OPERATION AND MAINTENANCE MANUAL

VERSA-SWITCH®
VS5100 – DUAL CHANNEL FLOW/LEVEL/TEMPERATURE SWITCH
LS51SC - SINGLE CHANNEL POINT LEVEL SWITCH
FS51SC - SINGLE CHANNEL MASS FLOW SWITCH
TS51SC – SINGLE CHANNEL TEMPERATURE SWITCH

DOCUMENT 5100-OM-5
REVISION 5

OCTOBER 2004

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MODEL NO._____ SERIAL NO._____

DATE OF SHIPMENT _____ INSTALLATION DATE_____

CUSTOMER TAG NO._____ PO NO._____

OPTIONS_____

_____

SPECIAL NOTES_____

_____

NOTICE

This manual covers the following model numbers:

VERSA-SWITCH® Series Models		LS51XX Point Level	FS51XX Mass Flow	TS51XX Temperature	VS51XX Flow/Level/Temp
Agency Approvals	Explosion-Proof Rating	Single Channel	Single Channel	Single Channel	Dual Channel
CSA	Class I Groups B,C,D Class II Groups E,F,G T4A	LS51SC	FS51SC	TS51SC	VS5100
Non Approved	Non-Explosion Proof	LS51NX	FS51NX	TS51NX	VS51NX
Switch Kits (No Enclosure)	Not Rated	FS51SK	FS51SK	TS51SK	VS51SK

BEFORE STARTING

DELTA M appreciates your choosing our VERSA-SWITCH® for your temperature, level, and/or flow monitoring application. We are committed to providing reliable, quality instrumentation to our customers.

Please take time to review these important notices prior to installation. It is recommended that this manual be reviewed in its entirety prior to installation and operation.

IMPORTANT

- **WHEN INSTALLING YOUR DELTA M SWITCH INTO A PIPE OR VESSEL USE A 1 1/8 (1.125) INCH (28.575MM) OPEN-END WRENCH TO TIGHTEN AT THE 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 BEING 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 INSTALLATIONS FOR POINT LEVEL DETECTION THE ORIENTATION MAKES NO DIFFERENCE. PROPER ORIENTATION IS MARKED ON THE SWITCH BODY FOR REFERENCE. (SEE FIGURE 5)**

- **THE VERSA-SWITCH® MUST BE CONFIGURED FOR PROPER POWER INPUT BEFORE THE POWER IS CONNECTED. (SEE SECTION 3.2.1).**

- **DOUBLE CHECK SELECTION OF VOLTAGE AND MODE (AC OR DC) OF ELECTRONICS AND ENSURE PROPER MATCH TO INPUT VOLTAGE AT FIELD WIRING CONNECTOR TO AVOID DAMAGE (SEE SECTION 3.2.1.)**

- **OPERATION ON 24 VAC IS NOT A FIELD SELECTABLE OPTION BUT CAN BE INSTALLED AT THE FACTORY. FOR 24 VDC OPERATION BE SURE SECOND JUMPER IS IN SOCKET E PROPERLY (SEE FIGURE 8).**

- **CHECK THAT THE VERSA-SWITCH® ELECTRONICS ARE PROPERLY CONFIGURED BEFORE CONNECTING POWER LEADS. (SEE SECTION 4.2 APPLICATION CONFIGURATIONS.)**

- **A GROUND WIRE MUST BE ATTACHED TO THE GROUND SCREW LOCATED INSIDE THE BACK OF THE INSTRUMENT ENCLOSURE FOR PROPER OPERATION (SEE FIGURE 9). CONDUIT IS RECOMMENDED FOR ALL WIRING TO THE SWITCH FOR PROTECTION AND RFI-EMI SHIELDING.**

BEFORE STARTING (CONT.)

- **FOR REMOVAL, REINSTALLATION, OR CHANGE OF A CONFIGURATION BOARD, TOUCH THE ENCLOSURE HEAD FIRST TO AVOID ELECTROSTATIC DISCHARGE TO THE ELECTRONICS.**

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

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

- **NOTE THAT THE TIME DELAY POT(S) ARE FACTORY SET TO ZERO (FULLY COUNTERCLOCKWISE) AND SHOULD ONLY BE ADJUSTED AFTER CALIBRATION IS COMPLETE AND ONLY WHEN THE FEATURE IS NEEDED IN THE APPLICATION. THE TIME DELAY POT(S) IS A SINGLE TURN POT, SO USE CAUTION WHEN ADJUSTING TO AVOID DAMAGE.**

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

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1.0 THE VERSA-SWITCH® BENEFITS

The benefits of DELTA M Corporation's Model VS5100 VERSA-SWITCH® are many. The purchase of this one instrument enables the monitoring of single or dual channel level or flow or the simultaneous measurement of flow and temperature, or point level and temperature. Further, the VERSA-SWITCH® can be configured for three phase level (dual interface) or dual channel flow where one channel monitors flow and the second channel monitors for a dry line indication warning. In addition, the input power is field selectable for 110 or 220 VAC, or 24 VDC operation. A state-of-the-art continuous monitoring failure alarm is also available as an option. Thus, a single VERSA-SWITCH® unit can be purchased, stocked, and then field configured for most any plant measurement and control application involving flow, level, and/or temperature.

SPECIAL NOTE*

If you have chosen a <u>dedicated</u> <u>single</u> <u>channel</u> VERSA-SWITCH® for liquid level (Model LS51SC) or mass flow (Model FS51SC), the second channel features are not present in your unit. Please disregard any references and instructions for the second channel operation. For temperature switch (Model TS51SC) only the second channel is in operation, thus disregard any first channel operations.

Flow, level, or temperature detection is accomplished by using a high resolution thermal differential technique. The sensor wetted parts are of durable 316L series stainless steel, welded construction with no moving parts. The VERSA-SWITCH® comes standard with an explosion proof enclosure. The switch is easy to install and adjust, giving reliable, low maintenance performance in the most demanding applications. A wide range of construction options such as fittings, flanges, fixed and adjustable insertion lengths, wetted materials, local or remote electronics operation, and rated enclosures are also available.

2.0 PRINCIPLE OF OPERATION

The Model VS5100 VERSA-SWITCH® uses a thermal differential technique to monitor flow, level, or temperature by sensing changes in the heat transfer characteristics of the media into which the thermal sensor is placed. Figure 1.0 shows the outline of the VERSA-SWITCH®. The sensor consists of a pair of matched, Resistance Temperature Detectors (RTD's). An RTD is a variable resistor that has a well defined resistance change with temperature. The most common RTD has a resistance of 100.0 ohms at 0°C and increases at a nearly constant rate of 0.385 ohms per °C. Thus by measuring the resistance, the temperature of the RTD can be determined.

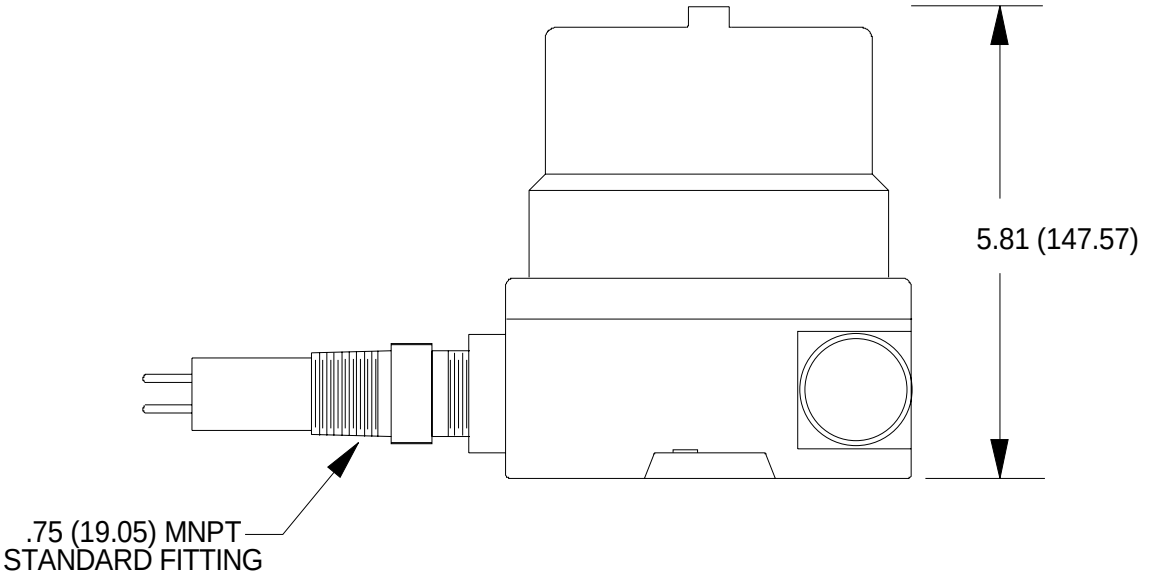
The standard VERSA-SWITCH® RTD's are encased in twin 316L stainless steel tubes. One RTD is self-heated using a constant DC current. The other RTD is unheated to provide an accurate process temperature reference. The unheated RTD is also used as the temperature measurement sensor when configured as a temperature switch.

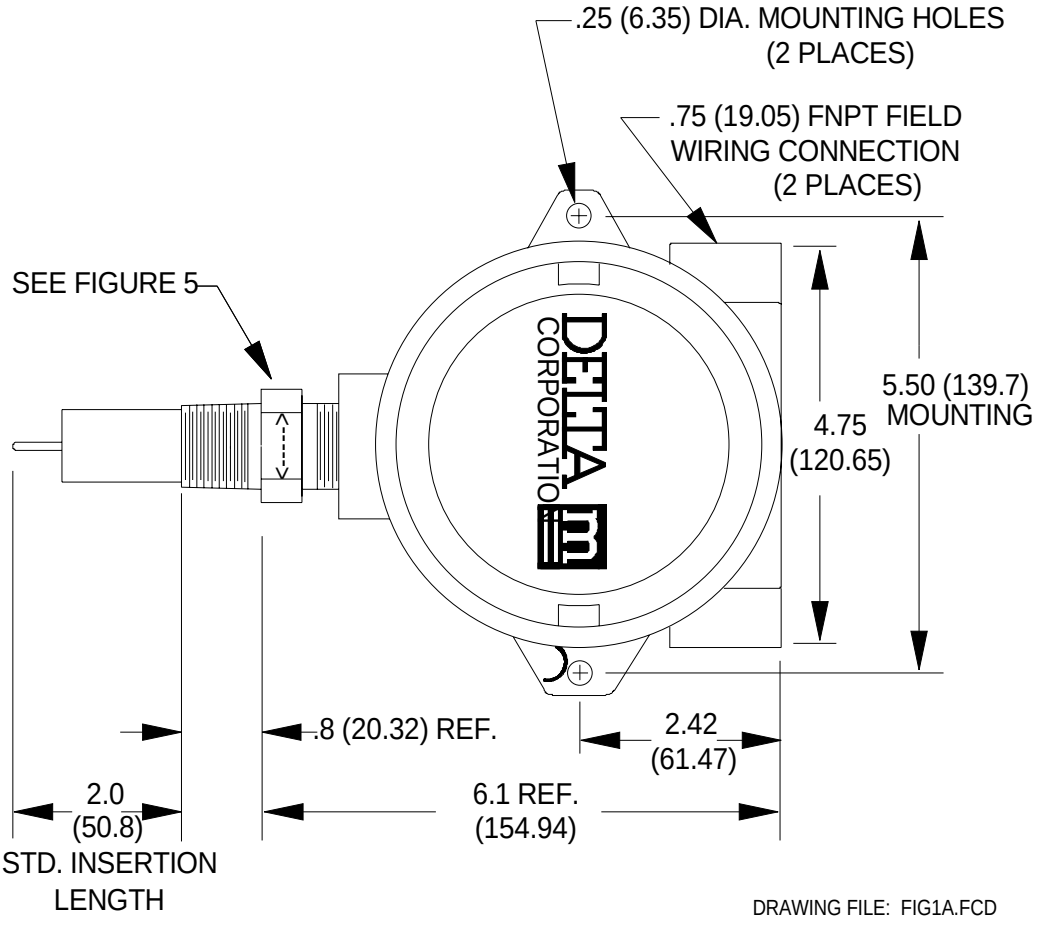
The DELTA M Corporation sensor excitation method relies on constant current to the heated and reference sensors. Thus power to the heated sensor is not constant but changes linearly with temperature as the sensor resistance changes. Temperature compensation is accomplished by using the amplified reference sensor voltage which also changes linearly with temperature, as a **dynamic reference**. During calibration dry/no flow and wet/full flow

2.0 PRINCIPLE OF OPERATION (cont.)

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 1A: VS5100 VERSA-SWITCH® OUTLINE DIAGRAM STANDARD 2.0" INSERTION (KILLARK ENCLOSURE – NEMA 4)

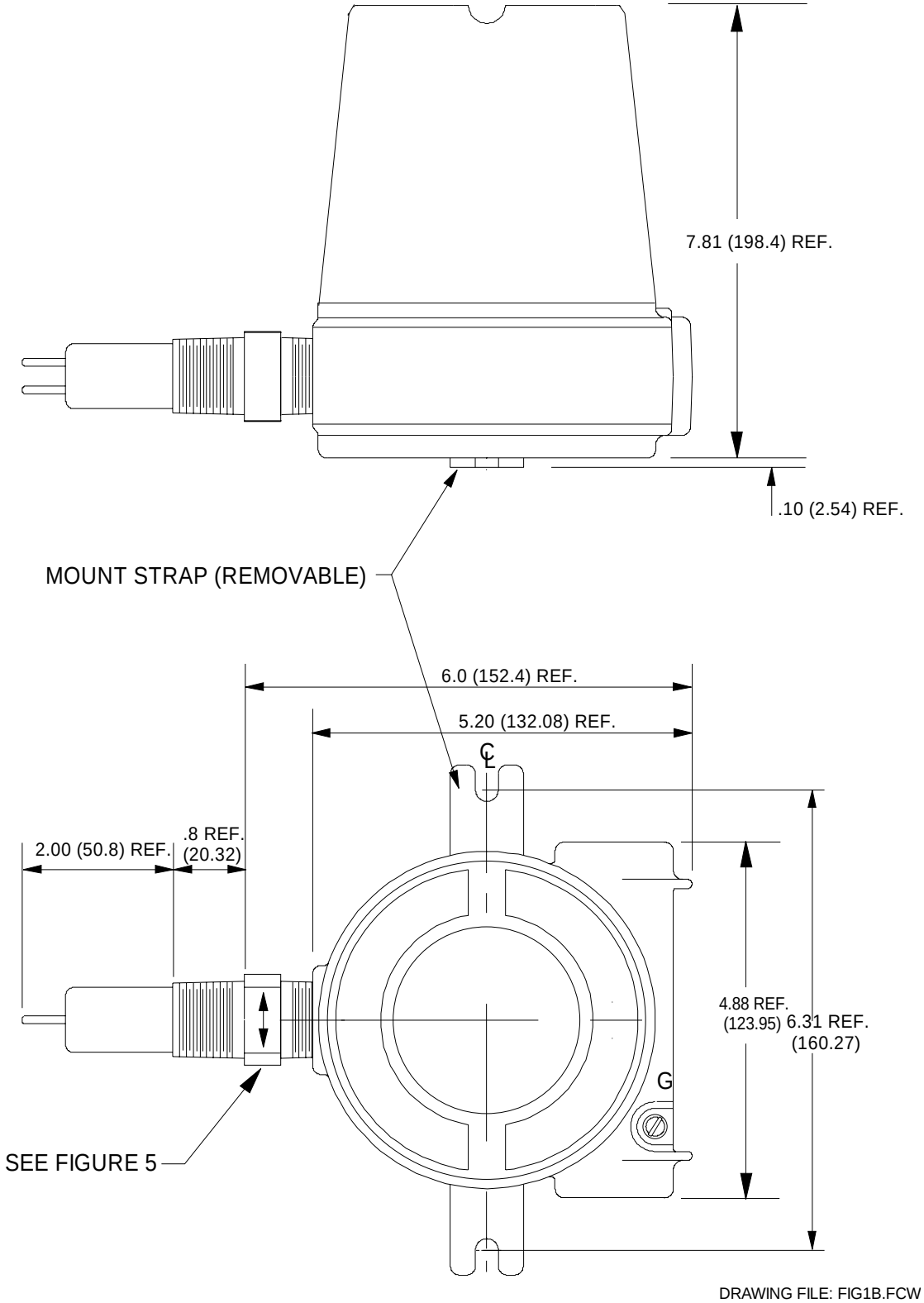




DRAWING FILE: FIG1A.FCD

DIMENSIONS IN INCHES (MILLIMETERS)

FIGURE 1B VS5100 VERSA-SWITCH® OUTLINE DIAGRAM STANDARD 2.0" INSERTION (AKRON ELECTRIC ENCLOSURE – NEMA 4X)



DIMENSIONS IN INCHES (MILLIMETERS)

FIGURE 2: VS5100 VERSA-SWITCH® FUNCTIONAL BLOCK DIAGRAM

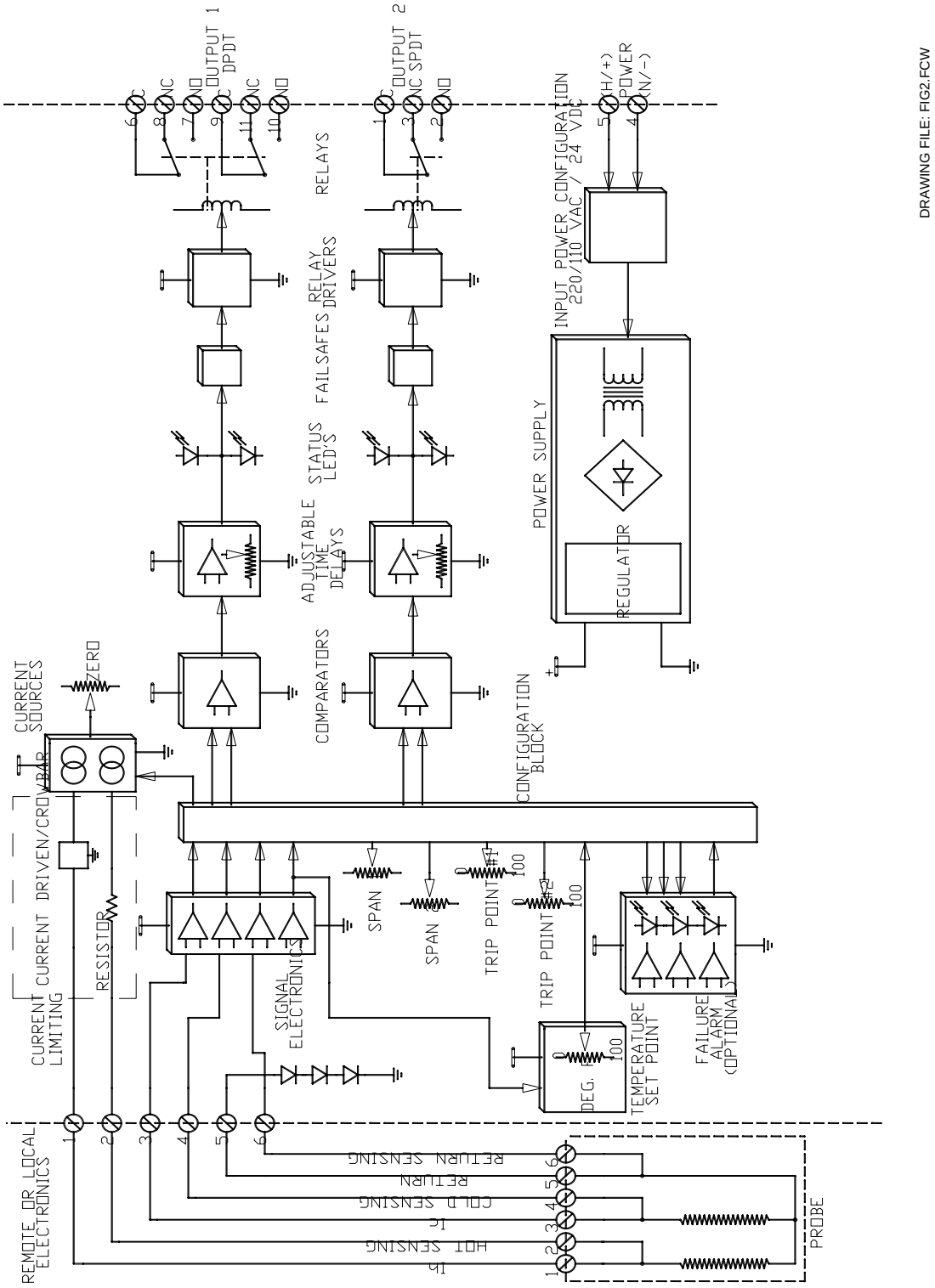


Figure 2 shows the VERSA-SWITCH® functional block diagram. The sensing probe RTD's are excited by two current sources and their resulting voltages are input to the signal processing electronics. The configuration block enables the switch to be reconfigured into the following:

- single channel level or flow
- single channel temperature
- channel 1 level or flow with channel 2 temperature
- dual channel flow (i.e. flow controller)
- two interface levels or flow plus dry line detection
- channel 1 level or flow and channel 2 failure alarm
- channel 1 level and channel 2 agitation indicator

Each independent channel includes an adjustable time delay (0-300 seconds) and a user selectable failsafe circuit to configure the relay to be normally energized or normally deenergized depending upon the application needs.

The VERSA-SWITCH® has incorporated in the design a current limiting feature that eliminates overheating of either sensor in case of a failure in the electronics. For the heated sensor, current limiting is accomplished by a current driven crowbar circuit that sinks all current to ground if it exceeds the maximum normal adjustable current by more than 6%. For the reference sensor, current limiting is accomplished via a limiting resistor that limits current for the worst case failure mode to approximately 60% of the heated sensor's maximum normal adjustable current.

2.1 Temperature Switching

The resistance of the reference RTD is used for temperature switching. The RTD resistance is 100.0 ohms at 0 degrees Celsius and increases by 0.385 ohms per degree Celsius increase in temperature. With a constant sensing current, the voltage across the reference RTD provides a proportional output signal as a function of temperature which is compared to the preset temperature trip point. When the RTD voltage equals that of the preset trip point, a trip occurs to the second channel relay.

2.2 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 VERSA-SWITCH® can discriminate between them. Figure 3 shows the relative signal output of the VERSA-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 VERSA-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

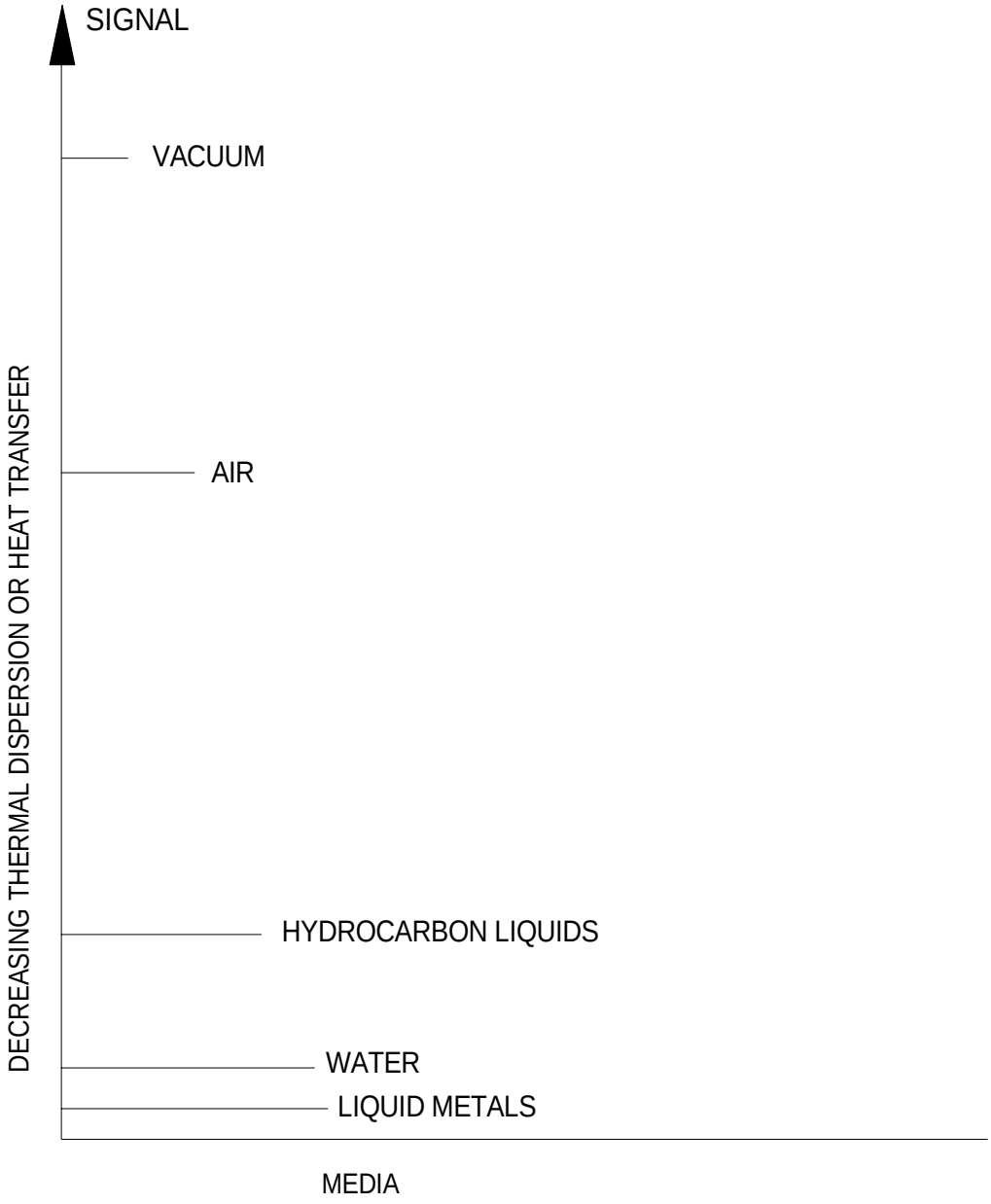
Liquid level

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

FIGURE 3: RELATIVE CHANGE IN RESPONSE OF A HEATED RTD IMMERSED IN VARIOUS MEDIA



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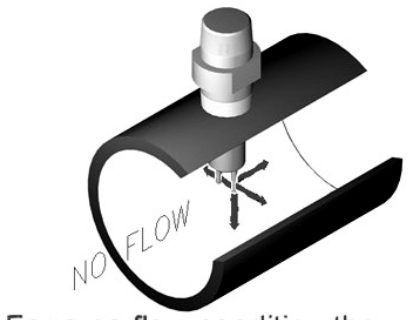
2.3 Flow Switching

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.

