

OPERATION AND MAINTENANCE MANUAL

microtuf® II

MODEL FS2100 SERIES – MASS FLOW SWITCH

MODEL LS1100 SERIES – POINT LEVEL SWITCH

DOCUMENT 1121-OM-00

REVISION 00

NOVEMBER 2009

DELTA M CORPORATION®

1003 LARSEN DRIVE

OAK RIDGE, TENNESSEE 37830

PH 865-483-1569

FAX 865-483-1142

TOLL FREE 800-922-0083

www.deltamcorp.com

email: service@deltamcorp.com

PROPRIETARY INFORMATION

THIS DOCUMENT IS THE PROPERTY OF DELTA M CORPORATION AND MAY CONTAIN INFORMATION COVERED BY PATENTS AND/OR CONSIDERED CONFIDENTIAL. UNLESS RIGHTS ARE EXPRESSLY GRANTED BY WRITTEN PERMISSION OF DELTA M CORPORATION THIS INFORMATION IN WHOLE OR IN PART MAY NOT BE DISCLOSED OR USED IN THE DESIGN, SALE, MANUFACTURE, TEST, OR SUPPLY OF THE SAME OR SIMILAR PRODUCTS.

MODEL NO. _____ SERIAL NO. _____

DATE OF SHIPMENT _____ INSTALLATION DATE _____

CUSTOMER TAG NO. _____ PO NO. _____

OPTIONS _____

SPECIAL NOTES _____

BEFORE STARTING

DELTA M 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:

- **WHEN INSTALLING YOUR DELTA M SWITCH INTO A PIPE OR VESSEL USE A 1 1/8 INCH OPEN-END 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 FIGURE 1).**
- **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).**
- **A GROUND WIRE MUST BE ATTACHED TO THE GROUND SCREW LOCATED INSIDE THE INSTRUMENT ENCLOSURE FOR PROPER OPERATION.**
- **BE SURE TO APPLY THE PROPER VOLTAGE AS CONFIGURED AT THE FACTORY. DO NOT APPLY AC VOLTAGE TO 24 VDC VERSIONS OR 24 VDC TO AC VERSIONS. THIS WILL DAMAGE THE UNITS AND VOID THE WARRANTY.**
- **FOR OPTIMUM OPERATION, CALIBRATION MUST BE ACCOMPLISHED AT ACTUAL PROCESS TEMPERATURE AND CONDITIONS.**
- **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 at (800) 922-0083, 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:

microtuf® II Series Models		FS2100	LS1100
Agency Approvals	Explosion-Proof rating	Mass Flow Switch	Point Level Switch
Non-Approved	Non-Explosion Proof	FS21NX	LS11NX
Switch Kits (No Enclosures)	Not Rated	FS21SK	LS11SK

SPECIAL NOTICE

The electronic assemblies contained in the microtuf® II models are configured for specific voltages and have specific modifications. 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 serial number tag.

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.

TABLE OF CONTENTS

1.0	INTRODUCTION
2.0	DESCRIPTION
2.1	LEVEL SWITCHING
2.2	FLOW SWITCHING
3.0	INSTALLATION
3.1	MECHANICAL INSTALLATION
3.2	ELECTRICAL INSTALLATION
3.2.1	LOCAL ELECTRONICS (LE OPTION/STANDARD)
3.2.2	REMOTE ELECTRONICS (RE) OPTION
4.0	OPERATION AND CALIBRATION OF THE microtuf® II SWITCH FOR FLOW APPLICATIONS
4.1	PRE-OPERATIONAL CHECKS
4.2	L.E.D. AND RELAY STATUS LOGIC (FAIL SAFE)
4.3	CALIBRATION – FLOW
5.0	OPERATION AND CALIBRATION OF THE microtuf® II SWITCH FOR POINT LEVEL APPLICATIONS
5.1	PRE-OPERATIONAL CHECKS
5.2	L.E.D. AND RELAY STATUS LOGIC (FAIL SAFE)
5.3	CALIBRATION – LEVEL
6.0	MAINTENANCE AND TROUBLE SHOOTING
6.1	CLEANING
6.2	TROUBLE SHOOTING
6.2.1	POWER AND CONTINUITY VERIFICATION
6.2.2	SENSOR/ELECTRONICS FUNCTIONALITY VERIFICATION
7.0	SPECIFICATIONS
8.0	WARRANTY AND SERVICE
8.1	WARRANTY
8.2	SERVICE
9.0	APPENDIX
9.1	VOLUME FLOW CONVERSION CHART
9.2	FLOW CONVERSION CHART
9.3	FLOW OF WATER THROUGH SCHEDULE 40 STEEL PIPE (<i>AVAILABLE IN PRINTED MANUAL ONLY</i>)
9.4	MODEL NUMBER DESIGNATION AND AVAILABLE OPTIONS
10.0	OPTIONS
10.1	SANITARY (3A1)

1.0 INTRODUCTION

The DELTA M microtuf[®] II 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 microtuf[®] II Switch uses a **thermal differential** technique to sense changes in the heat transfer characteristics of a media. Figure 1 shows the outline of the microtuf[®] II 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 not heated 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 in a level application).

The DELTA M Corporation sensor excitation method relies on constant current to the heated sensor. 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.

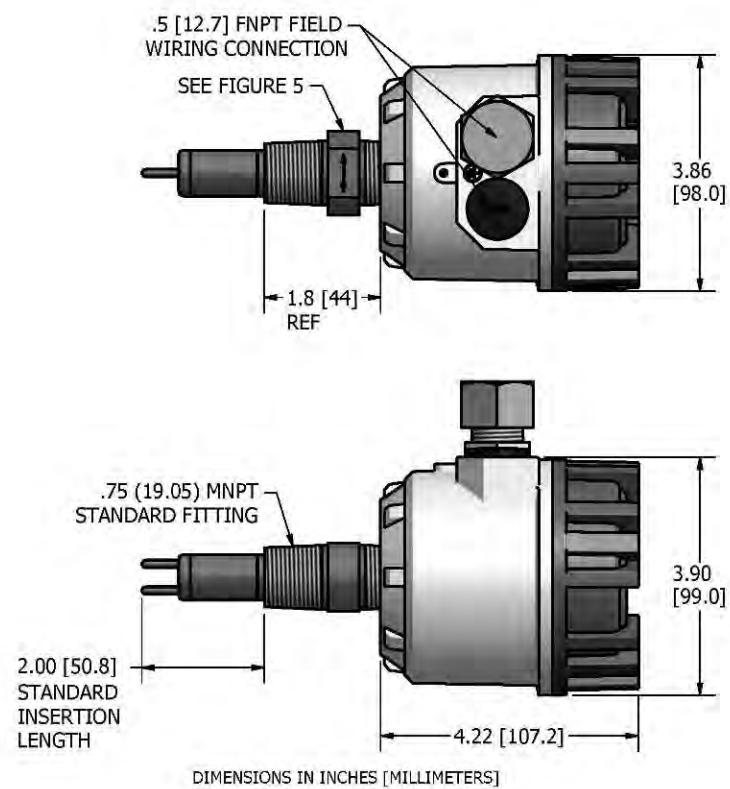


FIGURE 1 LS1100/FS2100 microtuf[®] II OUTLINE DIAGRAM STANDARD 2.0 INCH INSERTION

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 microtuf[®] II can discriminate between them. Figure 2A shows the relative signal output of the microtuf[®] II 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 microtuf[®] II 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

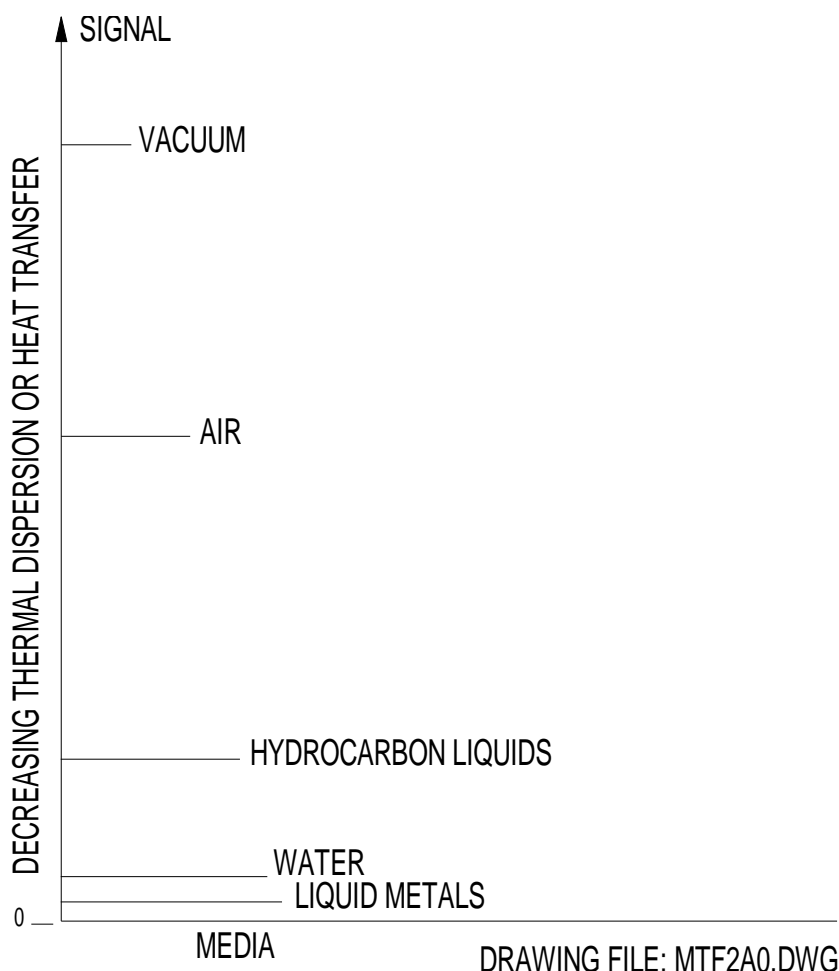


FIGURE 2A: RELATIVE CHANGE IN RESPONSE OF A HEATED RTD IMMERSSED IN VARIOUS MEDIA

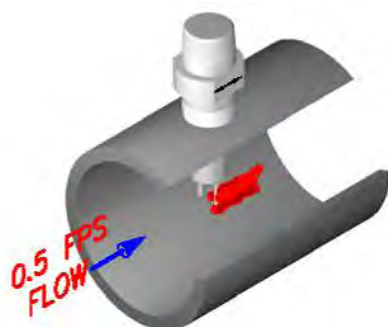
2.2 Flow Switching

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 DELTA M 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 microtuf® II compares this change to a preset flow trip point to switch the output. Figure 2B shows the model FS2100 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 sensitivity 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 2.5 FPS for water and 0.01 to 5 FPS Hydrocarbons. 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.



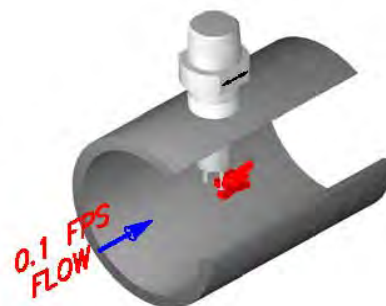
For a no flow condition the thermal differential between the two tips is high because of relatively low heat transfer.



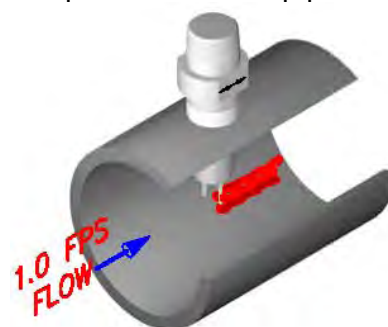
When the lower differential matches the customer select flow velocity trip point (set point) the switch relay and red LED are tripped.

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 .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.

