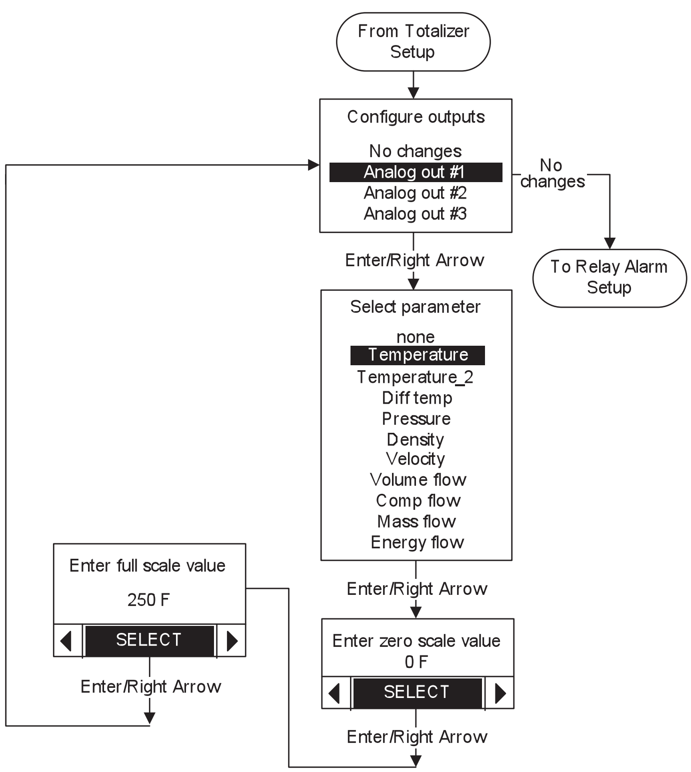
Setup Wizard (Totalizer assignment)

This menu lets the user configure the 2 totalizers. Note that any changes to a totalizer configuration will result in the resetting of the original totalizer value to zero.



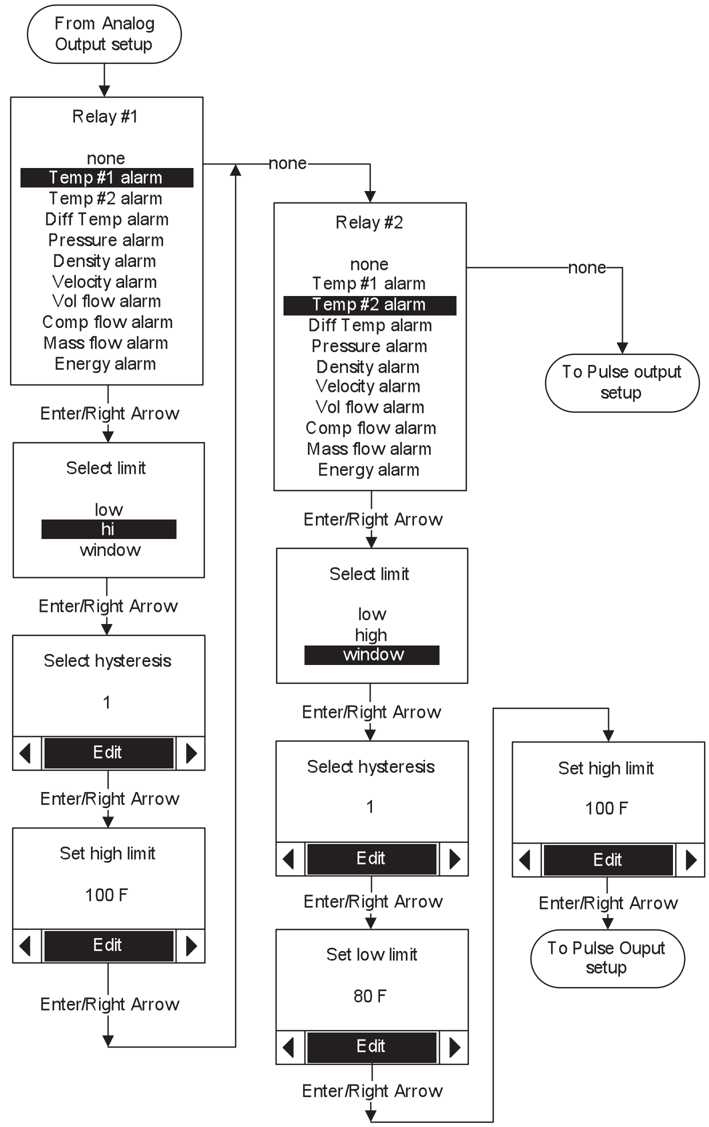
Setup Wizard (Analog outputs)

This menu lets the user configure the three analog outputs.



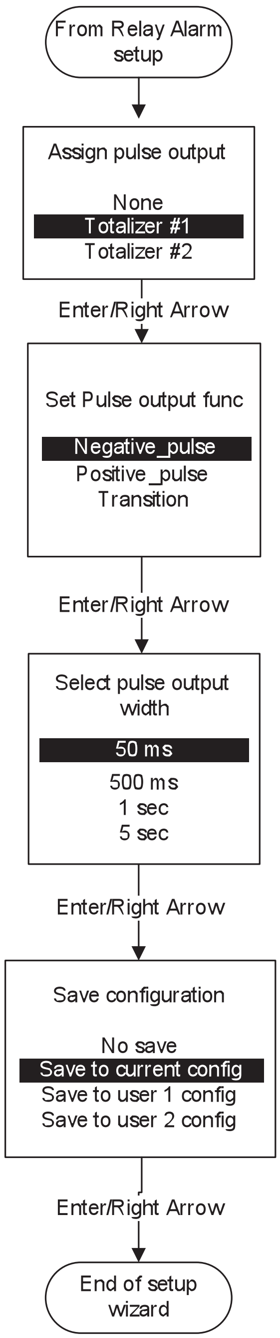
Setup Wizard (Relay alarms)

This menu lets the user configure the 2 alarms. These alarms actuate the meter relay outputs. Note that the Relay alarm function is a purchased option, and this menu will only display if enabled.



Setup Wizard (Pulse output totalizers)

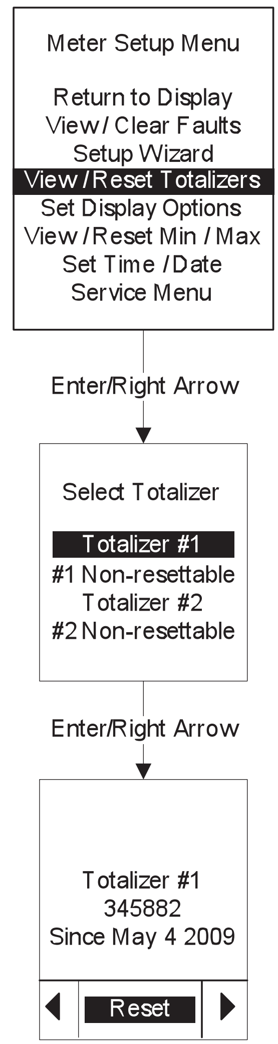
This menu lets the user configure the pulse output.



Reset Totalizers

Allows the user to view all totalizers and to clear the resettable totalizers.

There are 4 totalizer values shown in this menu, only the resettable totalizers can be reset to zero. The non-resettable totalizers can be viewed in this menu, but not reset to zero. The non-resettable totalizers are only resettable through the Service menu via the factory password.

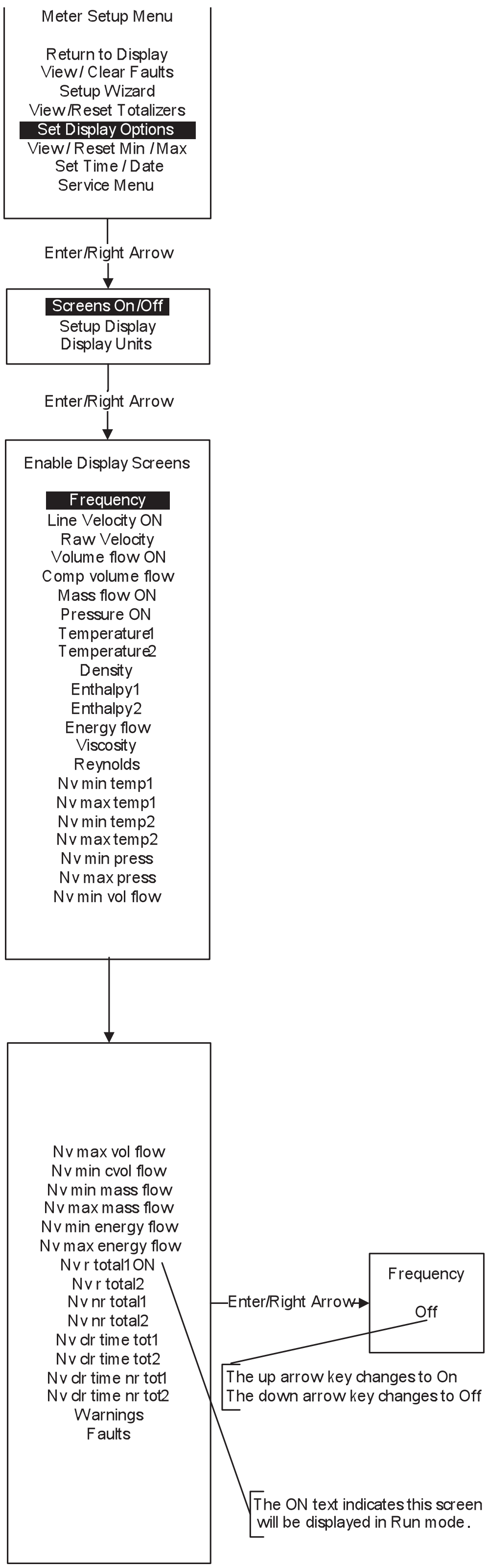


Display Setup (Screen Selection Menu)

This Display Setup has 2 sub-menus: Screens On/Off, and Display Units.

Screens On/Off - allows the user select which parameter screens they want to see during Run mode.

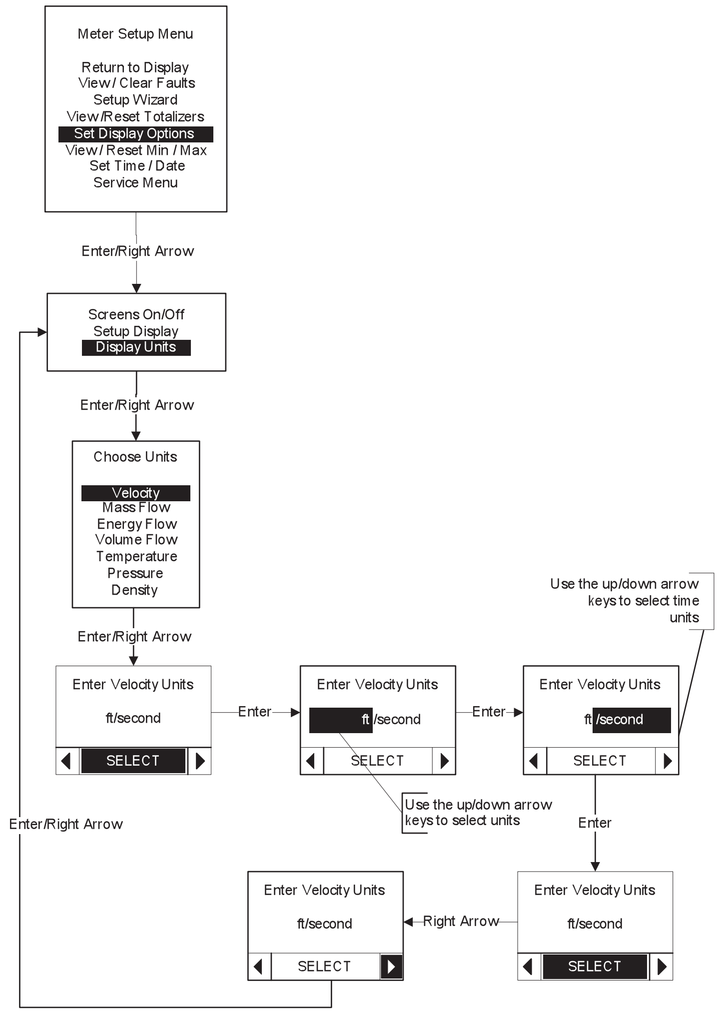
Display Units - allows the user configure different output units.



Display Setup (Display Units Menu)

Display Units allows the user configure the engineering unit and the time element.

In this example the user is reviewing the Velocity and may change either the engineering unit (ft), and the time element (second)



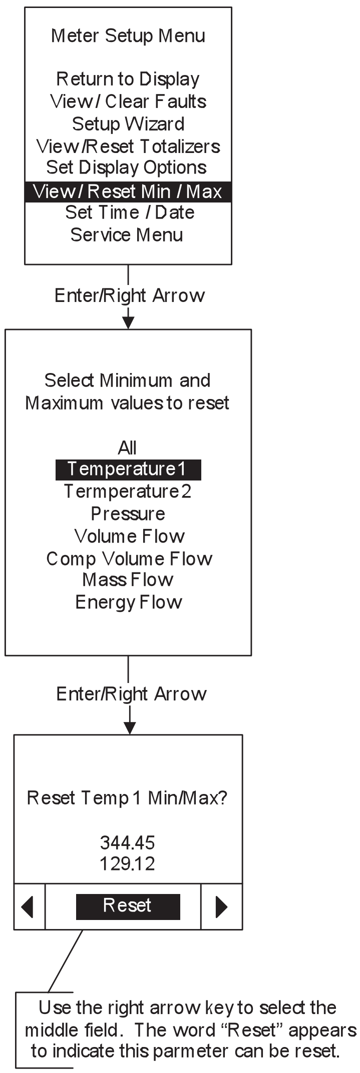
Reset Min/Max

The Reset Min Max allows the user to view and/or reset the minimum/maximum parameters.

The user can reset all simultaneously or individually. After a reset, the min and max values will be nearly equal.

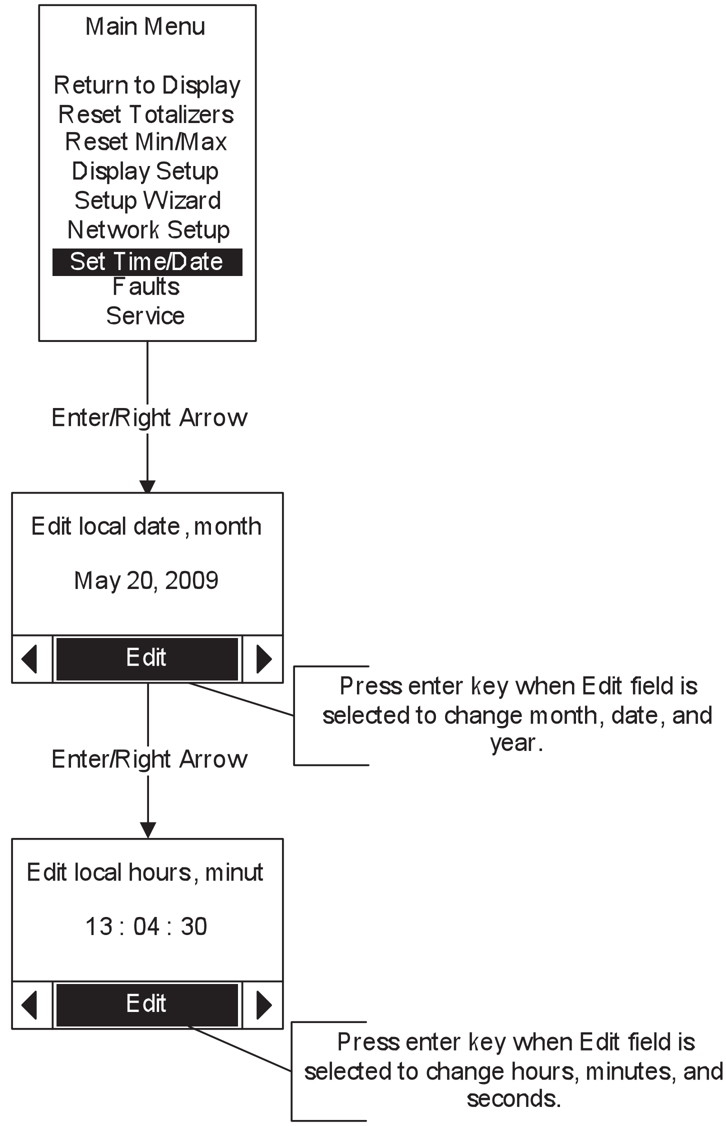
The example below shows resetting the minimum and maximum temperature values for the first temperature sensor (Temperature 1).

The Reset Temp 1 Min/Max screen shows the maximum measured value (line 2) and the minimum measured value (line 3).



Set Time/Date

Allows the user adjust the month, date, year, and local time. Note that the meter will restart after completing this menu.

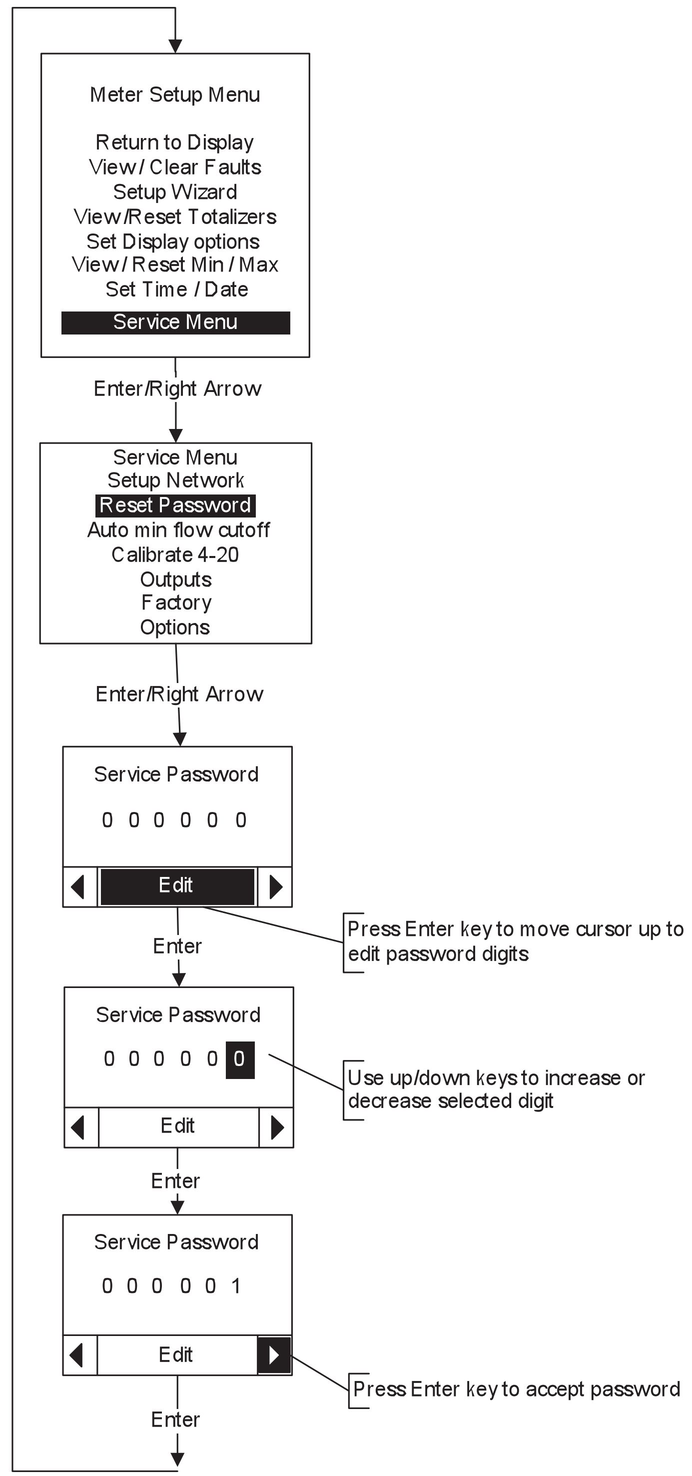


Service Menu

This menu lets the user change the password, perform analog input/output calibration, test the relay and pulse outputs, and clear the non-resettable totalizers.