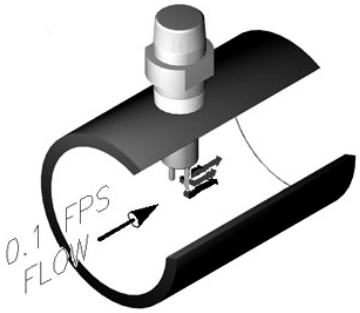
When the sensor is inserted into a liquid or gas the heated RTD is strongly affected by the velocity of the medium. Flow past the heated RTD changes the heat transferred from the surface of the sensor. This cooling effect reduces the temperature of the sensor. The VERSA-SWITCH® compares this change to a preset flow trip point to switch the output. Figure 4 shows the model VS5100 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. 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.



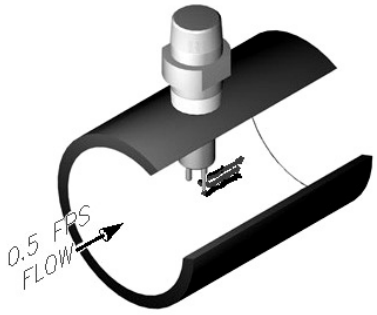
For a no flow condition the thermal differential between the two tips is high because of relatively low heat transfer.

Gas Or Liquid Flow

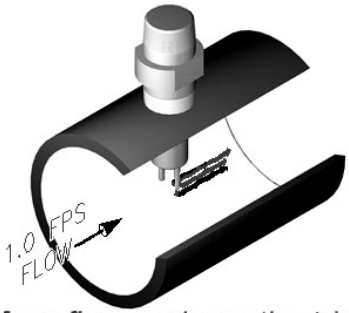
Note: The fluid velocity and heat absorption ability determine the differential between the tips. Their combination determines the measurable velocity. In water velocities from 0.01 to 5 FPS are measurable, whereas in air velocities of 0.1 to 500 FPS can be measured



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



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

FIGURE 4: VS5100 FLOW RESPONSE FOR THREE MEDIA

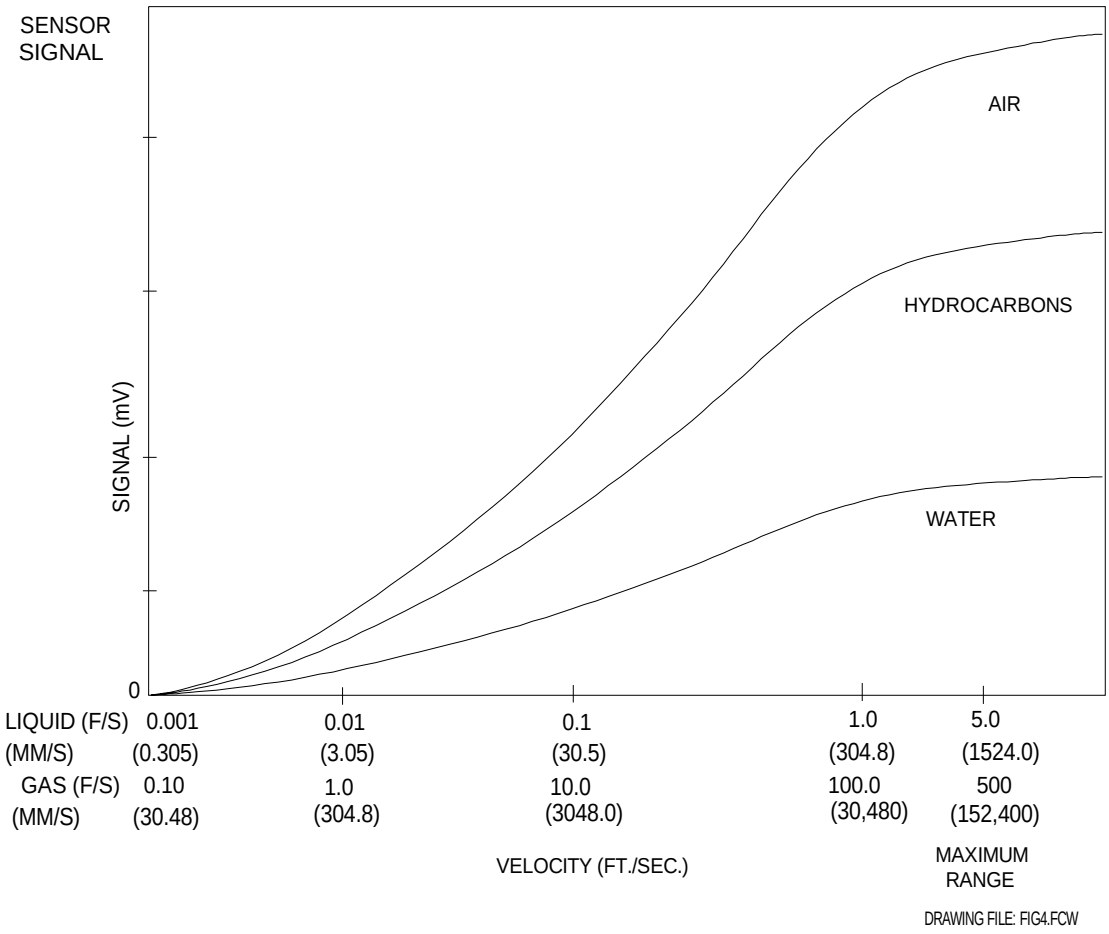
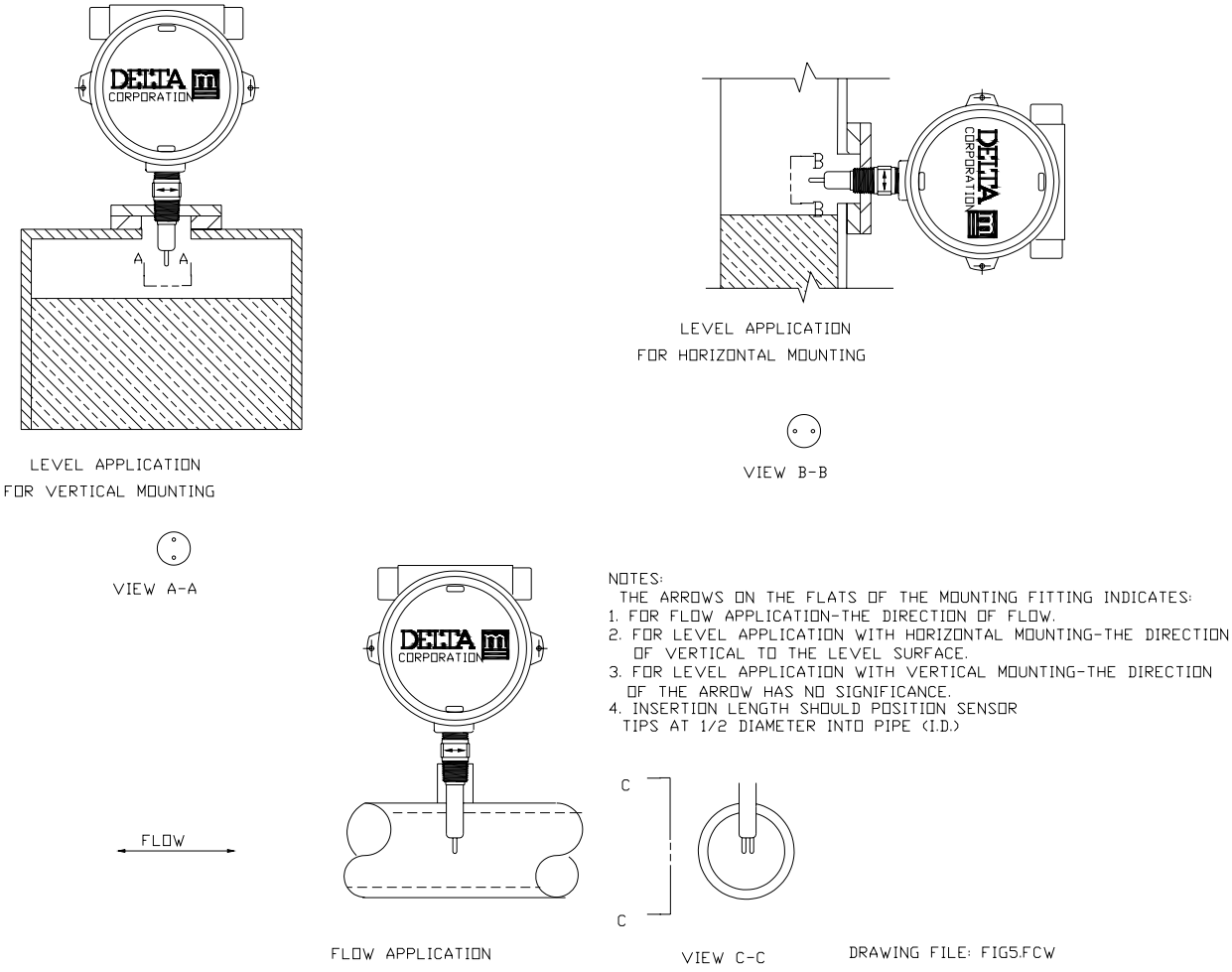


FIGURE 5: PROPER ORIENTATION OF THE SENSOR PROBE FOR LEVEL AND FLOW APPLICATION IS INDICATED BY THE ARROW ON THE FLAT OF THE MOUNTING FITTING.



3.0 INSTALLATION

3.1 Mechanical Installation

The standard VS5100 VERSA-SWITCH® has a ¾ (.75) inch MNPT mount designed for easy installation through a female threaded port. Optional configurations include various MNPT and flange mounts. Conduit is recommended for all wiring to the switch.

IMPORTANT

WHEN INSTALLING YOUR DELT M SWITCH INTO A PIPE OR VESSEL USE A 1 1/8 (1.125) INCH (28.575MM) OPEN-END WRENCH TO TIGHTEN AT THE FLATS OF THE MNPT OF A STANDARD SWITCH (IF YOU HAVE A NON-STANDARD SWITCH AN ALTERNATIVE 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

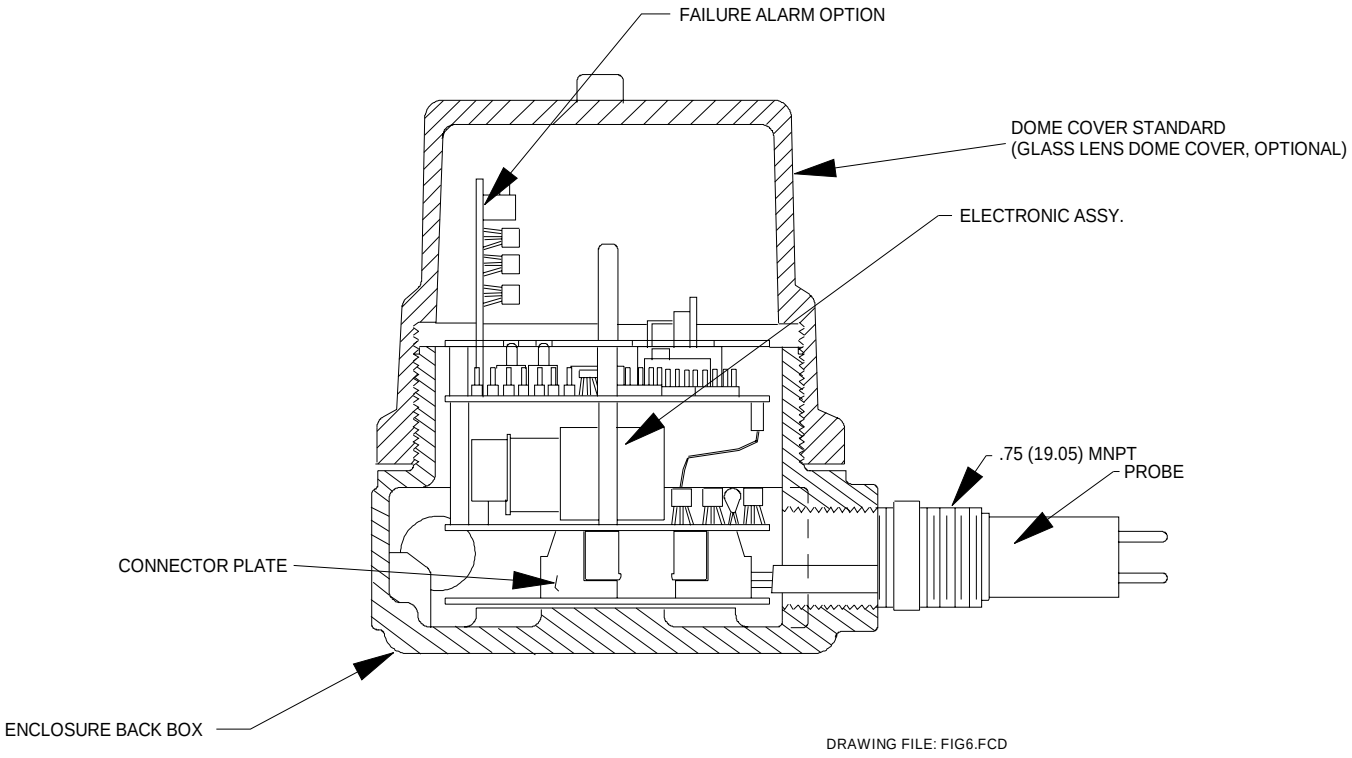
THE SWITCH BODY MUST BE ORIENTED TO HAVE THE TWIN SENSORS PARALLEL TO THE LEVEL BEING DETECTED WHEN THE SENSOR IS WHEN BEING INSTALLED HORIZONTALLY FOR POINT LEVEL APPLICATIONS. LIKEWISE, FOR FLOW APPLICATIONS, THE SWITCH BODY MUST BE ORIENTED TO HAVE THE TWIN SENSORS PERPENDICULAR TO THE FLOW BEING 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 MAKE NO DIFFERENCE. PROPER ORIENTATION IS MARKED ON THE SWITCH BODY FOR REFERENCE, SEE FIGURE 5.

3.2 Electrical Installation

The enclosure at the top of the unit contains the VS5100 VERSA-SWITCH® integral local electronics which are removable to access the field wiring terminal block to facilitate wiring. For applications where the model VS5100 electronics must be located away from the sensors due to elevated ambient plus process temperature greater than 140°F/60°C, accessibility, vibration, etc., another enclosure containing the model VS5100 electronics is remotely located. Figure 6 shows a cut away view of the model VS5100 with electronics installed.

FIGURE 6: CUT AWAY VIEW OF THE MODEL VS5100



3.2.1 Electrical Power Selection

The Model VS5100 is FIELD SELECTABLE FOR 24VDC, 110 VAC, or 220 VAC operation.

CAUTION
THE VERSA-SWITCH® MUST BE CONFIGURED FOR PROPER POWER INPUT BEFORE THE POWER IS CONNECTED.

Remove the instrument enclosure lid by unscrewing in a counter clockwise direction. Loosen the printed circuit board (PCB) retention lock screw until disengaged. Figure 7 shows the model VS5100 with enclosure lid removed. Remove the PC board by grasping the handle and pulling it straight out.

FIGURE 7: MODEL VS5100 WITH THE ENCLOSURE LID REMOVED AND HANDLE AND LOCK SCREW HIGHLIGHTED

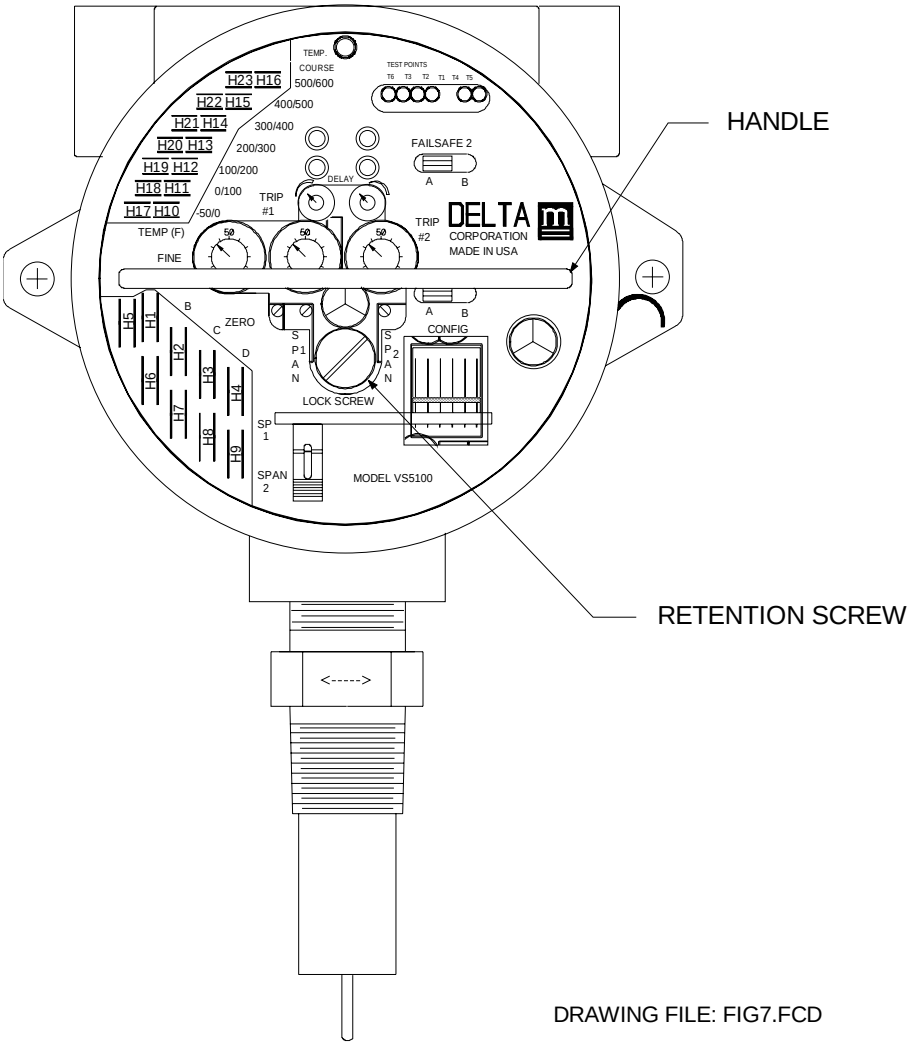
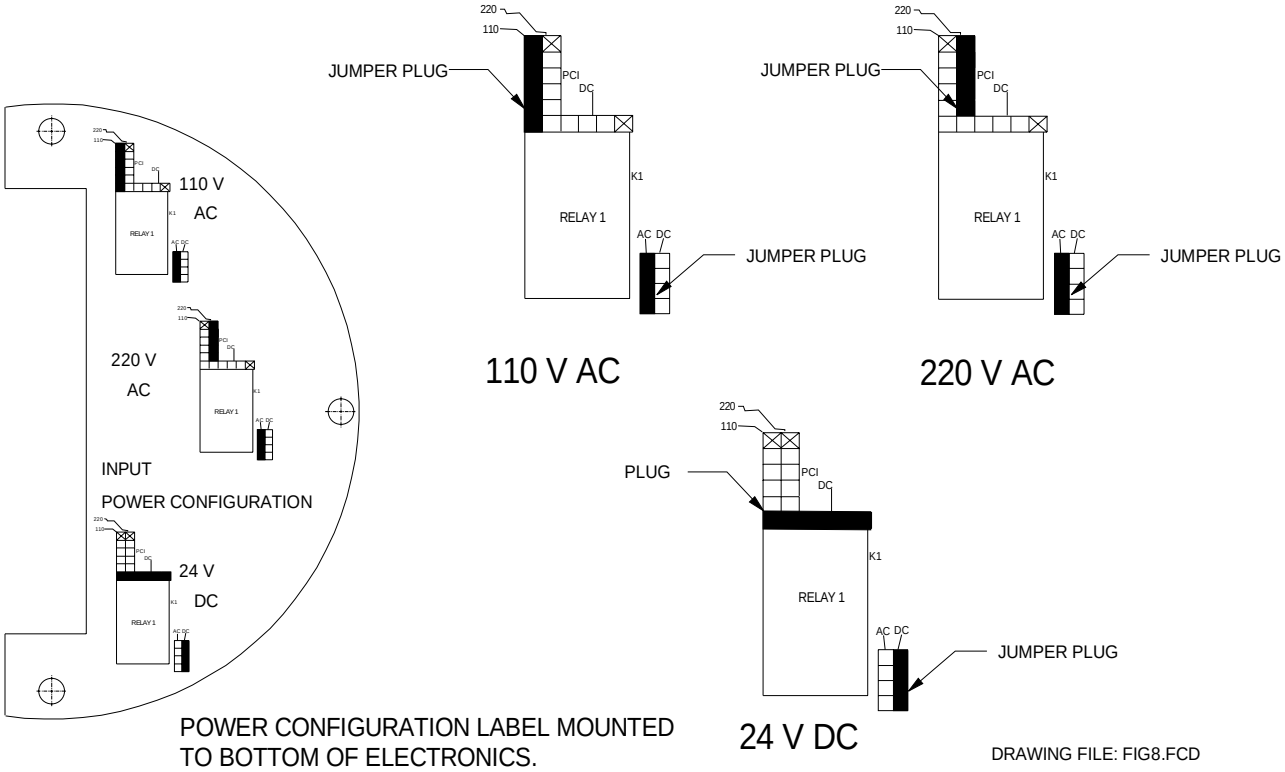


FIGURE 8: **THE INPUT POWER SELECTION CONFIGURATION CONSISTS OF THREE VOLTAGE SELECTION SOCKETS AND TWO AC/DC SELECTION SOCKETS. ONE JUMPER SELECTS VOLTAGE AND ANOTHER SELECTS AC OR DC OPERATION.**



The voltage selection jumpers are located on the bottom PCB adjacent to the right handle post and near Relay 1 (see K1 on P.C. Board and Figure 8).

The voltage selection information of Figure 8 is contained on translucent mylar on the bottom of the PC board assembly. On Figure 8 there are five sockets labeled (A) through (E). Sockets (A) through (C) are for 110, 220, and 24 volt inputs, respectively. Sockets (D) and (E) are for AC or DC operation, respectively. There are two jumpers. One jumper selects the input voltage amount by plugging into sockets (A), (B), or (C) and the other selects for AC or DC operation by plugging into sockets (D) or (E). Figure 8 shows the jumper arrangement for 110 VAC, 220 VAC, and 24 VDC operation, respectively.

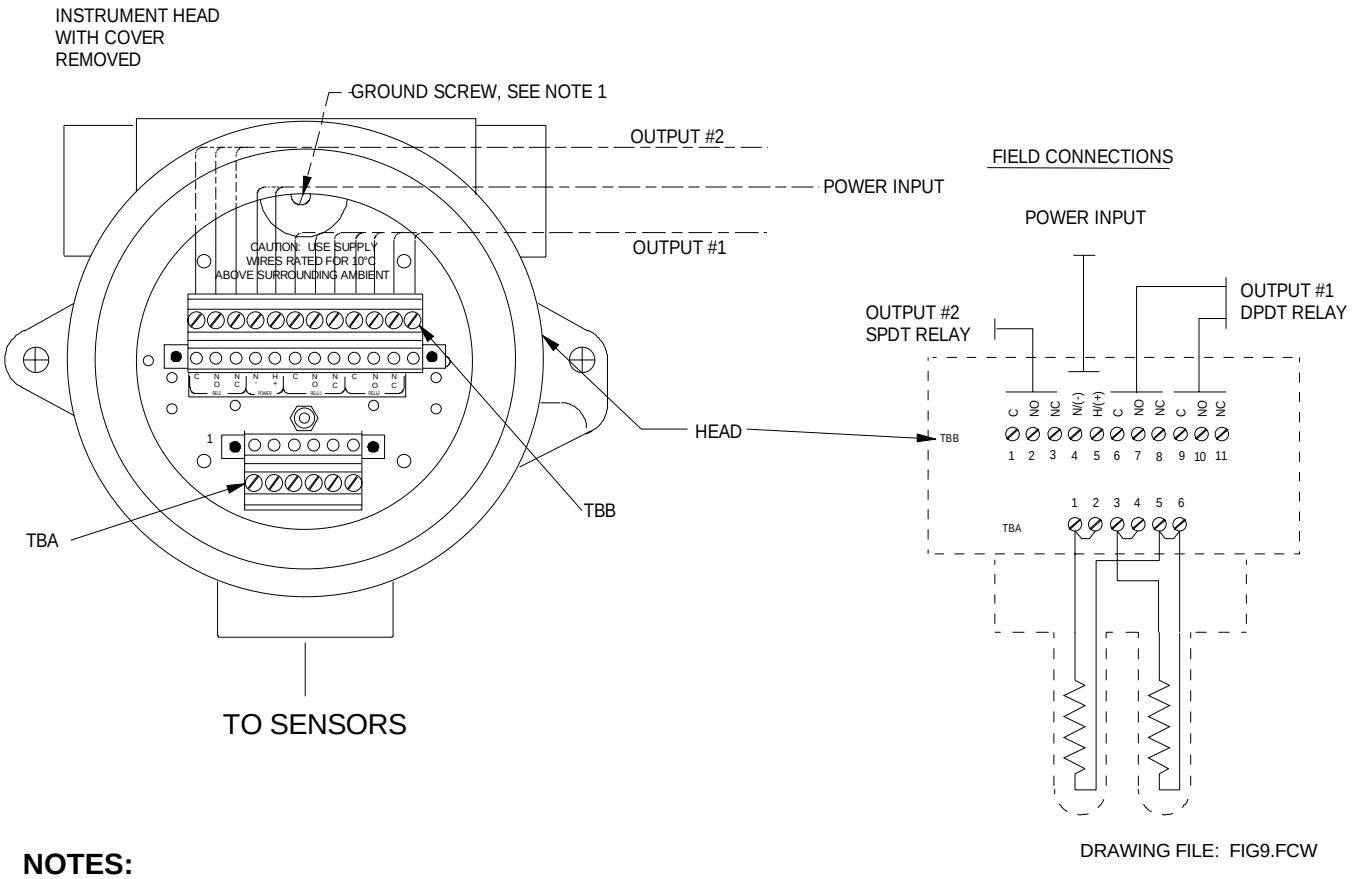
CAUTION

DOUBLE CHECK SELECTION OF VOLTAGE AND MODE (AC OR DC) OF ELECTRONICS AND ENSURE PROPER MATCH TO INPUT VOLTAGE AT FIELD WIRING CONNECTOR TO AVOID DAMAGE.

CAUTION

OPERATION ON 24 VAC IS NOT A FIELD SELECTABLE OPTION BUT CAN BE INSTALLED AT THE FACTORY. FOR 24 VDC OPERATION, BE SURE SECOND JUMPER PLUG IS IN SOCKET E PROPERLY. (SEE FIGURE 8)

FIGURE 9 VS5100 ENCLOSURE INTEGRAL LOCAL ELECTRONICS FIELD WIRING DIAGRAM



DRAWING FILE: FIG9.FCW

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. **Connect ground wire to ground screw located in or on the instrument enclosure.**

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 Model VS5100 Electronics in the Local Enclosure

With the electronic assembly removed, terminal blocks TBA and TBB are accessible within the enclosure head. Figure 9 shows these terminal blocks and their field connections.

