

# Innova-Switch™ Series

## 615 Series Mass Flow/Level Switch

# Instruction Manual

Part Number: IM-615, Rev. G 7/18



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### IMPORTANT CUSTOMER NOTICE- OXYGEN SERVICE

Unless you have specifically ordered Sierra's optional O<sub>2</sub> cleaning, this flow meter may not be fit for oxygen service. Sierra Instruments, Inc., is not liable for any damage or personal injury, whatsoever, resulting from the use of Sierra Instruments standard mass flow meters for oxygen gas. You are responsible for cleaning the mass flow meter to the degree required for your oxygen flow application. **However, some models can only be properly cleaned during the manufacturing process.**

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### TRADEMARKS

Innova-Switch™ is a registered trademark of Sierra Instruments, Inc. Other product and company names listed in this manual are trademarks or trade names of their respective manufacturers

## IMPORTANT CUSTOMER NOTICE

Before installing and operating the flow meter, please read this manual carefully and follow its instructions.

- Sierra has verified the conformity between the contents in this manual and the hardware and software described. However, errors may still exist. We regularly review the materials covered in this manual and correct errors with revisions. Any suggestions for improvement will be appreciated.
- Go to [www.sierrainstruments.com/products/downloads.html](http://www.sierrainstruments.com/products/downloads.html) for a most current electronic version of this manual.
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## WARNINGS IN THIS MANUAL

Caution and warning statements are used throughout this book to draw your attention to important information.



### WARNINGS

"Warning" indicates that ignoring the relevant requirements or precautions may result in personal injury or flow meter damage.



### NOTES

"Note" indicates that ignoring the relevant requirements or precautions may result in flow meter damage or malfunction.

## BEFORE STARTING

Sierra Instruments appreciates your choosing our product for your liquid level or liquid/gas flow switching application. We are committed to providing reliable, quality instrumentation to our customers.

To ensure the maximum and intended benefit of this instrument, we encourage you to read this brief operation and maintenance manual in its entirety prior to unpacking and installing the unit.



The following precautions should be noted immediately:

- φ **WHEN INSTALLING YOUR SIERRA INNOVA-SWITCH™ INTO A PIPE OR VESSEL USE A 1 1/8 INCH (28.575mm) OPEN-END OR ADJUSTABLE WRENCH TO TIGHTEN AT THE HEX FLATS OF THE MNPT OF A STANDARD SWITCH. (IF YOU HAVE A NON-STANDARD SWITCH AN ALTERNATE SIZE WRENCH MAY BE REQUIRED). DO NOT USE THE INSTRUMENT HEAD TO TIGHTEN THE SWITCH TO THE MOUNTING PORT. ROTATION OF THE INSTRUMENT HEAD WITH RESPECT TO THE SENSOR BODY CAN CAUSE INTERNAL WIRING DAMAGE (SEE FIGURES 1).**
- φ **THE SWITCH BODY MUST BE ORIENTED TO HAVE THE TWIN SENSORS PARALLEL TO THE LEVEL BEING DETECTED WHEN THE SENSOR IS INSTALLED HORIZONTALLY FOR POINT LEVEL APPLICATIONS. LIKewise, FOR FLOW APPLICATIONS, THE SWITCH BODY MUST BE ORIENTED TO HAVE THE TWIN SENSORS PERPENDICULAR TO THE FLOW BEING DETECTED. DUE TO THE PIPE THREAD MOUNTING, IT MAY BE NECESSARY TO MAKE A TRIAL FIT, ADD OR REMOVE TEFLON TAPE OR OTHER PIPE THREAD SEALANT, AND REINSTALL TO ACHIEVE A SATISFACTORY SEAL WITH THE SENSORS PROPERLY ORIENTED. FOR VERTICAL INSTALLATION OF SENSORS FOR POINT LEVEL DETECTION THE ORIENTATION MAKES NO DIFFERENCE. PROPER ORIENTATION IS MARKED ON THE SWITCH BODY FOR REFERENCE (SEE FIGURE 5).**
- φ **A GROUND WIRE MUST BE ATTACHED TO THE GROUND SCREW LOCATED INSIDE THE INSTRUMENT ENCLOSURE FOR PROPER OPERATION. FOR CENELEC/CE OPTION THE GROUND SCREW IS LOCATED OUTSIDE THE BODY OF THE INSTRUMENT ENCLOSURE (SEE FIGURE 6).**
- φ **BE SURE TO APPLY THE PROPER VOLTAGE AS CONFIGURED AT THE FACTORY. DO NOT APPLY 115 VAC TO 24 VDC VERSIONS OR 24 VDC TO 115 VAC VERSIONS. (LIKewise 230 VAC).**
- φ **FOR OPTIMUM OPERATION, CALIBRATION MUST BE ACCOMPLISHED AT ACTUAL PROCESS TEMPERATURE AND PRESSURE CONDITIONS IN GASES AND AT ACTUAL PROCESS TEMPERATURE CONDITIONS IN LIQUIDS.**
- φ **TO ENSURE ACCURATE CALIBRATION AND AVOID SET POINT DRIFT, IT IS IMPERATIVE THAT A MINIMUM OF 10 MINUTE WAIT BE OBSERVED AFTER POWER IS**

**APPLIED TO ALLOW THE SENSOR TO WARM-UP TO THE AMBIENT FLUID TEMPERATURE.**

**LIKEWISE, WHEN ADJUSTING THE ZERO, SPAN, AND SET POINTS POTS, A MINIMUM OF 30 SECONDS SHOULD BE OBSERVED TO ALLOW FOR STABILIZATION OF TEMPERATURE.**

φ **DO NOT SANDBLAST OR ABRASIVE CLEAN THE SENSING PROBES. THE SENSING PROBES COULD BE DAMAGED BY ABRASIVES.**

■ **ALL DIMENSIONS GIVEN IN THIS MANUAL ARE IN INCHES (AND MILLIMETERS).**

If you have any questions prior to or during installation and calibration, please do not hesitate to call the factory for assistance. We want to ensure the very best possible installation and operational results for your benefit.



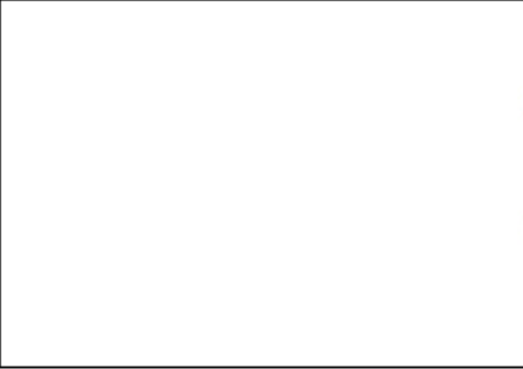











## NOTICE

This manual covers the following model numbers:

Innova-Switch™ Series Models		615- FS4200	615-LS3200
Agency Approvals	Explosion-Proof rating	Mass Flow Switch	Point Level Switch
CENELEC European	EEx d IIB T4 EEx d IIC T4 See Figure 1A and 1B	FS42CN	LS32CN
CSA Canadian Standards	T4A Class I, Group B,C,D Class II, Group E,F,G	FS42CS	LS32CS
Non-Approved	Non-Explosion Proof	FS42NX	LS32NX
Switch Kits (No Enclosures)	Not Rated	FS42SK	LS32SK
(Ref. Section CE 3.2.3 wiring)	EMC Directive: 89/336/EEC	Option – CE	Option -CE

**SPECIAL NOTICE**

The electronic assemblies contained in the Innova-Switch™ models are configured for specific voltages and have specific modifications to accommodate the various agency approvals. When ordering spare electronics, replacements, or exchanges in the field please ensure you identify the specific configuration you have by noting the boxes marked on the transformer configuration tag.

PN 200203		 <b>SIERRA</b> <small>EXPERIENCE OUR PASSION FOR FLOW!</small>	
			24 VAC
			
		24 VDC	
			
			
SN 		220 VAC	110 VAC
			

**\*WARNING\***

THE WETTED SENSOR OF THE SWITCH IS OF AN ALL WELDED CONSTRUCTION CREATING A PRESSURE BOUNDARY FROM THE PROCESS FLUID (LIQUID OR GAS). ANY BREACH OF THIS BOUNDARY THROUGH CORROSION, MISTREATMENT, OR MISAPPLICATION COULD ALLOW THE PROCESS FLUID TO ENTER THE ENCLOSURE OF THE UNIT.

PROCEED WITH CAUTION WHEN OPENING THE ENCLOSURE AFTER A BREACH OF THE PRESSURE BOUNDARY TO AVOID CONTACT WITH ANY PROCESS FLUIDS THAT MAYBE CONTAINED WITHIN THE ENCLOSURE.

**\*CAUTION\***

IF THE FLUID PROCESS TEMPERATURE EXCEEDS 40 DEG C, THIS INSTRUMENT CANNOT BE USED IN AN EXPLOSION PROOF APPLICATION UNLESS THE IGNITION TEMPERATURE OF THE FLUID ATMOSPHERE IS A MINIMUM OF 80 DEG C HIGHER THAN THE PROCESS TEMPERATURE.

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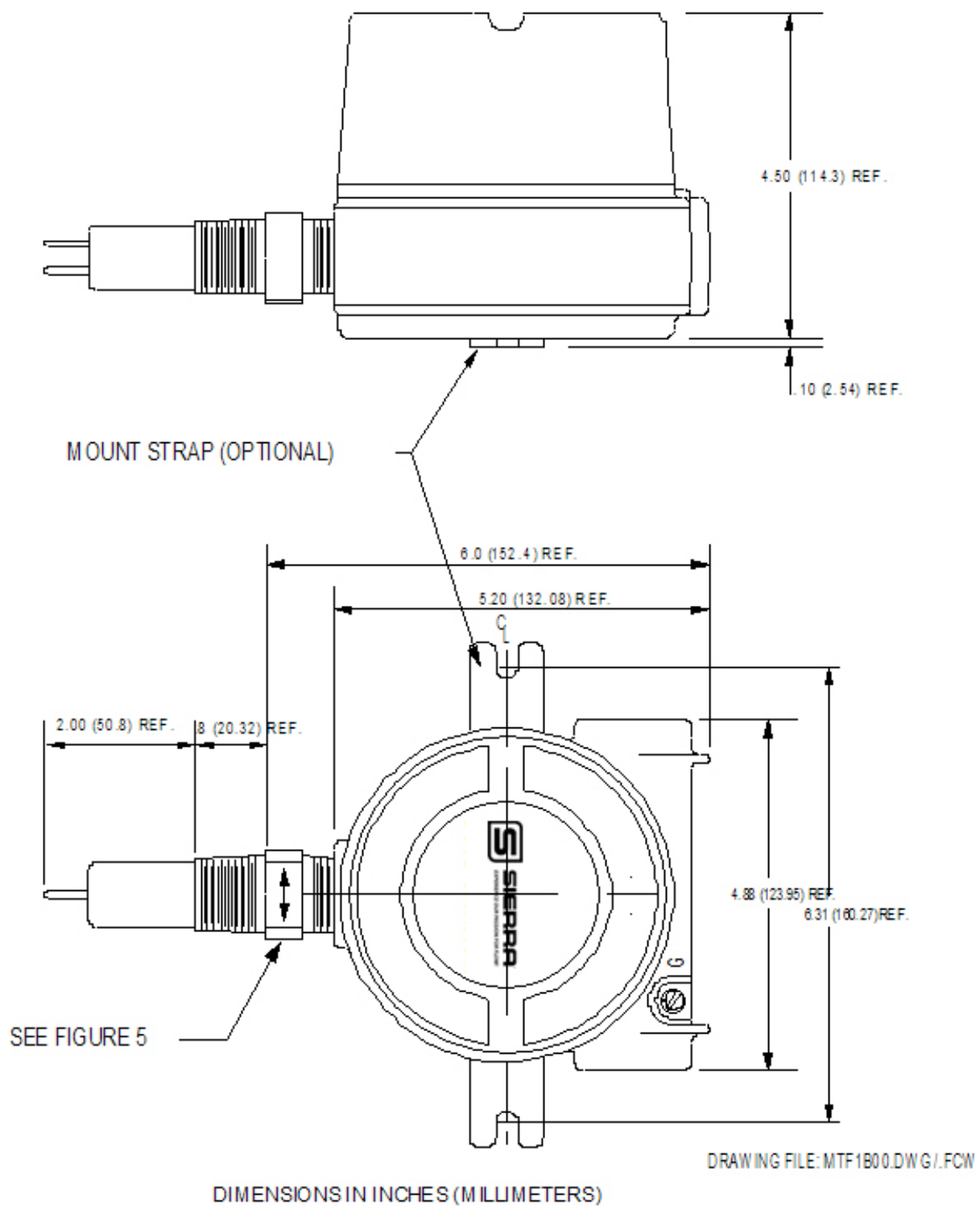
## 1.0 INTRODUCTION

The Sierra Innova-Switch™ is the state-of-the-art in gaseous and liquid flow switching or liquid level control. Flow or level detection is accomplished by using a high resolution **thermal differential** technique. The sensor wetted parts are of durable 316L series stainless steel, all welded construction with no moving parts. The switch is easy to install and adjust, giving reliable, low maintenance performance in the most demanding applications.

## 2.0 DESCRIPTION

The Innova-Switch™ uses a **thermal differential** technique to sense changes in the heat transfer characteristics of a media. Figures 1A and 1B show the outline of the Innova-Switch™. The sensor consists of a pair of matched, Resistance Temperature Detectors (RTD's) encased in twin 316L series stainless steel tubes. One RTD is self-heated using a constant DC current. The other RTD is unheated to provide an accurate process temperature reference. The **thermal differential** created between the heated and reference RTD pair is a function of the density and/or velocity of the media with which the sensor is in contact. Other physical properties may have a secondary effect as well. The differential is greatest at a no flow (or dry) condition and decreases as the rate of flow increases (or as a liquid quenches the sensor/wet condition).

The Sierra Instruments' sensor excitation method relies on constant current to the heated and reference sensors. Thus power to the heated sensor is not constant but changes linearly with temperature as the sensor resistance changes. Temperature compensation is accomplished by using the amplified reference sensor voltage which also changes linearly with temperature, as a dynamic reference. During calibration dry/no flow and wet/full flow conditions are impressed across the trip point potentiometer. Since this reference is not fixed but is set with respect to the reference sensor voltage, as temperature changes the trip point potentiometer voltage changes with temperature exactly the same as that of the heated sensor voltage with which it is being compared. Thus full temperature compensation is achieved with non constant power.



**FIGURE 1B** INNOVA-SWITCH 615 SERIES OUTLINE DIAGRAM STANDARD 2.0 INCH INSERTION ( NEMA 4X – EexdIIC, T4) (MTF1B00.DWG/.FCW)

## 2.1 LEVEL SWITCHING

The thermal differential created between the heated and reference unheated RTD pair is a function of the liquid or gas medium with which the sensor is in contact.

The point level measurement application uses the heat transfer differences between two media to detect liquid level. For example, air has a relatively poor heat transfer characteristic so the heated sensor will become relatively hot. If the sensor is then immersed in water, the relatively high heat transfer characteristics of water will cool the heated RTD surface causing a decrease in the signal output.