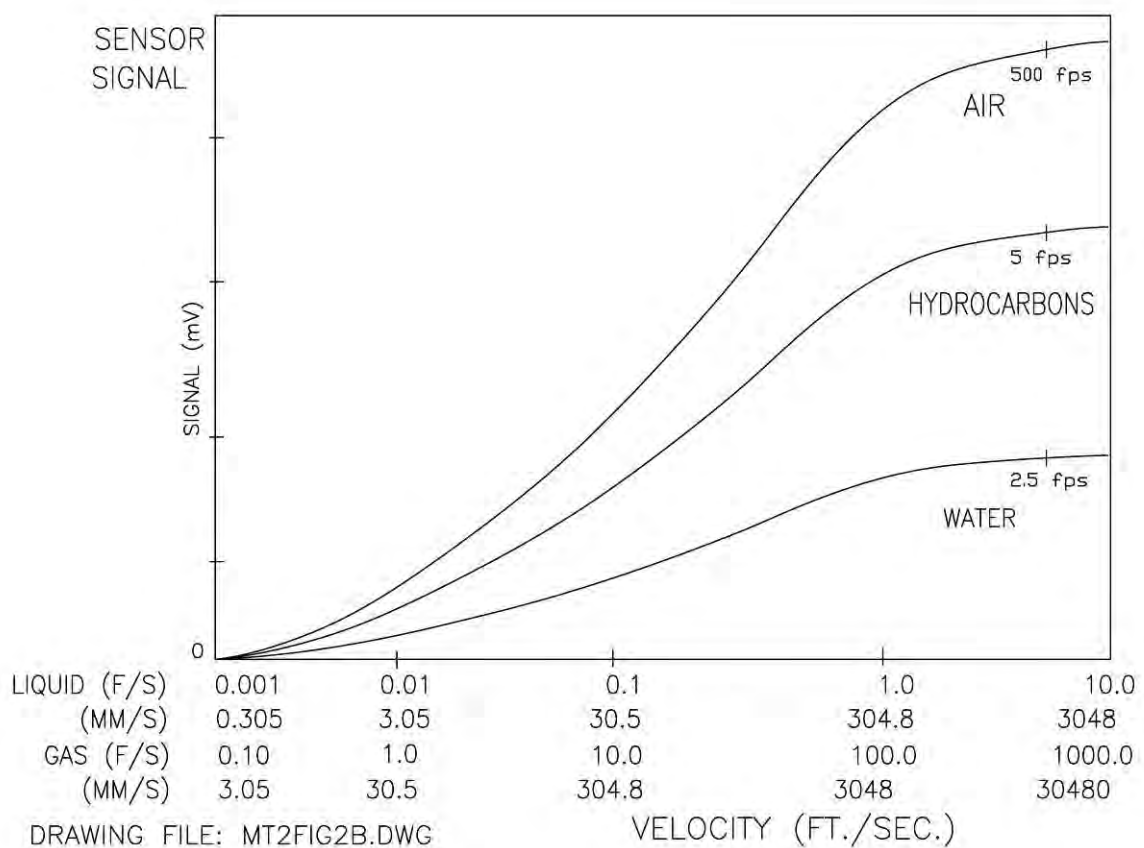


FIGURE 2B microtuf® II MODEL FS2100 FLOW RESPONSE FOR THREE MEDIA

Figure 3 shows a block diagram of the microtuf® II 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).

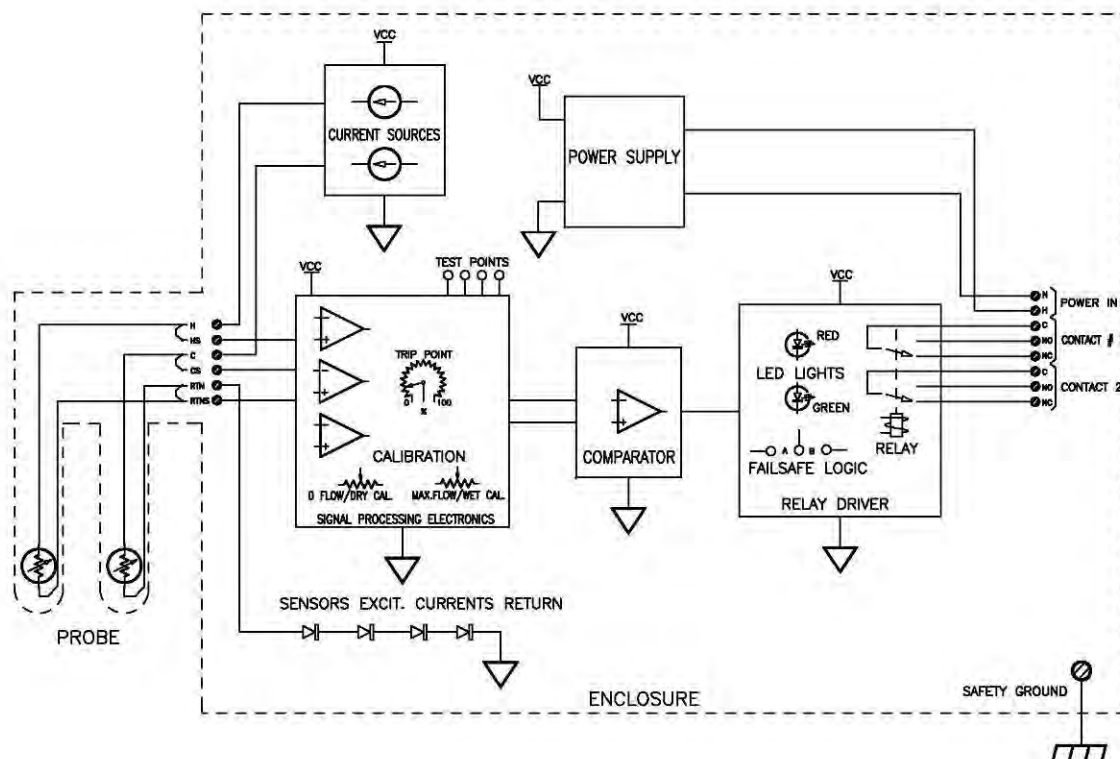


FIGURE 3: microtuf® II SERIES SWITCH BLOCK DIAGRAM
MODELS LS1100/FS2100 SERIES

The instrument enclosure mounted on top of unit contains the microtuf® II Switch electronics module with field wiring on top (see Figure 4.0). For applications where the electronics must be located away from the sensors due to elevated process temperature, accessibility, vibration, etc., another instrument head containing the electronics is remotely located (See option RE-Remote Electronics section 3.2.2).

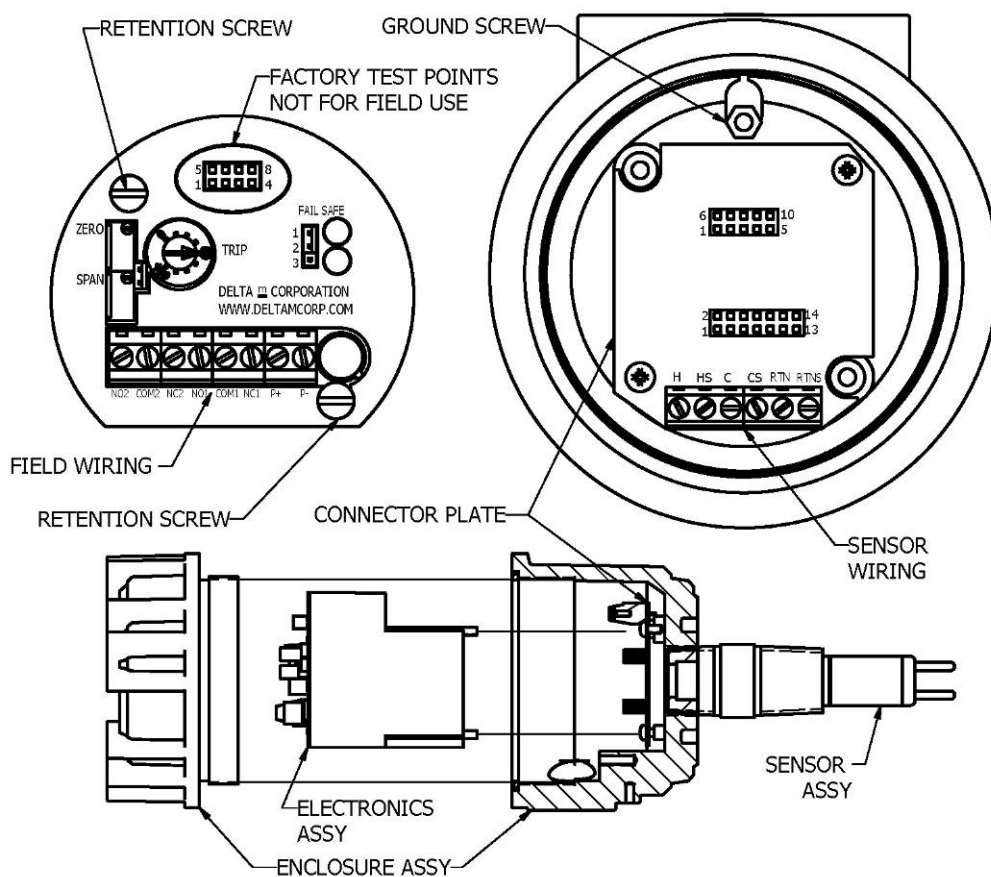


FIGURE 4 microtuf® II SWITCH ASSEMBLY

3.0 INSTALLATION

3.1 Mechanical Installation

The standard microtuf® II 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. It is recommended that the power wiring and relay output wiring be installed using separate conduits to the enclosure.**

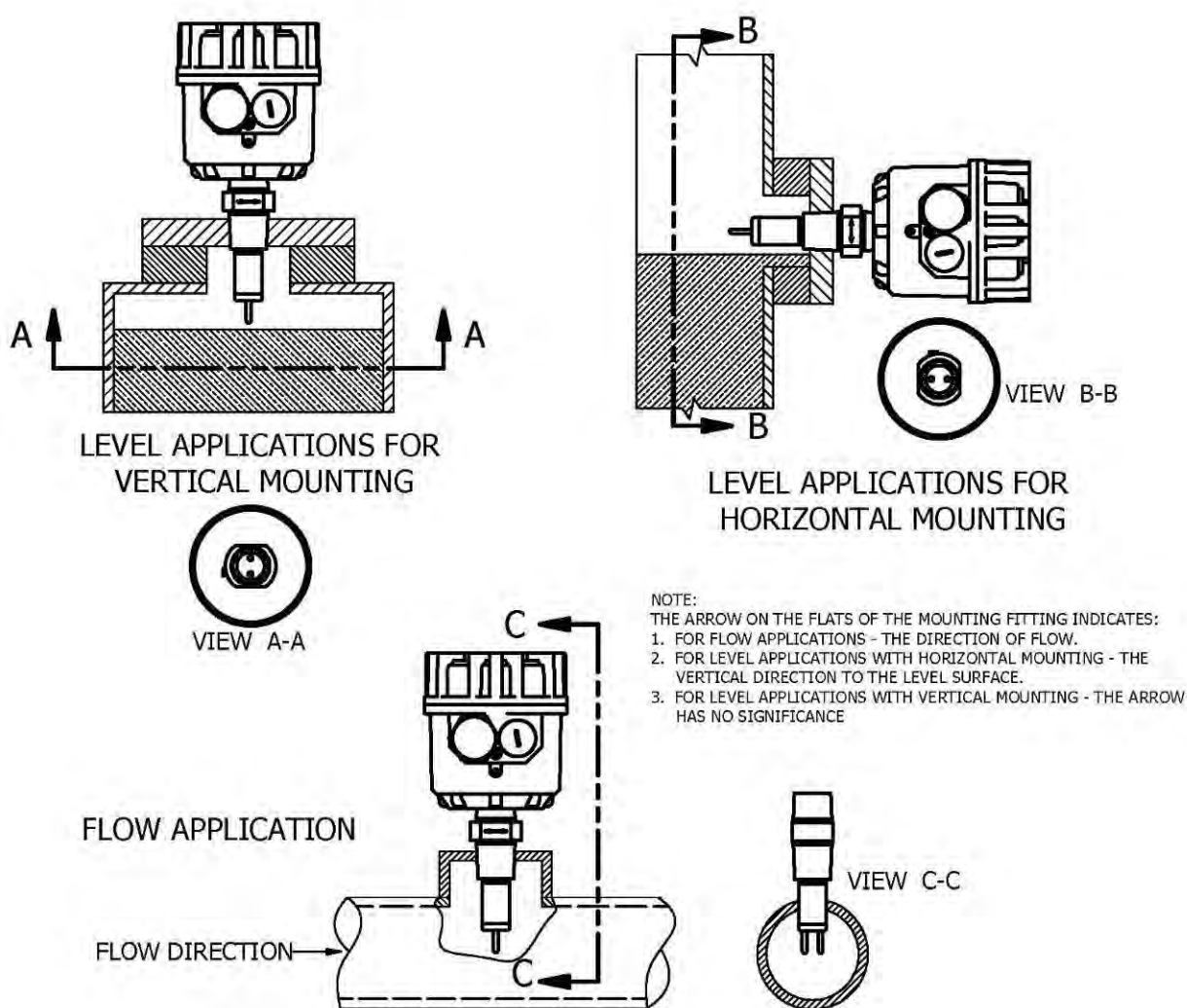


FIGURE 5: PROPER ORIENTATION OF THE SENSOR PROBE FOR LEVEL AND FLOW APPLICATION IS INDICATED BY THE ARROW ON THE FLAT OF THE MOUNTING FITTING. (MTF500.DWG/FCW)

3.2 Electrical Installation

3.2.1 Local Electronics (LE Option/Standard)

Remove the instrument enclosure lid by unscrewing in a counter clockwise direction. Connect power and alarm relay wiring to Terminal Block B as shown in Figure 6A.