The power is connected to TBB terminals 4 and 5. Terminal 5 is positive for DC operation and is the "HOT" lead for AC operation. Terminal 4 is the negative or neutral lead.

IMPORTANT

CHECK THAT THE VERSA-SWITCH® ELECTRONICS ARE PROPERLY CONFIGURED BEFORE CONNECTING POWER LEADS. SEE SECTION 3.2.1.

Connect output relay wiring to TBB as shown in Figure 9. Note that output relay #1 for channel 1 has a DPDT configuration while output relay #2 has a SPDT configuration. The relay contacts for relay #1 are rated at 5 amperes @ 240 VAC and for relay #2, 10 amperes @ 240 VAC.

IMPORTANT

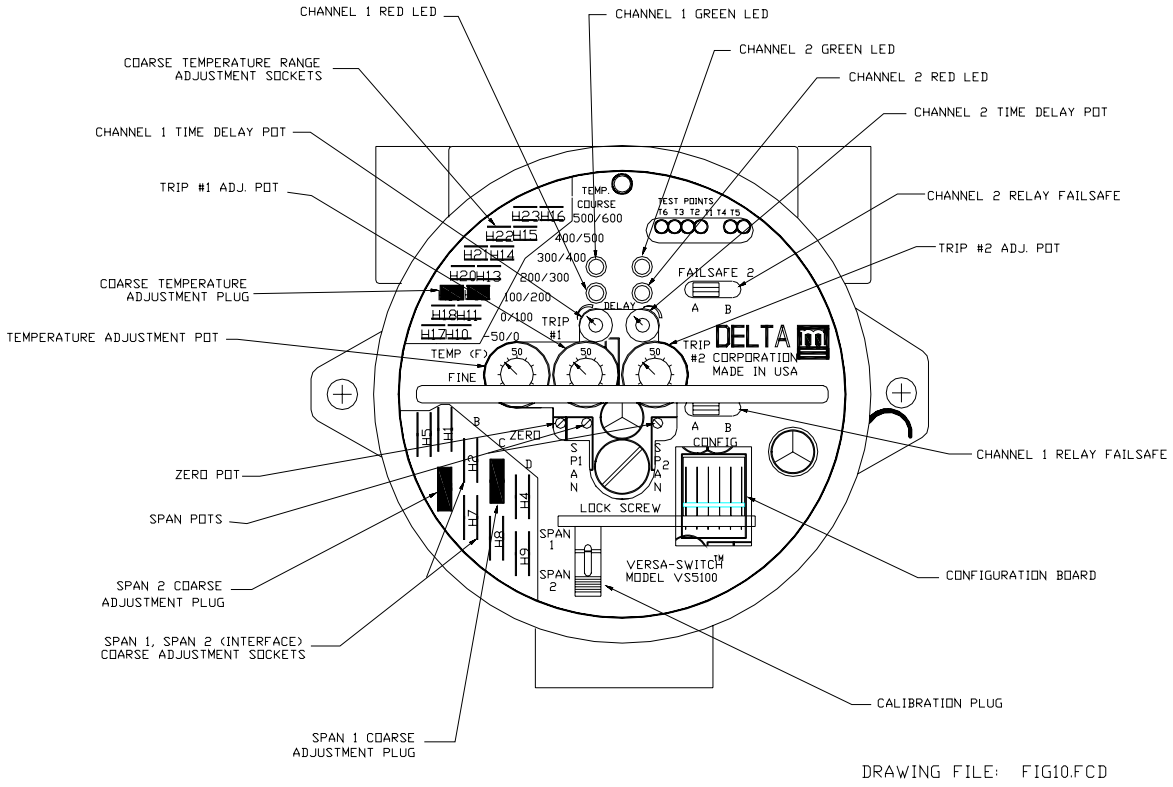
A GROUND WIRE MUST BE ATTACHED TO THE GROUND SCREW LOCATED INSIDE THE BACK OF THE INSTRUMENT ENCLOSURE FOR PROPER OPERATION (SEE FIGURE 9). CONDUIT IS RECOMMENDED FOR ALL WIRING TO THE SWITCH FOR PROTECTION AND RFI/EMI SHIELDING.

Connections of sensors to TBA are factory installed and should not be disconnected in the field.

3.2.3 Model VS5100 Remote Electronics

Reference Section 10.1 remote electronics option.

FIGURE 10 VERSA-SWITCH® INDICATORS AND CONTROLS



4.0 APPLICATION SPECIFIC CONFIGURATION AND CALIBRATION

SPECIAL NOTE

THIS VS5100-OM-3 MANUAL COVERS THE FOLLOWING MODELS:

VS5100 – DUAL CHANNEL FLOW/LEVEL/TEMPERATURE SWITCH
LS51SC – SINGLE CHANNEL POINT LEVEL SWITCH
FS51SC – SINGLE CHANNEL MASS FLOW SWITCH
TS51SC – SINGLE CHANNEL TEMPERATURE SWITCH
LS51NX – NON-EXPLOSION PROOF VERSION OF LS51SC
FS51NX – NON-EXPLOSION PROOF VERSION OF FS51SC
TS51NX – NON-EXPLOSION PROOF VERSION OF TS51SC
LS51SK – SWITCH KIT VERSION FOR LEVEL
FS51SK – SWITCH KIT VERSION FOR FLOW
TX51SK – SWITCH KIT VERSION FOR TEMPERATURE

PLEASE DISREGARD ANY SECTIONS OF THE MANUAL THAT DO NOT APPLY TO THE SPECIFIC MODEL YOU HAVE CHOSEN FOR YOUR APPLICATION.

4.1 Visual Indicators/Controls Layout and Function (Refer to Figure 10)

Figure 10 shows the Model VS5100 indicators and controls. The face plate contains labeling that provides explanation for most indicators, jumper plugs/sockets, and adjustment potentiometers. A more detailed explanation is provided here as an aid to calibration and operation of the switch.

4.1.1 Led Indicators

Channel 1 and 2 LED indicators provide a visual indication of whether the switch setting is above or below the set-point. The RED LED remains ON when the sensor indication is BELOW the set-point. ABOVE the set-point the RED LED is OFF and the GREEN LED is ON. Either the RED LED or GREEN LED will be on at all times but never both at the same time. If neither are on refer to Section 5.2 Troubleshooting.

4.1.2 Time Delay Potentiometers

SPECIAL NOTE

VERSA-SWITCH® IS SENT FROM THE FACTORY WITH THE TIME DELAY POT(S) FULLY COUNTER CLOCKWISE. THIS POT IS NOT USED FOR CALIBRATION AND SHOULD ONLY BE ADJUSTED AFTER CALIBRATION IS COMPLETE.

THIS IS A SINGLE TURN POT, SO USE CAUTION WHEN ADJUSTING TO AVOID DAMAGE.

The channel 1 and 2 time delay potentiometers enable adjustment of a time-delay-to-trip (0-300 seconds), after the switch set-point is reached. The delay prevents the "trip signal" from reaching the LED's and relays for the time adjusted on the delay potentiometer. The delay time

is linearly proportional to the potentiometer set angle from 0 to 300 seconds for 0 to 300° potentiometer shaft rotation.

4.1.3 Failsafe Jumpers (Refer to Figure 10)

The channel 1 and 2 relay failsafe jumpers allow user selection of the relay power off condition most appropriate to the application. In Position A, the factory set default position, the relay coil is ACTIVATED when the RED LED is ON (BELOW set-point). Alternatively in position B, the relay coil is DEACTIVATED when the RED LED is on (BELOW set-point). Refer to tables of sections 4.3.2.2 and 4.3.2.3 for LED's, relay coil and contact status for different positions of Failsafe Jumpers.

4.1.4 Configuration Board

The configuration board is a plug-in PCB that configures the switch for the selected application. See section 4.2 for configuration alternatives for various applications.

4.1.5 Trip Adjustment

The channel 1 and 2 trip adjustment potentiometers enable a trip point adjustment from zero to 100% of the span. When the switch is properly calibrated the span (dry to wet or no flow to flow) is impressed across the trip point potentiometers. The trip point may then be set to the desired tripping position within the span. See Section 4.4 for calibration details.

4.1.6 Calibration Plug

The calibration plug allows the "ZERO" and "SPAN" positions to be set during calibration and easily checked to validate it at any time. Setting the jumper at "ZERO" or "SPAN" is equivalent to adjusting the trip point potentiometers to zero or 100%, respectively. See section 4.4 for calibration details.

4.1.7 Span 1 and 2 Coarse Adjustment Plugs

The span 1 and 2 coarse adjustment plugs and sockets allow one of four spans (A-D) to be selected. This provides selection of the proper span range for such diverse applications as liquid flow, gas flow, liquid-liquid interface, or air-water level. Span 2 selection is used to set the second span for three phase fluids (example, air-oil-water) or for liquid flow - dry line indication or 2 flow rate set points high-low. Further explanation will be found in the calibration section, 4.4.

4.1.8 Span 1 and 2 Potentiometers

The span 1 and 2 potentiometers are used in conjunction with the span coarse adjustment plugs to "fine" adjust the span setting.

4.1.9 Zero Potentiometer

The zero potentiometer allows adjustment of the zero position at dry, no flow, or minimum flow conditions.

4.1.10 Coarse Temperature Adjustment Plugs (Refer to Figure 10)

This set of plug/sockets allows the coarse temperature for a temperature switch application to be set from -50 to 600°F in 100°F increments (except for the -50 to 0°F range). When the jumper is placed on the 200/300°F socket for example, the temperature range impressed across the

temperature potentiometer is 200°F to 300°F. For the minus 50°F to +0°F range, only a 50°F range is impressed across the temperature potentiometer.

4.1.11 Temperature Adjustment Potentiometer

The temperature adjustment potentiometer adjusts the temperature trip point within the range selected by the coarse temperature plug. The range is linear from 0 to 100°F within the selected range except for the -50 to 0°F range where it has a 50°F adjustment range.

4.2 Application Configuration

The VERSA-SWITCH® includes six application configurations that encompass a variety of measurement and alarm functions:

Standard
C1 - Single channel level (Model LS51SC) or flow (Model FS51SC) included w/single channel
C3 - Channel 1 level or flow and channel 2 temperature (Model VS5100) included w/VS5100
C4 - Dual channel flow (Model VS5100) included w/VS5100
C5 - Two interface levels or flow plus dry line indication (Model VS5100) included w/VS5100

Optional
C2 - Single channel temperature (Model TS51SC)
C6 - Channel 1 level or flow and channel 2 failure alarm (Model VS5100)

These configurations are selected by inserting the appropriate configuration board into the socket (see Figure 10). Configuration boards C2 through C5 are supplied with the standard VS5100. C6 is used in conjunction with the failure alarm option that provides an active real time monitoring of the proper function of sensor, electronics, wiring, and power. In the event of a malfunction, the channel 2 relay will trip to provide an alarm indication.

Configuration C4 provides two independent flow settings from a single span such as low/high (minimum/maximum) for control applications. Configuration C5 is used for dual channel monitoring of gas/liquid 1/liquid 2 interface (ex. air/oil/water) or liquid flow vs. dryline monitoring where two separate spans are required. In these cases the span 2 coarse and fine adjustments are used to set the second span.

IMPORTANT

FOR REMOVAL, REINSTALLATION, OR CHANGE OF A CONFIGURATION BOARD, TOUCH THE ENCLOSURE HEAD FIRST TO AVOID ELECTROSTATIC DISCHARGE TO THE ELECTRONICS.

4.3 Operation

4.3.1 Pre-Operational Check

With the switch installed the following procedure can be used to verify preliminary operation. The process should be at normal operational temperature and pressure conditions but need not be at a specific level or flow setting.

4.3.1.1 Remove the instrument enclosure cover by turning counter-clockwise to expose the Model VS5100 electronics. Remove electronics to ensure proper electrical connections. Reinstall board.

4.3.1.2 Check to determine which configuration board is installed (see Figure 11 for location). C1 through C6 will be printed on the face of the configuration board.

4.3.1.3 Turn on power at its source.

4.3.1.4 Table 1 shows the status of the LED's for the possible configurations of the VERSA-SWITCH®. Depending on whether the configuration is single channel, dual channel or failure alarm, there are several possibilities of LED's being illuminated.

		LED INDICATORS "ON"		
CONFIGURATION	BOARDS	CH1	CH2	FAILURE ALARM PCB
SINGLE CHANNEL	C1	RED OR GREEN	RED	N/A
DUAL CHANNEL	C1-C5	RED OR GREEN	RED OR GREEN	N/A
FAILURE ALARM	C6	RED OR GREEN	N/A	3 YELLOW
TEMP SW.	C2	RED	RED OR GREEN	N/A

Table 1 Status of LED's for various VERSA-SWITCH® configurations.

4.3.1.5 If indications are not in agreement with 4.3.1.4 refer to the troubleshooting Section, 5.2.

4.3.2 LED and Relay Status Logic (failsafe)

4.3.2.1 The LED's are an indication of the sensor status (i.e. flow or level below the set-point or above the set-point). A change in state of an LED will be concurrent with a change in state of the relay. (The time delay delays both LED and relay change of state.) The failsafe jumper changes the relay activation status allowing the user to select the failsafe power off condition most appropriate to the application. Refer to Tables 2 and 3 below that show the logic conditions between the sensors, LED lights or relay coil and contacts for each position of the failsafe jumper.

4.3.2.2 Normal Operation (as set at factory)

The switch comes configured from the factory for the following operations with the failsafe jumpers in the A position. (Refer to Figure 10).

SENSOR STATUS	L1 L2 RED LED	GREEN LED	RELAY COIL	RELAY CONTACT STATUS
Dry, No Flow, or Flow Below Set Point	ON	OFF	Activated	o NC Co o NO
Wet or Flow Above the Set Point	OFF	ON	Deactivated	o NC C o o NO

Table 2: Logic conditions for Failsafe Jumper in Position A.

4.3.2.3 Alternate Operation (Field Selectable)

The relay logic may be reversed by moving the failure jumpers to position B. (Refer to Figure 10.)

SENSOR STATUS	L1 L2 RED LED	GREEN LED	RELAY COIL	RELAY CONTACT STATUS
Dry, No Flow, or Flow Below Set Point	ON	OFF	Deactivated	o NC Co o NO
Wet or Flow Above the Set Point	OFF	ON	Activated	o NC C o o NO

Table 3: Logic conditions for Failsafe Jumper in Position B.

4.4 Calibration

The purpose of calibration is to electronically impress the span of the level or flow process application across the trip adjust potentiometer. When this is accomplished the span is normalized with temperature.

There is a wide variation in span for various level and flow applications. The span coarse adjustment plugs and span adjust potentiometers allow selection of the correct span range for each process. The zero and span adjustments are made with the trip adjust pot in the zero and one hundred positions, respectively. Adjustment of the zero or span potentiometer close to the correct setting is indicated by the RED and Green LED's toggling back and forth. The "ZERO" is then set by illuminating the RED LED and the "SPAN" position set by illuminating the GREEN LED.

The calibration can be validated or recalibrated without affecting the set point at any time by adjusting the process flow or level to the minimum zero and maximum span values, setting the calibration plug jumper to the corresponding "ZERO" or "SPAN" position, and adjusting the zero or span potentiometers to toggle the LED's. **The plug should be left in the "NORMAL" position for operation after recheck is complete.**

IMPORTANT

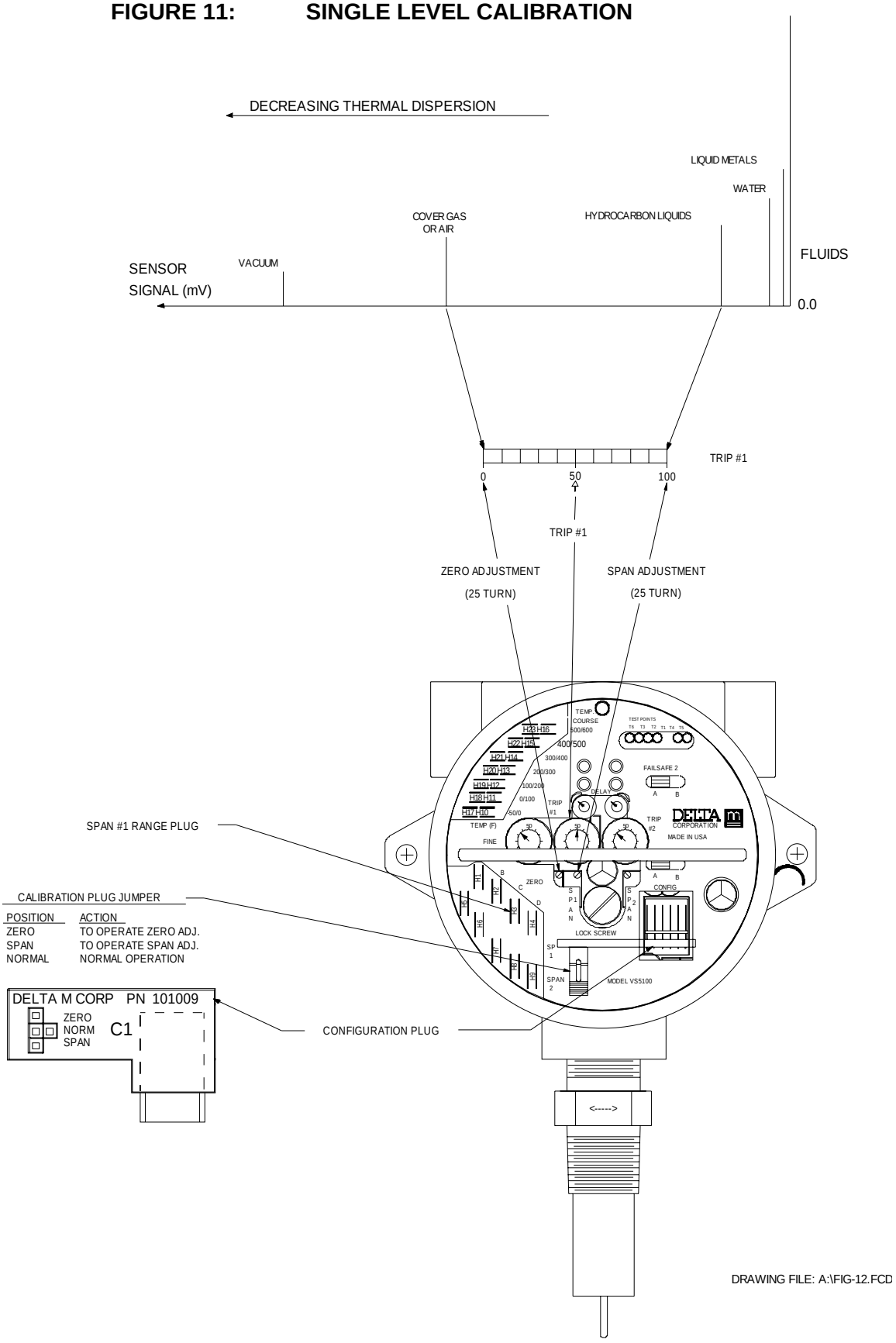
THE CALIBRATION PLUG JUMPER SHOULD BE LEFT IN THE “NORMAL” POSITION FOR OPERATION AFTER CALIBRATION IS COMPLETE.

Specific calibration procedures for level, flow and temperature applications are included in the following section. For clarity the following abbreviations are used: potentiometer = pot, clockwise = cw, counter clockwise = ccw.

*** 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.

FIGURE 11: SINGLE LEVEL CALIBRATION



4.4.1 Single Channel Level Calibration (Model LS51SC)

This calibration procedure is valid for a liquid-gas interface. Refer to Figure 11 as a calibration guide. For optimum calibration results, wet sensor and drain but do not dry.

1. Remove the instrument enclosure lid by turning ccw.

2. Ensure that the C1 configuration board for single channel level is installed. If it is not, install the proper board.

3. Apply power to the Model VS5100 Switch. Allow 5 minutes for it to warm up.

4. Ensure that the tank liquid level is below the probe sensor tips.

5. Move the Trip #1 Adjust to Pot zero (fully ccw). See Figure 11.

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 cw. If the RED LED is ON turn it ccw.

7. Toggle the Zero Adjust Pot back and forth until the switching point is well defined. Leave the RED LED illuminated.

8. Wait 30 seconds and repeat steps 6 and 7 until switching point no longer changes.

9. Raise the level of the liquid to be detected until the probe/sensor tips are submerged and wet (covered).

10. Move the Trip #1 Adjust Pot to 100 (fully cw). See Figure 11.

11. Adjust the Span Adjust Pot fully cw (25 turns).

12. Move the SPAN 1 Coarse Adjustment Plug progressively from position A towards position D until the RED LED illuminates. Leave the plug in the socket that results in the RED LED illumination.

13. Adjust the span 1 pot ccw until the GREEN LED illuminates.

14. Toggle the span 1 pot back and forth until the switching point is well defined. Leave the GREEN LED illuminated.

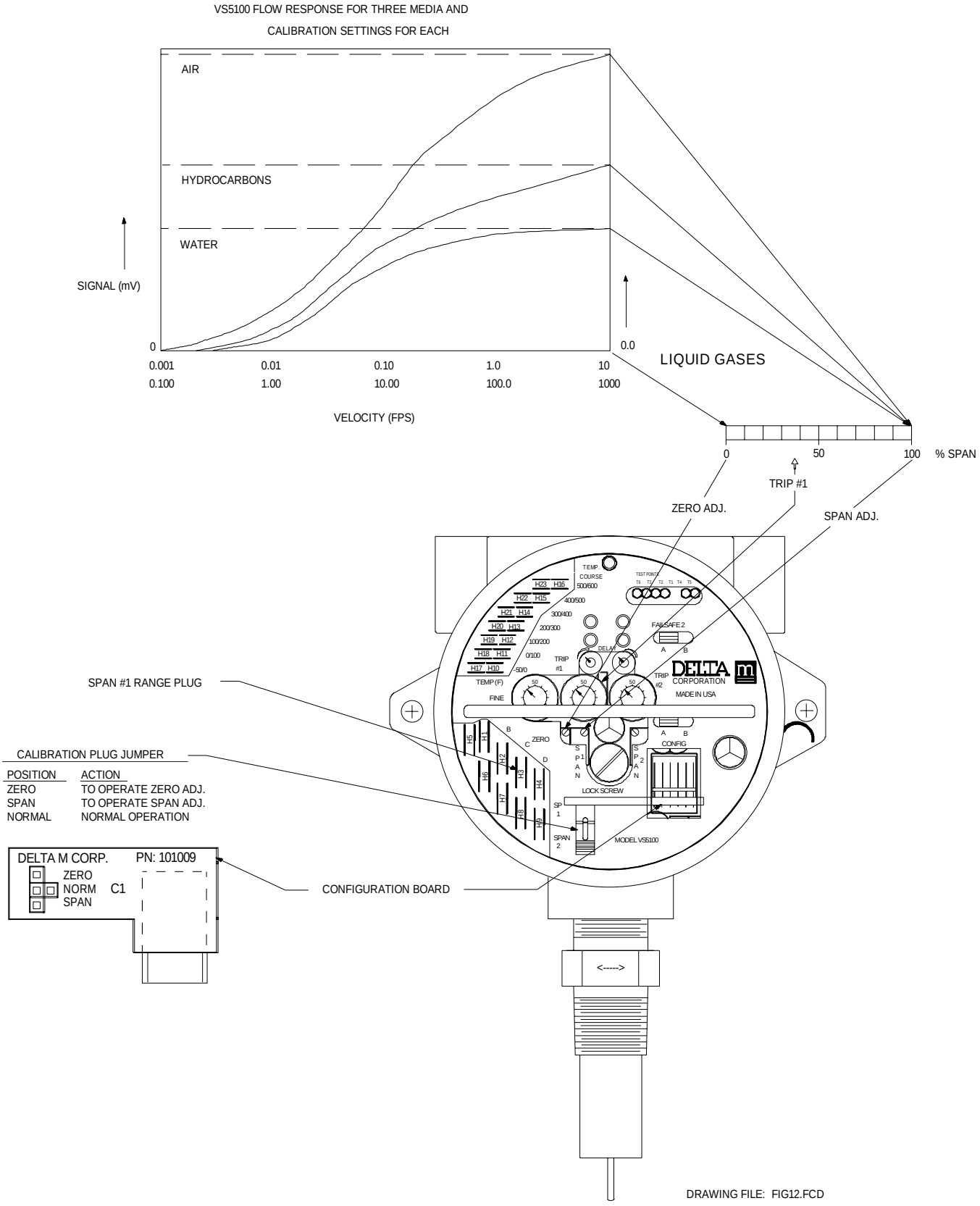
15. Setting the Trip #1 Adjust Pot to 80% will give an even balanced trip response time from wet to dry and dry to wet. The adjust pot can be varied to speed up or delay the trip response time for either changes of state depending on application needs.

16. Calibration is complete.

17. Recheck the zero and span settings at any time by adjusting the level to dry (zero) or wet (span), moving the calibration plug jumper to the corresponding "ZERO" or "SPAN" position, and toggling the Zero or Span Pots to check for correct setting. The setting should be within one half turn of the pots. **Return jumper to normal before resuming operation**. See Figure 11.

