FLUID COMPONENTS INTERNATIONAL LLC

Installation, Operation & Maintenance Manual

MT100
Multipoint Flow Meter

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Typographical Conventions

Important notes or warnings are shown like the following:

Note: A note is additional information that adds to or supplements the topic.

Caution: A caution indicates an action that can cause equipment damage, loss of data or software, or minor injury.

Warning: A warning indicates an action that can cause equipment damage, or serious injury/death, or both.

Caution symbols that may be marked on the product or its packaging are explained below:

Risk of Danger symbol (observe all warnings and cautions in manual).

Hot Surface Caution symbol (risk of burn from probe heater).

ESD (Electrostatic Discharge) Susceptibility symbol (do not touch without appropriate precautions).

Static-sensitive Devices symbol (use ESD handling procedures).

1 GENERAL

Description

The MT100 is a thermal dispersion, industrial process grade air and gas multipoint insertion mass flow meter in a local probe/remote transmitter configuration. The instrument provides direct mass flow measuring and measures flow rate, totalized flow and temperature. An average of the individual flow signals (up to eight) gives an output signal that represents the total mass flow. MT100S uses two or more single-point probe assemblies. MT100M uses one or more mast-style probe assemblies each of which contains two or more flow sensors.

The measurements are made available to the user by way of 4-20 mA analog output channels with digital bus protocol support (HART, Modbus, FOUNDATION Fieldbus, or PROFIBUS). The optional graphics display provides real-time process variable values along with flow range and process description information. There are no moving parts to clean or maintain. It is offered in a wide selection of process connections to fit with any process piping and versions are available for temperature service from -40 °F [-40 °C] to 850 °F [454 °C] (or for applications requiring T1/T450°C rating: 689 °F [365 °C]).

Theory of Operation

The instrument functionally is based on the thermal dispersion operating principal. A low powered heater produces a temperature differential between two resistance temperature detectors (RTDs) by heating one of the RTDs above process temperature. As the process mass flow rate changes the temperature differential between the RTDs changes as well. The differential temperature between the RTDs is proportional to the process mass flow. The flow transmitter converts the RTD differential temperature signal into a scaled flow output signal. The signal from the unheated RTD is used to provide the process temperature value.

Safety Instructions

Warning: Explosion Hazard. Do not disconnect equipment when flammable or combustible atmosphere is present.

Warning: Exposure to some chemicals may degrade the sealing properties of the materials used in the following devices: relays K1 and K2, model American Zettler AZ8-1CH-24DSE. FCI recommends periodic inspections of the relays for degradation and replace them when degradation occurs.

- Field wiring shall be in accordance with NEC (ANSI-NFPA 70) or CEC (CSA C22.1) locations as applicable.
- The instrument must be installed, commissioned and maintained by qualified personnel trained in process automation and control instrumentation. Installation personnel must ensure the instrument has been wired correctly according to the applicable wiring diagram.
- All location specific installation and wiring requirements must be met and maintained. FCI recommends an input power circuit breaker be installed between the power source and the flow meter. This facilitates easy power disconnection during commissioning and maintenance procedures. A switch or circuit breaker is required if installation is in a hazardous area.
- The flow meter contains electrostatic discharge (ESD) sensitive devices. Use standard ESD precautions when handling the circuit board assemblies.
- Hazardous Areas: The instrument is designed for use in hazardous areas. The approved area classification is identified on the nameplate along with the temperature and pressure limitations.
  - The USB port and the Ethernet port do not support the hazardous area requirements and should only be used when the area is declassified.
  - Remove any non-certified parts such as plastic protection caps from cable entry ports and replace by suitable wiring and cabling system certified by notified bodies for use in Hazardous areas.
  - Plug any unused ports with certified hazardous area hardware.
  - A portion of the enclosure is non-conducting and, under certain extreme conditions, may generate an ignition-capable level of electrostatic charges. The user shall ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment should be done only with a damp cloth.
  - The installer shall consider the relationship between the temperature code, ambient temperature and process temperature and ensure that the maximum specified ambient temperature is not exceeded.