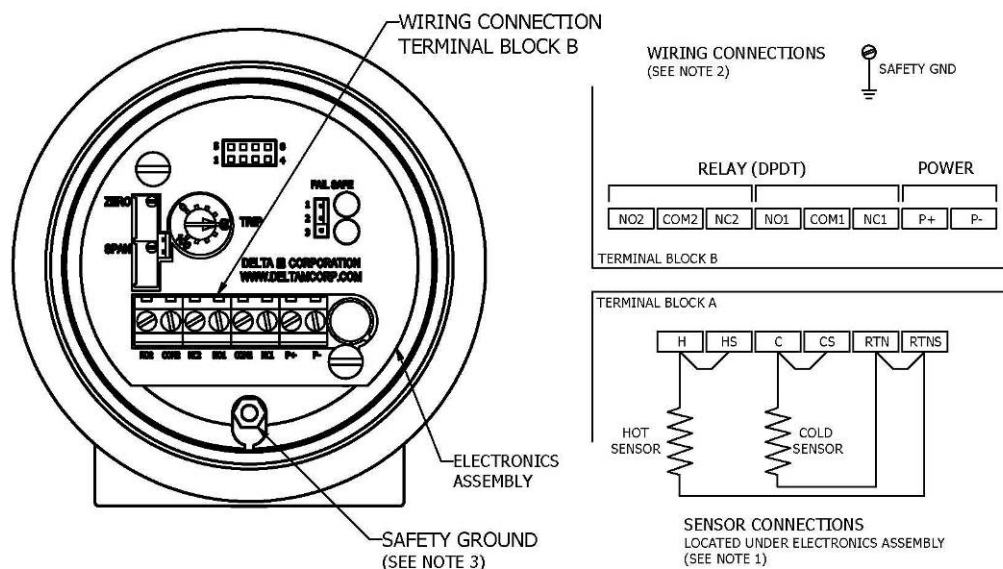


FIGURE 6.0 microtuf® II SWITCH LOCAL ELECTRONICS FIELD WIRING DIAGRAM (MTF600FCW/.DWG)

NOTES:

1. Connections to sensors Terminal Block A are factory installed and should not be disconnected in the field.
2. For 90 to 260 VAC VDC operation (factory prepared), connect +positive to P+ and negative to P-. For 90 to 260 VAC connect hot to P+ and neutral to P-.
3. Connect ground wire to ground screw located in 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 OF THE INSTRUMENT ENCLOSURE FOR PROPER OPERATION.

3.2.2 Remote Electronics (RE Option)

For the remote electronics option, install field wiring between the local enclosure and the remote instrument head with conduit. Connect the switch wiring between the microtuf® II Switch remote electronics as shown in Figures 7A and 7B. Connect power wiring and alarm relay wiring to the remote enclosure as shown in Figure 7A and 7B.

IMPORTANT
BE SURE TO APPLY THE PROPER VOLTAGE AS CONFIGURED AT THE FACTORY. DO NOT APPLY AC TO DC VERSIONS OR DC TO AC VERSIONS.

SPECIAL NOTICE

The electronic assemblies contained in the microtuf® II models are configured for specific voltages. When ordering spare electronics, replacements, or exchanges in the field please ensure you identify the specific configuration you have by noting the options marked on the serial number tag.

WARNING: ELECTROCUTION HAZARD
TUCK WIRES BEHIND STANDOFF TO PREVENT ABRADING OF WIRES WHEN CLOSING LID.

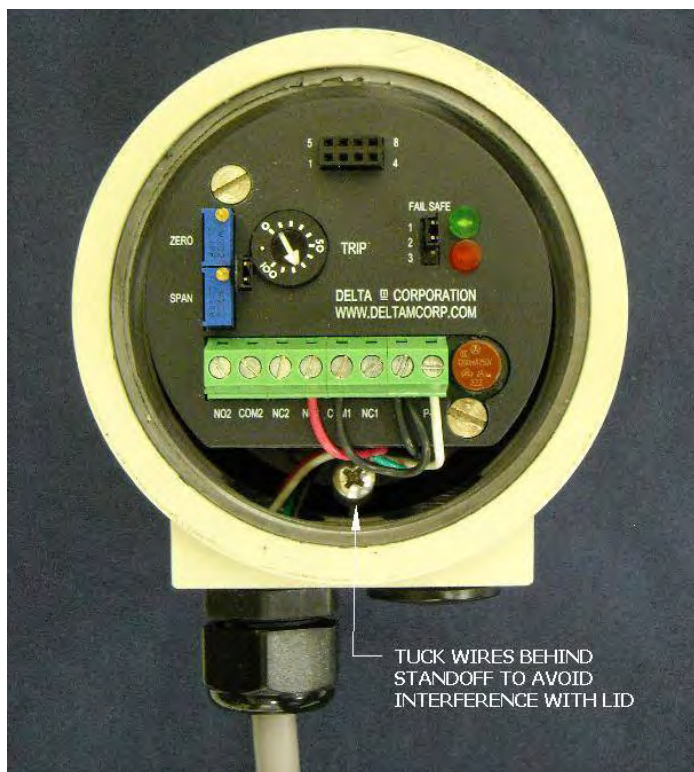


FIGURE 6A: microtuf® II SWITCH CUSTOMER WIRING ADVISORY

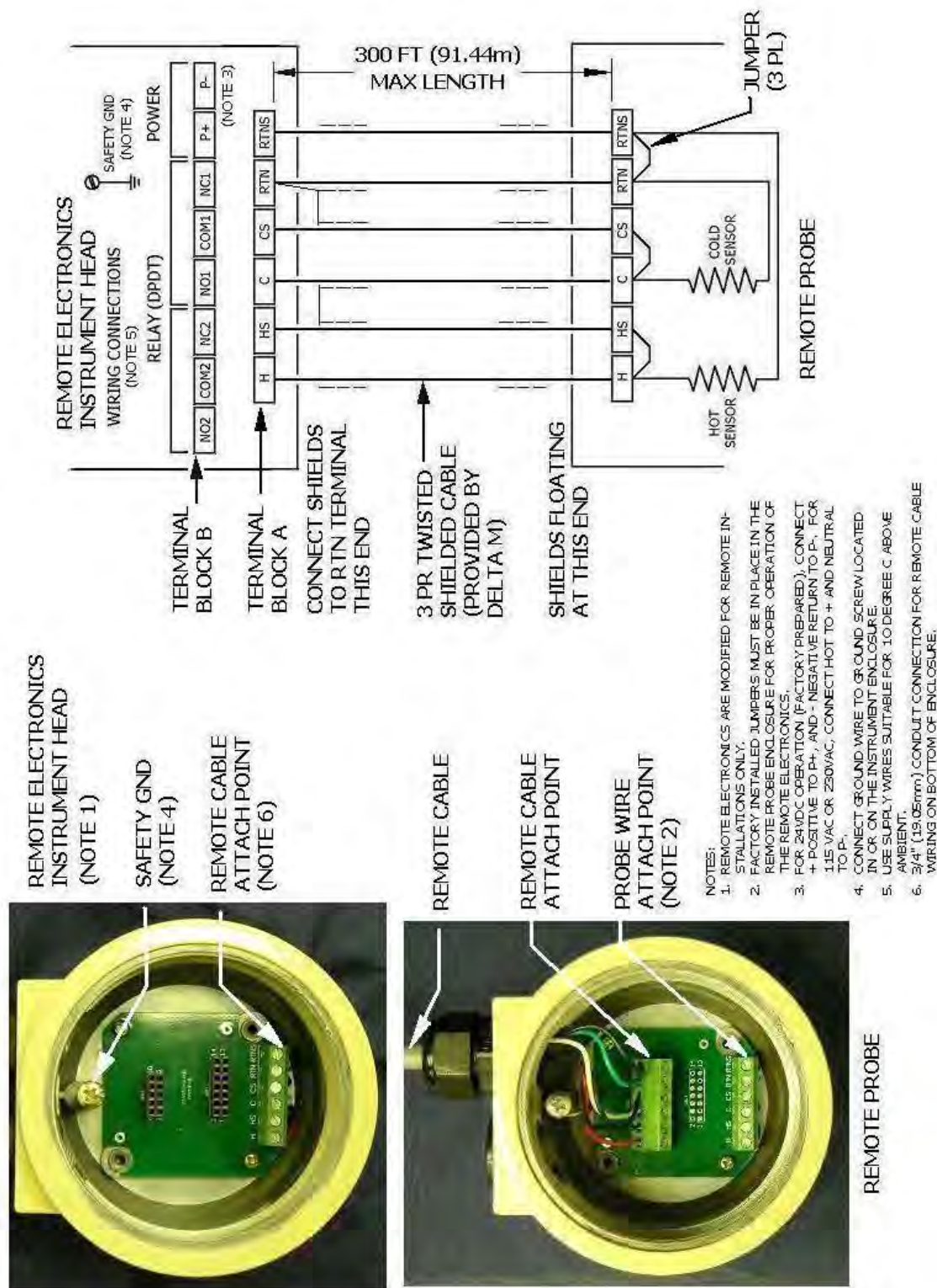


FIGURE 7A microtuf® II FLOW SWITCH REMOTE ELECTRONICS OPTION FIELD WIRING DIAGRAM (MTF701.DWG/.FCW)

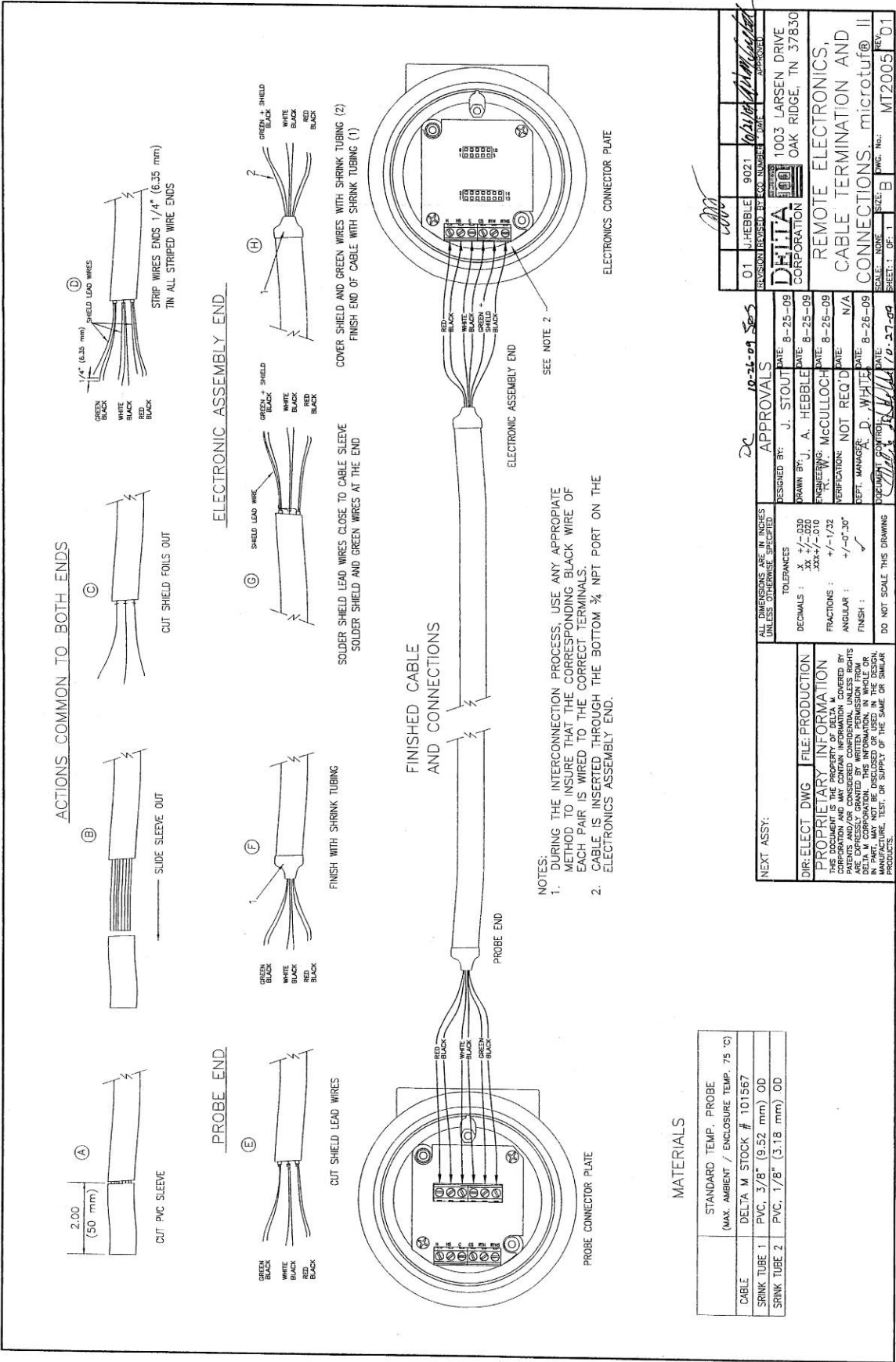


FIGURE 7B microtuf® II REMOTE ELECTRONICS CABLE TERMINATION AND CONNECTIONS

4.0 OPERATION AND CALIBRATION OF THE microtuf® II FS2100 SWITCH 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 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 (i.e. flow below the setpoint or flow above the set point) and are not affected by the position of the Fail Safe. The Fail Safe jumper 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.

