IOM A-0985B – SPI-MV-BAT
SINGLE POINT INSERTION FLOW METER VALVE - BATTERY POWERED

Installation and Operation Manual

SINGER VALVE
Result-Based Solutions. Globally.™

McCROMETER

Please read and understand the contents of this manual.

Table of Contents

1 Health and Safety: Read First

Throughout this manual are safety warning and caution information boxes. Each warning and caution box will be identified by a large symbol indicating the type of information contained in the box. The symbols are explained below:

This symbol indicates important safety information. Failure to follow the instructions can result in serious injury or death.

This symbol indicates important information. Failure to follow the instructions can result in permanent damage to the meter or installation site.

When installing, operating, and maintaining equipment where hazards may be present, you must protect yourself by wearing Personal Protective Equipment (PPE) and be trained to enter confined spaces. Examples of confined spaces are manholes, pumping stations, pipelines, pits, septic tanks, sewage digesters, vaults, degreasers, storage tanks, boilers, and furnaces.

You must follow all state and local laws, as well as Occupational Safety and Health Administration (OSHA) regulations concerning Personal Protective Equipment, confined-space entry, and exposure to bloodborne pathogens.

WARNING!

Incorrect installation or removal of SPI Mag meters can result in serious injury or death. Read the instructions in this manual on the proper procedures carefully.

WARNING!

Never enter a confined space without testing the air at the top, middle, and bottom of the space. The air may be toxic, oxygen deficient, or explosive. Do not trust your senses to determine if the air is safe. You cannot see or smell many toxic gases.

WARNING!

Never enter a confined space without the proper safety equipment. You may need a respirator, gas detector, tripod, lifeline, and other safety equipment.

WARNING!

Never enter a confined space without standby/rescue personnel within earshot. Standby/rescue personnel must know what action to take in case of an emergency.

WARNING!

Pressurized pipes should only be hot tapped, cut, or drilled by qualified personnel. If possible, depressurize and drain the pipe before attempting any installation.

WARNING!

Carefully read all safety warning tags attached to the meter.

2 Information

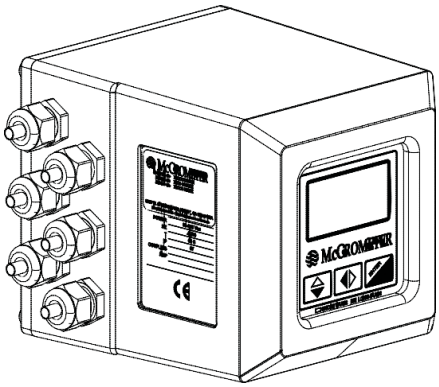
Read this entire manual prior to installing the SPI and/or changing any settings. Retain this manual in your records. DO NOT DISCARD.

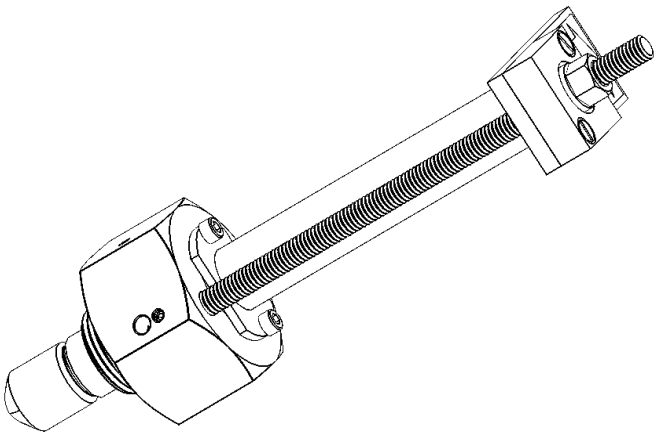
2.1 Design Information

With over 100 years of combined waterworks experience, Singer Valve and McCrometer have teamed up to provide a unique solution for in-valve flow measurement. Using McCrometer's proven Single Point Insertion Meter technology along with the reliability of a Singer Valve, the SPI-MV allows users to have both a flow meter solution along with any function of control valve. Whether it is pressure reducing, level control, or sustaining - all can now be installed with a very accurate flow meter solution.

The Singer Model 106-SPI-MV is a Single Point Insertion Electromagnetic Flow Meter, installed and calibrated for a Singer valve to provide an accurate flow rate that can be utilized with the metering valve to provide complete valve control. The SPI flow meter combines an innovative sensor with a comprehensive electronics package to provide accurate flow measurement for monitoring applications. The insertable sensor uses electromagnetic technology to measure water velocity. SPI has many features to suit a wide variety of applications, and is easily set up using the keypad and readouts.

The streamlined, debris-shedding sensor shape allows the SPI to be used under many flow conditions. The compact insertion design fits in confined spaces and offers complete accessibility. The flow meter can be removed for easy inspection and cleaning. This cost effective flow meter option is available for valve sizes from 3" (75mm) to 36" (900mm). The flow sensor comes pre-calibrated from McCrometer's NIST traceable Calibration Lab and requires no recalibration in the field. With no moving parts and a single-piece design, the SPI's sensor contains nothing to wear or break, and it is generally immune to clogging by sand, grit or other debris.





2.2 Specifications

2.2.1 Flow Measurements

Accuracy: +/-2% of reading +/- 0.03 ft/s zero stability
Velocity Range: +0.3 – 32 ft/s with reverse flow indication

2.2.2 Battery

Battery Type: Four D-cell lithium batteries, 3.6V, 19Ah
Life: 3-5 years, standard use

2.2.3 External Power (Optional)

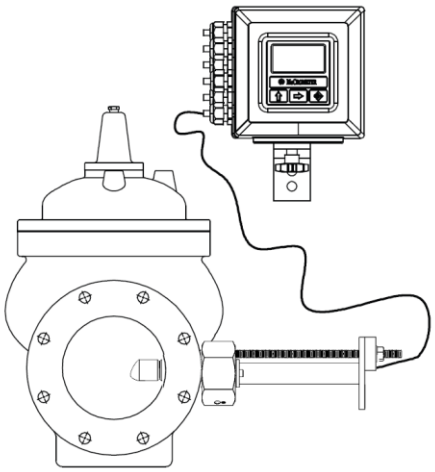
AC: 90 - 265V, 45 - 66 Hz (20W/25VA)
DC: 10 – 35V (21W)

2.2.4 Environmental Specifications

Insertion Tube Operating Temperature: Up to 160°F (71°C) at 250 PSI
Insertion Sensor Rating: IP68 (submersible)
Local Converter Operating Temperature: -4°F to 140°F (-20°C to 60°C)
Local Converter Enclosure Rating: IP67 (Temporary Immersion in up to 7ft)

2.2.5 Material Specifications

Probe Head: Polyurethane
Probe Pipe Sleeve: 316 Seamless Stainless Steel Pipe
Electrode: 580 Grade Carbon Rod
Nipple & Compression Assembly: 316 Stainless Steel
Compression Seal: Buna “N” O – Ring Seal
Thread Seal Between Probe and Probe Pipe: Mixture of Loctite 7649 and Loctite 564
Thread Sealant Tape between Nipple & Valve: PTFE
Sensor Cable: Twinmax Polyurethane
Local Converter Enclosure: Die Cast Aluminum (Standard)



3 Start-up Guide

WARNING: Read all manual sections referred to by this guide for full instructions and ensured safety.

NOTE: If SPI Sensor is not factory installed in the Singer Valve please refer to Appendix 12.1. for Step-by-step install instructions before proceeding with Start-up Guide.

NOTE: Where required, the **L2 Passcode is 000002**.

Basic Start-up Site Requirements Checklist:

- Pipe primed and pressurized with water.
- Ability to shut off flow and isolate Singer valve for zero flow calibration.
- Ability to flow varying flow through valve.

Proper Installation Checklist:

- Verify SPI-MV is installed with sufficient straight pipe upstream of the valve. See Section 4: *Application Details*.
- Verify SPI-MV sensor probe and the converter are grounded to a grounding ring, grounding rod, or similar. See section 8.8: *Grounding*.

Before Powering the SPI Convertor Checklist:

- Verify the SPI-MV sensor probe wires are wired to the SPI-MV convertor correctly. See section 8.7.2: *Sensor Wiring* for more details.
- If Pulse Outputs are being used, verify wires are wired to the SPI-MV convertor correctly. See sections 8.7.3 for more details.
- Verify all cables entering the converter are through the built-in cable compression glands and that all glands are tightened to maintain the converter's IP67 rating. See section 8.2: *Installing Cables to Converter and Service Loop* for more details.
- Ensure the SPI-MV converter rear panel is closed tightly to maintain the converter's IP67 rating.

During Converter Power-up Checklist:

- Ensure converter powers up and passes self-test. See section 8.7.5: *Converter Start-Up*.
    - If convertor fails self-test, error codes will display. Contact factory for support.

Converter Configuration Checklist:

- Use Left/Right arrow to navigate, See section 9.1 Front Panel Display to the Alarms Menu. Ensure there are no alarms present. If alarms are present See section 10 Alarm Messages.
- Press Enter/Esc to access the Quick Start Menu. See section 9.4.
- Perform Zero Calibration – See section 9.5.12: *Zero Cal*.
- Set Flow Range and Units – See section 9.6.1:*Fs*.
- Use Left/Right arrow to navigate, See section 9.1 Front Panel Display to the preferred display to be maintained during operation.

NAME: **DATE:**

SIGNED:

4 Application Details

4.1 Basic Insertion Parameters

For most application you need 3 Pipe diameters straight pipe upstream flange to flange from any in-line device, elbow, or tee.

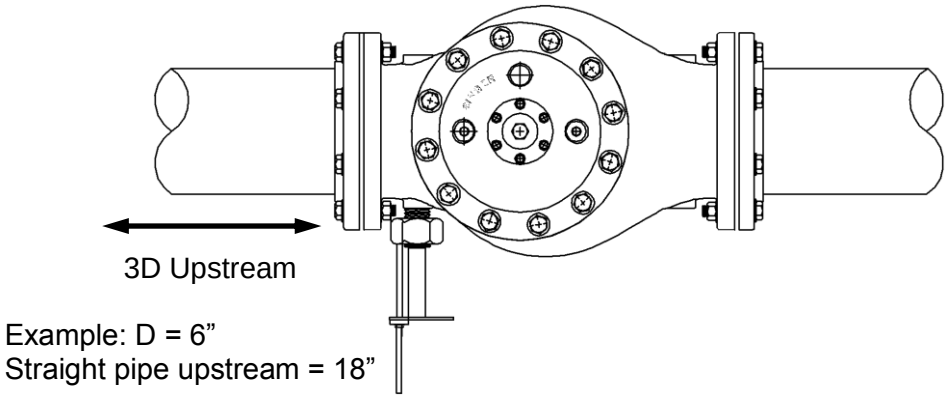


Figure 1: SPI-MV Basic Insertion

4.2 Exceptions

4.2.1 Gate Valve

Gate valve fully open will not cause any effect and can be mounted next to SPI-MV valve. Gate valve not fully open will cause a flow disturbance and will need 3D from SPI-MV valve

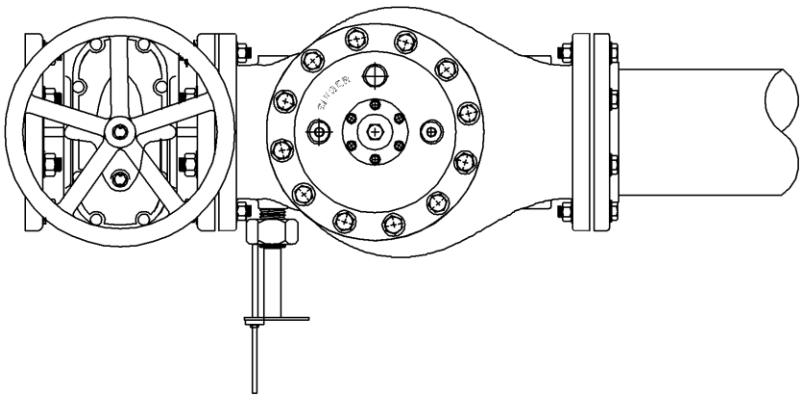


Figure 2: SPI-MV with Gate Valve

4.2.2 Butterfly Valves

A horizontal butterfly valve will cause a larger flow disturbance and will need three pipe diameters from SPI-MV valve

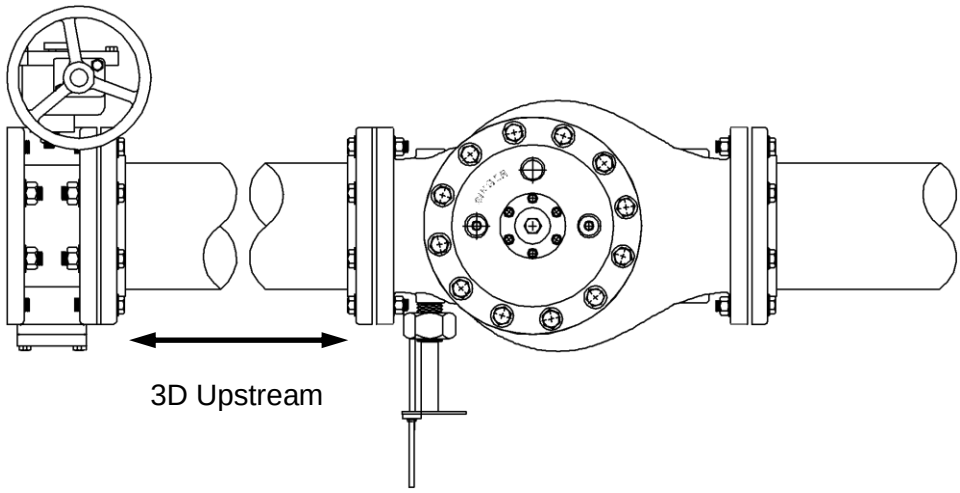


Figure 3: SPI-MV with Horizontal Butterfly Valve

A vertical butterfly valve fully open will cause a small disturbance and therefore will need only one pipe diameter to the SPI-MV valve.

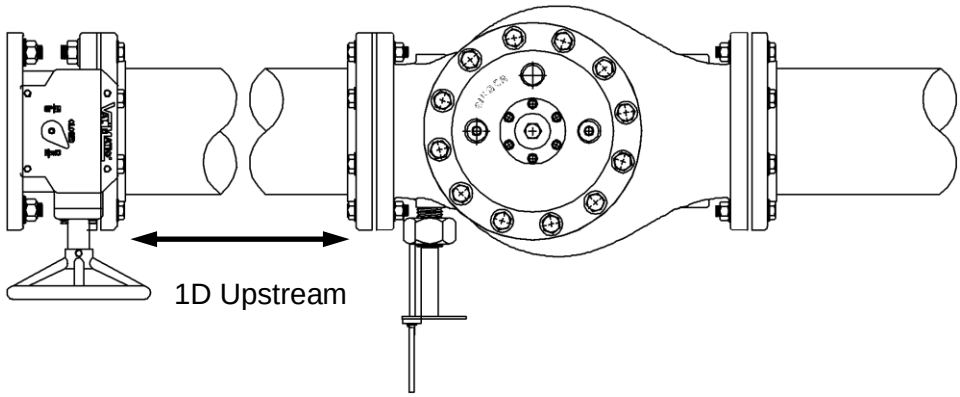


Figure 4: SPI-MV with Vertical Butterfly Valve

4.2.3 Reducers

Concentric Reducer: Does not affect system

Eccentric Reducer: 3D required

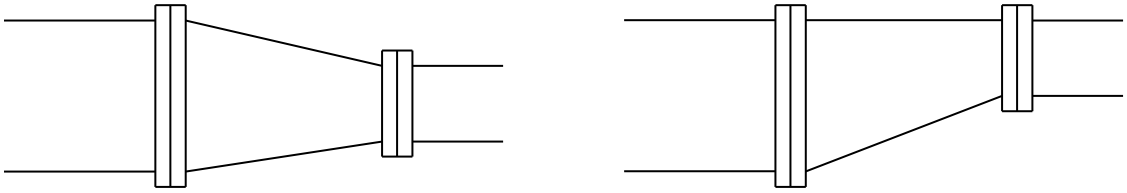


Figure 5: Reducers

4.2.4 Pumps

Pumps usually have a check valve which works well to stabilize flow, therefore use the usual 3 pipe diameter upstream after check valve for pump applications.

4.3 Anti-Cavitation Valve

During high pressure loss across a valve, the valve may experience cavitation. When cavitation occurs across the valve, the SPI-MV will experience a decrease in accuracy. An application where cavitation may occur is rectified by having a Singer Valve fitted with a Singer Anti-Cavitation Cage. If the valve is fitted with an anti-cavitation cage, the SPI-MV is able to maintain its high precision of accuracy. However, each cage is customized to the application and special testing is required to calibrate the SPI-MV when fitted with a cage.

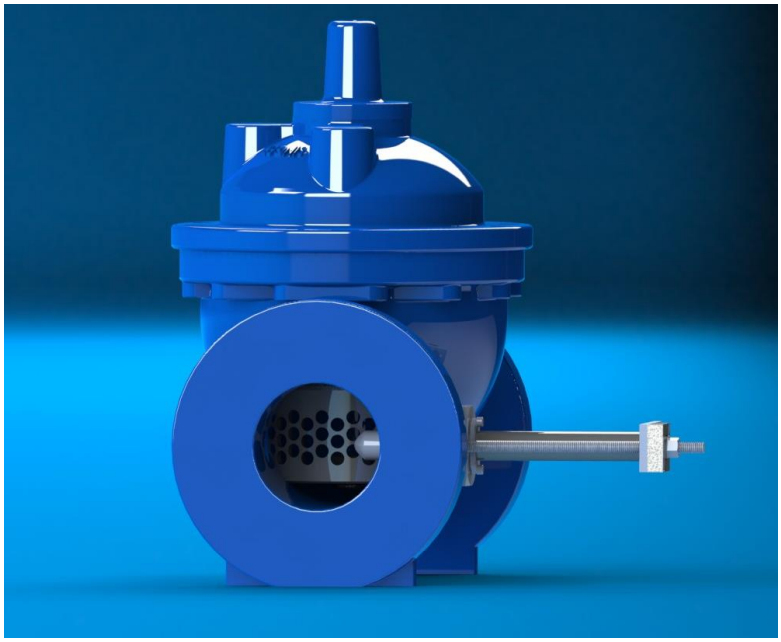


Figure 6: SPI-MV with Anti-Cavitation Cage

Check with a qualified Singer representative or contact Singer directly to see if your system will experience cavitation.