- When mounting the flow element into the process pipe, it is important that a lubricant/sealant is applied to the mating threads. A lubricant/sealant compatible with the process conditions should be used. All connections should be tightened firmly. To avoid leaks do not overtighten or cross-thread connections

Order Verification

- Verify the received hardware matches the purchased hardware and application requirements. Verify the Model number part number on the instrument I.D. tag (e.g., MT100S – 2180…) matches the purchased Model number part number. See Equipment Nameplate below for nameplate details.
- Review the Calibration requirements as specified on the Engineering Data Sheet in the documentation package. Verify the flow, temperature and pressure limits meet the application requirements.

Hardware – Model Descriptions

MT100S – Single point insertion element with flow and temperature process output

MT100M – Multipoint element with flow and temperature process output

Documentation and Accessories

06EN003460 MT100 Installation, Operation, & Maintenance Manual (this manual)

06EN003461 MT100 Configuration Software Manual

Calibration Certification Documentation

PC Configuration Software and USB cable

Supplemental Manuals, Optional

06EN003472 MT100 FOUNDATION Fieldbus Manual

06EN003474 MT100 PROFIBUS PA Manual

Equipment Nameplate

A nameplate is affixed to the local enclosure (flow element) and remote electronics enclosure (transmitter). In addition to the manufacturer (FCI) identification, the nameplate shows the information listed below.

Note: The nameplate details vary depending on the instrument's specific build configuration as specified in the OIS (order information sheet) and applicable approval ratings.

- Applicable enclosure ratings/agency approvals
- Model number (follows OIS block number information as specified in the order)
- Power input
- Wiring diagram drawing number
- Rated maximum pressure
- Serial number
- Date of manufacture
- Tag numbers (components of system)
- Multilingual Caution notes

Technical Specifications

Instrument

- **Measuring Capability**

  Multi-point, averaging flow rate system for air and gases in large diameter pipes and rectangular ducts; provides flow rate, totalized flow, temperature.

- **Basic Style**

  MT100M: Insertion with two or more sense points on one or more mast-type flow element probes; minimum of two (2) points per mast; maximum of eight (8) points on single mast.

  MT100S: Insertion with up to 8 single-point flow elements.

- **Flow Measurement Range**

  MT100M: 0.25 SFPS to 150 SFPS [0,07 NMPS to 46 NMPS]

  MT100S: 0.25 SFPS to 1000 SFPS [0,07 NMPS to 305 NMPS]

  Air @ standard conditions, 70 °F and 14.7 psia [21,1 °C and 1,01325 bar(a)]

- **Temperature Measurement Range**

  -50 °F to 500 °F [-45 °C to 260 °C] or
  -50 °F to 850 °F [-45 °C to 454 °C]

- **Media/Fluid**

  All air, gas and gas combinations that are compatible with the flow element's wetted materials.

- **Accuracy**

Flow (*MT100M*)	±2% of reading, ±0.5% of full scale
Flow (*MT100S*)	±0.75% of reading, ±0.5% of full scale
Temperature	±2 °F [±1 °C]

- **Repeatability**

Flow	±0.5% of reading
Temperature	±1 °F [±1 °C]

- **Temperature Coefficient (Flow)**

  With optional temperature compensation, valid from 10% to 100% of full scale calibration

  Maximum ± 0.015% of reading/°F up to 850 °F [± 0,03% of reading/°C up to 454 °C]

- **Turndown Ratio**

  Normally factory set and field adjustable from 2:1 to 100:1 within calibrated range; higher ratios possible with factory evaluation of application.

- **Temperature Compensation**

  Standard: ±30 °F [± 16 °C]

  Extended (optional): ±100 °F [± 55 °C]

- **Calibration**

  Performed using equipment traceable to NIST (US National Institute of Standards and Technology) and ISO/IEC 17025 international standards for test lab quality systems.

