Liquid Ultrasonic Flowmeters

Smith Meter®
Ultra™ Series C
Liquid Ultrasonic Flowmeters

Installation / Operation / Maintenance Manual

Bulletin MNLS005 ‖ Issue/Rev 0.3 (2/16)

+FMC Technologies

Important

All information and technical specifications in this documentation have been carefully checked and compiled by the author. However, we cannot completely exclude the possibility of errors. FMC Technologies is always grateful to be informed of any errors.

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1 – Overview

The Smith Meter Ultra Series liquid flow meters are multi-path ultrasonic meters with Signal Processing Unit (SPU) for custody transfer or custody transfer accuracy measurement of petroleum products. The following Ultra Series meters are covered under this manual.

Ultra™ 4c – Four path flow meter

Ultra™ 6c – Six path flow meter in sizes

Ultra™ 8c – Eight path flow meter

1.1 Principle of Operation

Smith Meter Ultra Series ultrasonic flow meters operate using the acoustic transit time measurement principle. The meter transmits ultrasonic signals between two transducers that are located on opposite sides of the meter body. These two transducers form a measurement path through the fluid with one transducer in the upstream position and the other downstream. The Ultra Series meters can have four, six or eight measurement paths depending on the model.

An ultrasonic signal that is transmitted from one transducer will travel through the fluid medium and be received by the transducer on the opposite side of the path. Each transducer can either send or receive a signal and the meter alternates between sending and receiving across the measurement path. [An ultrasonic pulse will travel through the meter at the velocity of sound of the fluid in the meter plus or minus the velocity that fluid medium itself.]

A pulse that is sent in the direction of the fluid flow will see a decrease in transit time as the signal travels with the flow. An ultrasonic pulse sent against the fluid flow will see an increase in transit time as it has to move against the fluid flow. Given both an upstream and downstream transit time, the meter electronics are able to calculate the exact velocity of the fluid traveling through the meter and the velocity of sound of the fluid in the meter.

The transducers are non-intrusive and flush mounted to ensure minimum risk of clogging by residues in the flow. The transducer is fully encapsulated and the transducer housing is manufactured in titanium.

1.2 Ultra Series Flow Meter Features

- **Custody Transfer Accuracy** – The Ultra Series meters combine the latest in ultrasonic design, sensitivity analysis, integration methods and signal processing optimization to deliver accurate custody transfer measurement.
- **Measurement Stability** – The path configuration and integration algorithms give superior flow profile correction and compensation for swirl and crossflow over a wide range of operating conditions.
- **Field Proven Electronics** – The Ultra Series meter designs use the proven know-how in ultrasonic measurement and microprocessor-based instrumentation for harsh outdoor petroleum applications from Smith Meter.
- **Excellent Noise Immunity** – The software and transducers are designed to operate in difficult applications with attenuation and noise for excellent performance in challenging applications.
- **In-line Transducer Replacement** – The transducer housings are separate from the inner transducers, allowing the transducers to be changed without special tooling and without shutting down the process.
- **Automatic Compensation for Path Loss** – In the unlikely event that a transducer should fail, the software will automatically compensate for the loss in path information, with reduced accuracy, in addition to advising the operator that an alarm is present.
- **Reciprocity** – Optimum transducer and electronics design ensures full reciprocity and zero influences on linearity, independent of pressure, temperature and transducer aging.

1.3 Applications

Measurement of hydrocarbon liquids for:

- Custody Transfer
- Allocation
- Leak Detection
- Inventory Control
- Off-loading and On-loading

1.4 Specifications

See Specification Bulletins:
SSLS006 (Ultra 8c)
SSLS004 (Ultra 6c)
SSLS003 (Ultra 4c)

1.5 Major Components of the Ultrasonic Flowmeter

The Ultra Series liquid flow meters consists of the following components:

- Meter Body
- Measurement Paths
  – Ultra 4c consists of 4 measurement paths in four chordal planes
  – Ultra 6c consists of 6 measurement paths in six chordal planes
  – Ultra 8c consists of 8 measurement paths in eight chordal planes
- Transducer Assemblies, two per measurement path
- Cable Manifolds
- Electronics Assembly consisting of:
  – Electronics Enclosure
  – UMCB (Ultrasonic Meter Control Board)

1.6 Receipt of Equipment

When the equipment is received, the outside packing case should be checked immediately for any shipping damage. If the packing case has been damaged, the local carrier should be notified at once regarding their liability. Carefully remove the unit from its packing case and inspect for damaged or missing parts.

If damage has occurred during shipment or parts are missing, a written report should be submitted to the Customer Service department by using the contact information at the beginning of this manual.

Prior to installation, the unit should be stored in its original packing case and protected from adverse weather conditions and abuse. Throughout the installation process, the electronics should be protected from adverse weather conditions.

1.7 Pre-Installation Inspection

Visually inspect the meter and meter nameplate to ensure the proper size, model number, flange rating and flow range. Note the direction of forward flow (described by an arrow) to determine the installation orientation.

Ultrasonic flow meters are precise measuring instruments and should be treated as such. Install the unit carefully. When transporting the meter, make certain it is not subjected to any severe shock as electronic components may be damaged. Cover flange openings to protect the internal diameter of the meter body. Lift the meter only by the lifting eyes located on each flange. **DO NOT** lift or move the meter by way of the cabling or conduit system. **DO NOT** lift or move the meter by inserting a forklift tine into the internal diameter of the meter.

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2 – Installation

2.1.   Mechanical Installation

2.1.1.   General

> *Warning: Care must be taken in the installation of the meter. The installer must comply with all national, regional, and local codes.*

Installation of the Ultra Series flow meter should follow good piping practices, such as alignment of the pipe center lines before installing the meter in order to minimize compressive, tensile or torsional stresses placed on the meter. A temporary, straight pipe spool can be used to align the process piping prior to meter installation if required. Do not use the meter to align the piping.

It is important that no portion of the gasket intrude into the ID of the pipe. This could cause a distorted flow profile in the meter that will affect the performance and stability of the measurement.

Gasket, bolt and nut materials selected must be compatible with the application environment and specifications. Pipe supports should be installed upstream and downstream of the meter to provide sufficient support of the process piping, in accordance with good piping practices.

It is recommended that the meter be installed in the section of piping where the pressure is highest, downstream from pumps and upstream from flow control valves. When it is expected that flow will be intermittent, the meter should not be mounted at or near a low point or high point in the piping. Solids or water will settle in a low point in the piping; gas will accumulate in a high point in the piping. Both of these conditions may impede proper meter operation.

The installation instructions described herein are intended to be general recommendations and, therefore, may require modification to fit your specific application.

2.1.2.   Handling of Flowmeter

Do not lift the flow meter by the electronics box. Use the lifting lugs that are attached to the flanges. Reference Bulletin SVLS003.

2.1.3.   Strainer

Although the flow meters do not have any moving parts and are non-intrusive to the flow stream, it is advisable to install a strainer upstream of the meter to protect the meter and other components such as the flow conditioner and flow control valve. For most pipeline installations, a 4 mesh basket will provide adequate protection.

2.1.4.   Flow Conditioning

Ultra 4c, 6c

Recommended Installation

For optimum performance, the flow meter installation should be designed to minimize excessive flow profile variation and swirl. The meter run must be the same inner diameter as the meter inlet and concentrically centered so that neither the pipe edge nor gasket protrude into the fluid flow. For correct centering it is recommended to use the centering dowel pin provided on the meter flange.

With the use of a flow conditioner, the upstream meter run recommendation is 5D straight length from the outlet of the flow conditioner to the meter inlet. Consult manufacturer for straight run before the flow conditioner. Without the use of a flow conditioner, recommended upstream meter run is 15D straight length from a concentric reducer or 20D straight length from a single elbow. Downstream meter run should be 5D of straight run with or without a flow conditioner. Consult factory for installations with a partially open valve, a pump, or double elbows out of plane within 30D of the upstream meter run entrance.

Ultra 8c

Recommended Installation

The Ultra 8c is designed for substantial resistance to measurement error resulting from flow profile variation and swirl. In order to optimize the stability and repeatability of the measurement the installation should be designed to minimize these effects where possible. The meter run must be the same inner diameter as the meter inlet and concentrically centered so that neither the pipe edge nor gasket protrude into the fluid flow. For correct centering it is recommended to use the centering dowel pin provided on the meter flange.

With the use of a flow conditioner, the upstream meter run recommendation is 5D straight length from the outlet of the flow conditioner to the meter inlet. Consult manufacturer for straight run before the flow conditioner. Without the use of a flow conditioner the meter is designed to exceed API straight run requirements. Please consult the factory for an installation recommendation to minimize metered run straight length without affecting the measurement performance.

2.2.   Electrical Installation

2.2.1.   General

The meter electronics are mounted in a flame-proof (explosion-proof) enclosure which is then mounted on top of the meter housing. Transducers are wired into the electronics enclosure by means of a cabling system. The meter electronics perform all signal processing calculations and outputs the indicated flow rate. The calculated flow rate is transmitted using the either the pulser output (0 – 10,000 Hz) or the analog (4-20 mA) output. Modbus and TCP/IP Ethernet communications can also be used to communicate flow rate as well as historical data and diagnostic information to other ancillary systems such as a P.C. or a PLC system.

The cable, conduit and conduit fittings must meet installation requirements, such as hazardous area classifications, humidity, temperature, voltage, current and others. All conduit connections must be installed with approved conduit seals installed within the required distance per the applicable electrical code(s).

CRITICAL

If the Ultra Series meter is NOT connected to an Ethernet network then FMC Technologies strongly recommends that an Ethernet cable is connected to the UMCB - ETH1 RJ45 connector on the meter and is fed into the closest control room. The cable does not need to be connected to any device but shall be available for connection by either service or Weights and Measures personnel. This way there will be no need to open the meter electronics enclosure in the field for verification of metrological parameters, applying software upgrades, and/or performing remote meter diagnostics.

2.2.2. **For ATEX and IEC Ex Installations**

The following installation instructions apply for the certified equipment listed in the equipment covered portion of the table below as per section 1.06 of Annex II of Directive 94/9/EC (ATEX Directive):

Standards used:

IEC 60079-0 6th Edition, EN 60079-0: 2012 +A11:2013 UL 60079-0 4th Edition

IEC 60079-1 6th Edition, EN 60079-1: 2007, UL 1203 4th Edition

IEC 60079-11 6th Edition, EN 60079-11: 2012, UL 60079-ll 5th Edition,
UL 913 7 Edition UL 1203 4th Edition

IEC 60079-28 1st Edition, EN 60079-28:2007

For wiring systems utilizing cable glands, the gland and or thread adaptor must be Ex d certified. The cable end must be securely installed and depending on the cable type be properly protected from mechanical damage.

For wiring systems utilizing conduit, an Ex certified sealing device must be used immediately at the entrance of the enclosure. Any unused entry must be suitably blocked with an Ex d certified plug. Any optical feed-through or bushing used must be Ex d certified.

Any fiber optic cables must be installed in accordance with the appropriate local standards such as: IEC/EN 60079-14, National Electrical Code (NFPA 70, esp. Article 770), Canadian Electrical Code (CSA C22, 1-12, esp. Section 56), for example, or other local codes, as applicable.

The maximum ambient temperature for the enclosure is 60°C; if the enclosure is directly mounted to a process piping system that exceeds this value then the enclosure(s) shall be remotely mounted to guarantee the 60°C ambient is not exceeded.

Equipment bonding shall be provided at the external grounding facility terminal, external connection is not required when using metallic conduit or armored cable.

Touch Screen: The touch screen (if provided) is protected by an intrinsic safe barrier. The enclosure must be grounded as per national electrical code regulations, such as NEC/CEC etc.

Fiber Optics Communication: This device contains a fiber optic Ethernet Transceiver module; any fiber optics device(s) connected to this device through the connecting fiber optic cable must be suitable for the location in which it is (they are) installed and any locations where the fiber optic cables are run, with respect to both electrical circuits and optical radiation, for ATEX and/or IECEx installations.

CAUTION: To prevent ignition of hazardous atmospheres and to prevent electrical shock, disconnect from supply circuits before opening, keep tightly closed when circuits are in operation.

$C \epsilon$ 0539 $\langle \text{Ex} \rangle$ II 2G

Marking	Equipment Covered	Certificate
Ex d IIB T4 – T6 IP66 Tamb = -40°C to +70°C	Ultrasonic Transducer	DEMKO 05 ATEX 05.11224
	Ultrasonic Transducer System	DEMKO 09 ATEX 0907098X
Ex d ia op is IIB T5 Gb (Um=250v) IP66 Tamb = -40°C to 60°C	Ultrasonic Meter Control (UCM) w/display	DEMKO 13 ATEX 1204991X
Ex d op is IIB T5 Gb IP66 Tamb = -40°C to 60°C	Ultrasonic Meter Control (UCM) w/o display	
Ex d ib IIB T5 Gb IP66 Tamb = -40°C to 60°C	Remote Mounted Display: Touch Screen Control Interface (TCI)	

> **WARNING:** *The enclosure contains an internal battery-powered circuit. To prevent ignition of hazardous atmospheres, do not open enclosure unless area is known to be non-hazardous. To reduce the risk of ignition of hazardous atmospheres, conduit runs must have a sealing fitting connected within 18 inches of the enclosure. Substitution of components may impair intrinsic safety and op is.*

Special conditions for safe use:

- Select wiring and cable glands suitable for 90°C operation.

- Contact manufacturer at address listed for information on the dimensions of the flameproof joints.

  FMC Technologies Measurement Solutions, Inc.
  1602 Wagner Avenue
  Erie, Pennsylvania 16510
  USA

- When Housing Model UMC - E - (A or S) - (P or H) - is used, the pedestal mount base shall provide a maximum 0.9246 in. (23.485 mm) O.D. for interface with an enclosure covered by ATEX Certificate DEMKO 09 ATEX 0907098X and IECEx Certificate IECEx UL 09.0023X with the required dimensions listed below. This joint will be factory made and the two ATEX / IECEx certified products will always be shipped together.

Required Dimensions:

  Maximum Diametrical Clearance = 0.003 in. (.075 mm)

  Minimum Length = 0.5 in. (12.7 mm)

The joints described above are held in place by use of two Allen head cap screws, DIN 912-A4-70 or DIN 912-A2-70, inserted through the Retaining Flange and threaded into the pedestal mount base.

2.2.3.   **For North American Installations:**

Conduit connections must be in accordance to: USA – National Electric Code (NFPA 70), Canada – Canadian Electric Code (CSA C22.1).

A listed seal-off box must be used immediately at the entrance of the enclosure. (i.e.: within 3 inches) Any unused entry must remain blocked with the provided plug or a suitably listed alternative at all times.

2.2.4.   **All Installations – Notes**

CAUTION: To prevent ignition of hazardous atmospheres, disconnect form supply circuit before opening any enclosure. Keep tightly closed when circuits are in operation.

WARNING: Contains internal battery-powered circuit. To prevent ignition of hazardous atmospheres, do not open enclosure unless area is known to be non-hazardous.

DO NOT SWITCH POWER ON until all questions pertaining to installation wiring are resolved. Any damage caused by unauthorized operation will void the warranty.

CAUTION: The cable installation must be performed according to the relevant cabling lists and/or connection diagrams.

2.2.5.   **Tool Kit**

A tool kit is provided with each meter to aid in installation and any future maintenance of the electronics. This tool kit should be stored such that it is available to any technician who may need to access the meter electronics in the future.

The tool kit contains:

• **6mm Allen Wrench** – Used for removing the electronic cover housing bolts
• **Small slotted screwdriver** – Used for tightening the screw terminals on the terminal blocks
• **Calibrated Torque Wrench** – Used for tightening/loosening the transducer coax connectors from the UMCB
• **Serrated Tweezers** – Used for moving jumpers on the UMCB (e.g. To disable the built in RS-485 termination resistor or to switch between copper and fiber Ethernet options (ETH1 and ETH2)).

2.2.6.   **Additional Equipment Required**

• Conventional hand tools for cable installation.
• If the meter is to be installed with fiber optic communications capability, special tools for terminating MT-RJ connectors to the fiber optic cable are required.

2.2.7.   **Electrical Installation**

Due to customer or location specific requirements, the cables for communication and power supply lines are not a part of the delivery. However, the technical specifications for the cables MUST be followed. Prior to installation, these requirements must be checked. The number of and types of cables are dependent on which options will be utilized by the end customer. A set of wiring diagrams are available covering the different options later in this manual.

Cables must be protected against mechanical damage.

Be aware of the minimum bending radius of the cable. The bending radius for multi-core cable is normally 6 times the diameter. However, the minimum bending radius for a fiber optic cable may vary from this and must be checked with the cable manufacturer in each case to ensure proper installation.

Cable installation and connection must be done by professionals with the necessary skills.

Loop checks of cables are usually done to ensure that the cable connections have been done correctly. The loop test should be performed according to relevant loop check schemes and procedures.

To ensure correct results of the loop check, the wires at both ends must be disconnected. The loop check should cover as much of the signal loop as possible, preferably from terminations at the meter to terminations in the control room.

Usually a multimeter with resistance measurement is sufficient for the loop check.

In some cases plant specifications require a megger-test. It is extremely important that the wires are disconnected from the Ultra electronics before the megger is used as this will cause permanent damage to the meter electronics. After the loop test, it is important that the wires are reconnected correctly.

If a cable with a shield per wire pair is used, the shield must be connected to earth ground at one end only. For cables between the control room and the Ultra, the shield are typically connected in the control room. For cables between the Ultra and external instrumentation, the shield should be connected at the meter. If the shields are specified to be grounded at the instrument, connect to the cable gland or ground lug on the internal area around the threaded conduit entrances.

If twisted pair cabling is used for current loops or RTDs, each signal with its reference (GND) should be in the same twisted pair. Do not mix different signals in the same pair.

2.2.8.   Fiber Optical Cables

An MT-RJ connector is used to connect the optical fiber cable to the Ultra. The MT-RJ plug must be terminated to the end of the cable entering the Ultra electronics enclosure. The connectors may be pre-terminated, or special tools must be available for mounting these.

> **NOTE:** *If the MT-RJ connector will be pre-terminated to the cable, ensure that it is possible to feed the connector through the cable gland.*

The maximum number of cable splices/junctions in one fiber run is given by the total power budget. This is dependent on the type of cable, length of cable, type of transmitter and receiver at both ends, use of repeaters and number of connections.

3 – UMCB (Ultrasonic Meter Control Board)
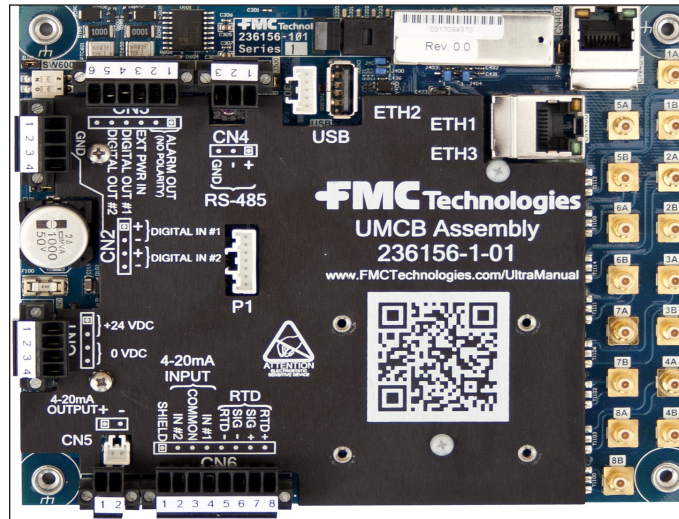
NOTE: On the UMCB cover shield legends position 1 is indicated by a circle enclosed in a square.

3.1.   Wiring Examples/Information

3.1.1.   Power Supply

The electronics are designed to be powered by 24 VDC. See specification sheets for additional information.

The shield of the cable should be connected only at the electronic enclosure, preferably via the cable gland.

Connect input power cable to connector CN1.

DC Input Wire	Terminal
24 VDC (+)	CN1-1 (or CN1-2)
Ground	CN1-3 (or CN1-4)

3.1.2.   Input / Output Wiring

- **Digital I/O**
  - (QTY 2) Digital Inputs (CN2)
  - (QTY 2) Digital Pulse Outputs/Digital outputs (CN3)
  - Alarm Output (CN3)

- **Analog I/O**
  - (QTY 2) 4 to 20 mA Input (CN6)
  - 4 to 20 mA Output (CN5)

- **Communications**
  - (QTY 2) ANSI/IEEE 802.3 Ethernet Port (ETH1 and ETH3)
  - Fiber Optic Port - 100Base-FX (ETH2)
  - RS-485 Half-Duplex (2-wire) (CN4)

> **NOTE:** *Reference the product specification sheets for technical specifications of the I/O.*
> **Note in diagrams below:**
>
> ☐ ─── ═ Customer Wiring / Equipment

3.1.3. Digital I/O

Connections for the digital I/O are made on the UMCB board using terminal CN2 and CN3

3.1.4. Digital/Pulse Output

The pulse output connections are made using terminal CN3 as follows:

Function	Connection Port
Digital/Pulse Out #1	CN3 - Terminal 4 and 6
Digital/Pulse Out #2	CN3 - Terminal 5 and 6

Pulse Out #2 is 90 electrical degrees out of phase with Pulse Out #1.

For forward flow, Pulse Out #2 lags Pulse Out #1.

For reverse flow, Pulse Out #2 leads Pulse Out #1.

The pulse outputs can be configured to act as active outputs or pseudo open collectors. They are "pseudo" because the two output grounds are not isolated from each other.

Digital Outputs - Active Output Mode - Preferred
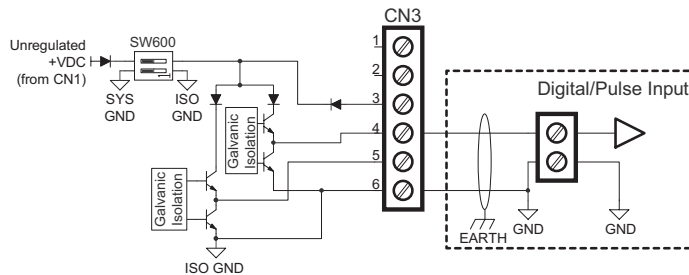
- OR -
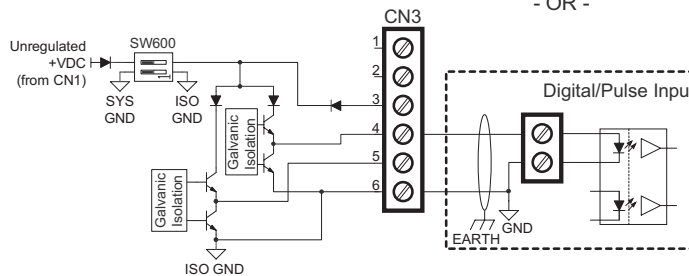
*Out2/B is wired identically between Positions 5 and 6

> **NOTE:** *Customer can power Active Outputs with higher or lower voltage by setting both positions of SW600 to OFF and connecting external power supply between CN3 positions 3 and 6.*
>
> **NOTE:** *If using dual pulse output the two conductors carrying the outputs must not be in the same pair and ideally are individually shielded.*

Digital Outputs - Active Output Mode
Externally Powered
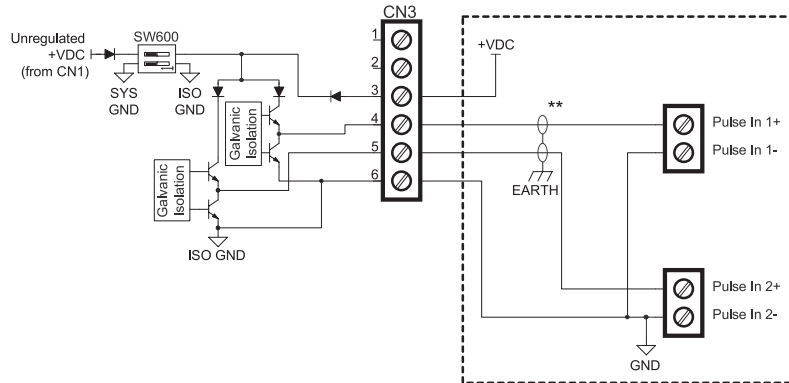
*SW600 Positions 1 and 2 must be set to OFF

** If using dual pulse output the two conductors carrying the outputs must not be in the same pair and ideally are individually shielded.