4.2.2 Normal Operation (as set at factory)

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

<u>SENSOR STATUS</u>	<u>RED LED</u>	<u>GREEN LED</u>	<u>RELAY COIL STATUS</u>	<u>RELAY CONTACT STATUS</u>
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>

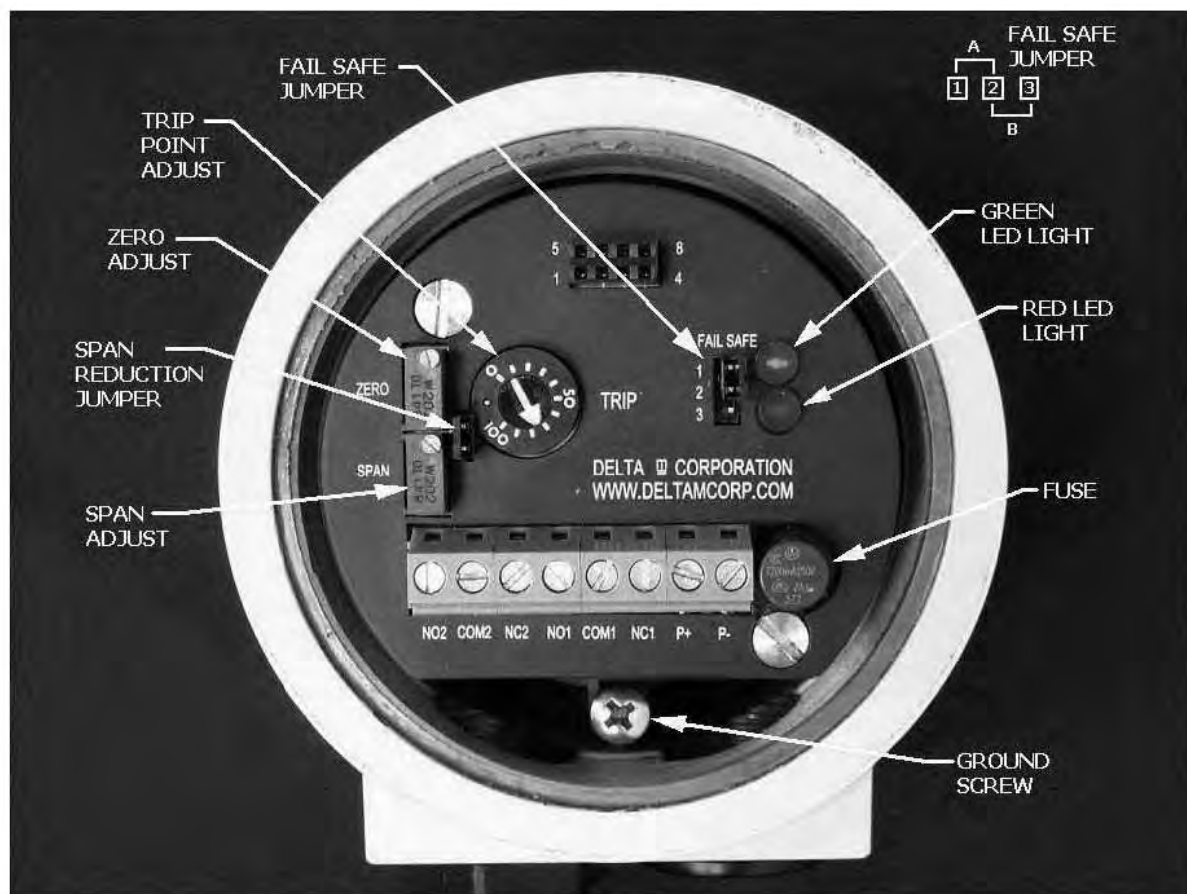
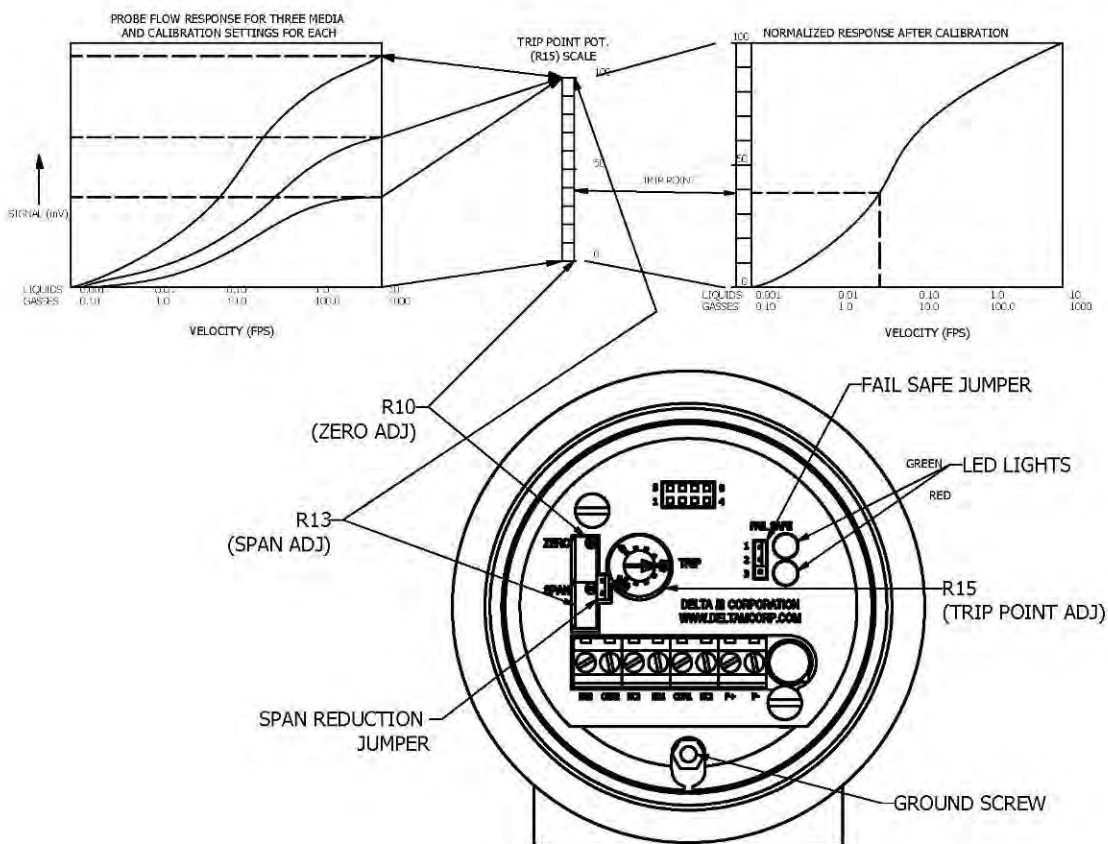


FIGURE 8.0 microtuf® II SWITCH ELECTRONICS

4.2.3 Alternate Operation (Field Selectable)

The relay logic may be reversed by moving the Fail Safe 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	<ul style="list-style-type: none"> o NC o NO
Flow or Flow Above Set Point	OFF	ON	Activated	<ul style="list-style-type: none"> o NC o NO



**FIGURE 9.0 microtuf® II FS2100 FLOW SWITCH
CALIBRATION REFERENCE DRAWING**

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 FS2100. **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 allowing 30 seconds between each toggle until the switching point no longer changes. Leave the Red LED illuminated.
7. Adjust the liquid or gas flow to maximum possible velocity. Insure that the flow is homogenous, constant and free of bubbles if a liquid. A minimum of 150 or 200 fps in gas is a good calibration.
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 allowing 30 seconds between each toggle until the switching point no longer changes. 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 microtuf® II LS1100 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 LS1100 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 (i.e. dry or wet) and are not affected by the position of the Fail Safe jumper. The Fail Safe jumper 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.

5.2.2 Normal Operation (as set at factory)

The switch comes configured from the factory with the following operation with the Fail Safe 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 (i.e. hydrocarbons)	ON	OFF	Activated	<div> <div>o NC</div> <div>o NO</div> </div>
Wet, or Higher Thermal Dispersion Fluid (i.e. 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 Fail Safe 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 (i.e. hydrocarbons)	ON	OFF	Deactivated	<ul style="list-style-type: none"> o NC o NO
Wet, or Higher Thermal Dispersion Fluid (i.e. water)	OFF	ON	Activated	<ul style="list-style-type: none"> o NC o NO