- **Agency Approvals** *(Optional)*

  CE marking, CRN *(pending, MT100S only)*

FM/FMc:	Class I, Division 2, Groups A, B, C, and D; T* Class II/III, Division 2, Groups E, F, and G; T* Type 4X, IP66
ATEX/UKEX: 	II 3 G Ex ec IIC T6...T1 Gc II 3 D Ex tc IIIC T85°C...T450°C Dc IP66
IECEx:	Ex ec IIC T6...T1 Gc, Ta = 65°C Ex tc IIIC T85°C...T450°C Dc IP66

  *T: For T-Rating details, refer to APPENDIX D.

- **CEMS Compliance** *(Optional)*

US EPA CEMS:	40 CFR 60 and 40 CFR 75
USA EPA GHG:	40 CFR 98.34(c)(1)

Flow Element

- **Material of Construction**

Mast-type	All-welded, 316L stainless steel
Single-point	All-welded, 316L stainless steel; Hastelloy C-276 Optional
Choice of flow sensor design:	– FP fast response with protective shroud – FPC same as – FP plus flow conditioner/isolator tab – S unshrouded for dirty or moist applications

- **Operating Temperature (Process)**

Mast-type	-50 °F to 500 °F [-45 °C to 260 °C] -50 °F to 850 °F [-45 °C to 454 °C]
Single-point	-40 °F to 500 °F [-40 °C to 260 °C] -40 °F to 850 °F [-40 °C to 454 °C]

- **Operating Pressure (Process)**

Mast-type	100 psig [6,9 bar(g)] Design pressure to 500 psig/34 bar(g))
Single-point	
Metal ferrule	1000 psig [70 bar(g)]
Teflon ferrule	150 psig [10 bar(g)] *@200 °F/93 °C maximum*
Fixed Connection (NPT)	1000 psig [70 bar(g)]
Fixed Connection (flanged)	per flange rating

- Process Connections

  Mast-type: 2" male NPT; 3" [DN50] or larger flanges

  Single-point

  Compression fittings: 3/4" or 1" male NPT, stainless steel with adjustable Teflon ferrule or metal ferrule; or flanged tapped and threaded for 3/4" fitting. ANSI or DIN flanges.

  Compression fitting not available with 850 °F / 454 °C temperature service versions

  Retractable packing glands: Low pressure 50 psig [3,5 bar(g)] or medium pressure 500 psig [34 bar(g)] with graphite or Teflon packing material; 1 1/4" male NPT or ANSI or DIN flange

  Teflon packing material required when process media is ozone, chlorine or bromine

  Fixed fittings: 1" male NPT, ANSI flange or DIN flange

Transmitter/Electronics

- Operating Temperature

  -40 °F to 150 °F [-40 °C to 65 °C]

  Display/Readout -4 °F [-20 °C]

- Input Power

  DC: 24 VDC (19.2 V to 28.8 VDC)

  AC: 85 V to 265 VAC

- Power Consumption

  DC: 17 W with 4 Flow Elements; 26 W with 8 Flow Elements

  AC: 29 W with 4 Flow Elements; 43 W with 8 Flow Elements

- Outputs

  Standard: Two 4-20 mA analog outputs[1] with NAMUR NE43 guidelines; output #1 with HART[2,3]; one 0-1 kHz frequency/pulse (pulse width = 500 µsec; available multipliers: 0.001, 0.01, 0.1, 1.0, 10.0, and 100.0); Modbus 485; USB port; Ethernet service port

  Optional: Foundation Fieldbus H1[3], PROFIBUS-PA[3]

  [1] *16-bit resolution*

  [2] *HART is version 7 with instrument and DD files certified by and registered with the HART organization.*

  [3] *Only one digital communication bus can be operated at a time; i.e., HART and Foundation Fieldbus cannot be in operation simultaneously.*

- CEMS Compliance *(Optional)*

  Complies with 40 CFR 60 and 40 CFR 75; provides 24-hour interval automated test of low, mid and high span points, and interference sensor check; test can also be performed on demand via button on LCD readout; test results provide data value with pass/fail indication; two relays are also provided for auxiliary connection to alarm panel, PLC or other external device in the event CEMS test fails.