Pull Up Addendum

*SW600 Positions 1 and 2 must be set to OFF

**If using dual pulse output the two conductors carrying the outputs must not be in the same pair and ideally are individually shielded.

***Customer Supplied Pull-Up Resistor

When operated in pseudo open collector mode, the outputs will require a "pull-up" resistor in order to function properly unless the receiving instrument has a current-limiting resistor built into the circuit.

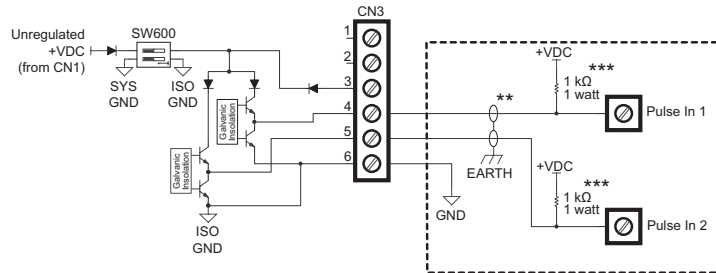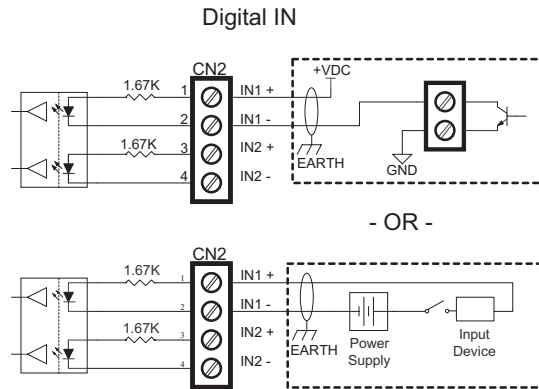### 3.1.5.   Digital Inputs

Function	Connection Port
Digital In #1	CN2 - Terminal 1 and 2
Digital In #2	CN2 - Terminal 3 and 4

Digital In #2 is currently dedicated to the use as an external Weights and Measures hardware lock switch.

Consult the factory for the available uses for Digital In # 1.

Digital IN

- OR -

*IN2 is wired identically

3.1.6.   Weights and Measures Lock

Weights and Measures parameters can be hardware locked by removing jumper J_WM which is located directly below CN2. If an external switch is desired, it can be connected to Digital In #2. In this case, jumper J_WM must be removed to allow the external switch to work.

3.1.7.   Analog Inputs

Connections for the Analog Inputs are made on the UMCB board using terminal CN6:

Function	Connection Port
4-20mA In #1	CN6 - Terminal 4 and 3
4-20mA In #2	CN6 - Terminal 2 and 3
RTD +	CN6 - Terminal 8
RTD Sig +	CN6 - Terminal 7
RTD Sig -	CN6 - Terminal 6
RTD -	CN6 - Terminal 5

Input Signal Ranges	
4-20mA In #1 and #2	3.8 - 22 mA
RTD	76.7278 - 168.4783Ω
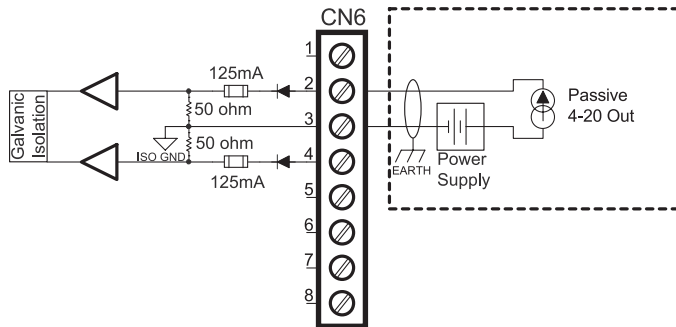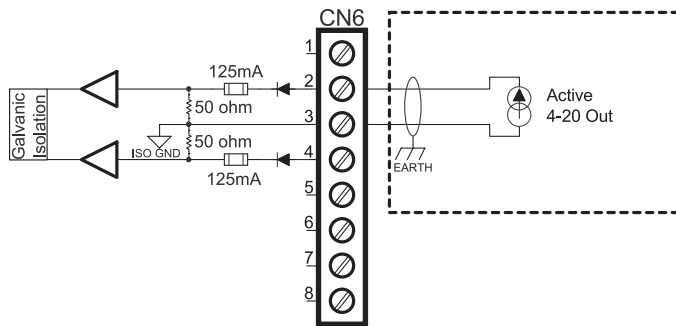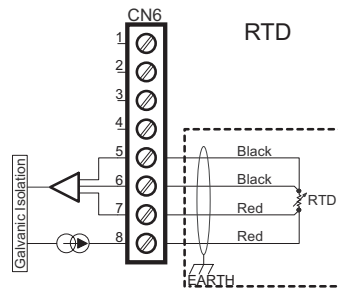
*IN2 is wired identically

3.1.8. Analog Outputs

Connections for the Analog Output are made on the UMCB board using terminal CN5:

Function	Connection Port
4-20mA In #1	CN5 - Terminal 1 and 2

The 4-20mA output is passive and requires an external voltage source. If an external isolated voltage source is not desired, the same 24 VDC that is powering the electronics may be used as the voltage source. This can be done by wiring CN5 Terminal 1 to CN1 Terminal 1 or 2.

Output Signal Range: 3.8 - 21.0mA

4-20 Out
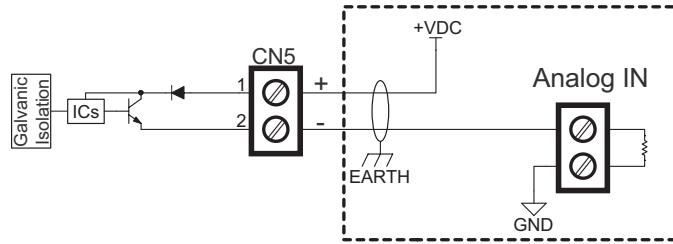
3.2.   Communications

3.2.1.   Ethernet

The 10/100 base-T Ethernet connections are made using terminal ETH1 and ETH3.

Fiber optic connection is made using terminal ETH2

Comm. Port	Connection Port
Copper Ethernet #1	ETH1
Copper Ethernet #2	ETH3
Fiber Optic	ETH2

If fiber optic communications is required, only one copper Ethernet port will be available, ETH2. The Unit will be factory set the Ethernet connectivity mode that was ordered.

Modifying the Ethernet connectivity ports requires removal of the UMCB board. Consult factory before proceeding. Proper ESD precautions must also be followed. The jumpers on the top and bottom side of the UMCB must be positioned according to the table below. Only modify jumpers with the power to the electronics off. DO NOT USE needle nose pliers or other large tools to move the jumpers as the jumpers and PCB can be damaged.

Jumper configuration for copper vs. fiber optic mode:

Jumper	Copper (CN401)	Fiber Optic (CN402)
J400	OUT	IN
J401	OUT	IN
J402	OUT	IN
J403	1 and 2	2 and 3
J404	1 and 2	2 and 3
J405 (under shield)	OUT	IN
J406 (bottom side of board)	2 and 3	1 and 2
J407 (bottom side of board)	2 and 3	1 and 2

3.2.2. Alarm Output

The alarm output connections are made using terminal CN3 as follows:

Analog Output	Connection Port
Alarm Out #1	CN3 - Terminal 1 and 2
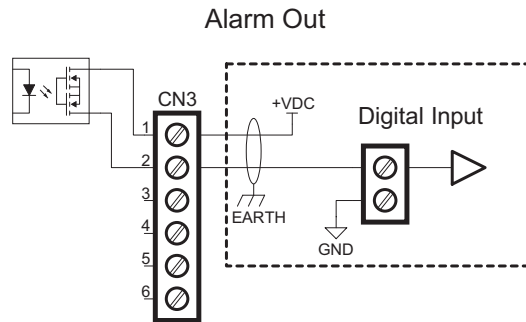
Alarm Out

The solid state relay is closed during normal operation. During an alarm, or when the power is off the SSR is open. The relay is DC only.

3.2.3. RS-485

The meter features a 2-wire (Half Duplex) RS-485 serial communication port. The serial port terminals are accessed on connector CN4 on the UMCB board. The port supports Modbus-ASCII and Modbus-RTU communication protocols. More information about Modbus-RTU communications can be found in the Communications Manual MNLS006.

RS485
(2-wire)
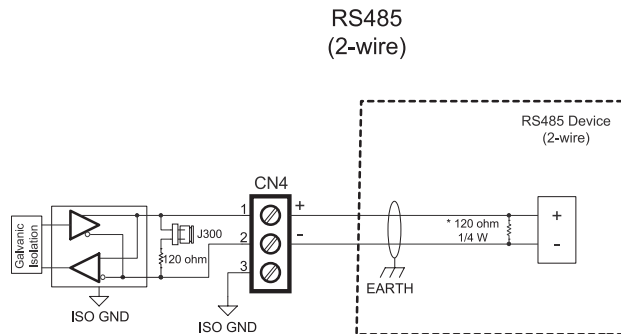
*Customer Supplied Resistor - Only necessary
if customer equipment does not have internal termination.

3.2.4. USB

A USB female A connector is provided on the UMCB for connection to FMC approved devices only. Connection of unauthorized devices may result in unexpected meter behavior, damage to the electronics, and a voided warranty. Do not connect anything unless directed to by the factory.

4 – Meter Start-up

Before powering on the meter and beginning flow measurement, verify that the following items are completed:

- Meter has been properly installed (flow direction is correct) in the piping and all connections are free from leaks.
- Power Supply, Input / Output connections have been checked for proper wiring and connection integrity.
- All conduit and/or gland connections are in adherence to applicable electrical codes.

When power is applied to the meter, it will go through a boot sequence and will then begin measurement automatically. This process takes several seconds. If flow is present, the pulse output will begin and the connected flow computer should begin totalizing.

If power is interrupted for a period of less than 20 ms during operation, the meter will continue operating with no loss of measurement. If power is lost for more than 100 ms during operation, the meter will reset. Once power is re-supplied, the Ultra Series meter will go through the power-on boot sequence and will resume measurement.

4.1. LEDs Overview

During start-up and normal operation four LEDs on the UMCB board above the ETH2 connector are visible and intended to communicate status information.
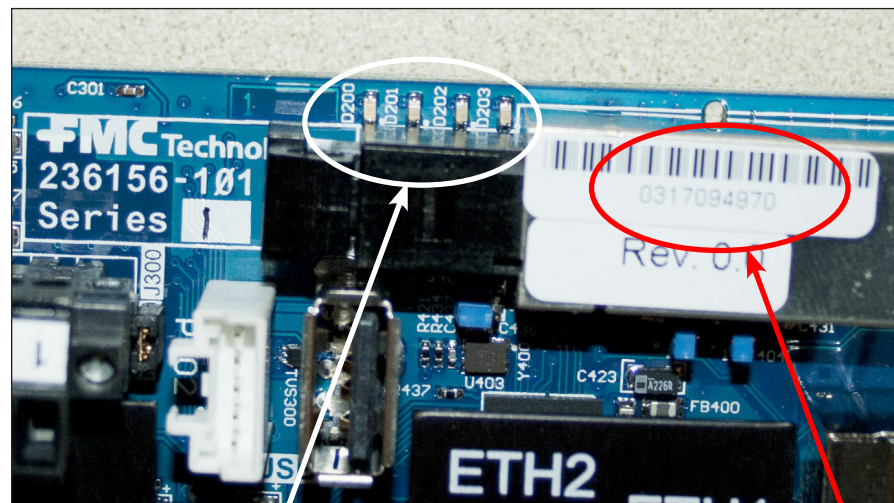
Meter Serial #

The LEDs consist of:

- LED 200 - Blue
- LED 201 - Green
- LED 202 - Yellow
- LED 203 - Red

4.1.1.   LED Behavior

4.1.2.   Start-Up

During start-up the following LED behavior should be observed:

All visible LEDs will briefly flash, then all shutoff except yellow. Yellow shuts off when the main OS starts booting.

4.1.3.   Normal Operation

During normal operation the following LED behavior should be observed:

Green turns on when the metering startup process has successfully completed.

The flashing blue LED is a heartbeat monitor that confirms the core measurement processes are running.

4.1.4.   Setting the Meter IP Address

There are two ways to identify the meter IP address after first starting up the meter:

A. The rotary switch can be used to force the IP address to the factory default value of 169.254.165.10. This will allow the user to access the meter interface to configure the permanent address settings. Before doing this, take note of the original position of the rotary switch and record this position. Then turn the switch to position 9.

The meter must re-boot for new address settings to activate. Either cycle power to the meter or reboot from the Diagnostics -> Meter restart menu.

The IP address will be 169.254.165.10. Type this address into the URL input of a browser (such as Firefox, Chrome, or IE9+), and a connection to the user interface will be established.

In order to change the meter's address settings to a different value set the rotary switch to position 0 and configure in the Settings -> Communications menu. The meter must re-start in order for communication setting changes to take effect.

IMPORTANT: The rotary switch must be set to position 0 and the meter restarted in order for the software configuration to take effect.

B. The meter can also be located using the "Ping" command from the command prompt if the serial number is known. The meter serial number is shown on the control board near the fiber optic input connector (see figure section 4.1).

Enter following ping command in the Command Prompt screen to communicate with the meter and receive the IP address (See illustration).

H:\>ping -4 <serial number> .local

C.   A service discovery software such as Bonjour can be used find the meter serial number if the meter is not physically accessible. The meter will broadcast the following identification data over the network.

1.   Manufacturer = FMC

2.   Instrument = meter

3.   Type = ultrasonic

4.   Serial = <electronics serial number>

5.   Tag = <configured tag name>

The value of Serial is set at the factory to the serial number of the meter electronics. This will also be the default configured tag name. Refer to I/O/M section 5.3.2.4.8 for updating the meter tag name once connected.

The following procedure can be followed to access the meter.

1.   Install the latest version of Bonjour:

2.   The Bonjour browser will show devices on the network as indicated below. Identify the meter as the device listed as an FMC Ultrasonic Meter

3.   Use the Serial number to "Ping" the meter from the command prompt as per Section B instructions above.
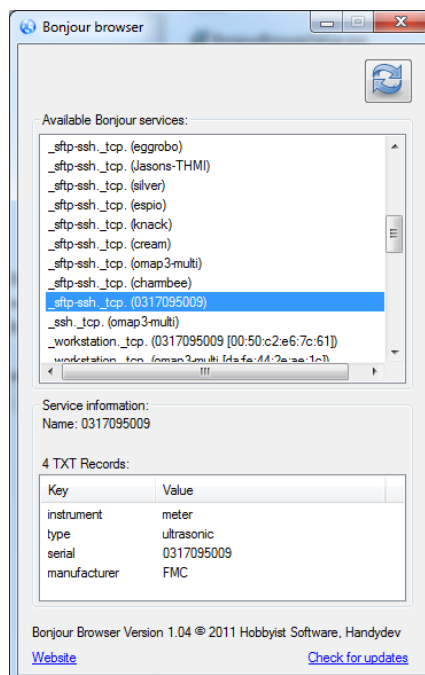
5 – Web User Interface

5.1.   Main Menu

The Ultra Series C Main Menu offers the ability to navigate anywhere on the user interface and offers large buttons that are easy to press along with icons that are easily recognized.

- Overview – general summary of prominent flow data.
- Settings – configuration parameters for the meter.
- Alarms – indicates 10 most current alarms, if they exist.
- Run Data – engineering/advanced-technical level information.
- Diagnostics – additional meter features.
- Meter Information – applicable meter properties.
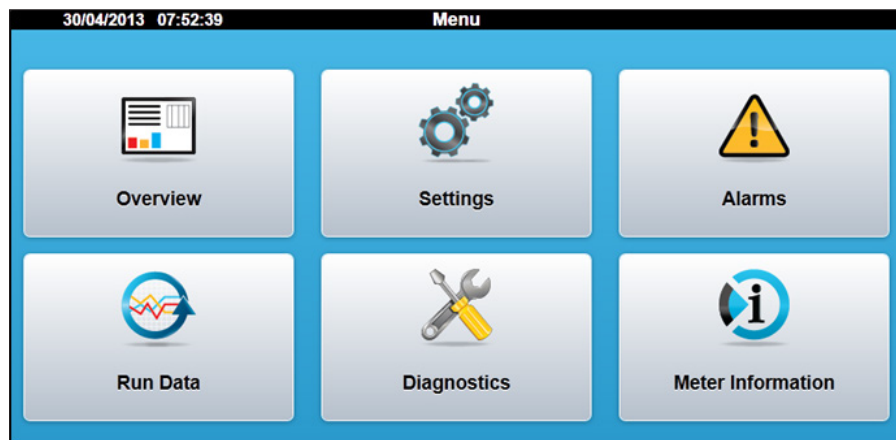
5.2.   Overview Menu

(Path: Main Menu > Overview)
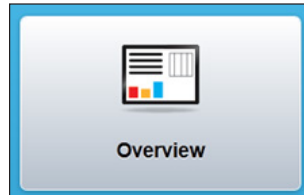
The Main Overview Tab shows general flow information of the meter.
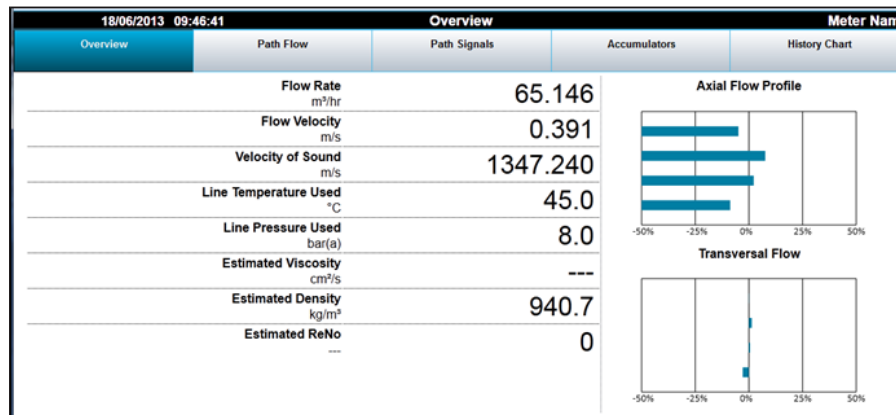
5.2.1.   Path Flow

(Path: Overview > Path Flow)

The Path Flow Tab shows the flow velocity, VOS (velocity of sound) and turbulence per path of the meter.

02/05/2013 11:04:36		Path Flow		
Overview	Path Flow	Path Signals	Accumulators	History Chart

Path	Flow Velocity (m/s)	VOS (m/s)	Turbulence (%)
1	0.183	1374.514	0.0
2	0.183	1374.514	0.0
3	0.212	1375.068	0.0
4	0.201	1373.860	0.0
5	0.196	1374.613	0.0
6	0.183	1374.514	0.0

5.2.2.   Path Signals

(Path: Overview > Path Signals)

The Path Signals Tab shows SNR (Signal Noise Ratio) Raw, SNR Used, Signal % and Gain per path per channel.

02/05/2013 11:03:54		Path Signals		
Overview	Path Flow	Path Signals	Accumulators	History Chart

Path	SNR Raw (dB)		SNR Used (dB)		Signal (%)		Gain	
	A	B	A	B	A	B	A	B
1	16.6	16.6	31.1	31.1	100.0	100.0	-2.5	-2.5
2	20.4	20.6	31.1	31.0	100.0	100.0	3.5	3.5
3	21.5	21.4	37.9	37.6	100.0	100.0	2.6	2.6
4	21.3	21.3	33.7	33.7	100.0	100.0	2.6	2.6
5	20.1	20.5	31.2	31.1	100.0	100.0	5.5	5.5
6	18.4	18.4	35.4	35.2	100.0	100.0	4.5	4.5

5.2.3.   Accumulators

(Path: Overview > Accumulators)

The Accumulators Tab shows Forward and Reverse Volume Totalizers; Forward and Reverse Error Volume Totalizers for the meter.

2015-03-31 12:35:27		Accumulators		038479930(
Overview	Path Flow	Path Signals	Accumulators	History Chart

Forward Volume Totalizer m³	00000293806.8819
Reverse Volume Totalizer m³	00000000014.8541
Forward Error Volume Totalizer m³	00000004199.5468
Reverse Error Volume Totalizer m³	00000000004.9202

5.2.4.   History Chart

(Path: Overview > History Chart)

History Chart Tab illustrates Flow Velocity and VOS (Velocity of Sound) trending.
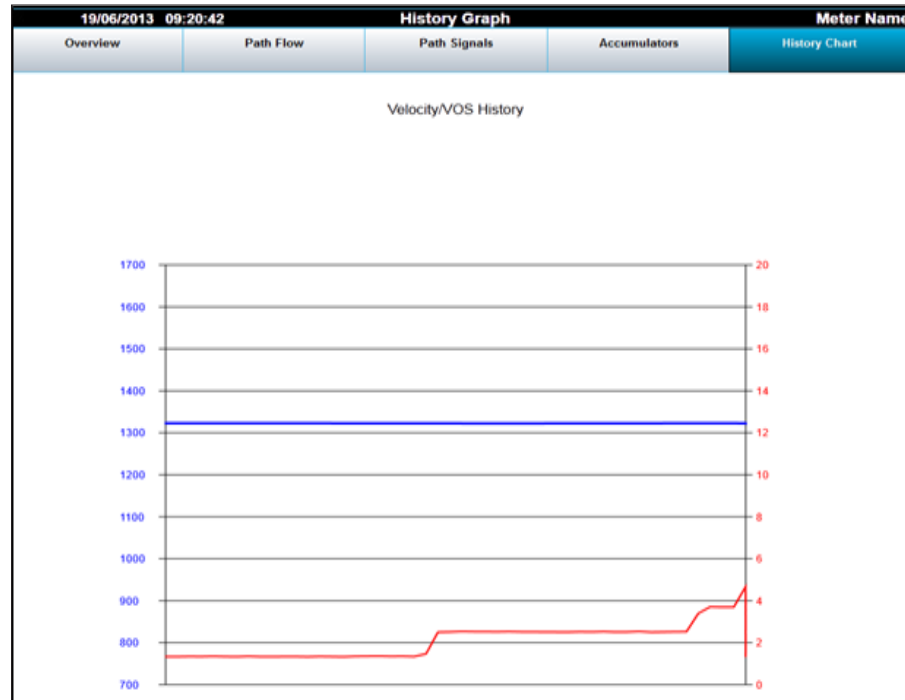
5.3.   Settings Menu

When the Settings Button Icon is selected, a Login Screen will appear. A password is required to access the configuration settings. There are (5) different levels of security access for the meter and each have the following default passwords:
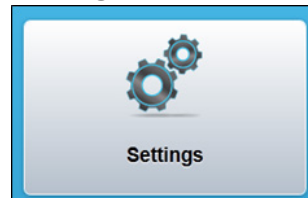
- Level 1 Password: 1111
- Level 2 Password: 2222
- Level 3 Password: 3333
- Level 4 Password: 4444
- Level 5 Password: 5555 Highest Level where changes can be made to the meter data, etc.

It is recommended that these default passwords be changed to a more secure password. This may be accomplished at the Account Administration screen (located: Settings -> General).

The passwords can be reset using the Diagnostics -> Reset Passwords function. This requires physically accessing the meter and setting the rotary dip switch to position 8. See IOM section 5.6.8 for further details.

5.3.1.   Login Screen
Select the desired user level and enter the corresponding password.
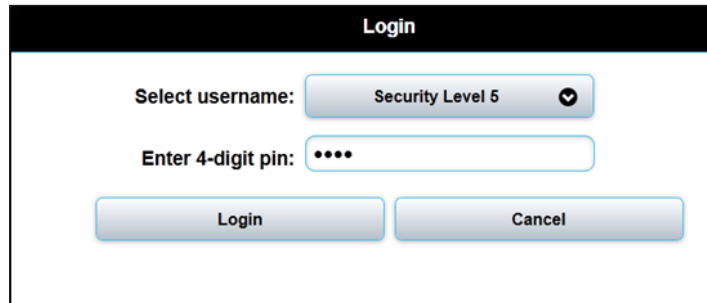
Contact factory if passwords need to be reset.