Reset Password

The screen below demonstrates how the user Resets the Password. The Password must be six digits, all numeric. The default Password is 000000.



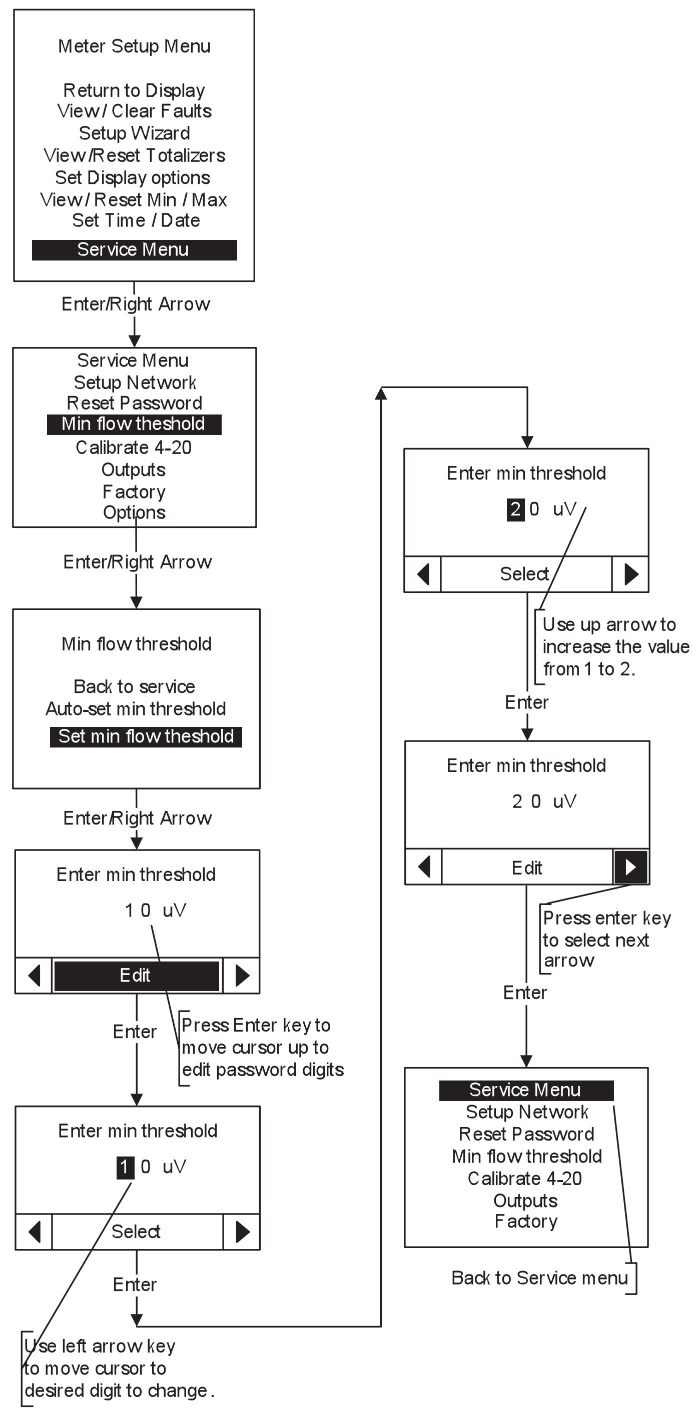
Minimum flow threshold

This allows the user set the minimum flow threshold. The purpose of adjusting the flow threshold is to eliminate system noise.

Auto-set threshold – should be run when the meter is first installed and can only be run when there is no flow.

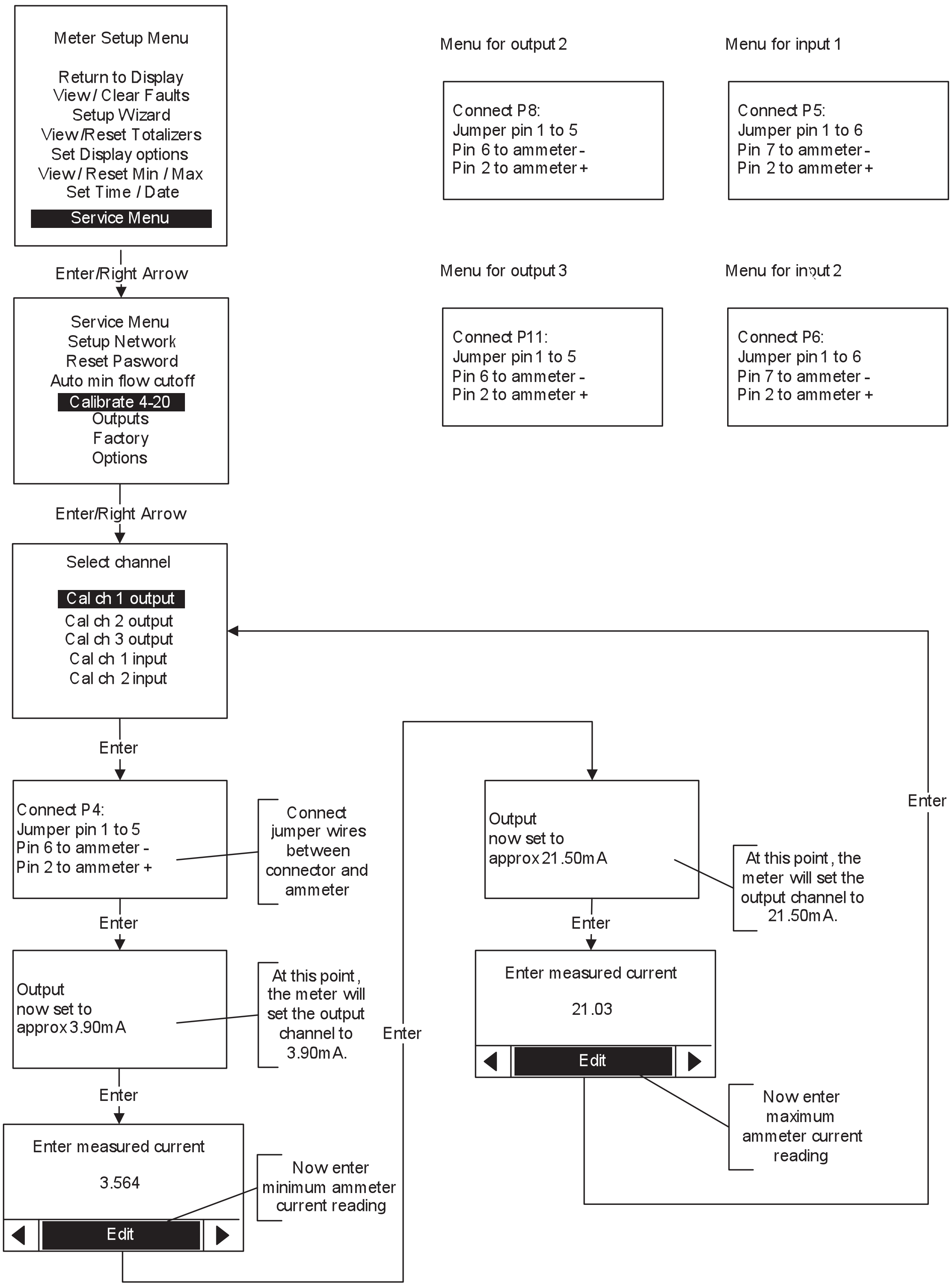
Set min flow threshold - allows the user to select the threshold value manually. This may be done to eliminate system noise, such as pumps, which are not eliminated when the Auto Threshold is run.

The minimum flow threshold values can be set between 0 – 5000. Increasing the Noise Threshold value will decrease the meter's low-end sensitivity.



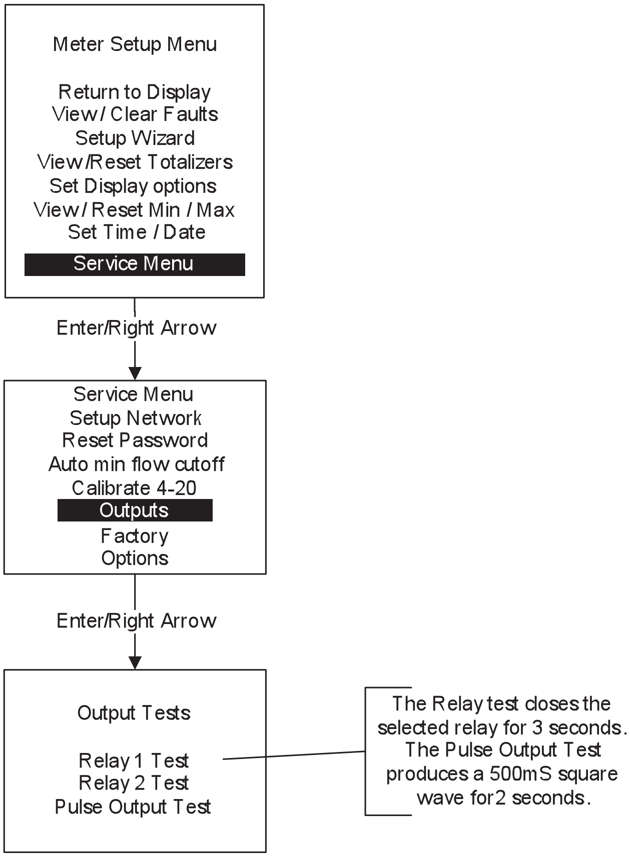
Calibrate 4-20 input/outputs

This allows user calibrate the three 4-20mA input and output channels. It requires a connection of an external ammeter to measure the calibration current.



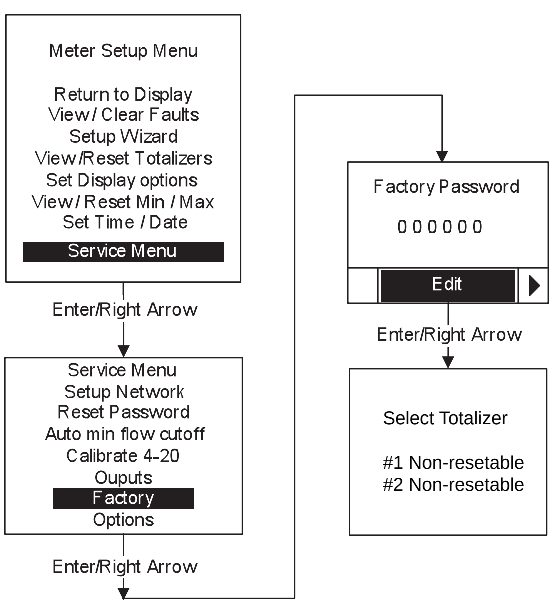
Outputs

Allows the user test the two relay alarms and the pulse output.



Factory settings

This allows a qualified service technician to reset the non-resettable totalizers using the factory password.



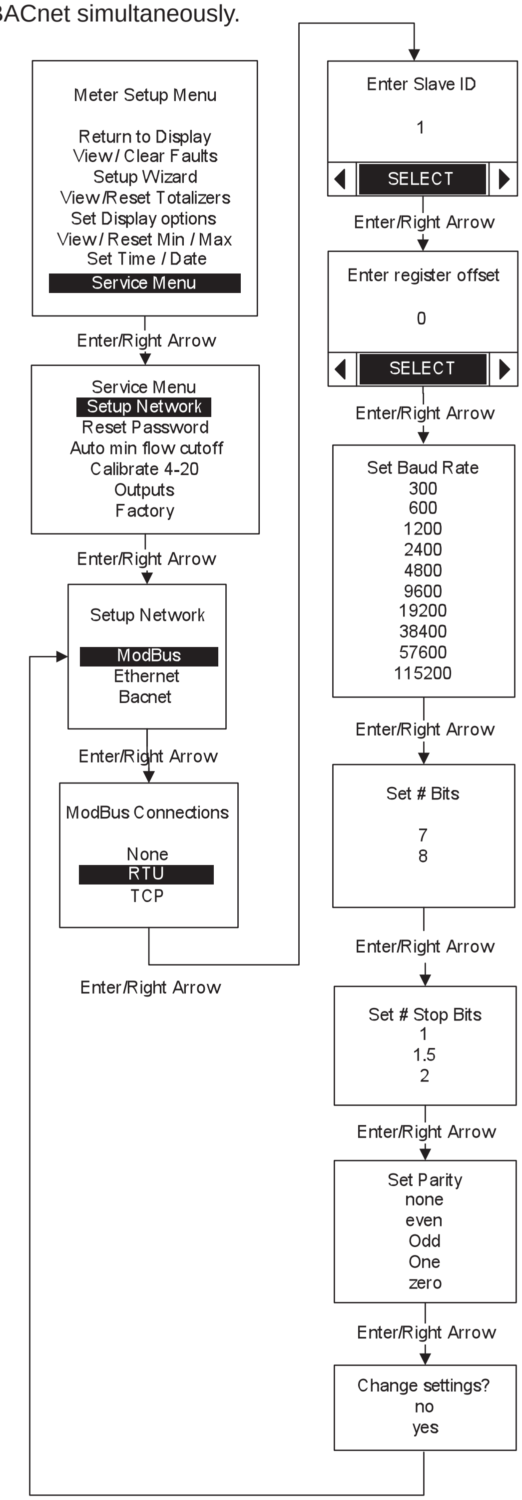
Setup Network

This allows the user set the Ethernet, Modbus, or BACnet parameters.

Note that the Modbus and BACnet interfaces are purchased options, and the menu will only display the Modbus or BACnet options if they have been enabled.

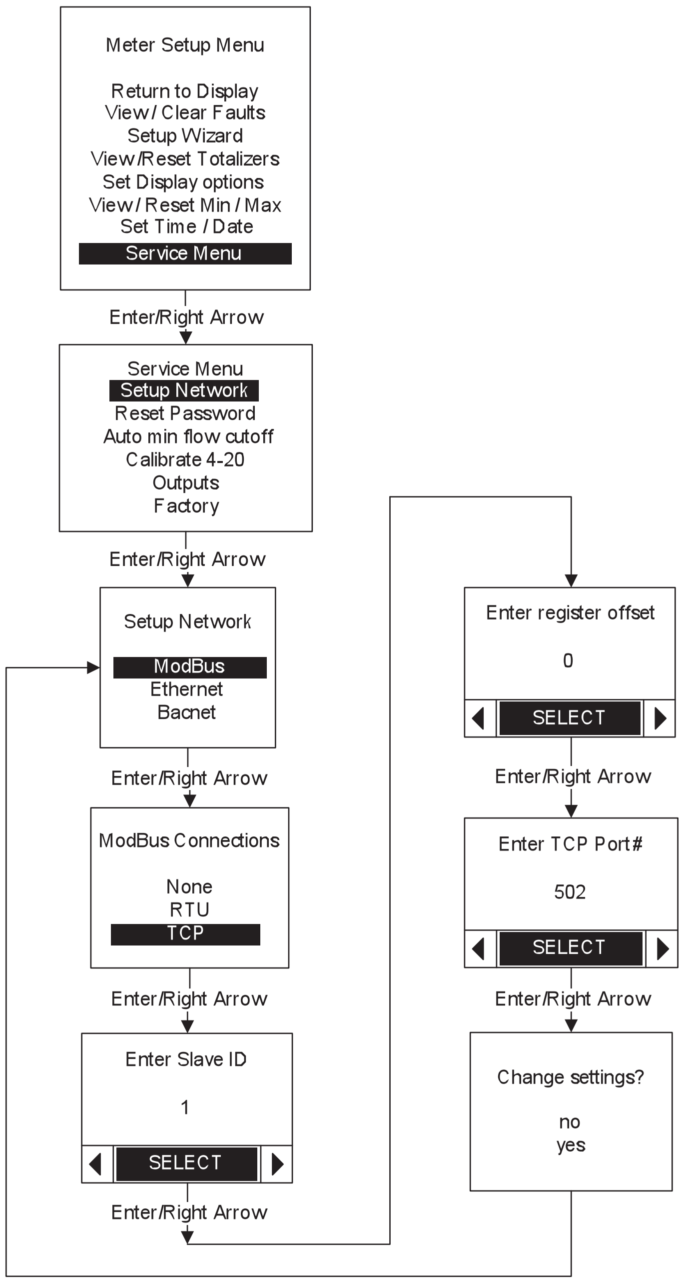
Modbus

Two kinds of Modbus interfaces are available: RTU or TCP. The RTU interface uses connector P9, which is also used for the BACnet interface; therefore it is not possible to use both Modbus RTU and BACnet simultaneously.



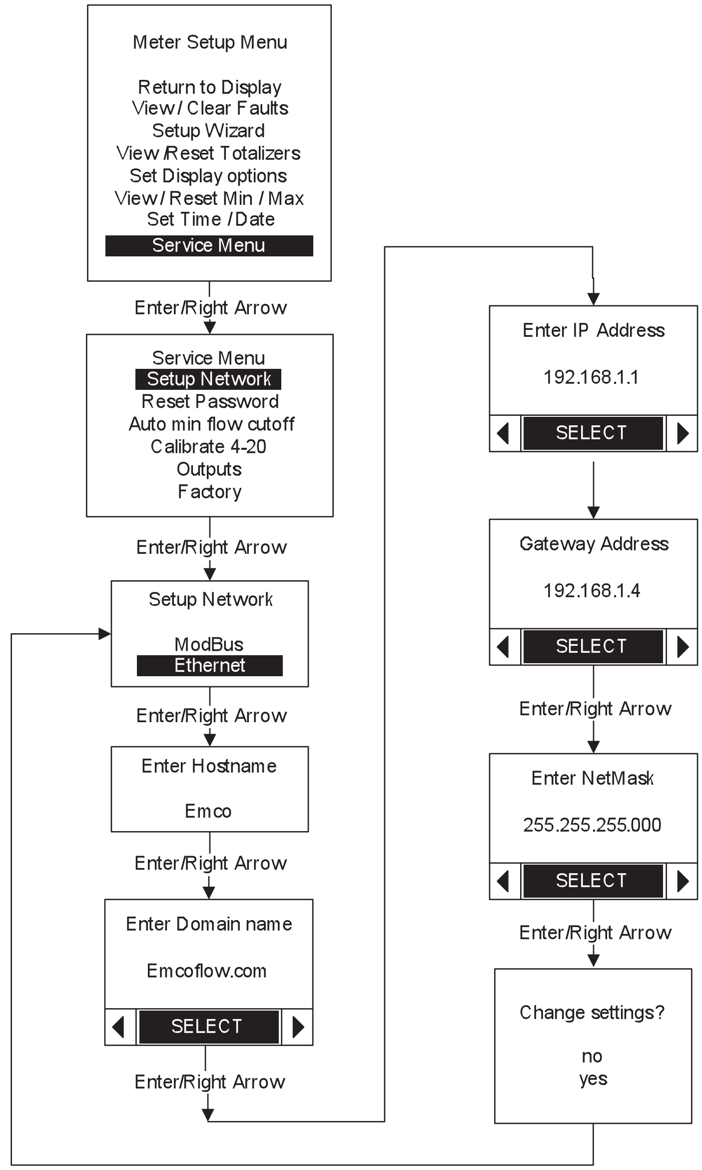
Modbus TCP

This menu shows the TCP Modbus menu. Note that the meter will restart if the user answers yes to Change settings.