18. If the time delay feature is needed in the application, refer to Section 4.1.2.

FIGURE 12: SINGLE FLOW CALIBRATION



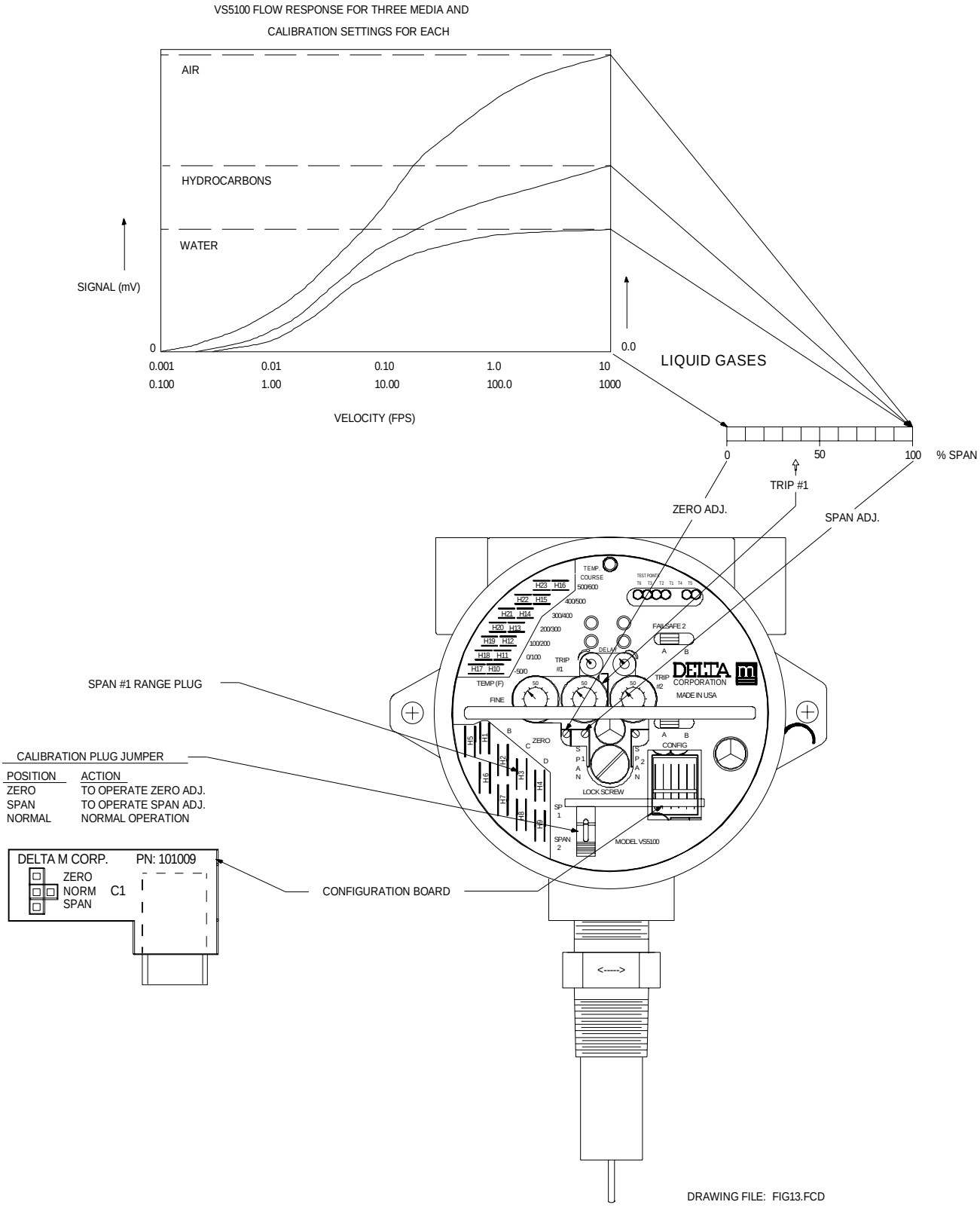
4.4.2 Single Channel Flow Calibration (Model FS51SC)

This calibration procedure is valid for liquids or gases. Refer to Figure 12 as a calibration guide.

1. Remove the instrument enclosure lid by turning ccw.
2. Ensure that the C1 configuration board for single channel flow is installed. If not, install the proper board.
3. Apply power to the Model VS5100 Switch. **Allow 5 minutes to warm up**.
4. Ensure that the pipeline is filled with fluid and at no or minimum flow.
5. Move the Trip #1 Adjust Pot to zero (fully ccw). See Figure 12.
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 cw. If the RED LED is ON turn it ccw.
7. Toggle with the Zero Adjust Pot back and forth until the switching point is well defined. Leave the RED LED illuminated.
8. Wait 30 seconds and repeat steps 6 and 7 until switching point no longer changes.
9. Adjust the liquid or gas flow to maximum velocity. Ensure that the flow is homogenous, constant, and free of bubbles if a liquid.

   NOTE: If the trip point is to be set near the high end, the maximum flow should be at least 1.5 times the trip set-point. The maximum trip set point for liquids is 5 FPS and for gasses is 500 FPS. Consult factory for questions.
10. Move the Trip #1 Adjust Pot to 100 (fully cw). See Figure 12.
11. Adjust the SPAN Adjust Pot fully cw (25 turns).
12. Move the SPAN Coarse Adjustment Plug progressively from position A towards position D until the RED LED illuminates. Leave the plug in the socket that results in the RED LED illumination.
13. Adjust the SPAN 1 pot ccw until the GREEN LED illuminates.
14. Toggle the SPAN 1 Pot back and forth until the switching point is well defined. Leave the GREEN LED illuminated.
15. If the switch is to be used for flow-no flow detection, set the trip #1 adjust pot to 50% and go to step number 18.
16. A more exacting flow rate setting may be made by establishing the flow at the desired rate with a separate flow meter and proceeding to step 17.
17. Adjust the Trip #1 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.
18. Verify that the switch will reset by returning the actual product flow to the maximum or minimum rates.
19. Recheck the ZERO and SPAN settings at any time by adjusting the flow rate to the minimum (zero) or maximum (span) values, moving the calibration plug jumper to the corresponding ZERO or SPAN position, and toggling the respective zero or span pot to check for correct setting. The setting should be within one half turn of the pots. **Return jumper to normal before resuming operation**. See Figure 12.
20. If the time delay feature is needed in the application, refer to Section 4.1.2.

FIGURE 13: DUAL FLOW SET POINTS



DRAWING FILE: FIG13.FCD

4.4.3 Dual Channel Flow Calibration (Model VS5100)

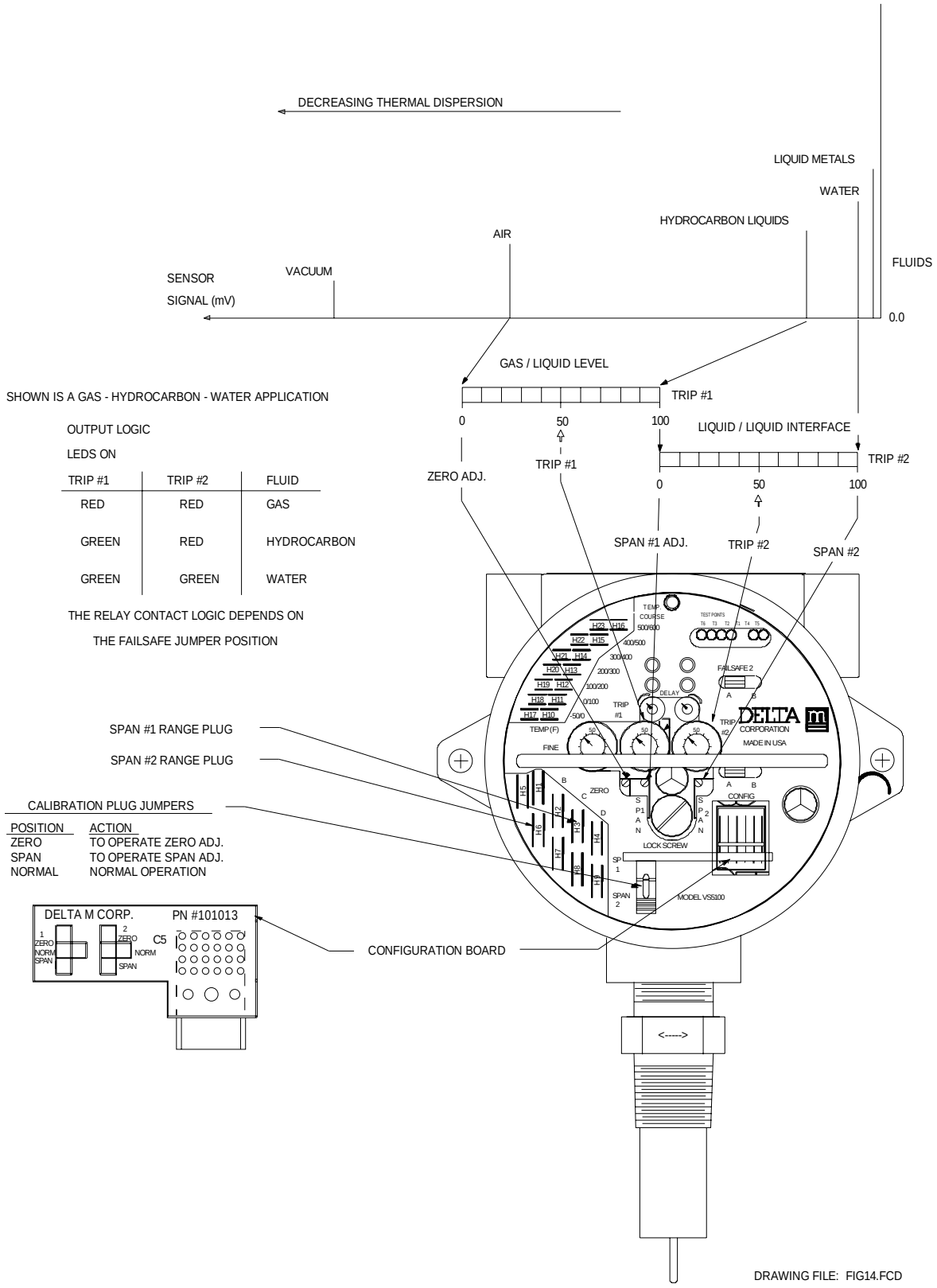
Refer to Figure 13 as a calibration guide. This procedure is identical to that of single channel flow calibration (section 4.4.2) except that a separate set point is established on each of the two channels (1 and 2). This calibration procedure is valid for liquids or gases.

1. Remove the instrument enclosure lid by turning ccw.
2. Ensure that the C4 configuration board for dual channel flow is installed. If not, install the proper board.
3. Apply power to the Model VS5100 Switch. **Allow 5 minutes to warm up**.
4. Ensure that the pipeline is filled with fluid and at no or minimum flow.
5. Move the Trip #1 and Trip #2 Adjust Pots to zero (fully ccw). See Figure 13.
6. Adjust the Zero Adjust Pot so that the RED LED's just do illuminate. This is a 25 turn pot. If the GREEN LED's are ON, turn the pot cw. If the RED LED's are ON turn it ccw.
7. Toggle with the Zero Adjust Pot back and forth until the switching point is well defined. Leave the RED LED's illuminated.
8. Wait 30 seconds and repeat steps 6 and 7 until switching point no longer changes.
9. Adjust the liquid or gas flow to maximum velocity. Ensure that the flow is homogenous, constant, and free of bubbles if a liquid.

   NOTE: If the trip point is to be set near the high end, the maximum flow should be at least 1.5 times the trip set-point. The maximum trip set point for liquids is 5 FPS and for gasses is 500 FPS. Consult factory for questions.

10. Move the Trip #1 and Trip #2 Adjust Pots to 100 (fully cw). See Figure 13.
11. Adjust the SPAN Pot fully cw (25 turns).
12. Move the SPAN Coarse Adjustment Plug progressively from position A towards position D until the RED LED's illuminate. Leave the plug in the socket that results in the RED LED's illumination.
13. Adjust the SPAN 1 pot ccw until the GREEN LED's illuminate.
14. Toggle the SPAN 1 Pot back and forth until the switching point is well defined. Leave the GREEN LED's illuminated.
15. If one channel is to be used for flow-no flow detection, set the Trip #1 adjust pot to 50%.
16. More exacting flow rate settings may be made by establishing the flow at the desired rates with a separate flow meter and proceeding to step 17 to establish the tripping points.
17. Adjust the Trip #1 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.
18. Verify that channel 1 will reset by returning the actual product flow to the maximum or minimum rates.
19. Repeat steps 16 through 18 for channel 2 using the Trip #2 Adjust Pot.
20. Recheck the ZERO and SPAN settings at any time by adjusting the flow rate to the minimum (zero) or maximum (span) values, moving the calibration plug jumper to the corresponding ZERO or SPAN position, and toggling the zero and span 1 pots to check for correct setting. The setting should be within one half turn of the pots. **Return jumper to normal before resuming operation**. See Figure 13.
21. If the time delay feature is needed in the application, refer to Section 4.1.2.

FIGURE 14 DUAL CHANNEL LEVEL CALIBRATION



DRAWING FILE: FIG14.FCD

4.4.4 Dual Channel, Three Phase Level (Dual Interface) Calibration (Model VS5100)

Refer to Figure 14 as a calibration guide. This procedure is similar to the single channel level calibration (section 4.4.1) except that separate spans are established for each of the two channels. The two spans are "stacked" as shown in Figure 14. The channel 1 span is that of gas to a low density liquid and the channel 2 span is that of a low density liquid to a high density liquid. Both SPAN 1 and SPAN 2 Course adjustment plugs are used and two calibration plugs are included on the configuration board (C5).

This calibration procedure is valid for an upper cover gas/low density liquid phase and a low density/higher density liquid-liquid phase. The phase change must be relatively discrete as liquid emulsion layers may not be detected. For optimum calibration results, wet sensor and drain but do not dry.

1. Remove the instrument enclosure lid by turning ccw.

2. Ensure that the C5 configuration board for dual channel, three phase level (dual interface) is installed. If not, install the proper board.

3. Apply power to the Model VS5100 switch. **Allow 5 minutes to warm up**.

4. Ensure that the liquid level is below the probe sensor tips (gas phase).

5. Move the Trip #1 Adjust Pot to zero (fully ccw). See Figure 14. Leave the Trip #2 Adjust Pot at 50%.

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 cw. If the RED LED is on, turn it ccw.

7. Toggle the Zero Adjust Pot back and forth until the switching point is well defined. Leave the RED LED illuminated.

8. Wait 30 seconds and repeat steps 6 and 7 until switching point no longer changes.

9. Raise the level until the lower density (phase 2) liquid is completely covering the sensor probe (ex. oil).

10 Move the Trip #1 Adjust Pot to 100 (fully cw). Leave the Trip #2 Adjust Pot at 50%. See Figure 14.

11. Adjust the Span 1 Adjust Pot fully cw (25 turns).

12. Move the SPAN 1 Coarse Adjustment Plug progressively from position A towards position D until the Channel 1 RED LED illuminates. Leave the plug in the socket that results in the RED LED illumination.

13. Adjust the span 1 pot ccw until the Channel 1 GREEN LED illuminates.

14. Toggle the Span 1 Pot back and forth until the switching point is well defined. Leave the GREEN LED illuminated.

    NOTE: This sets the span for the gaseous-low density liquid detection and also sets the zero for the low density-high density liquid/liquid detection.

15. Set the Channel 1 Trip Adjust Pot to 50%. The phase 1/phase 2 calibration is now complete. See Figure 14.

16. Move the Trip #2 Adjust Pot to 100 (fully cw). See Figure 14.

17. Raise the level until the high density liquid (phase 3) fluid is completely covering the sensor probe.

18. Adjust the Span 2 Adjust Pot fully cw (25 turns).

19. Move the SPAN 2 Coarse Adjustment Plug progressively from position A towards position D until the Channel 2 RED LED illuminates. Leave the plug in the socket that results in the RED LED illumination.

20. Adjust the span 2 pot ccw until the Channel 2 GREEN LED illuminates.

21. Toggle the Span 2 Pot back and forth until the switching point is well defined. Leave the GREEN LED illuminated.

22. Set the Trip #2 Adjust Pot to 50%. The phase 2/phase 3 calibration is now complete.

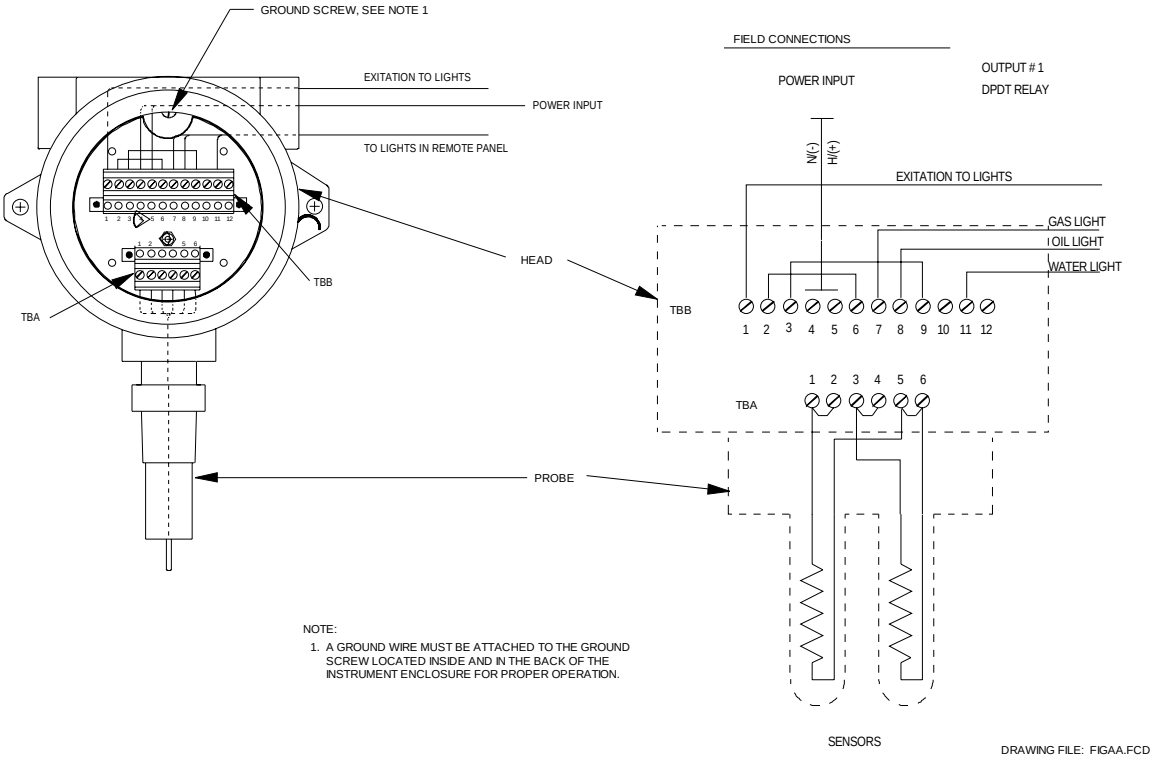
23. Recheck the ZERO, SPAN 1, and SPAN 2 settings at any time by adjusting the level to the gaseous phase, low density liquid phase, or high density liquid phase. Respectively, move the calibration plug jumper to the corresponding zero or span position, and toggle the ZERO, SPAN 1, and SPAN 2 pots, respectively. It is not necessary to do these in order; any of the three calibration points can be checked independently. **Return jumpers to normal before resuming operation**. See Figure 14.

24. Refer to the table on Figure 14 to note the LED status for each of the interface conditions.

25. Remote Indication and/or Control – Refer to Figures AA or AB for field wiring if it is desirable to have a remote indication of the interface status or to control the interface process (ex. oil/water separator).

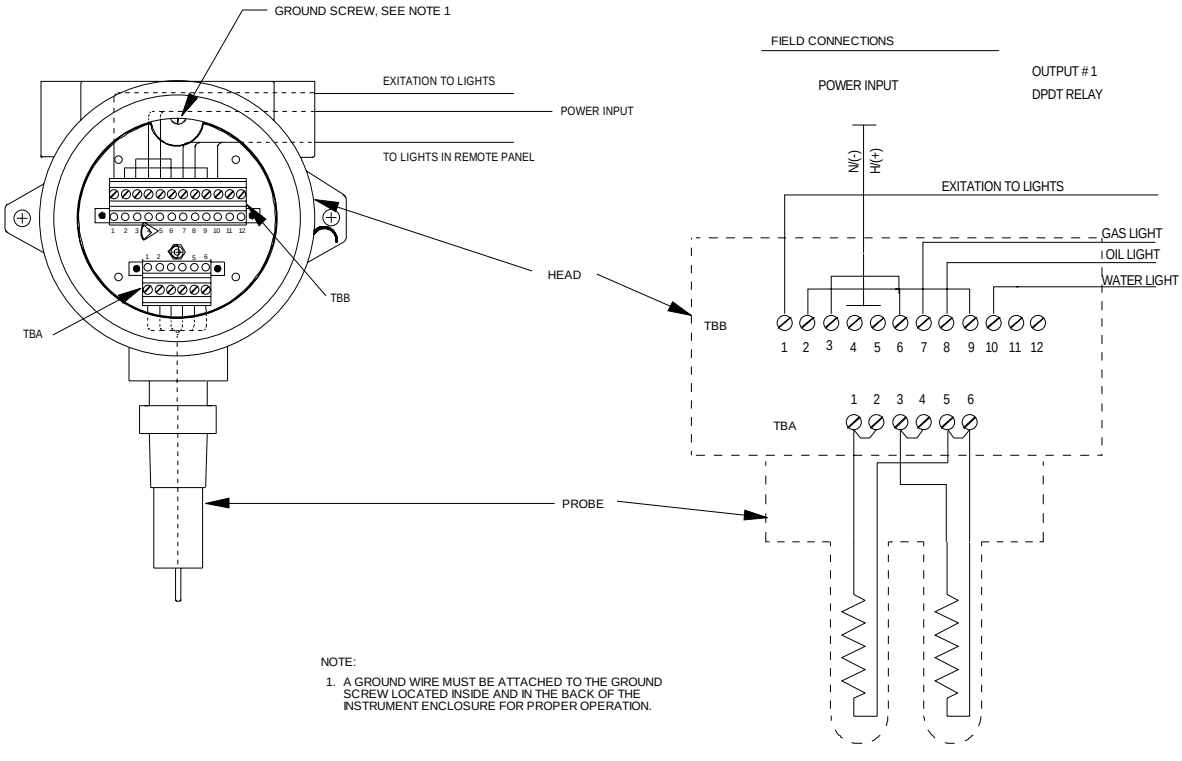
26. If the time delay feature is needed in the application, refer to Section 4.1.2.

FIGURE AA VS5100 FIELD WIRING DIAGRAM FOR LEVEL 3 PHASES, REMOTE INDICATION FAILSAFE IN POSITION A



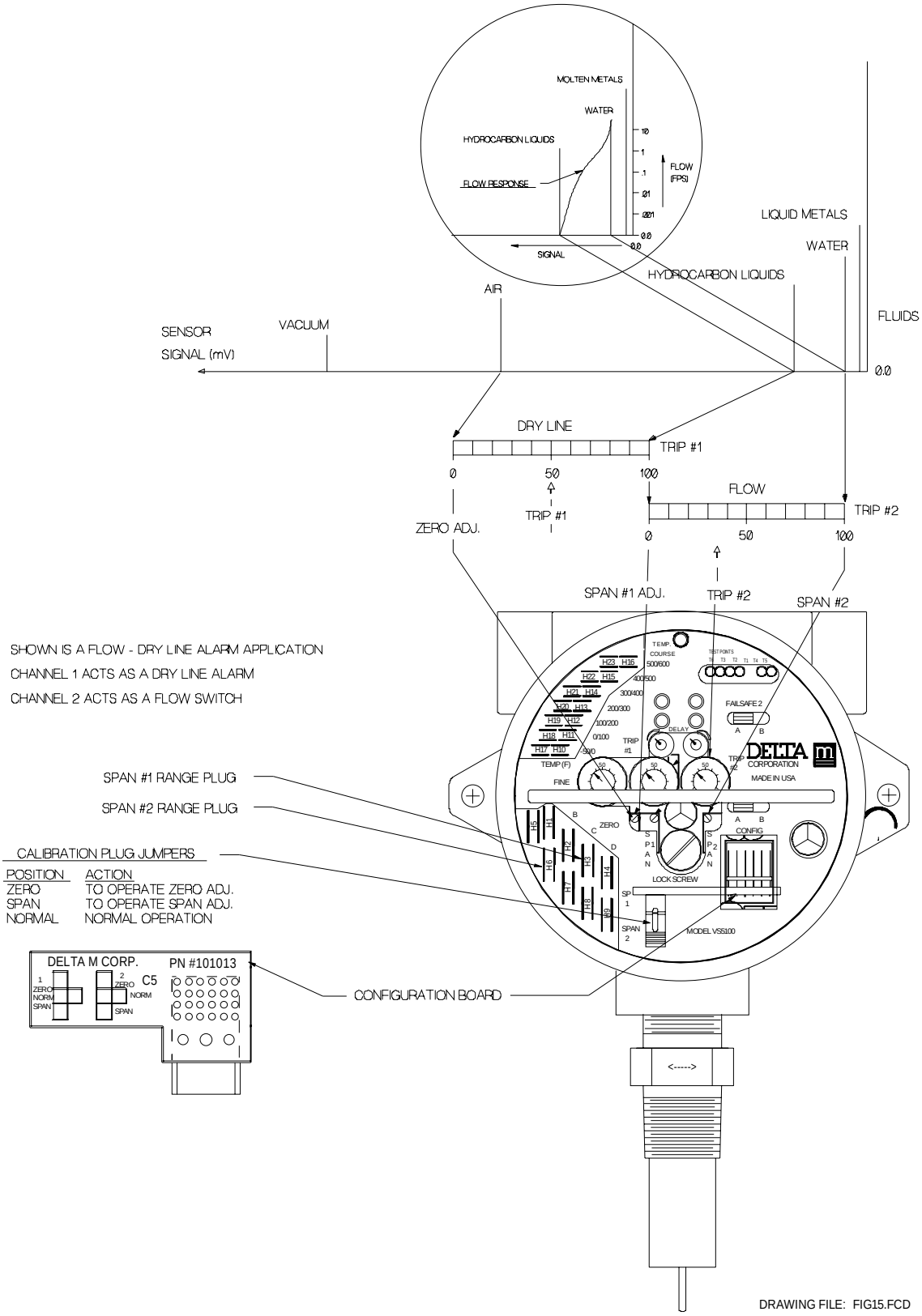
FAILSAFE IN POS. A

FIGURE AB VS5100 FIELD WIRING DIAGRAM FOR LEVEL 3 PHASES, REMOTE INDICATION FAILSAFE IN POSITION B



FAILSAFE IN POS. B

FIGURE 15 FLOW - DRY LINE ALARM CALIBRATION



4.4.5 Single Channel Liquid Flow Plus Dry Line Indication (Model VS5100)

Refer to Figure 15 as a calibration guide. This procedure is similar to the dual channel level/interface calibration (section 4.4.4). Channel 1 is set up for dry line alarm indication (liquid-gaseous phases) and Channel 2 is set up for flow calibration of the liquid phase. The two spans are "stacked" as shown in Figure 15. Both SPAN 1 and SPAN 2 Coarse Adjustment plugs are used. For optimum calibration results, wet sensor and drain but do not dry.

1. Remove the instrument enclosure lid by turning ccw.

2. Ensure that the C5 configuration board for Dual Channel Flow Plus Dry Line Indication is installed. If not, install the proper board.

3. Apply power to the Model VS5100 switch. Allow 5 minutes to warm up.

4. Ensure that the line is empty.

5. Move the Trip #1 Adjust Pot to zero (fully ccw) see Figure 15. Leave the Trip #2 Adjust Pot at 50%.

6. Adjust the Zero Adjust Pot so that the Channel 1 RED 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 it CCW.

7. Toggle the Zero Adjust Pot back and forth until the switching point is well defined. Leave the Channel 1 RED LED illuminated.

8. Wait 30 seconds and repeat steps 6 and 7 until switching point no longer changes.

9. Flood the pipe with liquid. Turn the flow off and let the system stabilize for five minutes with the pipeline full.

10. Move the Trip #1 Adjust Pot to 100 (fully cw) see Figure 15. Leave the Trip #2 Adjust Pot at 50%.

11. Adjust the Span 1 Adjust Pot fully cw (25 turns).

12. Move the Span 1 Coarse Adjustment Plug progressively from position A towards position D until the Channel 1 RED LED illuminates. Leave the plug in the socket that results in the RED LED illumination.