5.3.2.   Settings
(Path: Main Menu > Settings)

The meter settings are partitioned into smaller more manageable groups. The settings may be accessed by selecting a particular group.

Page 1

Page 2
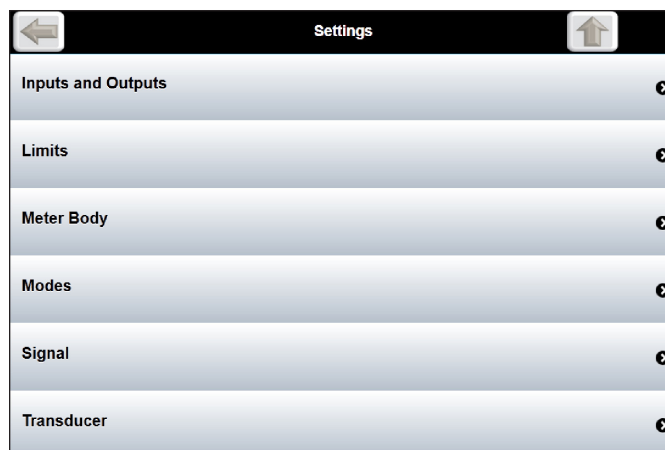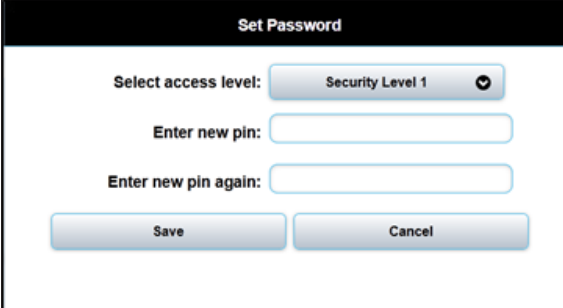
5.3.2.1.   General

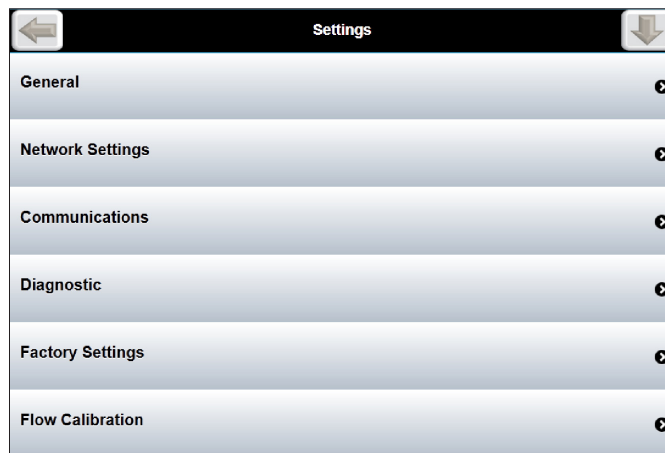#### 5.3.2.1.1. Account Administration

(Path: Settings > General > Account Administration)

Password modifications are accomplished here. The user level currently logged in is capable of changing its own password and any user level lower. (e.g. A user logged in at level 3 may change the password for levels 1-3).

- Drop down menu – contains all available user levels
- Input fields – enter new 4 digit numeric pin
- Save button – accepts new pin
- Cancel button – discards new pin

5.3.2.1.2. Date/Time

(Path: Settings > General > Date/Time)

The system date and time follow the international UTC standard.

- ✅ Button – save the current selection, exit dialog
- ❌ Button – discard changes, exit dialog

5.3.2.1.3. Units of Measurement

(Path: Settings > General > Units of Measurement)

Selecting any unit of measure to modify will display the dialog shown below:
- Lock Icon – Indicates the security level required to modify the current setting
- Drop Down Menu – Contains various units of measure options to choose from
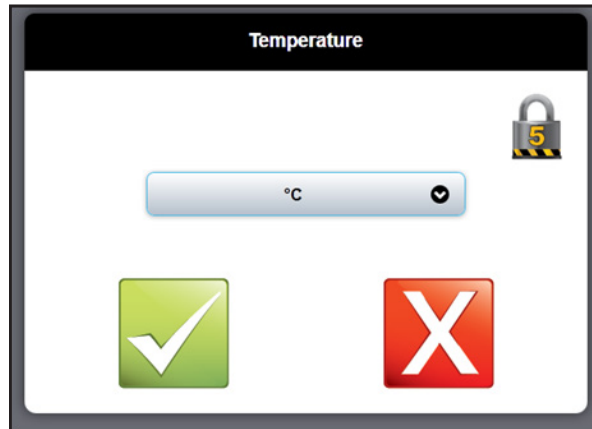
5.3.2.2. Network Settings

(Path: Settings > Network Settings)

Configure the necessary Ethernet settings for network communication.

- DHCP – Meter will automatically be assigned an IP per the network's DNCP server.
- Fixed – allows for manual configuration of the meter's network settings.
- Saved button – accepts new configuration.

NOTE: These changes will not take effect until the meter has been power cycled.
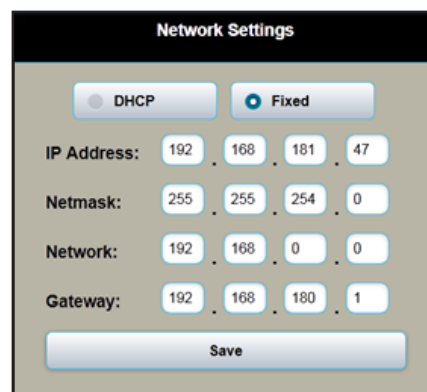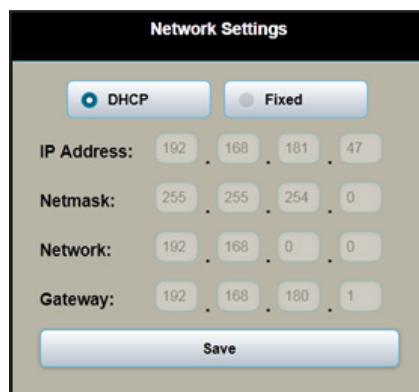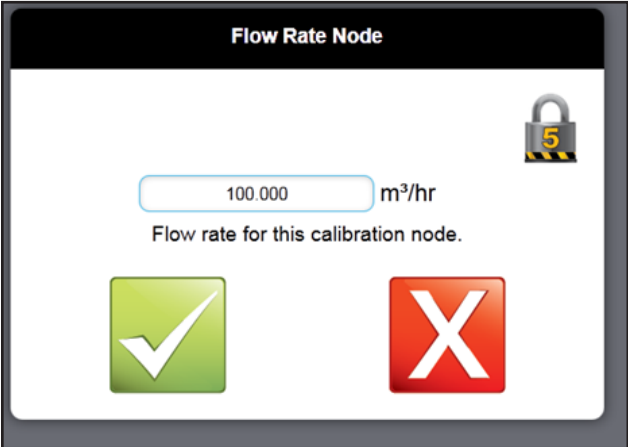
5.3.2.3.   Flow Calibration

(Path: Settings > Flow Calibration)

The menu allows for implementation of a meter factor that is variable with the flow rate over up to 16 meter factor Nodes. Each Node is comprised of 2 parameters: a flow rate and a corresponding meter factor. Calibration node 1 sets the meter factor for all flow rates at or below the entered flow rate. Additional calibration nodes can be entered in order from low to high flow rate in order to vary the meter factor with flow rate. Not all 16 available calibration nodes need to be configured. The last configured calibration node sets the meter factor for all flow rates at or above the entered flow rate. If a single calibration node is configured then this sets the meter factor for all flow rates above and below the flow rate set point.

Calibration Node Entry Guidelines:

1) All 16 of the calibration nodes do not need to be configured. Start the calibration range at Node 1 and leave unused nodes set to (0,0).

2) Use the single calibration Node 1 to set a fixed meter factor valid for all flow rates.

3) Program additional nodes starting at the lowest flow rate at Node 1 progressing to the highest.

4) Program nodes contiguously (don't leave unused nodes in the middle of the list).

5) The first configured node in the list sets the meter factor for all flow rates at or below the entered flow rate

6) The last configured node in the list before an un-configured node sets the meter factor for all flow rates above that flow rate.

- Lock Icon – Indicates the security level required to modify the current setting
- Input Field – Desired flow rate of meter factor values
- Unit Literal – Current unit of measure programmed in the meter
- Help Literal – Text describing the current parameter's purpose
- ✅ Button – save the units currently selected, exit dialog
- ❌ Button – discard changes, exit dialog

5.3.2.4. Communications

(Path: Settings > Communications)

This menu provides configuration options for the meter's only serial port (CN4).
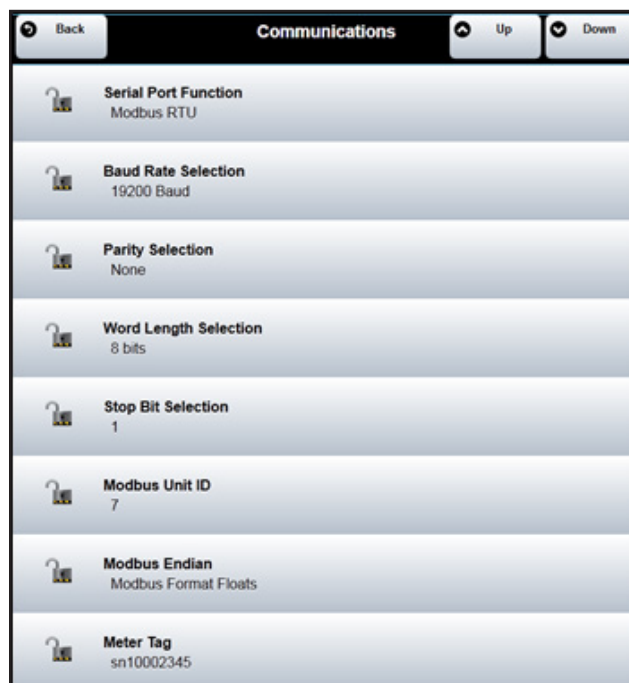
5.3.2.4.1. Serial Port Function[1]

(Path: Settings > Communications > Serial Port Function)

This option determines the primary functionality for the serial port (CN4).

Options:

- None (inactive)
- Modbus RTU
- Modbus ASCII
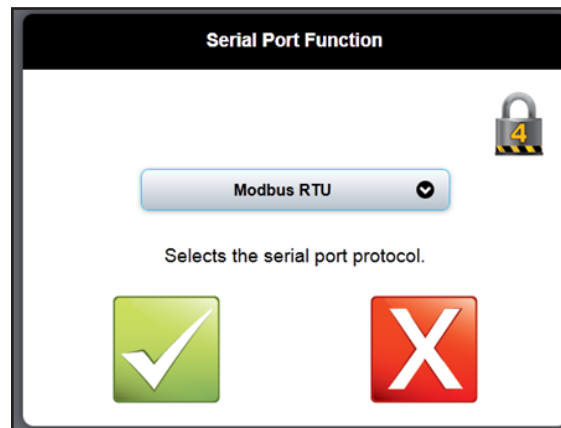
5.3.2.4.2. Baud Rate Selection[1]

(Path: Settings > Communications > Baud Rate Selection)

This option sets the serial port's rate of communication.

Options:

- 1200 Baud
- 2400 Baud
- 4800 Baud
- 9600 Baud
- 19200 Baud
- 38400 Baud
- 57600 Baud
- 115200 Baud
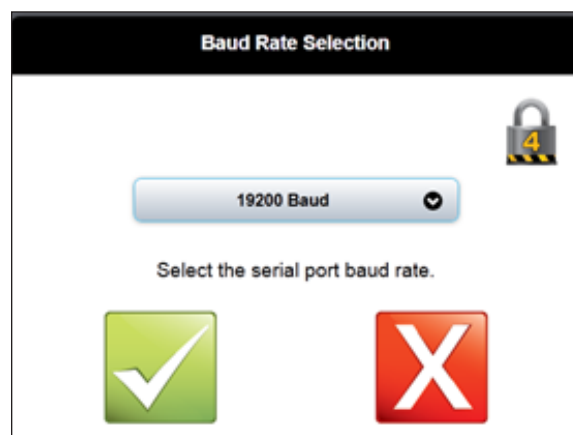
1 Note: Changes will not take effect until the meter has been power cycled.

5.3.2.4.3. Parity Selection[2]

(Path: Settings > Communications > Parity Selection)

This option dictates the use of a parity bit.

Options:

- None
- Odd
- Even
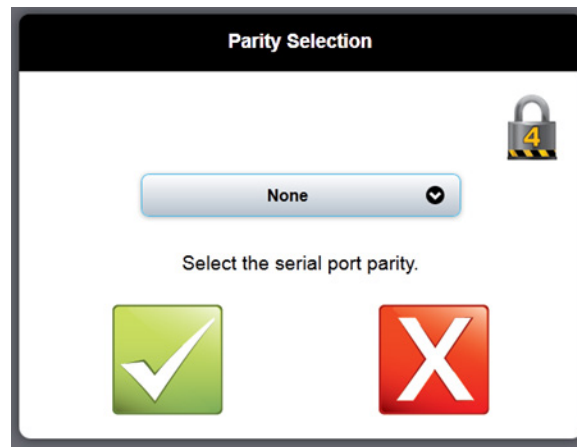
5.3.2.4.4. Word Length Selection[2]

(Path: Settings > Communications > Word Length Selection)

This option determines the word length for the serial port.

Options:

- 7 bits
- 8 bits
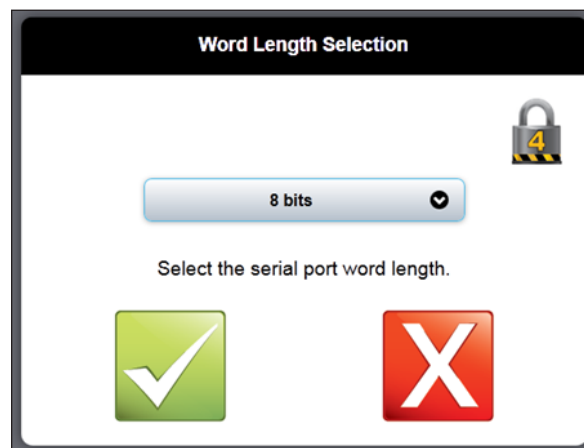
2 Note: Changes will not take effect until the meter has been power cycled.

5.3.2.4.5. Stop Bit Selection[3]
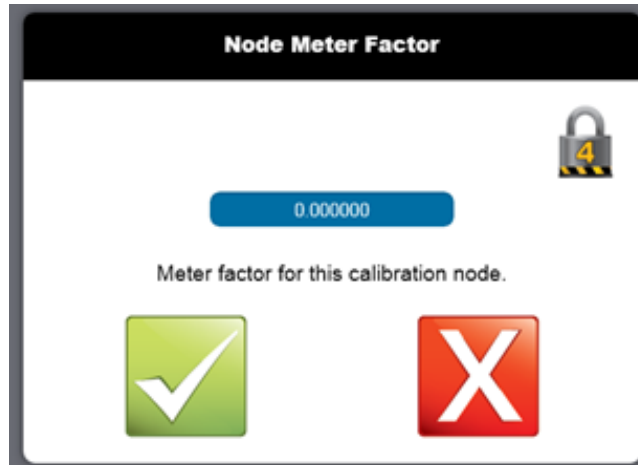
(Path: Settings > Communications > Stop Bit Selection)

This option determines the stop period between byte frames.

Options:

- 1
- 2
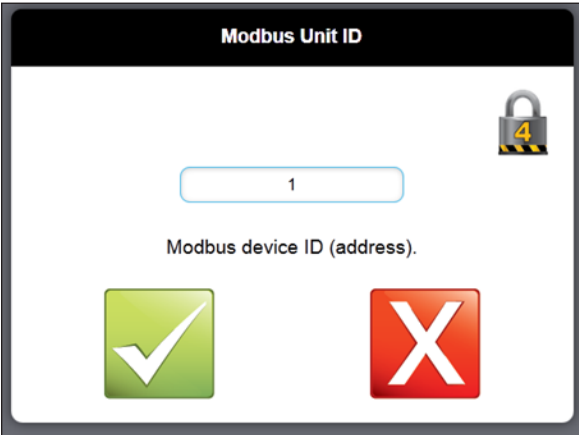
5.3.2.4.6. Modbus Unit ID[3]

(Path: Settings > Communications > Modbus Unit ID)

This parameter sets a unique address for the Modbus functionality to utilize during communications.

- Input Field – desired address (must match Modbus Master Device)

3 Note: Changes will not take effect until the meter has been power cycled.

5.3.2.4.7. Modbus Endian[4]

(Path: Settings > Communications > Modbus Endian)

This option determines the order in which words are transmitted via Modbus.

Options:

- Modbus Format Floats
- Alternate Format Floats

Value of Pi Test	Byte Order
Modbus Format Floats	0FDB 4049
Alternate Format Floats	4049 0FDB
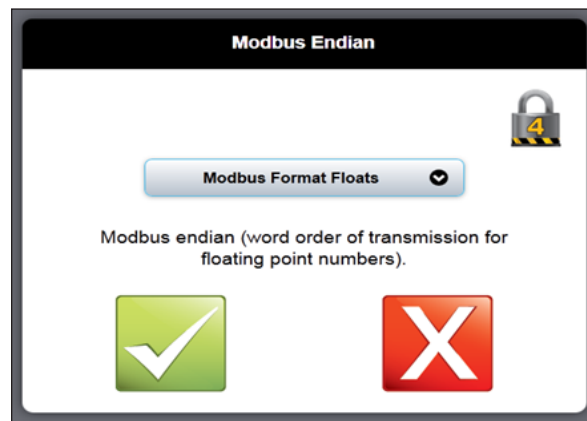
5.3.2.4.8. Meter Tag

(Path: Settings > Communications > Meter Tag)

This parameter provides the meter with a unique identifier for ease of distinguishing between it and other potential meters on the network. This tag is visible in the top-right corner of the Main Menu and Overview screens. By default this parameter is set to the UMCB's serial number.

- Input Field - Desired Tag

4 Note: Changes will not take effect until the meter has been power cycled.

5.3.2.4.9. Modbus NaN Substitution Mode

(Path: Settings > Communications > Modbus NaN Substitution Mode)

By default the meter outputs "NaN" (not a number) when an output is not being calculated or undefined. This output can be modified to output a user defined fail value instead by selecting "User Defined"
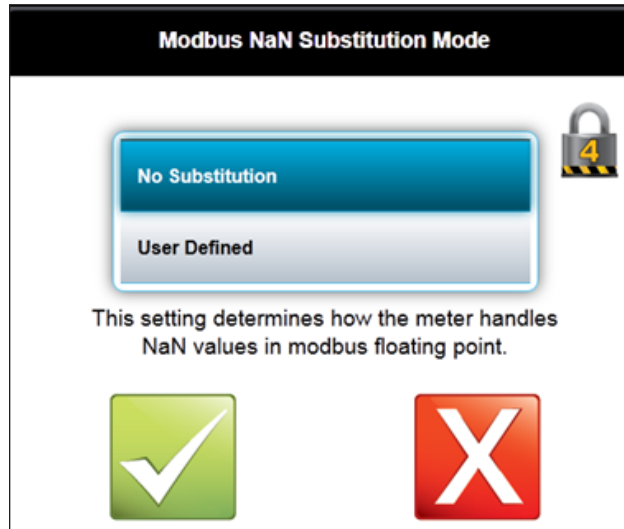
5.3.2.4.10. Modbus NaN Substitution Value

(Path: Settings > Communications > Modbus NaN Substitution Value)

When NaN output mode is set the "User Defined", the value entered here as the substitution value will be used in case the output is undefined or not calculated.
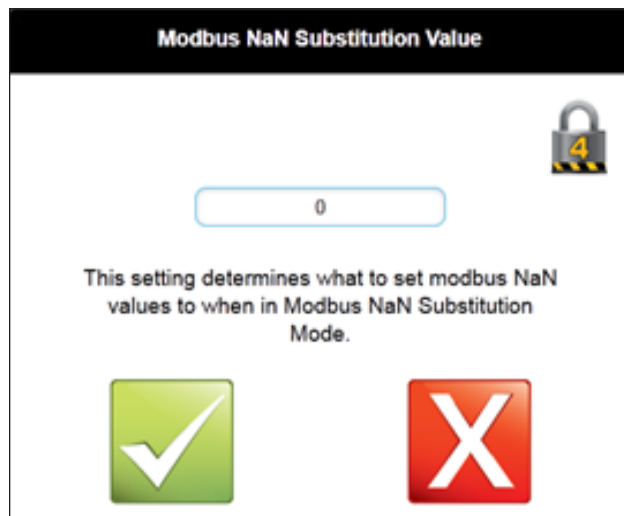
5.3.2.5. Diagnostic

(Path: Settings > Diagnostic)

This screen contains options that affect the collection of historical data

5.3.2.5.1. Datalog Interval

(Path: Settings > Diagnostic > Datalog Interval)

This option determines the type of, and the interval at which engineering data is stored to file.

Options:

- Off
- Avg Period, with Avg
- Avg Period without Avg

** It is recommended to keep the factory default setting for this parameter unless otherwise instructed by an authorized FMC Technologies' Engineer.
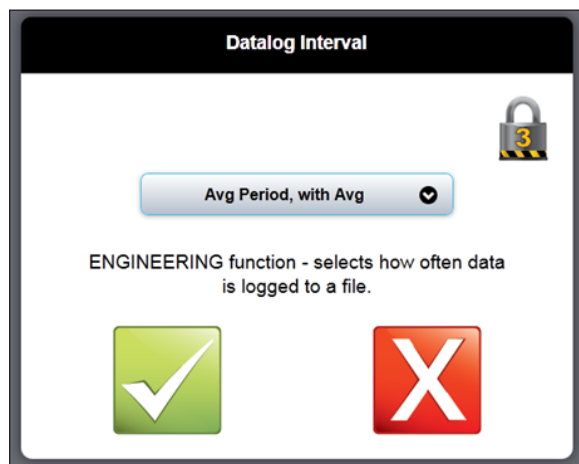
5.3.2.5.2. Signal Logging Interval

(Path: Settings > Diagnostic > Signal Logging Interval)

This option determines the interval at which signal data is stored to file.

Options:

•   Off

•   1 Minute

•   5 Minutes

•   10 Minutes

•   1 Hour

•   8 Hours

•   1 Day

** It is recommended to keep the factory default setting for this parameter unless otherwise instructed by an authorized FMC Technologies' Engineer.
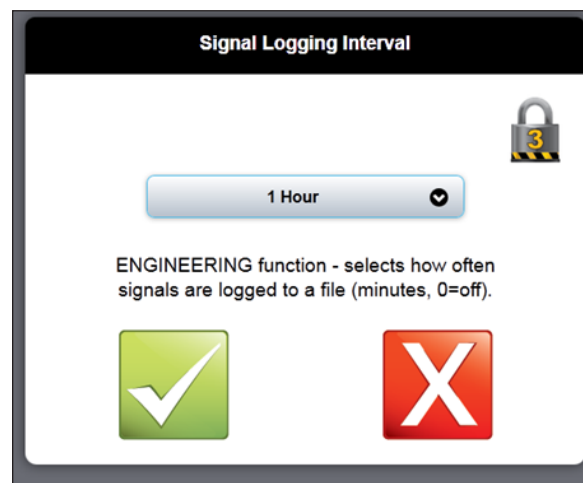
5.3.2.6.   Factory Settings

(Path: Settings > Factory Settings)

•   The data that is in this section is installed at the Factory. Do not attempt to change any values without pre-authorization.

5.3.2.7.   Meter Body

(Path: Settings > Meter Body)

•   The data that is in this section is installed at the Factory. Do not attempt to change any values without pre-authorization.