5 Sensor

The SPI insertion sensor makes use of Faraday's Law of Electromagnetic Induction to measure water velocity. Faraday's Law states:

A conductor, moving through a magnetic field, produces a voltage.

Because water is a conductor, water moving through a magnetic field produces a voltage. The magnitude of the voltage is directly proportional to the velocity of the water. The sensor generates an electromagnetic field in the water. A faster water velocity produces a higher voltage. The two velocity electrodes, along with the ground electrode measure this voltage. By accurately measuring this voltage, the velocity is determined.

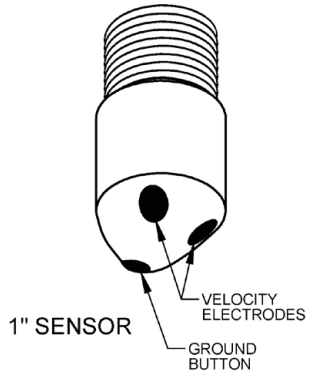


Figure 7: Sensor Electrodes

The velocity measurement provided by the sensor is used to calculate flow. Flow is the amount of fluid moving through a pipe in a period of time. To calculate the flow, two things are needed: The cross-sectional area of the pipe and the average velocity.

Flow = Average Velocity x Area

Each sensor is paired with a Converter that performs these calculations to convert the sensor signal into a flow value. The converter displays the flow on screen as well as retransmitting it as a 4-20mA signal.

5.1 Insertion Hardware

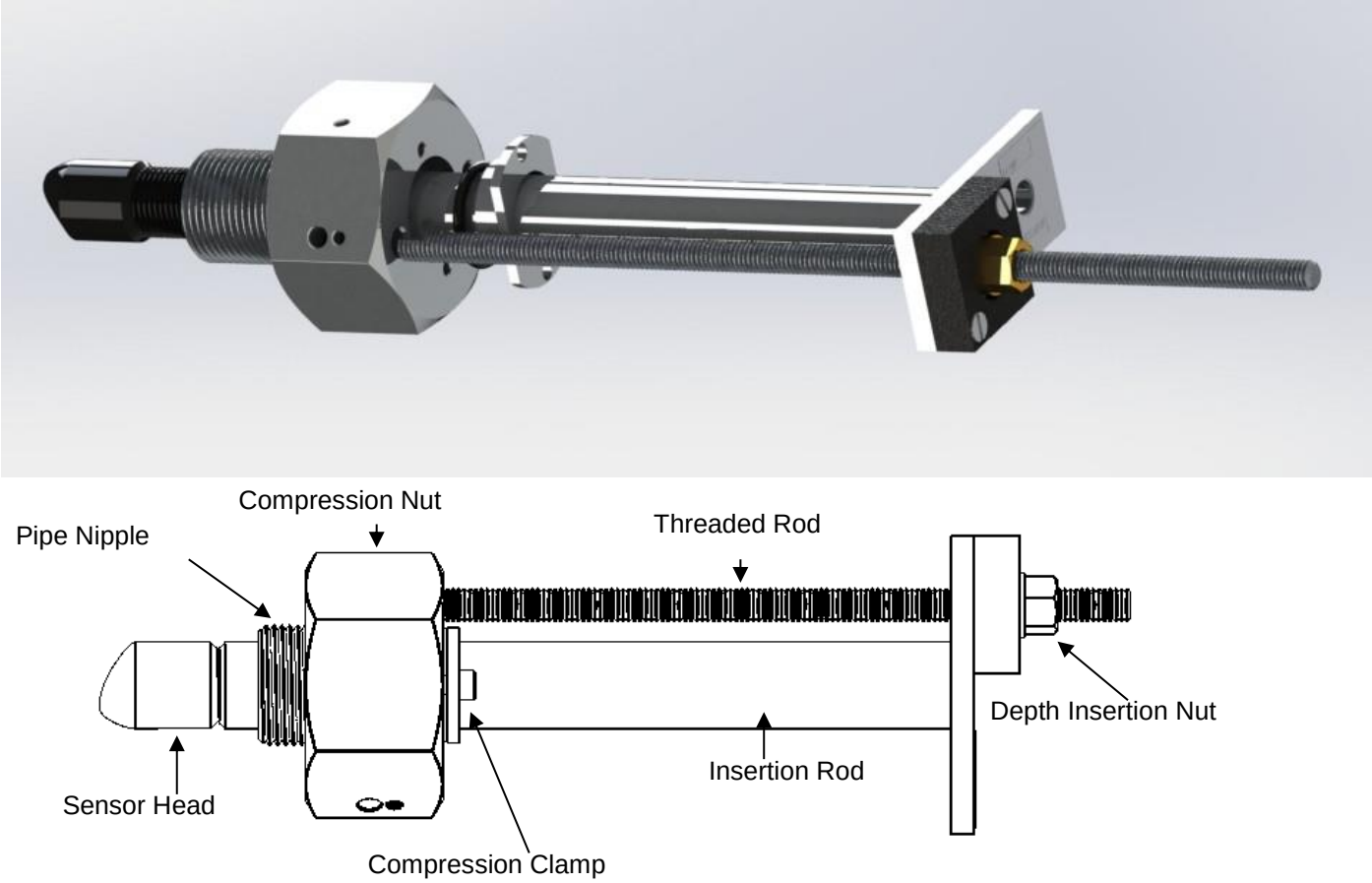


Figure 8: SPI Probe Insertion Assembly

5.2 Insertion Depth

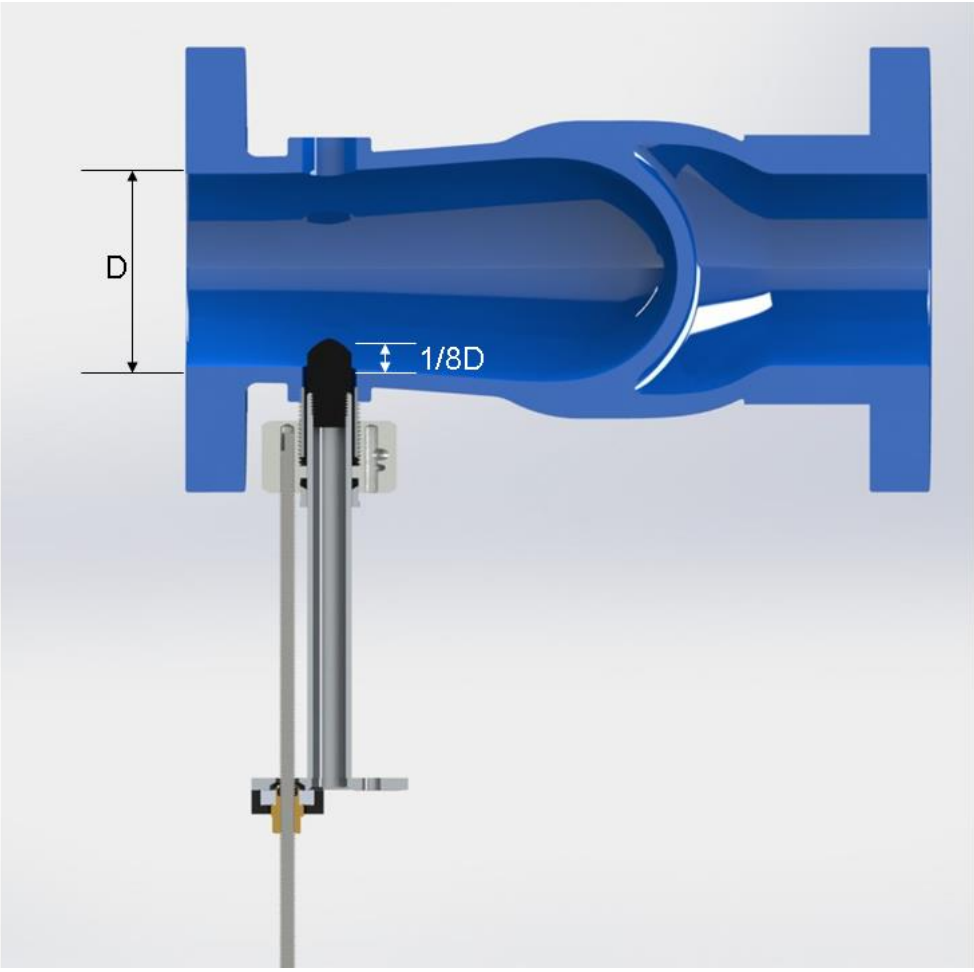


Figure 9: Probe Insertion Depth

McCrometer calibrates the SPI-MV sensor to calculate flow of the valve at an insertion depth of 1/8 the diameter of the valve. The 1/8 insertion depth is measured from the internal boss edge to the sensor electrodes. Singer will install the SPI sensor into main valve at the correct insertion depth before all orders are shipped. An insertion clamp lock nut will be added to the threaded rod to ensure that the sensor is maintained at this depth. See *Appendix 12.1 Installation Guide* for detailed installation instructions.

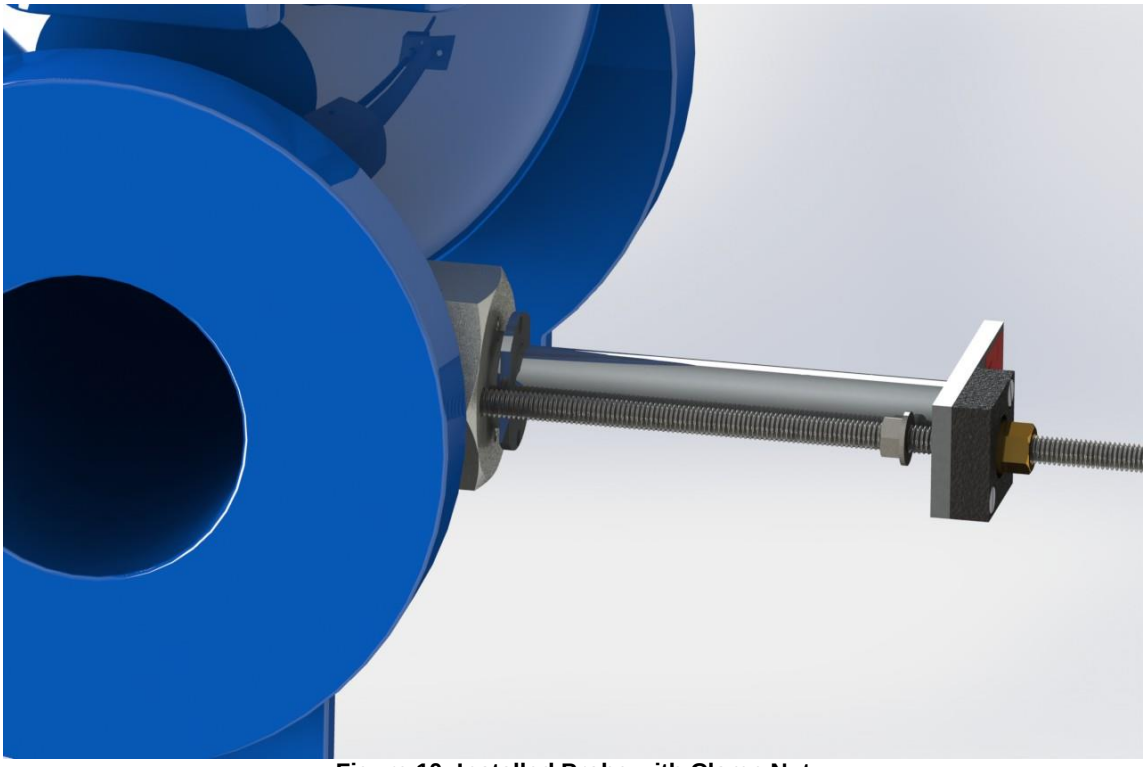


Figure 10: Installed Probe with Clamp Nut

NOTE: Do not remove the insertion clamp nut. An offset of insertion depth will cause an incorrect reading. A lock nut or two jam nuts may be used in place of a clamp nut. At minimum, the correct depth must be marked on the threaded rod before removal.

NOTE: Old style Singer valves bodies **cannot** be retrofitted to have an SPI meter.

6 Meter Removal

To remove the meter, follow the steps below:

WARNING!
The pipe may be under pressure. Serious injury or death may result if proper procedures are not followed.

DEPRESSURIZE THE LINE BEFORE ATTEMPTING REMOVAL OF THE SENSOR.

Loosen the compression clamp seal with an Allen key until the seal just begins to leak. This will relieve the pressure on the compression seal allowing the sensor to be removed. Draping a towel around the compression seal can reduce any spraying water.

Rotate the Depth Insertion Nut to start removing the sensor. This will cause the sensor to rise out of the compression nut and move along the threaded rod. Completely unthread the sensor off the threaded rod to remove the sensor from the valve.

Figure 11: Removing Probe

Figure 12: Valve with Probe Removed

6.1 Maintenance

The SPI is essentially a maintenance free meter with no user serviceable parts. However, the metered fluid may contain solids or other contaminants that coat the sensor electrodes. A periodic inspection may be recommended to ensure the sensor electrodes are clean. To clean the unit, remove the sensor following all of the instructions and safety warning contained in Section above. Once the sensor is removed from the pipe, carefully wipe down the sensor with a soft cloth and a mildly abrasive detergent, such as a liquid kitchen detergent. Once the sensor is clean, reinsert the sensor by rotating the Depth Insertion Nut until the sensor end butts up against the Insertion Clamp Nut. Tighten the Compression Seal and ensure the sensor is level again.

7 SPI Converter Overview

The SPI Signal Converter is the reporting, input and output control device for the sensor. The converter allows the measurements, control of the sensor and data recording to be communicated through the display and inputs & outputs. The SPI microprocessor-based signal converter has a twelve-point curve-fitting algorithm to improve accuracy and an 8-line graphical backlit LCD display with 3-key touch programming. The converter will output rate of flow and total volume. The converter also comes standard with password protection and many more features.

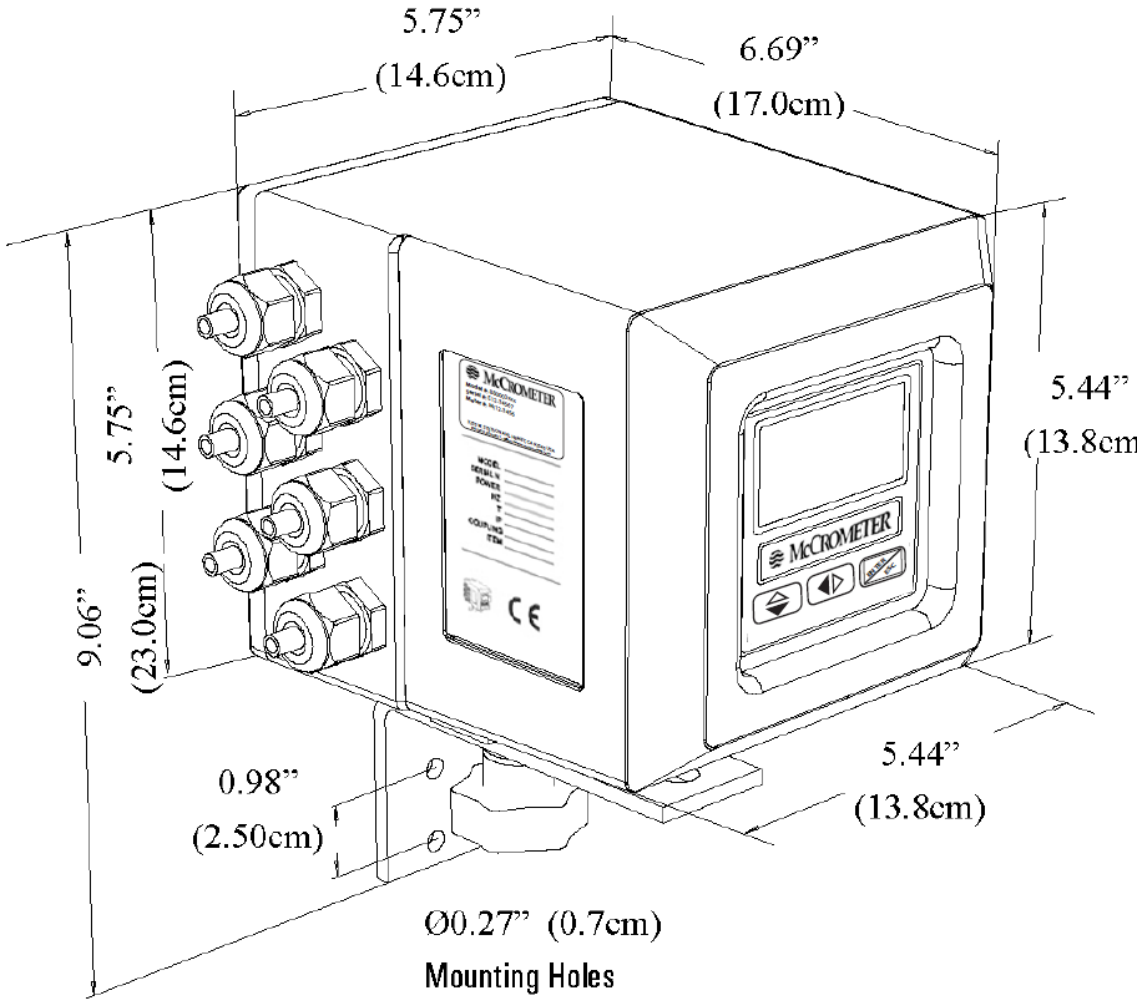


Figure 13: Local Converter Dimensions

8 Converter Installation

8.1 Mounting the Converter

If possible, mount the converter in an electronics shed or environmental enclosure. If the converter is mounted outdoors a sun shield is recommended. The sun shield should be oriented in a direction to reduce sun damage and ensure readability. The Converter is mounted using 2 bolts. A service loop in the cables is required.