Ethernet

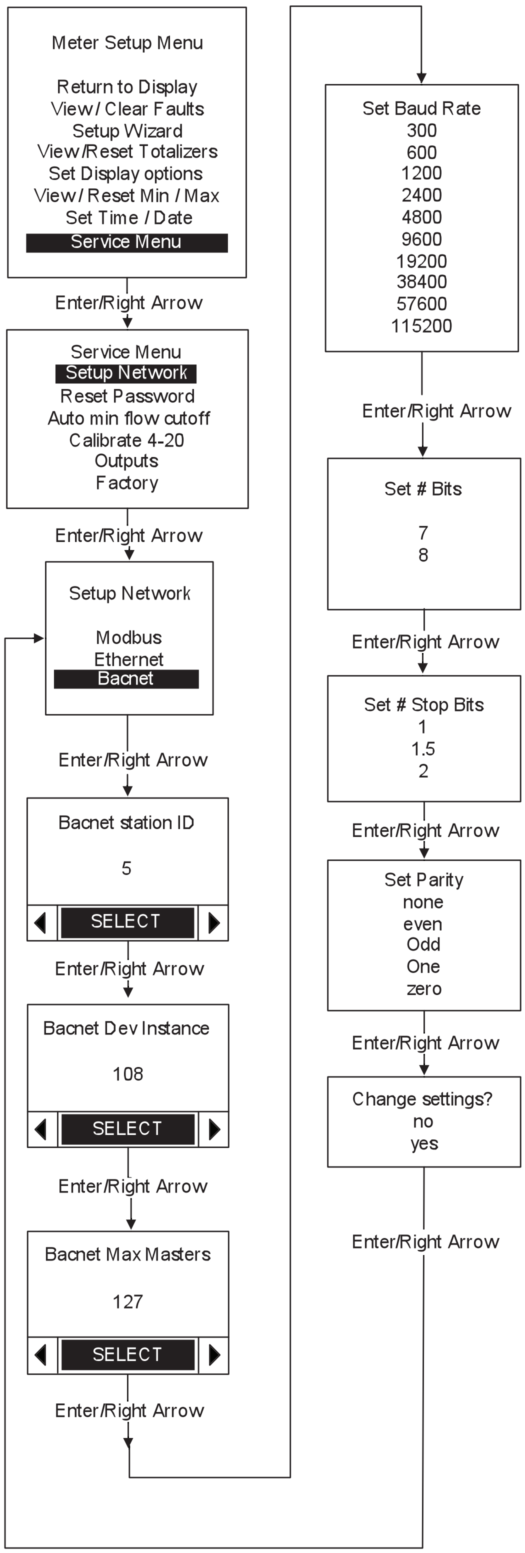
This allows the user view/change the Ethernet parameters.



BACnet MS/TP

This menu lets the user setup the BACnet MS/TP parameters.

The BACnet interface uses connector P9, which is also used for the Modbus RTU interface; therefore it is not possible to use both BACnet and Modbus RTU simultaneously.



6. VLM10 Web Interface

Introduction

The Web interface lets the user monitor and configure the meter, including inputs/outputs, using any device capable of internet access via a web browser.

The VLM10 uses static IP addressing, which means that the user must assign an IP address to the meter. This is different than using a dynamic IP addressing scheme where the network router assigns an address. The advantage in using a static address is that the IP address will never change.

For assistance in setting up a static IP address, consult the troubleshooting portion of the instruction manual.

The meter IP address is displayed on the front panel on the third line of the start-up screen as IP Addr: xxx.xxx.xxx.xxx. The meter home page is accessed by entering the IP address into a web browser address bar. For example, if the meter IP address is 192.168.6.188, then the browser address bar should read http://192.168.6.188/home.

Web Page Format

The top of the web page displays the Product and software version, along with the 4 navigation buttons. The buttons allow for navigation to other web functions.

The product code, meter location, serial number, and support information are shown at the bottom of the web page.

Clicking on the Spirax Sarco image at the top right of the web page brings up the Spirax Sarco, Inc. company website

Navigation Buttons

Home- displays the fluid being measured and the current values of the product, including any faults.

Service – allows the user to view the current configuration, view and download the log files, clear the log files and totalizers, and set or modify the noise threshold setting.

Setup - Set variables displayed on the home page, set variables the data logger will capture, set the system time, setup the Ethernet, Modbus or BACnet interfaces, and change the system password.

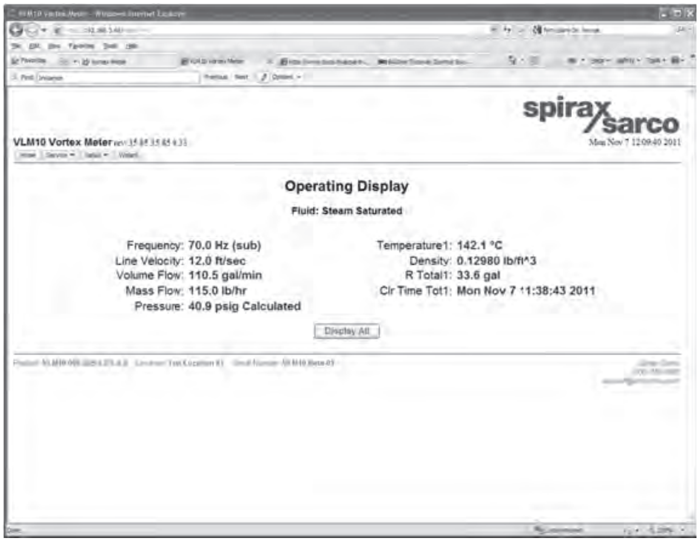
Wizard – guides the user through a complete meter configuration. This includes the fluid type, units measured, sensor inputs, and outputs.

Home Page

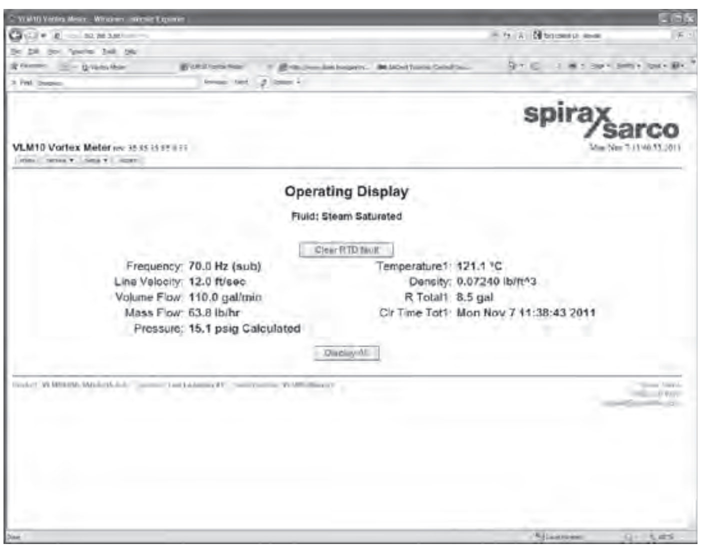
The Operating Display shows fluid measured, current values, and any faults

The values shown on the Home Page are selected using the Setup button.

The “Display All” button below the parameters will display all parameters, to display the original parameters select the “Display” button again.



An example of a system fault is shown below. This fault occurs when the meter has an RTD sensor failure. For a list of faults and fault resolution please consult the Troubleshooting section.



To clear this fault, it is necessary to fix the problem, and click on the “Clear RTD fault” button. If the fault condition has been fixed, the “Clear RTD fault” button will be removed from the home page. The time at which a fault occurred and when it was cleared is saved in the fault file, which can be viewed by clicking Service button.

Service

The Service menu has 4 drop down menus, Status, View Logs, Clear, and Noise Threshold.

Status

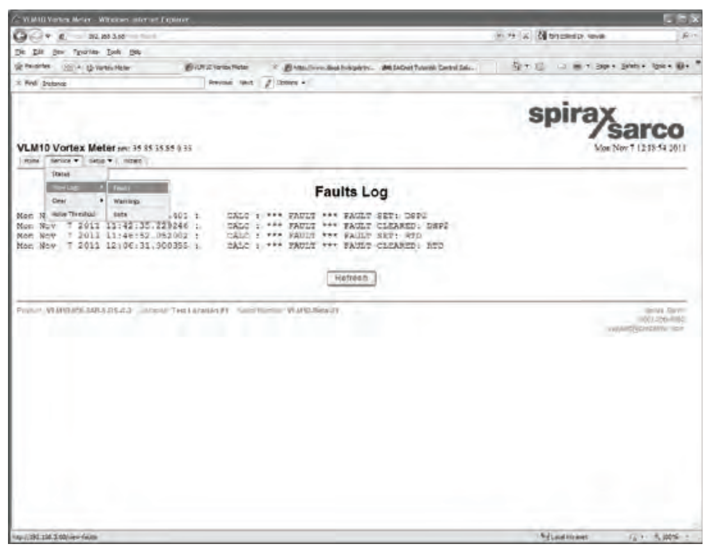
Selecting this brings up a web page that displays all configuration settings. The information on this page is read-only, and is intended as an advanced troubleshooting guide.

Service

View Logs - Faults

The Faults log contains information about the type and time at which a serious system fault occurred. When a fault occurs, the yellow fault LED on the front panel turns on, a fault will also be displayed on the Home page.

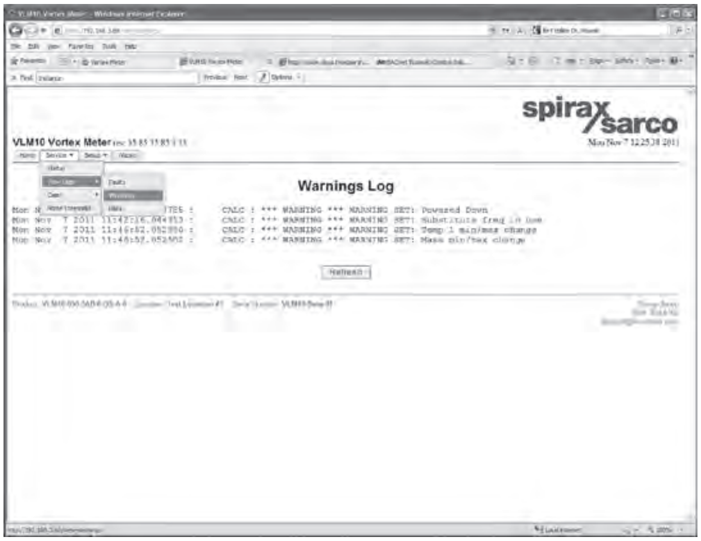
A Fault is considered to be failure that will affect the meter’s ability to accurately calculate flow parameters, and must be addressed quickly.



View Logs - Warnings

The warnings log contains general information about the meter state, such as power interruptions, min/max value changes, and relay/alarm conditions. A warning may not affect the meter’s performance, but it does indicate a condition which is not considered normal.

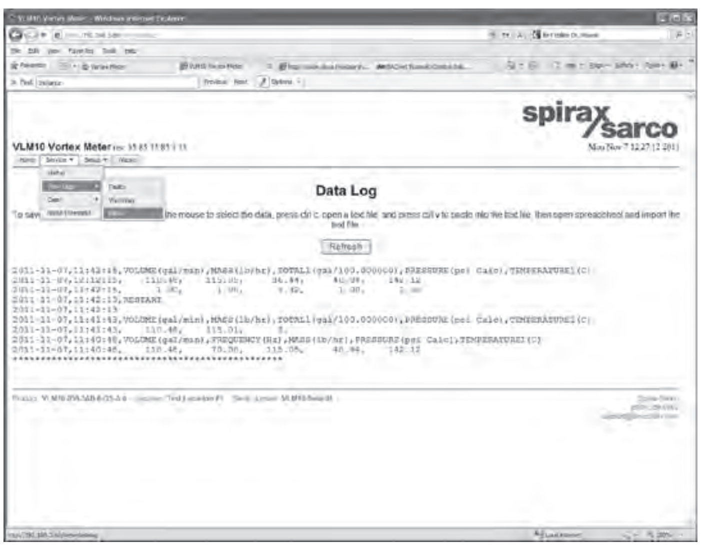
Warnings are not displayed on the front panel or the web home page, and are viewed by reviewing the Warnings Log.



View Logs - Data

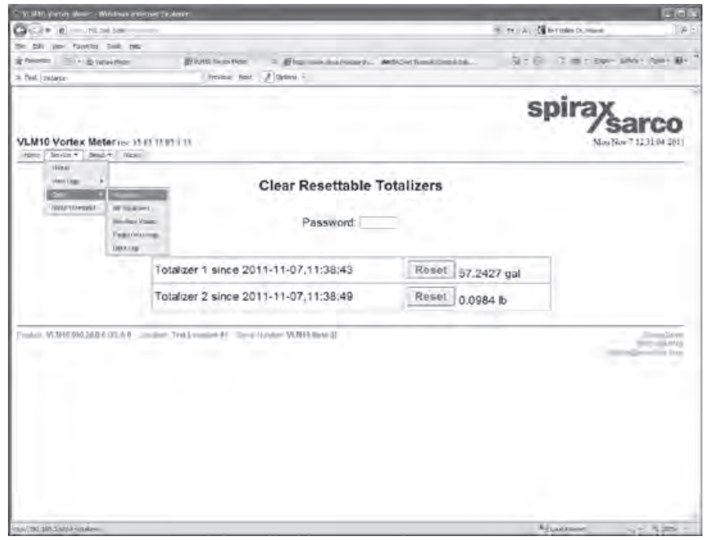
The Data Log page contains a timestamp of parameters the meter saves to the log file.

This file is in coma delimited format, to make it easy to select and copy the data to a spreadsheet. Instructions on how to download the data log file are displayed on this page.



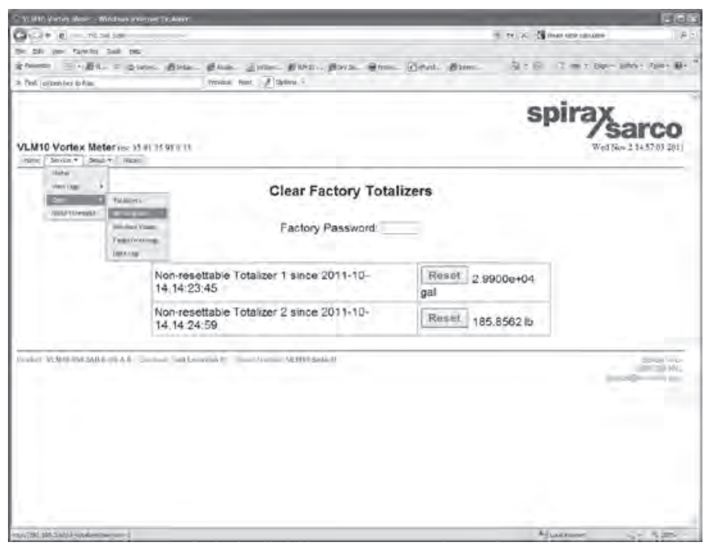
Clear - Totalizers

The clear totalizers page shows the current resettable totalizer values and times when last cleared. A user may clear up to 2 totalizers. The user must enter the system password before clearing a Totalizer. The default password is “000000”.



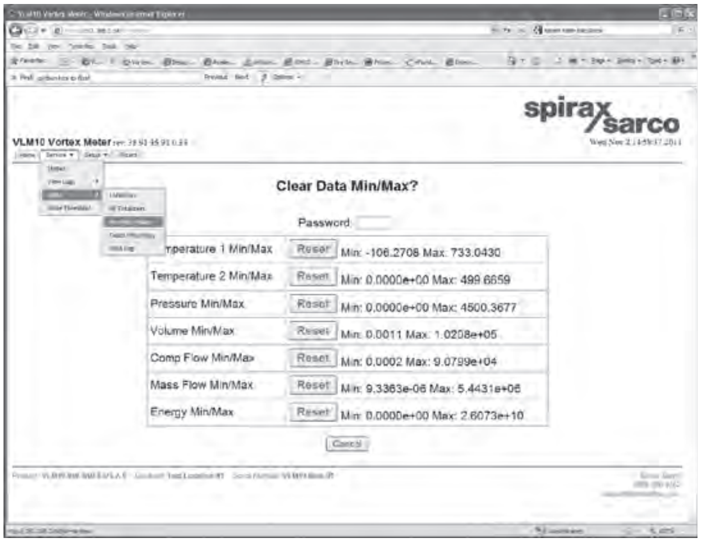
Clear - NR Totalizers

The non-resettable factory totalizers can only be reset using the factory password.



Clear - Min/Max Values

The Clear Data Min/Max page allows the user view and reset the minimum and maximum values of default runtime parameters. The system password must be entered before clicking the parameter reset button. When a parameter is reset, both the minimum and maximum values are set to the currently computed parameter value. For example, if Temperature 1 is currently at 278.0 degrees, and the Temperature 1 Min/Max reset button is clicked, both the Min: and Max: will read 278.0. After the reset, the meter will update the minimum and maximum values as they change over time.

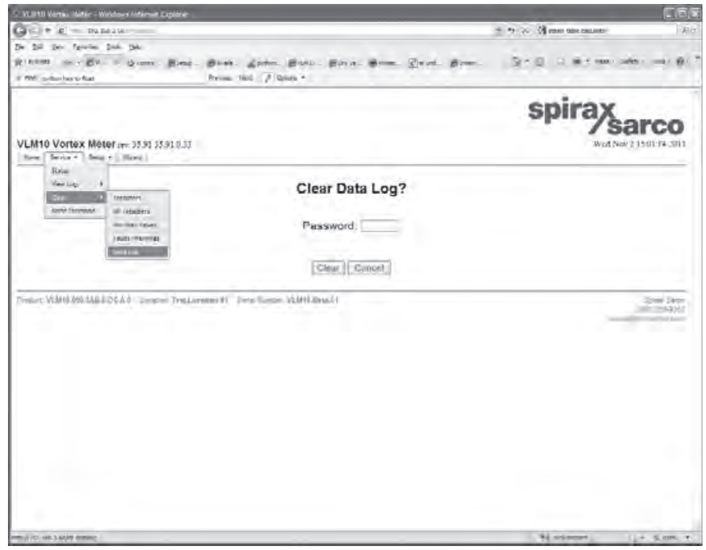


Clear – Faults/Warnings

It's also possible to Clear Faults and Warnings Log files after entering the system password.

Clear - Data Log

Clearing the data log file requires the user to enter the system password.



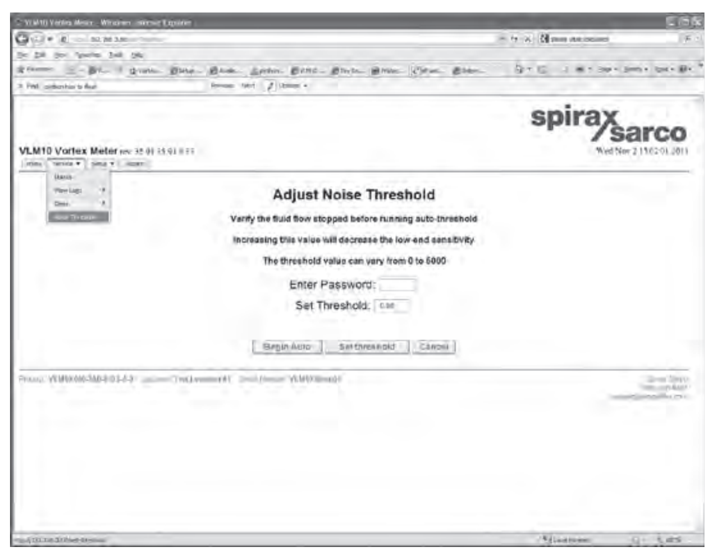
Service - Noise Threshold

The Adjust Noise Threshold allows the user control the amplitude filter of the vortex sensor. The purpose of adjusting the noise threshold is to eliminate system noise.