5.3.2.8.   Inputs and Outputs

(Path: Settings > Inputs and Outputs)

•   The data that is in this section is installed at the Factory. Do not attempt to change any values without pre-authorization.

5.3.2.9.　Limits

(Path: Settings > Limits)

These settings control the meter's built in alarms and other setpoint limits. Many values are set by the factory according to typical operation al limits. Please read these instructions or consult factory before adjusting Limits.
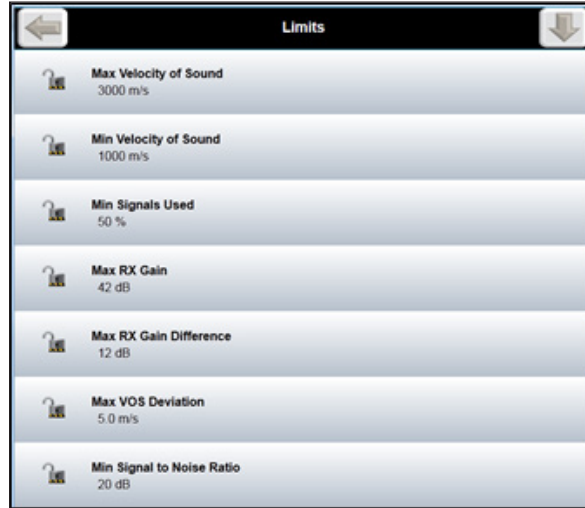
5.3.2.9.1　Min and Max Velocity of Sound

Sets the upper and lower limits for the measured fluid velocity of sound

5.3.2.9.2　Max RX Gain Difference

RX Gain the the amount of amplification the meter requires to receive the ultrasonic sound signal. This sets the upper limit alarm for receiver gain. The value is set by the factory and not typically adjusted unless otherwise instructed.

5.3.2.9.3.　Max VOS Deviation

Maximum deviation between the measured velocity of sound on any two paths.
The value is set by the factory and not typically adjusted unless otherwise instructed

5.3.2.9.4.　Min Signal to Noise Ratio

Signal to Noise Ratio measures the amount of signal noise being measured with the ultrasonic sound signals. A lower reading indicates increased noise. This limit sets the low limit value. This is set by the factory and not typically adjusted unless otherwise instructed.

5.3.2.9.5.　Max Turbulence Level

Turbulence is a measure of the variability of the flow rate. This limit sets the high level alarm.

5.3.2.9.6.　Max Swirl/Crossflow Deviation

The meter will alarm when the maximum % transverse flow is detected. This limit sets this percentage.

5.3.2.9.7.　Min and Max Flow Rate

Alarm on the minimum and maximum flow rate, in engineering units.

5.3.2.9.8. Max Profile Flatness Deviation

Maximum percentage deviation in flatness across the meter

5.3.2.9.9. Maximum Profile Symmetry Deviation

Maximum allowable profile symmetry

5.3.2.9.10. Low Flow Cutoff

When the measured flow drops below this value the meter will output zero flow. The low flow cutoff prevents random noise from registering as flow when the meter is in a shut in situation.

5.3.2.9.11. Enable Confidence Alarms

The confidence alarms provide an indication of the measurement quality for a number of meter outputs. These alarms output through Modbus measurement health status word only.

The input to enable the alarm is in the format of an eight bit integer that can be used to mask specific bits from activating if desired. Enter the integer value of the binary mask to enable the alarms. A value of zero disables all alarms and 31 (bin 11111) enables all five alarm bits.

The following alarms are available:

Bit	Process Variable	Description
0	Flow Rate	Flow rate output quality alarm
1	Velocity of Sound	Velocity of sound quality alarm
2	Density	Density computation quality alarm
3	Viscosity	Viscosity computation quality alarm
4	Reynolds Number	ReNo computation quality alarm
5	Analog Output	Analog output quality alarm

5.3.2.10. Modes

(Path: Settings > Modes)

5.3.2.10.1. Disable Paths

(Path: Settings > Modes > Disable Paths)

This option will disable a particular path and replace its flow profile factor value with an internally calculated substitution.

• Input Field – desired path state (1 = disabled/substitution)

5.3.2.10.2. Manual Values

(Path: Settings > Modes > Manual Valves)

This option places the meter into a simulation (non-measured) type mode. Be aware that measured values are not displayed while this mode is enabled.

Options:

• Disabled

• Enabled

**This is not typically changed from this menu: this mode is automatically enabled if a particular diagnostic feature is triggered; e.g. Simulate Flow.
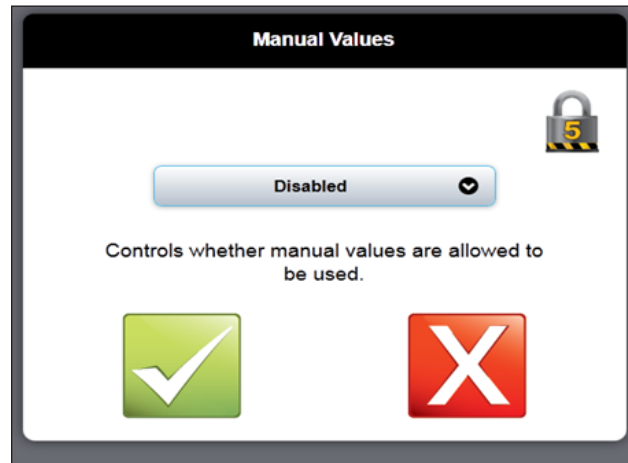
5.3.2.10.3. Line Temperature Input Mode

(Path: Settings > Modes > Line Temperature Input Mode)

This option determines the source of the temperature compensation value.

Options:

• Fallback – (programmed value)

• 4-20 mA Input #1 – (live input value)

• 4-20 mA Input #2 – (live input value)

• RTD Input – (live input value)

• Modbus – (provided through comm.)
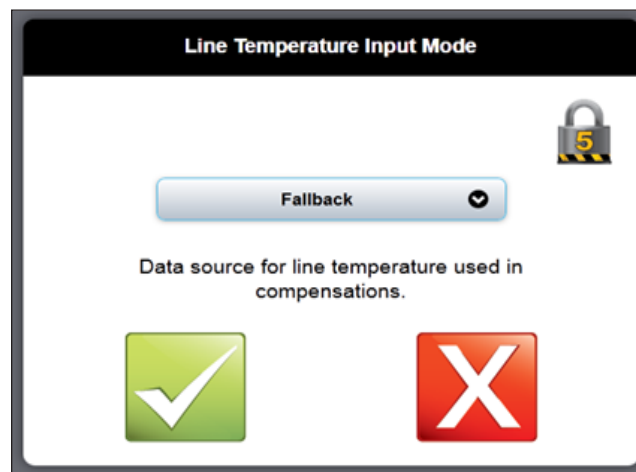
5.3.2.10.4. Line Pressure Input Mode

(Path: Settings > Modes > Line Pressure Input Mode)

This option determines the source of the pressure compensation value.

Options:

- Fallback – (programmed value)
- 4-20 mA Input #1 – (live input value)
- 4-20 mA Input #2 – (live input value)
- RTD Input – (live input value)
- Modbus – (provided through comm.)
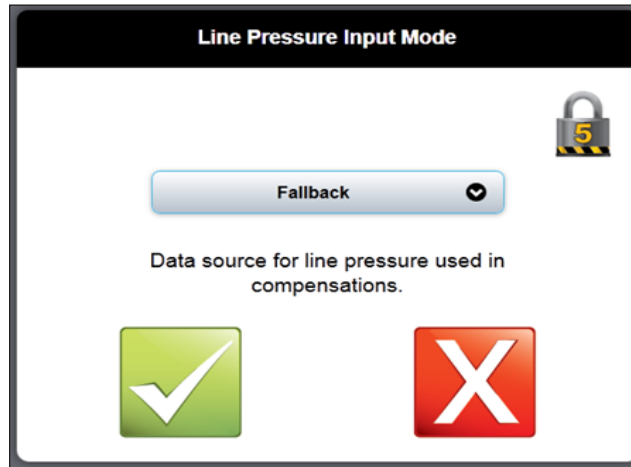
5.3.2.10.5. Line Temperature Fallback Value

(Path: Settings > Modes > Line Temperature Fallback Value)

This value is used in temperature compensation calculations; the *Line Temperature Input Mode* setting must be configured for *Fallback* in order to utilize this value.

- Input Field – Site value to match temperature of product flowing in line.
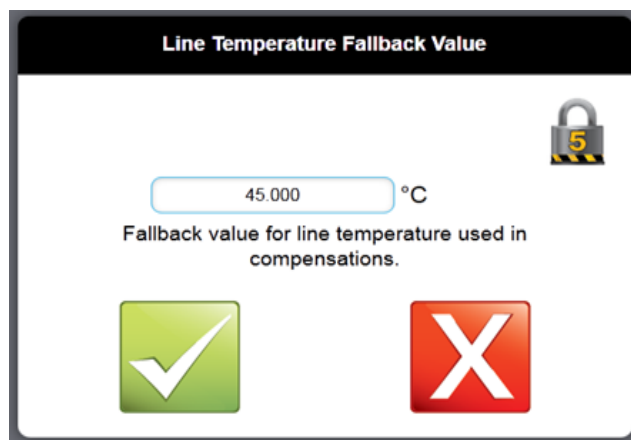
5.3.2.10.6. Line Pressure Fallback Value

(Path: Settings > Modes > Line Pressure Fallback Value)

This value is used in temperature compensation calculations; the *Line Pressure Input Mode* setting must be configured for *Fallback* in order to utilize this value.

•   Input Field – Site value to match pressure of product flowing in line.

5.3.2.10.7. Electronic Sealing Mode

(Path: Settings > Modes > Electronic Sealing Mode)

This determines the meter behavior on sealed and unsealed conditions as it relates to OIML test conditions. The selection options are "No Alarm" or "OIML". This must be set to "OIML" to comply with the EU-MID sealing requirements.

5.3.2.10.8. Electronic Seal State

(Path: Settings > Modes > Electronic Sealing Mode)

Setting the electronic seal prevents the manipulation of metrologically significant parameters unless the seal is broken. The selection options are "Open" or "Sealed". See Section 5.7.2 for a detailed description of software sealing.
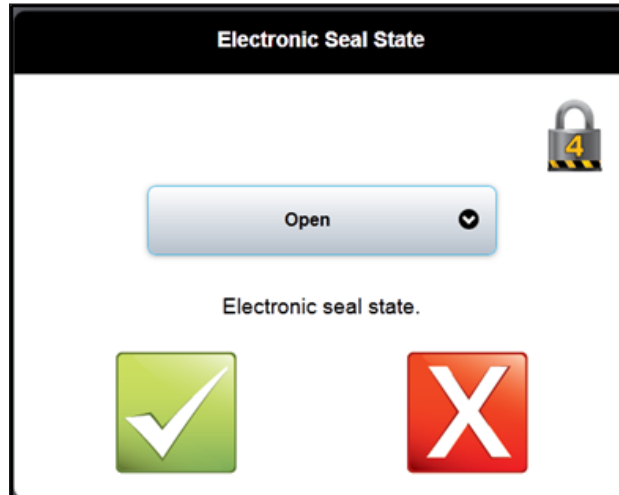
5.3.2.10.9. Diagnostic Mode

(Path: Settings > Modes > Diagnostic Mode)

Diagnostic mode allows the meter to be set into a bench test simulation mode. This setting eliminates actual flow measurement and replaces it with the selected simulated flow outputs. The following settings can be selected

- Off. Under this setting the meter operates normally
- External Loopback: A loopback coaxial connector must be jumpered to the Path 1 A and B transducer connection jacks. This allows the control board to exercise all circuit pathways while bypassing the transducers.
- Internal Loopback. Allows bench testing without the coaxial jumper on Path 1.
- Digital Loopback Alternate diagnostic mode without the use of jumper cables.
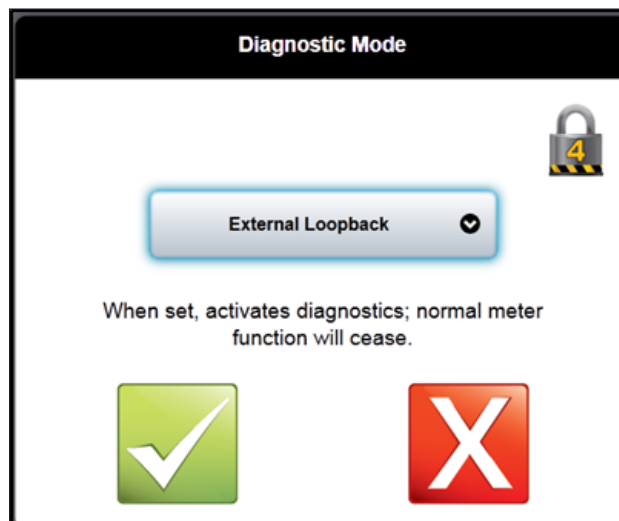
5.3.2.10.10. Loopback Flow Velocity

(Path: Settings > Modes > Loopback Flow Velocity)

Sets the simulated velocity to be used in the loopback mode simulation
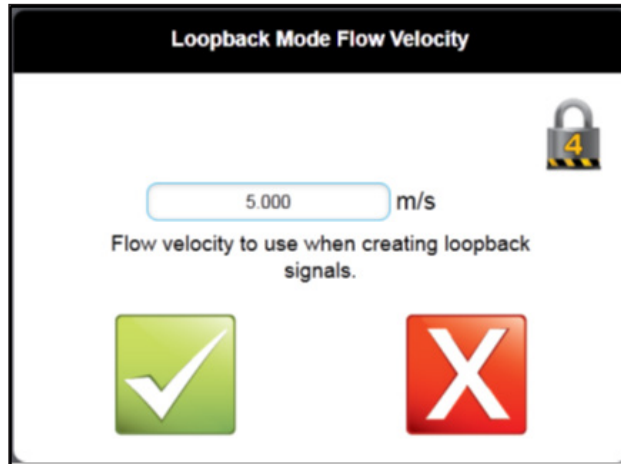
5.3.2.10.11. Loopback Velocity of Sound

(Path: Settings > Modes > Loopback Velocity of Sound)

Sets the simulated velocity of sound to be used in the loopback mode simulation
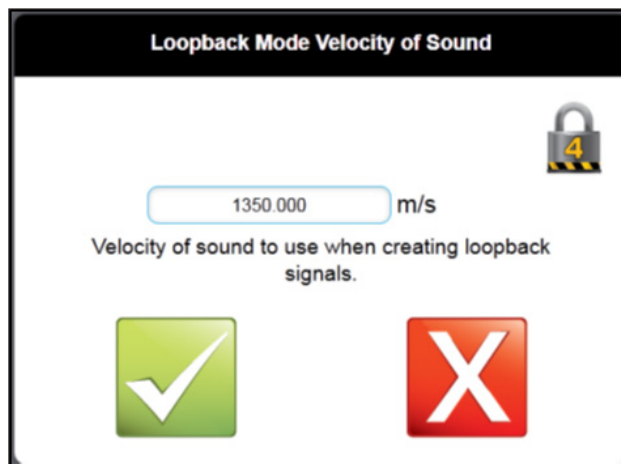
5.3.2.10.12. Loopback Flow Profile

(Path: Settings > Modes > Loopback Flow Profile)

Sets the simulated flow profile to be used in the loopback mode simulation
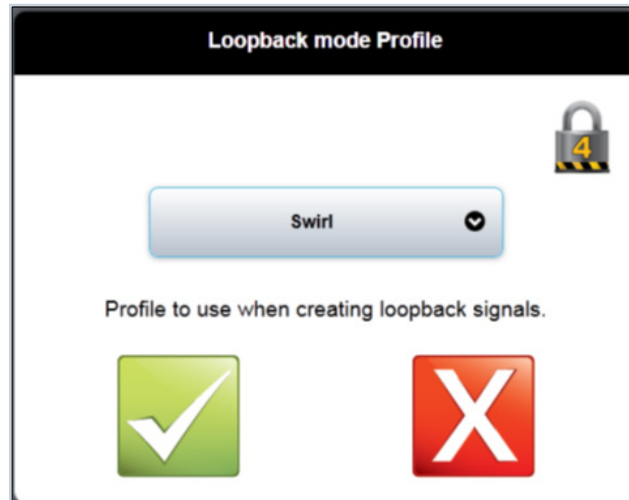
5.3.2.11. Signal

(Path: Settings > Signal)

•   The data that is in this section is installed at the Factory. Do not attempt to change any values without pre-authorization.

5.3.2.12. Transducer

(Path: Settings > Transducer)

•   The data that is in this section is installed at the Factory. Do not attempt to change any values without pre-authorization.

5.4.   Alarms Menu

The Alarms Button leads from the main menu to the Alarms Screen.
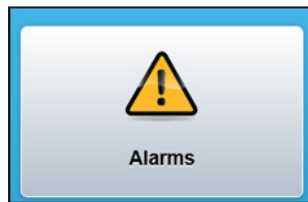
This screen displays the 10 most recent active alarms. These alarms are dynamically updated and cleared as the conditions are corrected.
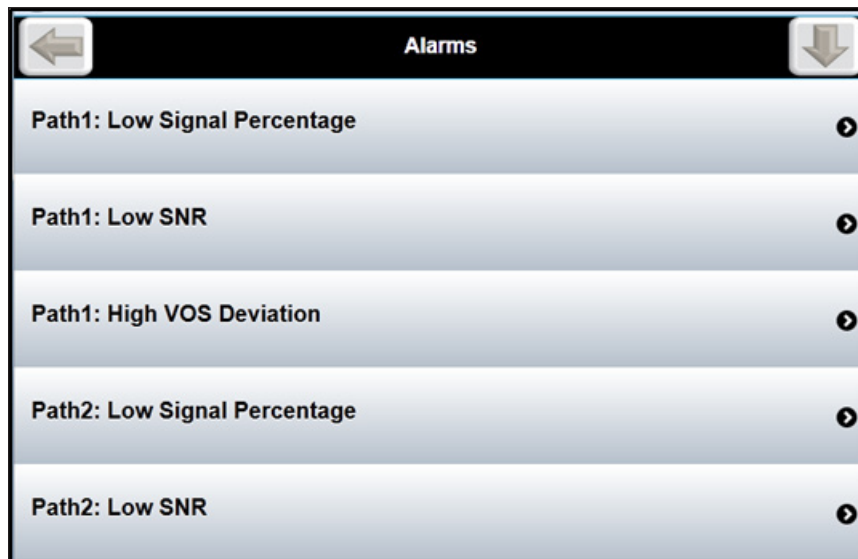
Refer to Appendix B on page 95.

5.5.   Run Data Menu

The Run Data Button leads from the main menu to the Path Data, System Data and Computational Data menus shown under Measurement Data.
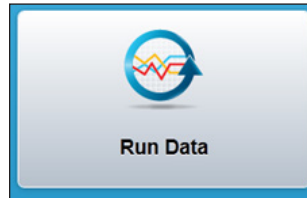
5.5.1.   Run Data Screens

(Path Main Menu > Run Data)
All meter information is grouped into three distinct sections:
- •   Path Data – information separated on a per path basis
- •   System Data – general meter information details
- •   Computation Data – calculated information
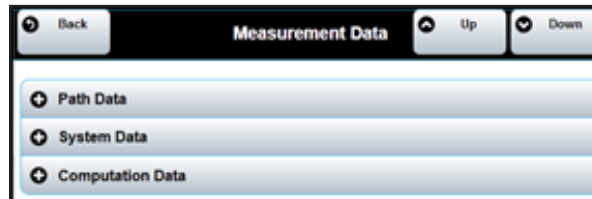
5.5.1.1.   Path Data

(Path: Run Data > Path Data)
This section shows the data for each individual path. Some of this information is also located on the Overview Path Flow screen.
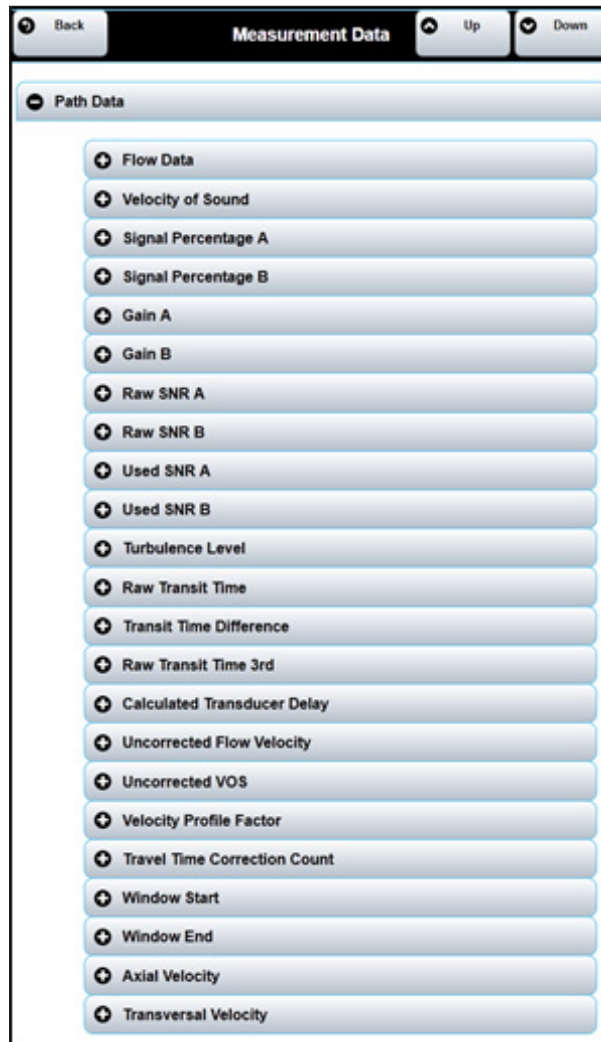
5.5.1.2. System Data

(Path: Run Data > System Data)

This section illustrates general system-level data. Some of this information is also located on the Overview screen.

System Data	
Flow Velocity	2.799 m/s
Velocity of Sound	1363.082 m/s
Flow Rate	466.688 m³/hr
Profile Flatness	86.2 %
Profile Symmetry	5.8 %
Swirl	1.2 %
Cross Flow	-0.5 %
TX Gain Used	-3.0 dB
Transducer Calibration Node Used	1
Profile Learner State	0
Velocity Profile X Value	1.063
Velocity Profile Correction	0.000 %
Measurement Round Counter	382687
Measurement Round Time	0 s

5.5.1.3.   Computation Data

(Path: Run Data > Computation Data)

This section exhibitions physical property data calculated within the meter.

Computation Data	
Computed Kinematic Viscosity	16.605 cSt
Computed Dynamic Viscosity	14.204 cP
Computed Fluid Density	855.45 kg/m³
Computed Reynolds Number	84006

5.6.   Diagnostics Menu

The Diagnostic Button leads from the Main Menu to the Diagnostics sub-menu.
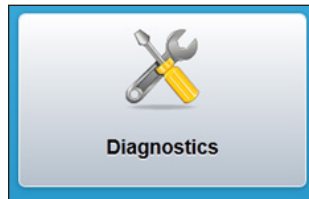
Top-Level Diagnostics Screen

This screen contains several meter diagnostic features partitioned into groups. Some of these menu options are user-interface-dependent and will be hidden if not supported. On a local touchscreen display, the Upload Program Parameters, Download Program Parameters, and the Update Software options are hidden. On a pc browser, the Refresh Display option is hidden. Monitoring and Commissioning are always accessible.
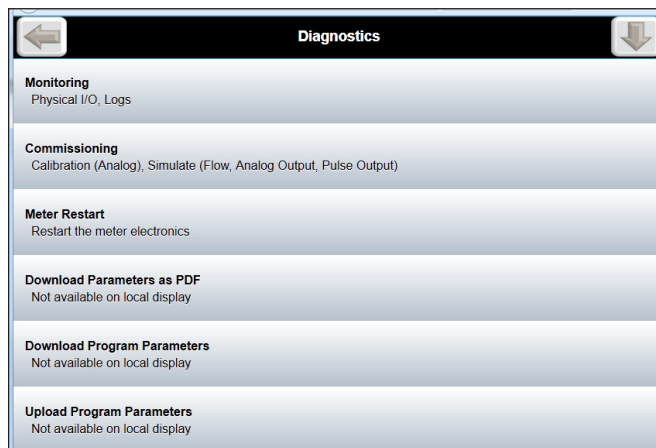
5.6.1.   Monitoring

(Path: Diagnostics > Monitoring)

This screen provides access to the:

- Inputs and Outputs --> displays current state of physical I/O
- Logs --> top-level menu for viewing log data

5.6.1.1. **Inputs & Outputs**

(Path: Diagnostics > Monitoring > Inputs & Outputs)

The display screen displays the current state of all physical inputs and outputs including the Welmec jumper. Normal ranges for the physical I/O are provided in the table below.