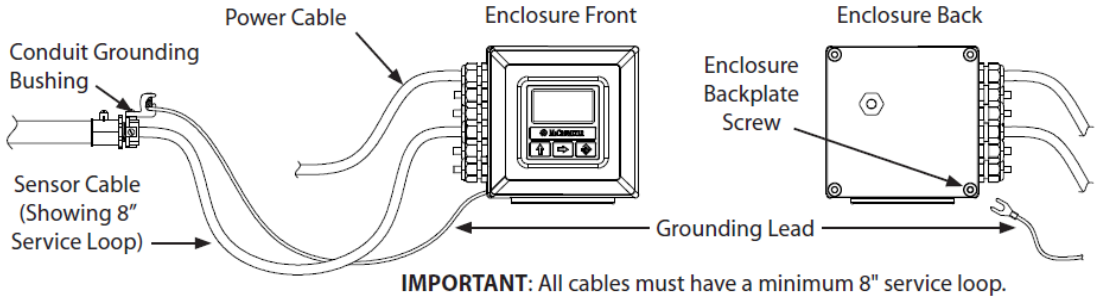
8.2 Installing Cables to Converter and Service Loop

Any cable running through a conduit must exit the conduit and have a minimum of an 8" service loop before entering the electronics enclosure through the cable glands. All cable compression glands must be properly tightened to prevent moisture intrusion and maintain the IP67 rating. This allows the electronics enclosure to be rotated and the rear panel to be accessed. If electrically bonding (grounding) the enclosure to metallic conduit or raceways, secure a lead wire to the enclosures back panel screw and attach the lead to a listed and approved conduit grounding bushing. To ensure IP67 rating use only round cable 0.125" to 0.375" in diameter.

IMPORTANT: Do not cut or alter the cable length on power or signal cables!
Connections to the sensor must be made with cable supplied by McCrometer specifically for that purpose. Do not substitute the supplied cable with other types of cable, even for short runs. For repairs or added lengths of cable, the entire cable between the sensor and the converter must be replaced. (Consult factory for replacement cable.)

WARNING: Do not connect any form of conduit directly to the converter enclosure. Doing so will allow moisture and potentially dangerous gasses to enter directly into the converter. Attaching any conduit to the enclosure, or altering the enclosure in any way will void the warranty.

Attaching conduit to the enclosure or altering the enclosure in any way will remove the IP67 rating and void the warranty.



IMPORTANT: All cables must have a minimum 8" service loop.

Figure 14: Cable Installation

8.3 Pulling Sensor Cable through Electrical Conduit

It is very important to protect the end of the sensor cable when pulling it through a conduit. Water can accumulate in low portions of conduit. Always use the factory supplied cable cover, or similar method, to seal the end of the cable against water when pulling the cable through conduit. This will ensure proper operation of the meter.

Pulling the Sensor Cable:

1. Tie a rope or cable-snake securely around the middle of the cable cover.
2. Carefully pull the rope or snake until the sensor cable end clears the conduit.
3. Bring the cable end to the converter location. If necessary, secure the cable so that it does not fall back through the conduit.
4. Remove the cable cover by pulling the rip wire. The cable cover will tear off (discard the cover).

CAUTION: Do not cut the cable cover off. Doing so may damage the sensor cable and adversely effect the calibration of the meter.

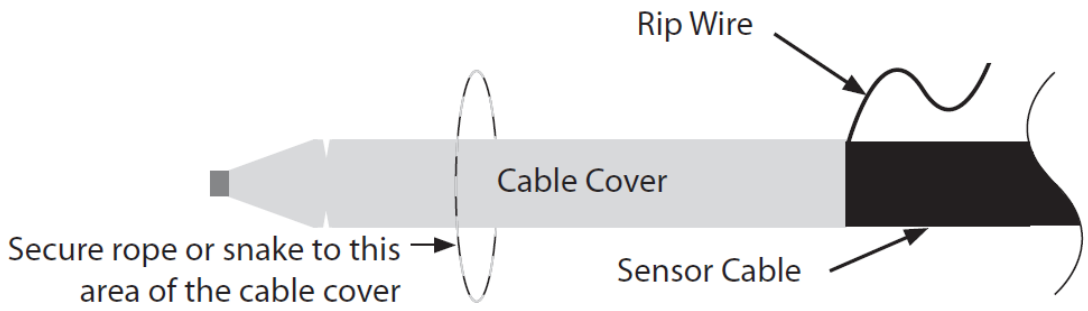


Figure 15: Cable Cover

8.4 Sensor Cable

SPI sensor cable is supplied standard as a 20 ft length.

Never under any circumstance cut the sensor cable. Specify length of cable needed when ordering the valve or have a Singer trained professional install the cable correctly.

NOTE: The length of sensor cable should to be minimized to ensure the best quality signal.

8.5 Battery Installation and System Start-Up

8.5.1 Battery Life

The estimated battery life with standard use and recommended sampling frequency (see section 8.5.7) is 3-5 years. Additionally, there is a battery life calculator available to estimate battery life in your specific application. Contact your local Singer representative or the Singer support team for a consultation on battery life.

8.5.2 Installing Batteries and Starting Up

Follow this procedure if you are installing batteries in the unit for the first time. If you are replacing batteries, go to section 8.5.4, "Replacing Batteries".

Note: Ensure there is no power connected externally and that the battery DIP switches are in the OFF position.

1. Remove the battery holder from the SPI converter by removing the two screws and lock washers holding it in place.
2. Place two double battery packs (part number AGM009) on the SPI converter battery holder as shown in .
3. Secure new battery packs to the battery holder using tie wraps.
4. Re-install the battery holder into the converter using the previously removed screws and washers.
5. Plug the battery pack connectors into the B1 and B2 sockets on the main board.
6. Wait one minute.
7. Move battery DIP switch B1/B2 to ON. The converter will begin booting and the red CPU LED will turn on solid. It will then begin flashing after it completes booting. Booting may take 2-3 minutes.

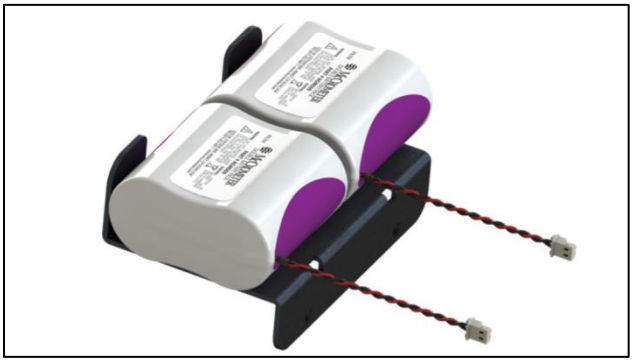


Figure 16: Converter Batteries

8.5.3 Setting the Time and Date

Each time the SPI Converter is powered up, the time and date need to be set immediately after the system finishes initialization. It does not retain time information when it is powered down. The correct time setting is necessary for data logging and even logging functions.

1. Allow the converter to complete its initialization sequence.
2. Press the **Enter** button to open the ***Quick Start*** menu. If the ***Quick Start*** menu is not enabled, skip step 3.
3. Navigate to the ***Main Menu*** using the **Up/Down** arrow key and press **Enter**.
4. Enter your level 2 access code (default is 000002) and press **Enter**.
5. Navigate to ***9-Data logger*** with the **Up/Down** arrow key and press **Enter**.
6. Using the **Right/Left** arrow key to navigate and the **Up/Down** arrow key to change the data, enter the date and time. Press **Enter** to accept the date and time.

7. Long press the **Enter** key twice to return to the main display.

8.5.4 Replacing Batteries

Contact your local Singer representative or Singer Customer Service to order replacement batteries.

1. **Power down the system.**
    a. If there is external power applied to the converter, unplug it.
    b. Press the **Enter/Esc** button for one second to turn on the front panel display.
    c. Press the **Enter/Esc** button again to display the menus.
    d. Select ***Main Menu*** and press **Enter**.
    e. Enter the L2 access code.
    f. Navigate to menu ***10-Diagnostic*** and press **Enter**.
    g. Select ***Stand-By*** and press **Enter**.
    h. Long press **Enter** to execute. The display will indicate "**Stand-By"** momentarily and then go blank.
    i. Move battery DIP switch B1/B2 to OFF.

The unit is now safely powered down.

2. **Remove the batteries.**
    a. Disconnect the battery connectors from the B1 and B2 sockets on the Main Board.
    b. Remove the two screws securing the battery holder to the converter housing.
    c. Remove the holder from the converter.

3. **Installing Batteries:**
    a. Remove the battery holder from the SPI-MV converter by removing the two screws and lock washers holding it in place.
    b. Cut the tie wraps from the batteries and dispose of the battery packs.
    c. Secure new battery packs to the battery holder using tie wraps.
    d. Re-install the battery holder into the converter using the previously removed screws and washers.
    e. Plug the battery pack connectors into the B1 and B2 sockets on the main board.

4. **Power up the system.**
    a. Wait one minute after plugging in the battery pack connectors.
    b. Move battery DIP switch B1/B2 to ON.
    c. The converter will begin powering up and the red CPU LED will turn on solid. It will then begin flashing after it completes booting.

Note: Powering up may take two to three minutes.

8.5.5 Powering-Down and Powering-Up the System

NOTE: This power-down procedure will only stop the system from operating. If you need to replace the batteries or prepare the unit for shipping, follow section 4.4.

Powering-Down:

1. Press the **Enter/Esc** button for one second to turn on the front panel display.
2. Press the **Enter/Esc** button again to display the menus.
3. Select ***Main Menu*** and press **Enter**.
4. Enter the L2 access code.
5. Navigate to menu ***10-Diagnostic*** and press **Enter**.
6. Select ***Stand-By*** and press **Enter**.
7. Long press **Enter** to execute. The display will indicate **Stand-By** momentarily and go blank.

The unit is now powered down.

Powering-Up:

1. Move battery DIP switch B1/B2 to OFF.
2. Wait one minute.
3. Move battery DIP switch B1/B2 to ON.
4. The converter will begin powering up and the red CPU LED will turn on solid. It will then begin flashing after it completes booting.

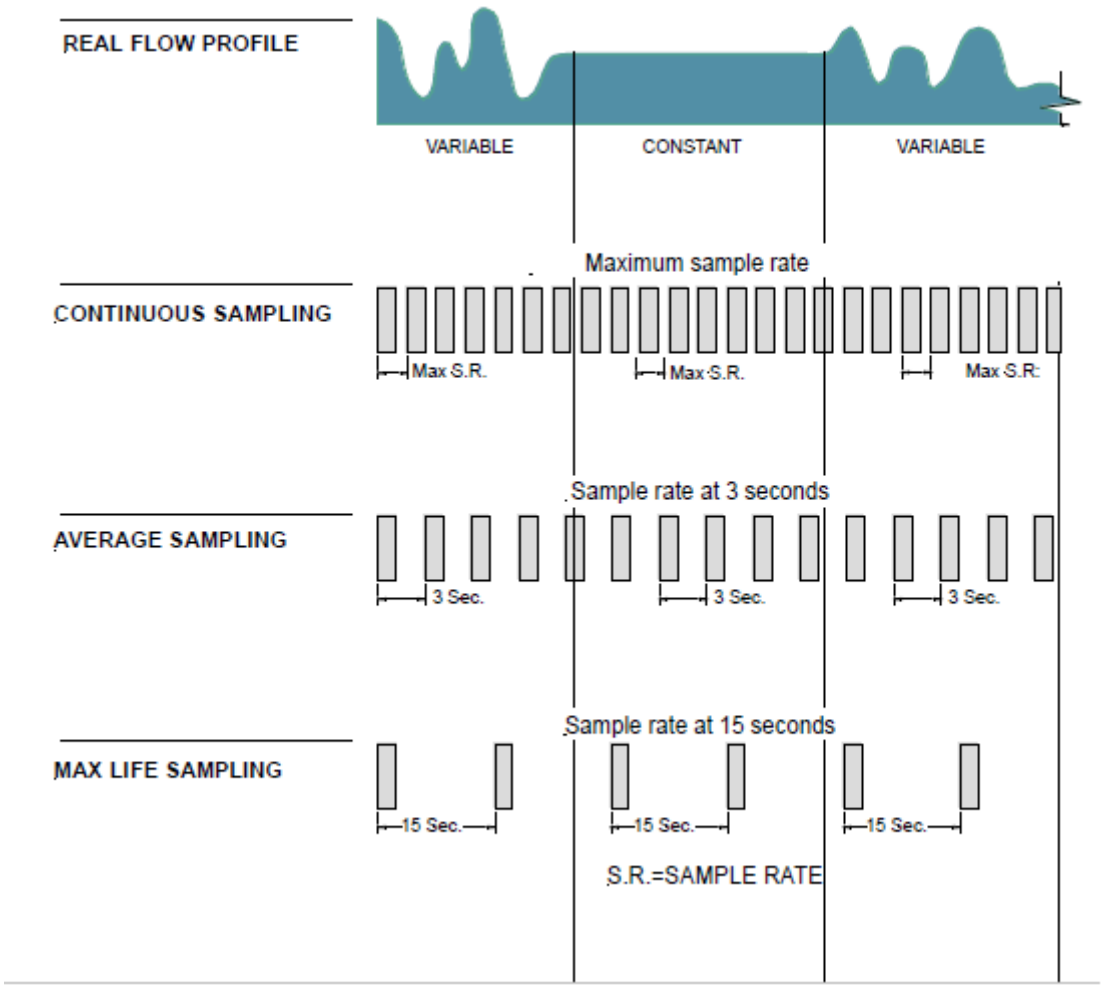
NOTE: Powering up may take two to three minutes.

8.5.6 Power Options

Depending on the sampling frequency (described in section 8.5.7), output options, and specific application position, you may choose to add additional power options to the battery powered converter. The 5W solar panel option (described in section 8.6) can extend battery life to 10-15 years. Additionally, you can attach a universal power supply (DC 12 - 60V or AC 100 - 240V).

8.5.7 Sampling Frequencies

The battery powered converter can be programmed to measure in these modes:



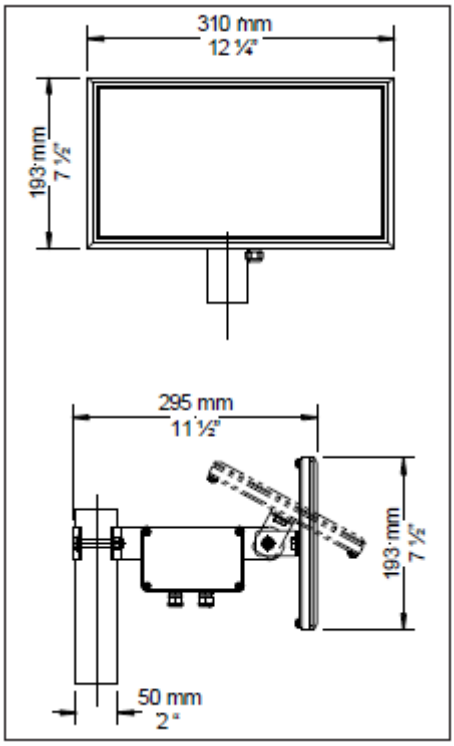
Each sampling frequency mode has a different effect on battery life. Note that the battery life shown below is under optimal conditions:

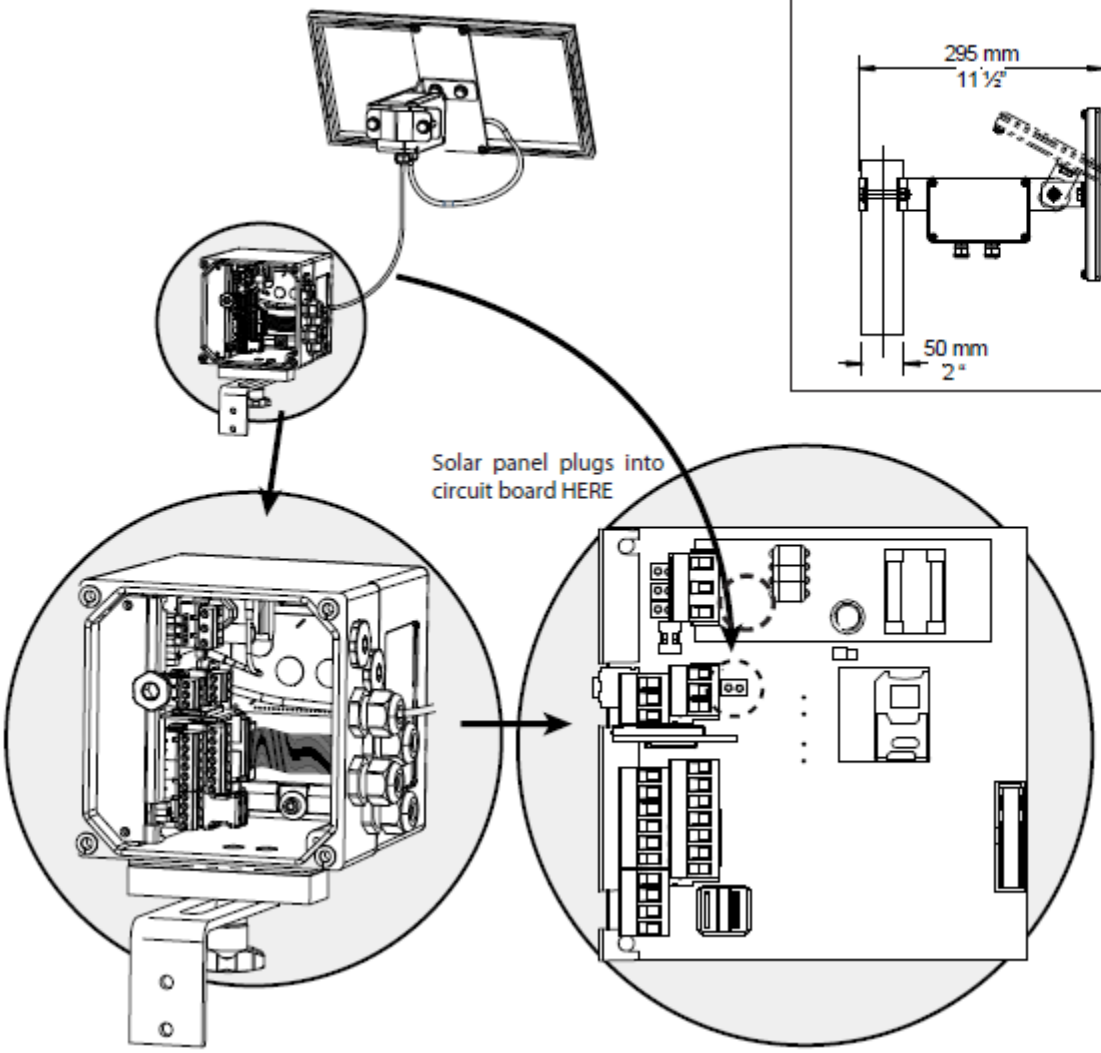
- Continuous sampling: < 6 months
- Average sampling: > 5 years
- Max life sampling: > 7 years

8.6 SOLAR PANEL OPTION

8.6.1 Description

The solar panel provides power to the converter by converting sunlight into electrical energy to recharge the solar panels' rechargeable battery. Its nominal power output is 5W. The solar panel comes complete with all accessories, except for the fixing rod.