It is recommended that the Auto Threshold be run when the meter is first installed. The Begin Auto button can only be run when there is no flow.

The Set threshold button allows the user to select the threshold value manually. This may be done to eliminate system noise, such as pumps, which are not eliminated when the Auto Threshold is run.

Note: The value in Set Threshold represents the current Noise Threshold. Increasing the Noise Threshold value will decrease the meter's low-end sensitivity.

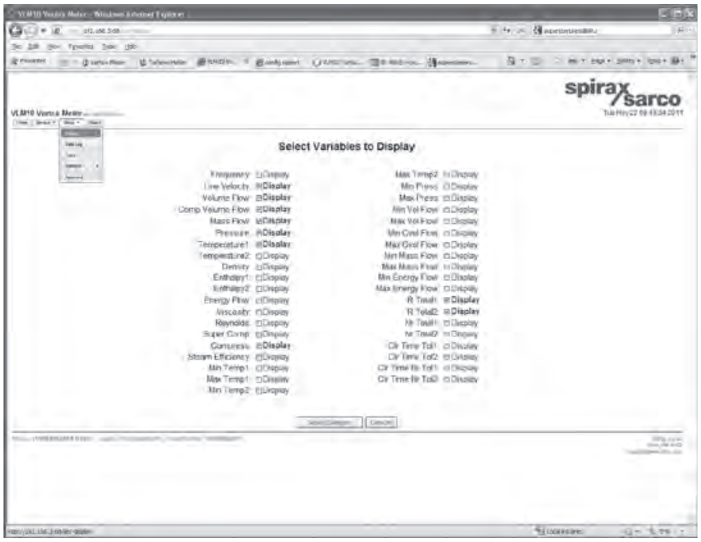


Setup

The Setup button is used to set the Web page and Front Panel Display, Data Log, Time, Network (ethernet, Modbus, BACnet), and Password on the meter.

Setup - Display

The Setup Display page lets the user set which variables are to be displayed on the Home page and the front panel.



Setup - Data Log

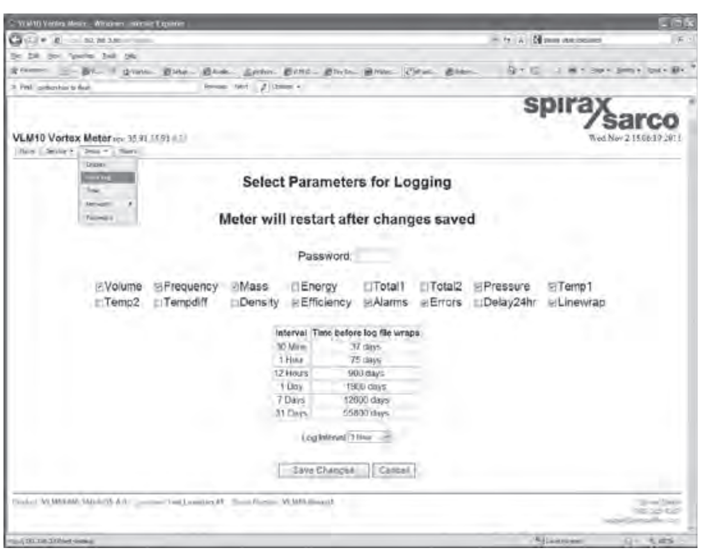
The Setup Data Log page lets the user select which variables are to be saved in the log file.

The user can also select the log time interval from 30 minutes to 31 days.

- Delay24hr - enables a delay of 24 hours before logging begins
- Linewrap - enables the meter to over-write the top of the file when the log file reaches the end.

A chart at the bottom of the page provides an estimate of how much data can be saved based on the log interval.

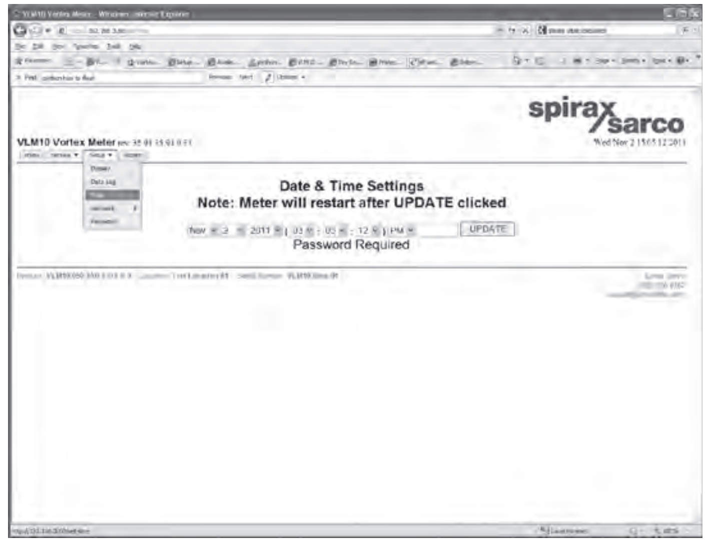
After the Save Changes button is selected, the meter will restart.



Setup – Time

System time is adjusted from the Setup/Time page.

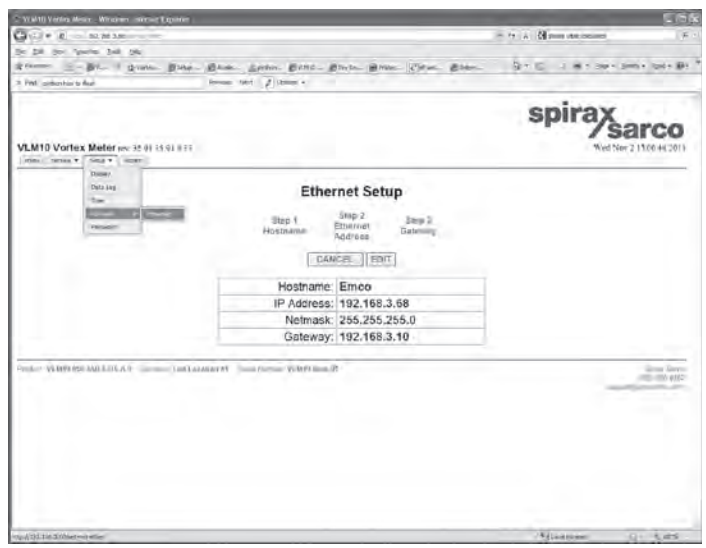
Note that after the update button is clicked, the meter will restart.



Setup – Network Ethernet

The Ethernet interface configuration page:

This is where the user enters the Hostname, static IP address, netmask, and gateway. The meter IP address is also displayed on the front panel on the third line of the start-up screen as IP Addr: xxx.xxx.xxx.xxx.



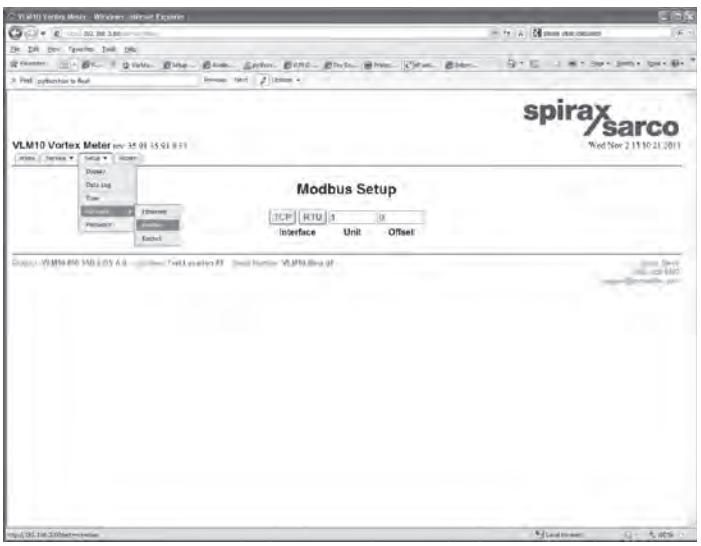
Setup – Network Modbus

If the Modbus interface option purchased, the Setup/Modbus tab is visible.

The VLM10 supports Modbus over TCP/IP and RTU (RS-485).

Unit - requires the user to set the Modbus unit number if the meter is installed on an RS-485 network with other Modbus devices.

Offset - allows the user to “adjust” the actual Modbus register addresses by subtracting the offset from the original address. As an example, the default address of the line velocity register is 41000, and the volume is at address 41002. If the offset is set to 41000, then the address the Modbus master should use to read the line velocity would be 0. The volume would then be accessed at address 2, etc.



Setup – Modbus TCP

If TCP is selected, it is only necessary to check the port number. Usually, port 502 is dedicated to the Modbus TCP/IP interface and needs not be changed. The meter IP address and the port number are all that is necessary. Note that the meter will restart after the Modbus setup is complete and the ok button clicked.

Modbus RTU Setup

User must define the serial port parameters (Baud Rate, Number of Bits, Stop Bits, and Parity).

The default settings are shown below.

Note that because BACnet MS/TP and Modbus RTU share the same RS-485 port (P9 on the terminal board) it is not possible to use both simultaneously.

Network - BACnet

If the BACnet interface option purchased, the Setup/BACnet tab is visible.

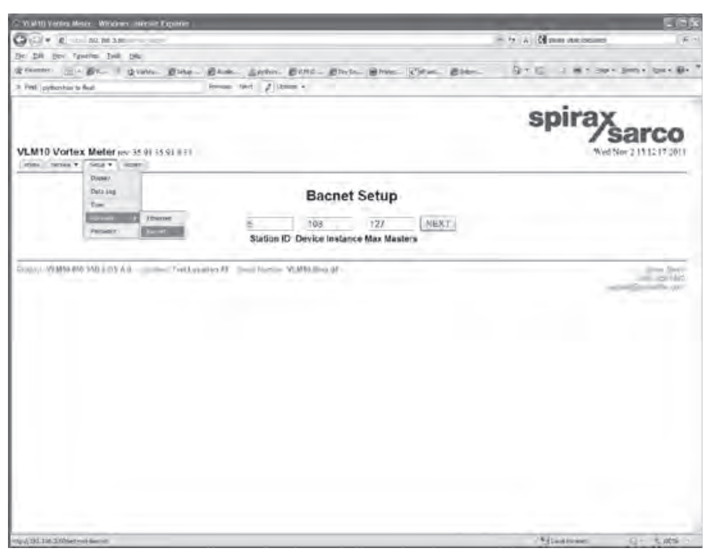
The BACnet setup page lets the user view and modify the Station ID, Device Instance and Max Masters parameters.

Station ID - is a local address, used to link physical devices. It is comparable to the Modbus RTU slave address.

Device Instance - is the logical address that must be unique in the entire BACnet network.

Max Masters - defines the highest MAC address on the BACnet network.

The default Max masters value is 127, but if all MACs are known on the network, then this value can be set to the device with the highest MAC address to improve communication performance.



Network - BACnet

BACnet MS/TP Setup - The final BACnet setup page is similar to the Modbus RTU setup (Baud Rate, Number of Bits, Stop Bits, and Parity).

Note that because BACnet MS/TP and Modbus RTU share the same RS-485 port (P9 on the terminal board) it is not possible to use both simultaneously.

Network - Password

Set Password – this allows the user to change the system password. The password can only be a 6-digit number, and the default password is 000000.

Wizard

The Setup Wizard starts the meter configuration utility. This utility takes the user through a series of 5 steps to ensure a correct configuration.

The first page asks the user to load a previously saved configuration to modify.

The Current selection is the configuration currently being used by the meter.

The Default selection will load in the original factory settings User1 and User2 are for user customized settings.

When using the Setup Wizard and if no changes are required in that Step, the user may select “Next” to move to the next step in the Setup Wizard.

Note: None of the changes made in the Setup Wizard will take effect until the Setup is saved. Saving occurs after Step 5 of the Setup Wizard.

Wizard

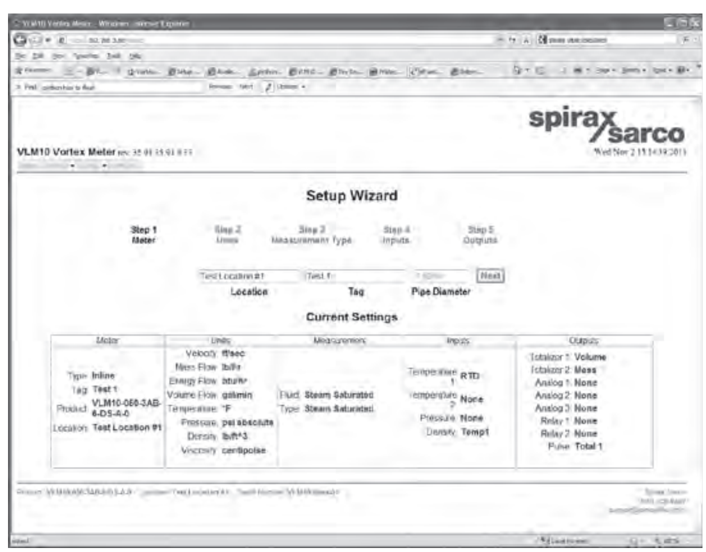
Step 1 – Meter

The meter’s Location, Tag and meter Pipe Diameter are shown on the top of the page.

Location and Tag can be modified on this page by moving the cursor to the appropriate text and changing the text.

Pipe Diameter is for reference only. It is set at the factory based on the size of flow tube being used. It is grayed out and cannot be updated.

The Current Settings chart summarizes the Meter, Units, Measurement, Inputs and Outputs that the meter is currently set.



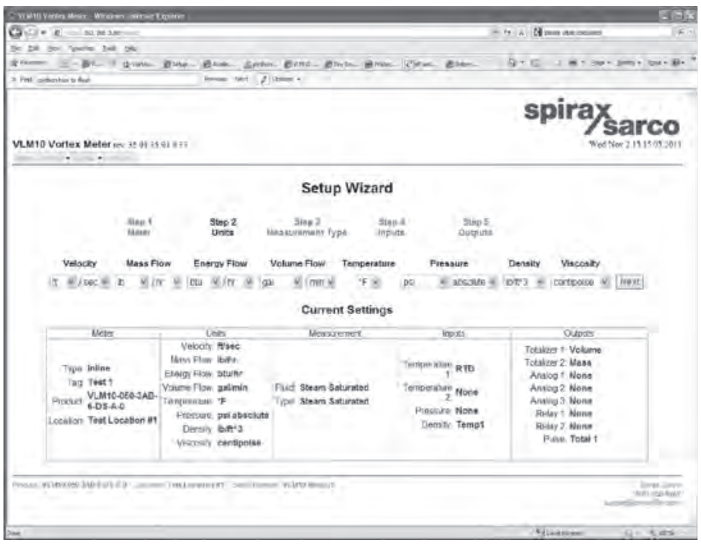
Wizard
Step 2 - Units

Allows the user choose the appropriate engineering units and time element for all variables shown on the web page, front panel and outputs.

The defined units are:

- Velocity – engineering unit and time element
- Mass Flow – engineering unit and time element
- Energy Flow – engineering unit and time element
- Volume Flow – engineering unit and time element
- Temperature – engineering unit
- Pressure – engineering unit, absolute or gauge
- Density – engineering unit
- Viscosity – engineering unit

There is a drop down menu for each engineering and time element.



Selecting the Next button will advance to Step 3 Measurement Type.

Step 3 - Measurement Type

The VLM10 has 6 Measurement Types and each requires specific variables in order to properly calculate flow.

The Measurement Types and required input variables are:

- Steam Saturated – temperature or pressure
- Steam Superheated – temperature and pressure
- Simple Steam Efficiency – two temperatures
- Gas Volume/Mass Flow – temperature and pressure
- Liquid Volume/Mass Flow – temperature
- Liquid Energy – two temperatures

Step 3 – Measurement Type
Saturated Steam

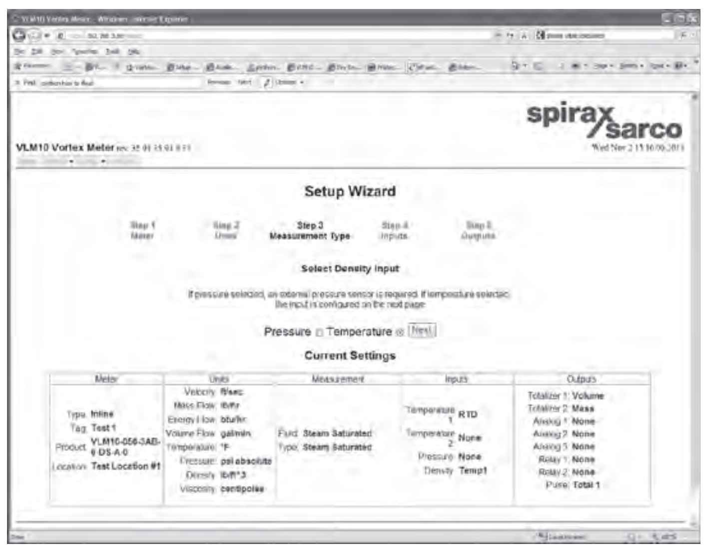
For the Saturated Steam setup, the wizard asks the user to pick which sensor will calculate fluid density.

The Wizard then asks the user to select whether the user wants to use Pressure or Temperature to calculate fluid density.

Note: All VLM10 meters have an internal RTD, which can be used as the temperature input if the user does not want to use an external sensor to calculate the fluid's density

Continuing the Saturated steam setup, the wizard will now ask the user to pick the temperature input.

There are five Temperature options:



None - meter will need to use pressure to calculate the density

Substitute – user enters the temperature value manually and the meter will calculate density based on this value. This is not recommended because a steam system's temperature is not static.

RTD - the meter will calculate the density based on the internal temperature sensor.

Ch1 4-20mA - the user needs to connect the temperature sensor to Channel 1 4-20mA input, and define the minimum temperature in F (4 mA) and the maximum temperature in F (20 mA). The 4 mA should be set to 0 and the 20 mA to the highest expected temperature.

Ch2 4-20mA - the user needs to connect the temperature sensor to Channel 2 4-20mA input, and define the minimum temperature in F (4 mA) and the maximum temperature in F (20 mA). The 4 mA should be set to 0 and 20 mA to the highest expected temperature.

If pressure is selected, there is a drop down menu with 3 pressure options:

Substitute – user enters the pressure value manually and the meter will calculate density based on this value. This is not recommended because a steam system's pressure is not static.

Ch1 4-20mA - the user needs to connect the pressure sensor to Channel 1 4-20mA input, and define the minimum pressure in psig (4 mA) and the maximum pressure in psig (20 mA). The 4 mA should be set to 0 and the 20 mA to the highest expected pressure.
Ch2 4-20mA - the user needs to connect the pressure sensor to Channel 2 4-20mA input, and define the minimum pressure in psig (4 mA) and the maximum pressure in psig (20 mA). The 4 mA should be set to 0 and 20 mA to the highest expected pressure.