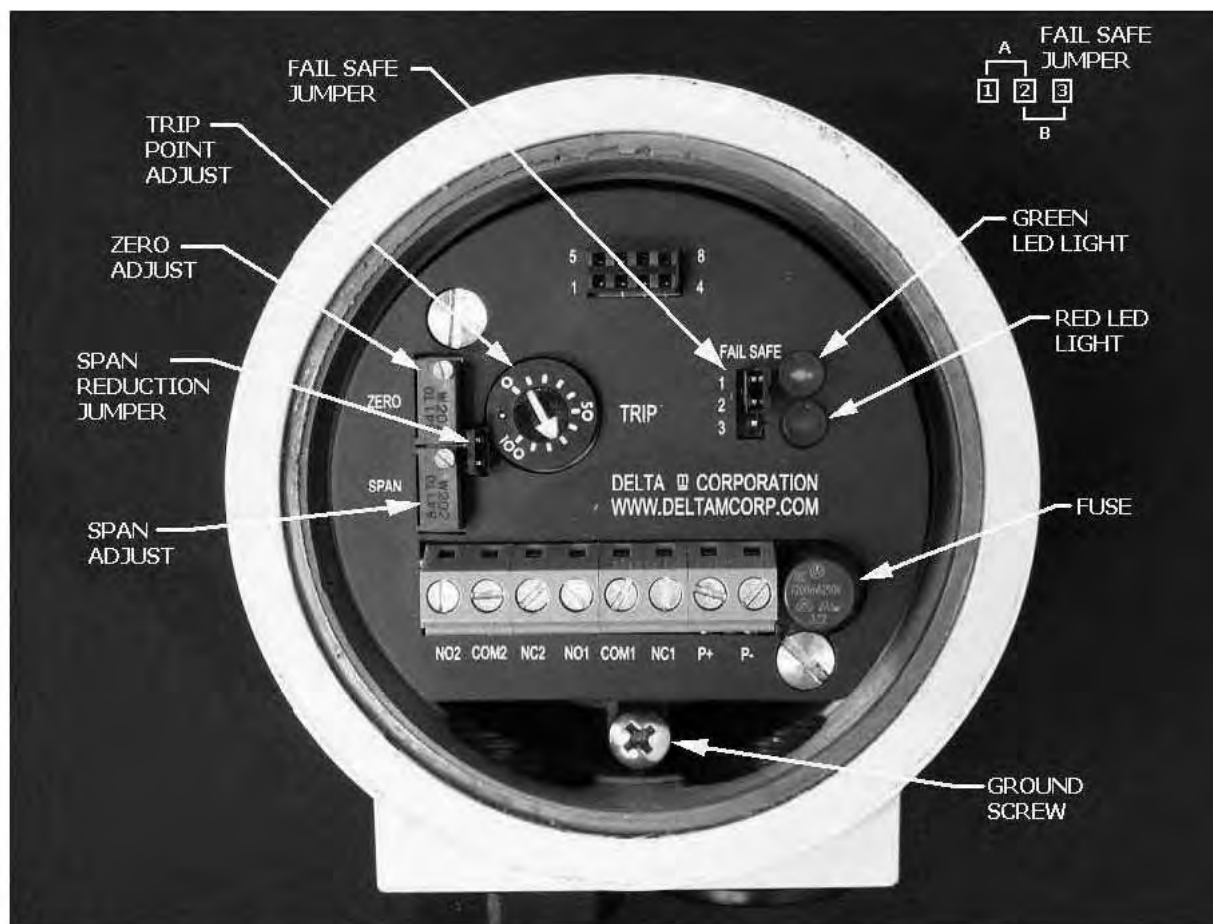


FIGURE 8.0 microtuf® II SWITCH ELECTRONICS

5.3 Calibration – Level

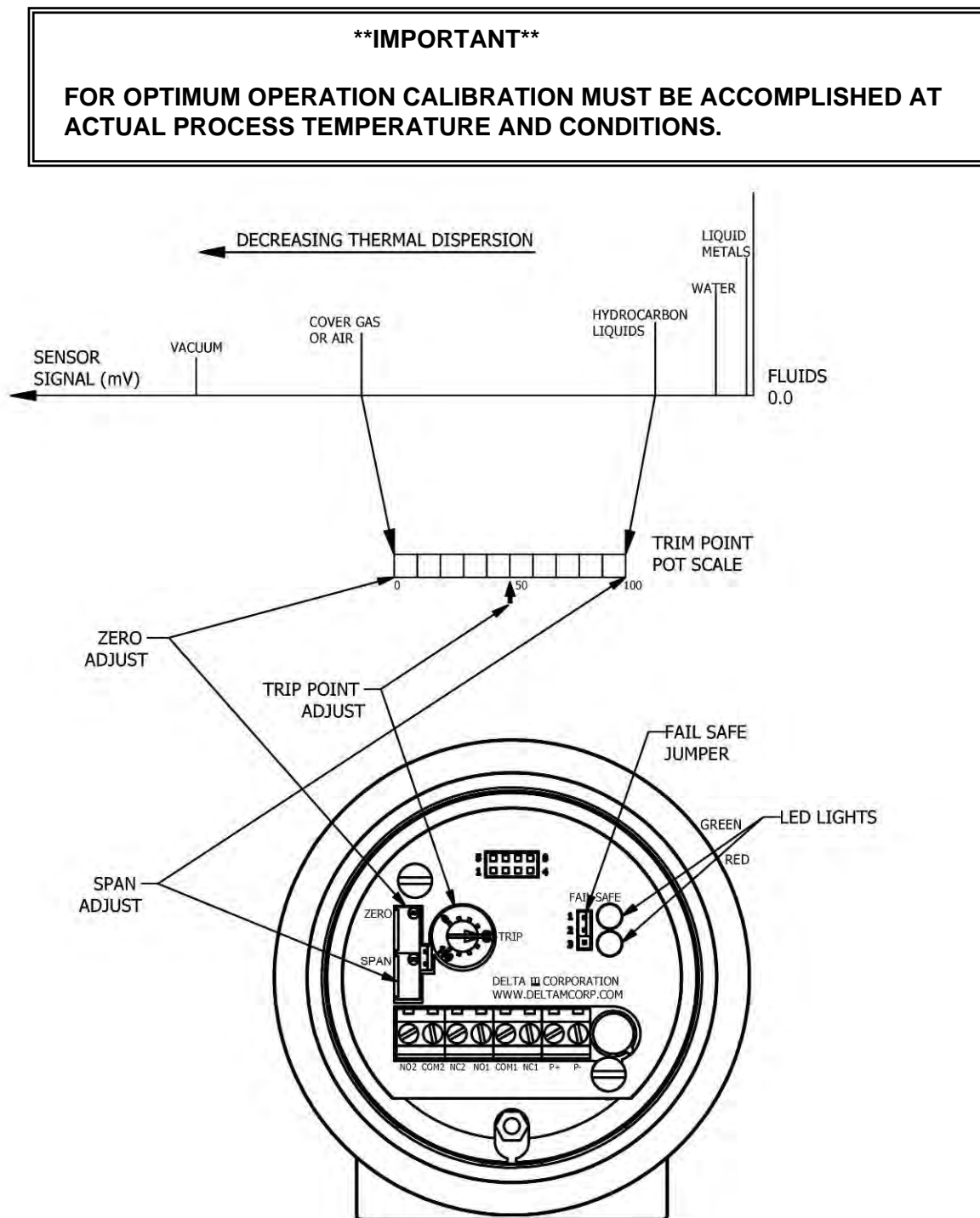


FIGURE 10.0 microtuf® II LS1100 POINT LEVEL SWITCH CALIBRATION

5.3 Calibration - Level

Using Figure 10.0 and Figure 8.0 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).
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 stable and 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 stable and 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 DELTA M 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 Troubleshooting

6.2.1 Power and Continuity Verification

1. Turn power off to the microtuf® II Switch.
2. Remove the instrument enclosure cover (ccw).
3. Reapply power and verify correct voltage at P+ and P- of terminal strip B on top of electronic assembly (See Figures 6.0 or 6A).
4. If voltage is correct, turn power off and pull fuse. 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.
5. If fuse is blown, replace with appropriate value (See 7.0 Specification).

6.2.2 Sensor/Electronics Functionality Verification

1. Turn power off to microtuf[®] II Switch.
2. Allow a 5 minute cool down.
3. Measure the resistance of each RTD at pins H and RTNS of sensor terminal strip under electronics assembly (See Figure 6.0 or 7.0) for the hot RTD and pins C and RTN of terminal A for the cold RTD. These resistances should be 110 ± 10 ohms (with sensors at approximately 70°F) and within 5% of each other in value.
4. Measure the insulation resistance between pin H, C, RTN and RTNS of terminal strip and the case of the microtuf[®] II Switch. It should be greater than 20 megohms.
5. If the microtuf[®] II Switch sensor assembly resistances are not as specified above, the switch sensor assembly must be replaced.
6. If the microtuf[®] II Switch sensor assembly resistances are as specified, the microtuf[®] II Switch PC electronic board must be replaced.

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.)
OPERATING TEMPERATURE:	Process: -70°C to + 200°C (-100°F to +390°F) standard 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 2.5 fps for water, 5 fps for hydrocarbons
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:	90-260 VAC, 4w, 50/60HZ standard (Optional 24 VDC, 3w); maximum
FUSE REQUIREMENTS (F1):	¼ Amp, Delta M PN# 101603
OUTPUT:	5A, 250 VAC, DPDT Standard 5A 30 VDC
STABILITY:	Temperature compensated over entire range.

8.0 WARRANTY AND SERVICE

8.1 Warranty

DELTA M Corporation warrants microtuf® II switches for a period of two years from the date of shipment and will repair or replace this product in the event of a defect in materials or workmanship. To have a product repaired, it should be returned at customer's expense, after obtaining return authorization as described in Section 8.2, to a repair facility designated by DELTA M and, after repair, DELTA M will prepay transportation to return the product to the customer. This limited warranty only covers failures due to defects in materials or workmanship which occur during normal use.

LIMITS AND EXCLUSIONS

DELTA M CORPORATION SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, LOSS OF USE, LOSS OF SALES, OR INCONVENIENCE) RESULTING FROM THE USE OF THESE PRODUCTS, OR ARISING OUT OF ANY BREACH OF THIS WARRANTY. EXCEPT AS SET FORTH ABOVE, THERE ARE NO EXPRESS OR IMPLIED WARRANTIES OR WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

8.2 Service

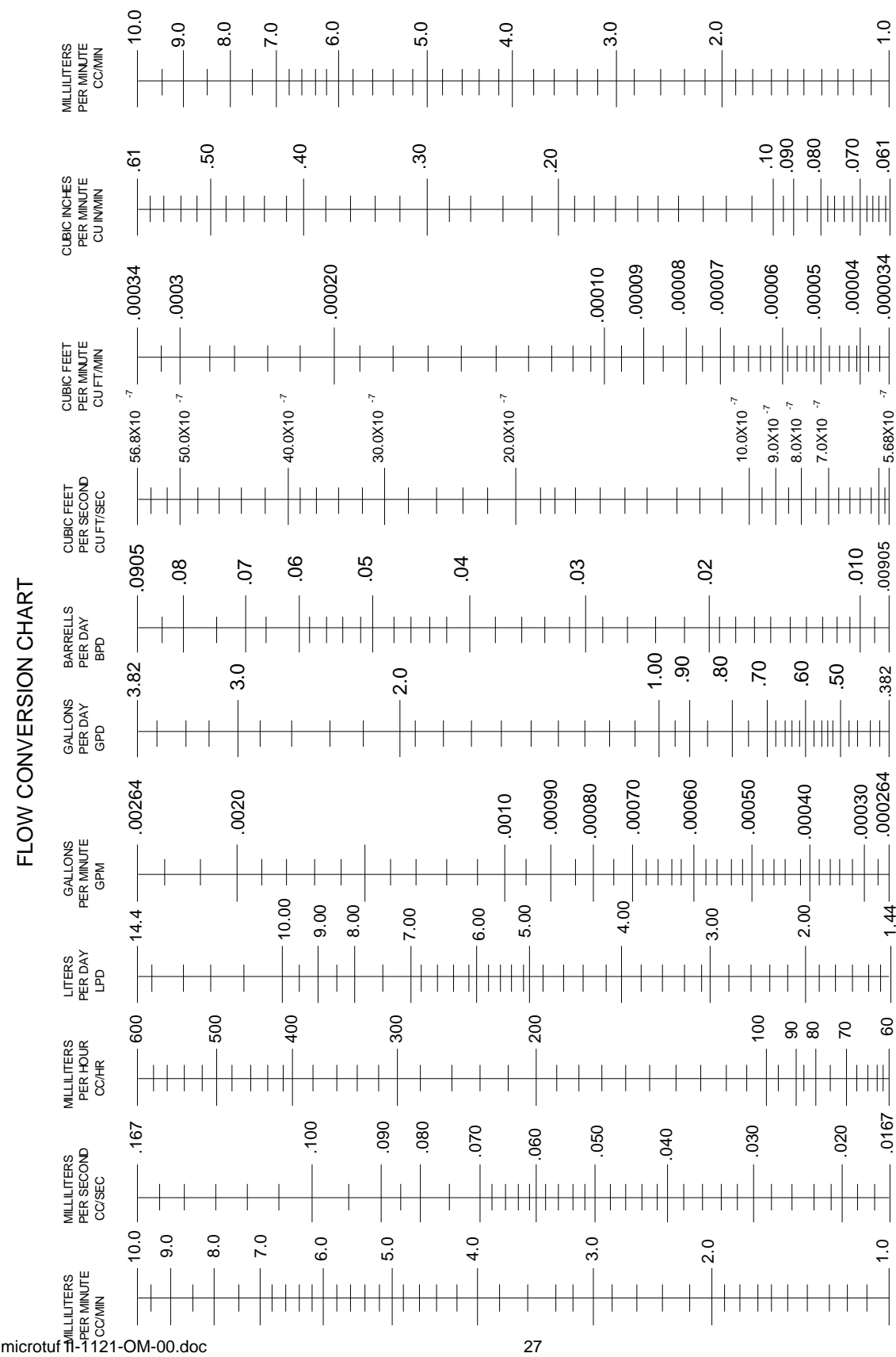
To receive prompt service call DELTA M's Customer Service Dept. (865) 483-1569 or toll free 1-800-922-0083. A representative will assist you in determining if the unit must be returned to the factory. A Return Authorization Number (RAN) will be given and should clearly mark the outside of the returning package. **Prior to calling, be sure to have the model number and serial number information for quick identification and service response.**

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

<u>TO CONVERT FROM</u>	<u>TO</u>	<u>MULTIPLY BY</u>
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)	CPFS	9.810 E-09
Liters Per Day (LPD)	CPFS	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