- Readout/Display/Keypad

  Large 7" diagonal color LCD with touch-screen; digital readouts, bargaphs, analog chart, engineering units, alarms and sensor status.

  – Digital display of flow rate, total flow and temperature; user selectable for engineering units in both imperial or metric units.
  – Analog bargraph of flow rate.
  – Analog time graph/plot of flow rate history; user settable time base in hours, days or weeks.
  – Alarm status with indication of which alarm and value exceeded.
  – CEMS test pass/fail status (if equipped with CEMS option).
  – User writable field of up to 20 characters; example: tag number, location, station, gas type.
  – Individual sensor diagnostics status lamp: Green = good; Red = service required
  – Touch-type screen for user programmable features and set-up *Password protected to prevent unauthorized changes.*

- Data Logger

  Log to on-board 8 GB microSD card; user programmable for measurements to be logged and time intervals (to maximum of 10 readings/second); SD card is removable and replaceable as needed; data is logged in comma separated value (.csv) format.

- Enclosures

  Main Transmitter/Electronics

  Polished stainless steel, 12.31" H x 10.31" W x 6.42" D [312,7 mm H x 261,9 mm W x 163 mm D] box with hinged front door; NEMA 4X/IP66 rated; four (4) 1" NPT or M25 conduit ports welded to bottom of enclosure.

  Local Enclosure (Attached to Flow Element)

  Mast-type (MT100M): Polished stainless steel, 10.28" H x 8.28" W x 4.22" D [261,2 mm H x 210,4 mm W x 107,1 mm D] box with hinged front door; NEMA 4X/IP66 rated; two (2) 1" NPT or M25 conduit ports welded to bottom of enclosure.

  Single-point (MT100S) *With compression fittings, 1" flange, or DN25 flange process connections.*

  Standard: NEMA 4X/IP67 polyester powder coated aluminum; 2 conduit ports threaded as 1/2" NPT or M20x1.5
  Optional: Same as above, in stainless steel

  Single-point (MT100S) *With flanges larger than 1"/DN25, packing gland, or fixed process connections*

  Standard: NEMA 4X/IP67 polyester powder coated aluminum; 1 conduit port threaded as 1" NPT or M20x1.5
  Optional: Same as above, in stainless steel

Other Options and Accessories

- Element Coatings and Materials

  For service in highly corrosive gases or erosive particulates, FCI can provide special coatings and wetted materials to protect, preserve and extend the service life of the flow elements; coating examples include chromium carbide and nickel.

- Ball Valves and Cable Glands
- Certifications, Testing, and Documentation

  Certificate of Conformance, Certificate of Origin, CMTR, welding and welder pedigree, customer witnessed factory acceptance, PMI, hydrostat test, dye penetrant test, radiography, and more.

- Start Up Assistance and Field Service

  Site visit by factory technicians for start-up, installation verification and commissioning; field service for service, repairs, pipe traverses/calibration, etc.

2 INSTALLATION

Warning: Consult the manufacturer if dimensional information on the flameproof joints is necessary.

Warning: The ambient temperature range and applicable temperature class of the MT100 Series flow meter is based on the maximum process temperature for the particular application as follows: T6 for -40°C < Ta < +46°C, T5 for -40°C < Ta < +57°C, T4 for -40°C < Ta < +65°C.

Warning: The painted surface of the MT100 Series flow meter may store electrostatic charge and become a source of ignition in applications with a low relative humidity < 30% relative humidity where the painted surface is relatively free of surface contamination such as dirt, dust, or oil. Clean the painted surface with a damp cloth only.