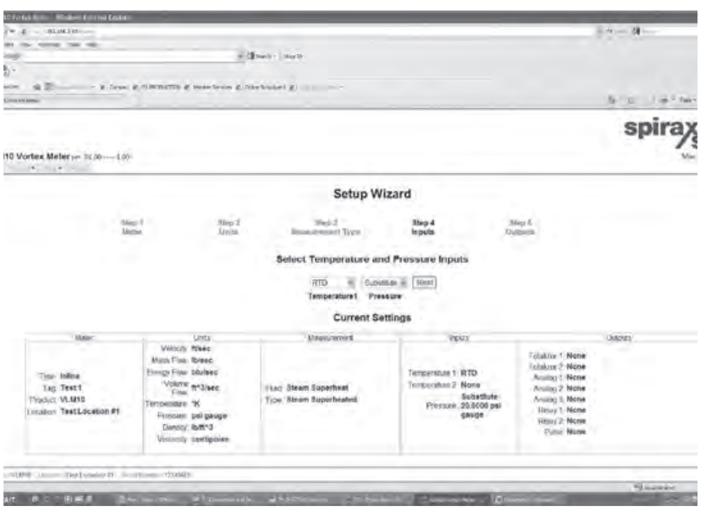
The Wizard will not move onto the next step until a Temperature or Pressure option is selected.

When temperature is finalized select Next to go to Step 5 Outputs.

Step 3 – Measurement Type
Superheated Steam

Choosing the Superheated Steam measurement type will bring up a page that will ask the user to select a temperature and a pressure input.

There is a drop down menu for both the Temperature and Pressure inputs which must be selected prior to moving to the next step.



Clicking on the Next button will present the user with the configure temperature and pressure inputs page.

Step 3 – Measurement Type
Simple Steam Efficiency

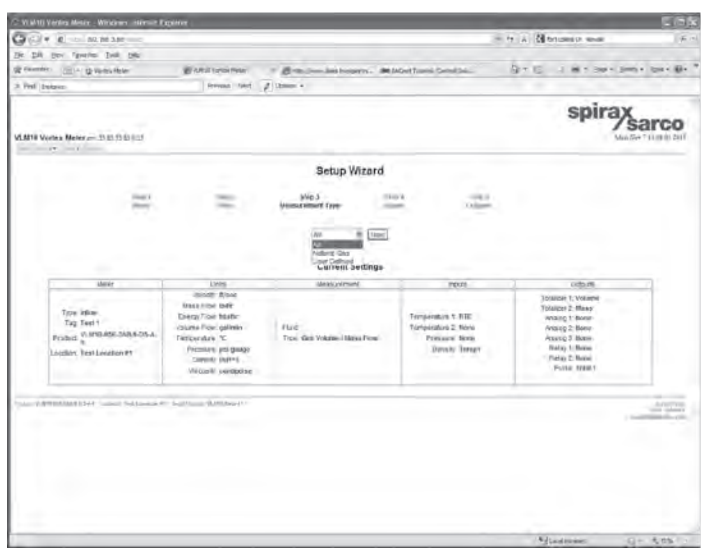
Simple Steam Efficiency calculates the efficiency of the steam system by measuring the steam temperature and the condensate return temperature. The efficiency is a percentage between 0% and 100%, and will increase as the condensate return temperature approaches the steam temperature.

Choosing the Simple Steam Efficiency measurement type will bring up a page that will ask the user to select which temperature input will be used for the density calculation.

Clicking on the Next button will ask the user to configure the two temperature inputs.

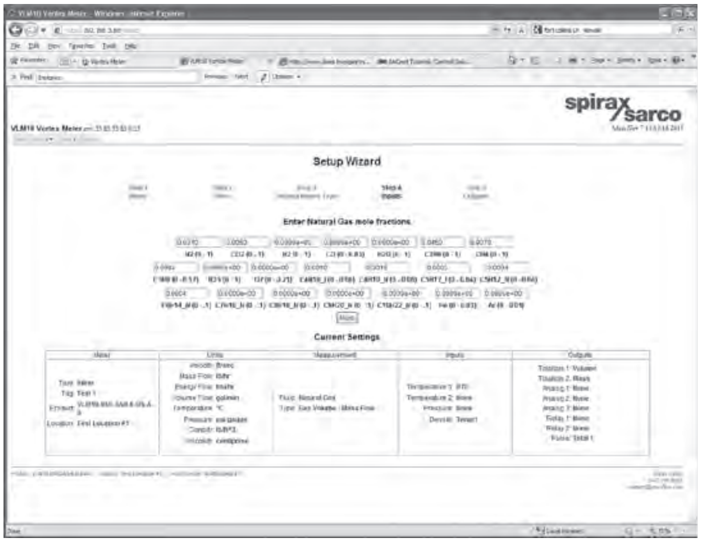
Step 3 – Measurement Type
Gas Volume / Mass flow - Air

Choosing the Gas Volume / Mass flow measurement type will bring up a page that will ask the user to select what type of gas is being measured. If air is selected, clicking on the Next button will ask the user to configure the temperature and pressure input.



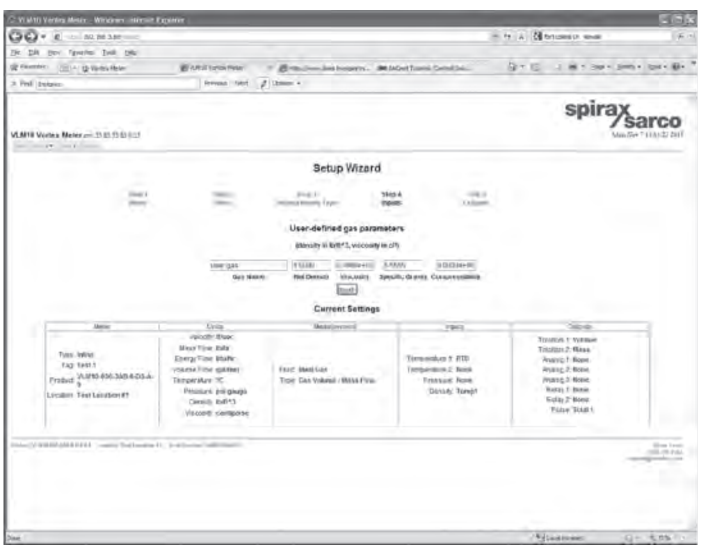
Step 3 – Measurement Type
Gas Volume / Mass flow – Natural Gas

Choosing the fluid as Natural Gas will bring up a page that will ask the user to enter the mole fractions of the natural gas mixture. Note that the total of all 21 parameters must equal 1.0. It is acceptable to leave fields with a value of 0.0 as long as the sum of all is 1.0. Clicking on the Next button will ask the user to configure the temperature and pressure input.



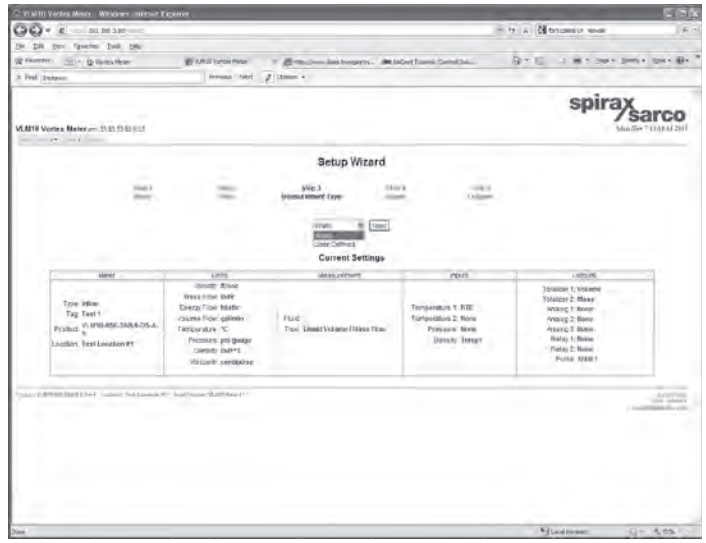
Step 3 – Measurement Type
Gas Volume / Mass flow – User Defined

Choosing the fluid as User Defined will bring up a page that will ask the user to enter the User gas name, reference density, viscosity, specific gravity, and compressibility of the gas mixture. Clicking on the Next button will ask the user to configure the temperature and pressure input.



Step 3 – Measurement Type
Liquid Volume / Mass flow – Water

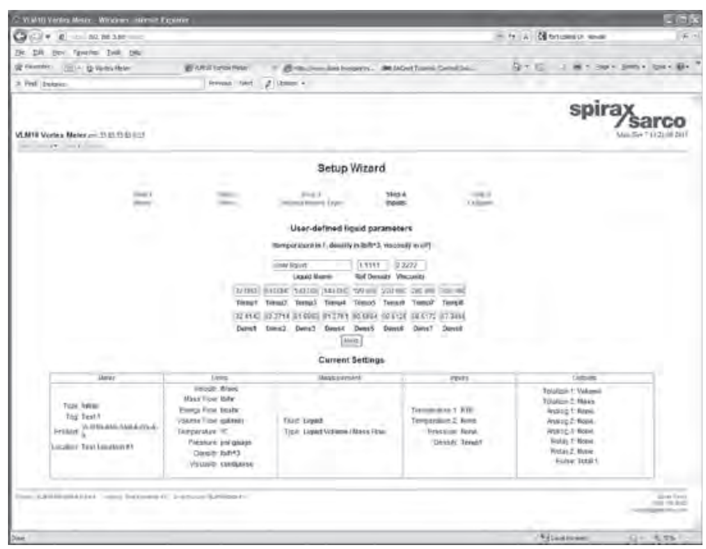
Choosing the Liquid Volume / Mass flow measurement type fluid and fluid type as Water and clicking on the Next button will ask the user to configure the temperature input.



Step 3 – Measurement Type
Liquid Volume / Mass flow – User Defined

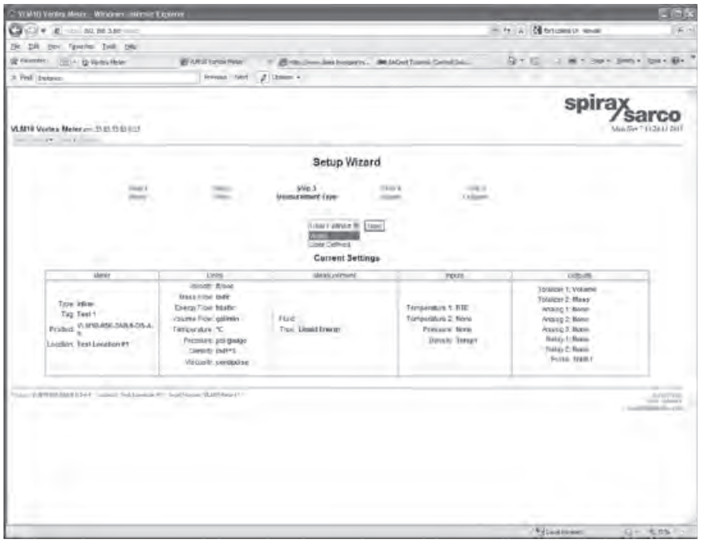
Choosing the Liquid Volume / Mass flow measurement type fluid and fluid type as User Defined will take the user to a screen that will ask for the Liquid name, reference density, viscosity, and a set of eight temperature/density pairs.

Clicking on the Next button will ask the user to configure the temperature input.



Step 3 – Measurement Type
Liquid Energy – Water

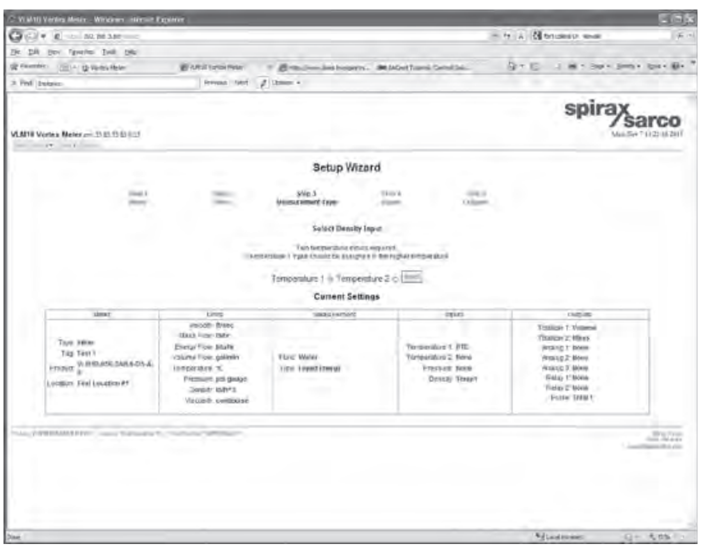
Choosing the Liquid Energy measurement type fluid and fluid type as Water and clicking on the Next button will take the user to a page that will ask the user to choose which temperature input will calculate the water density.



Step 3 – Measurement Type
Liquid Energy – Water

Choosing the Liquid Energy measurement type fluid and fluid type as Water will take the user to a screen that will ask the user to select the temperature input for the density calculation.

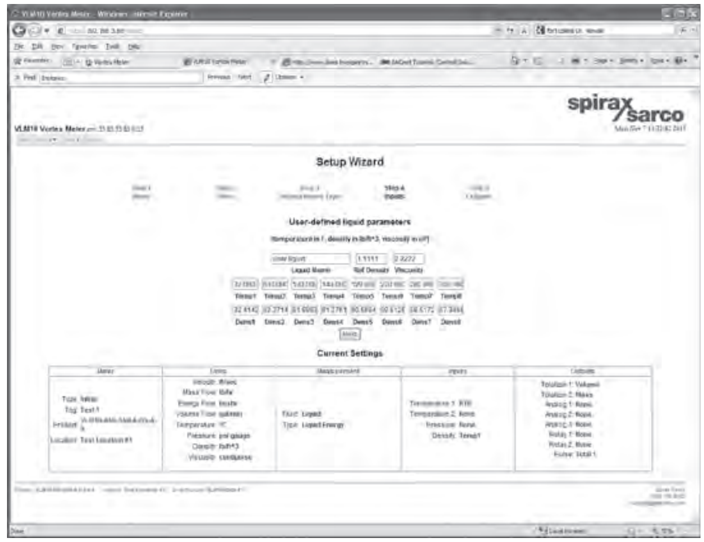
Clicking on the Next button will ask the user to configure the two temperature inputs.



Step 3 – Measurement Type
Liquid Energy – User Defined

Choosing the Liquid Energy measurement type fluid and fluid type as User Defined will take the user to a screen that will ask for the Liquid name, reference density, viscosity, and a set of eight temperature/density pairs.

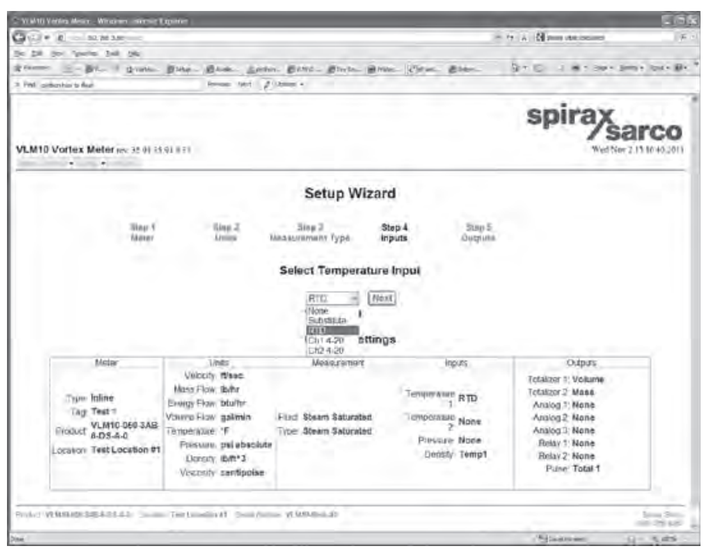
Clicking on the Next button will ask the user to configure the temperature input.



Step 4 – Inputs
Temperature Input

This screen shows the options available for a single temperature input.

Clicking on the Next button will take the user to a pressure input configuration if required, or if there is no pressure the Wizard will go to Step 5 Outputs.



Step 4 – Inputs
2 Temperature Inputs

This screen shows the options available for two temperature inputs.

Clicking on the Next button will take the user to Step 5 Outputs.

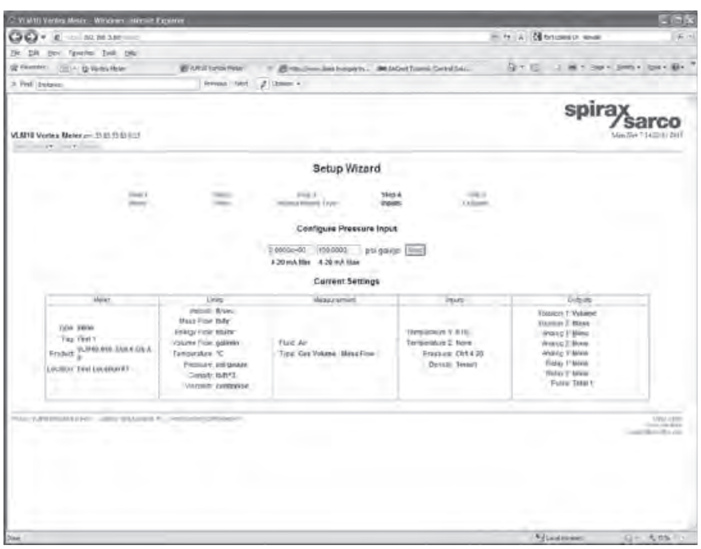
Step 4 – Inputs
Pressure Input

This screen Configures a 4-20 mA pressure input.

Note: The engineering unit for the pressure input is set in Step 2 Units of the Setup Wizard.

The minimum input (or 4mA) must always be set to 0 (zero), and the 20mA (Max) is set to the highest pressure value.

Clicking on the Next button will take the user to the Step 5 Outputs.



Step 5 – Outputs

At this step the user configures the various outputs.

Guides the user through configuration of the following outputs:

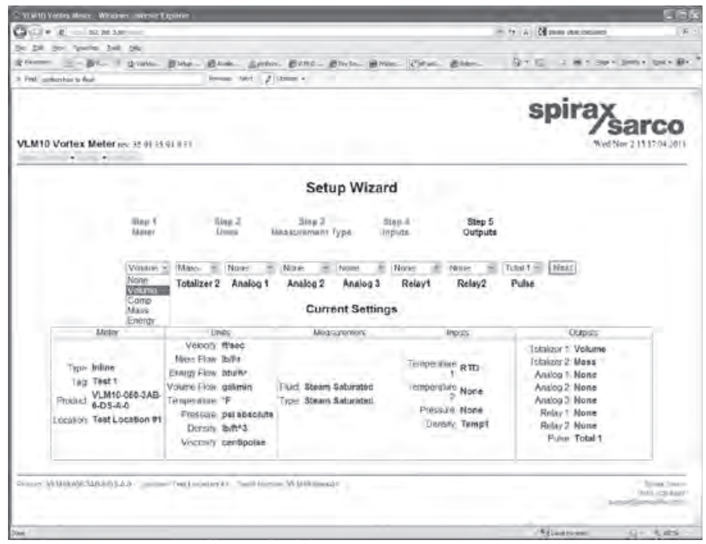
- Totalizer 1
- Totalizer 2
- 3 Analog outputs (Analog 1, Analog 2, Analog 3)
- 2 Relay outputs (if electronics option purchased)
- Pulse output

The Totalizers, 3 analog outputs, and the pulse output are all available in the standard configuration.

If the relay/alarm option has been purchased, then the 2 relay alarm options are editable.