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.															
		Veloc- ity	Press. Drop	Veloc- ity	Press. Drop	Veloc- ity	Press. Drop	Veloc- ity	Press. Drop	Veloc- ity	Press. Drop	Veloc- ity	Press. Drop	Veloc- ity	Press. Drop	Veloc- ity	Press. Drop
Gallons per Minute	Cubic Ft. per Second	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.
.2	0.000446	1.13	1.86	0.616	0.359												
.3	0.000668	1.69	4.22	0.924	0.903	0.504	0.159	0.317	0.061								
.4	0.000891	2.26	6.98	1.23	1.61	0.672	0.345	0.422	0.086								
.5	0.00111	2.82	10.5	1.54	2.39	0.840	0.539	0.528	0.167	0.301	0.033						
.6	0.00134	3.39	14.7	1.85	3.29	1.01	0.751	0.633	0.240	0.361	0.041						
.8	0.00178	4.52	25.0	2.46	5.44	1.34	1.25	0.844	0.408	0.481	0.102						
1	0.00223	5.65	37.2	3.08	8.28	1.68	1.85	1.06	0.600	0.602	0.155						
2	0.00446	11.29	134.4	6.16	30.1	3.36	6.58	2.11	2.10	1.20	0.526						
3	0.00668			9.25	64.1	5.04	13.9	3.17	4.33	1.81	1.09						
4	0.00891			12.33	111.2	6.72	23.9	4.22	7.42	2.41	1.83						
5	0.01114					8.40	36.7	5.28	11.2	3.01	2.75						
6	0.01337	0.574	0.044			10.08	51.9	6.33	15.8	3.61	3.84						
8	0.01782	0.765	0.073			13.44	91.1	8.45	27.7	4.81	6.60						
10	0.02228	0.956	0.108	0.670	0.046			10.56	42.4	6.02	9.99						
15	0.03342	1.43	0.224	1.01	0.094			9.03	21.6	5.57	6.36						
20	0.04456	1.91	0.375	1.34	0.158	0.868	0.056	12.03	37.8	7.43	10.9						
25	0.05570	2.39	0.561	1.68	0.234	1.09	0.083	0.812	0.041								
30	0.06684	2.87	0.786	2.01	0.327	1.30	0.114	0.974	0.056								
35	0.07798	3.35	1.05	2.35	0.436	1.52	0.151	1.14	0.704	0.882	0.041						
40	0.08912	3.83	1.35	2.68	0.556	1.74	0.192	1.30	0.095	1.01	0.052						
45	0.1003	4.30	1.67	3.02	0.668	1.95	0.239	1.46	0.117	1.13	0.064						
50	0.1114	4.78	2.03	3.35	0.839	2.17	0.288	1.62	0.142	1.26	0.076						
60	0.1337	5.74	2.87	4.02	1.18	2.60	0.406	1.95	0.204	1.51	0.107						
70	0.1560	6.70	3.84	4.69	1.59	3.04	0.540	2.27	0.261	1.76	0.143						
80	0.1782	7.65	4.97	5.36	2.03	3.47	0.687	2.60	0.334	2.02	0.180						
90	0.2005	8.60	6.20	6.03	2.53	3.91	0.861	2.92	0.416	2.27	0.224						
100	0.2228	9.56	7.59	6.70	3.09	4.34	1.05	3.25	0.509	2.52	0.272						
125	0.2785	11.97	11.76	8.38	4.71	5.43	1.61	4.06	0.769	3.15	0.415						
150	0.3342	14.36	16.70	10.05	6.69	6.51	2.24	4.87	1.08	3.78	0.580						
175	0.3899	16.75	22.3	11.73	8.97	7.60	3.00	5.68	1.44	4.41	0.774						
200	0.4456	19.14	28.8	13.42	11.68	8.68	3.87	6.49	1.85	5.04	0.985						
225	0.5013	...	...	15.09	14.63	9.77	4.83	7.30	2.32	5.67	1.23						
250	0.557	...	...	...	...	10.85	5.93	8.12	2.84	6.30	1.46						
275	0.6127	...	...	...	...	11.94	7.14	8.93	3.40	6.93	1.79						
300	0.6684	...	...	...	...	13.00	8.36	9.74	4.02	7.56	2.11						
325	0.7241	...	...	...	...	14.12	9.89	10.53	4.09	8.19	2.47						
350	0.7798	...	...	...	...	...	...	11.36	5.41	8.82	2.84						
375	0.8355	...	...	...	...	...	...	12.17	6.18	9.45	3.25						
400	0.8912	...	...	...	...	...	...	12.98	7.03	10.08	3.68						
425	0.9469	...	...	...	...	...	...	13.80	7.89	10.71	4.12						
450	1.003	...	...	...	...	...	...	14.61	8.80	11.34	4.60						
475	1.059	1.93	0.054	...	...	...	...	...	...	11.97	5.12						
500	1.114	2.03	0.059	...	...	...	...	...	...	12.60	5.65						
550	1.225	2.24	0.071	...	...	...	...	...	...	13.85	6.79						
600	1.337	2.44	0.083	...	...	...	...	...	...	15.12	8.04						
650	1.448	2.64	0.097	...	...	...	...	...	...	...	...
700	1.560	2.85	0.112	2.01	0.047	...	...	...	...	...	...
750	1.671	3.05	0.127	2.15	0.054	...	...	...	...	...	...
800	1.782	3.25	0.143	2.29	0.061	...	...	...	...	...	...
850	1.894	3.46	0.160	2.44	0.068	2.02	0.042	...	...	...	...		
900	2.005	3.66	0.179	2.58	0.075	2.13	0.047	...	...	...	...		
950	2.117	3.86	0.198	2.72	0.083	2.25	0.052	...	...	...	...		
1000	2.228	4.07	0.218	2.87	0.091	2.37	0.057	...	...	...	...		
1100	2.451	4.48	0.260	3.15	0.110	2.61	0.068	...	...	...	...		
1200	2.674	4.88	0.306	3.44	0.128	2.85	0.080	2.18	0.042	...	...				
1300	2.896	5.29	0.355	3.73	0.150	3.08	0.093	2.36	0.048	...	...				
1400	3.119	5.70	0.409	4.01	0.171	3.32	0.107	2.54	0.055	...	...				
1500	3.342	6.10	0.466	4.30	0.195	3.56	0.122	2.72	0.063	...	...				
1600	3.565	6.51	0.527	4.59	0.219	3.79	0.138	2.90	0.071	...	...				
1800	4.010	7.32	0.663	5.16	0.276	4.27	0.172	3.27	0.088	2.58	0.050						
2000	4.456	8.14	0.808	5.73	0.339	4.74	0.209	3.63	0.107	2.87	0.060						
2500	5.570	10.17	1.24	7.17	0.515	5.93	0.321	4.54	0.163	3.59	0.091						
3000	6.684	12.20	1.76	8.60	0.731	7.11	0.451	5.45	0.232	4.30	0.129						
3500	7.798	14.24	2.38	10.03	0.982	8.30	0.607	6.35	0.312	5.02	0.173						
4000	8.912	16.27	3.08	11.47	1.27	9.48	0.787	7.26	0.401	5.74	0.222						
4500	10.03	18.31	3.87	12.90	1.60	10.67	0.990	8.17	0.503	6.46	0.280						
5000	11.14	20.35	4.71	14.33	1.95	11.85	1.21	9.08	0.617	7.17	0.340						
6000	13.37	24.41	6.74	17.20	2.77	14.23	1.71	10.89	0.877	8.61	0.483						
7000	15.60	28.49	9.11	20.07	3.74	16.60	2.31	12.71	1.18	10.04	0.652						
8000	17.82	...	...	22.93	4.84	18.96	2.99	14.52	1.51	11.47	0.839						
9000	20.05	...	...	25.79	6.09	21.34	3.76	16.34	1.90	12.91	1.05						
10000	22.28	...	...	28.66	7.46	23.71	4.61	18.15	2.34	14.34	1.28						
12000	26.74	...	...	34.40	10.7	28.45	6.59	21.79	3.33	17.21	1.83						
14000	31.19	...	...	...	...	33.19	8.89	25.42	4.49	20.08	2.45						
16000	35.65	...	...	...	...	...	...	29.05	5.83	22.95	3.18						
18000	40.10	...	...	...	...	...	...	32.68	7.31	25.82	4.03						
20000	44.56	...	...	...	...	...	...	36.31	9.03	28.69	4.93						

For pipe lengths other than 100 feet, the pressure drop is proportional to the length. Thus, for 50 feet of pipe, the pressure drop is approximately one-half the value given in the table ... for 300 feet, three times the given value, etc.

Velocity is a function of the cross sectional flow area; thus, it is constant for a given flow rate and is independent of pipe length.