This same rational applies for any two media in contact with the sensor. Each medium will have its own characteristic heat transfer properties. As long as there is a reasonable difference in the heat transfer properties between the two media, the Innova-Switch™ can discriminate between them. Figure 2A shows the relative signal output of the Innova-Switch™ sensor to a range of different media. The maximum difference in output occurs between vacuum and liquid metal. However, a significant difference occurs between water and hydrocarbon liquids so the Innova-Switch™ can be used to detect a water/hydrocarbon liquid-liquid interface. In general, the interface between any two media with differing heat transfer properties can be detected.

### Thermal Differential Theory of Operation

Liquid level

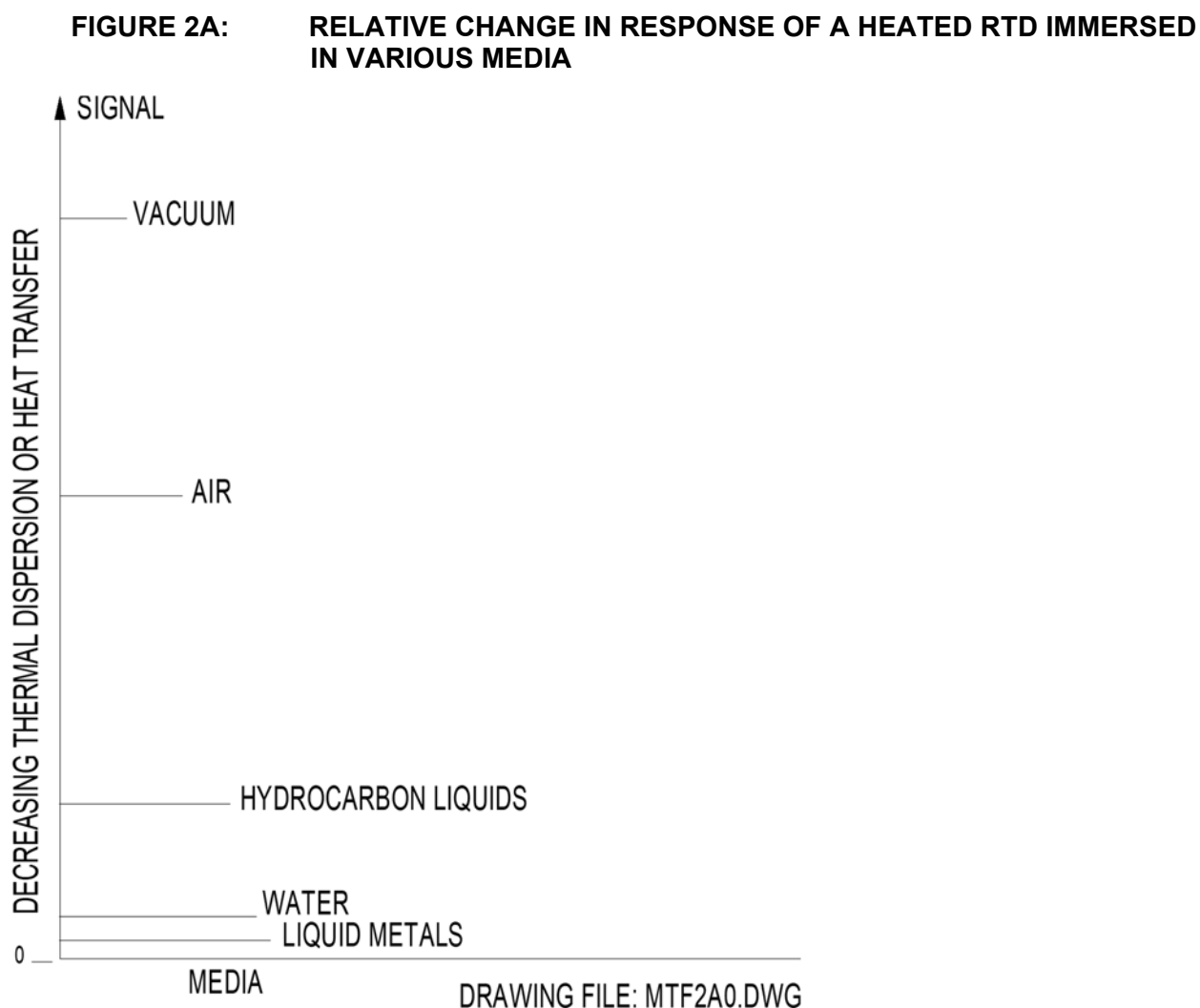
Note: Probe tips contain matched RTD's one of which is self-heated with about 400mw of power. The other provides temperature compensation



The heated RTD responds to the heat transfer coefficient of the media with which it is in contact. Gases with low heat transfer result in a high differential temperature between the heated and reference tips



When the heated tip makes contact with a liquid with higher heat transfer the differential temperature drops and the lower differential results in a switch trip to indicate liquid

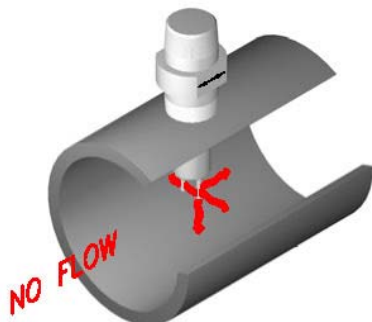


## 2.2 FLOW SWITCHING

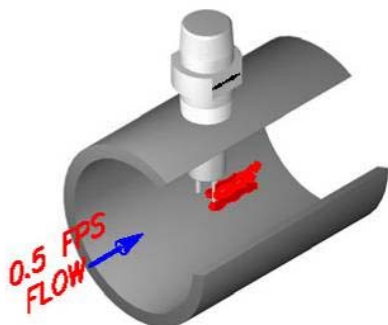
Most mass flow monitoring techniques calculate mass indirectly by measuring volumetric flow such as gallons per minute or cubic cm per second, then either measure density separately or calculate it from temperature measurements of the fluid and, finally, combine density and volumetric flow to obtain mass flow. The Sierra thermal-differential technique is one of two methods that directly measure the mass flow. For ease of comparison most flow applications are presented in terms of velocity which is independent of the flow cross sectional area (i.e. feet per second (FPS)). The true mass flow equivalent would be FPS multiplied by density but for simplicity FPS is used and density effects are ignored. This is normally not critical for flow switching applications.

When the sensor is inserted into a liquid or gas the heated RTD is strongly affected by the velocity of the medium. Flow past the heated RTD changes the heat transferred from the surface of the sensor. This cooling effect reduces the temperature of the sensor. The Innova-Switch™ compares this change to a preset flow trip point to switch the output. Figure 2B shows the model 615 signal change vs. flow rate for air, light hydrocarbon liquids, and water. The signal change vs velocity has the same general shape for all three media but the change is larger for air and the sensitive range is different for each. For air and most

gaseous media the range is 0.1 to 500 feet per second (FPS). For most liquid media the range is 0.01 to 5 FPS (Hydrocarbons) and 0.01 to 2.5 FPS (water). Appendices in section 9.0 contain flow conversion information to facilitate conversion from various units and pipe dimensions into flow velocity in feet per second.



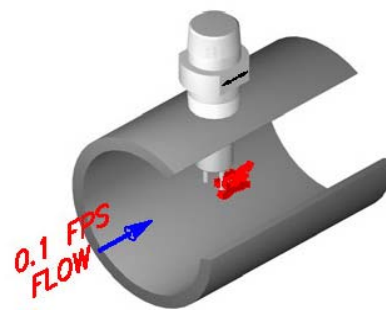
For a no flow condition the thermal differential between the two tips is high because of relatively low heat transfer.



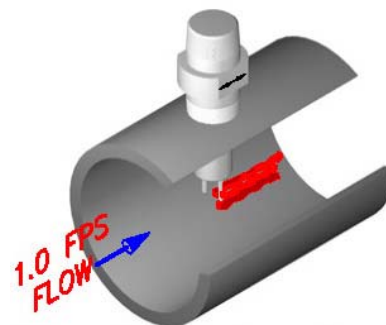
When the lower differential matches the customer select flow velocity trip point (set point) the switch relay and red LED are tripped.

### Gas Or Liquid Flow

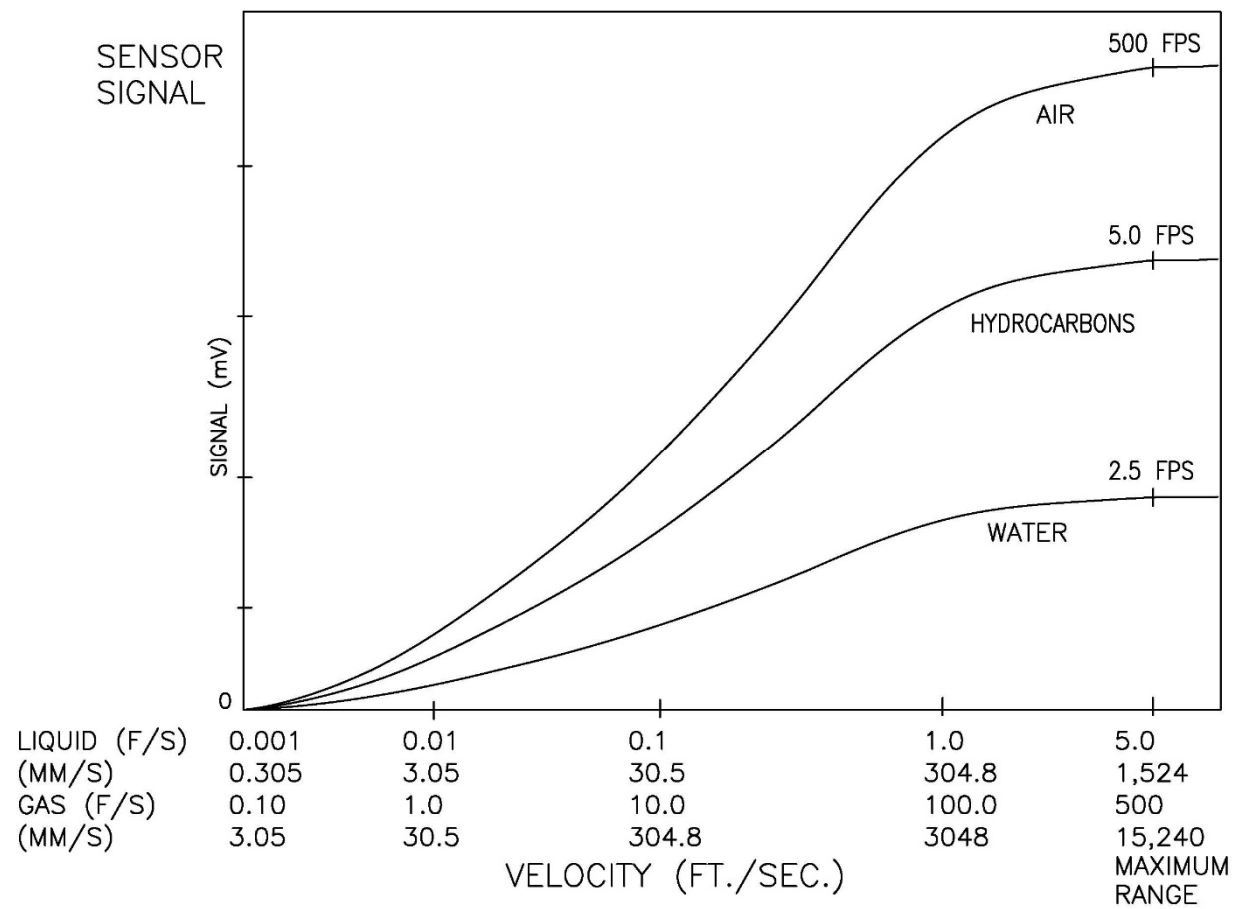
**Note:** The fluid velocity and heat absorption ability determine the differential between the tips. Their combination determines the measurable velocity. In water velocities from 0.01 to 2.5 FPS are measurable. In Hydrocarbons velocities from 0.01 to 5 FPS are measurable, whereas in air velocities of 0.1 to 500 FPS can be measured.



Flow across the tips decreases the thermal differential because of the higher heat transfer of flowing fluids. This differential is compared with the trip point.



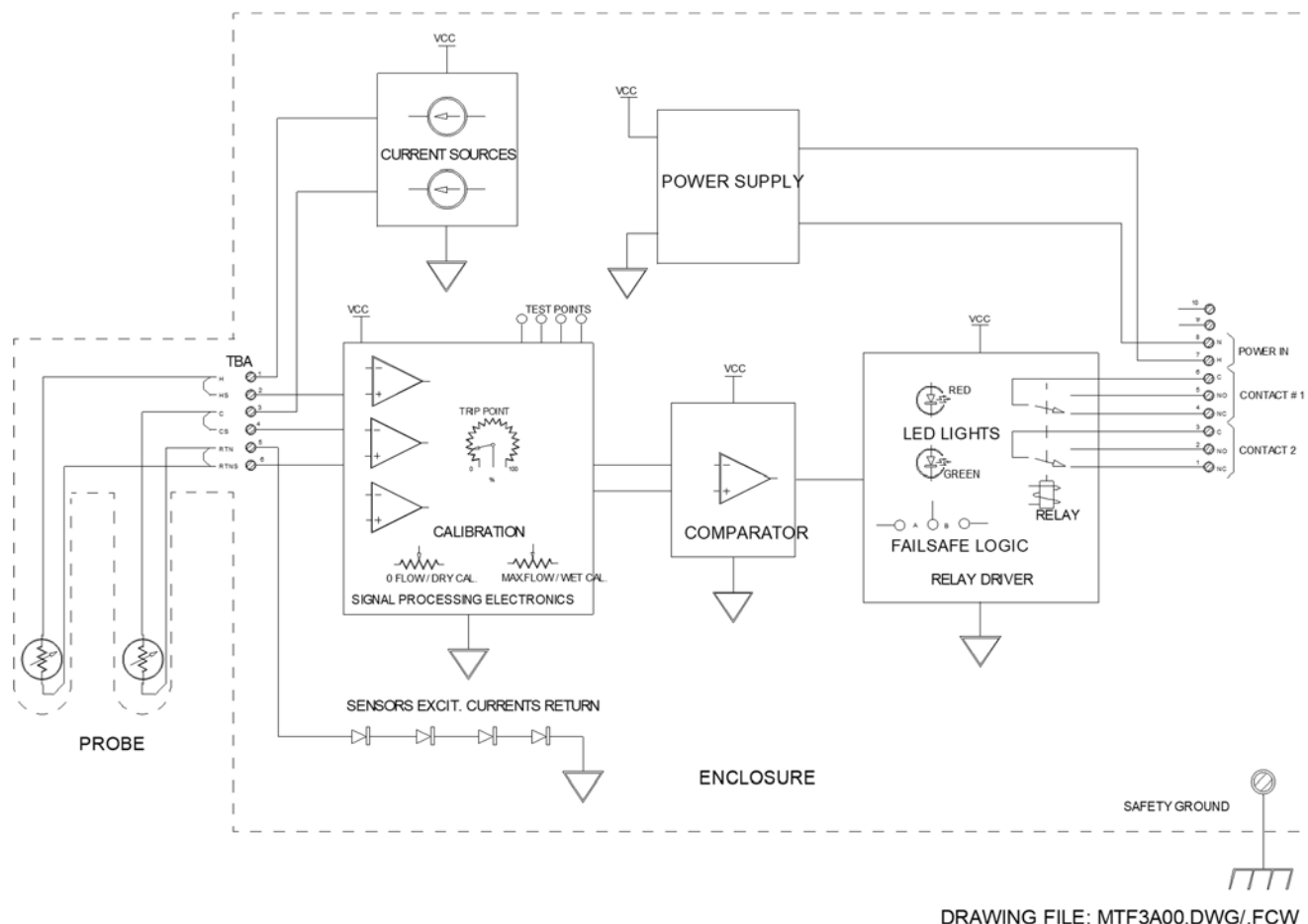
When flow is above the trip point the differential is smaller than at the set point and the relay and LED remain tripped.