Totalizers

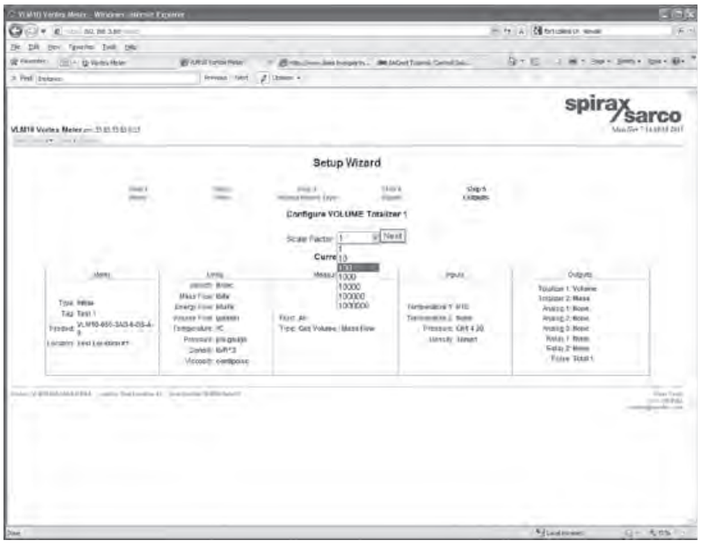
This example shows the options available for the Totalizers. A selection of None disables the selected output.



Step 5 – Outputs
Totalizers – Scale factor

At this step the user sets a scale factor to the totalizer counters. The scale factor is the volume, mass, or energy represented by one count of the totalizer.

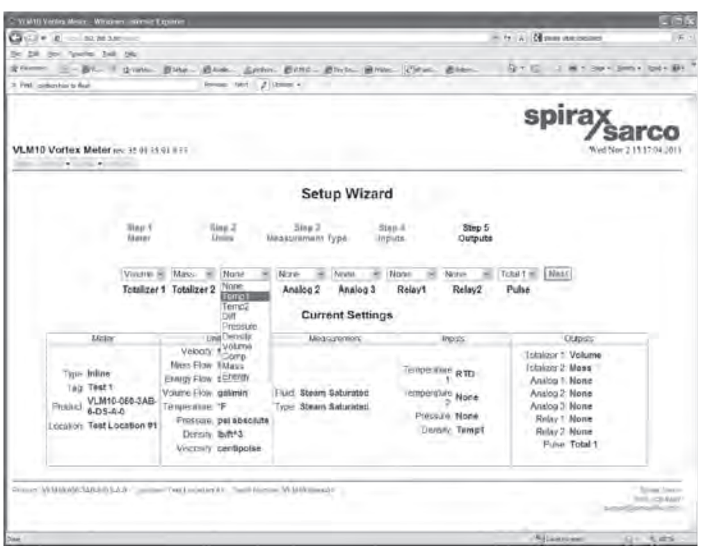
For example, if the totalizer is configured to accumulate mass flow in pounds, and the scale factor is set to 100, then each increment of the totalizer represents 100 pounds of fluid. Both settable and non-resettable totalizers use the same scale factor.



Step 5 – Outputs
Analog outputs

The 4-20mA Analog output selections are shown next.

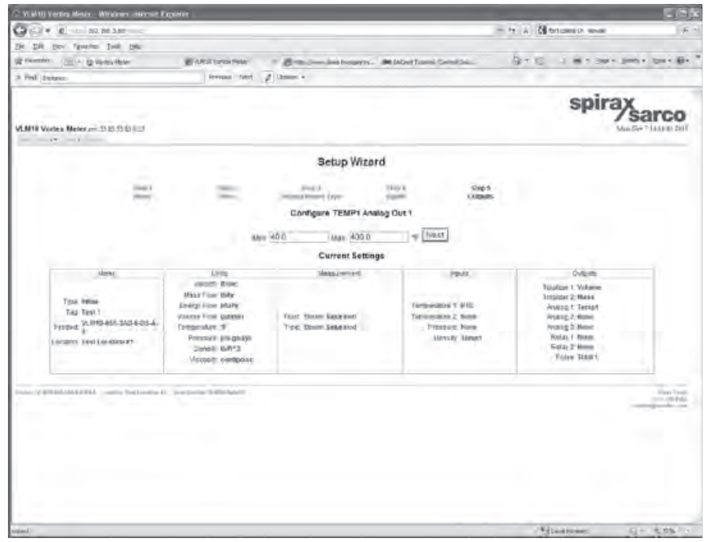
Selecting “None” will disable the output and force the un-configured output channel current to 4.00mA.



Step 5 – Outputs
Analog outputs

Following the selection of an output channel, minimum and maximum values are set. The minimum value is mapped to 4.0mA and the maximum value mapped to 20.0mA.

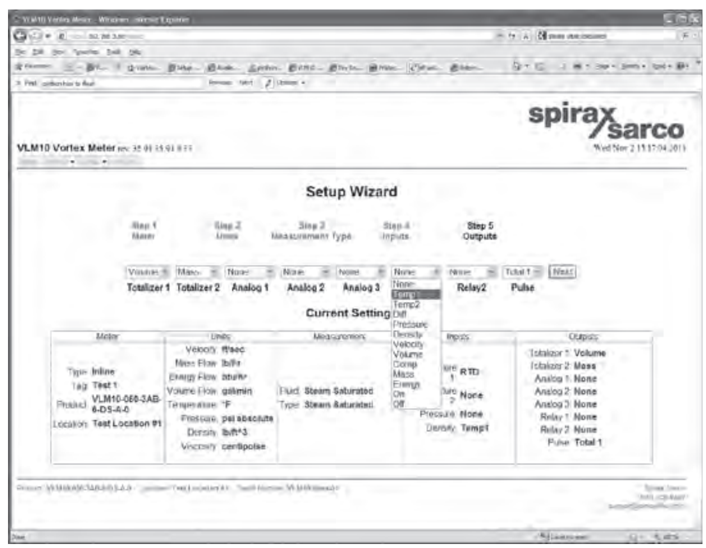
Note the minimum value (or 4 mA) must always be set to 0 (zero).



Step 5 – Outputs
Relay/Alarm outputs

The relay/alarm setup, if enabled, lets the user actuate the relay based on a number of different input values.

Note that the relay can be disabled or forced on or off. An upcoming page will detail the other alarm settings.



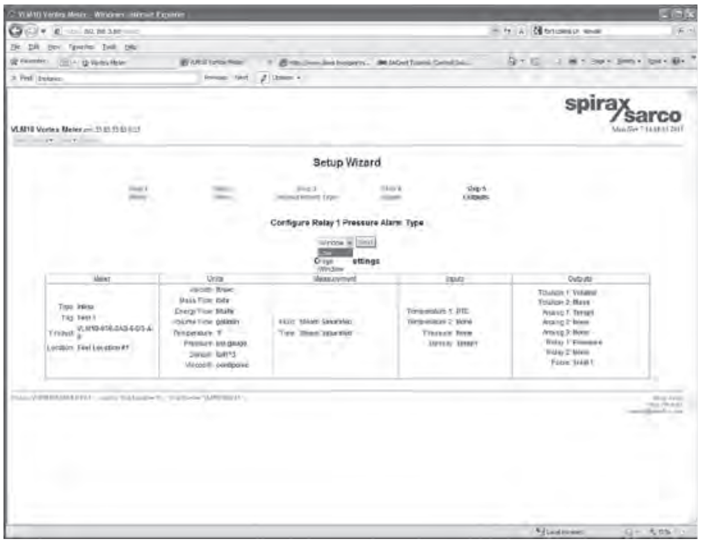
Step 5 – Outputs
Relay/Alarm outputs – type

The type of relay alarm defines the way in which the relay activates.

Low setting - means that the relay will close when the value falls below the set-point.

High setting - means the relay will close when the value is above the set-point.

Window setting - means the relay will close when the assigned value is above or below the high and low set-points.



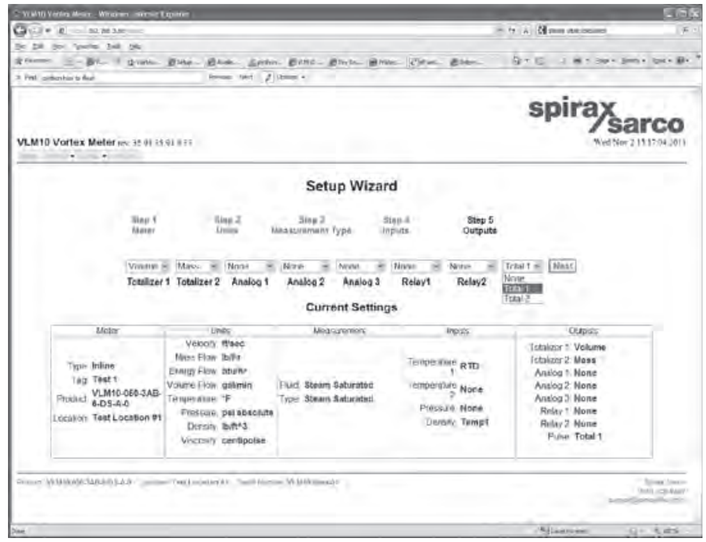
Step 5 – Outputs
Relay/Alarm outputs – set-point and hysteresis

This page lets the user enter the set-point and hysteresis for the selected relay/alarm. In this example, relay 1 has been configured to activate if the pressure drops below 5.0 psi. The hysteresis value of 1.0 means the relay cannot de-activate until the pressure rises to 4.0 psi. This prevents relay "chatter" if the selected alarm value stays near the set-point.

Step 5 – Outputs
Pulse output

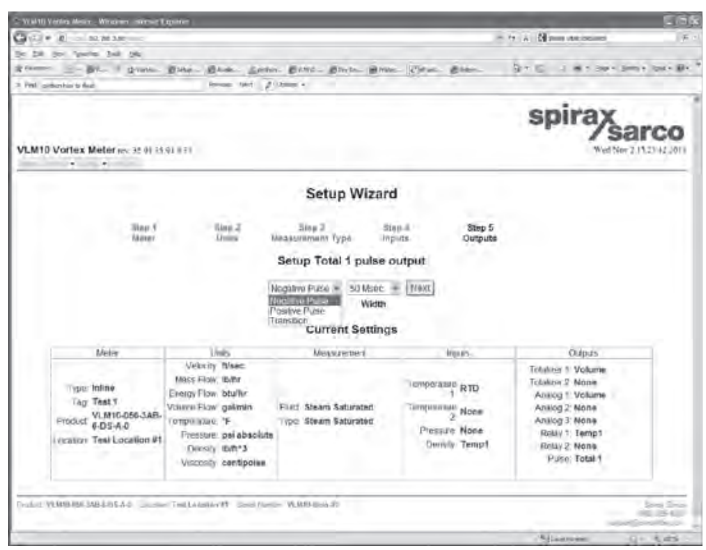
The pulse output setup lets the user select which of the 2 totalizer counters control the pulse output.

Clicking "Next" takes the user to the pulse output polarity setting.



Step 5 – Outputs
Pulse output – polarity and width

The pulse output setup lets the user set the way the relay actuates when the totalizer it's assigned to increments. Negative pulse causes the relay N.O. contacts to close for 50ms, then open when totalizer 2 increments by one. The positive pulse causes the relay N.O. contacts to open for 50ms when totalizer 2 increments. The Transition setting causes the relay N.O. contacts to toggle each time the totalizer increments. Note that the transition setting doesn't use the Width value. The available pulse widths are 50ms, 500ms, 1 sec, and 5 sec. Also note that if the pulse width is set too long, and the totalizer is incrementing too fast, a pulse output overflow error will result. To clear this error, the totalizer scale should be increased, or the pulse output width decreased.



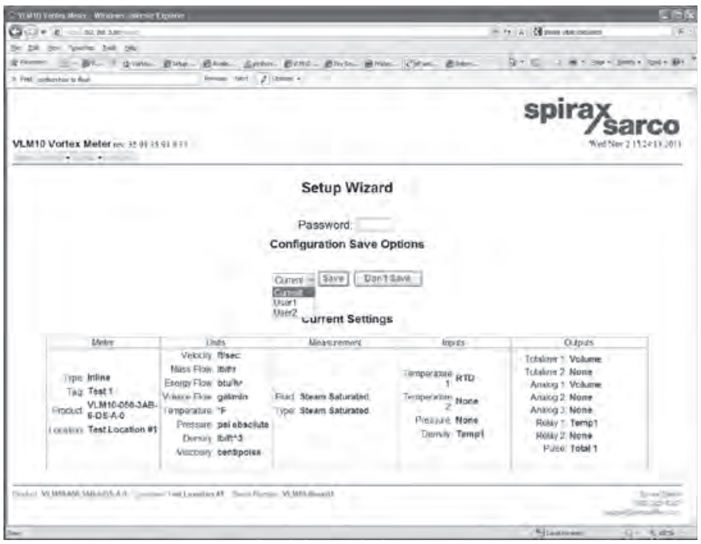
Configuration Save Options

The final wizard setup step is the saving of the configuration to the selected file.

Note that Current, User1 and User2 files are available.

After entering the password and selecting “Save”, the meter will save the new configuration, and return to the home page. Setup is now complete.

If “Don’t Save” is selected, none of the changes made in the Setup Wizard will be saved and the meter will continue to use the original Setup.



7. MODBUS

Introduction

Modbus is a serial communication protocol commonly used in industrial applications.

It allows communications between many devices and is typically used to transmit data from instruments or control devices back to a main controller or data gathering system.

The Modbus implementation for the VLM10 allows the user to view and modify meter parameters. Appendix A lists the available Modbus registers. Modbus uses a Master/Slave communication scheme. The VLM10 is always the Modbus slave. The customer must provide the Modbus Master. A Modbus Master we’ve used for testing is available at http://www.simplymodbus.ca. The initial free version allows a limited number of uses before a restart is required.

Supported Modbus Protocols

The VLM10 supports two types of Modus communications.

(1) Modbus TCP/IP.

(2) Modbus RS-485. (RTU)

Configuration:

Configuration of the VLM10 for Modbus consists of software setup and wiring.

(1) **Software:** Front Panel interface, select “Service/Setup Network/Modbus”. Web Page interface, select “Setup/Network/Modbus”. Select “TCP” for Ethernet or “RTU” for RS-485. Be sure to save when done. See Section 6 VLM10 Web Interface for web page screen shots. The Front Panel and Web page interface documentation provides details on meter operation.

NOTE: Always power-cycle the meter after making any changes to the Modbus configuration.

(2) **Wiring:** TCP/IP requires connecting an Ethernet cable from the meter to a PC/Controller or network. RS-485 requires wiring from the terminal block of the meter to a PC/Controller. A termination jumper is provided if the unit is the last device in the RS-485 network. See wiring diagram section for details.

Operation:

All registers are readable. Only the totalizer registers allow writes (to clear)

The following operations are required to perform a read operation using Modbus:

1. Start the Modbus master program, and verify connectivity to the meter. If using TCP/IP, verify the IP address, unit, port number and offset. For RTU, check the RS-485 serial parameters, unit number, and offset.

2. Select a register from the Modbus register list. Appendix A contains the registers whose values are converted to the user-selected units. Appendix B contains register values with the fixed, default units.

3. Read the register from the master. Note: Reading or writing a

Modbus register typically requires specifying the slave device id code, function code, register address, and the number of registers to access. Appendixes A and B contains the default register map. Note that the actual register address required is the default address – the offset value. For example, if the Modbus offset is set to 0, then the register addresses are exactly as shown in the appendix table. If an offset of 41000 is configured, then the addresses all start at 0. The user can use any offset. Two registers are not affected by the offset: Flow meter name (4101) and Flow meter serial number (4242)

4. The Modbus data packets are transferred as 2, 16-bit words, low word / high word, low byte / high byte. The Modbus master program must ensure that the 2 bytes that form the 16-bit words are ordered as high byte / low byte or Big-endian.

Modbus RTU Read Example:

Read float 4.560085 from holding register 41000 with an offset of 0.

Command: (from Master)

Field Name	Hex value
Slave ID	01
Function	03
Address byte Hi	A0
Address byte Lo	28
Bytes to read Hi byte	00
Bytes to read Lo byte	02
CRC Hi byte	66
CRC Lo byte	03

Response: (from VLM10)

Field Name	Hex value	
Slave ID	01	
Function	03	
Byte Count	04	
Data Hi (41000)	40	
Data Lo (41000)	91	
Data Hi (41000)	EC	
Data Lo (41000)	38	
		F3
CRC Hi byte	0C	
CRC Lo byte	00	

The returned 4 bytes will be in the order: 0x38 0xEC 0x91 0x40. To get the correct value of 4.560085 the bytes must be ordered as: 0x40 0x91 0xEC 0x38.

Appendix A: Modbus User Units Register Table

	Modbus Register Table					
	Parameter	**Register**	**R/W**	**Type**	**Bytes**	**Description**
1	Flow meter Name	4101	R	char	18	The flow meter name, identifier
2	Flow meter Serial Number	4242	R	char	18	Meter unique serial number
3	Calculated Velocity	41000	R	float	4	Line velocity value, user-selected units
4	Volumetric Flow	41002	R	float	4	Fluid volume, user-selected units
5	Pipe ID	41004	R	float	4	Pipe diameter, user-selected units
6	Resettable Totalizer #1	41006	R/W	float	4	Resettable totalizer #1
7	Resettable Totalizer #2	41008	R/W	float	4	Resettable totalizer #2
8	Temperature input #1	41010	R	float	4	Temperature input #1, user-selected units
9	Temperature input #2	41012	R	float	4	Temperature input #2, user-selected units
10	RTD Temperature	41014	R	float	4	Internal RTD temperature sensor, user-selected units
11	Differential temperature	41016	R	float	4	Temperature, difference between #1 and #2
12	Pressure	41018	R	float	4	Pressure, calculated or sensor, user-selected units
13	Compensated Volume flow	41020	R	float	4	Temperature compensated vol flow, user units
14	Mass flow	41022	R	float	4	Mass flow, user units
15	Energy flow	41024	R	float	4	Energy flow, user units
16	Density	41026	R	float	4	Density, user units
17	Viscosity	41028	R	float	4	Fluid viscosity, user units
18	Non-Resettable Totalizer #1	41030	R	float	4	Non-Resettable totalizer #1
19	Non-Resettable Totalizer #2	41032	R	Float	4	Non-Resettable totalizer #2
20	Flow sensor frequency	41034	R	Float	4	Flow sensor frequency, Hz
21	Fault Code	41036	R	Float	4	Fault code of 0 means system has no faults, see Appendix C for fault code definitions.

Note: The procedure to offset the Modbus Register can be found in the network setup portion of the Web interface.

Appendix B: Modbus Core Value Register Table

	Parameter	Register	R/W	Type	Bytes	Description
1	Core Calculated Velocity	41200	R	float	4	Fluid velocity, (ft/sec)
2	Core Volume	41202	R	float	4	Volumetric flow (ft^3/sec)
3	Core Temp 1	41204	R	float	4	Temperature input 1, (F)
4	Core Temp 2	41206	R	float	4	Temperature input 2, (F)
	Core RTD Temp	41208	R	float	4	Internal RTD temperature (F)
5	Core differential temperature	41210	R	float	4	Temperature difference (absolute) between Temp input 1 and Temp input 2 (F)
6	Core compensated volume	41212	R	float	4	Compensated volume flow (ft^3/sec)
7	Core Pressure	41214	R	float	4	Pressure (PSIA)
8	Core Mass	41216	R	float	4	Mass flow, (lbs/sec)
9	Core Energy	41218	R	float	4	Energy flow, (BTU/sec)
10	Core Density	41220	R	float	4	Fluid density (lb/ft^3)
11	Core Viscosity	41222	R	float	4	Fluid viscosity (cP)
12	Enthalpy 1	41224	R	float	4	Enthalpy from temp input 1 (btu/lb)
13	Enthalpy 2	41226	R	float	4	Enthalpy from temp input 2 (btu/lb)
14	Gas compressibility	41228	R	float	4	compressibility
15	Super compressibility	41230	R	float	4	Super compressibility

Appendix C: Fault Codes

This table defines the meaning of the bits in the faults register. The order is in Little- Endian, which means the least significant bit is on the right side, the most significant is on the left.