Current Input #1	3.8 - 22 mA
Current Input #2	3.8 - 22 mA
RTD Input Ω	76.7278 - 168.4783 ohms
Current Output	3.8 - 21.0 mA
Pulse Input	0 - 10,000 Hz, counts
Pulse Output	0 - 10,000 Hz, counts
Welmec Jumper	Locked/Unlocked
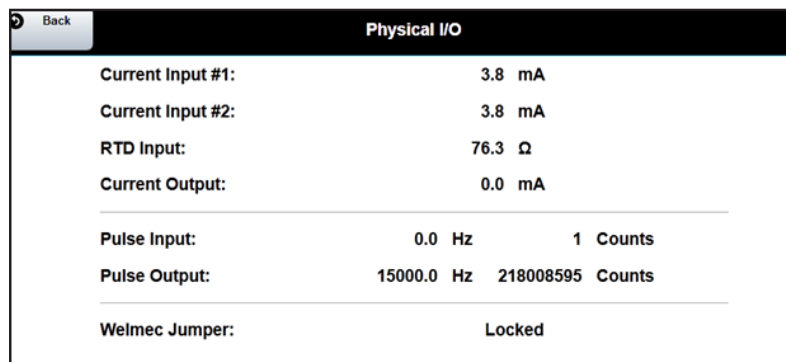
5.6.1.2. **Logs**

(Path: Diagnostics > Monitoring > Logs)

This menu provides access to the following:

     • Weights and Measures Log --> stored data entries

     • Alarm Log --> stored data entries

     • Event Log --> stored data entries

     • Download Logs[5] --> top-level menu for downloading log
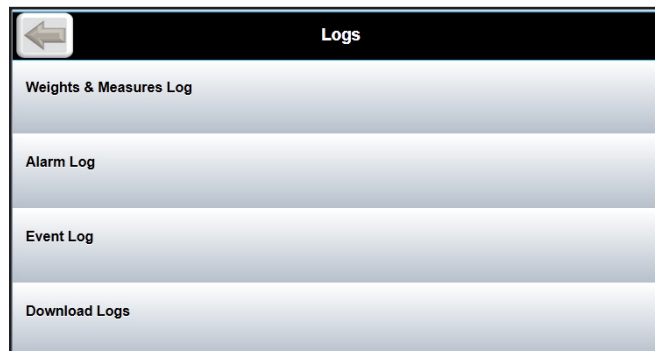
5.6.1.2.1. Weights and Measures Log

(Path: Diagnostics > Monitoring > Logs > Weights & Measures Log)

This screen displays all entries pertaining to anything Weights and Measures related. The entry layout is as follows:

Log Entry #	Date/Time	Entry	Details
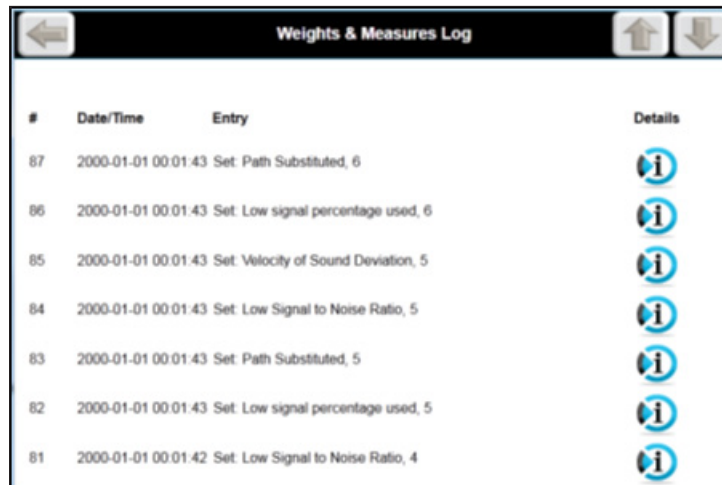
5.6.1.2.2. Alarm Log

(Path: Diagnostics > Monitoring > Logs > Alarm Log)

This screen displays all alarm related entries. The entry layout is as follows:

Log Entry #	Date/Time	Entry Description	Details
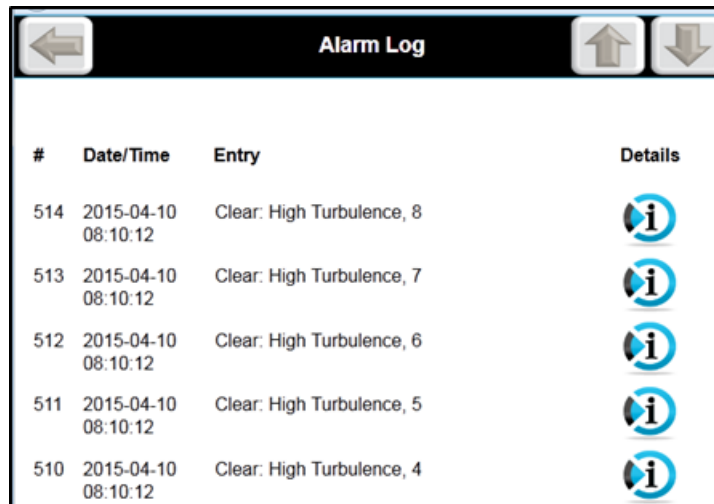
5 Note: This menu is not available on the meter's display.

5.6.1.2.3. Event Log

(Path: Diagnostics > Monitoring > Logs > Event Log)

This screen displays all entries pertaining to anything Weights and Measures related. The entry layout is as follows:

Log Entry #	Date/Time	Entry Description	Details
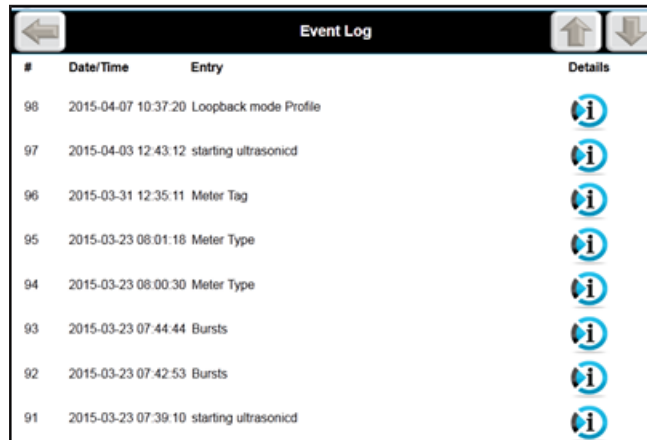
5.6.1.2.4. Download Logs

(Path: Diagnostics > Monitoring > Logs > Download Logs)

This screen provides a method for downloading any of the log files from the meter.

To download a log:

(1) Select the desired log to download

- The process will initiate automatically

- The meter gathers all available entries and creates a text file

- Once the text file is ready a prompt will appear to accept/decline the download

(2) Accept the download.

- The file will be located in the operating system's default Downloads folder
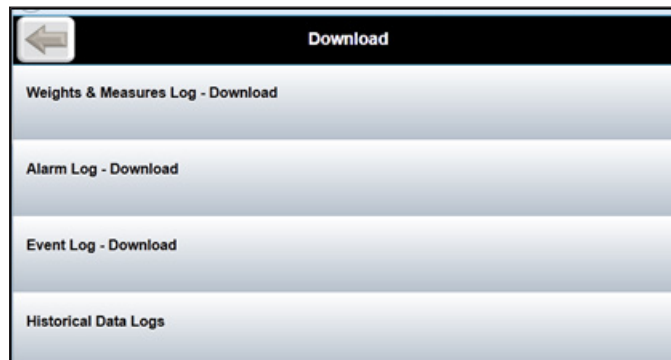
5.6.1.2.5. Historical Data Logs

(Path: Diagnostics > Monitoring > Logs > Download Logs > Historical Data Logs)

This screen provides a method for downloading the Engineering log files from the meter.

When the screen is first traversed the 10 most recent data logs will appear:

To download a log:

(1) Select the desired log to download

    • The process will initiate automatically

    • The checkbox associated with the file will be checked; although [checked the file may be downloaded as many times as desired]

    • Once the data file is ready a prompt will appear to accept/decline the download

(2) Accept the download.

    • The file will be located in the operating system's default Downloads folder

The logs may also be filtered on a per day basis. To filter the results:

(1) Select a desired date

(2) Check Filter Results
    • If logs exist for the filtered date, the list of logs will update accordingly
    • If no logs exist, a prompt will appear stating this
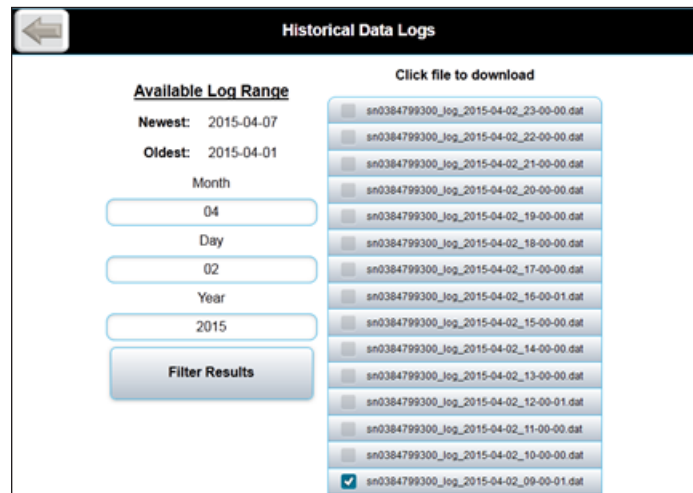
5.6.2. Commissioning

(Path: Diagnostics > Commissioning)

A user login of level 4 or level 5 is required in order to access the commissioning features.
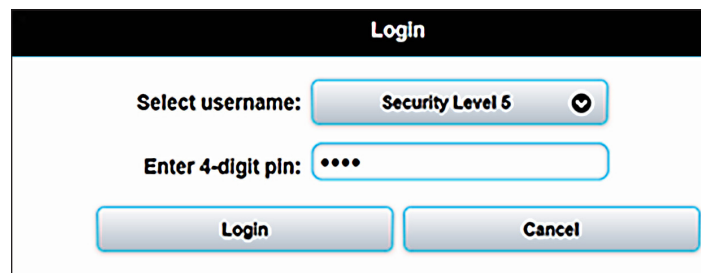
Top-Level Commissioning Screen

This screen provides two primary sets of features:

(1) To assist with commissioning of the meter, and

(2) Provide a mean for simulating meter operation.
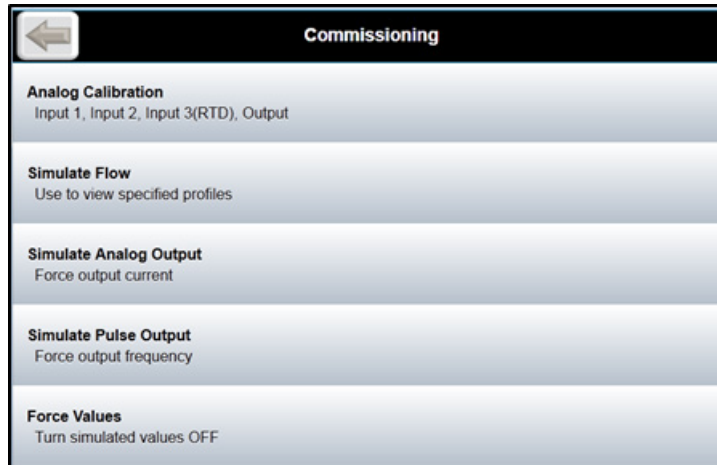
5.6.2.1.   Analog Calibration

(Path: Diagnostics > Commissioning > Analog Calibration)

Calibration uses a wizard type program to adjust the analog and RTD inputs for zero and span for optimum accuracy.
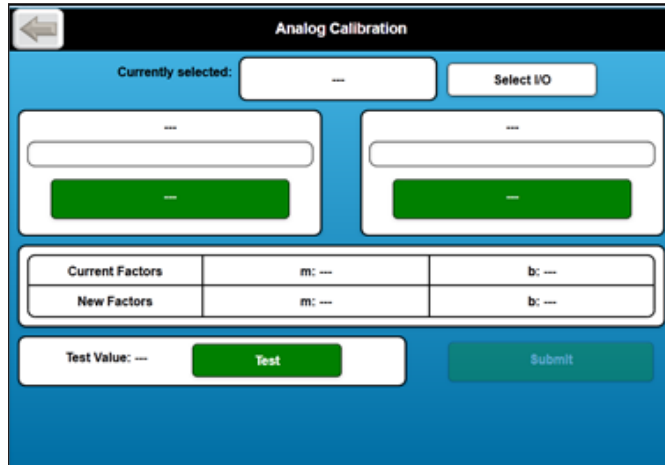
5.6.2.1.1. Example Non-RTD Calibration

Apply test inputs to meter

The calibration can now be tested. Apply an actual signal to the meter press "Test" to check if the meter reads the correct value. Enter "Submit" to enter new factors if the calibration was successful.

Current Factors	m: 0.00000286	b: -0.00049818
New Factors	m: ---	b: ---

Test Value: ---	Test	Submit

5.6.2.1.2. Example RTD Calibration

Apply test inputs to meter

Currently selected:	RTD Input	Select I/O
Apply 80Ω Load		Apply 120Ω Load
Sample		Sample

The calibration can now be tested. Apply an actual signal to the meter press "Test" to check if the meter reads the correct value. Enter "Submit" to enter new factors if the calibration was successful.

Current Factors	m: 0.00000286	b: -0.00049818
New Factors	m: ---	b: ---

Test Value: ---	Test	Submit

5.6.2.2. Simulate Flow

(Path: Diagnostics > Commissioning > Simulate Flow)

This option allows the meter to run in a simulated ("forced") state. While in this state, the values displayed **are not** real measured information. To simulate:

(1) Enter a desired flow velocity; typical 700-1700

(2) Enter a desired velocity of sound (VOS); typical 0-20

(3) Select a desired flow profile from the drop down menu (0-8)

(4) Press ✅ button to start simulation

** A "Forced Values" indicator will appear (if not already present) in the bottom right corner of the display denoting simulation started.

Profile	Behavior
0	Standard ("Normal") operation
1 - 8	Various non-standard flow profile types

Flow Simulator

Flow Velocity: [_____] m/s

VOS: [_____] m/s

Flow Profile: [0 ▼]

[✓]

5.6.2.3.   Simulate Analog Output

(Path: Diagnostics > Commissioning > Simulate Analog Output)

This option places the meter into a simulated ("forced") state and sets the output current (CN5) to the value set here.

- Input Field – desired current value
- ✓ button – accept value and simulate output

** A "Forced Values" indicator will appear (if not already present) in the bottom right corner of the display denoting simulation started.

Simulate Analog Out

Analog Output: [_____] mA

Present Output: 0.0   mA

[✓]

5.6.2.4.   Simulate Pulse Output

(Path: Diagnostics > Commissioning > Simulate Pulse Output)

This option places the meter into a simulated ("forced") state and set the output pulse frequency (CN3) to the value set here.

- •   Input Field – desired pulse frequency value
- •   ✅ button – accept value and simulate output

** A "Forced Values" indicator will appear (if not already present) in the bottom right corner of the display denoting simulation started.
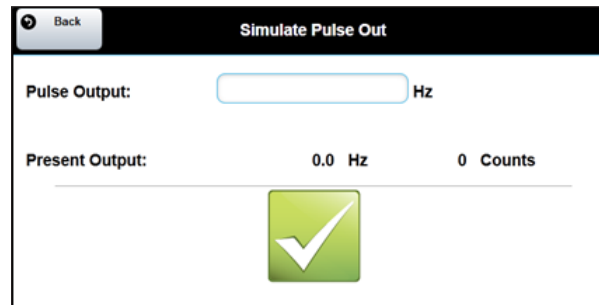
5.6.2.5.   Force Values

(Path: Diagnostics > Commissioning > Force Values)

This option used to indicate when the meter is in a simulation ("forced") state. While in this state, the information outputted by the meter may not be the real measured data. This state is meant for simulating flow and forcing desired analog and pulse output values.

Button State:

Turn Off --> Meter is currently in a simulated state

** A "Forced Values" indicator will appear (if not already present) in the bottom right corner of the display denoting simulation started.

5.6.3.   Meter Restart

(Path: Diagnostics > Meter Restart)

The meter restart is used to completely reboot the operating system. The meter will be offline and not metering during this sequence. A restart is required if the IP addressing settings are changed in order to initialize the new settings. This feature is also available to use as directed by a factory service representative.

Caution: The meter will be offline during the reboot time.
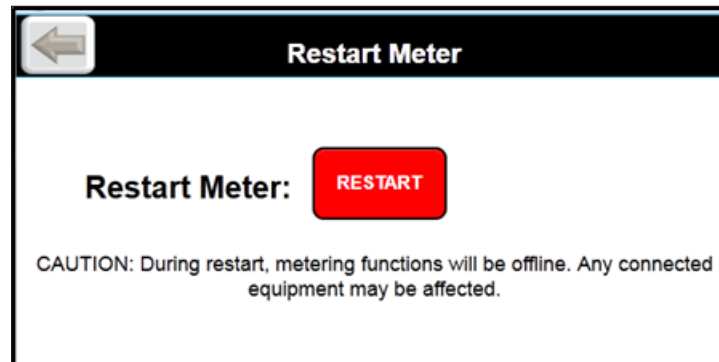
5.6.4.   Download Parameters as PDF

(Path: Diagnostics > Download Parameters as PDF)

The parameter download file documents lists all metrologically relevant settings in a conveniently formatted pdf document. This document serves as a link between the software checksum and actual software and configuration settings. The parameter file also documents all correction factors as configured for verification of calibration testing.

The following data is included in the Parameter Listing document.

Meter Information:

Meter type

Meter tag

Electronics Serial #

Software revision #

Checksums: Parameter, Ultrasonic, DSP and Modbus

Network settings: IP Address, Netmask, Network, Gateway

Communications

Serial port function

Baud Rate selection

Word length selection

Stop bit selection

Modbus unit ID

Modbus Endian

Factory Settings

Initial profile factor

Running average buffer size

VPCx average buffer size

Size constants A and B

VPCx and VPC Meter factor

ReNo VPCx and Reynolds Number

Path Constant

Profile Compensation A and B, low and gain

Flow Calibration

Flow Rates and Meter Factors

Inputs and Outputs

Pulse Output Function, K factor and reverse flow handling

Digital Output function, engineering value and calibration

Analog Output function, engineering value and calibration

Analog Input 1 and 2 function, engineering value and calibration

RTD input function, engineering value and calibration

Limits:

Internal meter alarm setpoints: Velocity of sound, signal %, max RX gain, max RX gain difference, max VOS deviation, signal to noise ratio, turbulence, swirl/crossflow deviation, max and min flow rate, max profile flatness deviation, max profile symmetry deviation, low flow cutoff

Meter Body:

Meter physical dimensions and measurement reference temperature

Modes:

.   Manually disabled paths

Manually forced ouputs

Line temperature correction settings

Line pressure correction settings

Electronic sealing mode

Electronic seal state

Diagnostic mode

Signal:

Signal type, frequency and filter settings

Transducer:

Port Numbers and Transducer Delays

Type, Nodes and Correction Modes

Node temperatures and pressures

5.6.5.   **Download Program Parameters**

(Path: Diagnostics > Download Program Parameters)

This feature is used to download a configuration file to the meter. To upload a configuration file:

(1) Select this feature on the screen

- The process will initiate automatically

- The meter gathers all configuration settings

- Once the USC-file is ready, a prompt will appear to accept/decline the download

(2) Accept the download

- The file will be located in the operating system's default download's folder

5.6.6.   Upload Program Parameters

(Path: Diagnostics > Upload Program Parameters)

This feature is used to upload a configuration file to the meter. To upload a configuration file:

(1) Select this feature on the screen

(2) Browse the local machine for the appropriate file

(3) Press the "Upload File" button

   - The uploading process will automatically start. Prompt based feedback from the meter will provide further instruction, if appropriate.

5.6.7.   Update Software

(Path: Diagnostics > Update Software)

This feature is used to update the software within a meter.

**Note: This process will reboot the meter upon completion. During the reboot period, the meter will be without measurement functionality.

As a precautionary measure, it is recommended that the current database be backed-up prior to updating the software. This is also done inside the 'Diagnostics' menu. In order to generate a back-up of the current database, please follow the instructions in paragraph 5.6.5

(1) *Locate the software package to be installed. The file should be in the following format: usm_X.upkg*

(2) *Click the 'Update Software' button. The following message will appear. Click anywhere on the screen to remove the warning.*

> **The following process will reboot the unit upon completion.**

(3) *Logon utilizing the proper credentials for 'Security Level 5'*

(4) *Select 'Browse*

(5) *Locate the proper software revision package*
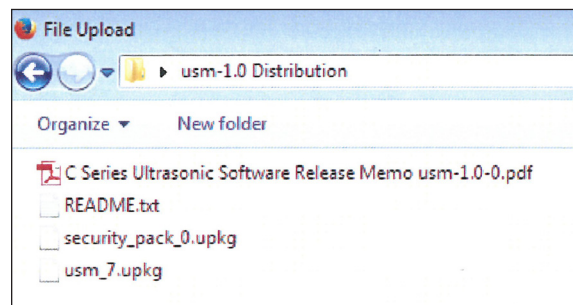
(6)   *Select the file in the format of 'usm_X.upkg' and select 'Open'*

(7)   *Once the proper file has been selected, click 'Upload File'*

(8)   *Waiting approximately 20 minutes is a safe way to ensure that the sotfware revision has completely installed*

(9)   After the 20 minutes has passed, re-type the IP Address into the web browser to refresh the meter.

(10)   Verify that the meter is properly functioning:
- *Verify that the Date and Time is updating and set properly*
- *Verify that there are no active alarms*

(11)   The meter will now be updated to the new software

5.6.8.   Reset Passwords

(Path: Diagnostics > Reset Passwords)

This selection resets all passwords to the factory default values in case the user defined passwords have been lost. In order to reset passwords, the meter must beopened in order to set the rotary dip switch.

> **Warning:** The electronics inside the explosion-proof enclosure are not suitable for exposure in a hazardous area. Proper precaustions must be taken before opening the enclosure when the meter is installed in a hazardous area.

The position of the rotary dip switch must be noted prior to making any adjustments. This switch can affect the Ethernet communication settings after a meter restart. The switch must be returned to the original position immediately after performing the reset operation.

Set the rotary switch to position 8 and following the on-screen instructions for the password reset and, when completed, return the switch to the original position.

5.7.   Weights and Measures: Sealing

Sealing Description

There are two main features that support controlling access to Legally Relevant parameters, hardware sealing and software sealing. Either system alone is a robust complete system and use of only one method provides adequate protection. Both may be used together if desired.

5.7.1.   Hardware Sealing

Hardware sealing is accomplished using a seal wire and a crimped lead seal. Two of the cover cap screws are drilled to accept a seal wire; this allows for detection of illegal entry into the enclosure. This seal protects the following hardware features within the enclosure.