13. Adjust the Span 1 Pot ccw until the Channel 1 GREEN LED illuminates.

14. Toggle the Span 1 Pot back and forth until the switching point is well defined. Leave the GREEN LED illuminated.

    NOTE: This sets the span for the dry line indication measurement and also sets the zero for the liquid flow measurement.

15. Set the Channel 1 Trip Adjust Pot to 50%. The dry line calibration is now complete.

16. Move the Trip #2 Adjust Pot to 100 (fully cw) see Figure 15

17. Adjust the liquid flow to maximum velocity. Ensure that the flow is homogenous, constant and free of bubbles.

    NOTE: If the trip point is to be set near the high end, the maximum flow should be at least 1.5 times the trip set-point. The maximum trip set point for liquids is 5 FPS and for gasses is 500 FPS. Consult factory for questions.

18. Adjust the SPAN 2 Pot fully cw (25 turns).

19. Move the SPAN 2 Coarse Adjustment Plug progressively from position A towards position D until the channel 2 RED LED illuminates. Leave the plug in the socket that results in the RED LED illumination.

20. Adjust the SPAN 2 pot ccw until the GREEN LED illuminates.

21. Toggle the SPAN 2 Pot back and forth until the switching point is well defined. Leave the GREEN LED illuminated.

22. If the switch is to be used for flow-no flow detection, set the Trip #2 Adjust Pot to 50% and go to step number 25.

23. A more exacting flow rate setting may be made by establishing the flow at the desired rate with a separate flow meter and proceeding to step 24.

24. Adjust the Trip #2 Adjust Pot to obtain a trip as exhibited by an LED illumination. To trip on increasing flow set the GREEN LED to illuminate. To trip on decreasing flow set the RED LED to illuminate.

25. Verify that the switch will reset by returning to the maximum or minimum (no) flow setting.

26. Recheck the zero, span 1, and span 2 settings at any time by moving the calibration plug jumpers and concurrently emptying the pipeline liquid, setting flow to zero, or setting flow to maximum, respectively and toggling the zero, span 1, and span 2 pots, respectively. It is not necessary to do these things in order. Any of the three calibration points can be checked independently. **Return jumpers to normal before resuming operation**.

27. If the time delay feature is needed in the application, refer to section 4.1.2.

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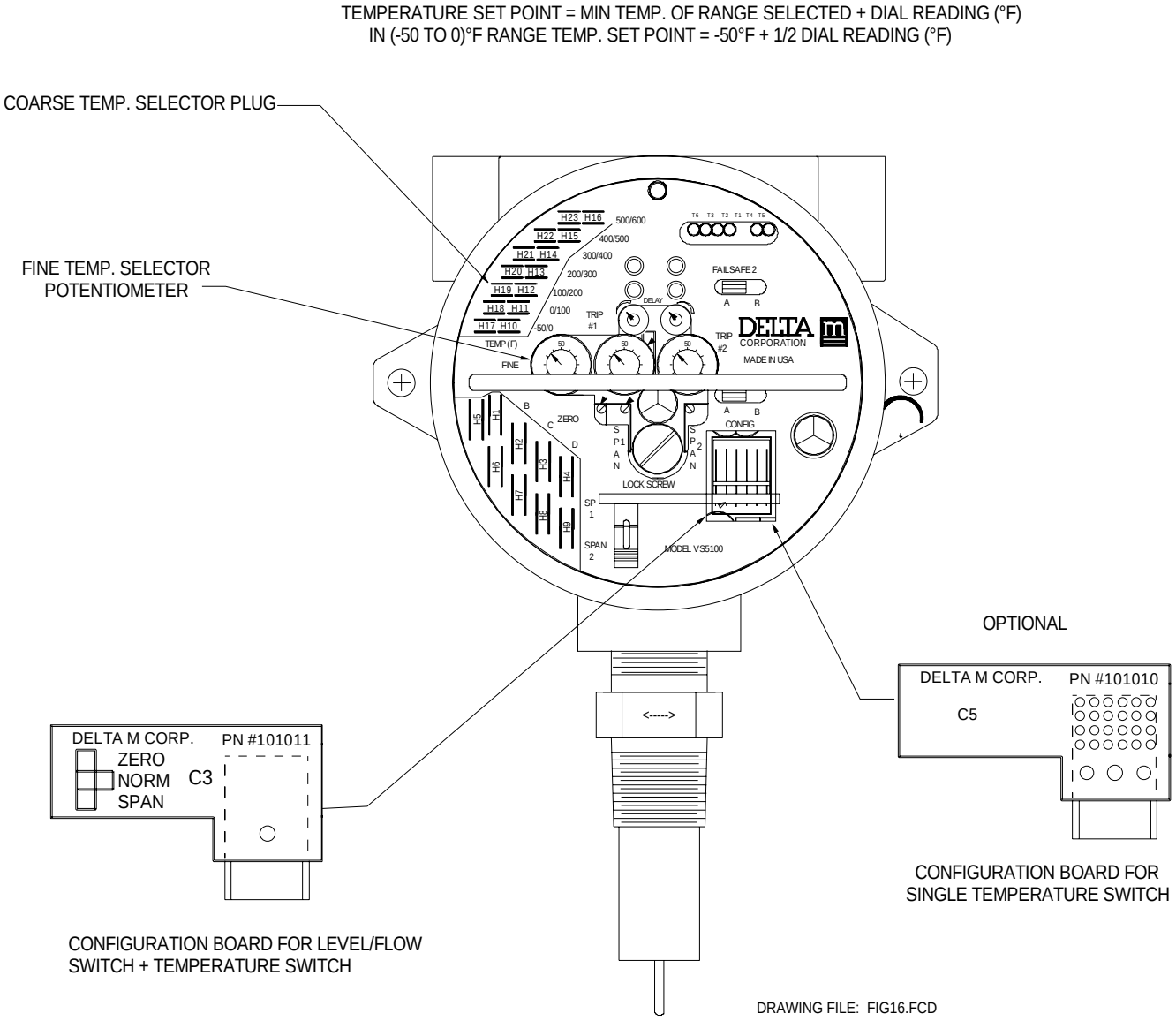
FIGURE 16 TEMPERATURE SWITCH POINT SETTING



4.4.6 Temperature Switch Point Setting Second Channel Of A Dual Channel Level or Flow Switch or for Single Channel Temperature Switch (TS51SC, TS51NX, TS51SK).

Refer to Figure 16 for a switch point setting guide. A temperature switch point setting applies to Channel 2 only for the C2 configuration plug, for single channel temperature or the C3 configuration plug for Channel 1 level or flow and Channel 2 temperature. It is assumed that the temperature switch point has been pre-determined by the user.

This switch point setting procedure is valid for any process liquid or gas in which the sensor probe is inserted and for a temperature range of -50°F to 600°F (-46°C to 316°C).

1. Remove the instrument enclosure lid by turning ccw.

2. Ensure that the C2 or C3 configuration board is installed. If not, install the proper board.

3. Apply power to the Model VS5100 with the probe inserted in the process liquid or gas to be monitored for temperature. Allow 5 minutes to warm up.

4. Move the Coarse Temperature Selector plug to the range encompassing the switch point. For example, if the switch point is to be 175°F, use the 100-200°F range.

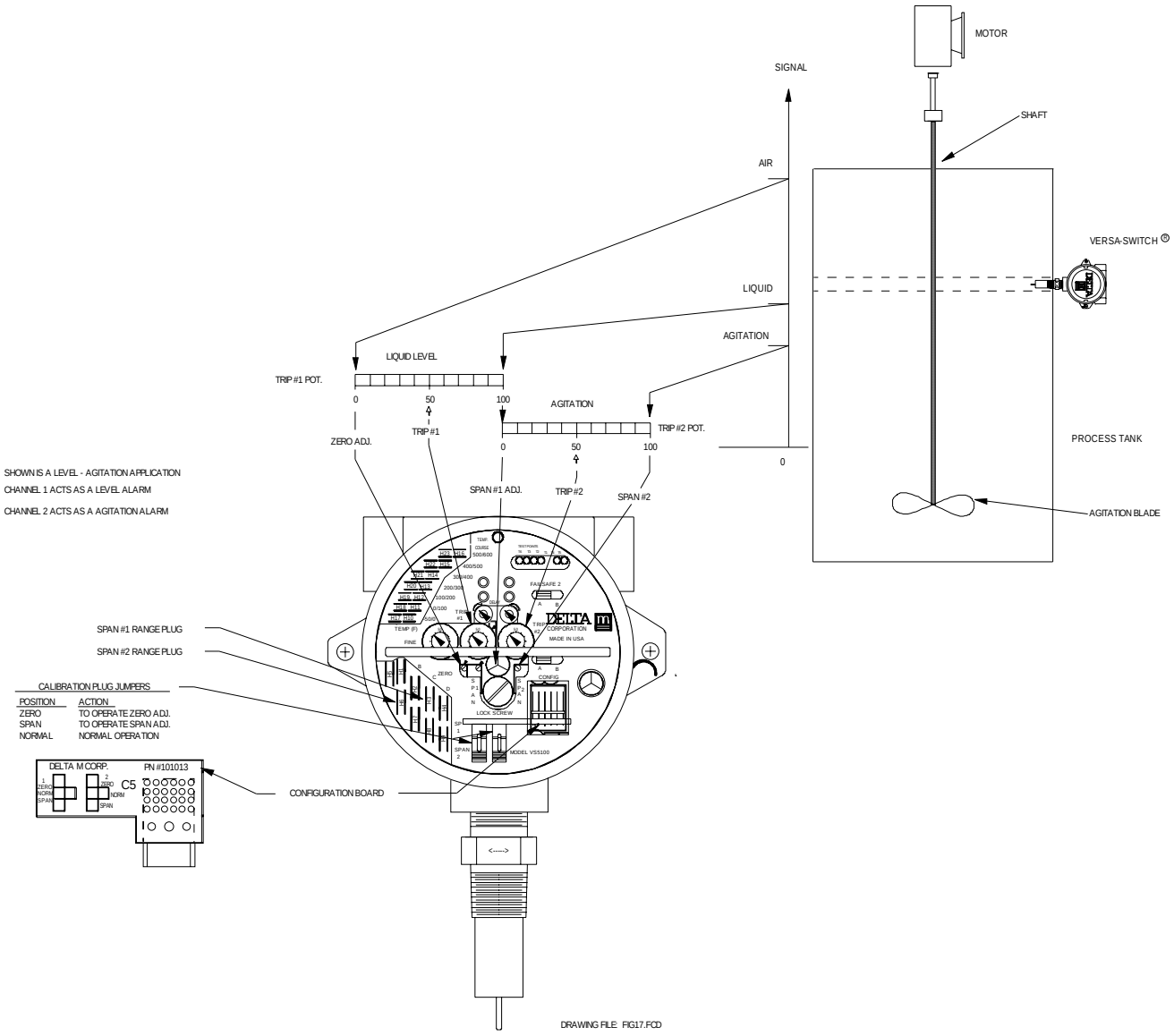
5. Dial the Temperature Fine Adjustment Potentiometer to the switch point temperature. For 100-200°F through 500-600°F ranges, zero is the lower temperature and 100 is the higher temperature. For the -50 to 0°F range, zero is -50°F and each percent equals 1/2°F so that 100 is 0°F. For example, if the switch point is to be 175°F, dial the temperature fine adjustment pot to 75.

6. If the process temperature where the sensor is inserted is less than the set-point temperature the GREEN LED will be illuminated. If it is higher, the RED LED will be illuminated. If possible, vary the process temperature or the set-point setting to effect a trip and verify proper operation.

   NOTE: With the C2 and C3 configuration plug, Channel 2 is the active channel for temperature switching. With C2 configuration (single temperature) Channel 1 is inactive and the corresponding RED LED will be permanently illuminated.

7. If the time delay feature is needed in the application, refer to Section 4.1.2.

FIGURE 17 DUAL CHANNEL LIQUID HIGH LEVEL ALARM PLUS AGITATION INDICATOR



4.4.7 Dual Channel Liquid Level Plus Agitation Indicator

Refer to Figure 17 for a switch point setting guide. This procedure is similar to the dual channel level/interface calibration (Section 4.4.4). **Channel 1** is set-up for a point liquid monitor (high level) but with a time delay to allow for the level to completely cover the sensor. **This high level alarm** will only trip when the vessel is full whether agitated or not.

The second channel is set to trip when liquid is agitated. Thus Channel 2 gives the indication that agitation is taking place at the top of the tank.

The two spans are "stacked" as shown in Figure 17. Both Span 1 and Span 2 coarse adjustment plugs are used. For optimum calibration results, wet sensor and drain but do not dry.

1. Remove the instrument enclosure lid by turning ccw.

2. Ensure that the C5 configuration board is installed. If not, install the proper board.

3. Apply power to the Model VS5100 switch. Allow 5 minutes to warm up.

4. Ensure that the tank liquid level is below the probe sensor tips.

5. Move the Trip #1 Adjust Pot to zero (fully ccw) see Figure 17. Leave the trip #2 adjust pot at 50%.

6. Adjust the Zero Adjust Pot so that the Channel 1 RED LED just does illuminate. This is a 25 turn pot. If the green LED is on, turn it CW. If the red LED is on turn it CCW.

7. Toggle the Zero Adjust Pot back and forth until the switching point is well defined. Leave the Channel 1 RED LED illuminated.

8. Wait 30 seconds and repeat steps 6 and 7 until switching point no longer changes.

9. Fill the vessel with liquid. Let the system stabilize for five minutes with the vessel full.

10. Move the Trip #1 Adjust Pot to 100 (fully cw) see Figure 17.

11. Adjust the Span 1 Adjust Pot fully cw (25 turns).

12. Move the Span 1 Coarse Adjustment Plug progressively from position A towards position D until the Channel 1 RED LED illuminates. Leave the plug in the socket that results in the RED LED illumination.

13. Adjust the Span 1 Pot ccw until the Channel 1 GREEN LED illuminates.

14. Toggle the Span 1 Pot back and forth until the switching point is well defined. Leave the GREEN LED illuminated.

NOTE: This sets the span for the high level indication and also sets the zero for the agitation indication.

15. Set the Channel 1 Trip Adjust Pot to 50%. The level calibration is now complete. If the application requires an equal response time to trip dry to wet and wet to dry, adjust the Trip Pot to 80%.

16. Adjust the channel 1 time delay pot to allow the level to fully cover the probe, careful not to overflow the tank.

17. Move the Trip #2 Adjust Pot to 100 (fully cw). See Figure 17.

18. Begin agitation and ensure the liquid has developed full agitation and is striking the sensor.

19. Adjust the span 2 pot fully cw (25 turns).

20. Move the SPAN 2 Coarse Adjustment Plug progressively from position A towards position D until the channel 2 RED LED illuminates. Leave the plug in the socket that results in the RED LED illumination.

21. Adjust the SPAN 2 pot ccw until the GREEN LED illuminates.

22. Toggle the SPAN 2 Pot back and forth until the switching point is well defined. Leave the GREEN LED illuminated.

23. Set the Trip Pot to 50%. The level plus agitation calibration is now complete.

24. Verify that the switch will reset by varying the level and starting and stopping agitator.

25. Recheck the zero, span 1, and span 2 settings at any time by moving the calibration plug jumpers and concurrently emptying the vessel liquid, starting and stopping the agitation, respectively and toggling the zero, span 1, and span 2 pots, respectively. It is not necessary to do these things in order. Any of the three calibration points can be checked independently.

26. If the time delay feature is needed in the application, refer to Section 4.1.2.

IMPORTANT

BE SURE TO SET THE CALIBRATION PLUG JUMPER TO NORMAL AFTER CALIBRATION TO ENSURE NORMAL OPERATION.

5.0 MAINTENANCE AND TROUBLESHOOTING

5.1 Cleaning Sensor Probe

The switch sensor probe 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.

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.

5.2 Troubleshooting

5.2.1 Self Test Feature

The self test feature of the VS5100 VERSA-SWITCH® is automatic during initial power-up. The switch may be rechecked at any time by turning off or interrupting the input power for two (2) minutes, reapplying power and observing the LED illumination sequence. This feature is only active, however, when the sensor probe is in the dry/uncovered or no flow condition. Additionally the switch must have been previously calibrated.

To do the self test:

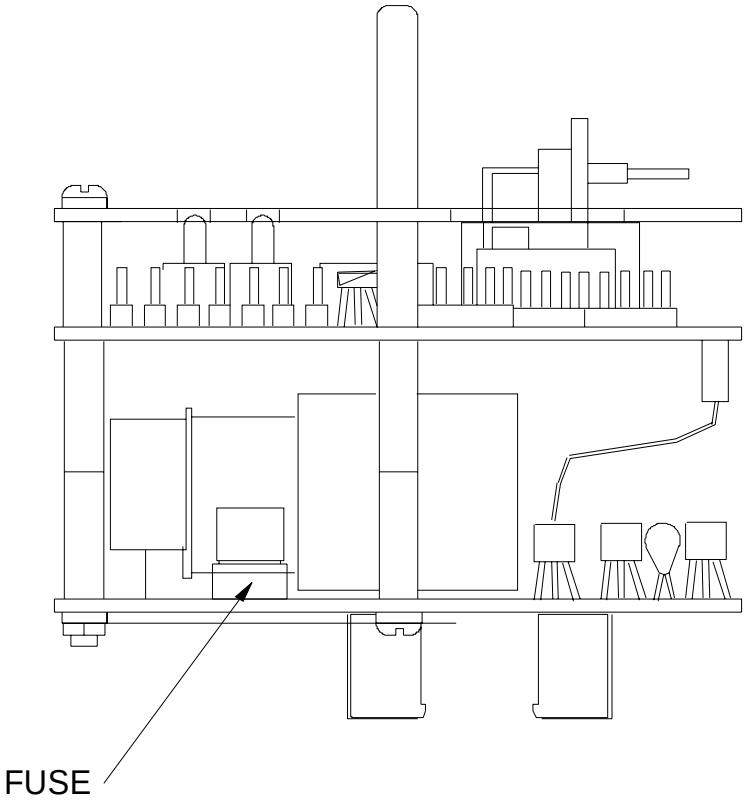
1. Turn off power for a minimum of two minutes. Reapply power and observe the following:

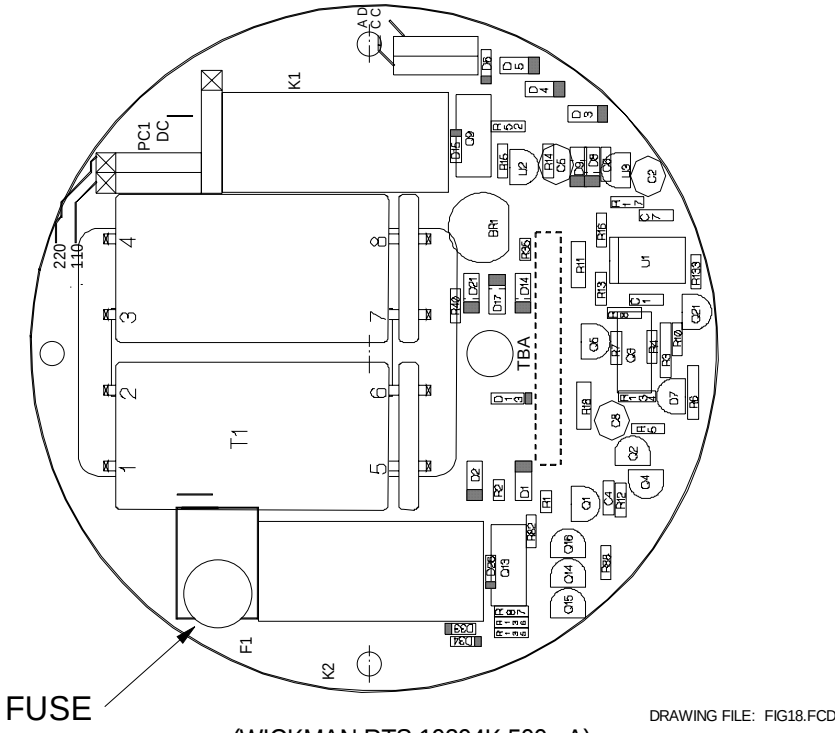
2. The GREEN LED will immediately illuminate indicating a wet/covered or high flow condition (above set point).

3. After a few seconds (10 to 30) the GREEN LED will go off and the RED LED will illuminate indicating the true state of the sensor as stated above.

This process provides a change of signal that results in a self test of the entire switch from the probe sensors to the relay contacts. If it does not function as stated here, proceed to section 5.2.2.

FIGURE 18 FUSE LOCATION





(WICKMAN RTS 19394K 500mA)

5.2.2 Power and Continuity Verification

1. Turn power off to the Model VS5100 VERSA-SWITCH®
2. Remove the instrument enclosure lid.
3. Loosen the retention screw until disengaged (see Figure 7 for location).
4. Unplug the PC board assembly from the enclosure by pulling straight out on the handle.
5. Reapply power and verify correct voltage at pins 4 (AC neutral or DC neg) and 5 (AC hot or DC positive) of TBB (see Figure 9 or 20A).
6. If voltage is correct, verify that the fuse (F1) on the PC Board is not blown (See Figure 18). If fuse is not blown, proceed to 5.2.3.
7. If fuse is blown replace with appropriate value (See Figure 18 and Specifications, Section 6.0).

5.2.3 Sensor/Electronics Functionality Verification

1. Turn power off to VERSA-SWITCH®.
2. Remove the instrument enclosure lid.
3. Loosen the retention screw until disengaged.
4. Unplug the PC board assembly from the enclosure by pulling straight out on the handle.
5. Allow a 5 minute cool down.
6. Measure the resistance of each RTD at pins 1 and 6 for the first RTD and pins 3 and 5 for the second RTD on connector TBA (see Figures 9 or 10). These resistances should be 110 ± 10 ohms (with sensors at approximately 70°F) and within 5% of each other in value.

   NOTE: Ensure jumper wires between terminals 1-2, 3-4, and 5-6 are in place at all times.

7. Measure the insulation resistance between pin 1 of TBA and the enclosure case ground of the VERSA-SWITCH®. It should be greater than 20 megohms.
8. If the VERSA-SWITCH® sensor assembly resistances are not as specified above, the switch sensor probe assembly must be replaced.
9. If the VERSA-SWITCH® sensor assembly resistances are as specified, the VERSA SWITCH® PC board assembly must be returned to the factory for repair or replacement.

6.0 SPECIFICATIONS

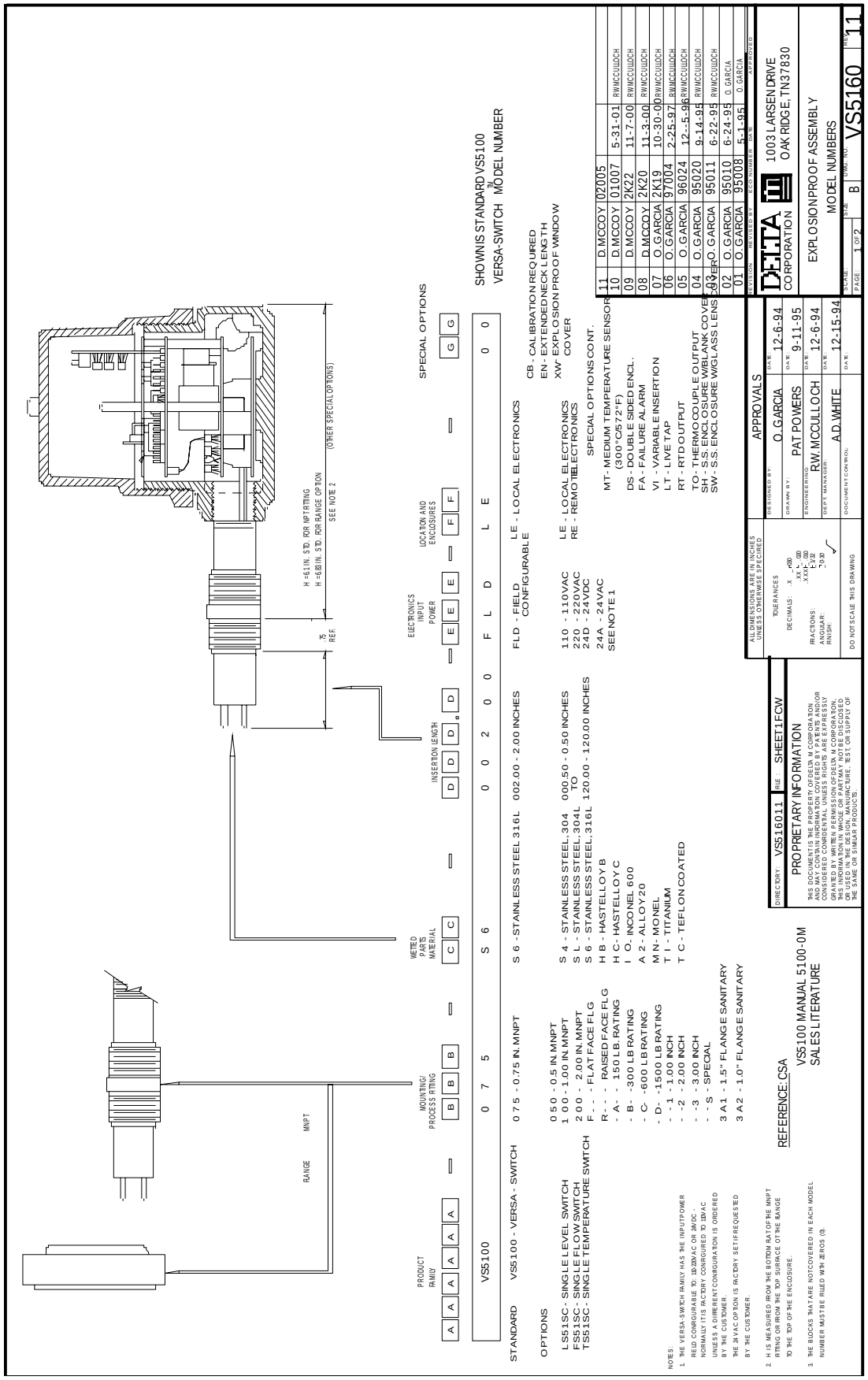
TYPE:	Thermal Differential-Dual RTD Sensors. Single or Dual Channel
PROCESS CONNECTIONS:	0.75 inch MNPT Standard, (0.5", 1" MNPT, and various flanges optional).
INSERTION LENGTH:	Two inch (5 cm) Standard, (0.5 inch to 30' optional).
CONSTRUCTION MATERIALS:	Wetted parts are 316L SS welded construction (exotic materials/coatings for corrosive environments available as options; consult factory.)
INSTRUMENT APPROVALS:	CSA: Class I, Group B,C,D Class II, Group E,F,G T4A Pollution Degree 2 (ANSI/ISA 582.02.01/IEC 1010)
OPERATING TEMPERATURE:	Process: Standard – 70°C to + 200°C (-100°F to + 390°F) Optional Medium Temp (MT) to +300°C (+572°F) High Temp (HT) to + 458°C (+850°F) Ultra High (UT) to 600°C (+1000°F) Electronics: -40°C to +60°C (-40°F to +140°F)
MAXIMUM WORKING PRESSURE (SENSORS):	To 3000 psig (20.4 MPa/207 bar) – Note the installed pressure rating is that of the process (NPT or flange) selected.
RANGE	Liquid flow 0.01 to 5.0 feet per second (FPS), Gases 0.1 to 500 FPS at 70°F (21°C)/14.7 psia (1 bar), Temperature - 50°F (-46°C) to 600°F (316°C)
REPEATABILITY:	Flow ±0.5% of setting, Level ±0.032" (0.08cm), Temperature ±1 °F (±0.5°C) liquid
ACCURACY:	±3.0% for Flow: ±2°F (±1°C) Temperature liquids
TIME RESPONSE:	0.5 to 10 seconds media dependent
SWITCH TIME DELAY:	Variable 0 to 300 seconds for each channel
INPUT POWER:	120 Vac, 50/60HZ standard, 220 Vac, 50HZ and 24 VDC, field-selectable, 24 Vac Factory configured, 4.2w. Installation Category II (ANSI/ISA 582.02.01/IEC 1010
FUSE REQUIREMENTS (F1):	Wickman RTS PN #19374K-500 mA.
OUTPUT:	Channel 1 DPDT 5A @ 277VAC, 5A @ 30VDC Channel 2 SPDT 10A @ 277VAC, 10A @ 30VDC
STABILITY:	Temperature compensated over entire range.
ADDITIONAL OPTIONS:	Remote electronics. Failure Alarm, 3A Sanitary, Variable Insertion, Live Tap, RTD Output, Thermocouple Output, Multipoints
CURRENT LIMITING SAFETY FEATURE:	Heated sensor - current driven crowbar, compensating sensor - current limiting resistor.