Fault Code bit position	Fault Description
0	DSP 1 (hardware failure)
1	DSP 2 (hardware or remote communications failure)
2	RTC (real-time clock failure)
3	Back-up RAM (corrupt memory)
4	Back-up EEPROM (corrupt memory)
5	Keypad (communication failure with keypad module)
6	Internal RTD sensor (connection failure to temperature senor in stem)
7	Pulse Output Overflow (configuration problem)
8	Analog Output 1 (configuration problem)
9	Analog Output 2 (configuration problem)
10	Analog Output 3 (configuration problem)
11	Analog Input 1 (configuration problem)
12	Analog Input 2 (configuration problem)
13	Internal Temperature (PCB temperature exceeds maximum)
14	Configuration (configuration problem)
31 - 15	Unused, always zero

8. BACnet

Introduction

BACnet is a network protocol that supports unlimited number of communication links. The protocol is commonly used in building automation (alarms, access key panels. lighting, etc.) The BACnet protocol is standardized so an operator can install a VLM10 on a BACnet Network and go to any BACnet master to download the object list that's described in this section. The following sections describes these objects in detail, see Appendix A to Appendix D.

Supported Data Link Layer

The VLM10 supports one type of BACnet Data Link Layer.
(1) MS/TP slave (Clause 9)
(2) baud rate(s): 9600(default), 19200, 38400

Supported Character Set

(1) ISO 10646 (ANSI X3.4)

Configuration:

NOTE: Both BACnet and Modbus drive the same port (P9). A customer cannot have both BACnet and Modbus RTU on the same device.

Configuration of the VLM10 for BACnet consists of software setup and wiring.

(1) **Software:** Front Panel interface, select "Service/Setup Network/BACnet". Web Page interface, select "Setup/Network/BACnet". After modifying the BACnet options, please enter to the last menu option to save your changes. The Front Panel and Web page interface documentation provides details on meter operation.

BACnet Options
- a. Station ID
  - i. Values can between: 1-127
- b. Device Instance
  - i. Values can between: 1-4194303
  - ii. Each meter in the BACnet Network must have a unique value.
- c. Max Masters
  - i. Values can between: 2-127
  - ii. Number of masters on the BACnet Network cannot exceed this value.

(2) **Wiring:** RS-485 requires wiring from the terminal block of the meter to a PC/Controller. See wiring diagram section for details.

Appendix A: BACnet Interoperability Building Blocks Supported (BIBB), Standard Object Types Supported

BIBBs
DS-RP-B
DS-WP-B

Standard Object Types Supported					
	Dynamically		**Writable**		**Property**
Object	Create	Delete	Non-Std	Continual	Range
Analog Input (AI)	no	no	none	no	unknown
Analog Value (AV)	no	no	none	no	unknown
Binary Input (BI)	no	no	none	no	unknown
Multi-State Value (MSV)	no	no	none	no	unknown
Device	no	no	none	no	unknown

Appendix B: Analog Input & Value Object List

The Analog Input (AI) Object Type are read only objects and are values that are measured values that are present in the meter.

The Analog Value (AV) Object Type stores the meter's totalizers. These objects are readable values and writable values. The totalizers can be reset to zero using BACnet, however it is recommended to clear totalizers through either the front panel or web interface.

The table shows the standard BACnet properties supported by these object types. The "units" property is dynamically selectable. Writing to Multi-State Value (MSV) Object Type (Appendix D) will change the units of each of the objects.

Analog Input Type Objects						
ID	**Name**	**Present Value**	**Status Flags**	**Event State**	**Out of Service**	**Units**
AI0	Volume Flow	0	F,F,F,F	Normal	False	"dynamically selectable"
AI1	Mass Flow	0	F,F,F,F	Normal	False	"dynamically selectable"
AI2	Energy Flow	0	F,F,F,F	Normal	False	"dynamically selectable"
AI3	Pressure	0	F,F,F,F	Normal	False	"dynamically selectable"
AI4	Temperature 1	0	F,F,F,F	Normal	False	"dynamically selectable"
AI5	Temperature 2	0	F,F,F,F	Normal	False	"dynamically selectable"
AI6	Diff Temperature	0	F,F,F,F	Normal	False	"dynamically selectable"
AI7	Density	0	F,F,F,F	Normal	False	"dynamically selectable"
AI8	Line Velocity	0	F,F,F,F	Normal	False	"dynamically selectable"

Analog Value Type Objects						
AV0	Totalizer 1	300	F,F,F,F	Normal	False	"dynamically selectable"
AV1	Totalizer 2	300	F,F,F,F	Normal	False	"dynamically selectable"

Appendix C: Binary Input Object List

The Binary Input (BI) Objects Types are settable and clearable, and represent various FAULTS and WARNINGS within the meter. Meter warnings are not captured and the once conditions creating them are "cleared" the warning will not be displayed. Meter faults are captured and they are clearable at any time. If the cause of the fault is not corrected, they will be captured when they occur again.

The columns of following table show the standard BACnet properties supported for Binary Input (BI) Object Type.

Binary Input Type Objects						
ID	**Name**	**Present Value**	**Status Flags**	**Event State**	**Out of Service**	**Polarity**
BI0	Watchdog Reset	Inactive	F,F,F,F	Normal	False	Normal
BI1	Signal Board Communication	Inactive	F,F,F,F	Normal	False	Normal
BI2	Configuration	Inactive	F,F,F,F	Normal	False	Normal
BI3	RTC	Inactive	F,F,F,F	Normal	False	Normal
BI4	Bacup RAM	Inactive	F,F,F,F	Normal	False	Normal
BI5	EEPROM	Inactive	F,F,F,F	Normal	False	Normal
BI6	Keypad	Inactive	F,F,F,F	Normal	False	Normal
BI7	RTD	Inactive	F,F,F,F	Normal	False	Normal
BI8	Vortex Sensor	Inactive	F,F,F,F	Normal	False	Normal
BI9	Pulse Output Overflow	Inactive	F,F,F,F	Normal	False	Normal
BI10	Analog Output	Inactive	F,F,F,F	Normal	False	Normal
BI11	Analog Input	Inactive	F,F,F,F	Normal	False	Normal
BI12	Temperature	Inactive	F,F,F,F	Normal	False	Normal
BI13	Pressure	Inactive	F,F,F,F	Normal	False	Normal
BI13	Configuration Changed	Inactive	F,F,F,F	Normal	False	Normal
BI15	Calibration Mode	Inactive	F,F,F,F	Normal	False	Normal
BI16	Thread	Inactive	F,F,F,F	Normal	False	Normal
BI17	Temperature 1 Min/Max Changed	Inactive	F,F,F,F	Normal	False	Normal
BI18	Temperature 2 Min/Max Changed	Inactive	F,F,F,F	Normal	False	Normal
BI19	Pressure Min/Max Changed	Inactive	F,F,F,F	Normal	False	Normal
BI20	Volume Min/Max Changed	Inactive	F,F,F,F	Normal	False	Normal
BI21	Compressed Volume Min/Max Changed	Inactive	F,F,F,F	Normal	False	Normal
BI22	Mass Min/Max Changed	Inactive	F,F,F,F	Normal	False	Normal
BI23	Energy Flow Min/Max Changed	Inactive	F,F,F,F	Normal	False	Normal
BI24	Totalizer 1	Inactive	F,F,F,F	Normal	False	Normal
BI25	Totalizer 2	Inactive	F,F,F,F	Normal	False	Normal
BI26	Analog In	Inactive	F,F,F,F	Normal	False	Normal
BI27	Analog Out	Inactive	F,F,F,F	Normal	False	Normal
BI28	Power Down	Inactive	F,F,F,F	Normal	False	Normal

Appendix D: Multi-State Value Object List

These selectable values are used to select the units for which the meter will display. Changing these values via the BACnet interface will affect all other meter interfaces and vice versa. For example if BACnet selected GAL for Volume units, the all other interfaces will display volume in terms of gallons too.

The columns of the following table show the standard BACnet properties supported for Multi-State Value (MSV) Object Type.

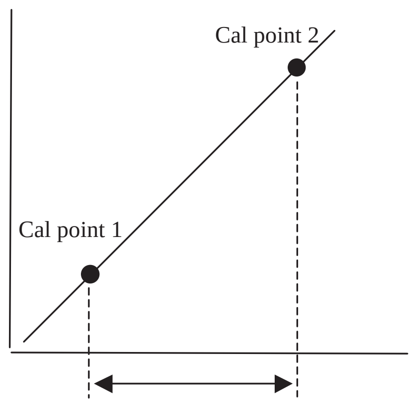
Multi-State Value Type Objects							
ID	**Name**	**Present Value**	**Status Flags**	**Event State**	**Out of Service**	**# of States**	**State Text**
MSV0	Velocity Units	1	F,F,F,F	Normal	False	4	FT,CM,M,IN
MSV1	Volume Units	1	F,F,F,F	Normal	False	8	FT3,CM3,GAL,BBL,CC,L,M3,QT
MSV2	Mass Units	1	F,F,F,F	Normal	False	5	LB,TON,G,KG, MTON
MSV3	Energy Units	1	F,F,F,F	Normal	False	9	BTU,KG,CAL,KCAL,MCAL,TON,KW, MW,GW
MSV4	Velocity Time Units	1	F,F,F,F	Normal	False	4	SEC,MIN,HR,DAY
MSV5	Volume Time Units	1	F,F,F,F	Normal	False	4	SEC,MIN,HR,DAY
MSV6	Mass Time Units	1	F,F,F,F	Normal	False	4	SEC,MIN,HR,DAY
MSV7	Energy Time Units	1	F,F,F,F	Normal	False	4	SEC,MIN,HR,DAY
MSV8	Temperature Units	1	F,F,F,F	Normal	False	4	K,C,R,F
MSV9	Pressure Units	1	F,F,F,F	Normal	False	5	PSI,ATM,BAR,KGCM3,MMHG
MSV10	Pressure Type	1	F,F,F,F	Normal	False	2	GUAGE, ABSOLUTE
MSV11	Density Units	1	F,F,F,F	Normal	False	3	LBFT3,GCC,KGM3
MSV12	K-Factor Units	1	F,F,F,F	Normal	False	2	FT,FT3
MSV13	Total Velocity Units	1	F,F,F,F	Normal	False	4	FT,CM,M,IN
MSV14	Total Volume Units	1	F,F,F,F	Normal	False	8	FT,IN3,GAL,BBL, CC,L,M3,QT
MSV15	Total Mass Units	1	F,F,F,F	Normal	False	5	LB,TON,G,KG, MTON
MSV16	Total Energy Units	1	F,F,F,F	Normal	False	9	BTU,KG,CAL,KCAL,MCAL,TON,KW, MW,GW

9. 4-20mA Loop Calibration

The VLM10 meter supports three 4-20mA output channels and two 4-20mA input channels. Each channel is calibrated at the factory. If a field calibration is required, follow the procedure outlined below.

Loop Calibration Methodology

The 4-20mA loops are each calibrated by a two-point slope and offset calibration, as illustrated in the diagram below. The slope and offset calibration nulls out any offset and gain errors that could occur in a system. While the VLM10 meter is factory calibrated to within the specified accuracy on all 4-20mA input and output channels, errors can be introduced when using the 4-20mA loops in a system that may add offset or gain errors to the current measurement.



Loop Calibration Procedure

CAUTION: Before applying loop power to the VLM10 meter, ensure that each 4-20mA loop will not exceed the maximum ratings, defined in the Electrical section of this document, when power is applied.

1. While in run mode (normal operating mode) activate the ‘ENTER’ key on the front panel five times, using the magnetic wand, to enter the ‘Meter Setup Menu’.

2. In the ‘Meter Setup Menu’, scroll down by activating the ‘DOWN arrow’ key until the ‘Service Menu’ option is highlighted. Activate the ‘ENTER’ key to select the ‘Service Menu’.

3. In the ‘Service Menu’, scroll down by activating the ‘DOWN arrow’ key until the ‘Calibrate 4-20’ option is highlighted. Activate the ‘ENTER’ key to select the ‘Calibrate 4-20’ option.

4. To calibrate an input channel go to step 15. To calibrate an output channel go to step 5.

4-20mA OUTPUT CALIBRATION:

5. From the ‘Select Channel’ menu, which appears after selecting ‘Calibrate 4-20’ in step 3, highlight the output channel to be calibrated by activating the ‘UP’ and ‘DOWN’ arrow keys until the correct channel is highlighted. Activate the ‘ENTER’ key to select the channel.

6. The first screen that is displayed describes the connector and pin-out that should be used to wire the channel to be calibrated. Activate the ‘ENTER’ key to continue.

7. The screen should now display ‘Output set to approx. 3.90mA’ and the output current from the 4-20mA channel should measure approximately 3.9mA DC. Activate the ‘ENTER’ key to continue.

8. The screen should now display ‘3.9mA’ and ‘Edit’ should be highlighted at the bottom of the display. Activate the ‘ENTER’ key while ‘Edit’ is highlighted to edit the current value.

9. The measured current should be entered into the value on this screen. The entry of the measured current is best entered from right to left. With the cursor now highlighting the ‘9’, use the ‘UP’ and ‘DOWN’ arrow keys to enter the least significant digit in the reported loop current. For example, if the measured loop current is 3.87mA, the least significant digit is a 7.

10. To edit the next digit to the left, use the ‘LEFT’ arrow key to move the cursor over. (Note that the decimal point can be changed to a number by highlighting it and using the ‘UP’ and ‘DOWN’ arrows to change it. Conversely, a number can be converted to a decimal point by highlighting the number and using the ‘UP’ or ‘DOWN’ arrow keys to change it to a decimal) Continuing the example from step 9 above, with 3.87mA measured current, move the cursor to the decimal point and use the ‘UP’ arrow to change the decimal point to the number 8.

11. Continue to enter the rest of the measured current using the arrow keys to move the cursor and change the value. When the current is entered correctly, activate the ‘ENTER’ key to highlight the right arrow icon at the bottom right of the screen. Activate the ‘ENTER’ key one more time to move to the next screen.

12. The screen should now display ‘Output now set to approx. 21.50mA’ and the output current from the 4-20mA channel should measure a little above 20mA DC. Activate the ‘ENTER’ key to continue.

13. Enter the measured current value. When the current is entered correctly, activate the ‘ENTER’ key to highlight the right arrow icon at the bottom right of the screen. Activate the ‘ENTER’ key one more time to move to the next screen.

14. The screen should now return to the ‘Select Channel’ menu, and the 4-20mA output channel should now be calibrated to the system. To calibrate additional outputs, select them and repeat the same process. Otherwise, to return to run mode, activate the ‘LEFT’ arrow key until the ‘Meter Setup Menu’ is displayed. From the ‘Meter Setup Menu’ highlight the ‘Return to Run Mode’ option and activate the ‘ENTER’ key.

4-20mA INPUT CALIBRATION:

15. From the ‘Select Channel’ menu, which appears after selecting ‘Calibrate 4-20’ in step 3, highlight the input channel to be calibrated by activating the ‘UP’ and ‘DOWN’ arrow keys until the correct channel is highlighted. Activate the ‘ENTER’ key to select the channel.

16. The first screen that is displayed describes the connector and pin-out that should be used to wire the channel to be calibrated. Activate the ‘ENTER’ key to continue.

17. The screen should now display ‘Set input current to 4mA or less’. At this point, the input current to the 4-20mA channel should be set to a value between 3.5mA to 4.0mA DC. Activate the ‘ENTER’ key to continue.

18. The screen should now display ‘3.9mA’ and ‘Edit’ should be highlighted at the bottom of the display. Activate the ‘ENTER’ key while ‘Edit’ is highlighted to edit the current value.

19. The measured current should be entered into the value on this screen. The entry of the measured current is best entered from right to left. With the cursor now highlighting the ‘9’, use the ‘UP’ and ‘DOWN’ arrow keys to enter the least significant digit in the reported loop current. For example, if the measured loop current is 3.87mA, the least significant digit is a 7.

20. To edit the next digit to the left, use the ‘LEFT’ arrow key to move the cursor over. (Note that the decimal point can be changed to a number by highlighting it and using the ‘UP’ and ‘DOWN’ arrows to change it. Conversely, a number can be converted to a decimal point by highlighting the number and using the ‘UP’ or ‘DOWN’ arrow keys to change it to a decimal) Continuing the example from step 19 above, with 3.87mA measured current, move the cursor to the decimal point and use the ‘UP’ arrow to change the decimal point to the number 8.

21. Continue to enter the rest of the measured current using the arrow keys to move the cursor and change the value. When the current is entered correctly, activate the ‘ENTER’ key to highlight the right arrow icon at the bottom right of the screen. Activate the ‘ENTER’ key one more time to move to the next screen.

22. The screen should now display ‘Set input current to 20mA or more’. At this point, the input current to the 4-20mA channel should be set to a value between 20mA to 21mA DC. Activate the ‘ENTER’ key to continue.

23. Enter the measured current value. When the current is entered correctly, activate the ‘ENTER’ key to highlight the right arrow icon at the bottom right of the screen. Activate the ‘ENTER’ key one more time to move to the next screen.

24. The screen should now return to the ‘Select Channel’ menu, and the 4-20mA input channel should now be calibrated to the system. To calibrate additional inputs, select them and repeat the same process. Otherwise, to return to run mode, activate the ‘LEFT’ arrow key until the ‘Meter Setup Menu’ is displayed. From the ‘Meter Setup Menu’ highlight the ‘Return to Run Mode’ option and activate the ‘ENTER’ key.

10. Diagnostics, Troubleshooting and Maintenance Diagnostics

The VLM10 Inline Vortex meter monitors its internal status during normal operation. Three specific conditions are monitored by the meter: faults, warnings, and alarms.

Faults

A fault is a condition that will negatively affect the meter’s performance. In the event of a fault condition, the yellow fault light on the front panel will illuminate, the fault will also be displayed on the Home page or the web-page interface. Fault conditions can be viewed using the front-panel, web-page, MODBUS or BACnet interfaces. All fault events are stored in a log file in the meter’s internal memory.

User intervention is required to clear a fault. A user can clear faults by using the front-panel or web-page interfaces. If the fault condition is still active when a user attempts to clear the fault, the meter will reassert the fault. However, if the fault condition is no longer active when a user attempts to clear the fault, the meter will clear the fault and return to a normal operating state.

To view and clear the active faults using the front-panel, follow the procedure below:

1. Activate the ‘RIGHT’ arrow key using the magnetic wand to take the meter out of screen saver mode.

2. While in run mode (normal operating mode) activate the ‘ENTER’ key on the front panel five times to enter the ‘Meter Setup Menu’.

3. In the ‘Meter Setup Menu’, scroll down by activating the ‘DOWN arrow’ key until the ‘View/Clear Faults’ option is highlighted. Activate the ‘ENTER’ key to select the ‘View/Clear Faults’ menu.

4. Any active faults will be displayed in this menu. To scroll through each fault, activate the ‘LEFT’ and ‘RIGHT’ arrow keys.

5. To clear a fault, move the cursor using the ‘LEFT’ or ‘RIGHT’ arrow keys until ‘Clear Fault’ is highlighted. Activate the ‘ENTER’ key to clear the fault.