9.4 MODEL NUMBER DESIGNATION AND AVAILABLE OPTIONS (sheet 1)

FLANGE

MINPT

INSERTION LENGTH

PRODUCT FAMILY

WETTED PARTS MATERIAL

ELECTRONICS INPUT POWER

LOCATIONS AND ENCLOSURES

SPECIAL OPTIONS

FSZ11NX

56

A C

LE

00

STANDARD FSZ11NX FLOW SWITCH

MODELS: microtuf® II SERIES

LS11NX - LEVEL SWITCH

FSZ11NX - FLOW SWITCH

0.75 - 0.75 IN (19.05) MNPT

0.50 - 0.5 IN (12.7) MNPT

0.75 - 0.75 IN (19.05) MNPT

1.00 - 1.00 IN (25.4) MNPT

1.50 - 1.50 IN (38.1) SANITARY

2.00 - 2.00 IN (50.8) SANITARY

2.50 - 2.50 IN (63.5) SANITARY

3.00 - 3.00 IN (76.2) SANITARY

3.50 - 3.50 IN (88.9) SANITARY

4.00 - 4.00 IN (101.6) SANITARY

4.50 - 4.50 IN (114.3) SANITARY

5.00 - 5.00 IN (127.0) SANITARY

5.50 - 5.50 IN (139.7) SANITARY

6.00 - 6.00 IN (152.4) SANITARY

6.50 - 6.50 IN (165.1) SANITARY

7.00 - 7.00 IN (177.8) SANITARY

7.50 - 7.50 IN (190.5) SANITARY

8.00 - 8.00 IN (203.2) SANITARY

8.50 - 8.50 IN (215.9) SANITARY

9.00 - 9.00 IN (228.6) SANITARY

9.50 - 9.50 IN (241.3) SANITARY

10.00 - 10.00 IN (254.0) SANITARY

10.50 - 10.50 IN (266.7) SANITARY

11.00 - 11.00 IN (279.4) SANITARY

11.50 - 11.50 IN (292.1) SANITARY

12.00 - 12.00 IN (304.8) SANITARY

12.50 - 12.50 IN (317.5) SANITARY

13.00 - 13.00 IN (330.2) SANITARY

13.50 - 13.50 IN (342.9) SANITARY

14.00 - 14.00 IN (355.6) SANITARY

14.50 - 14.50 IN (368.3) SANITARY

15.00 - 15.00 IN (381.0) SANITARY

15.50 - 15.50 IN (393.7) SANITARY

16.00 - 16.00 IN (406.4) SANITARY

16.50 - 16.50 IN (419.1) SANITARY

17.00 - 17.00 IN (431.8) SANITARY

17.50 - 17.50 IN (444.5) SANITARY

18.00 - 18.00 IN (457.2) SANITARY

18.50 - 18.50 IN (469.9) SANITARY

19.00 - 19.00 IN (482.6) SANITARY

19.50 - 19.50 IN (495.3) SANITARY

20.00 - 20.00 IN (508.0) SANITARY

20.50 - 20.50 IN (520.7) SANITARY

21.00 - 21.00 IN (533.4) SANITARY

21.50 - 21.50 IN (546.1) SANITARY

22.00 - 22.00 IN (558.8) SANITARY

22.50 - 22.50 IN (571.5) SANITARY

23.00 - 23.00 IN (584.2) SANITARY

23.50 - 23.50 IN (596.9) SANITARY

24.00 - 24.00 IN (609.6) SANITARY

24.50 - 24.50 IN (622.3) SANITARY

25.00 - 25.00 IN (635.0) SANITARY

25.50 - 25.50 IN (647.7) SANITARY

26.00 - 26.00 IN (660.4) SANITARY

26.50 - 26.50 IN (673.1) SANITARY

27.00 - 27.00 IN (685.8) SANITARY

27.50 - 27.50 IN (698.5) SANITARY

28.00 - 28.00 IN (711.2) SANITARY

28.50 - 28.50 IN (723.9) SANITARY

29.00 - 29.00 IN (736.6) SANITARY

29.50 - 29.50 IN (749.3) SANITARY

30.00 - 30.00 IN (762.0) SANITARY

30.50 - 30.50 IN (774.7) SANITARY

31.00 - 31.00 IN (787.4) SANITARY

31.50 - 31.50 IN (800.1) SANITARY

32.00 - 32.00 IN (812.8) SANITARY

32.50 - 32.50 IN (825.5) SANITARY

33.00 - 33.00 IN (838.2) SANITARY

33.50 - 33.50 IN (850.9) SANITARY

34.00 - 34.00 IN (863.6) SANITARY

34.50 - 34.50 IN (876.3) SANITARY

35.00 - 35.00 IN (889.0) SANITARY

35.50 - 35.50 IN (901.7) SANITARY

36.00 - 36.00 IN (914.4) SANITARY

36.50 - 36.50 IN (927.1) SANITARY

37.00 - 37.00 IN (939.8) SANITARY

37.50 - 37.50 IN (952.5) SANITARY

38.00 - 38.00 IN (965.2) SANITARY

38.50 - 38.50 IN (977.9) SANITARY

39.00 - 39.00 IN (990.6) SANITARY

39.50 - 39.50 IN (1003.3) SANITARY

40.00 - 40.00 IN (1016.0) SANITARY

40.50 - 40.50 IN (1028.7) SANITARY

41.00 - 41.00 IN (1041.4) SANITARY

41.50 - 41.50 IN (1054.1) SANITARY

42.00 - 42.00 IN (1066.8) SANITARY

42.50 - 42.50 IN (1079.5) SANITARY

43.00 - 43.00 IN (1092.2) SANITARY

43.50 - 43.50 IN (1104.9) SANITARY

44.00 - 44.00 IN (1117.6) SANITARY

44.50 - 44.50 IN (1130.3) SANITARY

45.00 - 45.00 IN (1143.0) SANITARY

45.50 - 45.50 IN (1155.7) SANITARY

46.00 - 46.00 IN (1168.4) SANITARY

46.50 - 46.50 IN (1181.1) SANITARY

47.00 - 47.00 IN (1193.8) SANITARY

47.50 - 47.50 IN (1206.5) SANITARY

48.00 - 48.00 IN (1219.2) SANITARY

48.50 - 48.50 IN (1231.9) SANITARY

49.00 - 49.00 IN (1244.6) SANITARY

49.50 - 49.50 IN (1257.3) SANITARY

50.00 - 50.00 IN (1270.0) SANITARY

50.50 - 50.50 IN (1282.7) SANITARY

51.00 - 51.00 IN (1295.4) SANITARY

51.50 - 51.50 IN (1308.1) SANITARY

52.00 - 52.00 IN (1320.8) SANITARY

52.50 - 52.50 IN (1333.5) SANITARY

53.00 - 53.00 IN (1346.2) SANITARY

53.50 - 53.50 IN (1358.9) SANITARY

54.00 - 54.00 IN (1371.6) SANITARY

54.50 - 54.50 IN (1384.3) SANITARY

55.00 - 55.00 IN (1397.0) SANITARY

55.50 - 55.50 IN (1409.7) SANITARY

56.00 - 56.00 IN (1422.4) SANITARY

56.50 - 56.50 IN (1435.1) SANITARY

57.00 - 57.00 IN (1447.8) SANITARY

57.50 - 57.50 IN (1460.5) SANITARY

58.00 - 58.00 IN (1473.2) SANITARY

58.50 - 58.50 IN (1485.9) SANITARY

59.00 - 59.00 IN (1498.6) SANITARY

59.50 - 59.50 IN (1511.3) SANITARY

60.00 - 60.00 IN (1524.0) SANITARY

60.50 - 60.50 IN (1536.7) SANITARY

61.00 - 61.00 IN (1549.4) SANITARY

61.50 - 61.50 IN (1562.1) SANITARY

62.00 - 62.00 IN (1574.8) SANITARY

62.50 - 62.50 IN (1587.5) SANITARY

63.00 - 63.00 IN (1600.2) SANITARY

63.50 - 63.50 IN (1612.9) SANITARY

64.00 - 64.00 IN (1625.6) SANITARY

64.50 - 64.50 IN (1638.3) SANITARY

65.00 - 65.00 IN (1651.0) SANITARY

65.50 - 65.50 IN (1663.7) SANITARY

66.00 - 66.00 IN (1676.4) SANITARY

66.50 - 66.50 IN (1689.1) SANITARY

67.00 - 67.00 IN (1701.8) SANITARY

67.50 - 67.50 IN (1714.5) SANITARY

68.00 - 68.00 IN (1727.2) SANITARY

68.50 - 68.50 IN (1739.9) SANITARY

69.00 - 69.00 IN (1752.6) SANITARY

69.50 - 69.50 IN (1765.3) SANITARY

70.00 - 70.00 IN (1778.0) SANITARY

70.50 - 70.50 IN (1790.7) SANITARY

71.00 - 71.00 IN (1803.4) SANITARY

71.50 - 71.50 IN (1816.1) SANITARY

72.00 - 72.00 IN (1828.8) SANITARY

72.50 - 72.50 IN (1841.5) SANITARY

73.00 - 73.00 IN (1854.2) SANITARY

73.50 - 73.50 IN (1866.9) SANITARY

74.00 - 74.00 IN (1879.6) SANITARY

74.50 - 74.50 IN (1892.3) SANITARY

75.00 - 75.00 IN (1905.0) SANITARY

75.50 - 75.50 IN (1917.7) SANITARY

76.00 - 76.00 IN (1930.4) SANITARY

76.50 - 76.50 IN (1943.1) SANITARY

77.00 - 77.00 IN (1955.8) SANITARY

77.50 - 77.50 IN (1968.5) SANITARY

78.00 - 78.00 IN (1981.2) SANITARY

78.50 - 78.50 IN (1993.9) SANITARY

79.00 - 79.00 IN (2006.6) SANITARY

79.50 - 79.50 IN (2019.3) SANITARY

80.00 - 80.00 IN (2032.0) SANITARY

80.50 - 80.50 IN (2044.7) SANITARY

81.00 - 81.00 IN (2057.4) SANITARY

81.50 - 81.50 IN (2070.1) SANITARY

82.00 - 82.00 IN (2082.8) SANITARY

82.50 - 82.50 IN (2095.5) SANITARY

83.00 - 83.00 IN (2108.2) SANITARY

83.50 - 83.50 IN (2120.9) SANITARY

84.00 - 84.00 IN (2133.6) SANITARY

84.50 - 84.50 IN (2146.3) SANITARY

85.00 - 85.00 IN (2159.0) SANITARY

85.50 - 85.50 IN (2171.7) SANITARY

86.00 - 86.00 IN (2184.4) SANITARY

86.50 - 86.50 IN (2197.1) SANITARY

87.00 - 87.00 IN (2209.8) SANITARY

87.50 - 87.50 IN (2222.5) SANITARY

88.00 - 88.00 IN (2235.2) SANITARY

88.50 - 88.50 IN (2247.9) SANITARY

89.00 - 89.00 IN (2260.6) SANITARY

89.50 - 89.50 IN (2273.3) SANITARY

90.00 - 90.00 IN (2286.0) SANITARY

90.50 - 90.50 IN (2298.7) SANITARY

91.00 - 91.00 IN (2311.4) SANITARY

91.50 - 91.50 IN (2324.1) SANITARY

92.00 - 92.00 IN (2336.8) SANITARY

92.50 - 92.50 IN (2349.5) SANITARY

93.00 - 93.00 IN (2362.2) SANITARY

93.50 - 93.50 IN (2374.9) SANITARY

94.00 - 94.00 IN (2387.6) SANITARY

94.50 - 94.50 IN (2400.3) SANITARY

95.00 - 95.00 IN (2413.0) SANITARY

95.50 - 95.50 IN (2425.7) SANITARY

96.00 - 96.00 IN (2438.4) SANITARY

96.50 - 96.50 IN (2451.1) SANITARY

97.00 - 97.00 IN (2463.8) SANITARY

97.50 - 97.50 IN (2476.5) SANITARY

98.00 - 98.00 IN (2489.2) SANITARY

98.50 - 98.50 IN (2501.9) SANITARY

99.00 - 99.00 IN (2514.6) SANITARY

99.50 - 99.50 IN (2527.3) SANITARY

100.00 - 100.00 IN (2540.0) SANITARY

100.50 - 100.50 IN (2552.7) SANITARY

101.00 - 101.00 IN (2565.4) SANITARY

101.50 - 101.50 IN (2578.1) SANITARY

102.00 - 102.00 IN (2590.8) SANITARY

102.50 - 102.50 IN (2603.5) SANITARY

103.00 - 103.00 IN (2616.2) SANITARY

103.50 - 103.50 IN (2628.9) SANITARY

104.00 - 104.00 IN (2641.6) SANITARY

104.50 - 104.50 IN (2654.3) SANITARY

105.00 - 105.00 IN (2667.0) SANITARY

105.50 - 105.50 IN (2679.7) SANITARY

106.00 - 106.00 IN (2692.4) SANITARY

106.50 - 106.50 IN (2705.1) SANITARY

107.00 - 107.00 IN (2717.8) SANITARY

107.50 - 107.50 IN (2730.5) SANITARY

108.00 - 108.00 IN (2743.2) SANITARY

108.50 - 108.50 IN (2755.9) SANITARY

109.00 - 109.00 IN (2768.6) SANITARY

109.50 - 109.50 IN (2781.3) SANITARY

110.00 - 110.00 IN (2794.0) SANITARY

110.50 - 110.50 IN (2806.7) SANITARY

111.00 - 111.00 IN (2819.4) SANITARY

111.50 - 111.50 IN (2832.1) SANITARY

112.00 - 112.00 IN (2844.8) SANITARY

112.50 - 112.50 IN (2857.5) SANITARY

113.00 - 113.00 IN (2870.2) SANITARY

113.50 - 113.50 IN (2882.9) SANITARY

114.00 - 114.00 IN (2895.6) SANITARY

114.50 - 114.50 IN (2908.3) SANITARY

115.00 - 115.00 IN (2921.0) SANITARY

115.50 - 115.50 IN (2933.7) SANITARY

116.00 - 116.00 IN (2946.4) SANITARY

116.50 - 116.50 IN (2959.1) SANITARY

117.00 - 117.00 IN (2971.8) SANITARY

117.50 - 117.50 IN (2984.5) SANITARY

118.00 - 118.00 IN (2997.2) SANITARY

118.50 - 118.50 IN (3009.9) SANITARY

119.00 - 119.00 IN (3022.6) SANITARY

119.50 - 119.50 IN (3035.3) SANITARY

120.00 - 120.00 IN (3048.0) SANITARY

120.50 - 120.50 IN (3060.7) SANITARY

121.00 - 121.00 IN (3073.4) SANITARY

121.50 - 121.50 IN (3086.1) SANITARY

122.00 - 122.00 IN (3098.8) SANITARY

122.50 - 122.50 IN (3111.5) SANITARY

123.00 - 123.00 IN (3124.2) SANITARY

123.50 - 123.50 IN (3136.9) SANITARY

124.00 - 124.00 IN (3149.6) SANITARY

124.50 - 124.50 IN (3162.3) SANITARY

125.00 - 125.00 IN (3175.0) SANITARY

125.50 - 125.50 IN (3187.7) SANITARY

126.00 - 126.00 IN (3200.4) SANITARY

126.50 - 126.50 IN (3213.1) SANITARY

127.00 - 127.00 IN (3225.8) SANITARY