**FIGURE 2B      INNOVA-SWITCH MODEL 615 FLOW RESPONSE FOR THREE MEDIA**

Figure 3.A shows a block diagram of the Innova-Switch™.

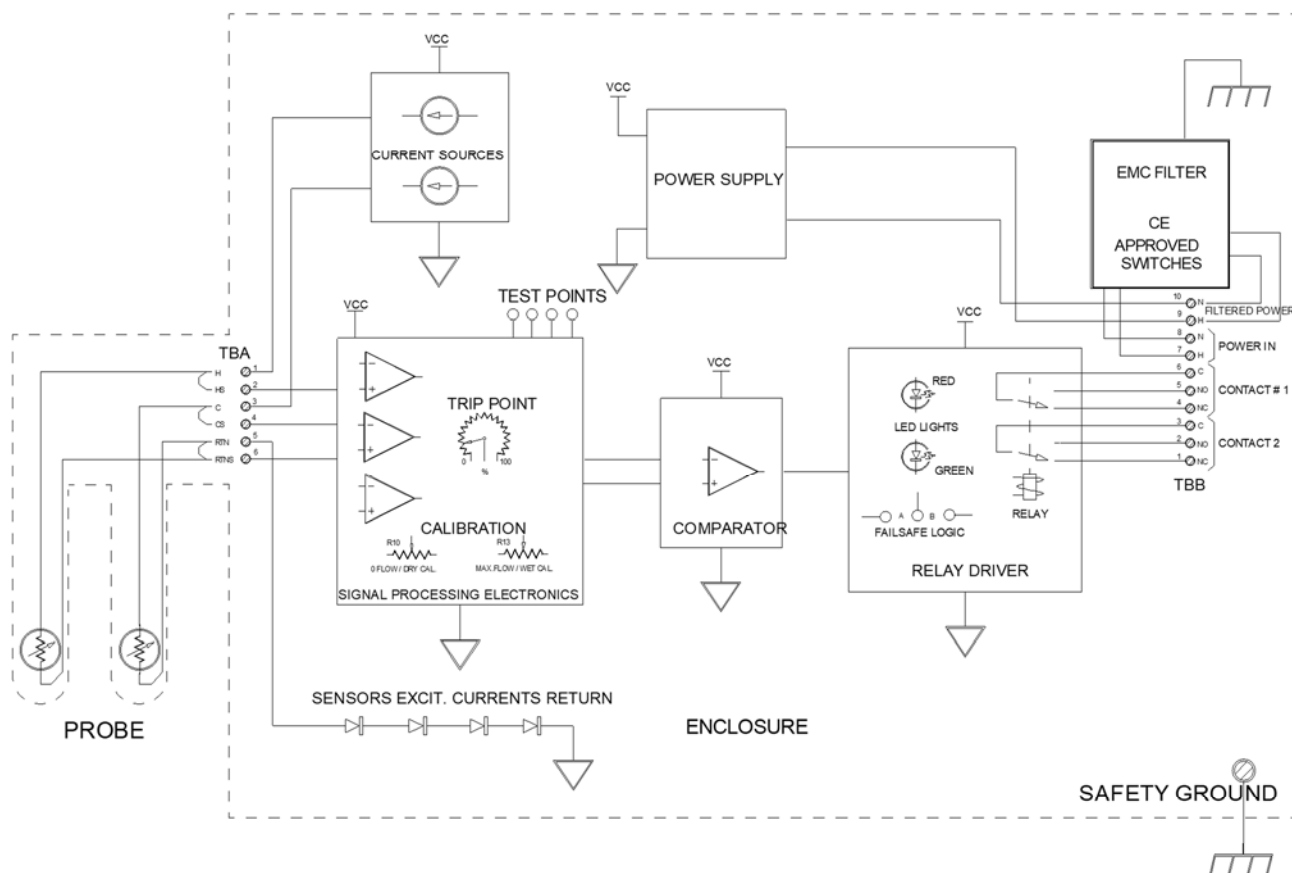
Once the switch is set to respond to the minimum and maximum flow rates (or wet vs. dry conditions), the trip point is set by adjusting the Trip Adjust Potentiometer. Solid state electronics transform the flow (or wetting) induced temperature differential into a voltage that is compared to a control voltage. Matching voltages cause actuation of a relay to indicate a change in state (flow vs. no-flow or dry vs. wet).



DRAWING FILE: MTF3A00.DWG/.FCW

FIGURE 3A: INNOVA-SWITCH SERIES BLOCK DIAGRAM  
MODELS LS32CS/FS42CS, LS32CN/FS42CN, LS32NX/FS42NX,  
AND LS32SK/FS42SK  
(MTF3A00.DWG/.FCW)

Figure 3B shows a block diagram of the Innova-Switch™ with the addition of an EMC filter required for the CE options (see section 7.0).

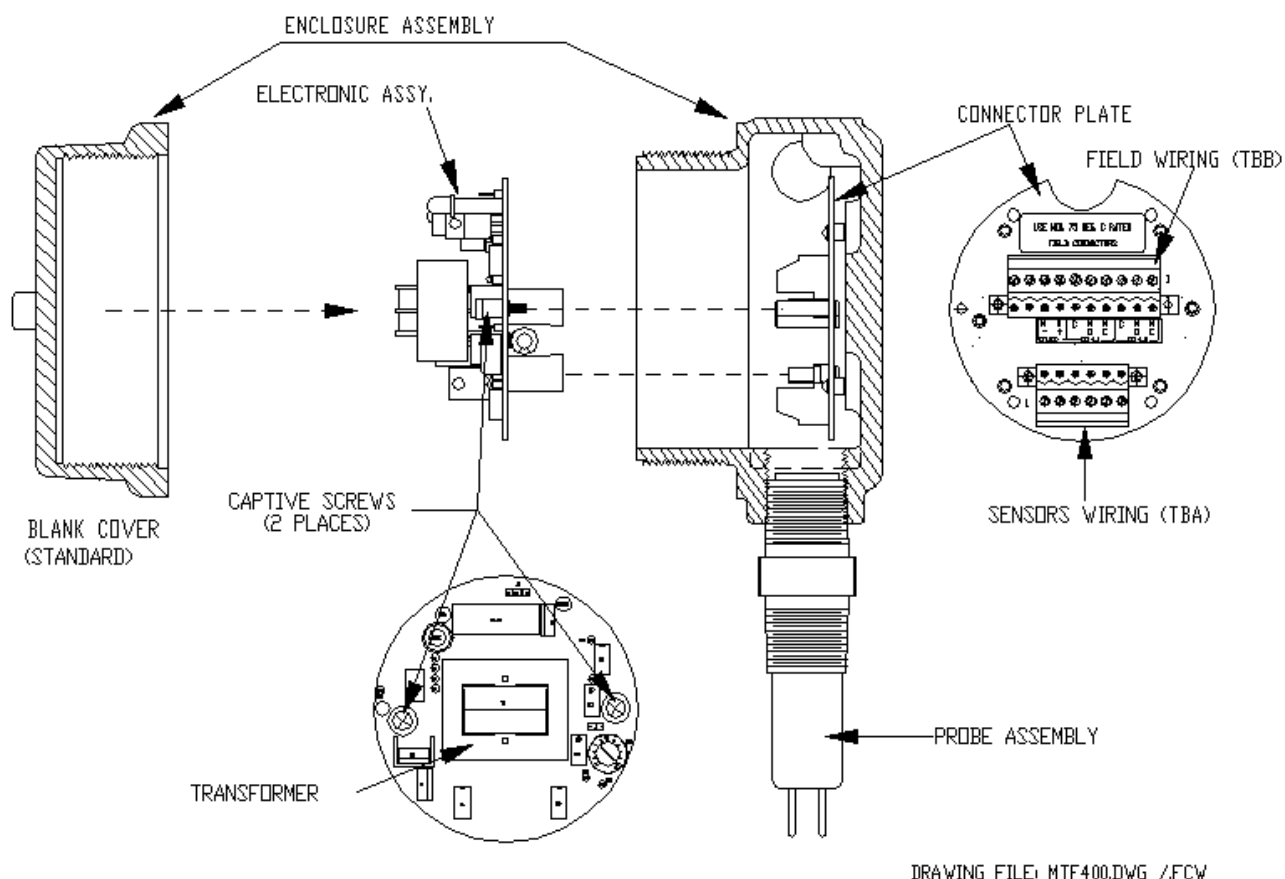


DRAWING FILE: MTF3B00.DWG

FIGURE 3B: INNOVA-SWITCH MODELS WITH THE CE OPTION SWITCH BLOCK DIAGRAM (MTF3B00.DWG)



The instrument enclosure at the top of unit contains the Innova-Switch™ electronics board which is removable to access the terminal block and facilitate field wiring (see Figure 4.0). For applications where the electronics must be located away from the sensors due to elevated process temperature, accessibility, etc., another instrument head containing the electronics is remotely located (See option RE-Remote Electronics section 3.2.2).



**FIGURE 4 INNOVA-SWITCH™ ASSEMBLY  
(MTF400.DWG/.FCW)**

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### 3.0 INSTALLATION

#### 3.1 MECHANICAL INSTALLATION

The standard Innova-Switch™ has a .75 inch (19.05mm) MNPT mount designed for easy installation through a threaded port. Optional configurations include .5" (12.7mm) or 1.0" (25.4mm) MNPT and flange mounts. Conduit is recommended for all wiring to the switch.

**\*IMPORTANT\***

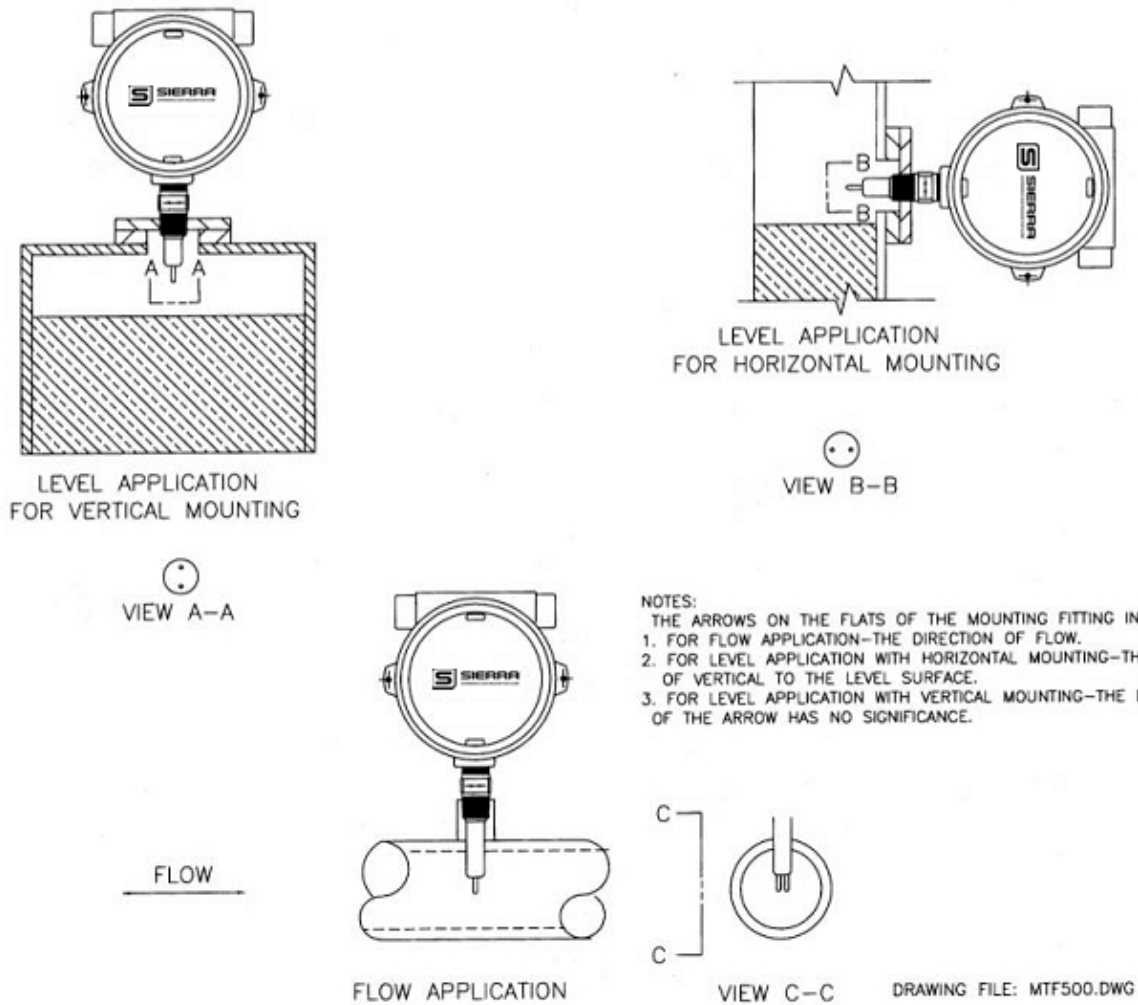
WHEN INSTALLING YOUR SIERRA INNOVA-SWITCH INTO A PIPE OR VESSEL USE A 1 1/8 INCH (28.575mm) OPEN-END OR ADJUSTABLE WRENCH TO TIGHTEN AT THE HEX FLATS OF THE MNPT OF A STANDARD SWITCH. (IF YOU HAVE A NON-STANDARD SWITCH AN ALTERNATE SIZE WRENCH MAY BE REQUIRED). DO NOT USE THE INSTRUMENT HEAD TO TIGHTEN THE SWITCH TO THE MOUNTING PORT. ROTATION OF THE INSTRUMENT HEAD WITH RESPECT TO THE SENSOR BODY CAN CAUSE INTERNAL WIRING DAMAGE.

**\*IMPORTANT\***

THE SWITCH BODY MUST BE ORIENTED TO HAVE THE TWIN SENSORS PROPERLY ORIENTED. DUE TO THE PIPE THREAD MOUNTING, IT MAY BE NECESSARY TO MAKE A TRIAL FIT, ADD OR REMOVE TEFLON TAPE OR OTHER PIPE THREAD SEALANT, AND REINSTALL TO ACHIEVE A SATISFACTORY SEAL WITH THE SENSORS PROPERLY ORIENTED. PROPER ORIENTATION IS MARKED ON THE SWITCH BODY FOR REFERENCE. SEE FIGURE 5.0 FOR DETAILS.

**\*IMPORTANT\***

FOR OPTIMUM PERFORMANCE OF THE INNOVA-SWITCH THERMAL FLOW SWITCH, THE RECOMMENDED LOCATION OF THE SENSOR SHOULD BE IN A STRAIGHT RUN, FREE OF OBSTRUCTION, FOR THEN (10) TIMES THE PIPE DIAMETER UPSTREAM OF THE SENSOR AND FIVE (5) TIMES THE PIPE DIAMETER DOWNSTREAM OF THE SENSOR.