To view and clear the active faults using the web-page interface, establish an Ethernet connection to the meter and then type the meter’s IP address into an internet browser’s URL. The faults will be displayed on the meter’s homepage and can be cleared by clicking on the fault.

The table on the following page lists each fault condition and a suggested solution:

Fault Condition and Suggested Solution Table

Fault Code	Description	Possible Reason	Solution
0	DSP	Internal communications failure	Power cycle the meter
			Replace electronics stack in the meter
1	DSP2	Remote communications failure	Verify remote wiring, including polarity of RS-485 bus
			Verify power is supplied to pipe-mount electronics
			Verify RS-485 bus is terminated
			Verify remote wiring is appropriately shielded from noise sources
2	RTC	Real-time clock	Power cycle the meter
			Replace electronics stack in the meter
3	BACKUP_ RAM	Faulty backup RAM battery	Power cycle the meter
			Replace electronics stack in the meter
4	EEPROM	Analog calibration values are out of range	Recalibrate the 4-20mA input and output circuits
5	KEYPAD	Internal communications failure to the keypad	Verify keypad ribbon cable is securely connected
6	RTD	RTD in flow tube is not reading correctly	Verify the RTD connector, in the terminal side of the enclosure, is securely connected
			Verify the signal connector, connecting on a right-angle to the signal board on the display side of the enclosure, is securely connected
			Replace RTD
			Replace electronics stack in the meter
7	PULSE_ OUTPT_ OFLOW	Pulse output queue is full, pulses lost	Verify the totalizer is set to increment at a rate slow enough to allow a full pulse to occur before the next totalizer event
8	ANALOG_ OUTPT_1	Analog output value is exceeding its scale	Verify the analog output is scale is set appropriately, if not adjust the scale
9	ANALOG_ OUTPT_2	Analog output value is exceeding its scale	Verify the analog output is scale is set appropriately, if not adjust the scale
10	ANALOG_ OUTPT_3	Analog output value is exceeding its scale	Verify the analog output is scale is set appropriately, if not adjust the scale
11	ANALOG_ INPT_1	Analog input value is exceeding its scale	Verify the analog input is scale is set appropriately, if not adjust the scale
12	ANALOG_ INPT_2	Analog input value is exceeding its scale	Verify the analog input is scale is set appropriately, if not adjust the scale
13	INTERNAL_ TEMP	Electronics at the meter, on the pipe, are too hot	Power-down the meter and verify proper installation for thermal mitigation, including thermal insulation blankets.
			Power-down the meter and verify that the ambient air temperature is not exceeding the max specified.
14	CONFIG	Invalid configuration setting	Power cycle the meter and verify that the configuration is correct
15	FREQ_OUT_ RANGE	Frequency is exceeding the expected range based on fluid type and line size	With no flow, run the auto-threshold routine to set the noise level of the meter
			Verify that the meter's configuration is correct
			Verify that the flow conditions are within the specified operating conditions of the meter
			Verify that the meter chassis is connected to earth ground through either the pipe-work or by use of an earth ground wire
			Verify the signal connector, connecting on a right-angle to the signal board on the display side of the enclosure, is securely connected

Warnings

A warning is an informational event that will not negatively affect the meter's performance. Warnings are logged to internal memory and can be viewed by a user for informational purposes.

Warning Codes and Possible Reasons Table

Warning Code	Description	Possible Reason
0	CFG_CHANGE	The configuration was changed
1	CAL_MODE	The meter was in a calibration mode
2	THREAD	Internal software failure. Meter will restart automatically.
3	TEMP1_MIN_MAX	The TEMPERATURE 1 parameter hit a new minimum or maximum value
4	TEMP2_MIN_MAX	The TEMPERATURE 2 parameter hit a new minimum or maximum value
5	PRESS_MIN_MAX	The PRESSURE parameter hit a new minimum or maximum value
6	VOL_MIN_MAX	The VOLUMETRIC flow rate parameter hit a new minimum or maximum value
7	CVOL_MIN_MAX	The "C" VOLUMETRIC flow rate parameter hit a new minimum or maximum value
8	MASS_MIN_MAX	The MASS flow rate parameter hit a new minimum or maximum value
9	ENERGY_MIN_MAX	The ENERGY flow rate parameter hit a new minimum or maximum value
10	TOTALIZER1	Totalizer1 assignment changed
11	TOTALIZER2	Totalizer 2 assignment changed
12	ANALOG_INPT	Analog input assignment changed
13	ANALOG_OUTPT	Analog output assignment changed
14	PWR_DOWN	The meter was powered-down
15	ALARM1_ON	ALARM 1 event turned-on
16	ALARM1_OFF	ALARM 1 event turned-off
17	ALARM2_ON	ALARM 2 event turned-on
18	ALARM2_OFF	ALARM 2 event turned-off
19	TEMP1_MIN_MAX_CHANGE	Temperature input 1 hit a new minimum or maximum value
20	TEMP2_MIN_MAX_CHANGE	Temperature input 2 hit a new minimum or maximum value
21	PRESS_MIN_MAX_CHANGE	Pressure input hit a new minimum or maximum value
22	VOLUME_MIN_MAX_CHANGE	Calculated volume hit a new minimum or maximum value
23	CVOLUME_MIN_MAX_CHANGE	Calculated compensated volume hit a new minimum or maximum value
24	MASS_MIN_MAX_CHANGE	Calculated mass hit a new minimum or maximum value
25	ENERGY_MIN_MAX_CHANGE	Calculated energy hit a new minimum or maximum value
26	SUB_FREQ_IN_USE	The meter was set to use a substitute frequency as a sensor input
27	SUB_TEMP1_IN_USE	The meter was set to use a substitute input for TEMPERATURE 1
28	SUB_TEMP2_IN_USE	The meter was set to use a substitute input for TEMPERATURE 2
29	SUB_PRESS_IN_USE	The meter was set to use a substitute input for PRESSURE

Alarms

Alarms are user-defined events that indicate a configured parameter is exceeding its user defined minimum or maximum value. Alarms can be configured by a user via the front-panel or web-page interfaces.

Symptom	User Interface	Possible Reason	Solution
Invalid or Missing Alarm	All	Incorrect configuration	Verify that the alarm event is configured correctly
	Relays	Relay not toggling on alarm event	Verify that the relay wiring is in accordance with the electrical installation and wiring instructions
			Verify that the relay is configured correctly for an alarm condition
		Faulty hardware	Replace electronics stack in the meter
		Inverted polarity	Swap the normally open and normally closed connections

Troubleshooting

If the VLM10 meter is not functioning as expected, refer to the table below for recourse. If an error, warning or alarm condition exists, refer to the Diagnostics section above. If, after trying the solutions listed in this manual, the malfunction still exists, contact your local Spirax Sarco sales representative.

Symptom	User Interface	Possible Reason	Solution
Blank display	Front Panel	Supply voltage	Verify that the meter power on the terminal board is within its operational specifications
		Display in screen saver mode	Verify that the meter's display is not in its screen saver mode. Use the magnetic wand to activate the 'LEFT' or 'RIGHT' arrow keys.
		Keypad cable not connected or loose	Verify keypad ribbon cable is securely connected
		Defective electronics	Replace electronics stack in the meter
Displays flow without output signal	4-20mA Output	Wrong configuration	Verify that the 4-20mA output configuration, including scale and offset, is correct
		Loop supply voltage	Verify that the 4-20mA loop supply voltage is within its operational specifications
		Loop load impedance	Verify that the 4-20mA loop load impedance is within its operational specifications
		Incorrect wiring	Verify that the 4-20mA loop wiring is in accordance with the electrical installation and wiring instructions
		Incorrect calibration values	Recalibrate the 4-20mA output channel
No flow reported with flow present	All	Wrong configuration	Verify that the meter's configuration is correct for the process fluid type
		Flow velocity too low or high	Verify that the process velocity is within the minimum and maximum specified velocity for the line size and fluid type
		Noise threshold set too high	Run the auto noise threshold routine with no flow to set the noise threshold
		No signal from piezoelectric crystal	Verify the signal connector, connecting on a right-angle to the signal board on the display side of the enclosure, is securely connected
			Check the resistance across piezo sensor wires: should be more than 20 Mohms
Flow reported with no flow present	All	Noise threshold set too low	Run the auto noise threshold routine with no flow to set the noise threshold. If after running the routine the meter still reports a flow with no flow present, manually change the noise threshold to a higher value.
		Electro-magnetic interference	Verify that the meter chassis is connected to earth ground through either the pipe-work or by use of an earth ground wire
		Pipe vibration or flow pulsations disturb flow signal	Manually increase the noise threshold value
Unstable flow signal	All	Flow velocity too low or high	Verify that the process velocity is within the minimum and maximum specified velocity for the line size and fluid type
		Noise threshold set too high	Run the auto noise threshold routine with no flow to set the noise threshold
		Electro-magnetic interference	Verify that the meter chassis is connected to earth ground through either the pipe-work or by use of an earth ground wire
		Air bubbles in the media	Follow piping guidelines
		Pulsating flow	Meter averages faster variation in flow but slower variation will be displayed

Troubleshooting (continued)

Symptom	User Interface	Possible Reason	Solution
Incorrect flow reading	All	Flow velocity too low or high	Verify that the process velocity is within the minimum and maximum specified velocity for the line size and fluid type
		Wrong calibration data	Verify that the K-factor/Reynolds pairs in the web-page correspond to the values in the calibration certificate
		Wrong configuration	Verify that the meter's configuration is correct for the process fluid type
		Piping not correct	Verify the piping installation has allowed for the required straight pipe run.
		RTD temperature errors	Verify that the reported RTD temperature is correct
No Web-page access	Ethernet	Wrong IP address	Verify that the browser's URL address is set to the meter's IP address. The meter's IP address is displayed on a scrolling screen on the front panel display.
		Subnet wrong	Verify with your IT department that the meter's subnet is valid for the network
		Firewall	Verify with your IT department that no firewalls are blocking access to the meter
		Network mask	Verify with your IT department that the meter's network mask is valid for the network
		Gateway IP	Verify with your IT department that the meter's gateway IP address is valid for the network
		Direct to PC connection	Verify that the PC has a static IP address with the same subnet as the meter's IP address
		Ethernet cable not connected	Verify that the Ethernet cable is connected and fully seated into the RJ-45 jack on the terminal side of the meter
No MODBUS commu-nications or invalid data	MODBUS RTU over RS-485	Incorrect wiring	Verify that the wiring is in accordance with the electrical installation and wiring instructions
		Wrong polarity	Verify that the wiring is connected to the correct polarity at each end of the RS-485 network
		Termination missing or excessive	Verify that the RS-485 bus is terminated in accordance with the electrical installation and wiring instructions
		Wrong baud rate	Verify that the host device has the same baud rate as the meter. Default baud rate is 9600 baud.
		Wrong data encoding	Verify that the host device has the same data encoding as the meter. The default encoding is 8 data bits, no parity, and 1 stop bit.
		Wrong address	Verify that the register set is addressed correctly as defined in the MODBUS register map
		Wrong data type	Verify that the data type of the addressed register matches the host command
No BACnet commu-nications or invalid data	BACnet MS/TP RS-485	Incorrect wiring	Verify that the wiring is in accordance with the electrical installation and wiring instructions
		Wrong polarity	Verify that the wiring is connected to the correct polarity at each end of the RS-485 network
		Termination missing or excessive	Verify that the RS-485 bus is terminated in accordance with the electrical installation and wiring instructions
		Wrong baud rate	Verify that the host device has the same baud rate as the meter. Default baud rate is 9600baud.
		Wrong data encoding	Verify that the host device has the same data encoding as the meter. The default encoding is 8 data bits, no parity, and 1 stop bit.
		Conflicting Station ID 1-127	Verify that the BACnet network stations have unique IDs. The default is 1.
		Conflicting Device ID 1-4194303	No more than 2 devices can have the same Device ID. Verify that all devices are configured with unique IDs.
		Max Masters 2-127	Verify that the number of BACnet masters on the network do not exceed the configured number of masters. The default is 127.

Maintenance

The VLM10 meter does not have a scheduled maintenance program. Recalibration of the flow meter does not need to be performed after the initial factory calibration because of the nature of a vortex meter. The frequency response from the sensor will not change over time unless the bluff body is physically damaged or worn. The RTD circuitry could exhibit some drift over time, and it could be recalibrated to maintain the best possible performance. If there is a need to recalibrate the meter, contact your local Spirax Sarco sales representative for further information on how to return a meter to the factory for recalibration. Note: it is possible to recalibrate 4-20mA input and output circuits in the field. Refer to the section on 4-20mA Loop Calibration in this manual for further details.

Setting a Static IP on a PC

It is possible to establish a direct connection between a PC and the VLM10 meter using Ethernet. This is often easier than networking the VLM10 meter, and it will allow a user to access the meter's webpages to view and configure meter parameters. In order to establish a connection, it is necessary to configure the PC or laptop with a static IP address. The instructions below detail the steps necessary to set a static IP address using the Windows XP operating system. Other operating systems will require a different procedure, but the concept is the same.

1. Connect an Ethernet CAT5 cable between the VLM10 meter's RJ-45 jack, accessible from the terminal side of the enclosure, and the PC's Ethernet port. The meter's electronics will automatically correct for a straight-through or cross-over cable, so it is not necessary to use one versus the other.

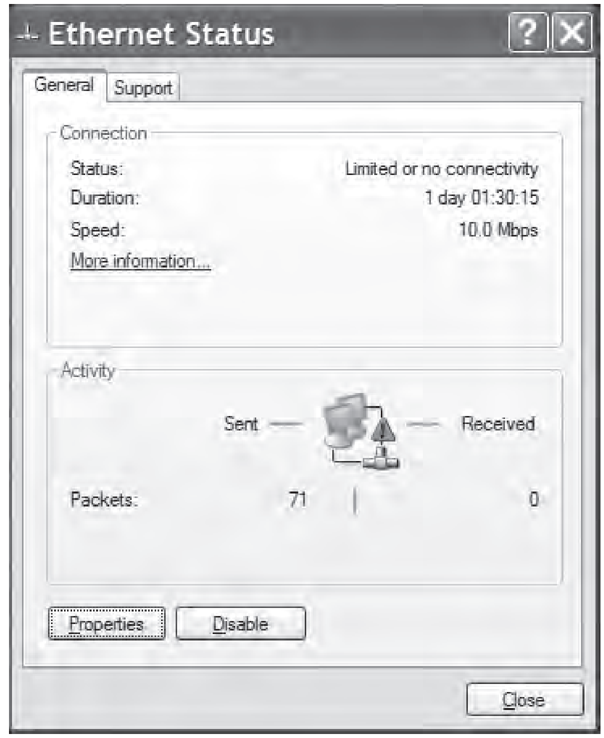
2. Power-on the meter.

3. Check the meter's IP address using the front-panel. Scroll through the displayed screens, using the 'LEFT' or 'RIGHT' arrow keys, until the meter's IP address is displayed.

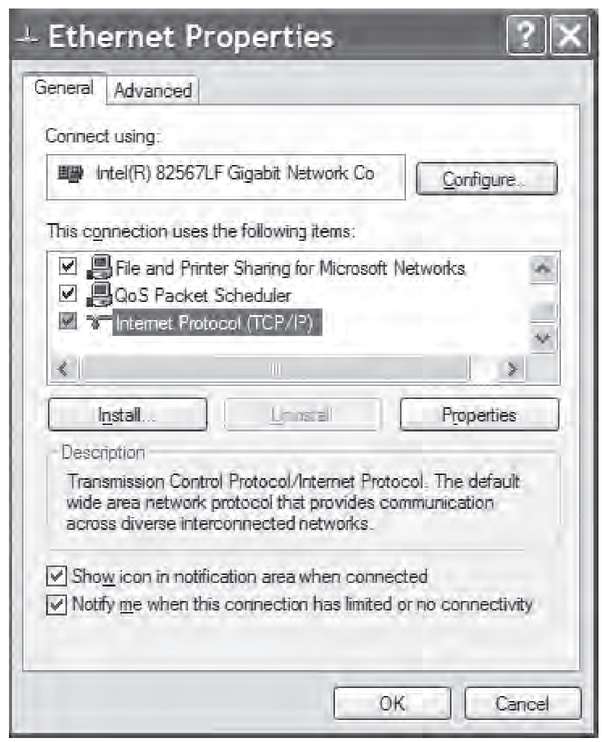
4. If the PC has a wireless connection, disable the connection to avoid IP conflicts between the wireless network assignment and the steps in this procedure.

5. Double click on the network icon, located in the lower right corner of the screen, beside the time. The connection indicator will likely display 'Not Connected' until the IP address is configured.

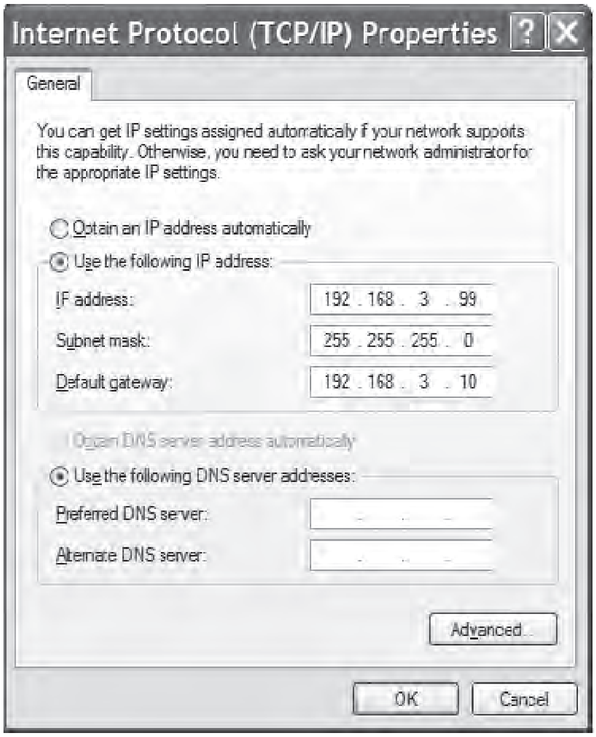
6. This will bring up the Ethernet Status window.



7. Click on the 'Properties' button in the Ethernet Status window.



8. Highlight the Internet Protocol (TCP/IP) option and click on the 'Properties' button.



9. Click on the 'Use the following IP address:' option and enter in an IP address, where the subnet, represented by the first 3 numbers, matches the meter's subnet. For example, if the meter has an IP address of 192.168.3.55, then the PC must be set to an IP address of 192.168.3.XXX, where XXX is any number between 0 and 255 that is unique from the meter's IP address and the gateway address.

10. Set the 'Subnet mask:' to 255.255.255.0.

11. Set the 'Default gateway:' to match the meter's subnet. The gateway address, the meter's IP address and the PC's IP address must have the same subnet but different addresses. For example, if the meter's IP address is 192.168.3.65, then the PC can have an address of 192.168.3.99 and the gateway can have an address of 192.168.3.10. It is also valid to set the gateway to 192.168.3.3 and the PC's IP address to 192.168.3.100 because the last number in the address should be unique, but the first three numbers in the address should be the same.

12. Click on 'OK'.

13. The Ethernet should now be connected between the meter and the PC.

Open a web browser and enter the meter's IP address into the URL to view the meter's web-pages.

Index

T

U

V

W

For more information contact:
Spirax Sarco, Inc.
2150 Miller Drive, Longmont, CO 80501
T: 800.356.9362 or 303.682.7060
F: 303.682.7069

www.spiraxsarco.com/us