7.0 MODEL NUMBER DESIGNATION AND OPTIONS

7.1 Model Number Designation

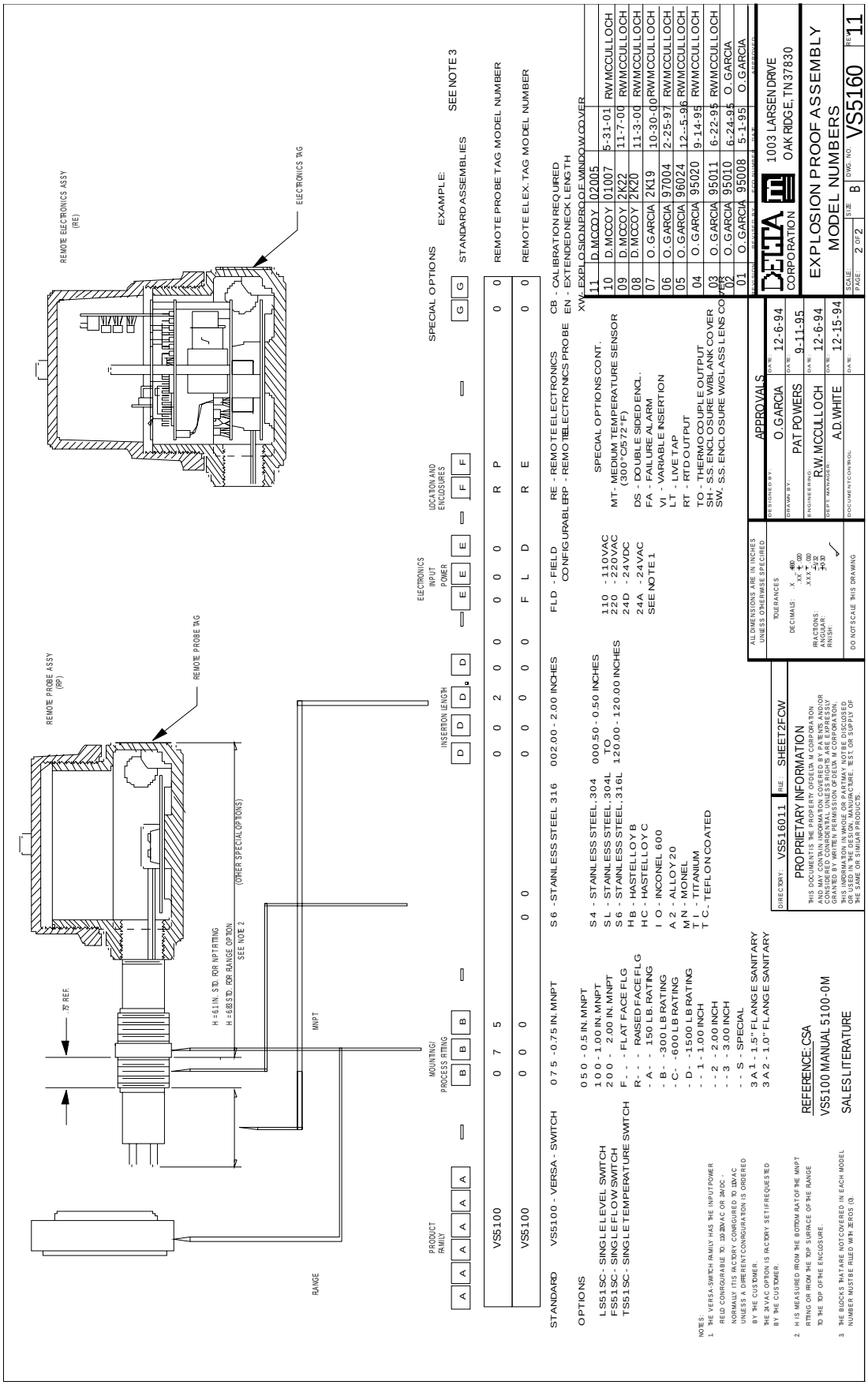
Figures 19a and 19b delineate the model numbering sequence for the VERSA-SWITCH® here are seven categories starting with the product family and ending with special options. Each has two to five alpha or numeric characters as defined for each category below the blocks in the figures. The model number for a standard VERSA-SWITCH® is shown on Figure 19a. An example of a VERSA-SWITCH® standard with remote electronics is shown on Figure 19b. Note separate model numbers are required for the two separate enclosures (probe and electronics).

FIGURE 19A.1



DRAWING FILE: FIG19A1.FCD

FIGURE 19A.2



DRAWING FILE: FIG19A2.FCD

FIGURE 19B.1

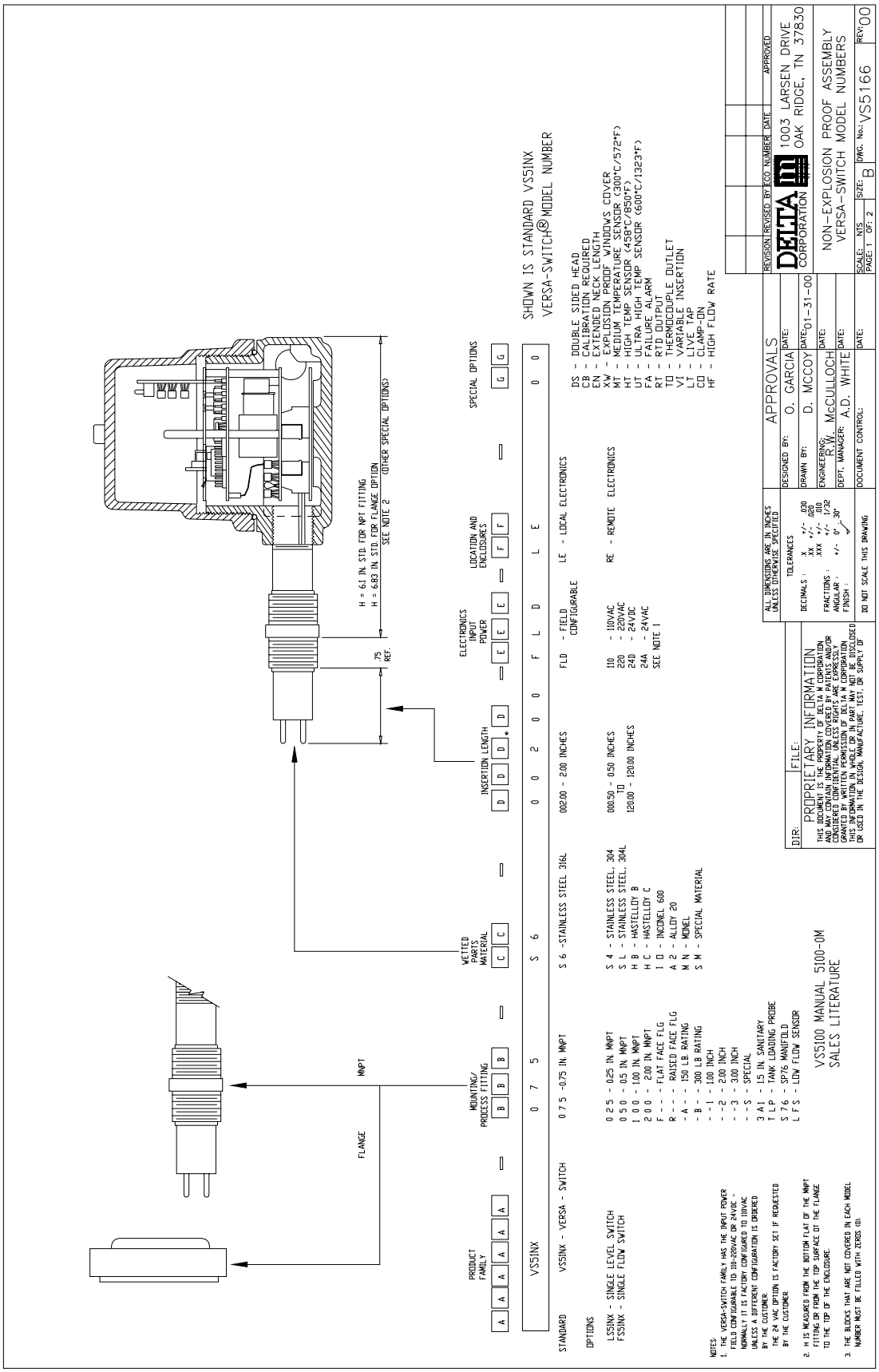
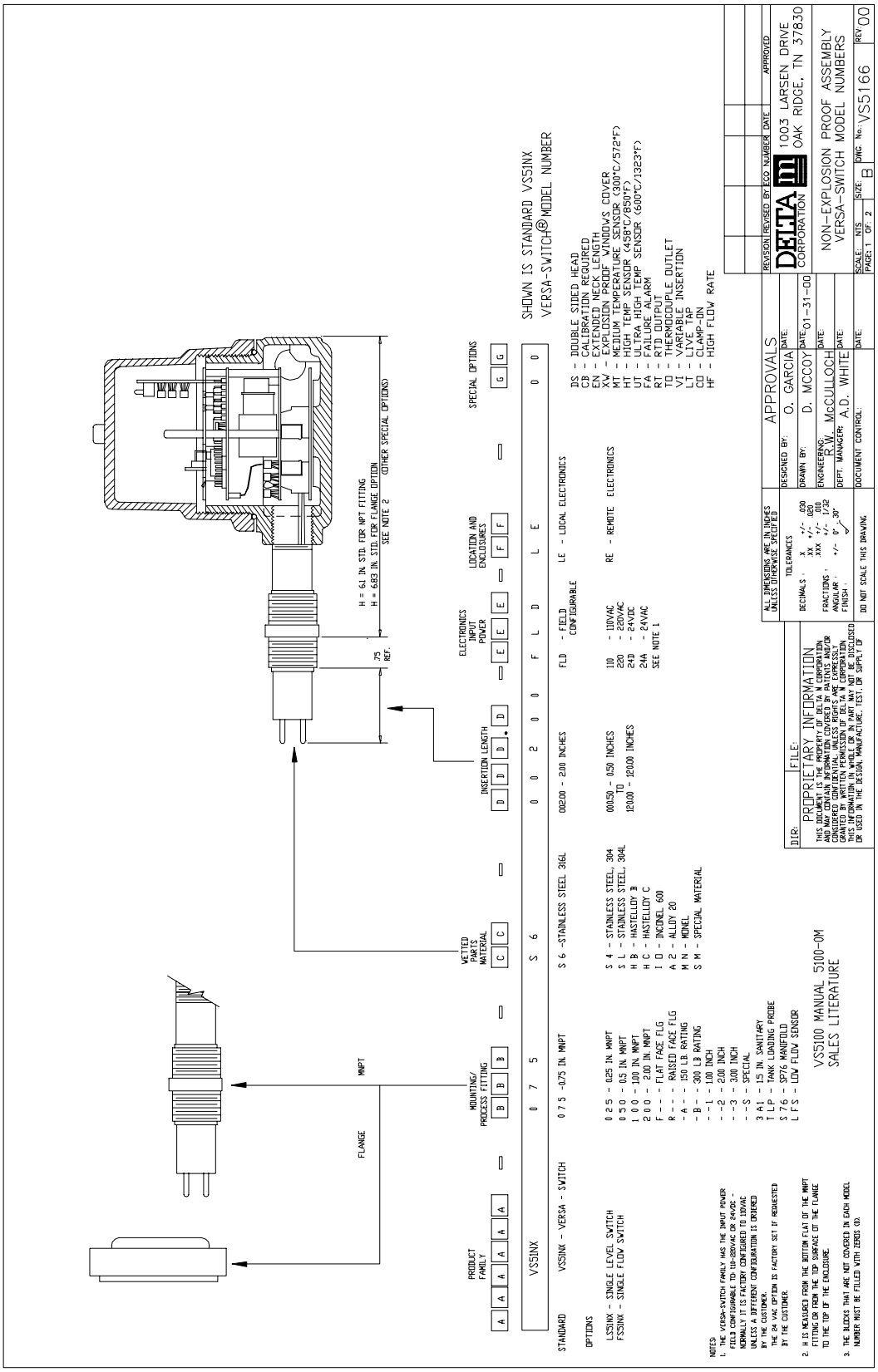

VS5100 MANUAL 5100-OM
SALES LITERATURE
PROPRIETARY INFORMATION
APPROVALS
DELTA M CORPORATION
1003 LARSEN DRIVE
OAK RIDGE, TN 37830
NON-EXPLOSION PROOF ASSEMBLY
VERSA-SWITCH MODEL NUMBERS
SHOWN IS STANDARD VS5INX
VERSA-SWITCH® MODEL NUMBER
VS5INX
STANDARD VS5INX - VERSA - SWITCH
OPTIONS
LS5INX - SINGLE LEVEL SWITCH
FS5INX - SINGLE FLOW SWITCH
NOTES:
1. THE VERSA-SWITCH FAMILY HAS THE INPUT POWER FIELD CONFIGURABLE TO 110-220VAC OR 24VDC - NORMALLY IT IS FACTORY CONFIGURED TO 110VAC UNLESS A DIFFERENT CONFIGURATION IS ORDERED BY THE CUSTOMER.
THE 24 VAC OPTION IS FACTORY SET IF REQUESTED BY THE CUSTOMER.
2. H IS MEASURED FROM THE BOTTOM FLAT OF THE NPT FITTING OR FROM THE TOP SURFACE OF THE FLANGE TO THE TOP OF THE ENCLOSURE.
3. THE BLOCKS THAT ARE NOT COVERED IN EACH MODEL NUMBER MUST BE FILLED WITH ZEROS (0).
FLANGE
NPT
H = 6.1 IN. STD. FOR NPT FITTING
H = 6.83 IN. STD. FOR FLANGE OPTION
SEE NOTE 2
(OTHER SPECIAL OPTIONS)
.75 REF
PRODUCT FAMILY
MOUNTING/ PROCESS FITTING
WETTED PARTS MATERIAL
INSERTION LENGTH
ELECTRONICS INPUT POWER
LOCATION AND ENCLOSURES
SPECIAL OPTIONS
0 7 5 - 0.75 IN. NPT
0 2 5 - 0.25 IN. NPT
0 5 0 - 0.5 IN. NPT
1 0 0 - 1.00 IN. NPT
2 0 0 - 2.00 IN. NPT
F - - - FLAT FACE FLG
R - - - RAISED FACE FLG
-A - - 150 LB. RATING
-B - - 300 LB. RATING
- - 1 - 1.00 INCH
- - 2 - 2.00 INCH
- - 3 - 3.00 INCH
- - S - SPECIAL
3 A1 - 1.5 IN. SANITARY
T L P - TANK LOADING PROBE
S 7 6 - SP76 MANIFOLD
L F S - LOW FLOW SENSOR
S 6 - STAINLESS STEEL 316L
S 4 - STAINLESS STEEL, 304
S L - STAINLESS STEEL, 304L
H B - HASTELLOY B
H C - HASTELLOY C
I D - INCONEL 600
A 2 - ALLOY 20
M N - MONEL
S M - SPECIAL MATERIAL
0 0 0 2 0 0 0 - 2.00 INCHES
0 0 0 5 0 - 0.50 INCHES
TO
1 2 0 0 0 - 120.00 INCHES
F L D - FIELD CONFIGURABLE
110 - 110VAC
220 - 220VAC
24D - 24VDC
24A - 24VAC
SEE NOTE 1
L E - LOCAL ELECTRONICS
RE - REMOTE ELECTRONICS
DS - DOUBLE SIDED HEAD
CB - CALIBRATION REQUIRED
EN - EXTENDED NECK LENGTH
XW - EXPLOSION PROOF WINDOWS COVER
MT - MEDIUM TEMPERATURE SENSOR (300°C/572°F)
HT - HIGH TEMP SENSOR (450°C/850°F)
UT - ULTRA HIGH TEMP SENSOR (600°C/1323°F)
FA - FAILURE ALARM
PT - PT100 RTD
TD - THERMOCOUPLE OUTLET
VI - VARIABLE INSERTION
LT - LIVE TAP
CD - CLAMP-ON
HF - HIGH FLOW RATE
G G
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED
TOLERANCES
DECIMALS : X +/- .020 XX +/- .010 XXX +/- .032
FRACTIONS : +/- 1/32
ANGULAR : +/- 0° 30'
FINISH :
DO NOT SCALE THIS DRAWING
DESIGNED BY: O. GARCIA DATE:
DRAWN BY: D. MCCOY DATE: 01-31-00
ENGINEERING: R.W. McCULLOCH DATE:
DEPT. MANAGER: A.D. WHITE DATE:
DOCUMENT CONTROL: DATE:
REVISION REVISED BY ECO NUMBER DATE APPROVED
SCALE: NTS SIZE: B DWG. No.: VS5166 REV: 00
PAGE: 1 OF: 2

FIGURE 19B.2


FLANGE
MNPT
H = 6.1 IN. STD. FOR MNPT FITTING
H = 6.83 IN. STD. FOR FLANGE OPTION
SEE NOTE 2
(OTHER SPECIAL OPTIONS)
.75 REF.
VS5INX 0 7 5 S 6 0 0 2 0 0 F L D L E 0 0
PRODUCT FAMILY
MOUNTING/ PROCESS FITTING
WETTED PARTS MATERIAL
INSERTION LENGTH
ELECTRONICS INPUT POWER
LOCATION AND ENCLOSURES
SPECIAL OPTIONS
SHOWN IS STANDARD VS5INX VERSA-SWITCH® MODEL NUMBER
STANDARD VS5INX - VERSA - SWITCH 075 -0.75 IN. MNPT S6 -STAINLESS STEEL 316L 00200 - 2.00 INCHES FLD - FIELD CONFIGURABLE LE - LOCAL ELECTRONICS
OPTIONS
LSSINX - SINGLE LEVEL SWITCH
FSSINX - SINGLE FLOW SWITCH
025 - 0.25 IN. MNPT
050 - 0.5 IN. MNPT
100 - 1.00 IN. MNPT
200 - 2.00 IN. MNPT
F - - - FLAT FACE FLG
R - - - RAISED FACE FLG
-A- - - 150 LB. RATING
-B- - - 300 LB RATING
- -1 - 1.00 INCH
- -2 - 2.00 INCH
- -3 - 3.00 INCH
- -S - SPECIAL
3A1 - 1.5 IN. SANITARY
TLP - TANK LOADING PROBE
S76 - SP76 MANIFOLD
LFS - LOW FLOW SENSOR
S 4 - STAINLESS STEEL, 304
S L - STAINLESS STEEL, 304L
H B - HASTELLOY B
H C - HASTELLOY C
I D - INCONEL 600
A 2 - ALLOY 20
M N - MONEL
S M - SPECIAL MATERIAL
00050 - 0.50 INCHES TO 12000 - 120.00 INCHES
110 - 110VAC
220 - 220VAC
24D - 24VDC
24A - 24VAC
SEE NOTE 1
RE - REMOTE ELECTRONICS
DS - DOUBLE SIDED HEAD
CB - CALIBRATION REQUIRED
EN - EXTENDED NECK LENGTH
EW - EXPLOSION PROOF WINDOWS COVER
MT - MEDIUM TEMPERATURE SENSOR (300°C/572°F)
HT - HIGH TEMP SENSOR (450°C/850°F)
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FA - FAILURE ALARM
RT - RTD OUTPUT
TO - THERMOCOUPLE OUTLET
VI - VARIABLE INSERTION
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CD - CLAMP-ON
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NOTES:
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2. H IS MEASURED FROM THE BOTTOM FLAT OF THE MNPT FITTING OR FROM THE TOP SURFACE OF THE FLANGE TO THE TIP OF THE ENCLOSURE
3. THE BLOCKS THAT ARE NOT COVERED IN EACH MODEL NUMBER MUST BE FILLED WITH ZEROS (0).
VS5100 MANUAL 5100-OM
SALES LITERATURE
DIR: FILE:
PROPRIETARY INFORMATION
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ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED
TOLERANCES
DECIMALS: X +/- .030 XX +/- .020 XXX +/- .010
FRACTIONS: +/- 1/32
ANGULAR: +/- 0° 30'
FINISH:
DO NOT SCALE THIS DRAWING
APPROVALS
DESIGNED BY: O. GARCIA DATE:
DRAWN BY: D. MCCOY DATE: 01-31-00
ENGINEERING: R.W. McCULLOCH DATE:
DEPT. MANAGER: A.D. WHITE DATE:
DOCUMENT CONTROL: DATE:
REVISION REVISED BY: ECO NUMBER DATE: APPROVED
DELTA M CORPORATION 1003 LARSEN DRIVE OAK RIDGE, TN 37830
NON-EXPLOSION PROOF ASSEMBLY
VERSA-SWITCH MODEL NUMBERS
SCALE: NTS SIZE: B DWG. No.: VS5166 REV: 00
PAGE: 1 OF: 2

8.0 WARRANTY AND SERVICE

8.1 Warranty

For a period of two years from the date of shipment DELTA M Corporation 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 a 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 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 to label 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.

*** IMPORTANT***

PLEASE DO NOT RETURN ANY UNIT TO DELTA M WITHOUT A RETURN AUTHORIZATION NUMBER CLEARLY MARKED ON THE OUTSIDE OF THE BOX.

8.3 Spare Parts List

Part No.	Description
Versa-Switch Electronics	
200068	FS/LS51SC (Single Channel)
200055	VS5100 (Dual Channel)
200065	VS5100 (Dual Channel w/ Failure Alarm)
200056	Conf Plug-C1 /Single Level/Flow
200057	Conf Plug-C2 /Single Temperature
200058	Conf Plug-C3/Single Level/Flow&Temp
200059	Conf Plug-C4/Dual Trip Flow
200060	Conf Plug-C5/Dual Level
200061	Conf Plug-C6/ Single L/F w/Failure Alarm
Connector Plates	
200032	VS5100/FS51/LS51 – Local Electronics
200450	Remote Connector Plate
200182	Remote – MT & HT Options
Fuses	
101206	Versa Switch – Wickmann 3740500041
Manuals	
101143	Versa Switch Manual
Enclosures	
101790	Standard Enclosure
101797	Standard Enclosure w/ Cenelec Approval
101798	Standard Enclosure w/ Glass Window
101611	Enclosure for Failure Alarm Option-Std.
101612	Enclosure for Failure Alarm Option – Cenelec
101613	Enclosure for Failure Alarm Option-Glass Window
Cable	
101567	Cable- Standard
101539	Cable- MT/HT Option
Sensor	
200711	Sensor Assy. .75-S6-2.00
200087	Sensor Assy. 1.00-S6-2.00
N/A	Sensor Assy. .50-S6-2.00
N/A	Other determined by original part no.

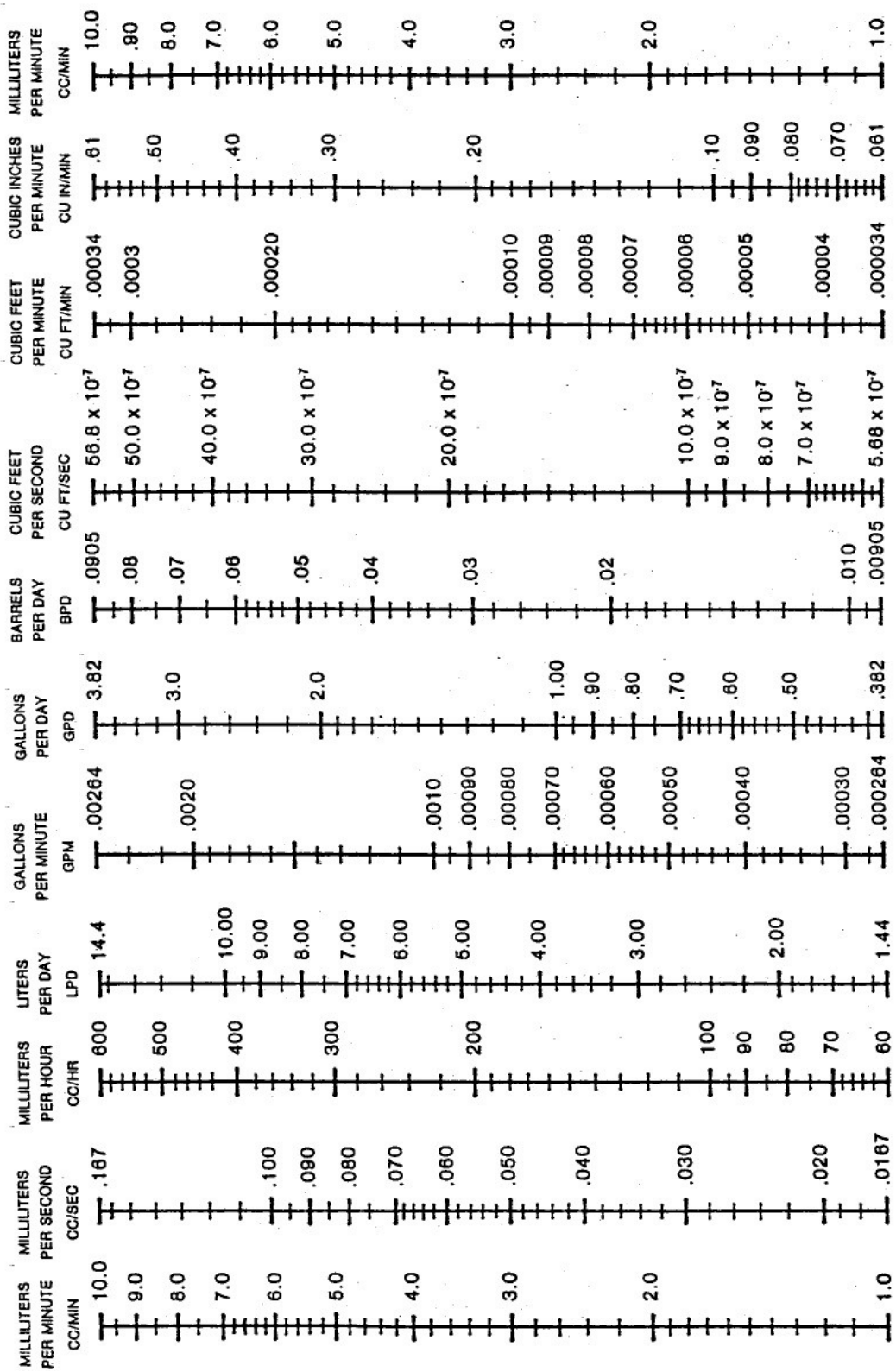
9.0 FLOW CONVERSION CHARTS AND APPLICATION INFORMATION

9.1 Flow Conversion Chart

Convert known units to cubic feet per second (CFPS) or gallons per minute (GPM) using the chart below or the line chart on the next page. Use these to determine velocity in FPS and/or pressure drop in lbs/in² with the chart showing water flow through a schedule 40 steel pipe.