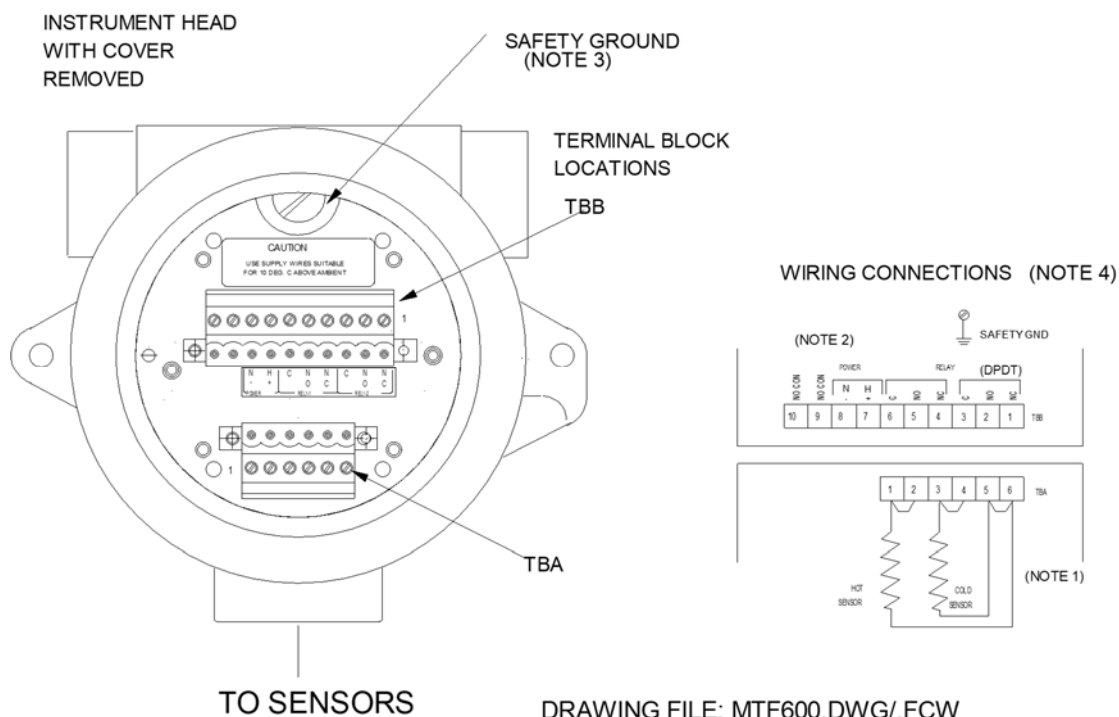


**FIGURE 5: PROPER ORIENTATION OF THE SENSOR PROBE FOR LEVEL AND FLOW APPLICATION IS INDICATED BY THE ARROW ON THE FLAT OF THE MOUNTING FITTING. (MTF500.DWG/FCW)**

## 3.2 ELECTRICAL INSTALLATION

### 3.2.1 LOCAL ELECTRONICS (LE OPTION/STANDARD)

Remove the instrument enclosure lid by unscrewing in a counter clockwise direction. Unscrew (CCW) the printed circuit board captive screws (See Figure 4.0 for locations). Remove the PC board by grasping the transformer and pulling it straight out. Connect power and alarm relay wiring to Terminal Block (TBB) as shown in Figure 6.0. Reinstall the Innova-Switch™ electronics and tighten the captive screws.



**FIGURE 6.0 INNOVA-SWITCH™ LOCAL ELECTRONICS FIELD WIRING DIAGRAM (MTF600FCW/.DWG)**

#### NOTES:

1. Connections to sensors terminal block A (TBA) are factory installed and should not be disconnected in the field. Note Jumpers 1-2, 3-4, and 5-6 must be in place on TBA for proper operation of local electronics.
2. For 24 VDC operation (factory prepared), connect +positive to TBB7 and –negative return to TBB8. For 110 VAC or 220 VAC connect hot to TBB7 and neutral to TBB8.
3. Connect ground wire to ground screw located in or on the instrument enclosure.
4. Use supply wires suitable for 10 Degrees C above ambient.

#### **\*IMPORTANT\***

**A GROUND WIRE MUST BE ATTACHED TO THE GROUND SCREW LOCATED INSIDE OR OUTSIDE OF THE INSTRUMENT ENCLOSURE FOR PROPER OPERATION.**

### 3.2.2 REMOTE ELECTRONICS (RE OPTION)

For the remote electronics option, mount the remote instrument head using two mounting wings or bracket provided. Connect the switch wiring between the Innova-Switch™ remote electronics as shown in Figure 7.0. Connect power wiring and alarm relay wiring to the remote enclosure as shown in Figure 7.0. Upon completion of wiring reinstall the Innova-Switch™ electronics and secure with the captive screws.


**\*IMPORTANT\***


**BE SURE TO APPLY THE PROPER VOLTAGE AS CONFIGURED AT THE FACTORY. DO NOT APPLY 110 VAC TO 24 VDC VERSIONS OR 24 VDC TO 110 VAC VERSIONS (LIKEWISE 220 VAC). NOTE THAT ALL VOLTAGES ARE NOMINAL.**


**SPECIAL NOTICE**

The electronic assemblies contained in the microtuf® models are configured for specific voltages and have specific modifications to accommodate the various agency approvals. When ordering spare electronics, replacements, or exchanges in the field please ensure you identify the specific configuration you have by noting the boxes marked on the transformer configuration tag and the serial number.

PN 200203

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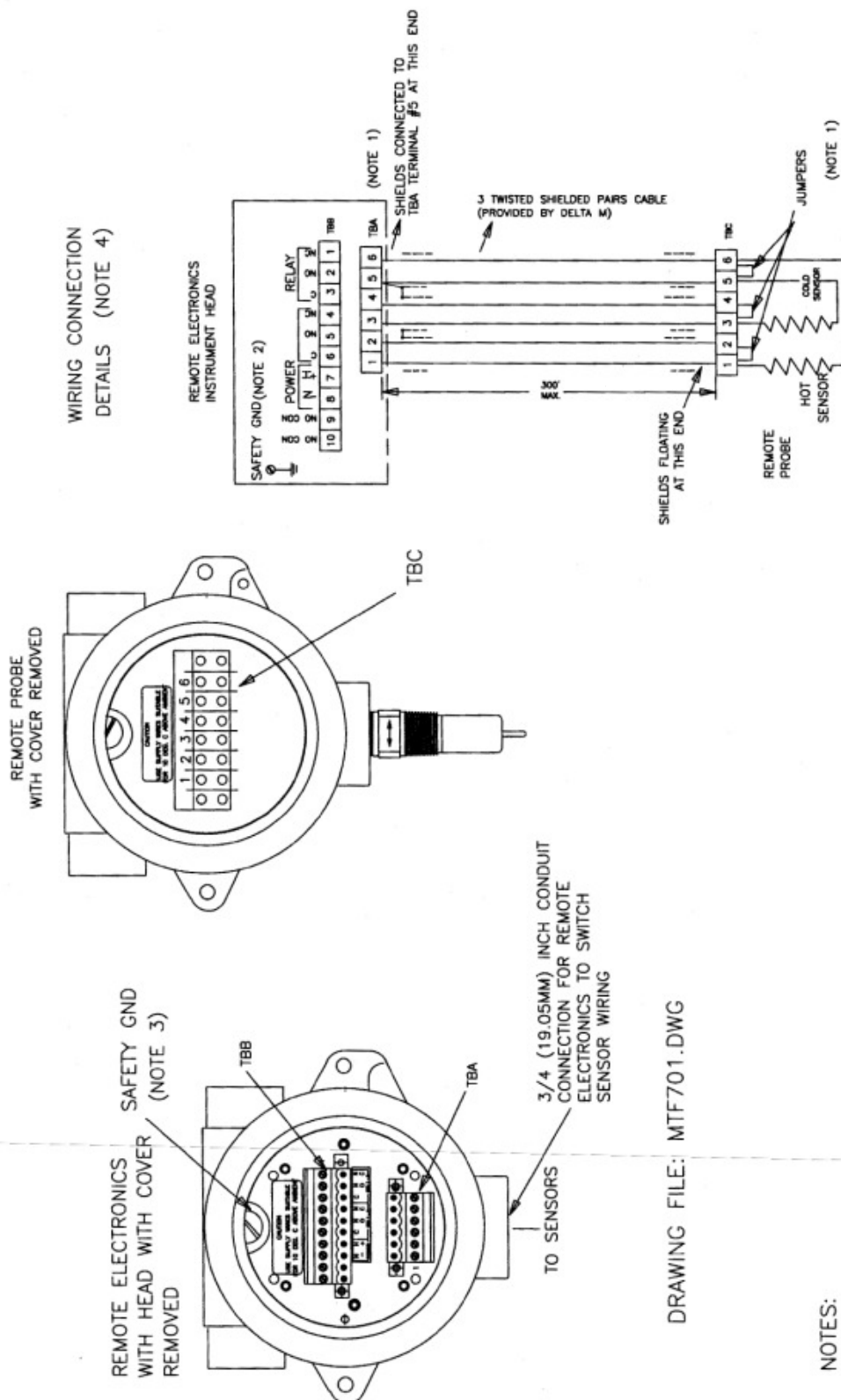
24 VAC ☐

24 VDC ☐

220 VAC ☐

110 VAC ☐

SN



NOTES:

1. JUMPER WIRES 1-2, 3-4, AND 5-6 MUST BE IN PLACE ON TBC IN THE REMOTE PROBE FOR PROPER OPERATION OF THE REMOTED ELECTRONICS.
2. FOR 24VDC OPERATION (FACTORY PREPARED), CONNECT + POSITIVE TO TBB7 AND - NEGATIVE RETURN TO TBB8. FOR 115VAC OR 230 VAC CONNECT HOT TO TBB7 AND NEUTRAL TO TBB8.
3. CONNECT GROUND WIRE TO GROUND SCREW LOCATED IN OR ON THE INSTRUMENT ENCLOSURE.
4. USE SUPPLY WIRES SUITABLE FOR 10 DEGREE C ABOVE AMBIENT.

**FIGURE 7A INNOVA-SWITCH™ REMOTE ELECTRONICS OPTION FIELD WIRING DIAGRAM (MTF701.DWG/.FCW)**

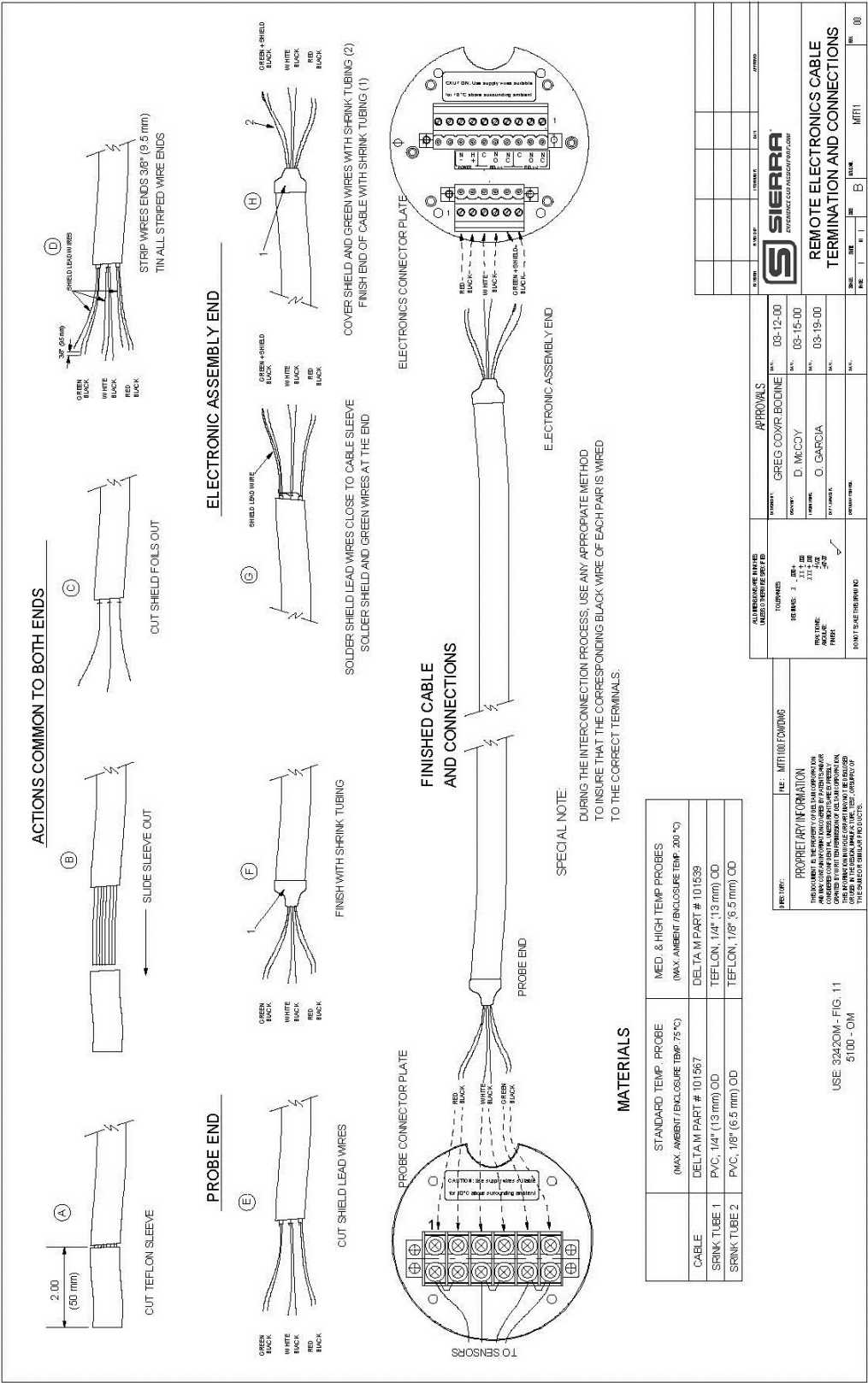
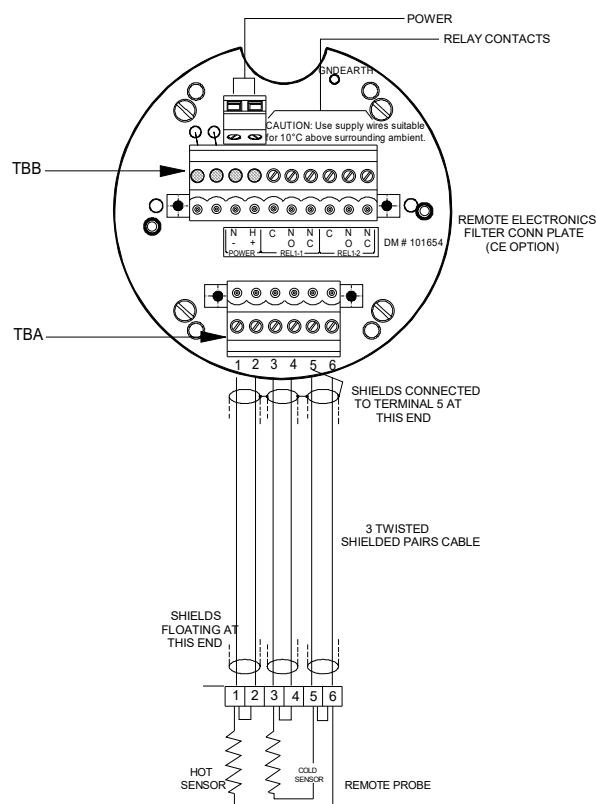


FIGURE 7B INNOVA-SWITCH REMOTE ELECTRONICS CABLE TERMINATION AND CONNECTIONS



### 3.2.3 CE OPTION FILTER BOARD CONNECTOR PLATE WIRING (CE OPTION)

Remove the instrument enclosure lid by unscrewing in a counter clockwise direction. Unscrew (CCW) the printed circuit board captive screws (See Figure 4.0 for locations). Remove the PC board by grasping the transformer and pulling it straight out. Connect power and alarm relay wiring to Power Block as shown in Figure 6A. Reinstall the Innova-Switch™ electronics and tighten the captive screws.