Option 1: Blind Cover   **Option 2: Exe Terminal Box**   **Option 3: LCD Display**

Top View: Cap Seal   **Bottom View: Cap Seal**
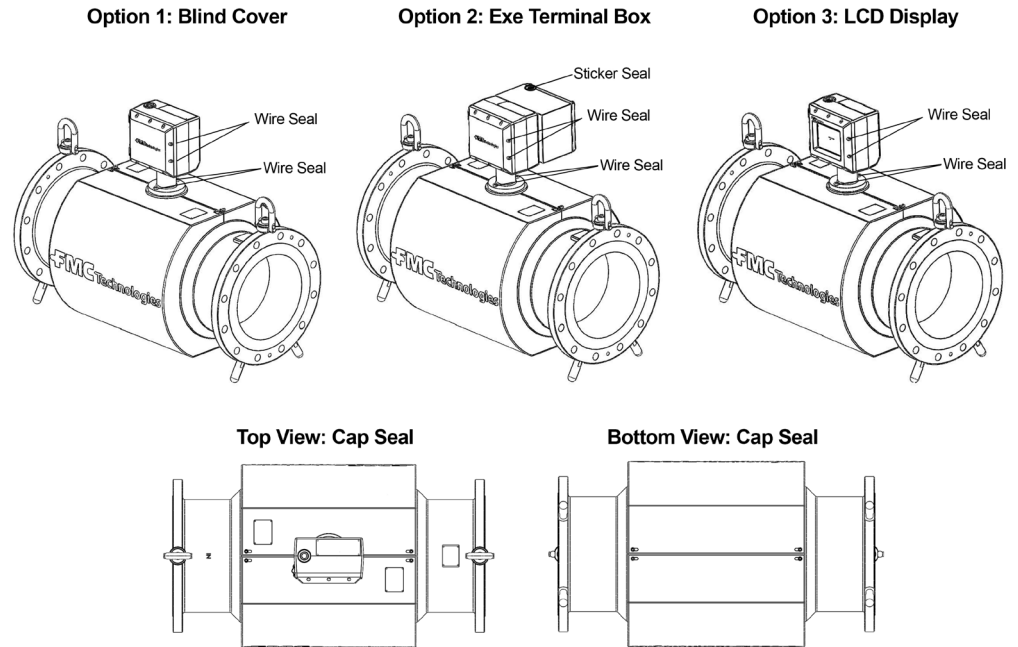
Inside the enclosure digital input #2, which is located on terminal strip CN2 terminals 3 and 4, provides the hardware seal. The meter is shipped from the factory with a jumper (J_WM) across the terminals. When removed, no legally relevant parameters may be changed.

The hardware seal may be wired out to a key switch or other security device supplied by the customer in order to provide remote activation/deactivation. When this feature is used, the customer is responsible for complying with appropriate Weights and Measures requirements.

There is also an encoder switch that may be set (using a screw driver) that allows for maintenance. Switch position 9 forces the unit to boot to a fixed, documented, IP address (for commissioning purposes). Switch position 8 allows for password reset to factory default values.

5.7.2.   Software Sealing

(Path: Settings > Modes > Electronic Sealing Mode/ Electronic Seal State)

Software sealing is accomplished by a 5 level password system and two program parameters that control software sealing. Passwords are 4 digit numbers. The 5 levels are:

(1) Lowest security level (not used)

(2) Diagnostic parameters that are not legally relevant

(3) Commissioning parameters that are not legally relevant, such as serial comm. parameters

(4) Owner, Legally Relevant parameters

(5) Weights and Measures, Legally Relevant parameters including sealing parameters.

The two parameters that control sealing are in the "Modes" menu under "Settings".

"Electronic Seal Mode" determines the alarms that are generated by the various checking

facilities. This must be set to "OIML" to comply with the EU-MID sealing requirements.
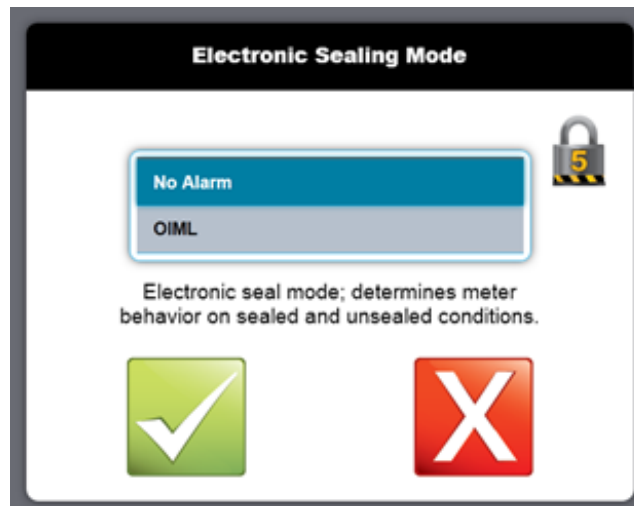
"Electronic Seal State" determines whether the unit is sealed by password or not. When set to "Sealed", no Legally Relevant parameter may be changed. When set to "Open", parameters may be changed according to the security level they are assigned. Security level 4 (Owner) and level 5 (Weights and Measures) may break a seal (switch from Sealed to Open); only security level 5 (Weights and Measures) may seal the unit (switch from Open to Sealed). This allows the owner control of the unit, yet allows the Weights and Measures level to detect the unsealed condition, and then may look into the logs for changes that have been made.

5.7.3.   Procedure for Weights and Measures Official

When using software sealing, the Weights and Measures official shall:

(1) Change the level 5 password and record in a private manner for future use.

(2) Set the Electronic Seal Mode in the Settings > Modes menu to "OIML".

(3) Set the Electronic Seal State in the Settings > Modes menu to "Sealed".

(4) Exit the settings screens and verify parameters have been saved.

(5) Navigate to the Meter Information screen and record the info.

(6) Verify the encoder switch on the board is in position 0.

(7) Close the box and apply a physical wire seal.

When using hardware sealing:

(1) Before the enclosure is sealed, the Weights and Measures official shall verify the rotary encoder switch is in position 0.

(2) If the jumper is to be used for parameter protection, it must be removed.

(3) If the digital input is used for parameter protection (customer decision), the jumper must also be removed, and external input mechanism validated.

(4) Close the box and apply a physical wire seal.

5.8. **Meter Information**
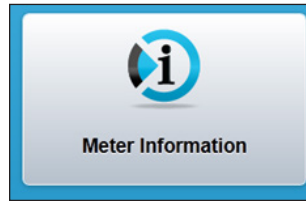
This screen provides pertinent meter information in regards to electronics software and hardware properties.

• Type – style of meter; e.g. Ultra 8c, Ultra 6c, etc.

• Tag ID – the unique identifier given to this particular meter

• Revision – current software running on the meter

• Serial – serial number of the UMCB

• Security – Weights and measures seal type and status:

• Checksums: Includes checksums for the Parameters, Ultrasonic, DSP and Modbus software and settings.

• Reference: QR code scan
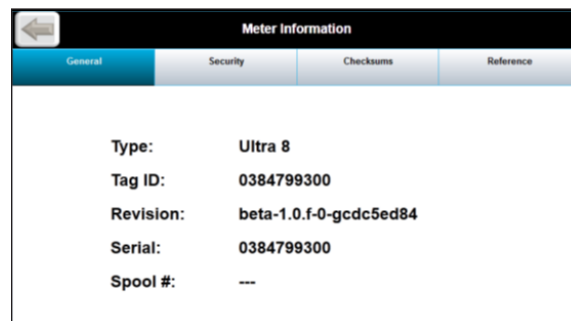
6 – Integrated Touch Screen Display

The Ultra Series flow meter integrated display is a touch screen device that functions as a complete HMI equivalent to a remote connection by PC. It allows complete access to interfaces to the web based user interface functions from Chapter 5.

The display includes all software for configuring connections ultrasonic meter control board (UMCB) in case the network configuration is changed from the default factory settings. The integrated display includes built in security functions for compliance with WELMEC standards for weights and measures. Once configured, the display will automatically connect to the desired Ultra Series flow meter upon start up.

6.1. Features

- **Touch Screen Display** – The touch screen display is usable wearing gloves and is enclosed behind an explosion proof enclosure for use in hazardous areas.
- **Security** – The display includes built in security features for compatibility with WELMEC standards for custody transfer.
- **Automatic Connection** – Once configured the display will automatically connect to the configured device upon reboot.

6.2. HMI Display Unit
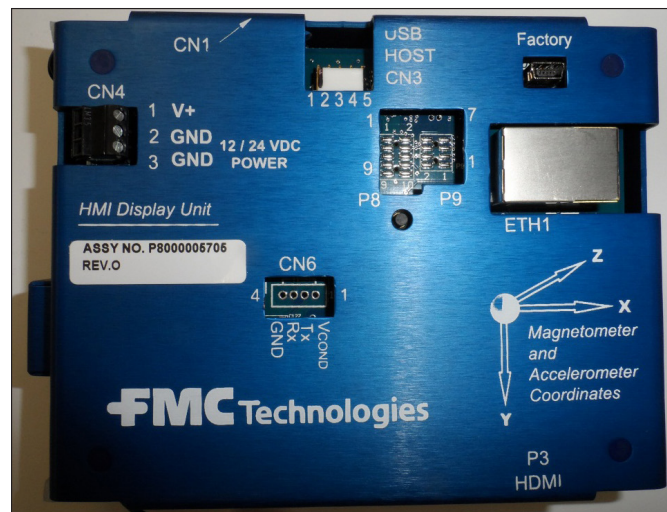
6.2.1. Electrical Installation

6.2.1.1. Power Supply

The electronics are designed to be powered by 24 VDC, +20% / -15%, 7W.

The shield of the cable should be connected at only the electronic enclosure, preferably via the cable gland.

Connect input power cable to connector CN4.

DC Input Wire	Terminal
24 VDC (+)	CN4-1
24 VDC (common)	CN4-2
Ground	CN4-3

6.2.1.2. Connection to Ultrasonic Meter Control Board

The display connects to the ultrasonic meter control board (UMCB) through an ANSI/ IEEE 802.3 Ethernet connection by way of an RJ45 jack.

HMI Display Unit	Ultrasonic Meter Control Board
ETH1	ETH1 or ETH3

6.2.1.3. Display Start-Up

The integrated display will require unique IP addresses that is separate from the main ultrasonic meter control board (UMCB). The display links to the ultrasonic meter control board by way of its configured IP address. The factory default network setting for the display is DHCP where the network automatically assigns this IP address. If the Ultra series meter is not connected to an Ethernet network or if the network does not support DHCP then a fixed address may need to be assigned.

Upon power up the unit will proceed through the following boot sequence:

1. FMC Technologies logo screen with boot progress bar

2. For a short period, a configuration icon is shown (gears graphic); if this button is pressed, the connection sequence in the next item is skipped and the display connects immediately to the Display main menu.

3. If the display is configured, it will attempt to connect with the host device:

    a. If the Primary URL is configured, the display will attempt to connect to this host. If the Primary URL fails it will try to connect to the device with the specified "Device Serial Number".

    b. If a host serial number is configured, the display will search the network for an FMC Technologies device with the specified serial number, obtain an IP address, and attempt to connect with that host. If it fails with the device serial number it will attempt to connect to the secondary URL.

    c. If a fallback URL is configured the Display will attempt to connect to that host.

4. If step 2 is unsuccessful in connecting to any configured device or if the Remote Display has not been configured, the Remote Display main menu will be shown. From the Main Menu the connection settings can be configured and the connection sequence repeated.

6.3. Integrated Display Operation

6.3.1. Display Main Menu

The display's main menu will be displayed if the display does not connect to the UMCB after powering up sequence. The display's main menu can also be accessed by interrupting the startup process by tapping the screen while the boot icon is displayed. The following options are provided:

• Configuration – settings for a connection to a device

• Maintenance – adjustment of display setting

• Information – Key identification and settings data

• Reconnect – Initiate a reconnection to the configured device
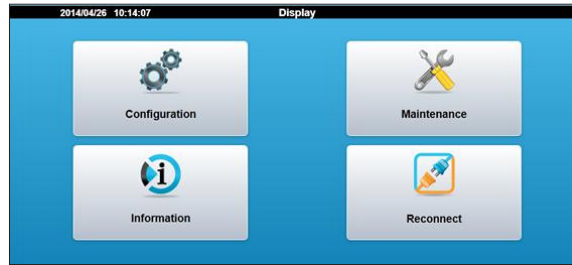
6.3.1.1. Display Configuration

The configuration tab is used to set up the display to communicate with the desired device and to set the password to control access of the display settings. A password is required to access the configuration settings. When the Configuration Button Icon is selected, a Login Screen will appear. There are two different levels of security access for the Display with the following default passwords:

• Level 4 Password: 4444 Network configuration level

• Level 5 Password: 5555 Weights and Measurement access level

It is recommended to change the passwords from the default value to a more secure setting. Refer to Section 5.2.1 for password setting instructions.

IMPORTANT: The password in the display menu is separate from ultrasonic meter control board (UMCB) password.
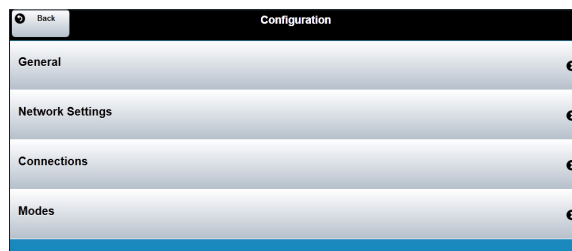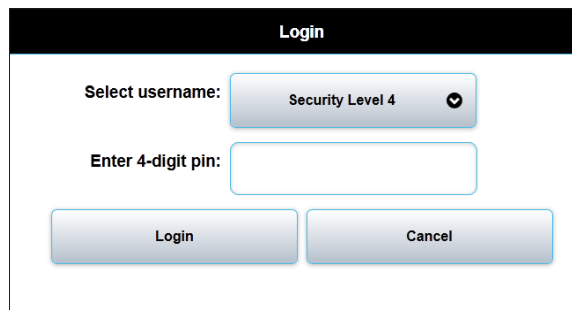
6.3.1.2. Display Configuration - General
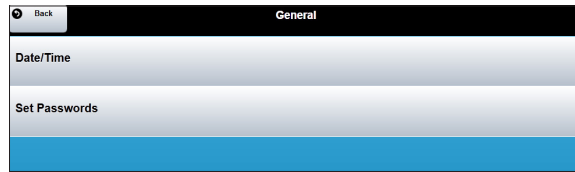
Date/Time – Adjust the date and time of the display unit. Once the display has been sealed the date and time adjustment will be locked out.

Set Passwords – Update the passwords for either level 4 or level 5 access. The screen will prompt for the old password and for the new password to be entered twice for confirmation.

The password is unique to the display and is not shared with the ultrasonic meter.

IMPORTANT: Record all password modifications and store in a secure location.

6.3.1.3. Display Network Settings

The network settings are to configure the address of the Display on the network. Note that this is not the address of the meter that the display is connecting to. The display is required to have a unique IP address because it exists as a device on the IP network. There are two modes to create the display's network address:

DHCP – The Dynamic Host Configuration Protocol is used to request the IP address from the network server. With this configuration checked, the DHCP server assigns a local IP address to the Display connected to the local network. This is the default network setting from the factory.

Fixed – If the Ethernet network does not support DHCP or if the meter is not connected to a network a fixed IP address should be used. The network settings for the fixed address must be entered manually on the display screen.
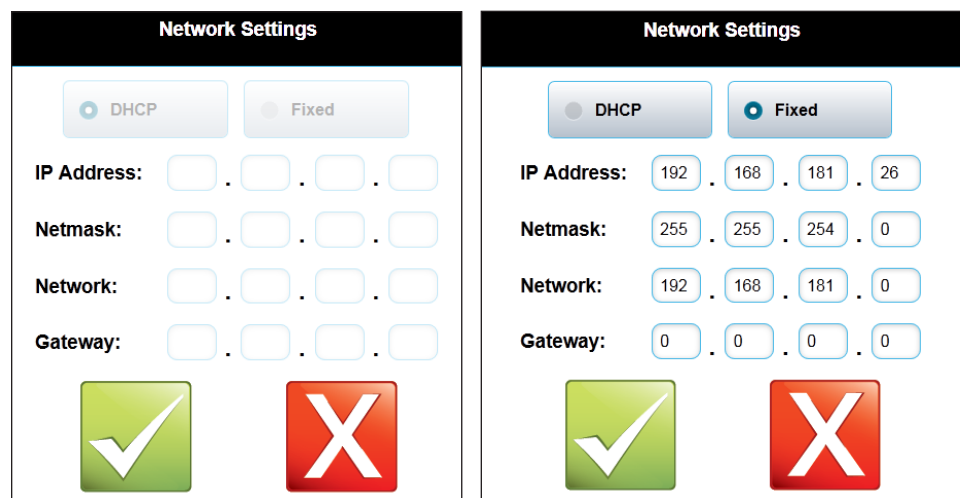
Note: The unit must be power cycled for the new settings to take effect.

6.3.1.4   **Display Connections**

The connections setting is used to connect to the desired ultrasonic flow meter.

Primary URL – This fixes a target IP/URL address that the Display will first attempt to connect to upon startup of the unit. In order to configure this value the IP address of the ultrasonic flow meter must be known.

Primary Timeout – Maximum time allowed for the primary URL connection attempt, in seconds. The URL connection attempt can be skipped by setting a zero timeout.

Device Serial Number – The unique serial number assigned to the ultrasonic meter control board. The Ultra series flow meter will broadcast this Serial Number over the network in a way that the display unit can detect. When the display matches the configured Serial Number to a device on the network it will form a connection. The ultrasonic meter Serial Number will be displayed in the meter electronics box. This is the recommended connection method to the ultrasonic flow meter.

Device Timeout – Maximum time allowed for the device Serial Number connection attempt.

Secondary URL – An alternate target IP/URL address the display will attempt to connect to. In order to configure this value the IP address of the ultrasonic flow meter must be known.

Secondary Timeout – Maximum time allowed for the secondary URL connection attempt, in seconds. The secondary URL connection attempt can be skipped by setting a zero timeout.

Minimum Up Time – A minimum time allowed since power up to allow attempting a host connection. Setting this to a larger value (in seconds) may be needed if the display attempts to connect to its host before the host is ready to accept connections (for example, if all instruments are turned on with the same power source, and the host takes longer to boot up).
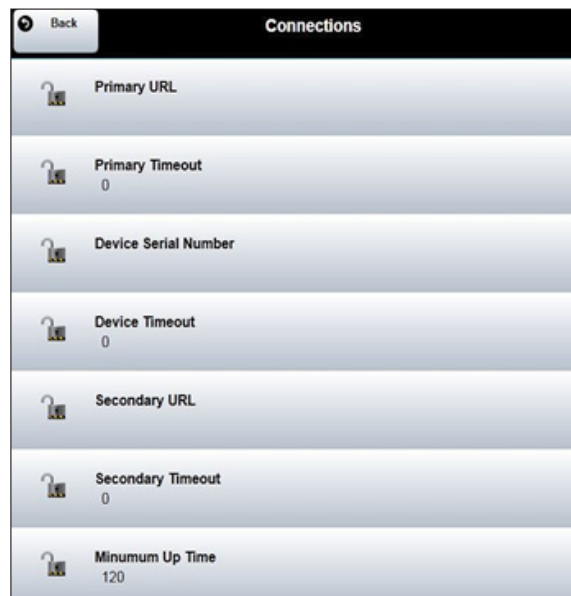
6.3.1.5.   Display Modes

The Modes setting is used configure the set the electronic seal and to configure the backlighting sleep mode for the display.

Electronic Seal State

This is used to set the electronic seal onto the display unit. Sealing locks out the adjustment of parameters that would be required to be fixed by a weights and measures official. Sealing can only be opened on Level 4 or 5 access level. Sealing can only be set by Level 5 access.
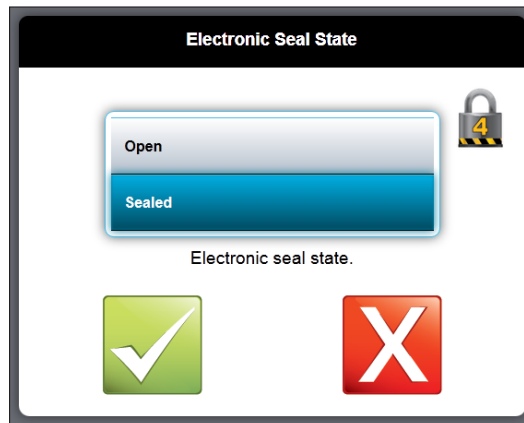
Backlight Timeout

This sets the amount of time before the LCD backlight switched off for a sleep mode. The following backlight timer duration options are available from the configuration screen.

- Always On
- 1 Minute
- 5 Minutes
- 20 Minutes
- 1 Hour
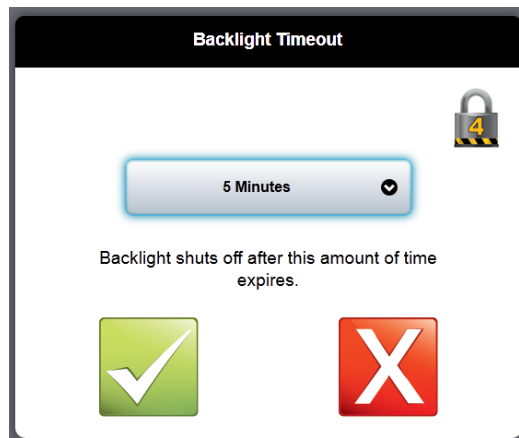
6.3.2.   Display Maintenance Settings

Allows for the unit to be reset to factory defaults by clearing all new settings.
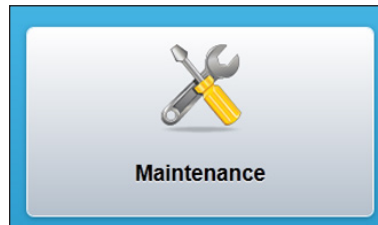
6.3.2.1.   Touch Screen Calibration

Opens a touch position calibration screen. This will calibrate the screen input by displaying a series of touch screen targets and matching the input values with the known location of the targets.

6.3.2.2.   Password Reset

This option allows resetting all passwords to factory defaults. The procedure described below must be followed to successfully accomplish this task. Please note that if successful, the electronic seal will be broken and the action logged; if the unit is under Weights and Measures control, it will need inspected and sealed again.

1. Order a USB adapter cable from FMC Technologies; this cable connects to CN3 and presents a standard type A USB connector.
2. Prepare a USB flash drive by creating an empty file named "password-reset.txt" on the root directory (folder).
3. Ensure the area contains no flammable gases and break the physical seal on the display enclosure. Open the housing and plug the adapter cable into CN3. Plug the USB flash drive into the other end of the cable.
4. Select the password reset on the Maintenance Menu and follow the instructions.
5. Once the passwords have been reset, remove the flash drive and cable.

6.3.3.   Display Information

The information screen displays key data about the integrated Display.
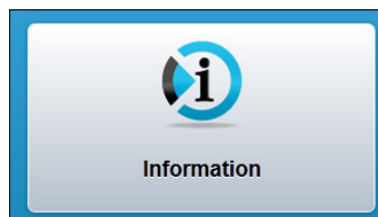
- • **Software Version** – Software version running on the display
- • **Browser Signature** – Checksum value to be noted after the unit has been sealed
- • **Parameter Seal** – Indicates if the display has been sealed; A lock icon for sealed and an unlock icon for unsealed
- • **Welmec Log** – A log of all changes to parameters than could be relevant to a Weights and Measures official

The entry layout is as follows:

Log Entry #	Timestamp	Entry Type	Description of Change

6.3.4.   Display Reconnect

The Reconnect button initiates an attempt to connect to configured devices using the same sequence used during power up.

If the connection attempts are unsuccessful the Remote Display will return to the main menu.
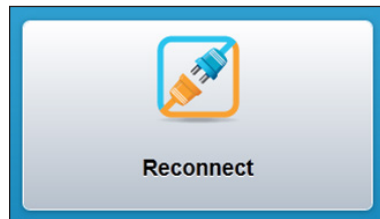
6.3.5.   Weights and Measures Sealing Procedures

The display may be sealed for Weights & Measures purposes; this guarantees the display may only connect to the devices configured and cannot be redirected using the touch screen. There are two seals that must be applied:

1. Electronic seal – this seal may only be activated using a level 5 password. When this seal is active, no Legally Relevant parameters may be changed; the seal must be deactivated before changes may be made. Note that the display seal is distinct and different than the Ultrasonic meter (UMCB) electronic seal; both must be sealed.