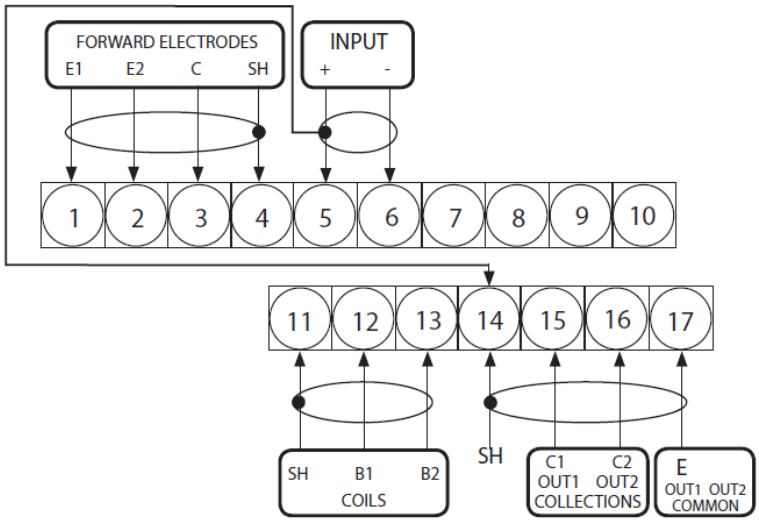




8.7 Sensor Electrical Cable Connections

All electrical cables enter the converter through compression fittings located on the side of the converter. Ensure that all compression glands are properly tightened and all unused fittings are plugged so the case remains sealed.

Always disconnect the power cord before attempting any electrical connections



8.7.1 Terminal Board

All connections are made on the terminal board. To access the terminal board, loosen the four screws on the back of the converter to remove the rear

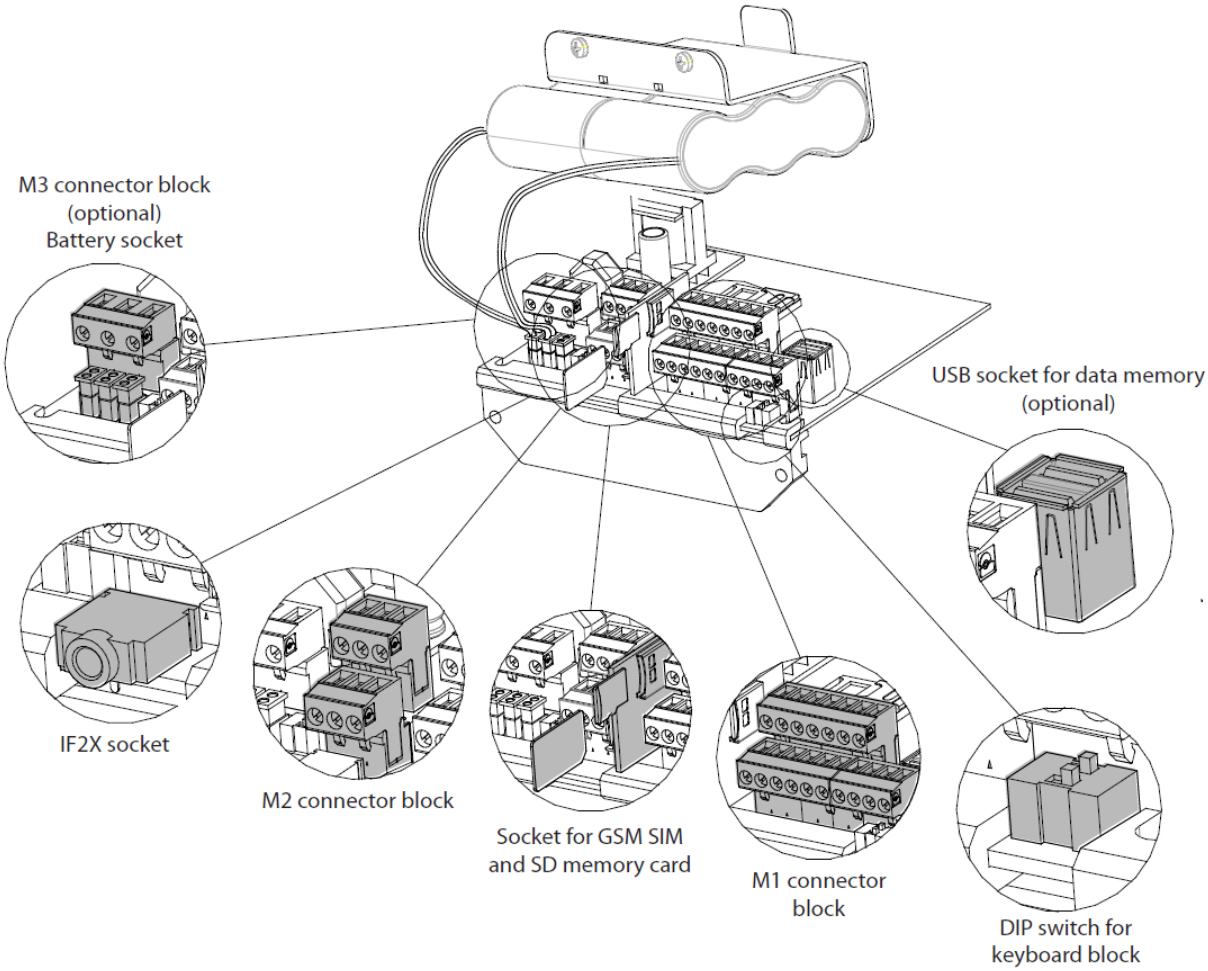


Figure 17: Terminal Board Layout

8.7.2 Sensor Wiring

Table 1: Terminal Block Assignments

Terminal	Wire Color	Connected To
#1	Blue	Sensing electrode
#2	White	Sensing electrode
#3	Black	Reference ground
#11	Black	Magnet shield / overall cable shield
#12	Red	Coil
#13	Yellow	Coil

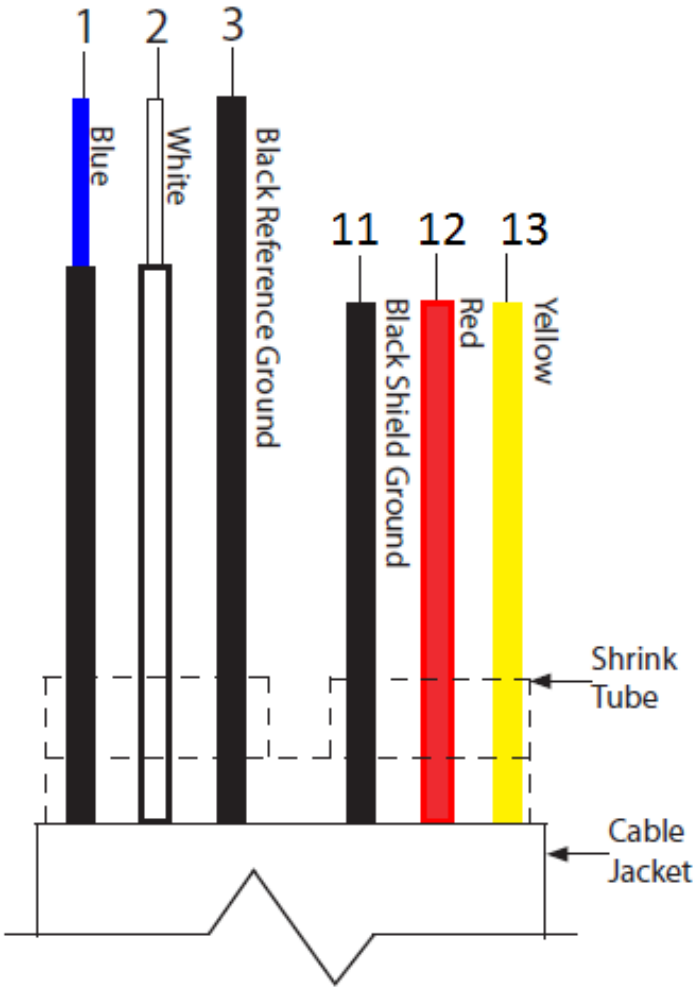


Figure 18: Wire Labeling

Figure 19: SPI Cable Wires

8.7.3 Opto-Isolated Pulse Output Hook-Up

The four pulse outputs are open collector transistor outputs used for communicating with or activating external devices.

Output Specifications:

- Opto-isolated output with collector and emitter terminals floating and freely connectable
- Max switching voltage: 40 VDC
- Max switching current: 100mA
- Max saturation voltage between collector and emitter: 1.2V@100mA
- Max switching frequency (load on the collector or emitter, RL=470Ω, VOUT=24VDC): 1250Hz
- Max reverse current bearable on the input during an accidental polarity reversion (VEC): 100mA
- Insulation from other secondary circuits: 500 V

See Table 2: Output Options in section 9.10 *Menu 6 - Outputs* for available output functions.

Figure 20 below shows the recommended wiring for a pulse output. The connection to output 1 is shown. For other outputs, replace terminal 6 with the terminal corresponding to the desired output (see Figure 17).

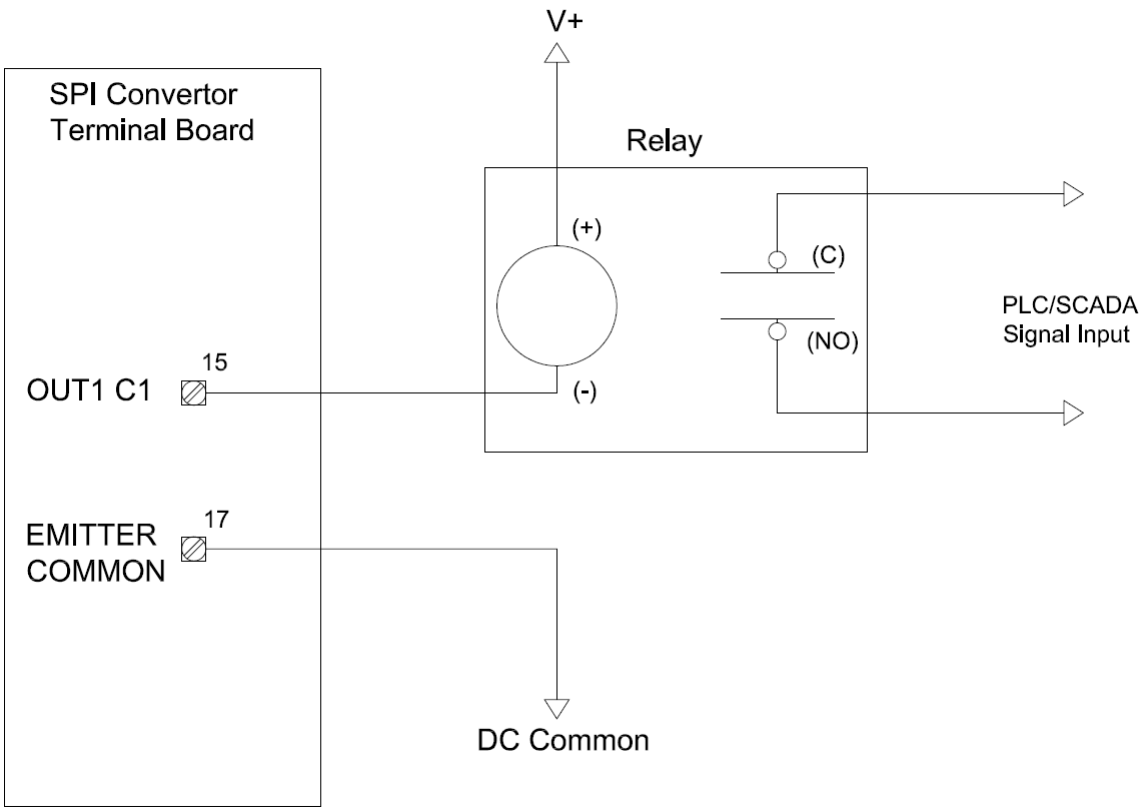


Figure 20: Opto-Isolated Pulse Output 1 Connection via Relay

8.7.4 Converter Power Hook-Up

WARNING!
Hazardous supply voltage can shock, burn, or cause death.

External power can be used as a main power supply alternative. When the main supply fails the battery will act as a backup and maintain power to the unit. The external power does not recharge the batteries. To recharge the batteries see section 8.6 solar panel.

The power supply line must be equipped with external surge protection for current overload (fuse or circuit breaker with limiting capacity not greater than 10A). It must be easily accessible for the operator and clearly identified. Power connection is made using the power terminal block on the upper right side of the terminal board.

NOTE: The terminal block unplugs from the circuit board for easy connection. Connect earth ground to the protective grounding terminal before making other connections. The power supply of this converter is 100 - 240 VAC, 44 - 66 Hz at maximum 4 W or 12-60 VDC.

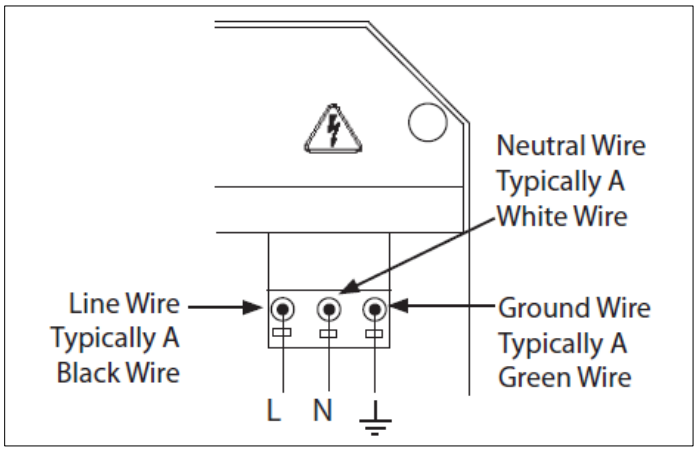


Figure 21: AC Power Wiring

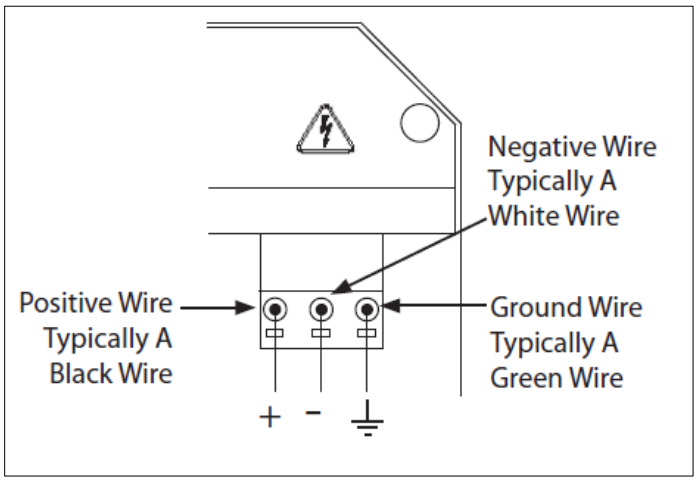


Figure 22: DC Power Wiring

8.7.5 Converter Start-Up

Before starting up the converter please verify the following:

- Power supply voltage must correspond to that specified on the data plate (located on the side of the converter)
- Electric connections must be wired as described in this manual
- Ground connections must be properly installed

When the converter is powered it initiates a verification cycle of the converter. During the verification cycle the converter displays an incrementing diagnostic number from 0 through 90. When the diagnostic is complete, if an error is found, an error code will be displayed. A text message will also be displayed on the alarm screen. If an error is found, contact factory for support.

8.8 Grounding

One of the most important installation details for magnetic flowmeters, in general, is proper process ground. A proper ground ensures that the fluid and sensor are at the same potential so that only the induced flow signal is measured. The most stable ground reference is the earth ground itself. By connecting the fluid, sensor, and converter to a stable and noise free reference point, the SPI will offer the best performance.

Note: The AC supply ground may not provide adequate grounding. In some cases, an AC ground can induce noise to the low voltage signals generated by the magnetic flowmeter. It is recommended to wire the ground connection to a separate low impedance earth ground or a dedicated instrumentation ground.

These are the recommended grounding arrangements:

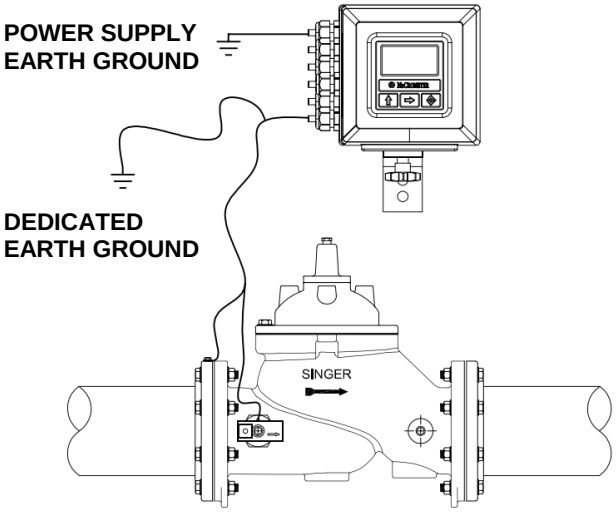


Figure 23: Grounding for conductive pipe or conductive-lined pipe

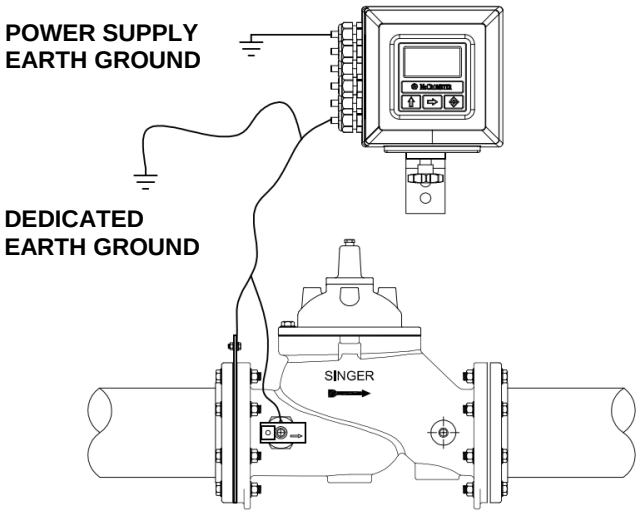


Figure 24: Grounding with grounding rings

See Figure 25, Figure 26, and Figure 27 below for examples of proper converter and probe grounding.