**FIGURE 6A INNOVA-SWITCH™ REMOTE ELECTRONICS FIELD WIRING DIAGRAM (MTF6A00FCW/.DWG)**

**NOTES:**

1. Connections to sensors terminal block A (TBA) are factory installed and should not be disconnected in the field. Note Jumpers 1-2, 3-4, and 5-6 must be in place on TBA for proper operation of local electronics.
2. For 24 VDC operation (factory prepared), connect +positive to TBB7 and –negative return to TBB8. For 110 VAC or 220 VAC connect hot to TBB7 and neutral to TBB8.
3. Connect ground wire to ground screw located in or on the instrument enclosure.
4. Use supply wires suitable for 10 Degree C above ambient.

**\*IMPORTANT\***

**A GROUND WIRE MUST BE ATTACHED TO THE GROUND SCREW LOCATED INSIDE OR OUTSIDE OF THE INSTRUMENT ENCLOSURE FOR PROPER OPERATION.**

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## 4.0 OPERATION AND CALIBRATION OF THE INNOVA- SWITCH™ MODEL 615 FOR FLOW APPLICATIONS

### 4.1 Pre-Operational Check

With the switch installed and process conditions at no-flow, the following procedure can be used to verify preliminary operation.

- 4.1.1 Remove the instrument enclosure cover by turning counter clockwise (ccw) to expose the Innova-Switch™ electronics.
- 4.1.2 Turn on power at its source.
- 4.1.3 Observe that either the red or green LED comes on.
- 4.1.4 If neither lamp illuminates refer to the trouble shooting Section, 6.2.

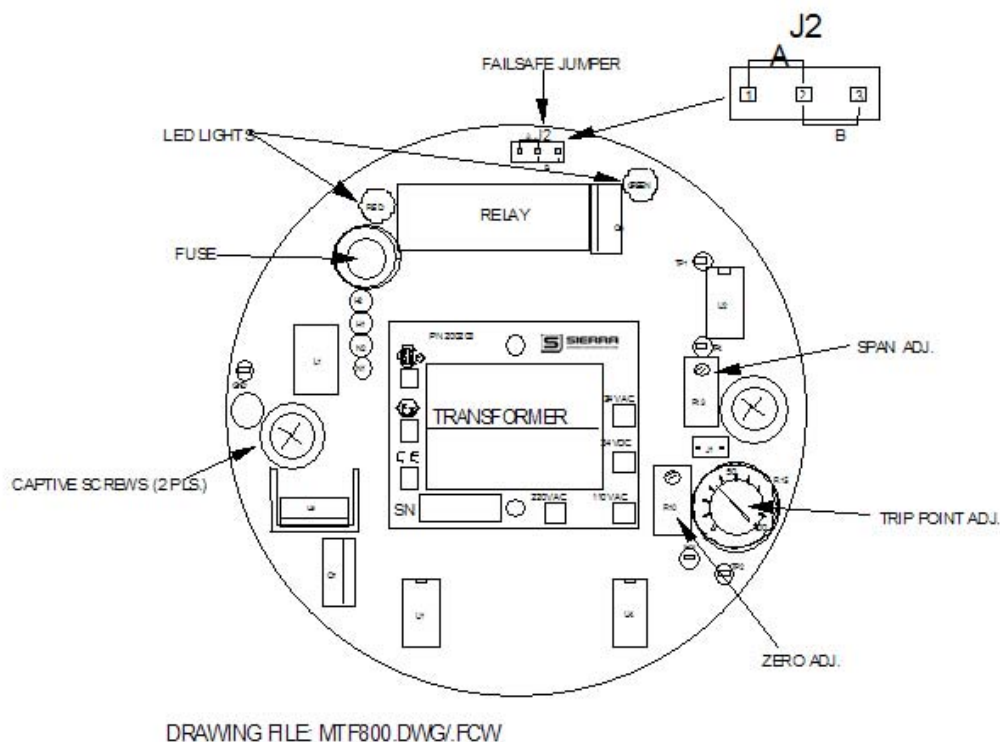
### 4.2 L.E.D. and Relay Status Logic (Fail-safe)

- 4.2.1 The L.E.D.s (Red; Green) are an indication of the sensors status (ie. flow below the setpoint or flow above the set point) and are not affected by the position of the failsafe jumper J-2. The failsafe jumper J-2 changes the relay activation status allowing the user to select the failsafe power off condition most appropriate to the application. Refer to the tables below that show the logic conditions between the sensors, L.E.D. lights, relay coil and contacts for each position of the failsafe jumper J-2.

#### 4.2.2 Normal Operation (as set at factory)

The switch comes configured from the factory with the following operation with the J-2 jumper in the B(2-3) position. (Refer to Figure 8.0.)

SENSOR STATUS	RED LED	GREEN LED	RELAY COIL STATUS	RELAY CONTACT STATUS
No Flow or Flow Below Set Point	ON	OFF	Activated	<div> <div>o NC</div> <div>o NO</div> </div>
Flow or Flow Above Set Point	OFF	ON	Deactivated	<div> <div>o NC</div> <div>o NO</div> </div>

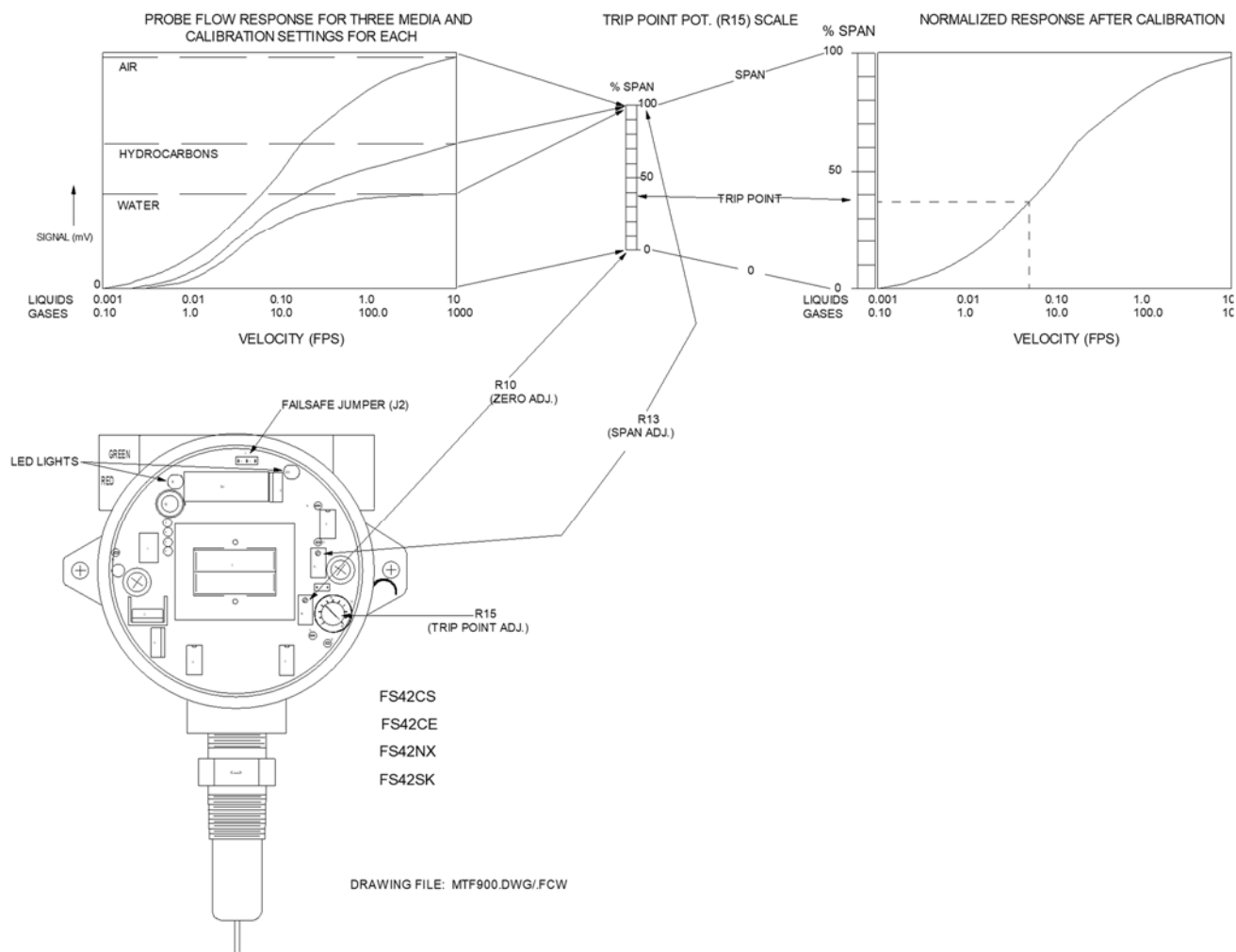


**FIGURE 8.0 INNOVA-SWITCH™ ELECTRONICS  
(MTF800.FCW/.DWG)**

#### 4.2.3 Alternate Operation (Field Selectable)

The relay logic may be reversed by moving the J-2 jumper to position A(1-2). (Refer to Figure 8.0.)

SENSOR STATUS	RED LED	GREEN LED	RELAY COIL STATUS	RELAY CONTACT STATUS
No Flow or Flow Below Set Point	ON	OFF	Deactivated	<div> <div>o NC</div> <div>o NO</div> </div>
Flow or Flow Above Set Point	OFF	ON	Activated	<div> <div>o NC</div> <div>o NO</div> </div>



**FIGURE 9.0 INNOVA-SWITCH MODEL 615 FLOW SWITCH  
CALIBRATION REFERENCE DRAWING  
(MTF900.DWG.FCW)**

## 4.3 CALIBRATION – FLOW

**\*\*IMPORTANT\*\***

**FOR OPTIMUM OPERATION, CALIBRATION MUST BE ACCOMPLISHED AT ACTUAL PROCESS TEMPERATURE AND PRESSURE CONDITIONS IN GASES AND AT ACTUAL PROCESS TEMPERATURE CONDITIONS IN LIQUIDS.**

See Figures 8.0 and 9.0 for location of potentiometers and LEDS on electronics PCB.

### 4.3.1 CALIBRATION PROCEDURE FOR FLOW SWITCHES

1. Remove the instrument enclosure lid by turning ccw.
2. Apply power to FS4200. **Allow 10 minute warm-up.**
3. Ensure that the pipeline is filled with fluid and at no or minimum flow.
4. Set the trip adjust pot to zero fully counterclockwise (fully ccw).
5. Adjust the zero adjust pot so that the Red LED just does illuminate. This is a 25 turn pot. If the Green LED is on, turn the pot ccw. If the Red LED is on, turn the pot clockwise (cw).
6. Toggle the zero adjust pot back and forth until the switching point is well defined. Leave the Red LED illuminated.
7. Adjust the liquid or gas flow to maximum velocity. Insure that the flow is homogenous, constant and free of bubbles if a liquid.

**\*\*NOTE\*\***

The flow rate (maximum) should be at least 5 fps (Hydrocarbons), 2.5 fps (water), or 500 fps (gas/air) if possible for best calibration. It is possible to achieve a 5 fps set point in water if a span of 7 fps can be achieved.



TO ENSURE ACCURATE CALIBRATION AND AVOID SET POINT DRIFT, IT IS IMPERATIVE THAT A MINIMUM OF **10 MINUTE WAIT** BE OBSERVED AFTER POWER IS APPLIED TO ALLOW THE SENSOR TO WARM-UP TO THE AMBIENT FLUID TEMPERATURE.

LIKewise, WHEN ADJUSTING THE ZERO, SPAN, AND SET POINT POTS, A **MINIMUM OF 30 SECONDS** SHOULD BE OBSERVED TO ALLOW FOR STABILIZATION OF TEMPERATURE.

8. Set the trip adjust pot to 100 (fully cw).
9. Adjust the span adjust pot so that the Green LED just does illuminate. This is a 25 turn pot. If the Green LED is on, turn the pot cw. If the Red LED is on, turn the pot ccw.
10. Toggle the span adjust pot back and forth until the switching point is well defined. Leave the Green LED illuminated.
11. If the switch is to be used for flow - no flow, set the trip adjust pot to 50 and go to step 14. (Note: This adjustment can be set for tripping points between 10% and 90% of the span from no flow to max flow).
12. A more exact flow rate setting may be made by establishing the flow at the desired rate with a separate flow meter and proceeding to step 13, to establish the trip point.

13. Adjust the trip adjust pot to obtain a trip as exhibited by an LED illumination. If a trip on decreasing flow is desired set for Red LED illumination. If a trip on increasing flow is desired set for Green LED illumination.
14. Verify that the switch will reset by returning the actual product flow to the maximum or minimum flow rates.

## 5.0 OPERATION AND CALIBRATION OF THE INNOVA-SWITCH™ 615 SERIES SWITCH FOR POINT LEVEL APPLICATIONS

### 5.1 PRE-OPERATIONAL CHECK

The switch is installed **and the product level is below sensor level (dry)**, the following procedure can be used to verify preliminary operation.

1. Remove the instrument enclosure cover by turning counter clockwise to expose the LS3200 Switch electronics.
2. Turn on power at its source.
3. Observe that either the red or green LED comes on.
4. If neither lamp illuminates refer to the trouble shooting Section, 6.2.

### 5.2 L.E.D. AND RELAY STATUS LOGIC (FAIL-SAFE)

- 5.2.1 The L.E.D.s (Red and Green) are an indication of the sensors status (ie. dry or wet) and are not affected by the position of the fail-safe jumper J-2. The fail-safe jumper J-2 changes the relay activation status allowing the user to select the fail-safe power off condition most appropriate to the application. Refer to the tables below that show the logic conditions between the sensors, L.E.D. lights, relay coil and contacts for each position of the fail-safe jumper J-2.