127.50 - 127.50 IN (3238.5) SANITARY

128.00 - 128.00 IN (3251.2) SANITARY

128.50 - 128.50 IN (3263.9) SANITARY

129.00 - 129.00 IN (3276.6) SANITARY

129.50 - 129.50 IN (3289.3) SANITARY

130.00 - 130.00 IN (3302.0) SANITARY

130.50 - 130.50 IN (3314.7) SANITARY

131.00 - 131.00 IN (3327.4) SANITARY

131.50 - 131.50 IN (3340.1) SANITARY

132.00 - 132.00 IN (3352.8) SANITARY

132.50 - 132.50 IN (3365.5) SANITARY

133.00 - 133.00 IN (3378.2) SANITARY

133.50 - 133.50 IN (3390.9) SANITARY

134.00 - 134.00 IN (3403.6) SANITARY

134.50 - 134.50 IN (3416.3) SANITARY

135.00 - 135.00 IN (3429.0) SANITARY

135.50 - 135.50 IN (3441.7) SANITARY

136.00 - 136.00 IN (3454.4) SANITARY

136.50 - 136.50 IN (3467.1) SANITARY

137.00 - 137.00 IN (3479.8) SANITARY

137.50 - 137.50 IN (3492.5) SANITARY

138.00 - 138.00 IN (3505.2) SANITARY

138.50 - 138.50 IN (3517.9) SANITARY

139.00 - 139.00 IN (3530.6) SANITARY

139.50 - 139.50 IN (3543.3) SANITARY

140.00 - 140.00 IN (3556.0) SANITARY

140.50 - 140.50 IN (3568.7) SANITARY

141.00 - 141.00 IN (3581.4) SANITARY

141.50 - 141.50 IN (3594.1) SANITARY

142.00 - 142.00 IN (3606.8) SANITARY

142.50 - 142.50 IN (3619.5) SANITARY

143.00 - 143.00 IN (3632.2) SANITARY

143.50 - 143.50 IN (3644.9) SANITARY

144.00 - 144.00 IN (3657.6) SANITARY

144.50 - 144.50 IN (3670.3) SANITARY

145.00 - 145.00 IN (3683.0) SANITARY

145.50 - 145.50 IN (3695.7) SANITARY

146.00 - 146.00 IN (3708.4) SANITARY

146.50 - 146.50 IN (3721.1) SANITARY

147.00 - 147.00 IN (3733.8) SANITARY

147.50 - 147.50 IN (3746.5) SANITARY

148.00 - 148.00 IN (3759.2) SANITARY

148.50 - 148.50 IN (3771.9) SANITARY

149.00 - 149.00 IN (3784.6) SANITARY

149.50 - 149.50 IN (3797.3) SANITARY

150.00 - 150.00 IN (3810.0) SANITARY

150.50 - 150.50 IN (3822.7) SANITARY

151.00 - 151.00 IN (3835.4) SANITARY

151.50 - 151.50 IN (3848.1) SANITARY

152.00 - 152.00 IN (3860.8) SANITARY

152.50 - 152.50 IN (3873.5) SANITARY

153.00 - 153.00 IN (3886.2) SANITARY

153.50 - 153.50 IN (3898.9) SANITARY

154.00 - 154.00 IN (3911.6) SANITARY

154.50 - 154.50 IN (3924.3) SANITARY

155.00 - 155.00 IN (3937.0) SANITARY

155.50 - 155.50 IN (3949.7) SANITARY

156.00 - 156.00 IN (3962.4) SANITARY

156.50 - 156.50 IN (3975.1) SANITARY

157.00 - 157.00 IN (3987.8) SANITARY

157.50 - 157.50 IN (4000.5) SANITARY

158.00 - 158.00 IN (4013.2) SANITARY

158.50 - 158.50 IN (4025.9) SANITARY

159.00 - 159.00 IN (4038.6) SANITARY

159.50 - 159.50 IN (4051.3) SANITARY

160.00 - 160.00 IN (4064.0) SANITARY

160.50 - 160.50 IN (4076.7) SANITARY

161.00 - 161.00 IN (4089.4) SANITARY

161.50 - 161.50 IN (4102.1) SANITARY

162.00 - 162.00 IN (4114.8) SANITARY

162.50 - 162.50 IN (4127.5) SANITARY

163.00 - 163.00 IN (4140.2) SANITARY

163.50 - 163.50 IN (4152.9) SANITARY

164.00 - 164.00 IN (4165.6) SANITARY

164.50 - 164.50 IN (4178.3) SANITARY

165.00 - 165.00 IN (4191.0) SANITARY

165.50 - 165.50 IN (4203.7) SANITARY

166.00 - 166.00 IN (4216.4) SANITARY

166.50 - 166.50 IN (4229.1) SANITARY

167.00 - 167.00 IN (4241.8) SANITARY

167.50 - 167.50 IN (4254.5) SANITARY

168.00 - 168.00 IN (4267.2) SANITARY

168.50 - 168.50 IN (4279.9) SANITARY

169.00 - 169.00 IN (4292.6) SANITARY

169.50 - 169.50 IN (4305.3) SANITARY

170.00 - 170.00 IN (4318.0) SANITARY

170.50 - 170.50 IN (4330.7) SANITARY

171.00 - 171.00 IN (4343.4) SANITARY

171.50 - 171.50 IN (4356.1) SANITARY

172.00 - 172.00 IN (4368.8) SANITARY

172.50 - 172.50 IN (4381.5) SANITARY

173.00 - 173.00 IN (4394.2) SANITARY

173.50 - 173.50 IN (4406.9) SANITARY

174.00 - 174.00 IN (4419.6) SANITARY

174.50 - 174.50 IN (4432.3) SANITARY

175.00 - 175.00 IN (4445.0) SANITARY

175.50 - 175.50 IN (4457.7) SANITARY

176.00 - 176.00 IN (4470.4) SANITARY

176.50 - 176.50 IN (4483.1) SANITARY

177.00 - 177.00 IN (4495.8) SANITARY

177.50 - 177.50 IN (4508.5) SANITARY

178.00 - 178.00 IN (4521.2) SANITARY

178.50 - 178.50 IN (4533.9) SANITARY

179.00 - 179.00 IN (4546.6) SANITARY

179.50 - 179.50 IN (4559.3) SANITARY

180.00 - 180.00 IN (4572.0) SANITARY

180.50 - 180.50 IN (4584.7) SANITARY

181.00 - 181.00 IN (4597.4) SANITARY

181.50 - 181.50 IN (4610.1) SANITARY

182.00 - 182.00 IN (4622.8) SANITARY

182.50 - 182.50 IN (4635.5) SANITARY

183.00 - 183.00 IN (4648.2) SANITARY

183.50 - 183.50 IN (4660.9) SANITARY

184.00 - 184.00 IN (4673.6) SANITARY

184.50 - 184.50 IN (4686.3) SANITARY

185.00 - 185.00 IN (4699.0) SANITARY

185.50 - 185.50 IN (4711.7) SANITARY

186.00 - 186.00 IN (4724.4) SANITARY

186.50 - 186.50 IN (4737.1) SANITARY

187.00 - 187.00 IN (4749.8) SANITARY

187.50 - 187.50 IN (4762.5) SANITARY

188.00 - 188.00 IN (4775.2) SANITARY

188.50 - 188.50 IN (4787.9) SANITARY

189.00 - 189.00 IN (4800.6) SANITARY

189.50 - 189.50 IN (4813.3) SANITARY

190.00 - 190.00 IN (4826.0) SANITARY

190.50 - 190.50 IN (4838.7) SANITARY

191.00 - 191.00 IN (4851.4) SANITARY

191.50 - 191.50 IN (4864.1) SANITARY

192.00 - 192.00 IN (4876.8) SANITARY

192.50 - 192.50 IN (4889.5) SANITARY

193.00 - 193.00 IN (4902.2) SANITARY

193.50 - 193.50 IN (4914.9) SANITARY

194.00 - 194.00 IN (4927.6) SANITARY

194.50 - 194.50 IN (4940.3) SANITARY

195.00 - 195.00 IN (4953.0) SANITARY

195.50 - 195.50 IN (4965.7) SANITARY

196.00 - 196.00 IN (4978.4) SANITARY

196.50 - 196.50 IN (4991.1) SANITARY

197.00 - 197.00 IN (5003.8) SANITARY

197.50 - 197.50 IN (5016.5) SANITARY

198.00 - 198.00 IN (5029.2) SANITARY

198.50 - 198.50 IN (5041.9) SANITARY

199.00 - 199.00 IN (5054.6) SANITARY

199.50 - 199.50 IN (5067.3) SANITARY

200.00 - 200.00 IN (5080.0) SANITARY

200.50 - 200.50 IN (5092.7) SANITARY

201.00 - 201.00 IN (5105.4) SANITARY

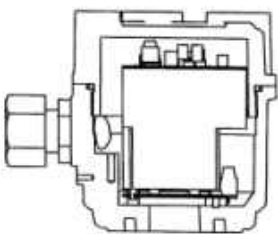
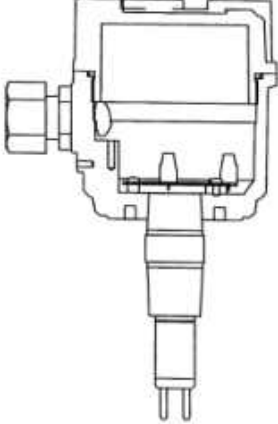
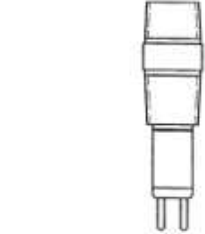
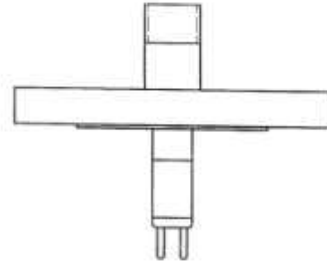
201.50 - 201.50 IN (5118.1) SANITARY

202.00 - 202.00 IN (5130.8) SANITARY

202.50 - 202.50 IN (5143.5) SANITARY

2

9.4 MODEL NUMBER DESIGNATION AND AVAILABLE OPTIONS (sheet 2)



PRODUCT FAMILY
[A][A][A][A]

MOUNTING/PROCESS FITTING
[B][B][B]

WETTED PARTS MATERIAL
[C][C]

INSERTION LENGTH
[D][D][D][D]

ELECTRONICS INPUT POWER
[E][E]

LOCATIONS AND ENCLOSURES
[F][F]

SPECIAL OPTIONS
[G][G]

FS21NX 0.00 0.00 0.00 0.00 0.00 0.00 0.00 REMOTE ELCT FS21NX SHOWN

FS21NX 0.75 0.00 0.00 0.00 0.00 0.00 0.00 REMOTE PROBE FS21NX SHOWN

STANDARD FS21NX REMOTE FLOW SWITCH 0.75 - 0.75 IN (19.05) MMPT

MODELS: microtuf® II SERIES

0.59 - 0.5 IN (12.7) MMPT

0.75 - 0.75 IN (19.05) MMPT

1.00 - 1.00 IN (25.4) MMPT

R - RAISED FACE FLG

A - 150 LB. RATING

B - 300 LB. RATING

-1 - 1.00 INCH (25.4)

-2 - 2.00 INCH (50.8)

3A1 - 1.50 IN (38.1) SANITARY

3A2 - 2.00 IN (50.8) SANITARY

LFR - LOW FLOW SENSOR

SPL - SPECIAL (SEE NOTE 6)

56 - STAINLESS STEEL, 316L

54 - STAINLESS STEEL, 304

55 - STAINLESS STEEL, 210L

5L - STAINLESS STEEL, 304L

HC - HASTELLOY C

3D - INCONEL 600

A2 - ALLOY 20

MN - MONEL

SM - SPECIAL MATERIAL

RE - REMOTE ELECTRONICS

RE - REMOTE ELECTRONICS

NP - REMOTE PROBE

CA - ADDITIONAL CABLE REQUIRED

CB - CALIBRATION REQUIRED

EN - EXTENDED NECK

PC - POTTED CABLE

00 - NO SPECIAL OPTION REQUESTED

SPECIAL OPTIONS:

NOTES:

1. THE MICROTUF® II FAMILY SWITCH POWER IS FACTORY SET TO THE POWER LISTED. THE CUSTOMER MUST ORDER HIS SELECTION.

2. THE SENSORS AND INSERTION EXTENSION HAVE A MAXIMUM WORKING PRESSURE (MWP) RATING OF 3000 PSI. THE ACTUAL PROCESS CONNECTION PRESSURE RATING DEPENDS ON THE PROCESS MOUNTING FLANGE RATING.

3. THE THREADED PROCESS FITTING PROBE HAVE A MWP OF 3,000 PSI @ 0-100°F.

4. SPECIAL MATERIALS OR CONSTRUCTION, IF NECESSARY, MUST OBTAIN PRELIMINARY AND TEMPERATURE RATING REVIEW TO BOLTER CODE REQUIREMENTS, INCLUDING INCONEL 600.

5. NUMBERS IN PARANTHESES ARE METRIC EQUIVALENTS.

6. ADDITIONAL PROCESS CONNECTIONS MAY BE ADDED AS NECESSARY (SPL).

APPROVALS

DESIGNED BY J. STOUT 10/25/2009

START BY J. HEBBLE 10/25/2009

REVISIONS R.W. MCILLOCH 10/25/2009

REVISIONS NOT RECD

DATE 10/1/2009

BY J. HEBBLE

DATE 10/1/2009

SCALE 3 OF 3

MT2060

01

01

DELTA CORPORATION

1003 LARSEN DRIVE

OAK RIDGE, TN 37830

MODEL NUMBER STRUCTURE, microtuf® II SERIES

microtuf II-1121-OM-00.doc

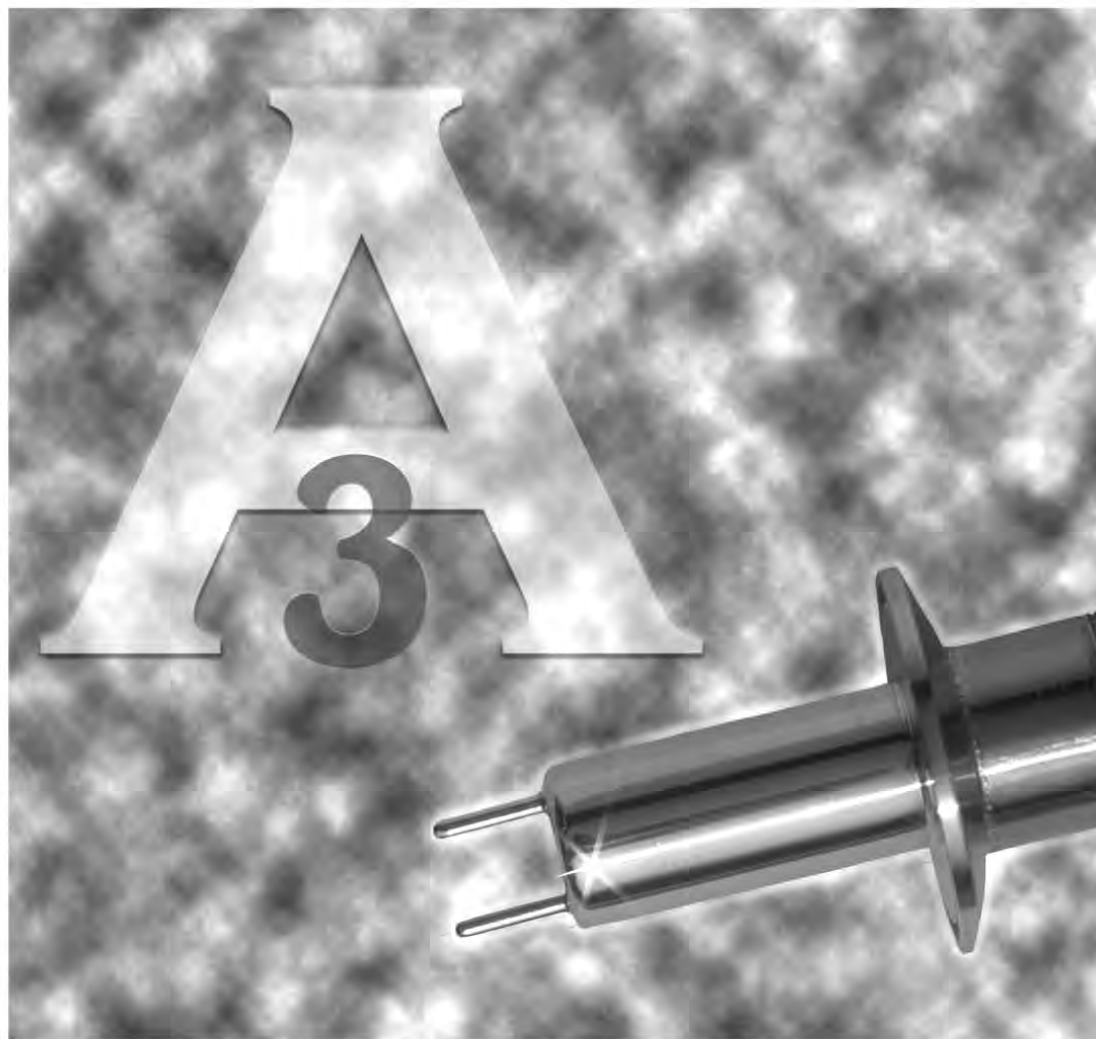
30

10.0 **OPTIONS**
10.1 **SANITARY (3A1)**

DELTA **m**
CORPORATION

A
3

Sanitary Switch
Specifications & Operating
Instructions



- DELTA M Corporation has received the authority to apply the 3-A symbol to our flow and level switches.
- For use with both the VERSA-SWITCH[®] and microtuf[®] line of DELTA M switches.
- Standard operating temperature range of -100°F to 390°F with options to 850°F.
- Standard Stainless Steel Construction.
- 3-A Authorization No. 950 issued to DELTA M by 3-A Sanitary Standards Symbol Administrative Council
- Designed for use in both food, beverage, and pharmaceutical applications.
- Available with insertion length to suit your specific level or flow application.
- Operating pressure rating of 1500 psig.

DELTA M Corporation - 1003 Larsen Drive - Oak Ridge, Tennessee 37830 - USA - Phone: (865) 483-1569 - Fax (865) 483-1142 - <http://www.deltamcorp.com>

VERSA-SWITCH® & microtuf® Switch Option



* Shown Above with Optional Sanitary Tee

Operating Instructions

Installation

DELTA M'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.

A3 Sanitary Switch

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

Form Number (DML1001.02)

DELTA M Corporation - 1003 Larsen Drive - Oak Ridge, Tennessee 37830 - USA - Phone: (865) 483-1569 - Fax (865) 483-1142 - <http://www.deltamcorp.com>