Figure 25: Converter & probe with ground wiring

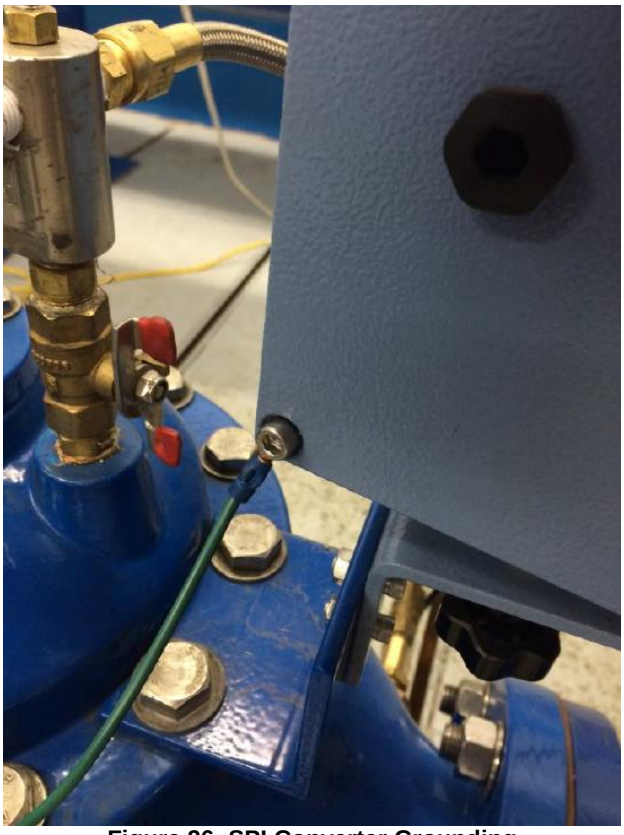


Figure 26: SPI Converter Grounding

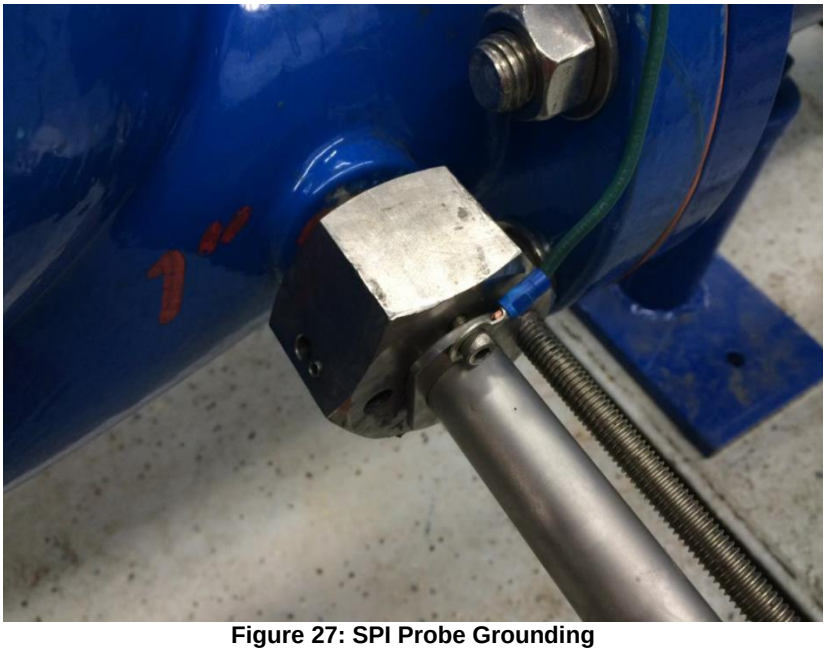
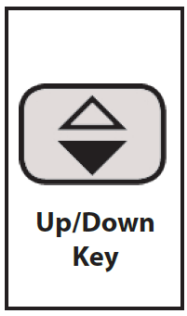
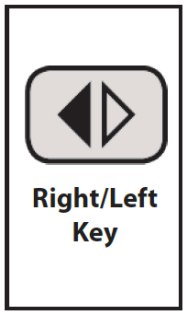


Figure 27: SPI Probe Grounding

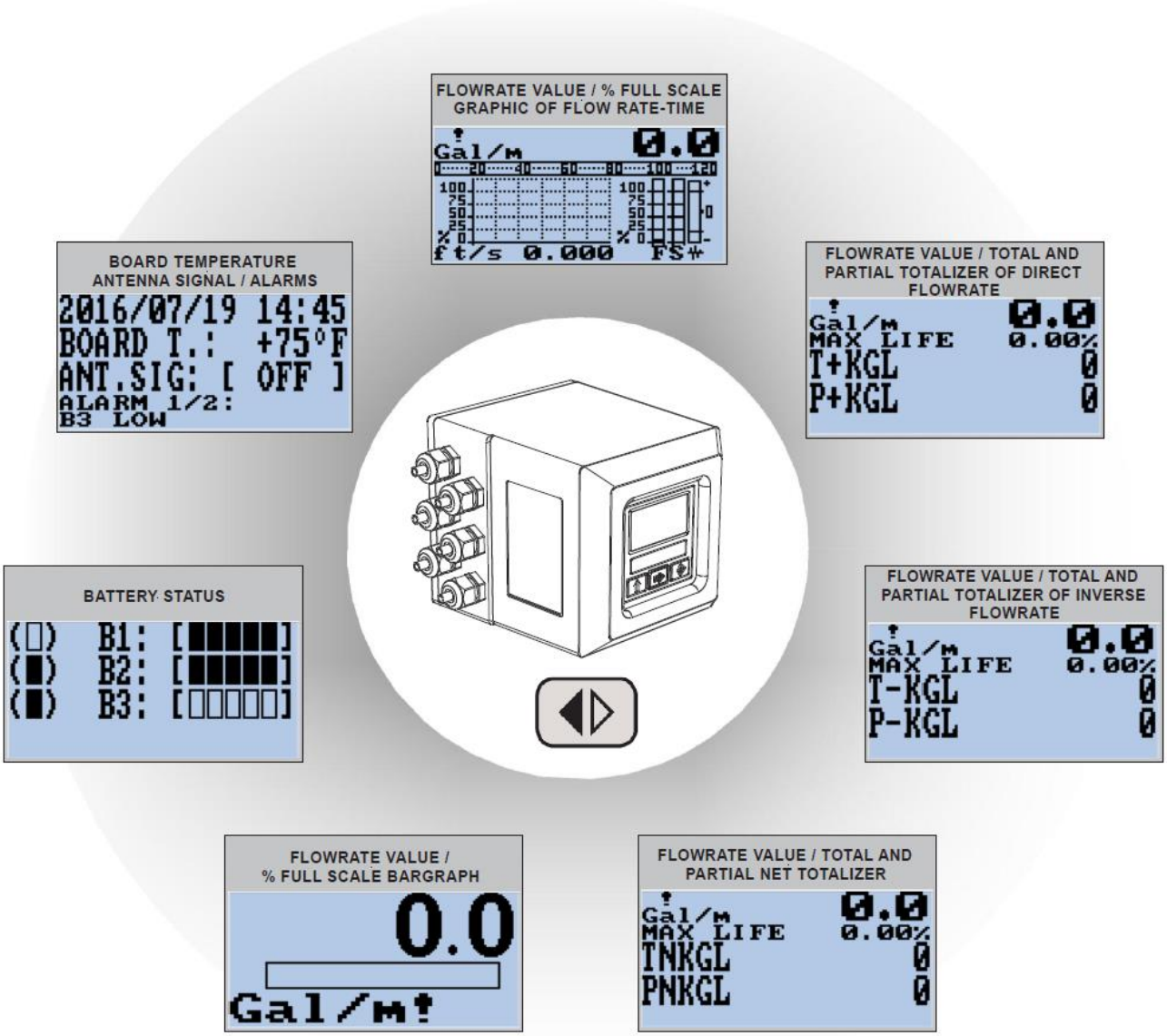
9 Menu Navigation

To navigate through the menus on the converter, the keys on the keypad use the following conventions:

Key:	Function:
 Up/Down Key	UP/DOWN KEY (for moving cursor up or down) **SHORT PRESSING (< 1 SECOND):** Moves the cursor up to the previous subject on the menu Increases the numeric figure of the parameter highlighted by the cursor **LONG PRESSING (> 1 SECOND):** Moves the cursor down to the next subject on the menu Decreases the numeric figure of the parameter highlighted by the cursor
 Right/Left Key	RIGHT/LEFT KEY (for moving cursor right or left) **SHORT PRESSING (< 1 SECOND):** Moves the cursor to the right on the input field Moves the cursor to the following subject of the menu Changes the display of the process data **LONG PRESSING (> 1 SECOND):** Moves the cursor to the left on the input field Moves the cursor to the previous subject on the menu **Note:** Push and hold for eight seconds to cycle through contrast settings.
 Enter/Esc Key	ENTER/ESC KEY (for changing settings) **SHORT PRESSING (< 1 SECOND)**: Opens the Quick Start menu for the instrument configuration Enters the selected function Cancels the selected function under progress **LONG PRESSING (> 1 SECOND):** Confirms the selected function Leaves the current menu

9.1 Front Panel Display

Short-press the Right/Left arrow key to view different visualization screens.



9.1.1 Factory Pre-Setting

The converter is delivered with “Quick start menu” enabled and with **passcode L2 = 000002**. Press the Enter/Esc key to access the Quick start menu.

ATTENTION!

It is very important to record any customized code as it CANNOT be retrieved if it is lost!

9.2 SPI Menu Structure

The following is the menu structure for the SPI-MV Battery converter.
Main menu access requires the **L2 passcode 000002**.