#### 5.2.2 NORMAL OPERATION (AS SET AT FACTORY)

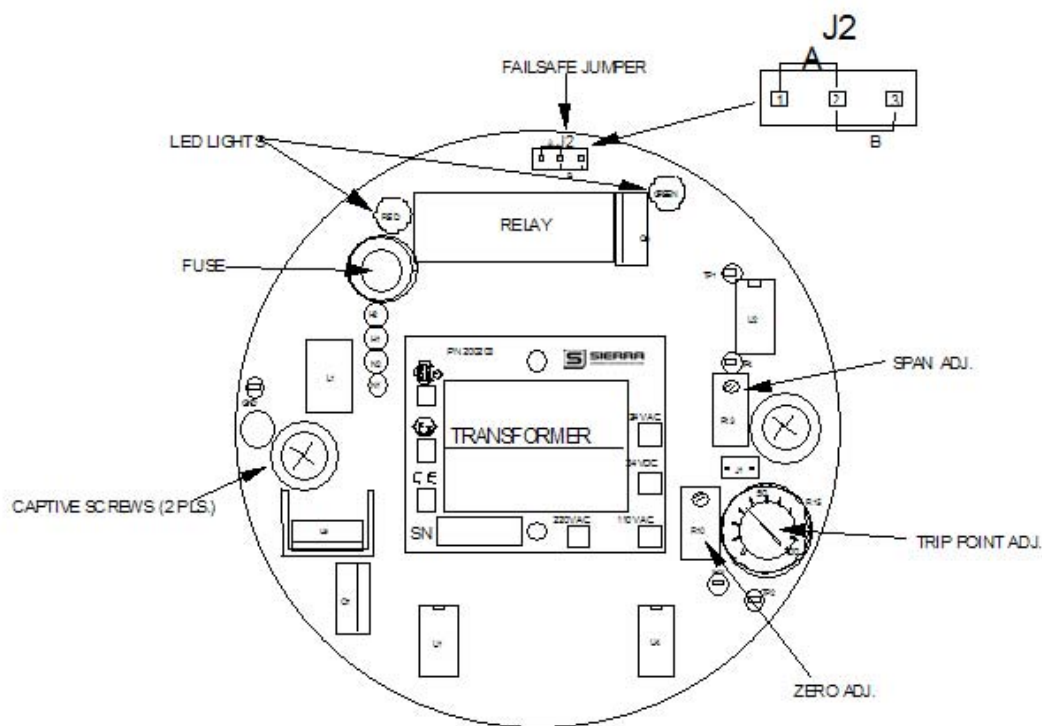
The switch comes configured from the factory with the following operation with the J-2 jumper in the B (2-3) position. (Refer to Figure 8.0.)

SENSOR STATUS	RED LED	GREEN LED	RELAY COIL STATUS	RELAY CONTACT STATUS
Dry, or Lower Thermal Dispersion Fluid (ie. hydrocarbons)	ON	OFF	Activated	<div> <div>o NC</div> <div>o NO</div> </div>
Wet, or Higher Thermal Dispersion Fluid (ie. water)	OFF	ON	Deactivated	<div> <div>o NC</div> <div>o NO</div> </div>

### 5.2.3 ALTERNATE OPERATION (FIELD SELECTABLE)

The relay logic may be reversed by moving the J-2 jumper to position A(1-2). (Refer to Figure 8.0.)

SENSOR STATUS	RED LED	GREEN LED	RELAY COIL STATUS	RELAY CONTACT STATUS
Dry, or Lower Thermal Dispersion Fluid (ie. hydrocarbons)	ON	OFF	Deactivated	<ul style="list-style-type: none"> <li>o NC</li> <li>o NO</li> </ul>
Wet, or Higher Thermal Dispersion Fluid (ie. water)	OFF	ON	Activated	<ul style="list-style-type: none"> <li>o NC</li> <li>o NO</li> </ul>



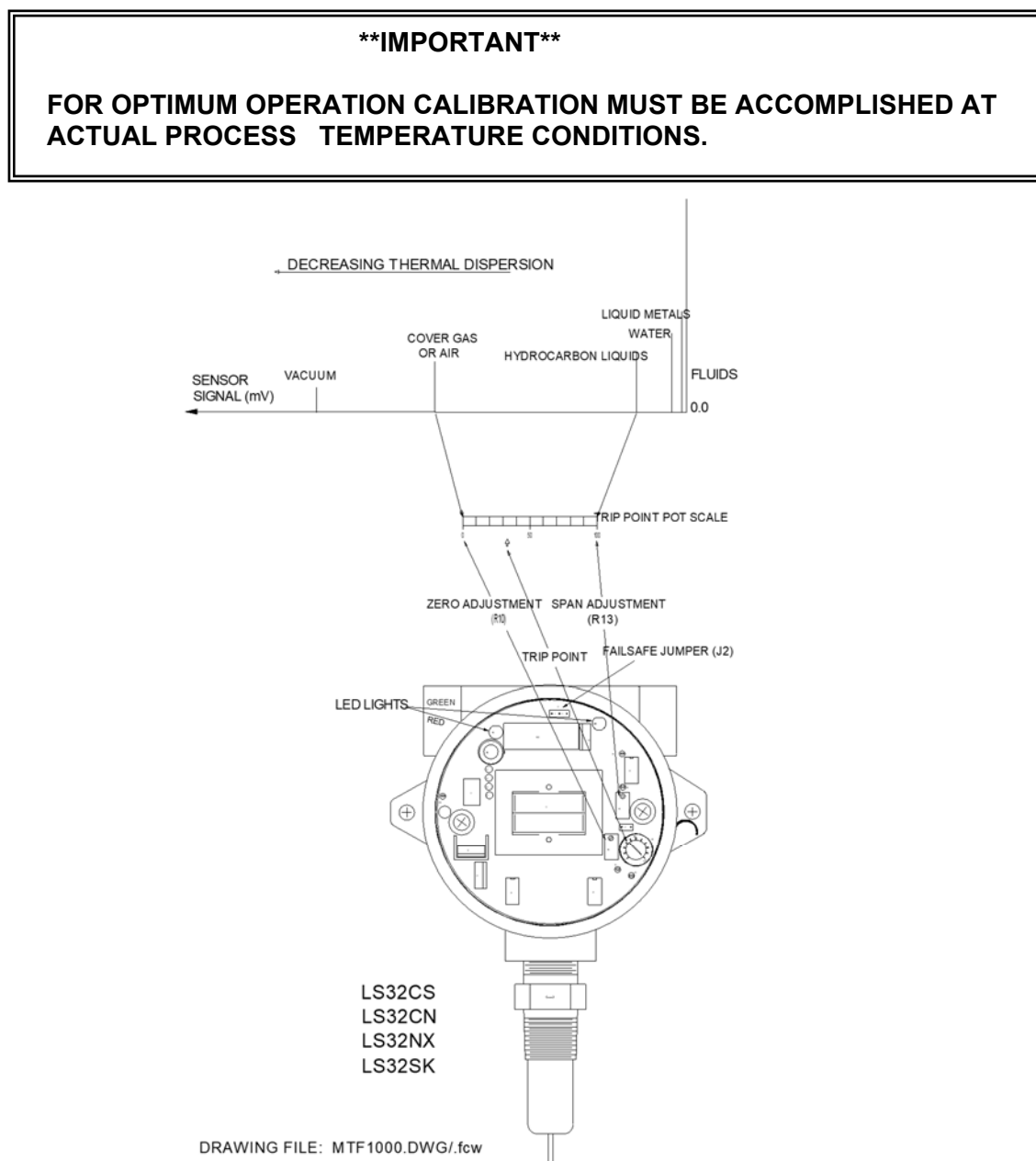
DRAWING FILE: MTF800.DWG/.FCW

FIGURE 8.0

**INNOVA-SWITCH™ ELECTRONICS**  
(MTF800.FCW/.DWG)



### 5.3 CALIBRATION – LEVEL



**FIGURE 10.0 INNOVA-SWITCH MODEL 615 POINT LEVEL SWITCH CALIBRATION  
REFERENCE DRAWING  
(MTF1000.DWG/.FCW)**

### 5.3 CALIBRATION - LEVEL

Using Figure 10.0 as a location guide adjust the system as follows:

1. Remove the instrument enclosure lid by turning ccw.
2. Apply power to the unit. **Allow 10 minute warm-up.**
3. For optimum calibration results, wet sensor and drain but do not dry.
4. Ensure that the tank liquid level is below the probe sensor tips.
5. Set the trip adjust pot to zero, fully counterclockwise (fully ccw).

TO ENSURE ACCURATE CALIBRATION AND AVOID SET POINT DRIFT, IT IS IMPERATIVE THAT A MINIMUM OF **10 MINUTE WAIT** BE OBSERVED AFTER POWER IS APPLIED TO ALLOW THE SENSOR TO WARM-UP TO THE AMBIENT FLUID TEMPERATURE.

LIKewise, WHEN ADJUSTING THE ZERO, SPAN, AND SET POINT POTS, A **MINIMUM OF 30 SECONDS** SHOULD BE OBSERVED TO ALLOW FOR STABILIZATION OF TEMPERATURE.

6. Adjust the zero adjust pot so that the Red LED just does illuminate. This is a 25 turn pot. If the green LED is on, turn the pot counterclockwise (ccw). If red LED is on, turn the pot clockwise (cw).
7. Toggle the zero adjust pot back and forth until the switching point is well defined. Leave the Red LED illuminated.
8. Raise the level of the liquid to be detected until the probe/sensor tips are submerged and wet (covered).
9. Set the trip adjust pot to 100 (fully cw).
10. Adjust the span adjust pot so that the Green LED just does illuminate. This is a 25 turn pot. If the Green LED is on, turn the pot cw. If the Red LED is on, turn the pot ccw.
11. Toggle the span adjust pot back and forth until the switching point is well defined. Leave the green LED illuminated.
12. Adjust the trip adjust pot to 80 and the calibration is complete. Setting this pot to 80 gives an approximate equal trip time from wet to dry and from dry to wet. Setting this pot closer to zero will speed up dry to wet trip time and slow down wet to dry trip time. Setting this pot closer to 100 will slow down the dry to wet trip time and speed up wet to dry trip time.

## 6.0 MAINTENANCE AND TROUBLE SHOOTING

### 6.1 CLEANING

The switch can be cleaned by soaking, spraying solvents or detergent-and-water onto the sensor tubes, or by ultrasonic cleaning.

Lime deposits can be safely removed by soaking in 20% hydrochloric acid. Warming to 150°F is permissible to speed this process. The acid must be thoroughly rinsed off once cleaned.

For unusual cleaning problems, call Sierra and determine the exact materials of construction and chemical compatibility before using strong acids or unusual cleansers.

**\*\*IMPORTANT\*\***

**DO NOT SANDBLAST OR ABRASIVE CLEAN THE SENSING PROBES.  
THE SENSING PROBES COULD BE DAMAGED BY ABRASIVES.**

### 6.2 Trouble Shooting

#### 6.2.1 Power and Continuity Verification

1. Turn power off to the Innova-Switch™.
2. Remove the instrument enclosure cover (ccw).
3. Loosen the two PC captive screws (see Figure 4.0 for location).
4. Unplug the PC board from the instrument enclosure by pulling straight out on the transformer.
5. Reapply power and verify correct voltage at pins 7 (positive for DC) and 8 (negative for DC) of TBB (see Figures 6.0 or 7.0).
6. If voltage is correct, verify the fuse (F1) on the PC board is not blown (See Figure 8.0). If fuse is not blown proceed to 6.2.2.
7. If fuse is blown replace with appropriate value (See 7.0 Specification).

### 6.2.2 SENSOR/ELECTRONICS FUNCTIONALITY VERIFICATION

1. Turn power off to Innova-Switch™.
2. Allow a 5 minute cool down.
3. Measure the resistance of each RTD at pins 1 and 6 of TBA (see Figure 6.0 or 7.0) for the hot RTD and pins 3 and 5 of TBA for the cold RTD. These resistances should be  $110 \pm 10$  ohms (with sensors at approximately 70°F) and within 5% of each other in value.
4. Measure the insulation resistance between pin 1 of TBA and the case of the Innova-Switch™. It should be greater than 20 megohms.
5. If the Innova-Switch™ sensor assembly resistances are not as specified above, the switch sensor assembly must be replaced.
5. If the Innova-Switch™ sensor assembly resistances are as specified, the Innova-Switch™ PC electronic board must be replaced.

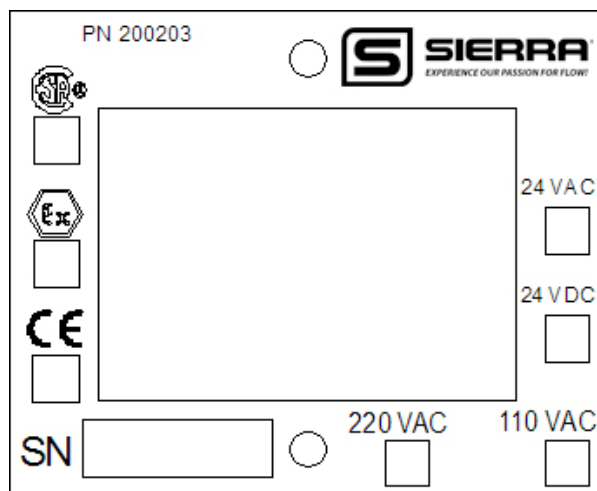
### 6.2.3 SET POINT DRIFT

TO ENSURE ACCURATE CALIBRATION AND AVOID SET POINT DRIFT, IT IS IMPERATIVE THAT A MINIMUM OF **10 MINUTE WAIT** BE OBSERVED AFTER POWER IS APPLIED TO ALLOW THE SENSOR TO WARM-UP TO THE AMBIENT FLUID TEMPERATURE.

LIKEWISE, WHEN ADJUSTING THE ZERO, SPAN, AND SET POINT POTS, A **MINIMUM OF 30 SECONDS** SHOULD BE OBSERVED TO ALLOW FOR STABILIZATION OF TEMPERATURE.

### SPECIAL NOTICE

The electronic assemblies contained in the Innova-Switch™ models are configured for specific voltages and have specific modifications to accommodate the various agency approvals. When ordering spare electronics, replacements, or exchanges in the field please ensure you identify the specific configuration you have by noting the boxes marked on the transformer configuration tag.



## 7.0 SPECIFICATIONS

TYPE:	Thermal Differential-Dual RTD Sensors		
PROCESS CONNECTIONS:	0.75" (19.05mm) MNPT Standard, 0.5"(12.7mm), 1" (25.4mm) MNPT, and various flanges optional.		
INSERTION LENGTH:	Two inch (50.8mm) Standard, (shorter 0.5 inch (12.7mm) and longer to 120 inch (3048mm) optional).		
CONSTRUCTION MATERIALS:	Wetted parts are 316L SS welded construction (alternate materials for corrosive environments available as options. Consult factory.)		
AGENCY INSTRUMENT RATINGS:	CSA Explosion Proof: (CS series) T4A Class I, Group B, C, and D Class II, Group E, F, and G CENELEC/Explosion Proof (CN Series): EEx d IIC T4(Akron Electric Enclosure) EEx d IIB T4(Killark Enclosure) CE: EMC Directive: 89/336/EEC (CE Option)		
OPERATING TEMPERATURE:	Process: -70°C to + 200°C (-100°F to +390°F) standard (to + 600°C (+1000°F) optional) Electronics: -40°C to +60°C (-40°F to +140°F)		
PRESSURE RATED:	To 3000 psig (20.4 MPa)		
RANGE	Gaseous Mass Flow: 0.1 to 500 fps Liquid Mass Flow: 0.01 to 5 fps (Hydrocarbons) 2.5 fps (water)		
REPEATABILITY:	± 1% of Set Point or ± 1/32 inch (±.8mm)		
TIME RESPONSE:	0.5 to 10 seconds no-flow (dry) to flow (wet) and 2 to 60 seconds flow (wet) to no-flow (dry) (application dependent)		
INPUT POWER:	110 Vac, 50/60HZ standard. (220 Vac, 50/60HZ, 24 Vdc, or 24 Vac optional); 3.1w. maximum.		
FUSE REQUIREMENTS (F1):		<u>SIERRA PART NO.</u> <u>CSA/FM</u>	<u>CENELEC</u>
	110 Vac: 1/4 amp	101603	101605
	220 Vac: 1/4 amp	101603	101605
	24 Vdc: 1/4 amp	101603	101605
OUTPUT:	5A, 250 VAC, DPDT Standard (Optional 10A, 250 Vac SPDT) 5A 30 VDC		
STABILITY:	Temperature compensated over entire range.		