TO CONVERT FROM	TO	MULTIPLY BY
Gallons Per Minute (GPM)	Cubic Feet 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

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 known value of flow and read the equivalent value on any of the other scales.

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.													
		Velocity	Press. Drop	Velocity	Press. Drop	Velocity	Press. Drop	Velocity	Press. Drop	Velocity	Press. Drop	Velocity	Press. Drop	Velocity	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.
		1/8"		1/4"		3/8"		1/2"							
.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	3/4"					
.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"		1 1/4"	
1	0.00223	5.65	37.2	3.08	8.28	1.68	1.85	1.06	0.600	0.602	0.155	0.371	0.048		1 1/2"
2	0.00446	11.29	134.4	6.16	30.1	3.36	6.58	2.11	2.10	1.20	0.526	0.743	0.164	0.429	0.044
3	0.00668			9.25	64.1	5.04	13.9	3.17	4.33	1.81	1.09	1.114	0.336	0.644	0.090	0.473	0.043
4	0.00891			12.33	111.2	6.72	23.9	4.22	7.42	2.41	1.83	1.49	0.565	0.858	0.150	0.630	0.071
5	0.01114	2"				8.40	36.7	5.28	11.2	3.01	2.75	1.86	0.835	1.073	0.223	0.788	0.104
6	0.01337	0.574	0.044	2 1/2"		10.08	51.9	6.33	15.8	3.61	3.84	2.23	1.17	1.29	0.309	0.946	0.145
8	0.01782	0.765	0.073			13.44	91.1	8.45	27.7	4.81	6.60	2.97	1.99	1.72	0.518	1.26	0.241
10	0.02228	0.956	0.108	0.670	0.046			10.56	42.4	6.02	9.99	3.71	2.99	2.15	0.774	1.58	0.361
15	0.03342	1.43	0.224	1.01	0.094	3"				9.03	21.6	5.57	6.36	3.22	1.63	2.37	0.755
20	0.04456	1.91	0.375	1.34	0.158	0.868	0.056	3 1/2"		12.03	37.8	7.43	10.9	4.29	2.78	3.16	1.28
25	0.05570	2.39	0.561	1.68	0.234	1.09	0.083	0.812	0.041	4"		9.28	16.7	5.37	4.22	3.94	1.93
30	0.06684	2.87	0.786	2.01	0.327	1.30	0.114	0.974	0.056			11.14	23.8	6.44	5.92	4.73	2.72
35	0.07798	3.35	1.05	2.35	0.436	1.52	0.151	1.14	0.704	0.882	0.041	12.99	32.2	7.51	7.90	5.52	3.64
40	0.08912	3.83	1.35	2.68	0.556	1.74	0.192	1.30	0.095	1.01	0.052	14.85	41.5	8.59	10.24	6.30	4.65
45	0.1003	4.30	1.67	3.02	0.668	1.95	0.239	1.46	0.117	1.13	0.064			9.67	12.80	7.09	5.85
50	0.1114	4.78	2.03	3.35	0.839	2.17	0.288	1.62	0.142	1.26	0.076	5"		10.74	15.66	7.88	7.15
60	0.1337	5.74	2.87	4.02	1.18	2.60	0.406	1.95	0.204	1.51	0.107			12.89	22.2	9.47	10.21
70	0.1560	6.70	3.84	4.69	1.59	3.04	0.540	2.27	0.261	1.76	0.143	1.12	0.047			11.05	13.71
80	0.1782	7.65	4.97	5.36	2.03	3.47	0.687	2.60	0.334	2.02	0.180	1.28	0.060			12.62	17.59
90	0.2005	8.60	6.20	6.03	2.53	3.91	0.861	2.92	0.416	2.27	0.224	1.44	0.074	6"		14.20	22.0
100	0.2228	9.56	7.59	6.70	3.09	4.34	1.05	3.25	0.509	2.52	0.272	1.60	0.090	1.11	0.036	15.78	26.9
125	0.2785	11.97	11.76	8.38	4.71	5.43	1.61	4.06	0.769	3.15	0.415	2.01	0.135	1.39	0.055	19.72	41.4
150	0.3342	14.36	16.70	10.05	6.69	6.51	2.24	4.87	1.08	3.78	0.580	2.41	0.190	1.67	0.077		
175	0.3899	16.75	22.3	11.73	8.97	7.60	3.00	5.68	1.44	4.41	0.774	2.81	0.253	1.94	0.102		
200	0.4456	19.14	28.8	13.42	11.68	8.68	3.87	6.49	1.85	5.04	0.985	3.21	0.323	2.22	0.130	8"	
225	0.5013	...	...	15.09	14.63	9.77	4.83	7.30	2.32	5.67	1.23	3.61	0.401	2.50	0.162	1.44	0.043
250	0.557	...	...	...	...	10.85	5.93	8.12	2.84	6.30	1.46	4.01	0.495	2.78	0.195	1.60	0.051
275	0.6127	...	...	...	...	11.94	7.14	8.93	3.40	6.93	1.79	4.41	0.583	3.05	0.234	1.76	0.061
300	0.6684	...	...	...	...	13.00	8.36	9.74	4.02	7.56	2.11	4.81	0.683	3.33	0.275	1.92	0.072
325	0.7241	...	...	...	...	14.12	9.89	10.53	4.09	8.19	2.47	5.21	0.797	3.61	0.320	2.08	0.083
350	0.7798			...	...	...	...	11.36	5.41	8.82	2.84	5.62	0.919	3.89	0.367	2.24	0.095
375	0.8355			...	...	...	...	12.17	6.18	9.45	3.25	6.02	1.05	4.16	0.416	2.40	0.108
400	0.8912			...	...	...	...	12.98	7.03	10.08	3.68	6.42	1.19	4.44	0.471	2.56	0.121
425	0.9469			...	...	...	...	13.80	7.89	10.71	4.12	6.82	1.33	4.72	0.529	2.73	0.136
450	1.003	10"		...	...	...	...	14.61	8.80	11.34	4.60	7.22	1.48	5.00	0.590	2.89	0.151
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
1 000	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
1 100	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
1 200	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
1 300	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
1 400	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
1 500	3.342	6.10	0.466	4.30	0.195	3.56	0.122	2.72	0.063	18"				16.66	5.85	9.62	1.46
1 600	3.565	6.51	0.527	4.59	0.219	3.79	0.138	2.90	0.071					17.77	6.61	10.26	1.65
1 800	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
2 000	4.456	8.14	0.808	5.73	0.339	4.74	0.209	3.63	0.107	2.87	0.060	20"		22.21	10.3	12.82	2.55
2 500	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
3 000	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	24"		19.24	5.59
3 500	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
4 000	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
4 500	10.03	18.31	3.87	12.90	1.60	10.67	0.990	8.17	0.503	6.46	0.280	5.20	0.162	3.59	0.065	28.87	12.2
5 000	11.14	20.35	4.71	14.33	1.95	11.85	1.21	9.08	0.617	7.17	0.340	5.77	0.199	3.99	0.079	...	...
6 000	13.37	24.41	6.74	17.20	2.77	14.23	1.71	10.89	0.877	8.61	0.483	6.93	0.280	4.79	0.111	...	...
7 000	15.60	28.49	9.11	20.07	3.74	16.60	2.31	12.71	1.18	10.04	0.652	8.08	0.376	5.59	0.150	...	...
8 000	17.82	...	...	22.93	4.84	18.96	2.99	14.52	1.51	11.47	0.839	9.23	0.488	6.38	0.192	...	...
9 000	20.05	...	...	25.79	6.09	21.34	3.76	16.34	1.90	12.91	1.05	10.39	0.608	7.18	0.242	...	...
10 000	22.28	...	...	28.66	7.46	23.71	4.61	18.15	2.34	14.34	1.28	11.54	0.739	7.98	0.294	...	...
12 000	26.74	...	...	34.40	10.7	28.45	6.59	21.79	3.33	17.21	1.83	13.85	1.06	9.58	0.416	...	...
14 000	31.19	...	...	...	...	33.19	8.89	25.42	4.49	20.08	2.45	16.16	1.43	11.17	0.562	...	...
16 000	35.65	...	...	...	...	...	...	29.05	5.83	22.95	3.18	18.47	1.85	12.77	0.723	...	...
18 000	40.10	...	...	...	...	...	...	32.68	7.31	25.82	4.03	20.77	2.32	14.36	0.907	...	...
20 000	44.56	...	...	...	...	...	...	36.31	9.03	28.69	4.93	23.08	2.86	15.96	1.12	...	...

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.

10. OPTIONS

10.1 Remote Electronics Option

Figure 20A shows the configuration and field wiring for the remote electronics option. The remote electronics enclosure contains the input power and relay outputs connectors TBA and the probe/sensor connector TBB. The probe/sensor enclosure contains TBC, a matching terminal to TBA for the probe/sensor field wiring. Connect the field wiring between the probe/sensor enclosure and remote electronics as shown in Figure 20A. Use Figure 20B as a guide to prepare the cable terminations and connections.

IMPORTANT

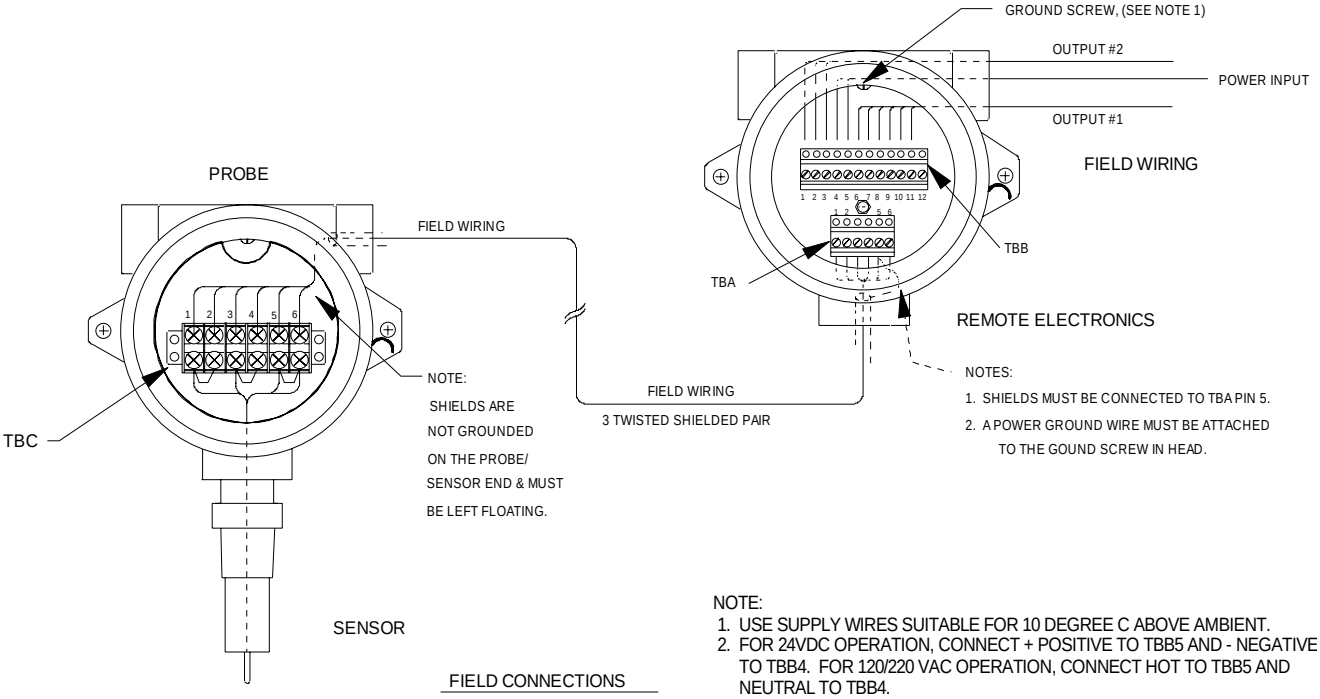
NOTE THAT THE SHIELDS ARE GROUNDED AT THE REMOTE ELECTRONICS END AND ARE FLOATING (NOT GROUNDED) AT THE PROBE SENSOR END. CONDUIT IS RECOMMENDED FOR ALL WIRING TO THE SWITCH FOR PROTECTION AND RFI-EMI SHIELDING.

Power and relay connections on TBB are identical to those of Figure 9 for electronics in the integral local enclosure.

Recommended cable is 6 conductor/3 twisted and shielded pairs (22 gauge) – with a pvc jacket (Alpha Part No. 6053C or DELTA M Part No. 101567).

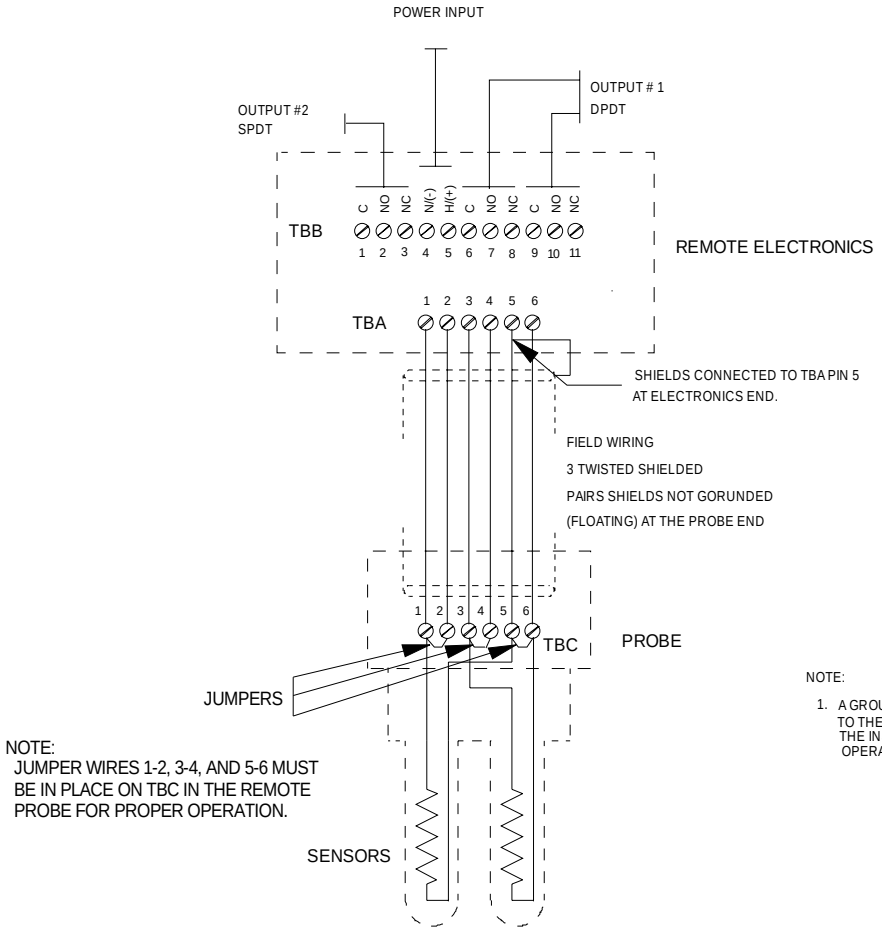
10.1 REMOTE ELECTRONICS OPTION (continued)

FIGURE 20A VERSA-SWITCH® REMOTE ELECTRONICS OPTION FIELD WIRING DIAGRAM



NOTE:
1. USE SUPPLY WIRES SUITABLE FOR 10 DEGREE C ABOVE AMBIENT.
2. FOR 24VDC OPERATION, CONNECT + POSITIVE TO TBB5 AND - NEGATIVE TO TBB4. FOR 120/220 VAC OPERATION, CONNECT HOT TO TBB5 AND NEUTRAL TO TBB4.

FIELD CONNECTIONS

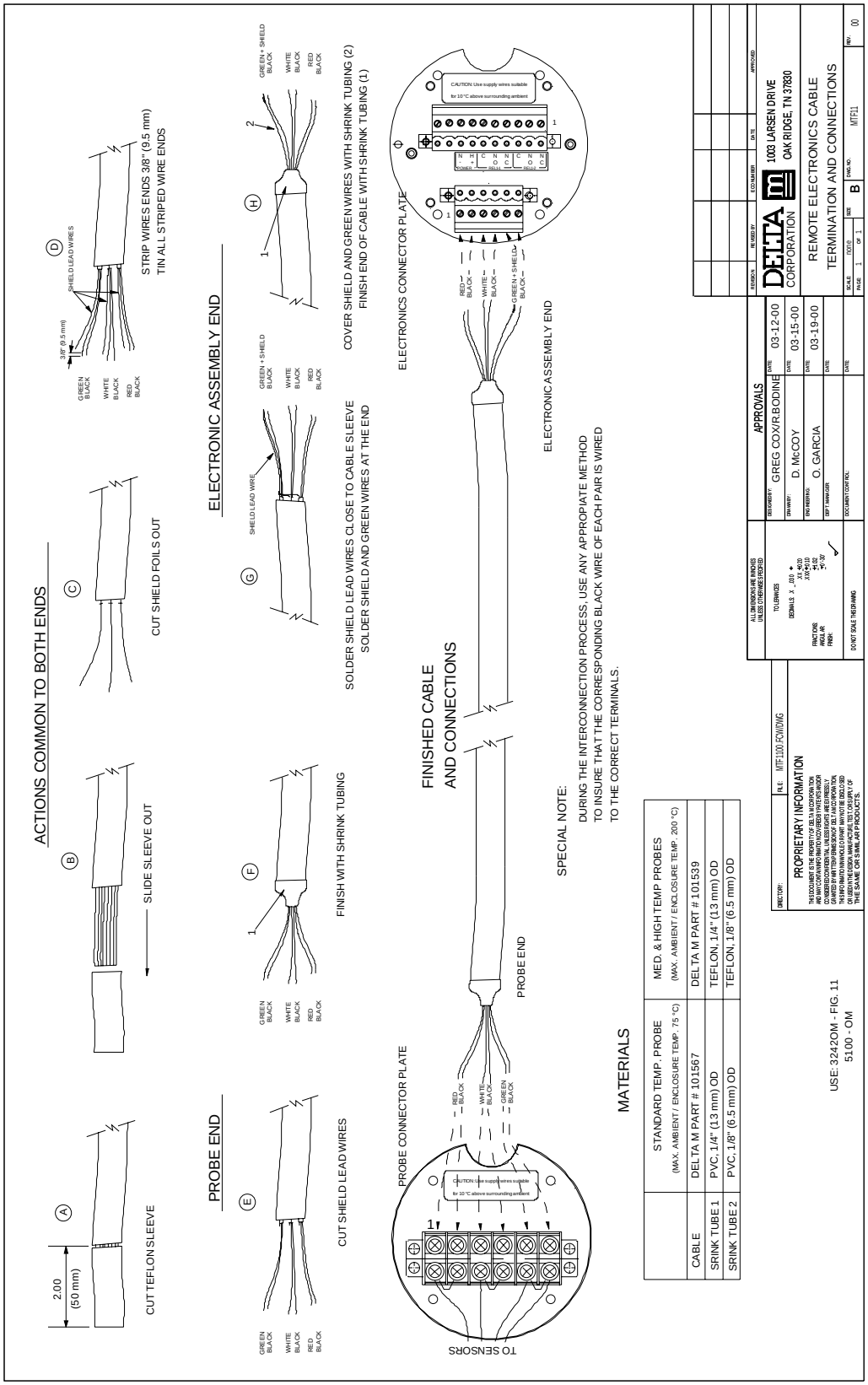


NOTE:
JUMPER WIRES 1-2, 3-4, AND 5-6 MUST BE IN PLACE ON TBC IN THE REMOTE PROBE FOR PROPER OPERATION.

NOTE:
1. A GROUND WIRE MUST BE ATTACHED TO THE GROUND SCREW LOCATED INSIDE OR ON THE INSTRUMENT ENCLOSURE FOR PROPER OPERATION.

DRAWING FILE: FIG20A.FCD

FIGURE 20B VERSA-SWITCH® REMOTE ELECTRONICS CABLE TERMINATION AND CONNECTIONS



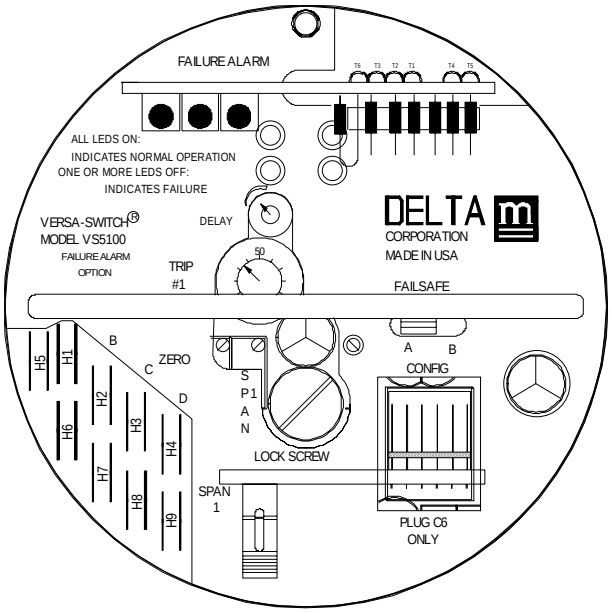
10.2 Failure alarm option

The failure alarm option of the VS5100 VERSA-SWITCH® consists of a separate electronic circuit board with circuitry that monitors critical circuitry and functions of the VERSA-SWITCH® on a permanent, real time basis. This "watch dog" circuitry has an output alarm trip on channel two if a malfunction occurs in any of the following:

- sensors
- field wiring (remote)
- sensor excitation electronics
- sensing and signal conditioning electronics
- power supply regulator
- electrical power source

In normal operation the channel two relay is activated and three yellow LED's are illuminated indicating an "Alarm Ready" status. If a failure occurs in any of the above components or functions, the failure alarm relay will deactivate and one or more of the yellow LED's will extinguish. The combination of "off" and "on" LED's will provide an indication of the probable malfunction. Table # 5 lists the various combinations. It is helpful in troubleshooting the malfunction. Refer to Section 5.2, Troubleshooting, once the probable cause has been indicated.