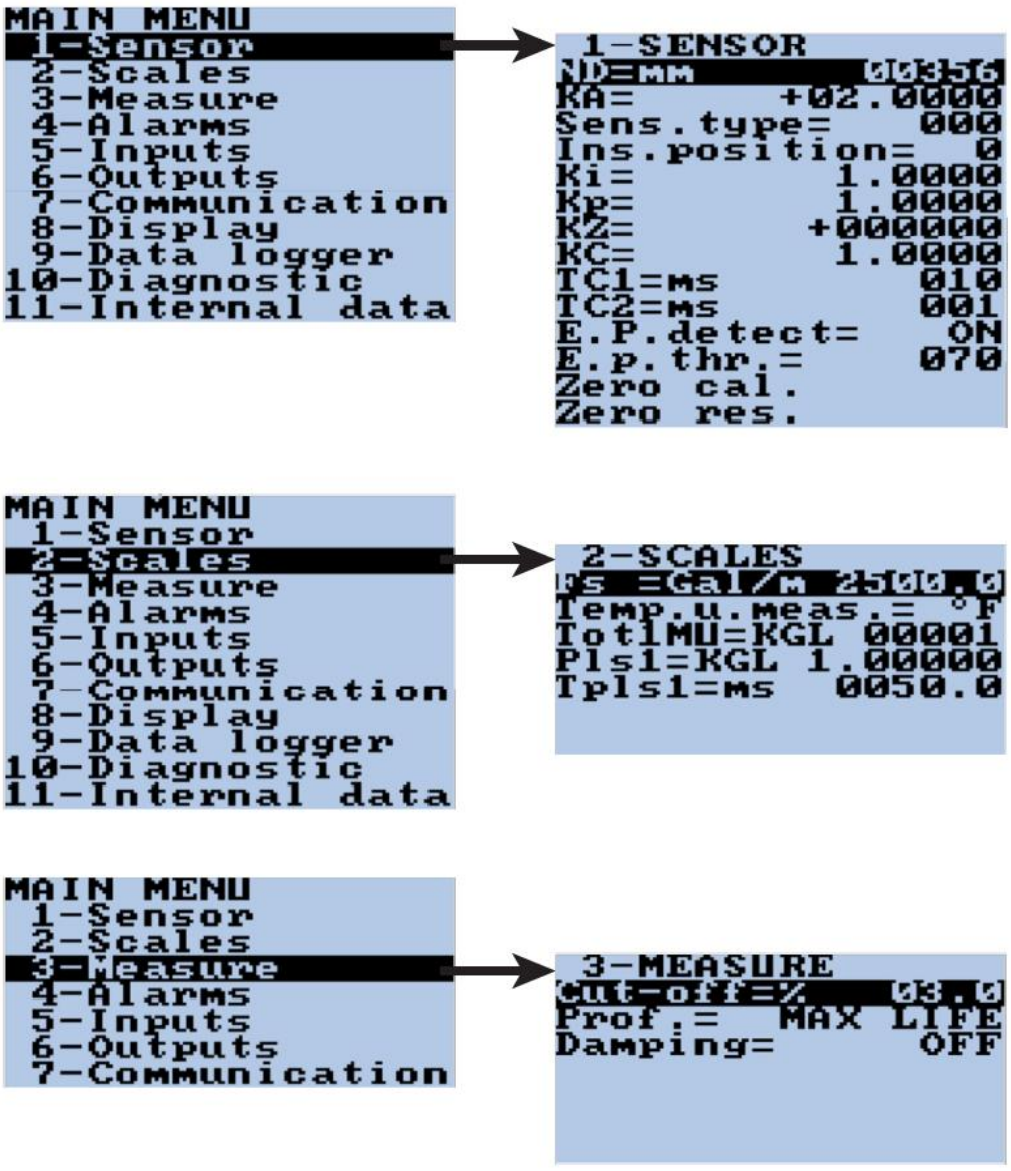


Figure 28: Menu Structure Part 1

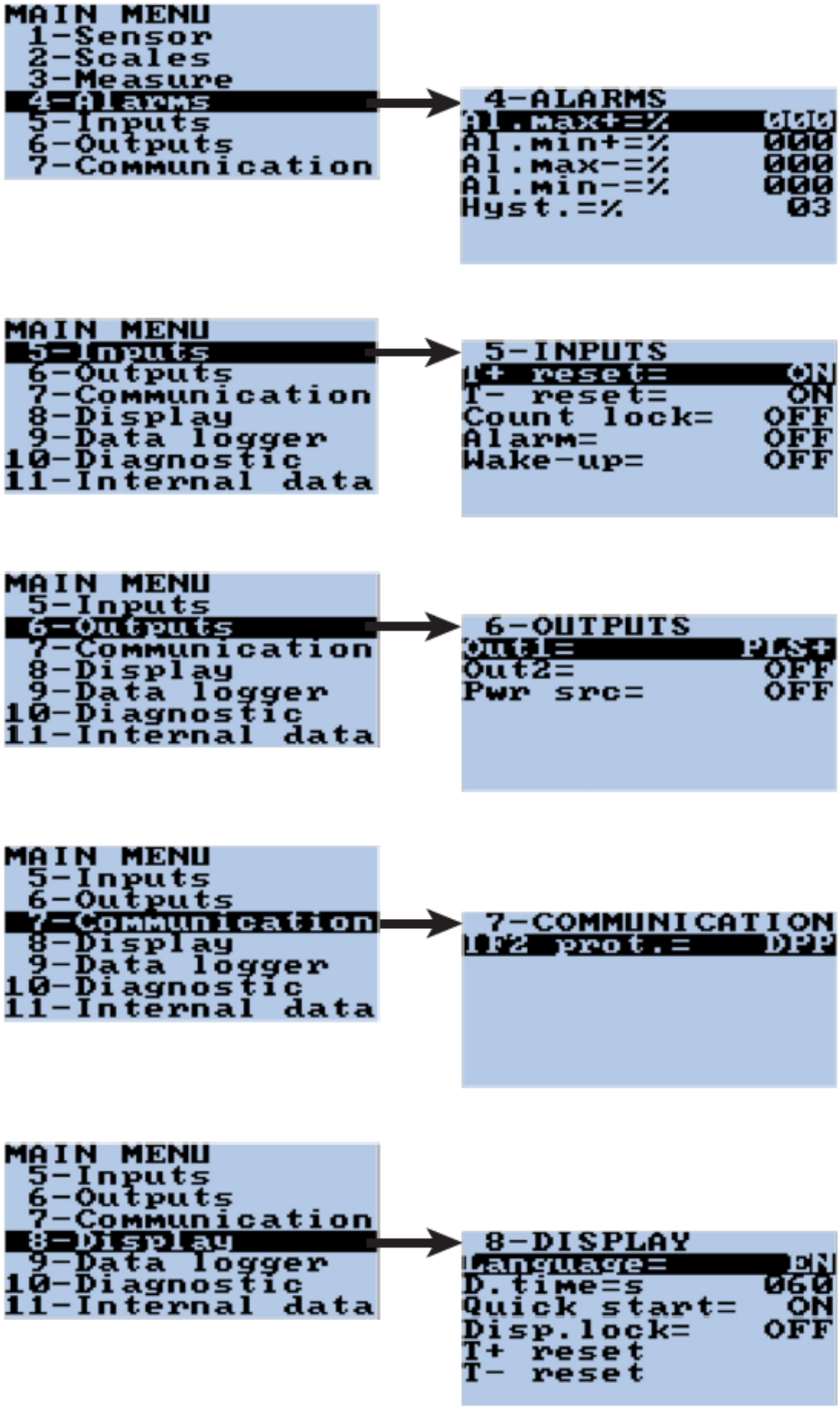


Figure 29: Menu Structure Part 2

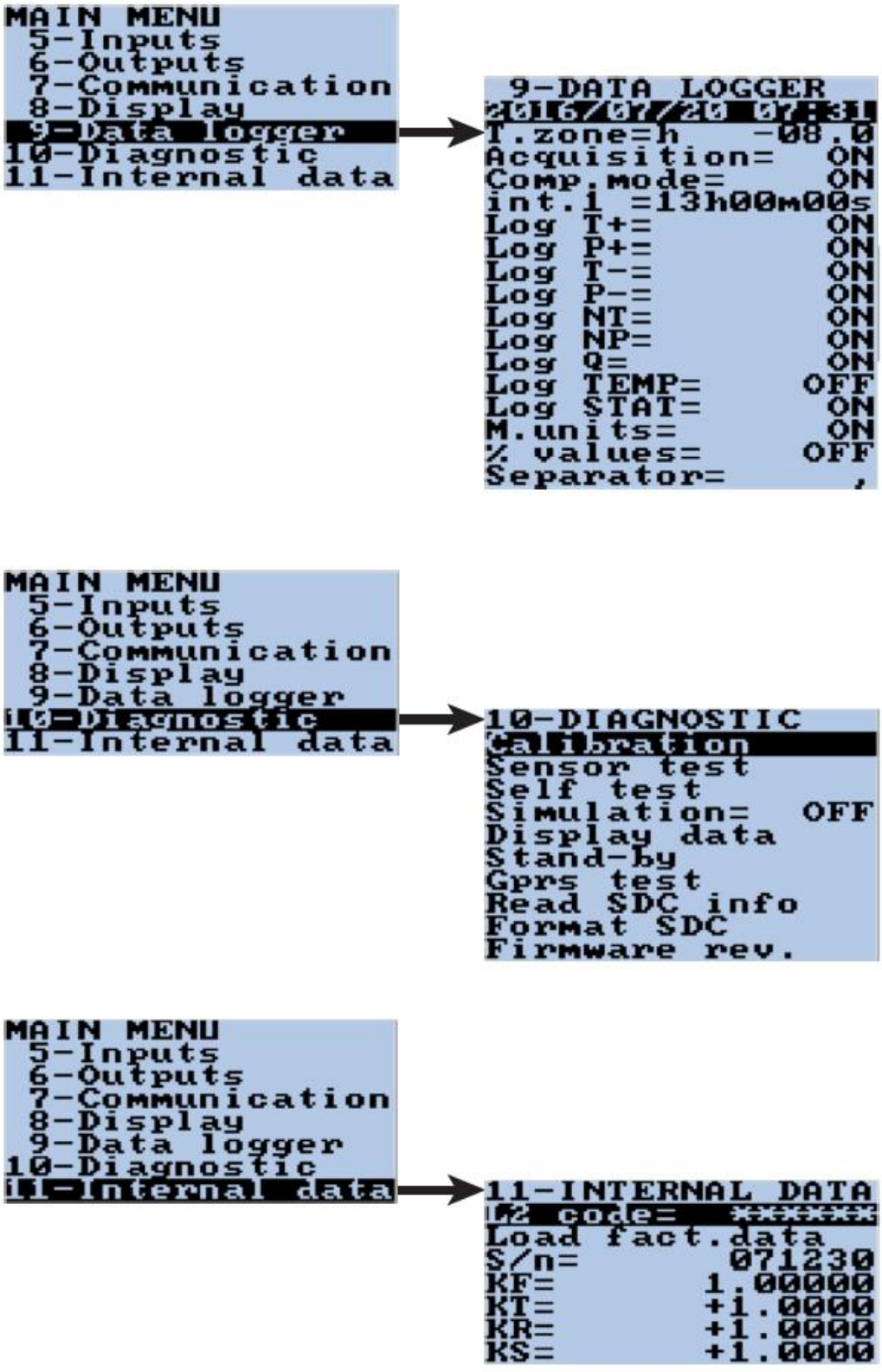
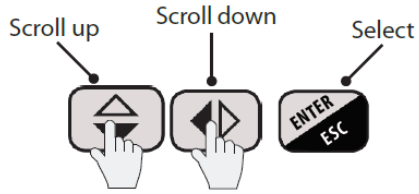


Figure 30: Menu Structure Part 3

9.3 Programming Example

The steps below demonstrate how to modify the full scale value from 3500 Gal/m to 3000 Gal/m on the “Quick Start Menu”. You can enter the "Quick Start Menu" from any Visualization Page.

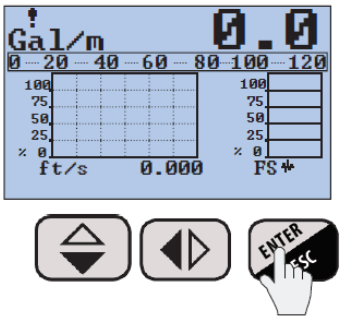
Note: The function used in the example is the top menu item, so you will not need to scroll through the ***Quick Start*** menu. However, to do so, you need to have the full menu item highlighted and press **Left/Right** or **Up/Down**.



You will start with a blank screen.

1. Long press on Enter/ESC.

This will wake up the front panel display.



2. Short press on Enter/ESC.

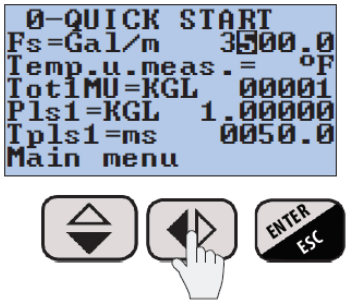
This will take you to the Quick Start menu.

3. Short press on Enter/ESC.

This will highlight the GAL setting.

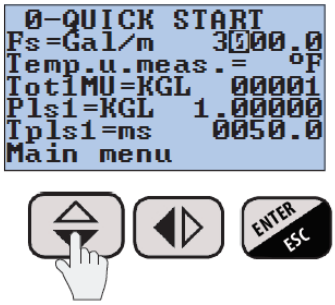
4. Press Left/Right to find the next selection.

Press Left/Right until you highlight the **5** as shown.



5. Press Up/Down.

Press Up/Down to change the value to 0.



6. Short press on Enter/ESC.

This will confirm and save the setting.

7. Long press on Enter/ESC.

This will exit programming and return to the visualization page.

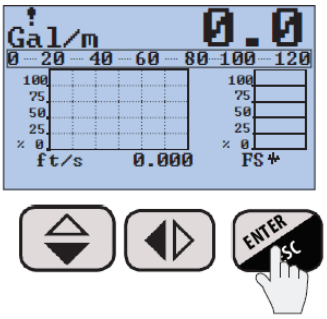
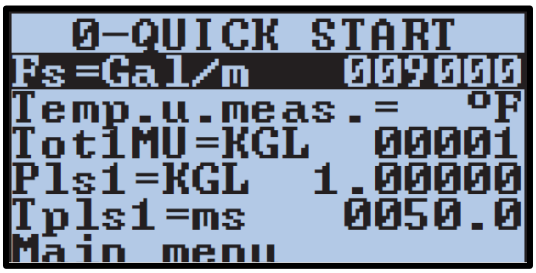


Figure 31: Programming Example: Changing Full Scale Value

9.4 Quick Start Menu

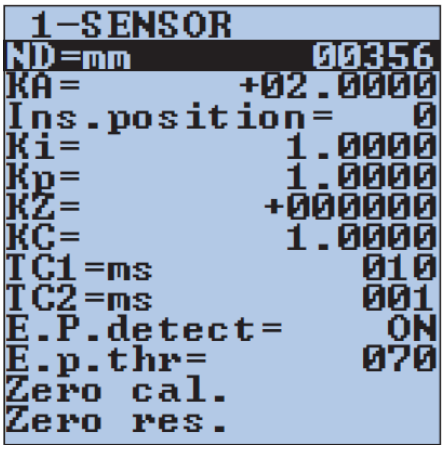


The Quick Start menu gives you quick access to frequently used functions. It consists of the same functions from **Menu 2 - Scales**. See section 9.6 for a complete description of accessing and making programming changes to these menu items.

NOTE: If the Quick Start Menu is disabled:
From the flow visualization, press the Enter/Esc key. The L2 passcode screen will appear. Enter the **passcode of 000002**, then press the Enter/Esc key to access the main menu. When the Quick Start Menu is enabled, you can enter the Main menu from the "Quick start menu".

To access the main menu, select **Main menu** and enter **passcode 000002.**

9.5 Menu 1- Sensor



9.5.1 ND Inside Pipe Diameter

Inside Pipe Diameter in millimeters. This is factory set to match the measured ID of the Singer Valve it is calibrated for. Should not be changed from factory setting.

9.5.2 KA

Factory calibrated gain for the forward flow. Do not change the value.

9.5.3 Ins. Position

Insertion position as ratio of ID. Factory set to 0 = (1/8D), do not change.

9.5.4 Ki

Automatic setting according to ID (insertion meter only).

9.5.5 Kp

Automatic setting according to ID (insertion meter only).

9.5.6 KZ

This is the Zero Calibration constant. The KZ updates every time the Zero Calibration is performed.

9.5.7 KC

This is a coil current adjustment factor for use between sensor families.

9.5.8 TC1

This is the time needed to stabilize coil current when switching from no current.

9.5.9 TC2

This is the time needed to stabilize coil current when switching coil polarity.

9.5.10 E.P. Detect

Set the empty pipe alarm to on or off. Factory default = ON.

NOTE: Setting the E.P. Detect to "off" will disable an alarm when an empty pipe is present. When the pipe is empty, sensor may display environmental/electrical noise as flow.

9.5.11 E.p. thr

Empty Pipe Threshold is the numeric value selected during the Empty Pipe Calibration function. In some cases it may be required to manually adjust this value to be more compatible with an installation. For assistance adjusting this value contact Technical Support. Available settings are from 0 – 250 with a factory default of 195.

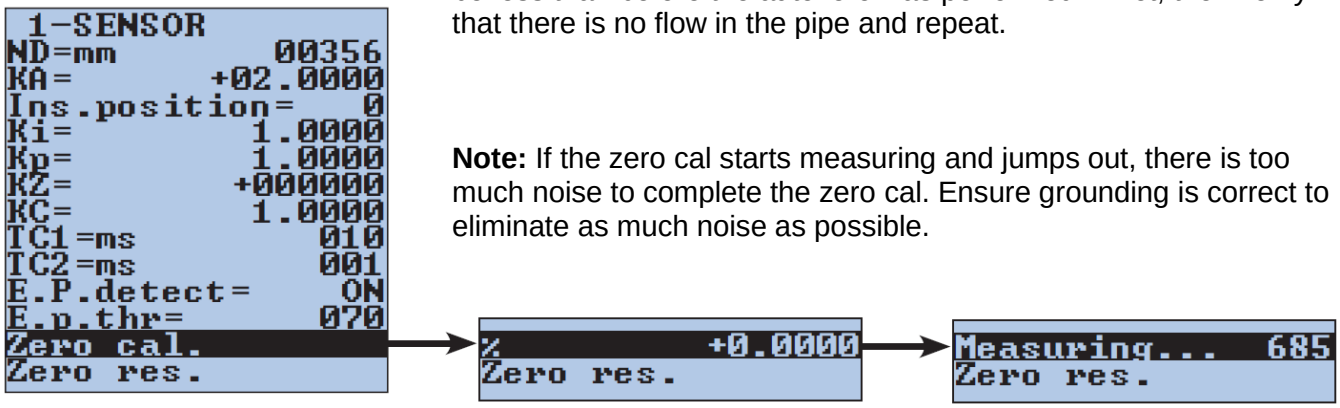
NOTE: If there is a high level of noise, the E.P Alarm may be active even though the pipe is full of water. Ensure grounding is correct to eliminate as much noise as possible.

9.5.12 Zero Cal

IMPORTANT - The water must be perfectly still before starting the Zero Cal process or an offset will be introduced into the flow report.

Zero point calibration function. To perform the Zero point Calibration, select the Zero Cal. Menu and press the Enter/Esc key. This will enable the zeroing function. You will see a percent value that is positive or negative.

Now press and hold the Enter/Esc key and release when the message "Measuring. . . " appears. The converter counts up from zero to 700, after which the zero point is set. The new value should be less than before the autozero was performed. If not, then verify that there is no flow in the pipe and repeat.

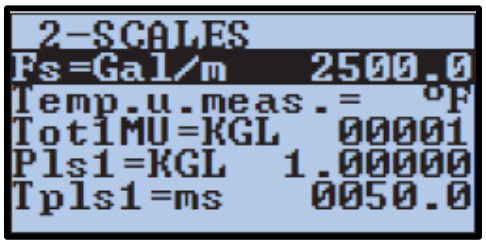


Note: If the zero cal starts measuring and jumps out, there is too much noise to complete the zero cal. Ensure grounding is correct to eliminate as much noise as possible.

9.5.13 Zero res.

This resets the Zero Calibration.

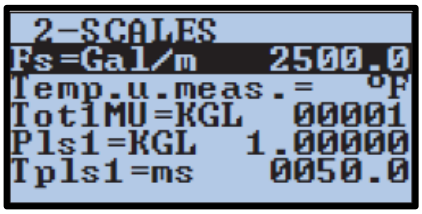
9.6 Menu 2 – Scales

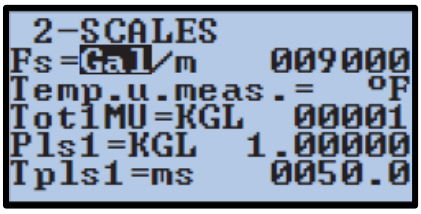


9.6.1 Fs

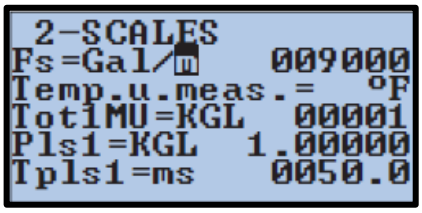
The units of measure and full scale range of the meter. Generally this value is set 10% over the anticipated max flow. US standard & metric units are selectable from this menu. See *Appendix 12.3 Units of Measure* for available units of measure.

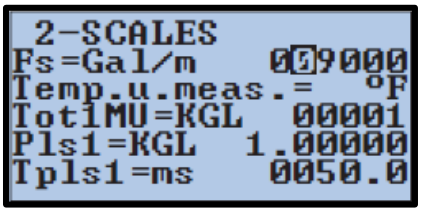
To change the full scale value, highlight the “Fs” menu and press the Enter/Esc key. The unit will highlight. Press the Up/Down key to scroll thru the different available units.





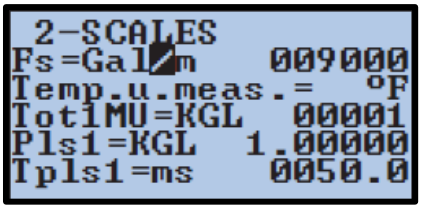
Once you have selected the desired unit, press the Right/Left key twice to highlight the lower case letter that represents the time unit. Again press the Up/Down key to scroll thru the available time units. Once the unit of measure and time unit have been selected, press the Right/Left key to select the numeric value. Press the Up/ Down key to set the digit and Right/Left key to move to the next digit. Once the desired value is entered, press the Enter/Esc key to exit/highlight the menu.





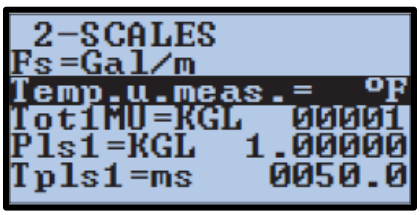
NOTE: If a unit you are looking for is not in the current list, press the Right/Left key and scroll to the “/” between the unit of measure and time unit selections and press the Up/Down key to switch between U.S. Standard and Metric units.

Once the desired value is entered, quick push the Enter/Esc key to highlight the entire line and then long push Enter/Esc to exit back to the display.



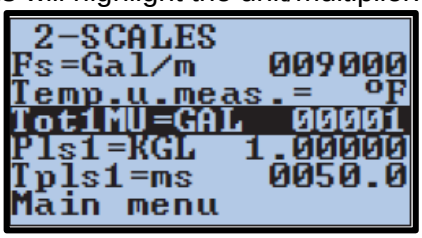
9.6.2 Temp.u.meas

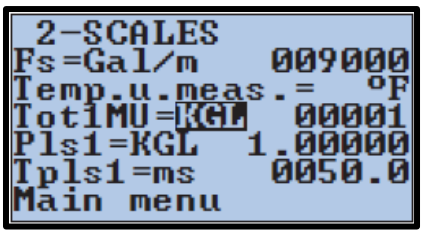
This sets the unit of measure of temperature.



9.6.3 Tot. MU

The totalizer unit/multiplier and decimal resolution. See *Appendix 12.3 Units of Measure* for available units of measure. To change the totalizer unit/multiplier, select the Tot. MU menu and press the Enter/Esc key. This will highlight the unit/multiplier.

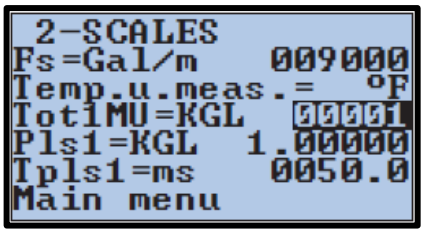


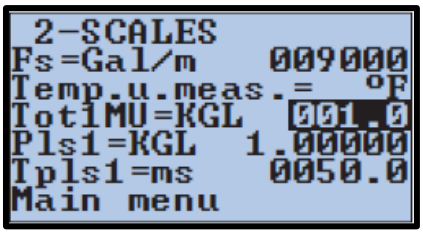


Press the Up/Down key to scroll through the available units until the desired unit has been selected.

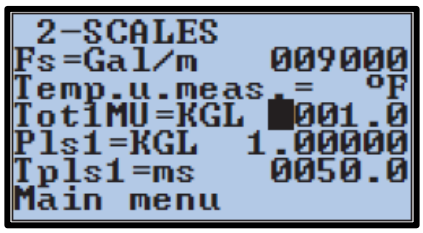
NOTE: The totalizer multiplier is built into the unit of measure, so for gallons multiplied by 1000, select KGal.

Once the unit of measure is selected, press the Right/Left key twice to highlight the numeric value to the right. Then press the Up/Down key to change the decimal resolution displayed for this totalizer. Changing the decimal resolution will not change the multiplier. The available selections are 00001, 001.0, 01.00, and 1.000.