2. Physical seal – this is the wire and seal crimped on to the enclosure such that it is impossible to open the enclosure without destroying the seal.

The following procedure must be used to seal the unit (in addition to the procedure to seal the UMCB) using either the UMCB serial number or the primary URL connection method.

UMCB Serial Number Connection Method

1. Ensure that only the UMCB and Display are connected together and that no other Ethernet devices are active. If the UMCB and Display are in the same enclosure, ensure the display is the only device connected to the Ethernet ports on the UMCB.

2. Configure the display.
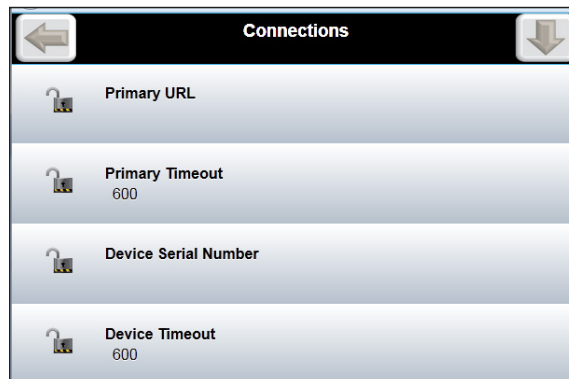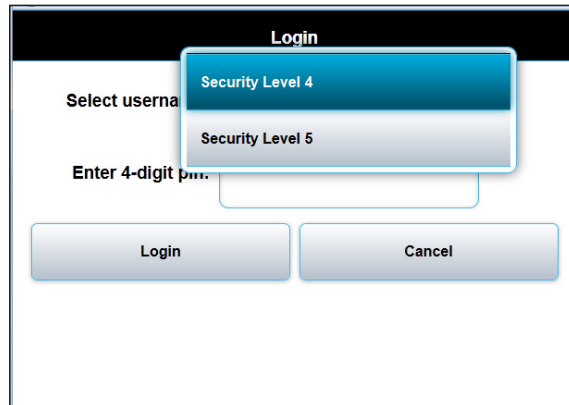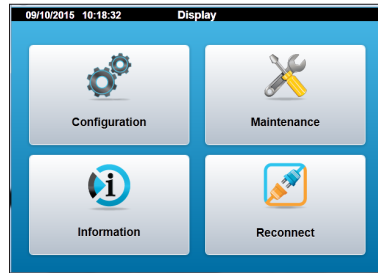
- Select Configuration
    - Select Security Level 5
    - Enter 4-digit pin [default is 5555]
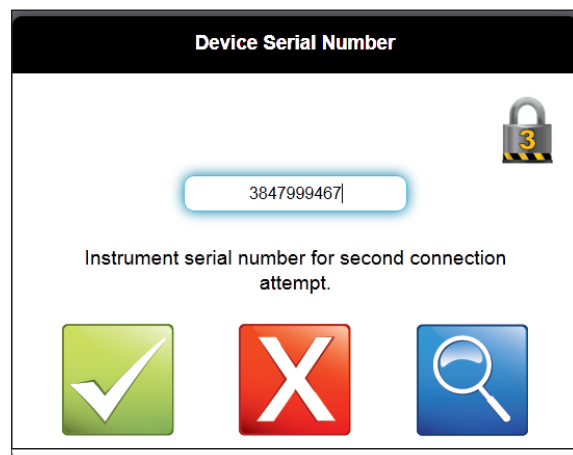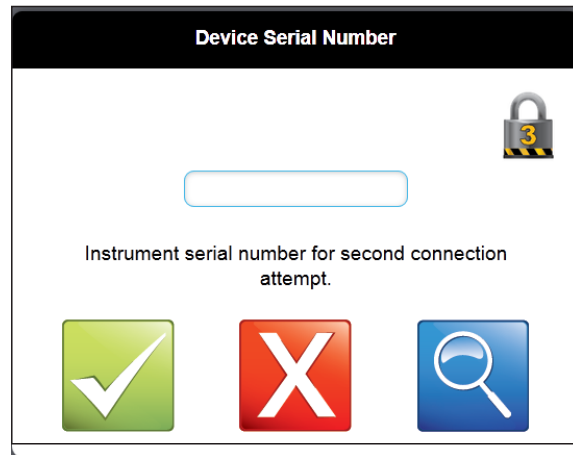
- • Select the blue find button
- • The display will find the UMCB unique identifier serial number.
- • Press the return key (upper left hand corner)
- • The serial number is shown in the display dialog box.
  Write this number down for future reference.
- • Press the green accept button
- Select Primary URL
  - • Ensure no data is entered in the dialog box (disables search)
  - • Press green accept button
- Select Primary Timeout
  - • Ensure 0 is entered in the dialog box (disables time to search)
  - • Press green accept button
- Select Secondary URL
  - • Ensure no data is entered in the dialog box (disables search)
  - • Press green accept button
- Press down arrow in upper right hand corner
- Select Secondary Timeout
  - • Ensure 0 is entered in the dialog box (disables time to search)
  - • Press green accept button
- Select the back button in the upper left hand corner of the display
- SUCCESS message is displayed. Touch the display anywhere to acknowledge the success message.
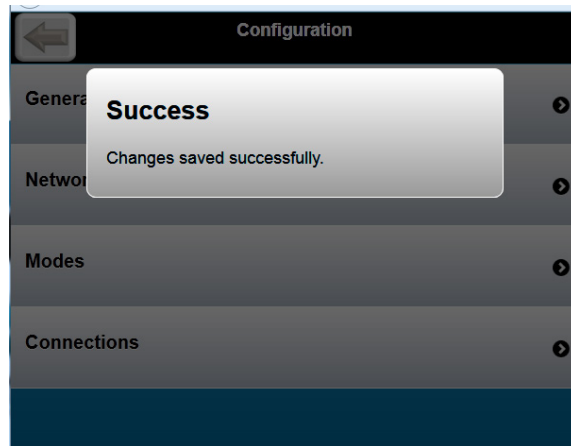
3.   Change the display passwords.

- Select General
  - Select Set Passwords
  - Select Security Level 5
  - Put in new security code
  - Select Save
  - SUCCESS message is displayed. Touch the display anywhere to acknowledge the success message.
  - Press Cancel to return to the previous screen
  - Select the back button in the upper left hand corner of the display

4.   Change the display electronic seal state parameter to "Sealed".

- Select Configuration
    - Select Security Level 5 and sign in
    - Select Modes

- Select Electronic Seal State
- Select the drop down
- Select Sealed
- Press green accept button

5. Verify software seal.
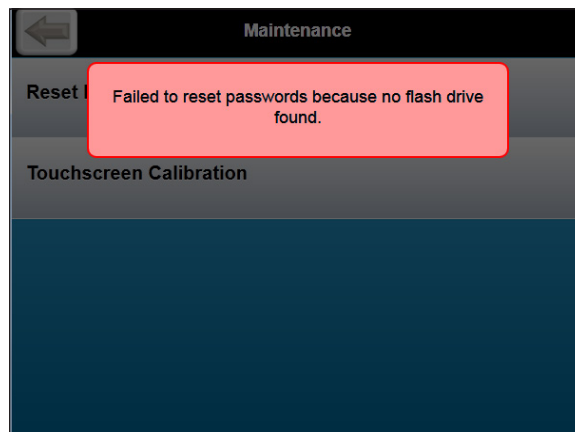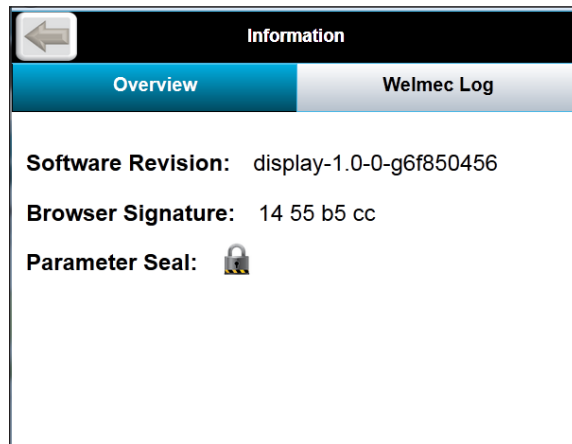
- Select Information
  - Verify that the Parameter Seal shows a closed lock
  - Select the back button in the upper left hand corner of the display
- Select Maintenance
  - Select reset passwords
    - Press green accept button
  - Verify that an error message is displayed, "Failed to reset passwords because no flash drive found." Touch the display anywhere to acknowledge the message.
  - Select the back button in the upper left hand corner of the display

6. Finding the meter serial number
  - Select Configuration
    - Select Security Level 4
    - Enter 4-digit pin [default is 4444]
    - Press Login
      - Press Connections
      - Notice that all options are greyed out and that a lock appears in front of all of the selections.
      - The Device Serial Number is shown under the selection and can be read from this screen. Write down the number for later reference.
      - Press the return key (upper left hand corner)

7. Verify the connection parameters only allow the display to connect with devices that are part of the Legally Relevant system.
    •   Select Reconnect
        •   Verify that the serial number written down earlier is shown in the upper left hand corner of the meter display overview screen.
        •   Note that you can also select the Meter Information Screen and the serial number is displayed in the General category of that page.
8. For a remote display, inspect the connections to the display; verify there are NO connections to the display except for power (CN4) and Ethernet (ETH1). Any other connections to the display are not allowed as they compromise security. Bolt the enclosure closed and apply a seal wire such that it must be destroyed to open the enclosure again.

Primary URL Connection Method
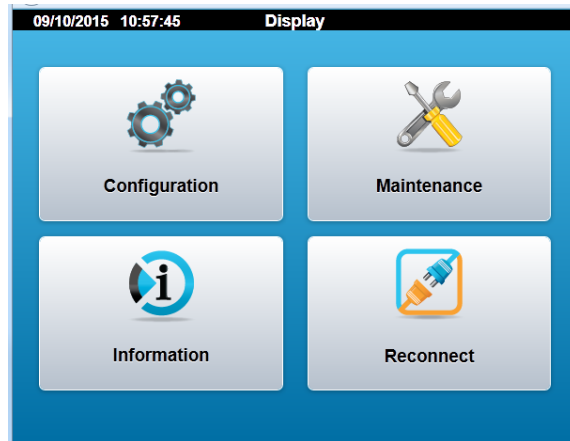
1. Ensure that only the UMCB and Display are connected together and that no other Ethernet devices are active. If the UMCB and Display are in the same enclosure, ensure the display is the only device connected to the Ethernet ports on the UMCB. Note that this process assumes that the URL of the meter has been set and is known.
2. Configure the display.
    •   Select Configuration
        •   Select Security Level 5
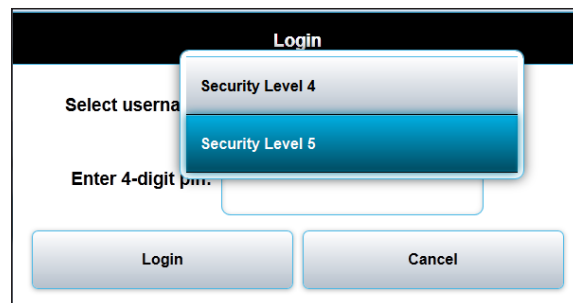
- Enter 4-digit pin [default is 5555]
- Press Login
  - Press Connections
  - Select Primary URL
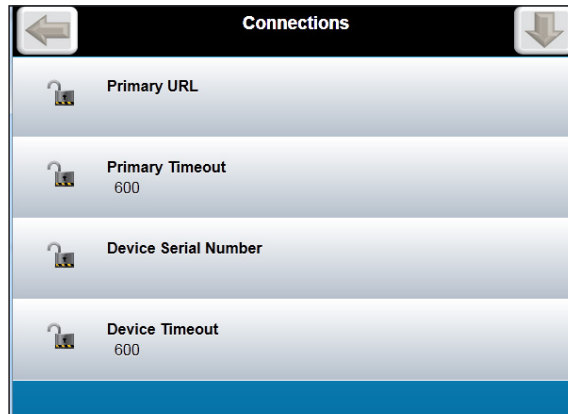
- Select the dialog box
- Enter the Primary URL (address of the meter assigned during meter setup) using the on-screen alphanumeric keyboard
  EX: http://192.168.181.7
- Press the checkmark (accept) key

- Ensure that the Primary Timeout value is set (default is 600). This value, set in seconds, is the maximum amount of time that the display will spend attempting to contact the meter before reverting to the display main menu.
- Select Device Serial Number
  - Ensure no data is entered in the dialog box
  - Press green accept button
- Select Device Serial Number Timeout
  - Ensure 0 is entered in the dialog box
  - Press green accept button

- Select Secondary URL
  - Ensure no data is entered in the dialog box
  - Press green accept button
- Press down arrow in upper right hand corner
- Select Secondary Timeout
  - Ensure 0 is entered in the dialog box
  - Press green accept button
- Select the back button in the upper left hand corner of the display
  - SUCCESS message is displayed. Touch the display anywhere to acknowledge the success message.
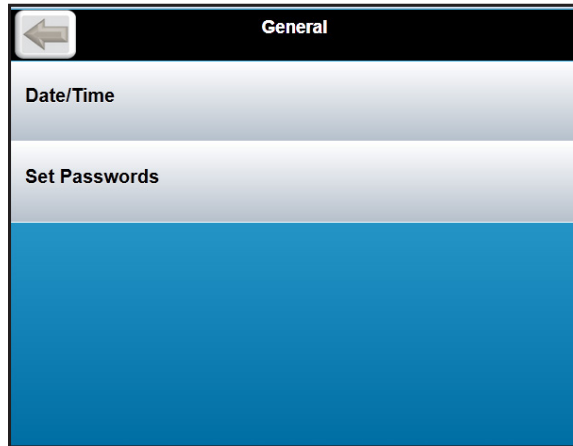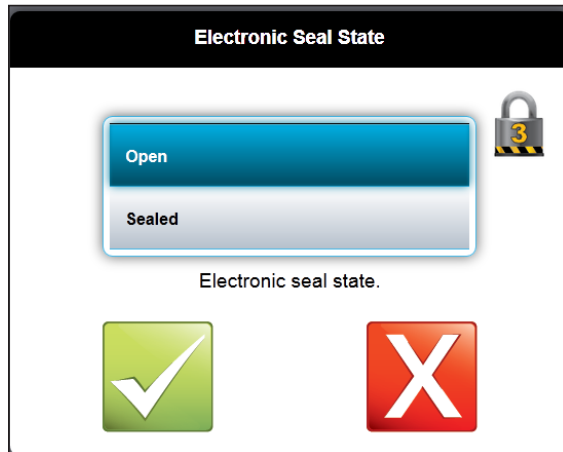3. Change the display passwords.
4. Change the display electronic seal state parameter to "Sealed".
   - Select Information
     - Verify that the Parameter Seal shows a closed lock
     - Select the back button in the upper left hand corner of the display
   - Select Maintenance
     - Select reset passwords
       - Press green accept button
     - Verify that an error message is displayed, "Failed to reset passwords because no flash drive found." Touch the display anywhere to acknowledge the message.
   - Select the back button in the upper left hand corner of the display
5. Verify the connection parameters only allow the display to connect with devices that are part of the Legally Relevant system.
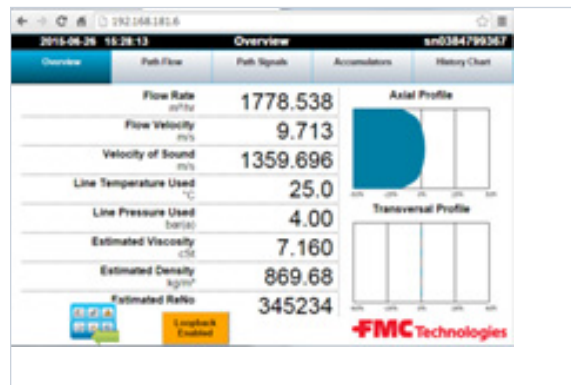
- Select Reconnect
  - Write down the serial number of the meter that is shown in the upper right hand corner of the display.
- Note that you can also select the Meter Information Screen and the serial number is displayed in the General category of that page.
- For a remote display, cycle power to the display.
- For a local display (where the display is the front panel of the meter), cycle main power.
- When power is restored the display will automatically connect to the meter.
- Verify that the meter serial number written down previously is the same number as is now shown (after the power cycle) in the upper right hand corner of the display.

6. For a remote display, inspect the connections to the display; verify there are NO connections to the display except for power (CN4) and Ethernet (ETH1). Any other connections to the display are not allowed as they compromise security. Bolt the enclosure closed and apply a seal wire such that it must be destroyed to open the enclosure again. Note that the meter enclosure must also be sealed (software and/or Weights & Measure jumper and physical seal wire on bolts) as shown in the manual.

6.3.6.   Display Network Configuration

The ultrasonic meter control board (UMCB) and optional integrated display will be configured with DHCP network settings as a default. In this mode the meter and display will wait to be assigned an IP address from the network server. If the ultrasonic meter is started without a network connection then a fixed IP address may need to be configured to the UMCB during commissioning.

If fixed addresses are to be used, both the Ultrasonic board and the Display must be assigned addresses. Using the display, configure the Ultrasonic address first. Cycle power and force the display into local mode (press the configuration icon when it shows). Configure the display address and also configure the Ultrasonic address into the "Primary URL" (example format: HTTP://192.168.1.22).

7 – Maintenance

7.1. Transducer Replacement – Inner Transducer

To change the inner transducer (with thread adapter and cable manifold), follow the subsequent steps below.

Suggested Tool list for removal and re-assembly of Ultra Series Transducers:
• (1) 5 mm Hex Key Allen Wrench
• (1) 6" Crescent Wrench
• (1) 12" Crescent Wrench
• (1) Channel Lock Pliers
• (1) Slip Joint Pliers
• (1) Small Slotted Screwdriver
• (1) 1¼" Deep Well Socket (medium frequency transducers)
• (1) 1⅝" Deep Well Socket (low frequency transducers)

1. Ultra Meter Assembly
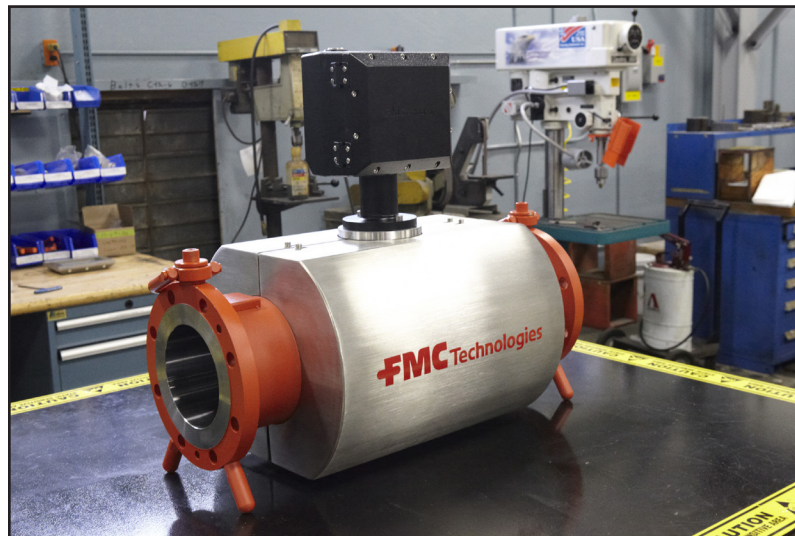
2. Remove outer cover from housing – (2) screws top of cover and (2) screws bottom of cover. (5 mm Allen Wrench required). The cover is still attached to the housing by secure button latches. To remove outer cover grab the sides in middle and pull hard.

3. Separate the retaining nut of the manifold and remove SMB wire connected to transducer. (Crescent wrench or Channel Locks required).

    When handling the manifold, be careful not to twist or bend the tubing within 0.5" (12mm) of the brazed connection.
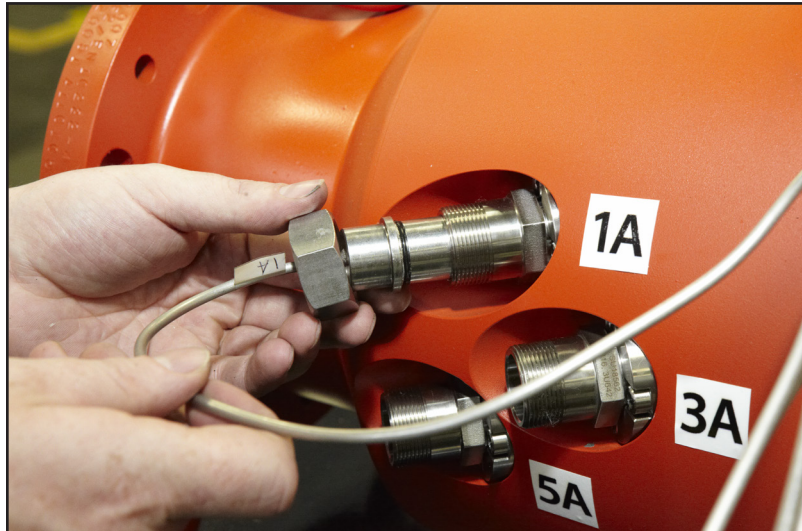
4. Use a deep well socket to remove thread adapter.

(1¼" Deep Well Socket for medium frequency transducer;

1⅝" Deep Well Socket for low frequency transducers).

5. Use a small wrench or a pair of pliers to unloosen the transducer

6. Location of flats on inner transducer to remove from meter.

7. Once the inner transducer is removed, immediately mark and attach a paper tag with a short description of issue(s).

8. To install new inner transducer, apply a drop of pure silicone oil – (part number P800005877) to the tip of the new inner transducer to ensure a good acoustic coupling between the piezo-electric crystal and the bottom of the transducer well.
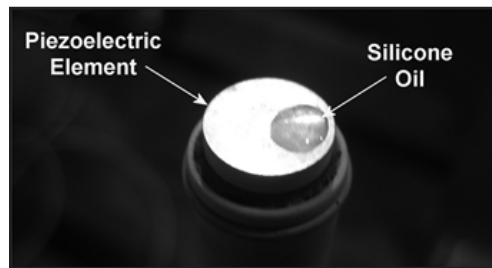
9. Carefully place inner transducer inside of outer transducer housing and retighten using a small wrench or a pair of pliers.
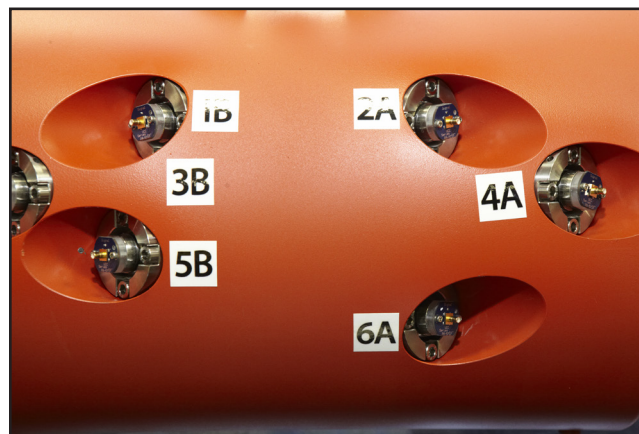
Reassembly

10. Re-attach the threaded adapter to the transducer's external threads, the SMB connection will seat itself on the transducer.

11. Re-attach the retaining nut assembly of the manifold and tighten retaining nut.

12. Re-attach the cover and (4) Screws top (4) screws bottom.

7.2   Transducer Replacement – Complete Transducer

> **WARNING:** *If the outer transducer housing needs to be removed for any reason, the meter must be de-pressurized and drained of all product before proceeding.*

If the complete transducer needs to be changed, flow must be stopped. The meter must be powered off during the entire procedure.

To change the complete transducer (with thread adapter and cable manifolds), follow these subsequent steps:

1. Separate the retaining nut of the micro-conduit manifold to expose the SMB connector. (Reference procedure for inner transducer replacement).

2. Using a deep well socket or wrench, remove the thread adapter. (Reference procedure for inner transducer replacement).