## 8.0 WARRANTY AND SERVICE

### **LIMITED WARRANTY POLICY- REGISTER ONLINE**

Sierra's Innova-Switch™ Flow Level Switches are warranted to be free from defects in material and workmanship and will be repaired or replaced at no charge to Buyer, provided return or rejection of product is made within a reasonable period but no longer than two (2) years for calibration and non-calibration defects, from date of delivery. To assure warranty service, customers must register their products online on Sierra's website. Online registration of all of your Sierra products is required for our warranty process. Register now at [www.sierrainstruments.com/register](http://www.sierrainstruments.com/register). Learn more about Sierra's warranty policy at [www.sierrainstruments.com/warranty](http://www.sierrainstruments.com/warranty).

## 9.0 APPENDIX

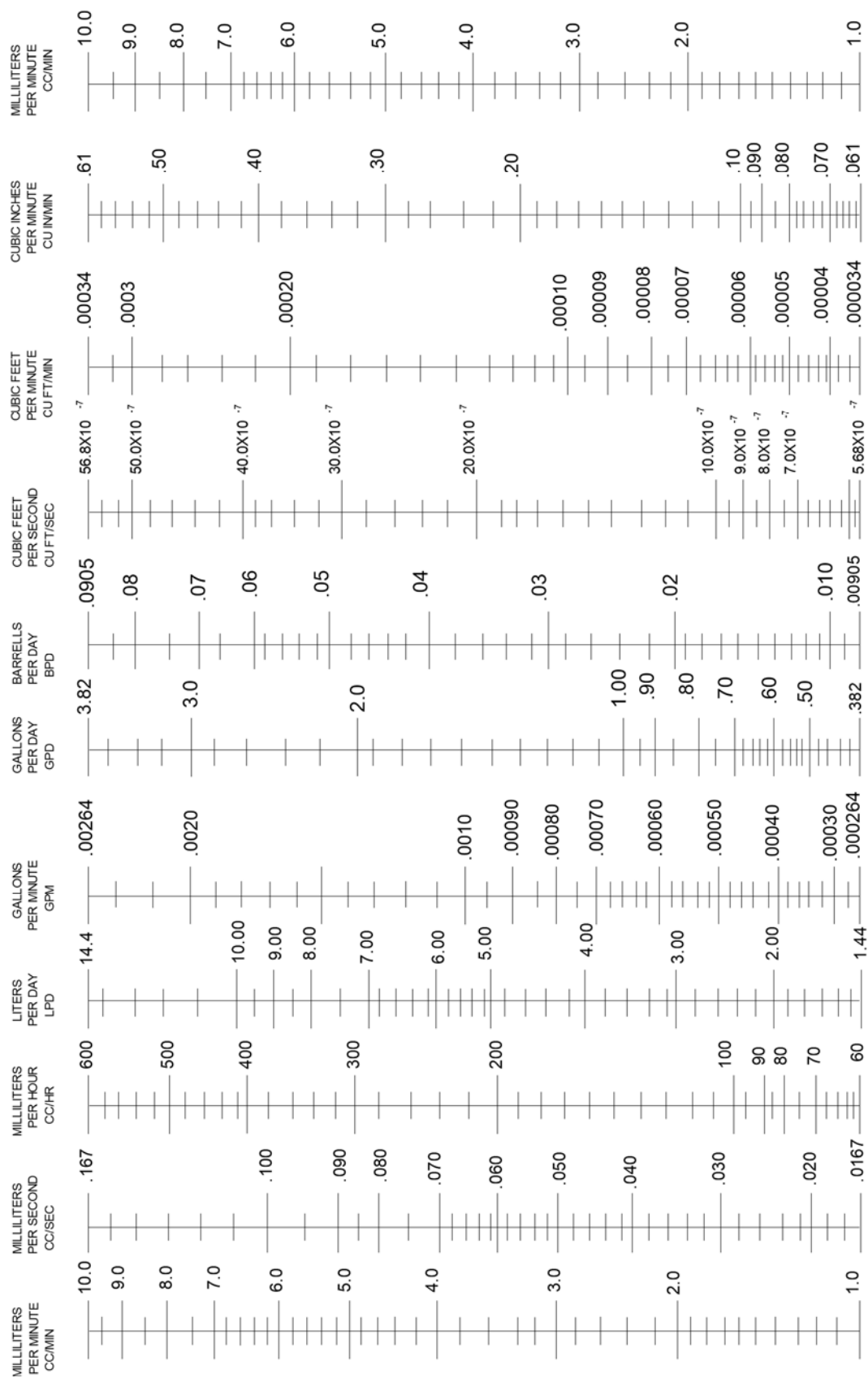
### 9.1 VOLUME FLOW CONVERSION CHART

Convert known units to cubic feet per second (CFPS) or gallons per minute (GPM) for use with Chart A.2

<b>TO CONVERT FROM</b>	<b>TO</b>	<b>MULTIPLY BY</b>
Gallons Per Minute (GPM)	Cubic Feet Per Per Second (CFPS)	2.228 E-03
Gallons Per Day (GPD)	CFPS	1.547 E-06
Barrels Per Day (BPD)	CFPS	6.531 E-5
Cubic Ft. Per Minute (CFPM)	CFPS	1.667 E-02
Cubic In. Per Minute (CIPM)	CFPS	9.645 E-06
Milliliters Per Minute (MLPM)	CFPS	5.886 E-07
Milliliters Per Second (MLPS)	CFPS	3.531 E-05
Milliliters Per Hour (MLPH)	CFPS	9.810 E-09
Liters Per Day (LPD)	CFPS	4.087 E-07
Gallons Per Day (GPD)	GPM	6.944 E-04
Barrels Per Day (BPD)	GPM	2.931 E-02
Cubic Ft. Per Second (CFPS)	GPM	4.488 E+02
Cubic Ft. Per Minute (CFPM)	GPM	7.481
Cubic In. Per Minute (CIPM)	GPM	4.329 E-03
Milliliters Per Minute (MLPM)	GPM	2.642 E-04
Milliliters Per Second (MLPS)	GPM	4.403 E-06
Milliliters Per Hour (MLPH)	GPM	1.585 E-02
Liters Per Day (LPD)	GPM	1.835 E-04

## 9.2 FLOW CONVERSION CHART

FLOW CONVERSION CHART



THIS LINE CHART PROVIDES AN EASY METHOD FOR CONVERTING UNITS OF VOLUME FLOW. SIMPLY DRAW A LINE PERPENDICULAR TO THE SCALE LINES THROUGH A VALUE OF FLOW AND READ THE EQUIVALENT VALUE ON ANY OF THE OTHER SCALES.



## 9.3 FLOW OF WATER THROUGH SCHEDULE 40 STEEL PIPE

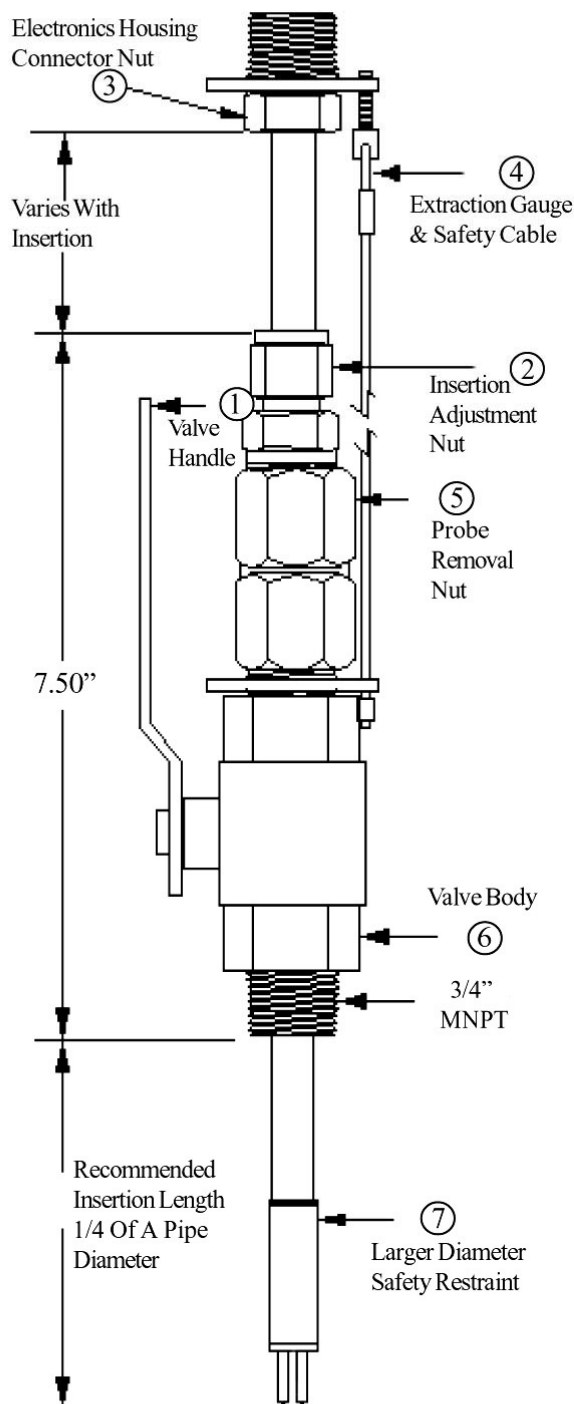
### FLOW OF WATER

#### Flow of Water Through Schedule 40 Steel Pipe

Discharge		Pressure Drop per 100 feet and Velocity in Schedule 40 Pipe for Water at 60 F.															
Gallons per Minute	Cubic Ft. per Second	Velocity	Press.	Velocity	Press.	Velocity	Press.	Velocity	Press.	Velocity	Press.	Velocity	Press.	Velocity	Press.	Velocity	Press.
		Feet per Second	Lbs. per Sq. In.	Feet per Second	Lbs. per Sq. In.	Feet per Second	Lbs. per Sq. In.	Feet per Second	Lbs. per Sq. In.	Feet per Second	Lbs. per Sq. In.	Feet per Second	Lbs. per Sq. In.	Feet per Second	Lbs. per Sq. In.	Feet per Second	Lbs. per Sq. In.
		1/8"		1/4"		3/8"		1/2"		3/4"		1"		1 1/4"		1 1/2"	
.2	0.000446	1.13	1.86	0.616	0.359	0.504	0.159	0.317	0.061								
.3	0.000668	1.69	4.22	0.924	0.903	0.762	0.245	0.422	0.086								
.4	0.000891	2.26	6.98	1.23	1.61	1.04	0.339	0.539	0.127								
.5	0.00111	2.82	10.5	1.54	2.39	1.36	0.440	0.638	0.167	0.301	0.033						
.6	0.00134	3.39	14.7	1.85	3.29	1.67	0.541	0.751	0.210	0.361	0.041						
.8	0.00178	4.52	25.0	2.46	5.44	2.24	0.742	1.008	0.284	0.481	0.102						
1	0.00223	5.65	37.2	3.08	8.28	2.86	1.05	1.36	0.384	0.602	0.155	0.371	0.048				
2	0.00446	11.29	134.4	6.16	30.1	5.72	2.10	2.72	0.768	1.20	0.310	0.743	0.164	0.429	0.044	0.473	0.043
3	0.00668			9.25	64.1	8.58	3.15	4.08	1.15	1.81	0.465	1.114	0.246	0.844	0.090	0.630	0.071
4	0.00891			12.33	111.2	11.44	4.20	5.44	1.54	2.42	0.638	1.49	0.336	1.073	0.150	0.788	0.071
5	0.01114					14.44	5.24	6.72	1.85	2.91	0.793	1.86	0.414	1.29	0.223	0.788	0.104
6	0.01337	0.574	0.044	2 1/2"		16.44	6.28	8.00	2.16	3.21	0.858	2.23	0.499	1.44	0.354	0.946	0.145
8	0.01782	0.765	0.073			18.44	7.32	9.28	2.47	3.61	0.973	2.49	0.564	1.59	0.399	1.061	0.164
10	0.02228	0.956	0.108	0.670	0.046					4.01	1.09	2.75	0.629	1.73	0.444	1.176	0.183
15	0.03342	1.43	0.224	1.01	0.094					4.81	1.31	3.56	0.884	2.15	0.544	1.58	0.261
20	0.04456	1.91	0.375	1.34	0.158	0.868	0.056			5.62	1.54	4.37	1.039	2.30	0.619	1.73	0.289
25	0.05570	2.39	0.561	1.68	0.234	1.09	0.083	0.812	0.041			5.18	1.67	2.45	0.674	1.88	0.317
30	0.06684	2.87	0.786	2.01	0.327	1.30	0.114	0.974	0.056			5.74	1.81	2.60	0.739	2.03	0.345
35	0.07798	3.35	1.05	2.35	0.436	1.52	0.151	1.14	0.074	0.882	0.041	6.30	1.95	2.75	0.804	2.18	0.373
40	0.08912	3.83	1.35	2.68	0.556	1.74	0.192	1.30	0.095	1.01	0.052	6.86	2.09	2.90	0.879	2.33	0.401
45	0.1003	4.30	1.67	3.02	0.668	1.95	0.239	1.46	0.117	1.13	0.064	7.42	2.23	3.05	0.954	2.48	0.429
50	0.1114	4.78	2.03	3.35	0.839	2.17	0.288	1.62	0.142	1.26	0.076	7.98	2.37	3.20	1.029	2.63	0.457
60	0.1337	5.74	2.87	4.02	1.18	2.60	0.406	1.95	0.204	1.51	0.107	8.54	2.51	3.35	1.104	2.78	0.485
70	0.1560	6.70	3.84	4.69	1.59	3.04	0.540	2.27	0.261	1.76	0.143	9.10	2.65	3.50	1.179	2.93	0.513
80	0.1782	7.65	4.97	5.36	2.03	3.47	0.687	2.60	0.334	2.02	0.180	9.66	2.79	3.65	1.254	3.08	0.541
90	0.2005	8.60	6.20	6.03	2.53	3.91	0.861	2.92	0.416	2.27	0.224	10.22	2.93	3.80	1.329	3.23	0.569
100	0.2228	9.56	7.59	6.70	3.09	4.34	1.05	3.25	0.509	2.52	0.272	10.78	3.07	3.95	1.404	3.38	0.597
125	0.2785	11.97	11.76	8.38	4.71	5.43	1.61	4.06	0.769	3.15	0.415	12.01	3.41	4.29	1.579	3.72	0.672
150	0.3342	14.36	16.70	10.05	6.69	6.51	2.24	4.87	1.08	3.78	0.580	14.23	3.75	4.63	1.754	4.06	0.747
175	0.3899	16.75	22.3	11.73	8.97	7.60	3.00	5.68	1.44	4.41	0.774	16.45	4.09	4.97	1.929	4.35	0.822
200	0.4456	19.14	28.8	13.42	11.68	8.68	3.87	6.49	1.85	5.04	0.985	18.67	4.43	5.31	2.104	4.64	0.897
225	0.5013	...	...	15.09	14.63	9.77	4.83	7.30	2.32	5.67	1.23	20.89	4.77	5.65	2.279	4.93	0.972
250	0.557	...	...	...	...	10.85	5.93	8.12	2.84	6.30	1.46	23.11	5.11	5.99	2.454	5.22	1.047
275	0.6127	...	...	...	...	11.94	7.14	8.93	3.40	6.93	1.79	25.33	5.45	6.33	2.629	5.51	1.122
300	0.6684	...	...	...	...	13.00	8.36	9.74	4.02	7.56	2.11	27.55	5.79	6.67	2.804	5.80	1.197
325	0.7241	...	...	...	...	14.12	9.59	10.53	4.09	8.19	2.47	29.77	6.13	7.01	2.979	6.09	1.272
350	0.7798	...	...	...	...	...	...	11.36	5.41	8.82	2.84	32.00	6.47	7.35	3.154	6.38	1.347
375	0.8355	...	...	...	...	...	...	12.17	6.18	9.45	3.25	34.22	6.81	7.69	3.329	6.67	1.422
400	0.8912	...	...	...	...	...	...	12.98	7.03	10.08	3.68	36.45	7.15	8.03	3.504	6.96	1.497
425	0.9469	...	...	...	...	...	...	13.80	7.89	10.71	4.12	38.67	7.49	8.37	3.679	7.25	1.572
450	1.003	...	...	...	...	...	...	14.61	8.80	11.34	4.60	40.89	7.83	8.71	3.854	7.54	1.647
475	1.059	1.93	0.054	...	...	...	...	...	...	11.97	5.12	7.62	1.64	5.27	0.653	3.04	0.166
500	1.114	2.03	0.059	...	...	...	...	...	...	12.60	5.65	8.02	1.81	5.55	0.720	3.21	0.182
550	1.225	2.24	0.071	...	...	...	...	...	...	13.85	6.79	8.82	2.17	6.11	0.861	3.53	0.219
600	1.337	2.44	0.083	...	...	...	...	...	...	15.12	8.04	9.63	2.55	6.66	1.02	3.85	0.258
650	1.448	2.64	0.097	12"	...	...	...	...	...	...	...	10.43	2.98	7.22	1.18	4.17	0.301
700	1.560	2.85	0.112	2.01	0.047	...	...	...	...	...	...	11.23	3.43	7.78	1.35	4.49	0.343
750	1.671	3.05	0.127	2.15	0.054	14"	...	...	...	...	...	12.03	3.92	8.33	1.55	4.81	0.392
800	1.782	3.25	0.143	2.29	0.061	...	...	...	...	...	...	12.83	4.43	8.88	1.75	5.13	0.443
850	1.894	3.46	0.160	2.44	0.068	2.02	0.042	...	...	...	...	13.64	5.00	9.44	1.96	5.45	0.497
900	2.005	3.66	0.179	2.58	0.075	2.13	0.047	...	...	...	...	14.44	5.58	9.99	2.18	5.77	0.554
950	2.117	3.86	0.198	2.72	0.083	2.25	0.052	...	...	...	...	15.24	6.21	10.55	2.42	6.09	0.613
1000	2.228	4.07	0.218	2.87	0.091	2.37	0.057	16"	...	...	...	16.04	6.84	11.10	2.68	6.41	0.675
1100	2.451	4.48	0.260	3.15	0.110	2.61	0.068	...	...	...	...	17.65	8.23	12.22	3.22	7.05	0.807
1200	2.674	4.88	0.306	3.44	0.128	2.85	0.080	2.18	0.042	...	...	...	...	13.33	3.81	7.70	0.948
1300	2.896	5.29	0.355	3.73	0.150	3.08	0.093	2.36	0.048	...	...	...	...	14.43	4.45	8.33	1.11
1400	3.119	5.70	0.409	4.01	0.171	3.32	0.107	2.54	0.055	...	...	...	...	15.55	5.13	8.98	1.28
1500	3.342	6.10	0.466	4.30	0.195	3.56	0.122	2.72	0.063	...	...	...	...	16.66	5.85	9.62	1.46
1600	3.565	6.51	0.527	4.59	0.219	3.79	0.138	2.90	0.071	...	...	...	...	17.77	6.57	10.26	1.65
1800	4.010	7.32	0.663	5.16	0.276	4.27	0.172	3.27	0.088	2.58	0.050	...	...	19.99	8.37	11.54	2.08
2000	4.456	8.14	0.808	5.73	0.339	4.74	0.209	3.63	0.107	2.87	0.060	...	...	22.21	10.3	12.82	2.55
2500	5.570	10.17	1.24	7.17	0.515	5.93	0.321	4.54	0.163	3.59	0.091	...	...	...	...	16.03	3.94
3000	6.684	12.20	1.76	8.60	0.731	7.11	0.451	5.45	0.232	4.30	0.129	3.46	0.075	...	...	19.24	5.59
3500	7.798	14.24	2.38	10.03	0.982	8.30	0.607	6.35	0.312	5.02	0.173	4.04	0.101	...	...	22.44	7.56
4000	8.912	16.27	3.08	11.47	1.27	9.48	0.787	7.26	0.401	5.74	0.222	4.62	0.129	3.19	0.052	25.65	9.80
4500	10																