NOTE: If the desired unit of measure is not in the current list, press the Right/Left key and scroll to the blank space between the unit/multiplier and the numeric decimal resolution selection and press the Up/Down key to switch between U.S. Standard and Metric units.



9.6.4 Pls1

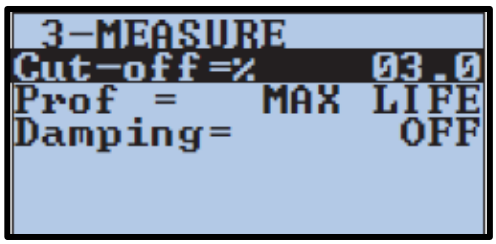
The pulse increment value and unit of measure for the pulse output 1. This option is only available when “out1” in “Menu 6 – Outputs” (section 9.10.1) is set to #1 IMP+.

9.6.5 Tpls1

Duration of the pulse output 1 expressed in milliseconds. The pulse duration can be set from .4 to 9999.99. This option is only available when “out1” in “Menu 6 – Outputs” (section 9.10.1) is set to #1 IMP+. Factory set to 50ms, which should not need to be changed.

IMPORTANT

The converter cannot detect the type of device it is connected to so it is up to the user to verify the setting is compatible with the external device receiving the pulse. Incorrect settings can damage the receiving device. See section 8.10, "Menu 6 - Outputs", for output specifications.



9.7 Menu 3 - Measure

9.7.1 Cut-off

Cut off point which all flow is reported as zero. This value is set as a percentage of the full scale.

9.7.2 Prof

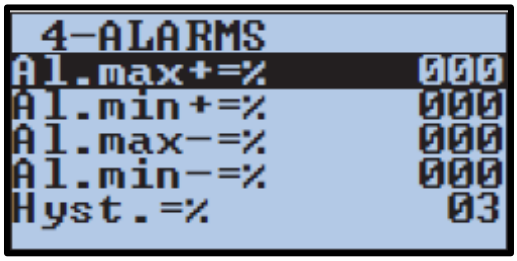
The flow measurement profile.

- 0 = Continuous Power
- 1 = Smart
- 2 = Average
- 3 = Max Life

Continuous Power uses more battery power and is not recommended. Max Life uses the least battery power and is the default.

9.7.3 Damping

Measure Filter Damping Profile Enable is only valid in the Smart Profile setting. This applies a fixed filter to the reading.



9.8 Menu 4 - Alarms

9.8.1 Al.max+

Maximum flow threshold, forward flow. This is the set point to trigger a high flow alarm set as a percentage of full scale. This function is disabled when set to zero.

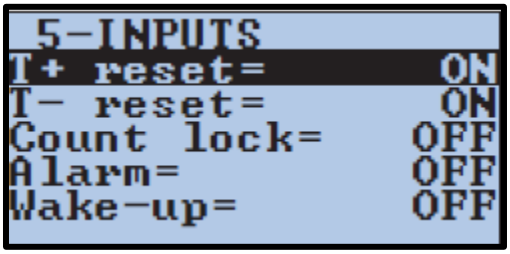
9.8.2 Al.min+

Minimum flow threshold, forward flow. This is the set point to trigger a low flow alarm set as a percentage of full scale. This function is disabled when set to zero.

9.8.3 Hyst,

Set 0-25%. This sets the lag in response based on a percentage of the full scale. Example if the alarm triggers at 100% and the hysteresis is set to 2% then once triggered the current rate must change beyond 2% to exit out of the current alarm state. This setting applies to all alarms.

9.9 Menu 5 - Inputs



9.9.1 T+ reset

Positive Totalizer Reset Enable. Set by turning on or off. This allows for the positive total totalizer to be reset through the input.

9.9.2 T- reset

Negative Totalizer Reset Enable. Set by turning on or off. This allows for the negative total totalizer to be reset through the input.

9.9.3 Count lock

Totalizer Count Lock Input Enable, Set by turning on or off. This allows for the totalizers to be locked (frozen) when the input is active.

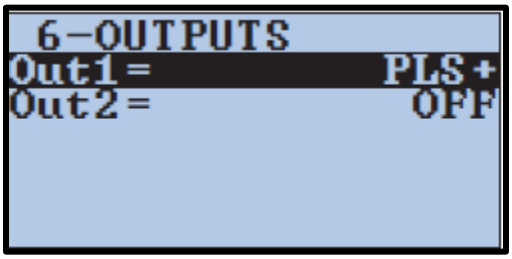
9.9.4 Alarm

Allows the input to be wired to an external alarm output such as a water intrusion alarm.

9.9.5 Wake-up

Wake up the display with an input.

9.10 Menu 6 - Outputs



9.10.1 Out 1

Transistor output channel 1. See Table 2: Output Options.

9.10.2 Out 2

Transistor output channel 2. See Table 2: Output Options.

Table 2: Output Options

Function Symbol	Function Explanation
OFF	Disabled
PLS	Pulse for positive and negative flow volume
PLS-	Pulse for negative flow volume
PLS+	Pulse for positive flow volume
F.SIGN	Flow direction output (energised = -)
DIRECT. DR.	Direct output drive
ALL ALRMS	All alarms
OVR.RANGE.	Out of range alarm output (energised = flow rate ok)
HARDW.AL.	Cumulative alarm out interrupt coils, empty pipe, meas. Error (ENERG. = NO ALARMS)
P.EMPTY	Empty pipe alarm output (energised = full pipe)
MX+MN ALL	Max and min alarm output (energised=al. Off)
MX+MN TEMP	Max and min temperature output (energised= al. Off)
MIN TEMP	Max and min temperature output (energised= al. Off)
MAX TEMP	Max temperature output (energised= al. Off)
MX+MN P12	Max and min pressure 1 and 2 output (energised= al. Off)
MX+MN DP	Max and min differential pressure output (energised= al. Off)
MIN DP	Min differential pressure output (energised= al. Off)
MAX DP	Max differential pressure output (energised= al. Off)
MX+MN P2	Max and min pressure 2 output (energised= al. Off)
MIN P2	Min pressure 2 output (energised= al. Off)
MAX P2	Max pressure 2 output (energised= al. Off)
MX+MN P1	Max and min pressure 1 output (energised= al. Off)
MIN P1	Min pressure 1 output (energised= al. Off)
MAX P1	Max pressure 1 output (energised= al. Off)
MX+MN Q	Max and min flow rate alarm output (energised=al. Off)
MX+MN Q-	Max and min negative flow rate alarm output (energised=al. Off)
MIN Q-	Min negative flow rate alarm output (energised=al. Off)
MAX Q-	Max negative flow rate alarm output (energised=al. Off)
MX+MN Q+	Max and min positive flow rate alarm output (energised=al. Off)
MIX Q+	Min positive flow rate alarm output (energised=al. Off)
MAX Q+	Max positive flow rate alarm output (energised=al. Off)

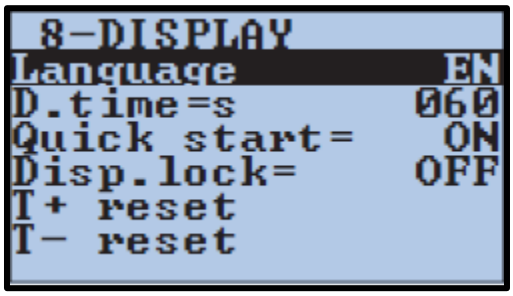
NOTE: Only the highlighted options are operationally available for the SPI-MV.

9.11 Menu 7 - Communication

9.11.1 IF2 pr.

Protocol for IF2 port. Set to DPP or HTP. This set the protocol used for communication to the IF2 device, either Data Packet Protocol (DPP) or Hyper Text Protocol (HTP). Default is DPP.

9.12 Menu 8 - Display



9.12.1 Language

This sets the converter language EN (English), IT (Italian), FR (French), SP (Spanish), or DE (German).

9.12.2 D.Time

Energy Saving Display Time will turn the display off after 20-250 seconds. 60 is default.

9.12.3 Quick start

Quick Start Menu Enable. This setting toggles between on and off. If set to "off" it will hide the quick start menu.

9.12.4 Disp.lock

Locks the front panel display so you can't switch between displays

9.12.5 T+ reset

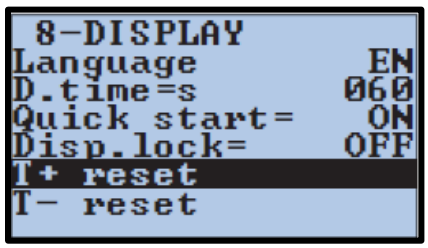
Totalizer reset, forward. Resets the forward flow totalizer.

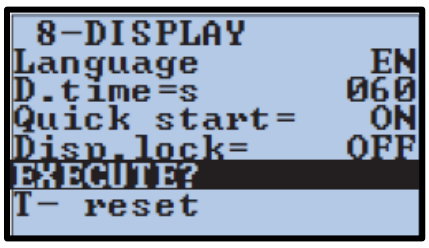
9.12.6 T- reset

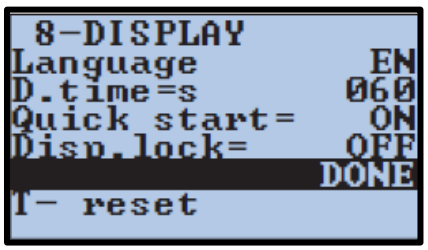
Totalizer reset, reverse. Resets the reverse flow totalizer.

To reset the totalizer, highlight the totalizer reset option to be reset. Quick press the Enter/Esc key. The display will show "EXECUTE?". Press and hold the Enter/Esc to continue. The display will flash "Done". The visualization pages will now show the totalizer as reset.

NOTE: There is no function to reset the Net Totalizer. Reset both the "+" and the "-" totalizers to reset the Net total.







9.13 Menu 9 - Data Logger

9.13.1 YYYY/MM/DD

Date and time. This sets the date and time in the converter. The format for entering the date and time is year / month / day and time is hours : minutes : seconds.

9.13.2 T.zone=h

Time Zone. ±12 hours. GMT ± the number of hours. Pacific time is -8.

9.13.3 Acquisition

Enable Data Logging Function.

9.13.4 Comp.mode

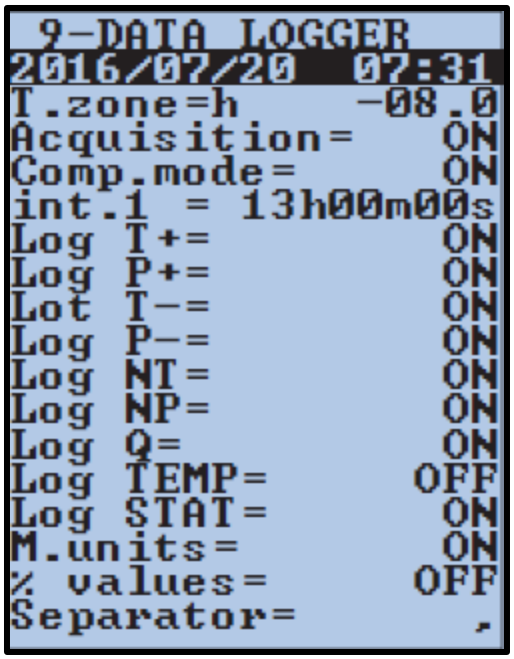
Format the Data Logging Data to the previous version of this converter. Default=Off

9.13.5 int.1

Data Logging Interval. HH:MM:SS

9.13.6 Log T+

Include the T Positive Totalizer for Data Logging.



9.13.7 Log P+

Include the P Positive Totalizer for Data Logging.

9.13.8 Lot T-

Include the T Negative Totalizer for Data Logging.

9.13.9 Log P-

Include the P Negative Totalizer for Data Logging.

9.13.10 Log NT

Include the Net T Totalizer for Data Logging.

9.13.11 Log NP

Include the Net P Totalizer for Data Logging.

9.13.12 Log Q

Include the Flow Rate for Data Logging.

9.13.13 Log STAT

Include Statistics like the board temperature and cycles/h for Data Logging.

9.13.14 M.units

Include the Units of Measure for Data Logging.

9.13.15 % values

Include the Flow Rate % of full scale and optional analog inputs for Data Logging.

9.13.16 Separator

The delimiter for the Data Logger file. 0=, 1=;. Default =,

9.14 Menu 10 – Diagnostics

9.14.1 Calibration

Initiates the calibration of the converter. To activate press the Enter key and then, at the question: “EXECUTE?” press the Esc key to start calibration, or any other key to cancel. During the calibration process a “C” is displayed in the upper left corner of the display.

9.14.2 Sensor test

Performs a Sensor Test.

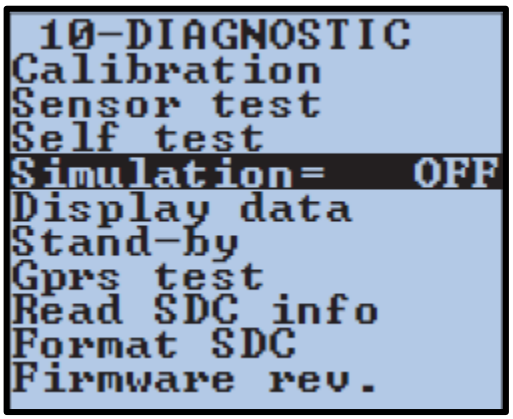
9.14.3 Self-test

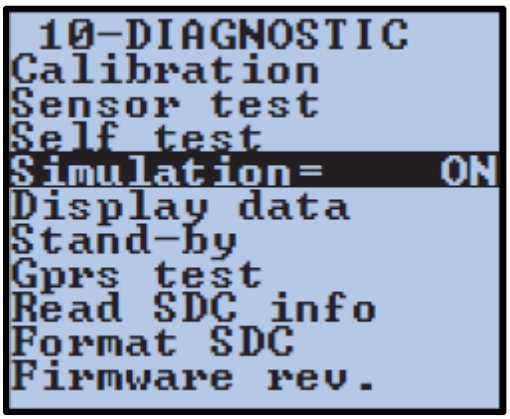
Converter self-test. Executed command. Running the self-test will cause the converter to run an internal diagnostic test that will check for internal hardware and software errors. The converter will reboot. Once the self-test is complete if any errors are found then the error code for each error will be displayed. Contact factory for support.

9.14.4 Simulation

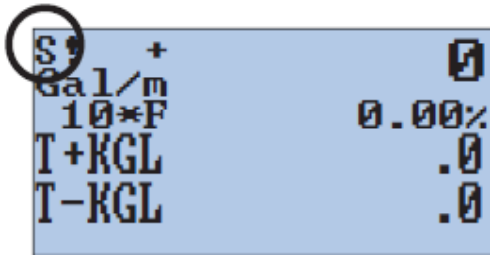
Simulation enable. Setting this menu to ON will generate an internal signal that simulates flow and allows the outputs and all connected instruments to be tested. After simulation is set to ON, the flow can be set to a percentage based on the current FS1 setting of -125% to 125%.

To enable the simulation function, use the Right/Left key to highlight the Simulation menu and press the Enter/ Esc key. Toggle the simulation function from OFF to ON using the Up/Down key. Press and hold the Enter/ Esc key to exit back to the main menu and once again to exit to the visualization page.

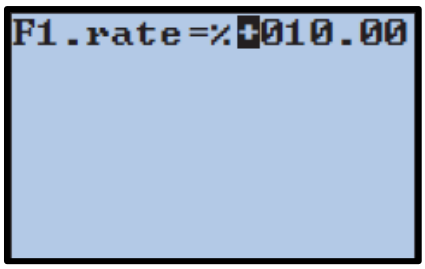




NOTE: you will now have an “S” in the upper left corner; this indicates the simulation mode is active.

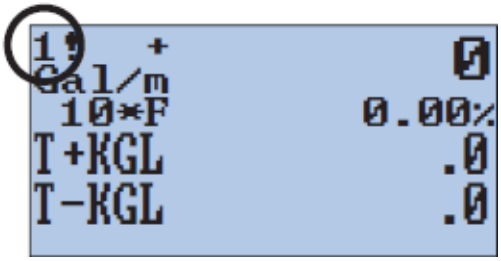


Press the Enter/Esc key. This will bring up the flow simulation set up screen. Use the Right/Left key and the Up/ Down key to enter in the flow rate percentage value for the simulation. Press the Enter/Esc key to enter that value.



The converter will start to read flow. It may take a few seconds for the readings to appear. Repeat the above steps as needed to observe the different flow rates desired.

To exit out of simulation mode, re-enter into the simulation set up screen (see above) and then press and hold the Enter/Esc key. This will exit out to the visualization screen, and the “S” in the upper left corner of the screen will return to a “1”.



9.14.5 Display data

Numeric display for various internal settings and raw measured signals. This is a Factory service menu.

9.14.6 Stand-by

Use this function before powering down the converter. This will save any unsaved data and turn off the converter. Once the converter is in Stand-by, you can switch the batteries off or change the batteries. To turn the converter back on you must switch the battery switch to off and after approximately 5 minutes, turn the switch to ON.

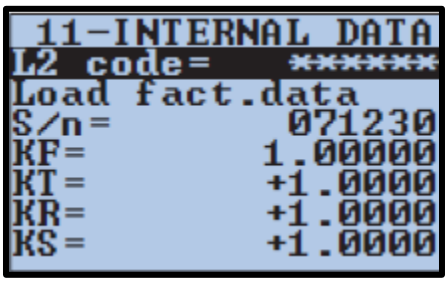
9.14.7 Read SDC info

Displays the total capacity and the capacity free of the SD Memory card.

9.14.8 Firmware rev.

This temporarily displays the model and Firmware of the converter.

9.15 Menu 11 - Internal Data



9.15.1 L2 code

Level 2 passcode. This menu changes the 2 level passcode. The factory default is **000002**

CAUTION - if the passcode is changed from the default value and is lost, it CANNOT be recovered. In the event the passcode is lost the converter can be returned to the factory to be reset. Note all data is lost during this process.

9.15.2 Load fact. data.

Load factory presets. This will configure the converter to the configuration when it left McCrometer.

NOTE: This menu is customized for a specific sensor. Confirm the converter has not been moved or paired with another sensor prior to executing this menu.

9.15.3 S/n

Displays the board serial number.

9.15.4 KT

Used to adjust gain errors. This factor is generated by the converter at power up.