TABLE 5: FAILURE ALARM LEDS INTERPRETATION AND OUTPUT #2 RELAY STATUS



FAILURE MODES

LEDS: OFF D2 D4 D5

PROBABLE CAUSE: 1) POWER OFF

OUTPUT #2: RELAY STATUS: DEACTIVATED

CONTACT STATUS: C O O NC O NO

LEDS: OFF D5 ON D2 D4

PROBABLE CAUSE:
1) HOT & COLD SENSORS FAILURE
2) HOT & COLD SENSORS CURRENT SOURCES FAILURE
3) U4B OR U4D FAILURE
4) SENSING WIRES FAILURE

OUTPUT #2: RELAY STATUS: DEACTIVATED

CONTACT STATUS: C O O NC O NO

LEDS: OFF D4 ON D2 D5

PROBABLE CAUSE:
1) POWER SUPPLY FAILURE, OVER VOLTAGE OR UNDER VOLTAGE
2) POWER LINE LOW VOLTAGE

OUTPUT #2: RELAY STATUS: DEACTIVATED

CONTACT STATUS: C O O NC O NO

LEDS: OFF D2 D4 ON D5

PROBABLE CAUSE:
1) COLD SENSOR FAILURE
2) HOT & COLD SENSORS CURRENT SOURCES FAILURE
3) U4 COMBINED OP AMPS FAILURE
4) WIRING BETWEEN SENSORS AND ELECTRONICS FAILURE

OUTPUT #2: RELAY STATUS: DEACTIVATED

CONTACT STATUS: C O O NC O NO

NORMAL OPERATION

INDICATION: NORMAL OPERATION - FAILURE ALARM READY

LEDS: ON D2 D4 D5

OUTPUT #2: RELAY STATUS: ACTIVATED

CONTACT STATUS: C O O NC O NO

LEDS: OFF D2 ON D4 D5

PROBABLE CAUSE:
1) HOT SENSOR
2) HOT SENSOR CURRENT SOURCE
3) U4A OR U4C FAILURE
4) HOT SENSOR WIRES FAILURE

OUTPUT #2: RELAY STATUS: DEACTIVATED

CONTACT STATUS: C O O NC O NO

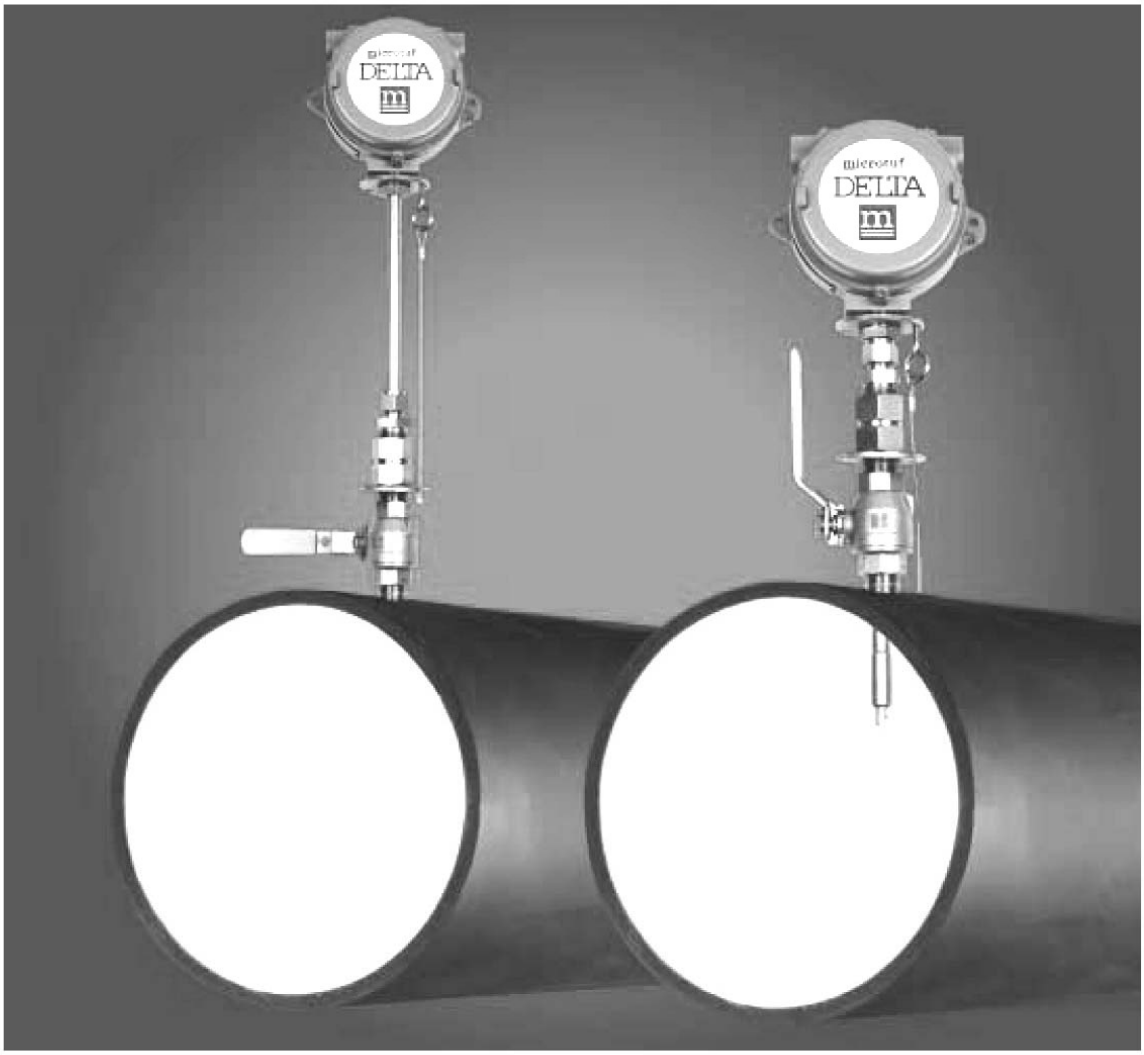
DRAWING FILE: TABLE5.FCD

10.3 Livetap (LT)

DELTA m® CORPORATION

Livetap (LT)

Specifications & Operating Instructions



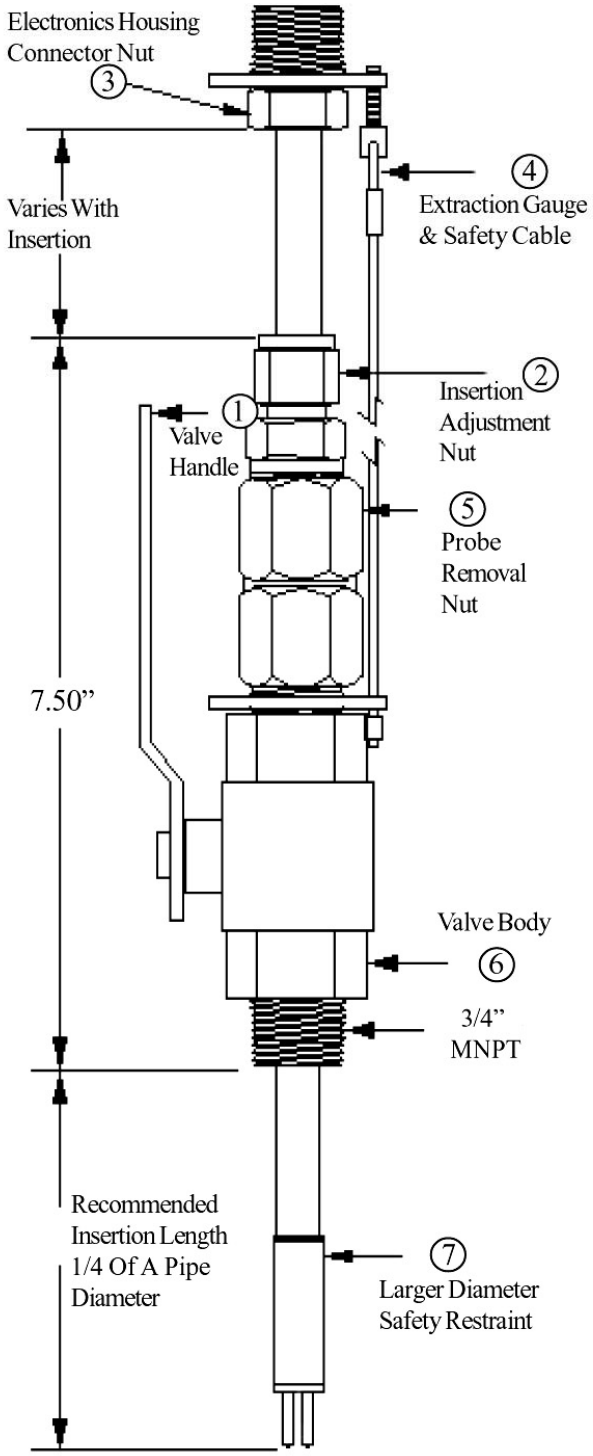
- Allows for the safe insertion and removal of DELTA M switches without interrupting the flow in your pipelines.
- For use with both the VERSA-SWITCH® and microtuf® line of DELTA M switches.
- External extraction gauge lets you know when the switch is clear of the valve.
- Standard Stainless Steel Construction.
- Operating temperature rating of 390° F. Allows for use in many high temperature applications.
- Dual safety restraint design to aid in the prevention of accidents.
- Live tap may be installed in both tanks and pipes without regard for orientation.
- Operating pressure rating of 300 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® and microtuf® Switch Option

Livetap (LT)

Operating Instructions



Installation

DELTA M'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.

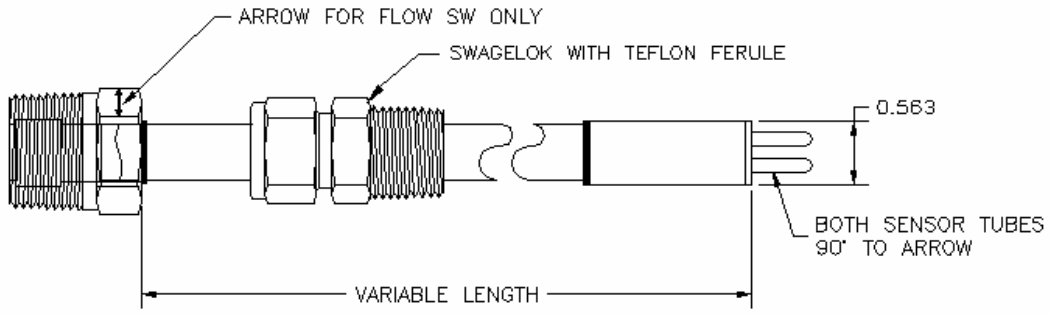
Third close valve handle (1) (handle turned so that it is perpendicular to the probe).

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.

Form Number (DML 1008.02)

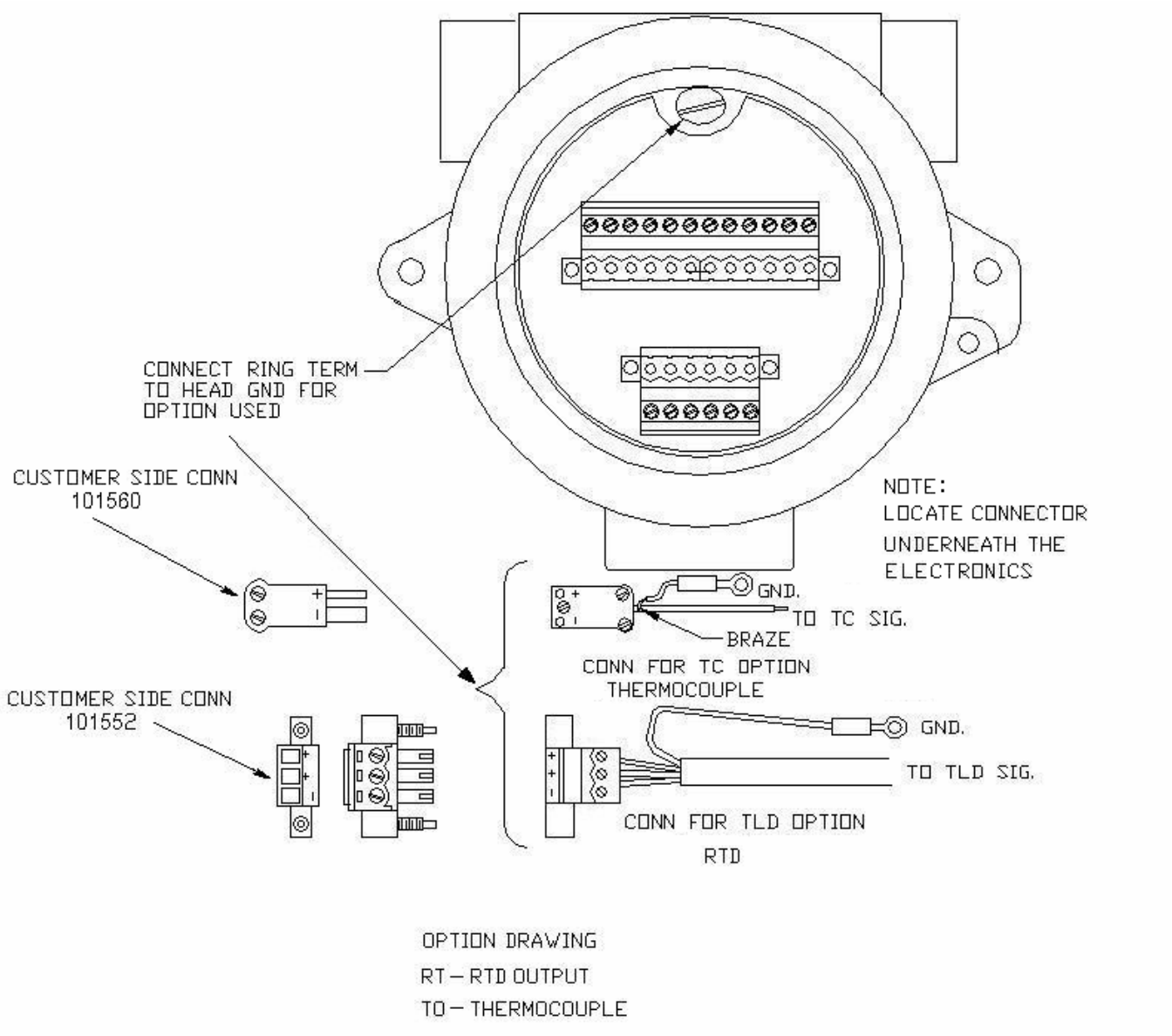
DELTA M Corporation - 1003 Larsen Drive - Oak Ridge, Tennessee 37830 - USA - Phone: (865) 483-1569 - Fax (865) 483-1142 - http://www.deltamcorp.com

10.4 Variable Insertion (VI)



MAX PRESSURE AT TEFLON
SEAL IS 10 PSI

10.5 Thermocouple Output (TO) and 10.6 RTD Output(RT)

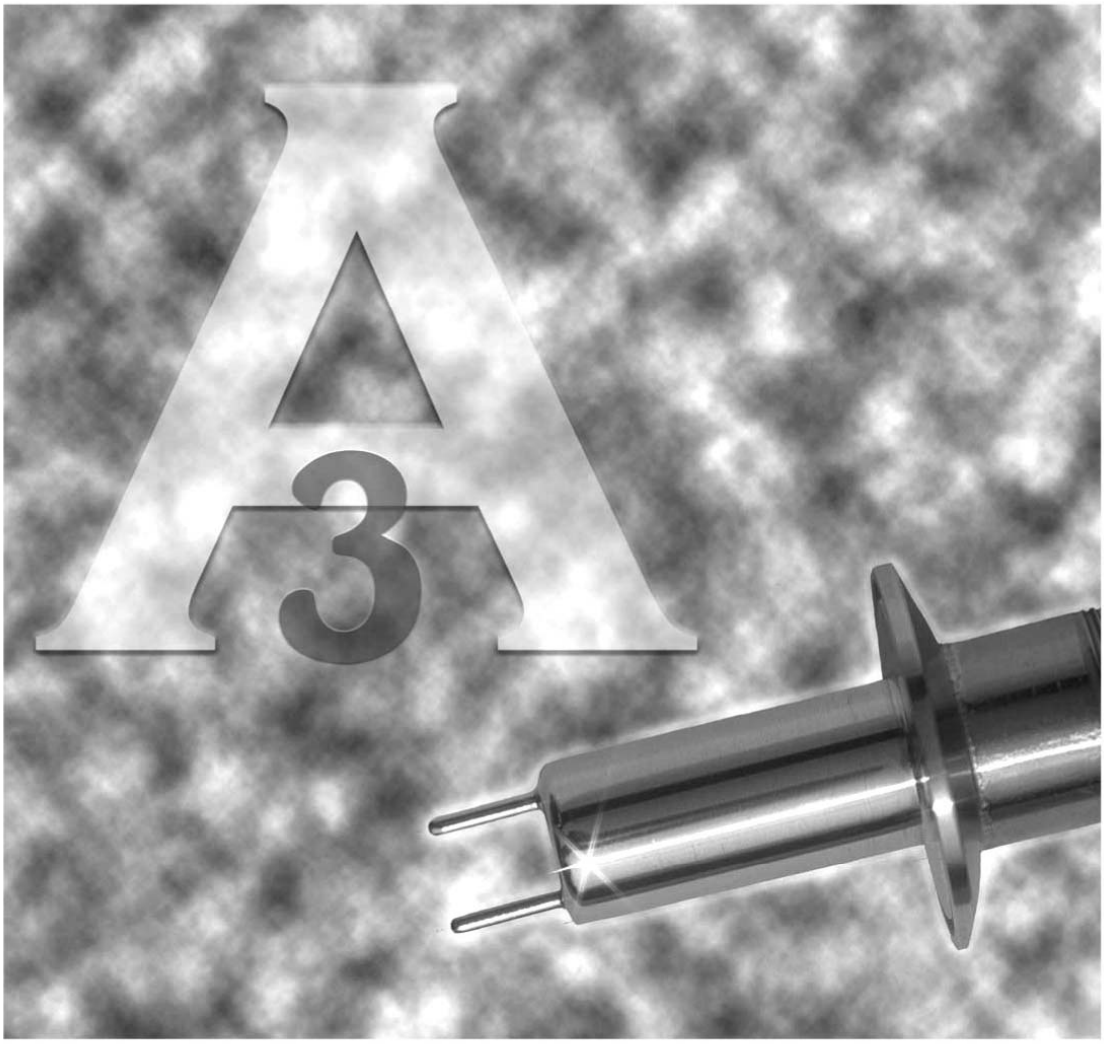


10.7 Sanitary (3A1)

DELTA m CORPORATION

3A 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.

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VERSA-SWITCH® & microtuf® Switch Option

* Shown Above with Optional Sanitary Tee

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 ±50° F. Temperature compensated throughout entire range

Repeatability:
±1% of setpoint

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.

Form Nuniber (DML1001.02)

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10.8 SP76 Manifold (S76)

SP76 Compliant Mass Flow Switch

SPECIFICATIONS

Sensor

Type:
Thermal Differential, Dual RTD Sensors
Process Connection:
SP 76 Compliant 1.5 x 1.5 inch
Sensor Dimensions:
Height 4.4 inch
Width 1.5 inch
Length 1.5 inch
Operating Temperature Range:
Standard -100°F to 390°F (-70°C to +200°C)
Materials of Construction:
Standard 316L Series Stainless Steel
Operating Pressure Range:
Standard to 3000 psia (207 bar)

Electronics

Power:
Standard 110VAC Optionally 220VAC, or 24VDC at 3 watts (No heater power required)
Operating Temperature Range:
Standard -40°F to +140°F (-40°C to +60°C)
Outputs:
microtuf®
DPDT Relay contacts rated at 5 amp, 250 VAC with fail safe capability
VERSA-SWITCH®
Independent primary relay DPDT and secondary relay SPDT, contacts rated at 5 amp, 250 VAC with fail safe capability; built in time delay 0 to 300 seconds for each channel
Self-Test:
Integral and automatic during power up
Enclosure:
Explosion proof; NEMA 3, 4, 7, and 9; CSA, FM, UL, CENELEC, and EECS approved

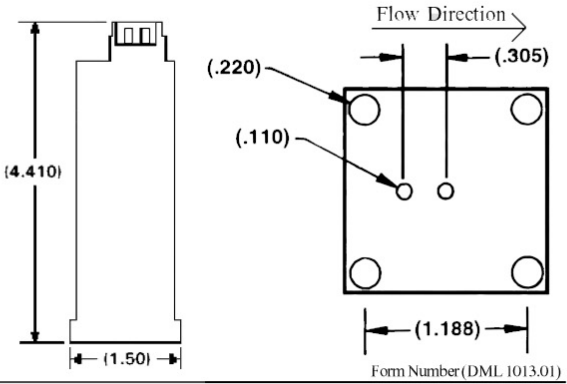
Instrument

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 ±50° F. Temperature compensated throughout entire range
Repeatability:
±1% of setpoint
Approvals:
Intrinsically Safe when used with IS option and proper barriers Class 1 Div. 1 Groups A,B, C, & D

Model Number Selection Guide

Code Model
VS5100 - Dual Channel VERSA-SWITCH
VS51NX- Dual Channel Non Explosion Proof
FS51SC - Single Channel Mass Flow Switch
FS51NX- Single Channel Flow Non Explosion Proof
FS42CS - CSA Approved Switch
FS42CN - CENELEC Approved Switch
FS42NX - Non Explosion Proof Switch
Code - Process Connection
S76 - SP76 Compliant
Code - Sensor Material
S6 - 316L Stainless Steel (std)
SM - Special Material
Code - Insertion Length
000.00 -000.00 inch (std)
Code - Power Input
FLD - Field Config. (Versa only)
110 - 110 VAC
220 - 220 VAC
24D - 24 VDC
24A - 24 VAC(Versa only)
Code - Configuration
RE-Remote Electronics
Code - Special Option
QD - Quick Disconnect (Standard)
XW- X Proof Window
DS - Double Sided
FA - Failure Alarm (VS5100 Only)
RT - RTD Output
TO-Thermocouple Out
CA - Additional Cable
CE - CE Approved
NP - Pipe Connection
IS - Intrinsically Safe

FS42NX - S76 -S6 - 000.00-24D-RE-QD Model Number



Form Number (DML 1013.01)

10.9 Tank Loading Probe (TLP)

DELTA m CORPORATION

Truck & Rail Car Loading Sensor

DELTA M has a specially designed sensor for use in loading trucks and railcars. This unit has a quick locking clamp that attaches to the manhole and allows the probe to be adjusted to the desired level inside of the tank. These units can be used in hazardous areas and corrosive environments. The use of these sensors has been instrumental in preventing spills caused by accidental over filling and in preventing the time and cost involved in off loading material when a truck has been filled beyond its weight restrictions.

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SPECIFICATIONS

Sensor

Type:
Thermal Differential, Dual RTD Sensors
Process Connection:
Automatically latching clamp
Insertion Length:
Standard 32.0 inch
Optionally 12 inch to 96 inches
Operating Temperature Range:
Standard -100°F to 390°F (-70°C to +200°C)
Medium Temperature to +572°F (+300°C)
Materials of Construction:
Standard 316L Series Stainless Steel
Optionally Hastelloy, Monel, Inconel and other exotic materials
Operating Pressure Range:
Standard to 3000 psia (207 bar)

Electronics

Power:
Standard 110VAC Optionally 220VAC, or 24VDC at 3 watts (No heater power required)
Operating Temperature Range:
Standard -40°F to +140°F (-40°C to +60°C)
Outputs:
microtuff®
DPDT Relay contacts rated at 5 amp, 250 VAC with fail safe capability
VERSA-SWITCH®
Independent primary relay DPDT and secondary relay SPDT, contacts rated at 5 amp, 250 VAC with fail safe capability; built in time delay 0 to 300 seconds for each channel
Self-Test:
Integral and automatic during power up
Enclosure:
Explosion proof; NEMA 3, 4X, 7, and 9; CSA, FM, UL, CENELEC, and EECS approved

Instrument

Operating Range:
Switch on level change of .03 inch. Available with insertion lengths from 12 to 96 inches.
Response Time:
Sensor response time 0.1 to 1 second media dependent
Stability:
Drift < .5% from calibrated setpoint over a range of ±50° F. Temperature compensated throughout entire range.
Repeatability:
±1% of setpoint
Approvals:
Opptionally CE, CSA,CENELEC
Class 1 Div. 1 Groups B, C, & D when used with explosion proof cable and conduit.
Intrinsically Safe when used with IS option and proper barriers Class 1 Div. 1 Groups A,B, C, & D

Code Model
VS5100 - Dual Channel VERSA-SWITCH
VS51NX- Dual Channel Non Explosion Proof
LS51SC - Single Channel Mass Flow Switch
LS51NX- Single Channel Flow Non Explosion Proof
LS32CS - CSA Approved Switch
LS32CN - CENELEC Approved Switch
LS32NX - Non Explosion Proof Switch
Code - Process Connection
TLP - Truck Loading Probe
Code - Sensor Material
S6 - 316L Stainless Steel (std)
HB - Hastelloy B
HC - Hastelloy C
IO - Inconel 600
MN - Monel
A2 - Alloy 20
SM - Special Material
Code - Insertion Length
32.00 -32.00 inch (std)
00.00 - 12" to 96.00" in .25"
Code - Power Input
FLD - Field Config. (Versa only)
110 - 110 VAC
220 - 220 VAC
24D - 24 VDC
24A - 24 VAC(Versa only)
Code - Configuration
RE-Remote Electronics (std)
RC-Remote Control Unit
Code - SpecialOption
CO- Clamp On (std)
XW- X proof Window
DS - Double Sided
FA - Failure Alarm (VS5100 Only)
RT - RTD Output
TO-Thermocouple Out
CA - Additional Cable
CE - CE Approved
IS - Intrinsically Safe (LS32NX only)
XC- X Proof Cable

LS32NX - TLP - S6 - 32.00 - 24D - RE -CO Model Number

Represented In Your Area By

Form Number (DML 1016.00)

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10.10 Low Flow Sensor (LFS)

DELTA m® CORPORATION

Low Flow Sensor

- Developed for low flow gas and liquid applications where reliability and durability are mandatory
- Very low internal volume so that sample times are very short and sample system response remains quick
- All Welded Stainless Steel Construction
- For use with both the VERSA-SWITCH® and microtuf® line of DELTA M switches
- Standard operating temperature range of -100° F to 390° F
- 1/4 inch FNPT process ports that can easily be adapted to tubing by using standard fittings

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SPECIFICATIONS

Sensor

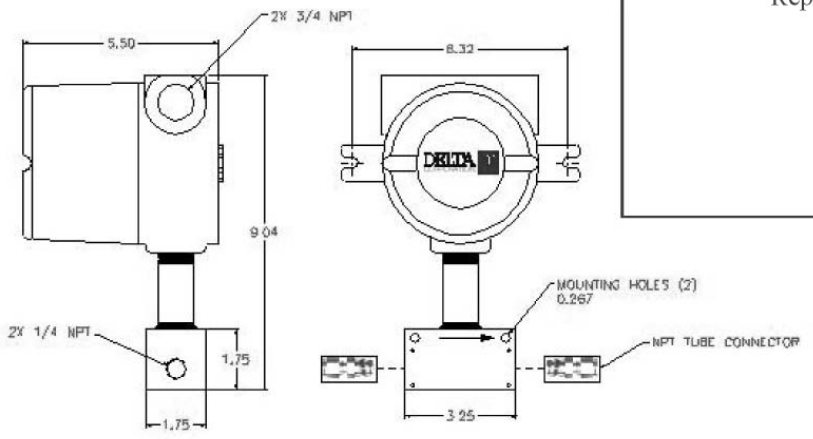
Type:
Thermal Differential, Dual RTD Sensors
Process Connection:
1/4" FNPT (2) Inlet and Outlet
Operating Temperature Range:
Standard -100°F to 390°F (-70°C to +200°C)
Material of Construction:
Standard 316L Series Stainless Steel
Operating Pressure Range:
Standard to 3000 psia (207 bar)

Electronics

Power:
Standard:110VAC, Optionally: 220VAC, 24VDC or 24VAC at 3 watts (No heater power required)
Operating Temperature Range:
Standard -40°F to +140°F (-40°C to +60°C)
Outputs:
microtuf®
DPDT Relay contacts rated at 5 amp, 250 VAC with fail safe capability
VERSA-SWITCH®
Independent primary relay DPDT and secondary relay SPDT, contacts rated at 5 amp, 250 VAC with fail safe capability; built in time delay 0 to 300 seconds for each channel
Self-Test:
Integral and automatic during power up
Enclosure:
Explosion proof; NEMA 3, 4X, 7, and 9; CSA, FM, UL, and EECS approved

Instrument

Operating Range:
.33ccm to 2000ccm in liquid and 30ccm to 200,000ccm in gas
Approvals:
Optionally CE, CSA,
Class 1 Div. 1 Groups B, C, & D



INTERNAL VOLUME= 0.038 in³

Model Number Selection Guide

Code Model
VS5100 - Dual Channel VERSA-SWITCH
VS51NX- Dual Channel Non Explosion Proof
FS51SC - Single Channel Mass Flow Switch
FS51NX- Single Channel Flow Non Explosion Proof
FS42CS - CSA Approved Switch
FS42NX - Non Explosion Proof Switch

Code - Process Connection
LFS - Low Flow Sensor

Code - Sensor Material
S6 - 316L Stainless Steel (std)

Code - Insertion Length
00.00 - None

Code - Power Input
FLD - Field Config. (Versa only)
110 - 110 VAC
220 - 220 VAC
24D - 24 VDC
24A - 24 VAC

Code - Configuration
LE-Local Electronics (std)
RE-Remote Electronics

Code - Special Option
OO - No Special Option
XW- X Proof Window
PC - Potted Cable
FA - Failure Alarm (VS5100 Only)
RT - RTD Output
TO-Thermocouple Out
CA - Additional Cable
CE - CE Approved (microtuf® Only)
QD - Quick Disconnect
CB - Calibration req.

FS42CS - LFS - S6 - 00.00 - 110 -LE-OO Model Number

Represented In Your Area By

Form Number (DML 1018.00)

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