3. Remove (4) M6 screws that secure the transducer into the meter body.
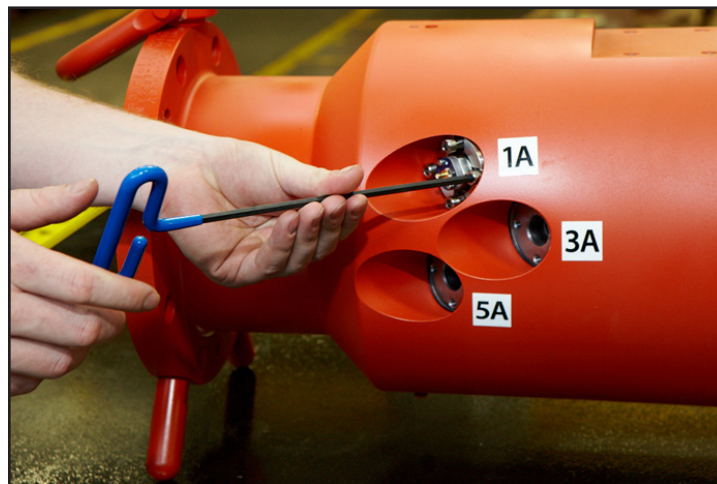
4. Remove transducer assembly from housing.

5. Separate the transducer from the transducer mount.

6. Lubricate (with petroleum jelly) the sealing o-ring on the new transducer and the bore of the bottom plate with an appropriate lubricate to ensure it is not damaged during assembly.

7. Install the new transducer into the meter body transducer bore and align the through holes in the transducer mount with the threaded holes in the housing.
8. Re-install (4) M6 screws to secure the transducer into the meter body.
9. Re-attach the thread adapter to the transducer external threads.
10. Re-attach the retaining nut assembly and tighten retaining nut.
11. Re-attach cover and (4) screws.

After the transducer has been replaced, the path length may need to be changed in the meter database. The actual path length can be calculated based on the face-to-face distance of the transducer nozzles and the flange-to-face length of the original and replacement transducers. The face-to-face distance of the transducer nozzles and the flange-to-face length of the original transducer will be included in the data packet originally supplied with the meter. The flange-to-face length of the replacement transducer will be included with the replacement transducer. For assistance, contact the factory by using the information provided on page 2 – Customer Support section of this manual.

7.3.   Replacement of Electronics Boards

> *Note:* The meter must be powered off while the electronics enclosure is open in a hazardous atmosphere. The meter must also be powered off if any electronic boards are to be replaced.

> *Important:* Removal of the UMCB board or handling the board outside of the enclosure should only be performed while following ESD-safe procedures. Electronic assemblies should be immediately placed into Anti-Static bag(s) upon removal and sealed. A grounded wrist strap, such as 3M #2209, should be worn anytime the boards are handled.

7.3.1.   UMCB Board Replacement

To replace the UMCB board, follow these steps:

1.   Save the meter database.
2.   Remove power from the device.
3.   Open the electronics box.
4.   Disconnect/Remove all connectors from CN1, CN2, CN3, CN4, CN5, CN6, ETH1 or ETH2 or ETH3.
5.   Remove the transducer cable connectors 1 through 6 for the Ultra 6c and 1 through 4 for the Ultra 4c with the included torque wrench from tool kit.
6.   Remove the (4) screws on the UMCB board with a screwdriver and gently pull the UCMB board out of the Electronics Box.
7.   Repeat this procedure in reverse order to install a new UMCB board.

After replacement of the UMCB board, the following actions must be performed:

1.   Configure UMCB board with correct network IP address.
2.   Load current firmware.
3.   Load meter with saved meter database file. (If unavailable, meter must be re-programmed manually.)

> *WARNING:* Breaking the physical seals and changing the hardware lock from closed to open should only be done when approved by the authorities having jurisdiction.

7.4.   Storage and Preservation of the Ultra and Spare Parts

7.4.1.   SHORT Term Storage – Up to One Month

- Depending on where the meter is stored, indoors or outdoors, precautions should be taken to preserve the meter during storage. Even for outdoor storage less than a day, precautions are required.
- When the meter is delivered, it is guarded by protection covers. Inspect them for damage, and keep them on during storage.
- For outdoor storage, protect the flanges and inner pipe with Cortech or similar corrosion inhibitor to prevent degradation of the spool (unless the spool is made of non-corrosive material). For indoor storage at room temperature and low humidity, this is not necessary. Ensure that the transducer fronts and o-rings inside the spool piece are not subjected to any solvents. This may lead to component damage.
- Mount protection covers on the flanges to prevent mechanical damage.
- Store the meter in such a way that it is not subject to inadvertent damage caused by the handling of other equipment.
- If outdoor storage, plug all cable glands and check that the electronics enclosure is properly closed. This is very important to prevent water ingress.

- Make sure the ambient temperature and humidity is within the meter's specifications at all times.
- Make sure that the meter is properly placed and secured against tilting. Provide necessary supports.

7.4.2.   LONG Term Storage – More than One Month

Precautions must always be taken to preserve the meter during storage. The preservations must be checked every three months. Precautions are the same as for short term storage, with the following additions:

- Flanges and inner pipe must be protected with Cortech corrosion inhibitor or similar to prevent degradation of the spool (unless the spool is made of non-corrosive material).
- Make sure that the transducer-fronts and o-rings inside the spool piece are not subjected to any solvents. This may lead to damage.

Note: If the meter has been subject to long term storage, all o-rings and backup-rings must be checked and if necessary changed.

7.4.3.   Preservation

For preservation of the meter, the following is required:

- Cortech or a similar corrosion inhibitor to prevent degradation of the spool.
- Covers for the flanges, to protect against mechanical damage.
- Necessary supports and extra covers to secure against damage caused by handling of other equipment.

7.4.4.   Returned Goods Policy

A Return Material Authorization (RMA) number must be obtained prior to returning any equipment to FMC Technologies Measurement Solutions, Inc. for any reason. An RMA number can be obtained by contacting Customer Service via the information on page 2 of this manual.

To conform with the OSHA "Right to Know Act" and provide a safe working environment for our employees, the following requirements have been made for any returned material:

1. All equipment must be completely cleaned and decontaminated. Incomplete cleaning of the returned equipment may result in having the equipment cleaned or returned at the owner's expense.
2. A Material Safety Data Sheet (MSDS) is required for all process fluids and fluids used for cleaning that have come in contact with the equipment.
3. The RMA number must be clearly marked on the outside of the shipping container. A document packet containing copies of the RMA and MSDS forms for all process fluids and cleaning fluids must also be attached to the outside of the shipping container.

Returned equipment that does not conform to these requirements may not be processed.

8 – Appendix A – Description of Legally Relevant Parameters

Ultra Series Meter Database Parameters

The following is a list of all parameters. All parameters at security levels 3, 4 and 5 (Commissioning, Owner and Weights and Measures) are Legally Relevant; there are no Legally Relevant parameters at levels 1 and 2.

Parameter Name	Menu	Security Level	Range	Nominal	Description
Electronic Sealing Mode	Modes	5	-no alarm -OIML	Default is "no alarm"	Electronic seal mode; determines meter behavior on sealed and unsealed conditions.
Length	Meter Body	4	50 mm 1500 mm	Depends on meter size	Length measured between transducer faces (one parameter for each path)
Angle	Meter Body	4	40 degrees 60 degrees and -40 degrees -60 degrees	Depends on path configuration of meter spool	Angle between transducer path and flow direction (one parameter for each path)
Lateral Position	Meter Body	4	-1.0 1.0	Depends on path configuration of meter spool	Lateral level of each path: -1=bottom, zero=center, 1=top (one parameter for each path)
Upstream Port Number	Transducer	4	0 15	Depends on path configuration of meter spool	Upstream transducer electrical port number. (one parameter for each path)
Downstream Port Number	Transducer	4	0 15	Depends on path configuration of meter spool	Downstream transducer electrical port number. (one parameter for each path)
Initial Profile Factor	Factory Settings	4	0.8 1.0	Depends on path configuration of meter spool	Profile (reference factor) to use before the learner runs. (one parameter for each path)
Disable	Modes	4	0 or 1	0 (enabled)	Disable this path (will be substituted). (one parameter for each path)
Transducer Delay	Transducer	4	-3.0 us +15.0 us	Depends on transducer type	Transducer delay value (node 1 if multiple nodes are programmed). (one parameter for each path)
Transducer Delay (node 2)	Transducer	4	-3.0 us +15.0 us	Depends on transducer type	Transducer delay value (node 2). (one parameter for each path)
Transducer Delay (node 3)	Transducer	4	-3.0 us +15.0 us	Depends on transducer type	Transducer delay value (node 3). (one parameter for each path)
Internal Diameter	Meter Body	4	70 mm 1500 mm	Depends on meter size	Average spool internal diameter at reference temperature.
Wall Thickness	Meter Body	4	20 mm 100 mm	Depends on meter construction	Average thickness of the spool wall; used for p/t correction of spool dimensions.
Material	Meter Body	4	Carbon steel, Stainless steel, Duplex	Depends on meter construction	Material of spool construction; used for p/t correction of spool dimensions.
Reference Temperature	Meter Body	4	15 C 30 C	Depends on ambient conditions	Temperature of the spool when the path lengths and inner diameter were measured.

Parameter Name	Menu	Security Level	Range	Nominal	Description
Diameter Compensation Mode	Meter Body	4	-None -Pipe Model	None	Specifies spool compensation algorithm to use for p/t correction of spool dimensions.
Meter Type	Meter Body	4	-Ultra4 -Ultra5 -Ultra6 -Ultra8	Depends on meter construction	Meter type and configuration; select from list.
Signal Type	Signal	4	-Burst -Chirp	Depends on meter type	Type of signal to use.
Signal Filter Kernel Length	Signal	4	1 1000	Depends on transducer type	Size of the filter kernel to use (in samples).
Signal Frequency	Signal	4	50 kHz 3000 kHz	Depends on transducer type	Signal frequency (or starting frequency).
Signal End Frequency	Signal	4	50 kHz 3000 kHz	Depends on transducer type	Signal ending frequency (chirp signals only).
Signal Length	Signal	4	0.3 us 260 us	Depends on transducer type	Signal length (duration).
Bursts	Signal	4	-1 -3 -5 -7 -11 -13	Depends on transducer type	Number of bursts (burst signals only).
Burst Interval	Signal	4	100 2000	Depends on transducer type	Distance between bursts in samples (burst signals only).
Low Pass Filter Frequency	Signal	4	50 kHz 3200 kHz	Depends on transducer type	Low pass filter frequency -3dB point.
High Pass Filter Frequency	Signal	4	50 kHz 3200 kHz	Depends on transducer type	High pass filter frequency -3dB point.
Delay Between Firings	Signal	4	0 us 100000 us	0 us	Additional delay added between ultrasonic burst transmissions.
Level Control Setpoint	Signal	4	0.2 V 0.8 V	0.5 V	Signal level the control algorithm will attempt to maintain.
Detection Method	Signal	4	-single -multiple -zero cross only -hilbert only -correlation top	Depends on transducer type and signal selections	Method used to detect the signal.
Transducer Type	Transducer	4	-long without matching layer -short without matching layer	Depends on transducer type	Type of transducer installed.
Number of Zero Crossings	Signal	4	1 20	Depends on transducer type	Number of Zero Crossings.
Manual TX Gain	Signal	4	-40 dB 0 dB	Depends on transducer type	Manual setting for ultrasonic transmit gain, 0.0 dB is max, negative values attenuate.
Low Flow Cutoff	Limits	4	0 m/s 10 m/s	0.2 m/s	Below this velocity limit, flow will be registered as zero.
Running Average Mode	Factory Settings	4	-no averaging -modbus -modbus and pulse output	no averaging	Mode determines how the running average will affect other functions.

Parameter Name	Menu	Security Level	Range	Nominal	Description
Running Average Buffer Size	Factory Settings	4	0 200	0	Size of the running average buffer (amount of filtering).
VPCX Average Buffer Size	Factory Settings	4	0 500	100	Size of the VPCX running average buffer (amount of filtering).
Pulse Output Factor	Inputs and Outputs	4	100 p/m3 100000 p/m3	Depends on meter size and max flow rate	Factor relating meter measurement volume to pulses. (max output frequency is 10 kHz)
Reverse Flow Handling	Inputs and Outputs	4	-bidirectional -forward only -reverse only	Default: forward only	Pulse output behavior during reverse flow.
Digital Output Function	Inputs and Outputs	4	-quadrature (I,Q) -pulse (forward, reverse) -(pulse, flow direction)	Default: quadrature	Digital output function.
An Out Function	Inputs and Outputs	4	-flow rate -viscosity -density -Reynolds number	Default: flow rate	Analog output function.
An Out Max Engineering Value	Inputs and Output	4	-1000000 1000000	Depends on output variable selected	Upper engineering value.
An Out Min Engineering Value	Inputs and Outputs	4	-1000000 1000000	Depends on output variable selected	Lower engineering value.
An Out Cal Factor A	Inputs and Outputs	4	3000 5000	Depends on electronics tolerances	Hardware calibration factor (Ax+B).
An Out Cal Factor B	Inputs and Outputs	4	-50000 50000	Depends on electronics tolerances	Hardware calibration factor (Ax+B).
An In Cal Factor A	Inputs and Outputs	4		Per calibration	Calibration Factor A.
An In Cal Factor B	Inputs and Outputs	4		Per calibration	Calibration Factor B.
An In Alarm Hysteresis	Inputs and Outputs	4	0 % 10 %	1 %	Hysteresis for alarm trigger points.
An In High Alarm Point	Inputs and Outputs	4	4 mA 22 mA	20.1 mA	High alarm trigger point.
An In Low Alarm Point	Inputs and Outputs	4	3.8 mA 20 mA	3.9 mA	Low alarm trigger point.
An In Engineering Value at Max	Inputs and Outputs	4	(no limits)	Per commissioning requirements	Engineering value to use at the maximum electrical input range.
An In Engineering Value at Min	Inputs and Outputs	4	(no limits)	Per commissioning requirements	Engineering value to use at the minimum electrical input range.
An In High Limit	Inputs and Outputs	4	12 mA 22 mA	22 mA	Electrical input above this limit will not be allowed.

Parameter Name	Menu	Security Level	Range	Nominal	Description
An In Low Limit	Inputs and Outputs	4	3.8 mA 12 mA	3.8 mA	Electrical input below this limit will not be allowed.
RTD In Temperature Offset	Inputs and Outputs	4	-10 C +10 C	0 C	Temperature offset to apply to the measured temperature.
RTD Input High Limit	Inputs and Outputs	4	100 Ohms 168.4783 Ohms	168.4783 Ohms	Electrical input above this limit will not be allowed.
RTD Input Low Limit	Inputs and Outputs	4	76.3278 Ohms 100 Ohms	76.3278 Ohms	Electrical input below this limit will not be allowed.
Line Temperature Input Mode	Modes	4	-fallback -4-20mA input #1 -4-20mA input #2 -RTD input -modbus	Default: fallback	Data source for line temperature used in compensations.
Line Pressure Input Mode	Modes	4	-fallback -4-20mA input #1 -4-20mA input #2 -modbus	Default: fallback	Data source for line pressure used in compensations.
Electronic Seal State	Modes	4	-open -sealed	Default: open	Electronic seal state.
Line Temperature Fallback Value	Modes	4	-40 C 150 C	20 C typ.	Fallback value for line temperature used in compensations.
Line Pressure Fallback Value	Modes	4	0 bar(a) 250 bar(a)	5 bar(a) typ.	Fallback value for line pressure used in compensations.
Number of Cal Nodes	Transducer	4	0 3	0	Number of transducer calibration nodes.
Correction Mode	Transducer	4			Mode selection for transducer calibration algorithm.
Node Pressure	Transducer	4	0 bar(a) 250 bar(a)	Per transducer calibration	Node calibration point pressure.
Node Temperature	Transducer	4	-40 C 150 C	Per transducer calibration	Node calibration point temperature.
Flow Rate Node	Calibration	4	(no limits)	Per calibration	Flow rate for this calibration node.
Node Meter Factor	Calibration	4	0.9 1.1	Per calibration	Meter factor for this calibration node.
Node A coeff	Factory Settings	4			Node A coeff.
Node B Coeff	Factory Settings	4			Node B coeff.
VPC X	Factory Settings	4	1.0 4.0	Per calibration	Velocity profile correction node X value.
VPC Meter Factor	Factory Settings	4	0.9 1.1	Per calibration	Meter factor for this calibration node.
ReNo Node VPC X	Factory Settings	4	1.0 4.0	Per calibration	Velocity profile correction node X value.
ReNo Node Reynolds Number	Factory Settings	4	10 10000000	Per calibration	Corresponding Reynolds number.

Parameter Name	Menu	Security Level	Range	Nominal	Description
Meter Tag	Communications	4	Up to 16 characters	(factory set to electronics serial number)	Unique tag name designated for this meter; used for identification.
Max Velocity of Sound	Limits	3	300 m/s 4000 m/s	Depends on meter type	Alarm when measured velocity of sound exceeds this value.
Min Velocity of Sound	Limits	3	300 m/s 4000 m/s	Depends on meter type	Alarm when measured velocity of sound falls below this value.
Min Signals Used	Limits	3	1 % 99 %	50% typ.	Alarm when percentage of signals used falls below this value.
Max RX Gain	Limits	3	-12 dB 48 dB	30 db typ.	Alarm when receiver gain exceeds this value.
Max RX Gain Difference	Limits	3	0 dB 64 dB	10 dB typ.	Alarm when the gain on an individual path differs more than this value compared to the median gain.
Max VOS Deviation	Limits	3	0 m/s 1000 m/S	Depends on meter type	Alarm when the velocity of sound on an individual path differs more than this value compared to the median velocity of sound.
Min Signal to Noise Ratio	Limits	3	0 dB 60 dB	20 dB typ.	Alarm when the used signal to noise ratio falls below this value.
Max Turbulence Level	Limits	3	0 % 50 %	20 % typ.	Alarm when the turbulence level exceeds this value.
Max Swirl/ Crossflow Deviation	Limits	3	0% 70 %	10 %	Alarm when the transversal flow exceeds this value.
Max flow rate	Limits	3	5 m/s 40 m/s	Depends on meter type	Alarm when the flow velocity exceeds this value.
Min flow rate	Limits	3	-40 m/s -5 m/s	Depends on meter type	Alarm when the flow velocity falls below this value.
Max Profile Flatness Deviation	Limits	3	0 % 50 %	20 %	Alarm when the profile flatness deviates this amount.
Max Profile Symmetry Deviation	Limits	3	0 % 50 %	10 %	Alarm when the profile symmetry deviates this amount.
Manual (force) Values	Modes	3	-off -on	-off	Controls whether manual values are allowed to be used.
Serial Port Function	Communications	3	-none -modbus RTU -modbus ASCII	-modbus RTU	Selects the serial port protocol.
Baud Rate Selection	Communications	3	-1200 -2400 -4800 -9600 -19200 -38400 -57600 -115200	-9600	Select the serial port baud rate.
Parity Selection	Communications	3	-none -odd -even	-none	Select the serial port parity.

Parameter Name	Menu	Security Level	Range	Nominal	Description
Word Length Selection	Communications	3	-7 bits -8 bits	-8 bits	Select the serial port word length.
Stop Bit Selection	Communications	3	-1 -2	-1	Select the serial port stop bits.
Ethernet Address Mode	Network Settings	3	-DHCP -fixed	Per user	Ethernet mode: DHCP acquired address or static address.
Ethernet IP Address	Network Settings	3	IPv4	Per user	Static Ethernet IP address, first octet.
Ethernet IP Subnet	Network Settings	3	IPv4	Per user	Static Ethernet IP subnet mask, first octet.
Ethernet Network Address	Network Settings	3	IPv4	Per user	Static Ethernet network, first octet.
Ethernet Gateway Address	Network Settings	3	IPv4	Per user	Static Ethernet gateway address, first octet.
Modbus Unit ID	Communications	3	1 247	Per user	Modbus device ID (address).
Modbus Endian	Communications	3	-modbus format floats -alternate format floats	-modbus format floats	Modbus endian (word order of transmission for floating point numbers).
Datalog Interval	Diagnostic	2	-off -avg period, with avg -avg period, without avg	-avg period, with avg	ENGINEERING function - selects how often data is logged to a file.
Signal Logging Interval	Diagnostic	2	-off -1 min -5 min -10 min -1 hr -8 hr -1 day	-1 hr	ENGINEERING function - selects how often signals are logged to a file (minutes, 0=off).

9 – Appendix B – Alarm List

Path Alarms

Name	Description
Low Signal Percentage Used	Signal percentage for this path has dipped below the programmed limit.
Receiver Gain too High	Receiver gain for this path has exceeded the programmed limit.
Path Substituted	This path has been deemed unfit for use, and measurement values have been substituted based on measurements taken on other working paths.
Low Signal to Noise Ratio	The signal to noise ratio for this path has dipped below the programmed limit.
High Turbulence	The turbulence value for this path has exceeded the programmed limit.
Velocity of Sound Deviation	The velocity of sound for this path has deviated from the others by more than the programmed limit. Grounds for path substitution.
Receiver Gain Deviation	The receive gain for this path has exceeded the programmed limit.

Flow Alarms

Name	Description
Abnormal Flow Profile	At least one flow profile measurement has exceeded the programmed limit.
Flow Out of Range	The flow rate has exceeded (forward or reverse) the programmed limit.

System Alarms

Name	Description
Analog Input 1 Out of Range	Analog input #1 is not in the range of 4-20 mA.
Analog Input 2 Out of Range	Analog input #2 is not in the range of 4-20 mA.
RTD Inputs Out of Range	The RTD input has exceeded the hardware limits for input resistance.
Signature Failure	At least one program parameter signature failed to check; database is possibly corrupt. DB should be restored from a previous save and/or all parameters checked. To clear the alarm, seal the unit (and unseal it again if desired), and then cycle power (or activate a reboot on the diagnostics screen).
Code Integrity Check Failed	The Ultrasonic daemon program file is corrupt. Software must be updated.
Memory Checksum Failure	RAM memory changed that should not have changed. Consult the factory.
Modbus Code Check Failed	The Modbus daemon program file is corrupt. Software must be updated.
Software not Running	The Ultrasonic daemon failed to start. This may be caused by many reasons. First, cycle power and see if the alarm returns. Next, verify program parameters to be sure there is not a bad combination (example, meter dimensions are "impossible"). If the alarm persists, consult factory. Note: this alarm is only cleared on reboot.
Accumulator Memory Error	During startup, the signature values for the last known totalizer (accumulator) values did not check. The totalizers were reset to zero. Restart the meter to clear this alarm.
Flow Rate PV Confidence	This process variable may be uncertain, and the "health" bit is set.
Velocity of Sound PV Confidence	This process variable may be uncertain, and the "health" bit is set.
Density PV Confidence	This process variable may be uncertain, and the "health" bit is set.
Viscosity(Kin) PV Confidence	This process variable may be uncertain, and the "health" bit is set.
Reynolds No PV Confidence	This process variable may be uncertain, and the "health" bit is set.
Analog Output Out of Range	The analog output has exceeded the 4-20 mA range.
Viscosity(Dyn) PV Confidence	This process variable may be uncertain, and the "health" bit is set.

10 – Related Publications

The following literature can be obtained from FMC Technologies Measurement Solutions Literature Fulfillment at measurement.fulfillment@fmcti.com or online at www.fmctechnologies.com/measurementsolutions.

When requesting literature from Literature Fulfillment, please reference the appropriate bulletin number and title.

Ultra 4c Specifications ....Bulletin SSLS003
Ultra 6c Specifications ....Bulletin SSLS004
Ultra 8c Specifications ....Bulletin SSLS006
Remote Display Register Specifications..Bulletin SSLS008
Remote Display Register Installation / Operation / Maintenance Manual ....Bulletin MNLS007
External Data Communication, Procedure Manual ....Bulletin MNLS006

Revisions included in MNLS005 Issue/Rev. 0.3 (2/16):

Sections 2.23, 4.1, and 6.3.5 have been updated. Edits and additions made throughout section 5. Appendix B - Alarms List added to page 96.

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