9.15.5 KS

Field adjustment coefficient. This value is a direct multiplier that is used as a field adjustment/correction coefficient.

10 Alarm Messages

During meter setup, you may see alarm messages. These alarms and some common solutions are explained in Table 3 below. Contact factory for further support.

Table 3: Alarm Messages

MESSAGE	CAUSE	ACTION
NO ALARMS	--	--
SYSTEM STARTUP	The system was started	--
P.EMPTY	The system detected an empty pipe alarm condition	Check the empty pipe settings and the process conditions
EL.SIG.ERROR	The system detected a measuring error/noisy input at the electrodes	Check the flow sensor cables, the electrodes surface, the grounding and the process conditions
EXCIT.ERROR	The system detected an error in the coils excitation circuit	Check the flow sensor cables, the coil insulation and resistance
FLOW>FS	The flow rate is higher than the full scale set	Check the maximum full scale set and the process conditions
PULS.1>F.MAX	The pulse frequency at output 1 is too high	Reduce the pulse duration if the connected counter allows this or increase the pulse unit value
PULS.2>F.MAX	The pulse frequency at output 2 is too high	Reduce the pulse duration if the connected counter allows this or increase the pulse unit value
MAX Q+	The Positive flow rate is higher than the maximum threshold value set	Check the maximum threshold positive flow rate alarm value and the process conditions
MIN Q+	The Positive flow rate is lower than the minimum threshold value set	Check the minimum threshold positive flow rate alarm value and the process conditions
B3 LOW	The battery B3 powering the MODUM is exhausted	Replace the battery
B2 LOW	The battery B2 powering the main board is exhausted	Replace the battery
B1 LOW	The battery B1 powering the main board is exhausted	Replace the battery
SYSTEM RESTART	The system was restarted after a reset signal	If this message appears after an AUTO-TEST command, it is not an error indication, otherwise check all the connections, the batteries and the grounding
POWER FAILURE	The system experienced a loss of power	Check the status of the batteries and all their connections. This message may appear when the system is switched off without first putting it in stand-by mode
POWER SUPPLY OFF	The power coming from the universal power supply went off	Check the power supply source and cables
ALARM INPUT ACT.	The digital input detected an alarm signal condition	Check the process condition

B.TEMP.OUT R.	The measured board temperature is out of the allowed range	Ensure that the instrument is operating within the specified temperature conditions
FIRMW.FILE ERR	The file containing the firmware was received with errors	Re-send the firmware file
CONFIG.ENTERED	The system detected an access to the configuration parameters	Check the events log and take appropriate action according to your data protection policy
SD MEMORY FULL	the SD card memory is full (no more space for new data)	Change the SD card memory or erase all the unwated data
SD MEMORY ERROR	The SD card installed is missing, not valid, not formatted or incompatible with the system	Replace the SD memory, format it or check if it is properly inserted

11 Troubleshooting Guide

Table 4 below provides suggestions for fixing common problems. Contact factory for further support.

Table 4: Troubleshooting

Problem	Troubleshooting Steps
Excitation Fail (0800) Alarm	• Ensure the wiring is firmly connected • Disconnect the coil wires from the converter and check their resistance with a standard multi-meter. Contact the factory for the proper value for the sensor. • Ensure the wiring is firmly connected to any PreAmp being used.
Noisy Input Alarm	• Verify there is a jumper on terminals 3 and 4 • Verify the converter ground is to earth ground • Check for damaged cable between the sensor and converter
Empty Pipe Alarm	• Confirm the pipe is full • Verify there is a jumper on terminals 3 and 4 • Check EP Threshold. Set to 192 if short cable (less than 50 ft.), set to <120 if longer cable (50 ft. to 100 ft.). Consult the factory for assistance in selecting the correct value. • Conduct a bucket test to confirm the EP Threshold value is set correctly. Consult the factory for assistance. • Check for damaged cable between the sensor and converter
Unstable Flow Readings	• Check grounding connections • Check power circuit. What other devices are on the circuit • Install dedicated ground circuit
Menu Not Accessible	• Confirm the password being used is 000002 • Verify dip switches in the back panel next to the terminals 1 and 2 are both down.
Rate Of Flow Report Is Not As Expected	• Confirm the unit is programmed correctly by requesting a program setting report from the factory.

12 Appendix

12.1 Installation Guide

Purpose:

To provide a step by step procedure for installing the SPI flow meter inline to ensure correct insertion depth and calibration.

12.1.1 SPI Probe Installation:

Step 1:
Ensure you have a 1” NPT drilled hole on the inlet of the valve.

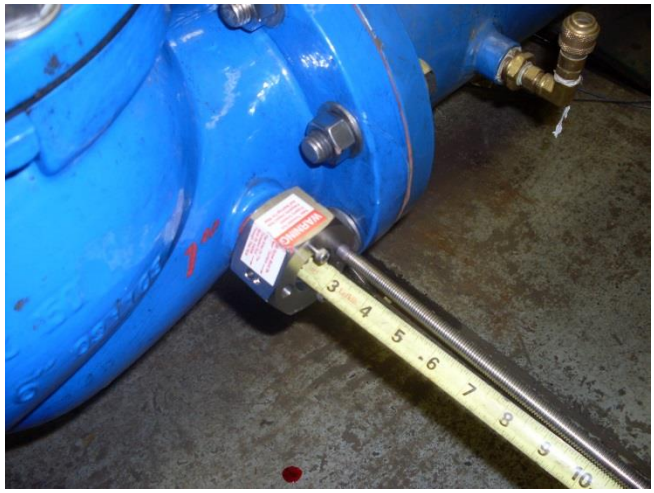
Step 2:
Put a generous amount of thread sealant on the pipe nipple and thread it into the 1” NPT hole on the valve

Step 3:
Put a generous amount of lock tight on the other side of the pipe nipple and thread the compression nut on the pipe nipple. Ensure there is an o-ring in the compression nut on the sensor side.

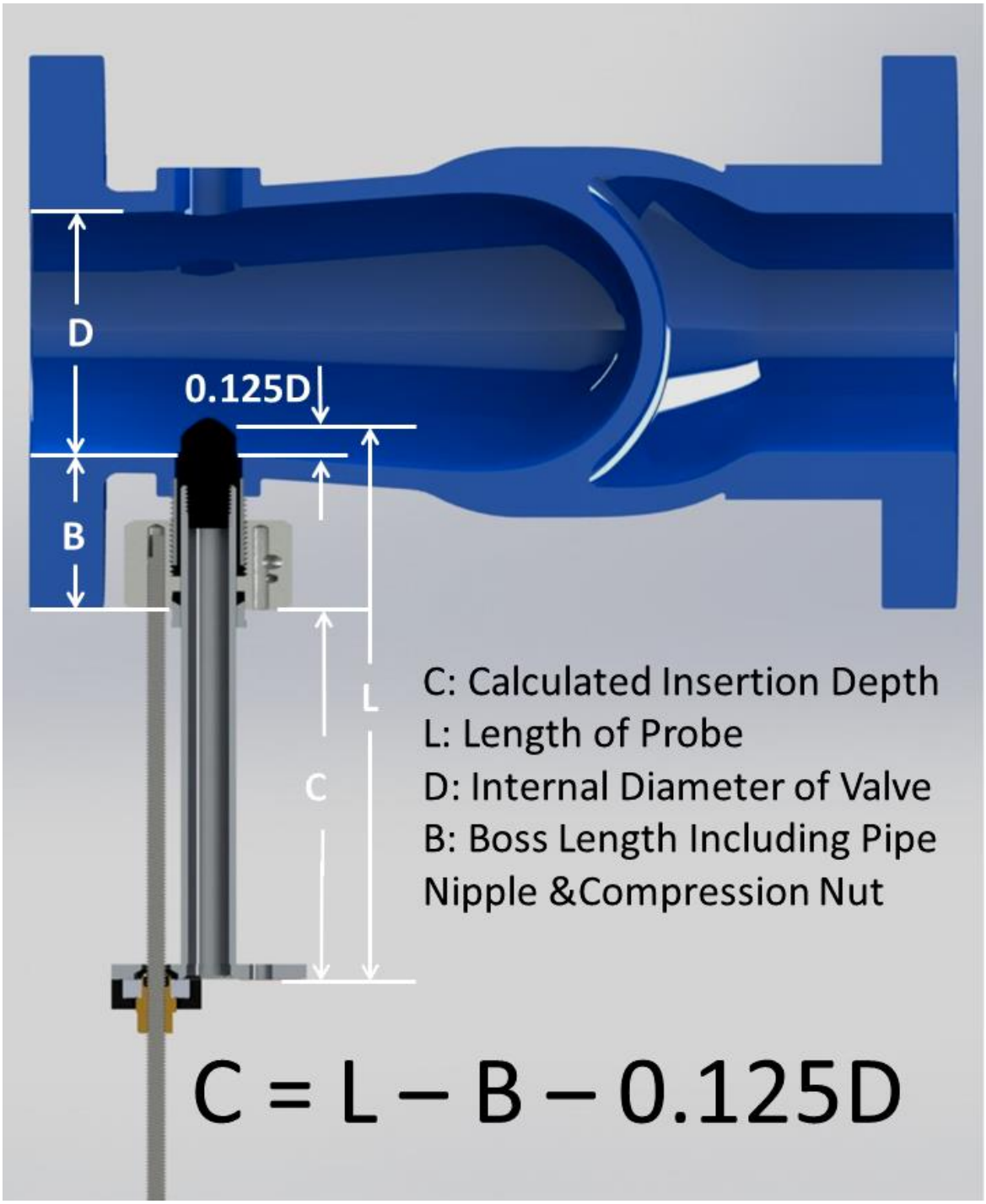
Step 4:
Tighten the compression nut which in turn will tighten the pipe nipple. Tighten till hand tight to ensure tight water seal. Ensure the ready rod threading holes are horizontal in final tightened position.

Step 5:
Put some anti-seize on the ready rod and thread the rod into the upstream side of the compression nut. Once threaded tighten set screw

Step 6:
Measure the Length of the Probe, the Boss Length, and the Inner Diameter (also shown in Converter Quick Start Menu)..



Calculate the insertion depth based on the measured values:

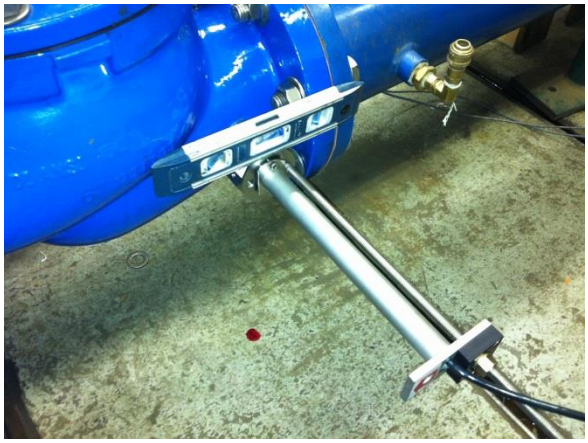


- **LENGTH OF PROBE (L)** is measured from the middle of the electrodes on the sensor to the end of the sensor.
- **BOSS LENGTH (B)** is a measurement from the inner of the valve to the end of the compression nut. This is the Fittings & Body Width
- **0.125D** is the insertion depth of the probe into the valve. This is 1/8 of the internal diameter of the valve

Step 7:
Insert the SPI sensor ensuring the flow arrow points down steam and tighten the nut with the socket wrench provided with the SPI package.


Step 8:
Tighten till the correct insertion depth and tighten the compression clamp. Once the compression clamp tightens on the o-ring the SPI sensor is sealed

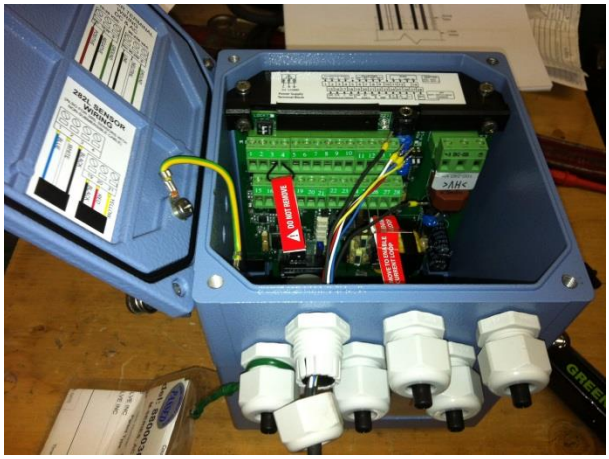

Step 9:
Ensure both the compression nut and SPI sensor are horizontal to ensure correct sensor alignment.



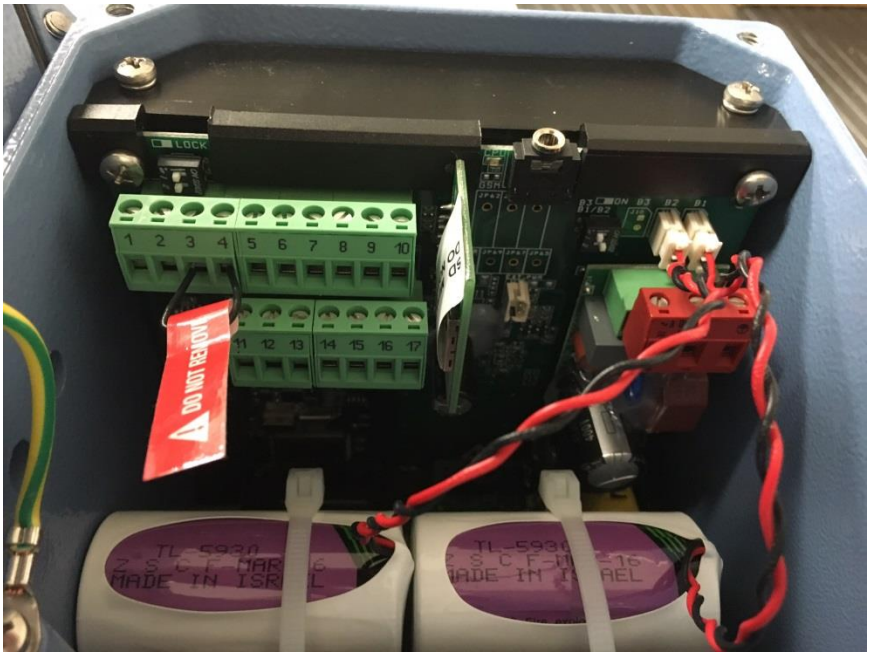

12.1.2 Converter Wiring Installation:

Step 1:
Locate and pull the rip wire on the sensor cable. Open the back of the Converter.

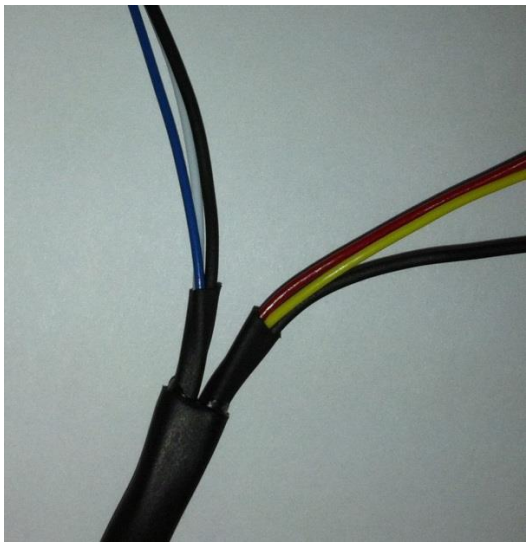
Step 2:
Thread the sensor cable through the enclosure connection and tighten the enclosure connector.



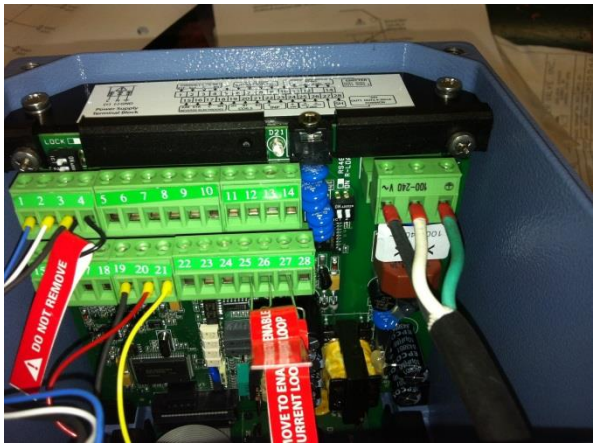
Step 3:
Install the Sensing Electrodes, Reference Ground, Coils and Shield wires. Take note of how the Ground and Shield black wires are heat wrapped separately to indicate which wire is which.



Terminal	Wire Colour	Connection
#1	Blue	Sensing Electrode
#2	White	Sensing Electrode
#3	Black	Reference Ground
#11	Black	Cable Shield
#12	Red	Coil
#13	Yellow	Coil



Step 4 (Optional):
Install power cable provided with SPI package. Thread the power cable through the enclose connections and tighten the enclosure connector. Install Line (black), Neutral (white), Ground (green) wires.



12.2 Installation Record

The following table can be used to record probe insertion measurements for reinsertion after maintenance.

Date	Sensor Length (C)	Nipple & Nut Length (B)	1/8 Valve Diameter (A)	Insertion Depth (Y)

12.3 Units of Measure

The units available for Full Scale Range (FS1) and Totalizer (Tot.MU) in the Converter are shown in the tables below:

U.S Standard	
Gal	U.S. Gallons
IGL	Imperial Gallons
KGL	Thousand Gallons
IKG	Thousand Imperial Gallons
ttG	Ten Thousand Gallons
MGL	Mega Gallons*
in^3	Cubic Inches*
ft^3	Cubic Feet
hf^3	Hundred Cubic Feet
kf^3	Thousand Cubic Feet
Ain	Acre Inches
Aft	Acre Feet
bbl	Standard Barrels
BBL	Oil Barrels

Metric	
ml	milliliters*
l	Liters
dal	Decaliter
hl	Hectoliter
Ml	Megaliters
cm^3	Cubic Centimeters*
dm^3	Cubic Decimeter
m^3	Cubic Meters

Time	
s	Seconds
m	Minutes
h	Hours
d	Days

*These units only available for the Totalizer (Tot. MU)

Please read and understand the contents of this manual.