## 10.0 OPTIONS

### 10.1 LIVETAP (LT)



## Livetap (LT)

### Operating Instructions

#### Installation

Sierra's Livetap needs to be installed using industry standard piping practices. Install Livetap using the valve body (6) only to tighten.

#### Probe Insertion

First the valve handle (1) must be in the open position (handle turned so that it is parallel to the probe).

Second loosen nut (2) so that probe can be pushed into the pipe or tank by putting pressure on the switch head.

Third make sure that nut (3) touches nut (2). This ensures that the probe has been inserted the proper distance.

Fourth tighten nut (2). This will lock the probe in the inserted position.

#### Probe Removal

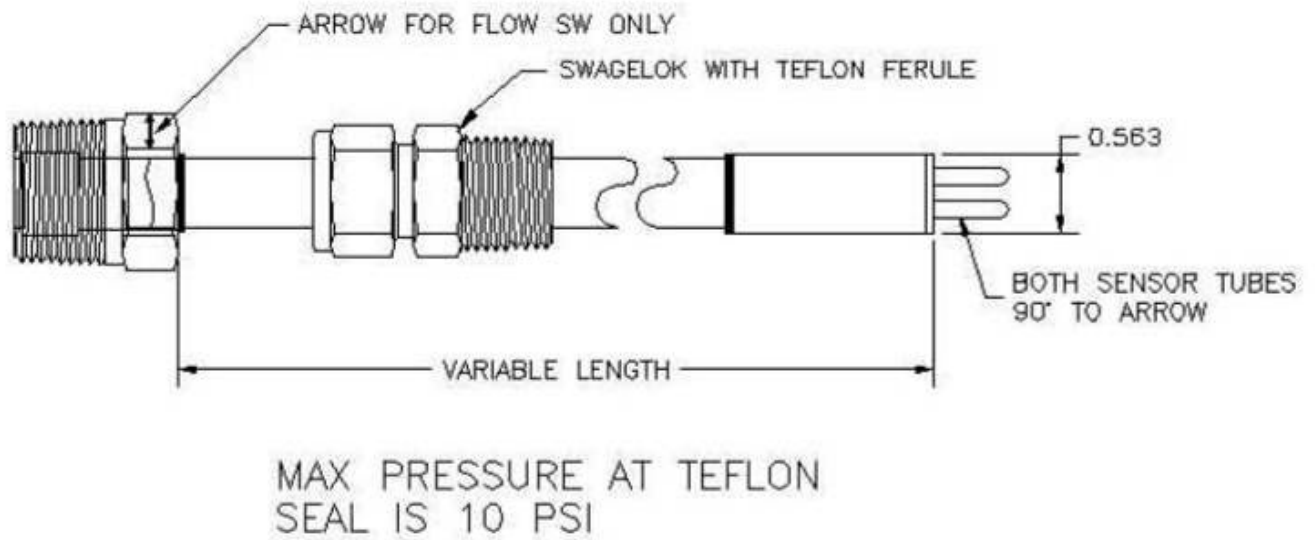
First loosen nut (2). This will allow for the removal of the switch from the flow stream by gently pulling on the switch head.

Second make sure that safety cable (4) is taut. This will ensure that the probe is clear of the valve.

Third close valve handle (1) (handle turned so that it is perpendicular to the probe).

Fourth loosen nut (5) completely. This will allow the probe with the larger diameter safety restraint assembly (7) to be removed from the valve assembly.

## 10.2 VARIABLE INSERTION (VI)



### 10.3 SANITARY (3A1)

## Innova-Switch™ Sanitary



\*Shown above with optional Sanitary Tee

## Sanitary Switch Operating Instructions

### Installation

Sierra's Sanitary Switch Option is to be installed using industry standard piping practices. Make sure that you have selected the proper gasket and clamp designed for your pressure, temperature and process fluid.

### SPECIFICATIONS

**Sensor Type:**

Thermal Differential, Dual RTD Sensors

**Process Connection:**

Standard 1.5 inch sanitary  
Optionally 1.0 inch and larger

**Insertion Length:**

Standard 2.53 inch  
Optionally custom length to suit your specific application.

**Operating Temperature Range:**

Standard -100°F to 390°F (-70°C to +200°C)

Medium temp to +572°F (+300°C)

High temp to +850°F (+458°C)

**Materials of Construction:**

Standard all welded 316L series stainless steel with nickel filler.

**Operating Pressure Range:**

Standard to 1500 psia (102 bar) with the proper clamp and gasket.

**Operating Range:**

Adjustable flow rate (feet per second - fps), typical: 0.01 to 5.0 fps liquids and 0.1 to 500 fps gases

**Response Time:**

Sensor response time 0.5 to 10 seconds media dependent

**Stability:**

Drift < .5% from calibrated setpoint over a range of  $\pm 50^\circ$  F. Temperature compensated throughout entire range

**Repeatability:**

$\pm 1\%$  of setpoint

## 10.4 InnovaSwitch Single Channel Mass Flow Or Point level Switch Product Specifications)

### PERFORMANCE SPECIFICATIONS

#### Operating Range:

Flow Switch: Adjustable flow rate (feet per second-fps), typical: 0.01 to 5.0 fps liquids and 0.1 to 500 fps gases  
Level Switch: Switch on level change of 0.03 inch

#### Response Time:

Flow Switch: 0.5 to 10 seconds (media dependent)  
Level Switch: 0.1 to 1 second (media dependent)

#### Repeatability:

+/- 1% of setpoint (Flow) or 1/32" (0.8mm) Level

#### Stability

Drift <0.5% from calibrated setpoint over a range of +/-50F.  
Temperature compensated through entire range.

### OPERATION SPECIFICATIONS

#### Operating Temperature:

Process: -73.3°C to 200°C (-100°F to 390°F) standard.  
Medium T to 300°C (572°F) optional  
Hi T to 454°C (850°F)  
Electronics: -40°C to 60°C (-40°F to 140°F). Optional remote electronics for use in medium and Hi T environments

#### Operating Pressure:

to 3000 psia (207 bar)

#### Input Power:

115 VAC, 50/60Hz standard. 230 VAC, 50/60Hz optional, 24VDC optional. 3.1 Watt maximum

#### Output

5A. 250 VAC. DPDT with fail safe capability

### PHYSICAL SPECIFICATIONS

#### Wetted Materials:

316 L SS, Hastelloy, Monel, Inconel or other materials optional

#### Enclosure:

Explosion Proof; NEMA 3,4X,7,9. CSA, FM, UL, CENELEC and EECS approved

#### Process Connection:

0.75" MNPT standard. 0.5" and larger MNPT and various other process connections such as sanitary and flanges optional

#### Insertion Length:

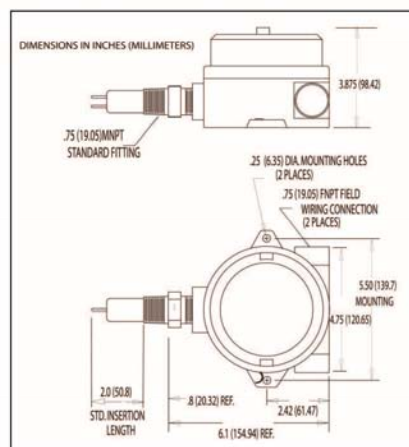
2.0" standard. 0.5" or greater optional

#### Approvals

CE, CSA, CENELEC Class 1 Div 1 Groups B,C,D

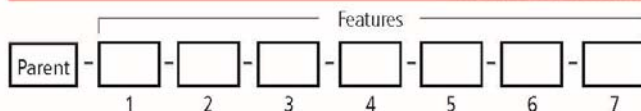
### DIMENSIONS

#### Front and Side Views of InnovaSwitch



## ORDERING THE INNOVASWITCH™ 615

3



Instructions: To order the 615, please fill in each number block by selecting the codes from the corresponding features below.

Parent Number	
615-LS32	InnovaSwitch LEVEL Switch
615-FS42	InnovaSwitch™ Flow Switch

Feature 1: Approvals	
CS	CSA approved
NX	Non-explosion proof switch (STD)

Feature 2: Mounting	
3A1	1.5-inch Sanitary with 3A stamp
75	0.75-inch MNPT (STD)
50	0.50-inch MNPT
100	1-inch MNPT
RA1	Stainless steel raised face flange class 150 1 inch
RA2	Stainless steel raised face flange class 150 2 inch
RB1	Stainless steel raised face flange class 300 1 inch
RB2	Stainless steel raised face flange class 300 2 inch
SPL	Special
LFS	Low flow sensor

Feature 4: Insertion Length	
2	2.0 inch (50.8 mm) (STD)
xxx.xx	0.5 inch to 120 inch (12.7 mm to 3048 mm) in .25 inch (6.35 mm) increments (example 20.25)

Feature 3: Materials	
S6	316L SS
S4	304SS
SL	304L SS
HC	Hastalloy® C
IO	Iconel 600
MN	Monel
A2	Alloy 20
SM	Special material

Feature 5: Power Input	
110	2.0 inch (50.8 mm) (STD)
220	0.5 inch to 120 inch (12.7 mm to 3048 mm) in .25 inch (6.35 mm) increments (example 20.25)
24D	24 VDC not available with HT Switch (615-FS42)

Feature 6: Configuration	
LE	Local electronics (STD)
RE	Remote Electronics (25 ft of cable). Note that MT and HT option MUST be RE and RE adder is included in the MT and HT price)
PC	Potted cable (not Ex Proof)

Feature 7: Special Options			
0	No special options	HT	High temperature (includes RE with 6-inch EN with no price adder)
CB	Calibration required (air, water only, all others consult factory)	RTD	RTD output
EN	Extended neck (specify length up to 6 inches (152.4mm))	TO	Thermocouple output
XW	Explosion proof window	CA	Additional cable
VI	Variable insertion (>3-inch pipe ID req), 3/4-inch NPT with Teflon ferrules. 15 psig (1.0 barg) max	TG	Stainless steel tag
LT	Live (hot) tap	CE	CE approval
DS	Double sided	O <sub>2</sub> Cleaning	O <sub>2</sub> Cleaning
MT	Medium temperature (includes RE with 3-inch EN with no price adder)		