Warning: Do not replace internal battery when an explosive gas atmosphere is present.

Receiving/Inspection

- Unpack carefully, observe electrostatic discharge (ESD) precautions if handling the flow transmitter.
- Inspect for damage to the flow element and the flow transmitter.
- Verify that all items in the packing list were received and are correct.
- Verify the Delta R data sheet and the instrument information sheet are included in the instrument's documentation package.

If the above items are satisfactory then proceed with installation. If not, then stop and contact the FCI customer service representative for instructions.

Packing/Shipping/Returns

These issues are addressed in APPENDIX E, page 145.

Factory Calibration Note

The flow meter is factory calibrated to the flow range specified in the order. There is no need to perform any verification or calibration steps prior to installing and placing the flow meter in service.

Pre-Installation Procedure

Warning: This instrument is to be installed by qualified personnel only. Install and follow safety procedures in accordance with current national electrical codes, local amendments/supplements to the national electrical code and all applicable company safety procedures for this application/process environment. Make sure that power is OFF during installation. Any instances where power is to be applied to the flow meter will be noted in this manual. Where the instructions call for the use of mains power, the operator assumes all responsibility for conformance to safety standards and practices.

Caution: The flow transmitter contains electrostatic discharge (ESD) sensitive devices. Use standard ESD precautions when handling the flow transmitter. See below for ESD details.

The flow meter is not designed for weld-in-place applications. Never weld to process connection or a structural support.

Damage resulting from moisture penetration of the local or remote enclosure is not covered by product warranty.

Use Standard ESD Precautions

Use standard ESD precautions when opening an instrument enclosure or handling the flow transmitter. FCI recommends the use of the following precautions: Use a wrist band or heel strap with a 1 megohm resistor connected to ground. If the instrument is in a shop setting there should be static conductive mats on the work table and floor with a 1 megohm resistor connected to ground. Connect the instrument to ground. Apply antistatic agents to hand tools to be used on the instrument. Keep high static producing items away from the instrument such as non-ESD approved plastic, tape and packing foam.

The above precautions are minimum requirements to be used. The complete use of ESD precautions can be found in the U.S. Department of Defense Handbook 263.

Verify Serial Numbers

Verify that the equipment tags on the remote enclosure and associated flow transmitter have matching serial numbers.

Refer to the appropriate drawing in APPENDIX A, page 101 for nameplate tagging information.

Prepare or Verify Flow Element Location

The flow element location should have been previously determined before the time of order. Mounting the flow element in a position different than originally determined may cause reading errors. Prepare the process pipe for installation, or inspect the already prepared location to ensure that the instrument will fit into the system. The flow element length (U-length) is customer specified. The recommended diameter for the clearance hole needed to mount the flow element is specified in the top assembly drawing in APPENDIX A, page 101.

Verify Dimensions

Verify the customer specified flow element U-length and instrument mounting interface dimensions are correct for the application. Referencing the equipment dimensions in the appropriate top assembly drawing in APPENDIX A, compare the instrument hardware and the process interfaces for fit.

Verify Flow Direction for Flow Element Orientation and Placement

The flow element comes with a flat surface machined on the flow element near the enclosure. This flat surface is known as the reference (or orientation) flat, which includes a flow arrow etched on its surface to indicate flow direction. See Figure 1 and Figure 3 below.

Align the flow element with the flat parallel to the flow and the flat's arrow pointing in the same direction as the flow. Failure to correctly install the flow element reduces the accuracy of the flow meter. Refer to APPENDIX A for specific information.

Note: A flow element assembly has its reference flat in a particular location with its arrow pointing in a certain direction depending on its configuration. Verify that the flow element assembly is the correct configuration for its installed location. Duct mount configurations, for example, can include side/bottom/top mount and horizontal left/right flow or vertical up/down flow. Refer to APPENDIX A for configuration information specific to the unit's serial/tag number.

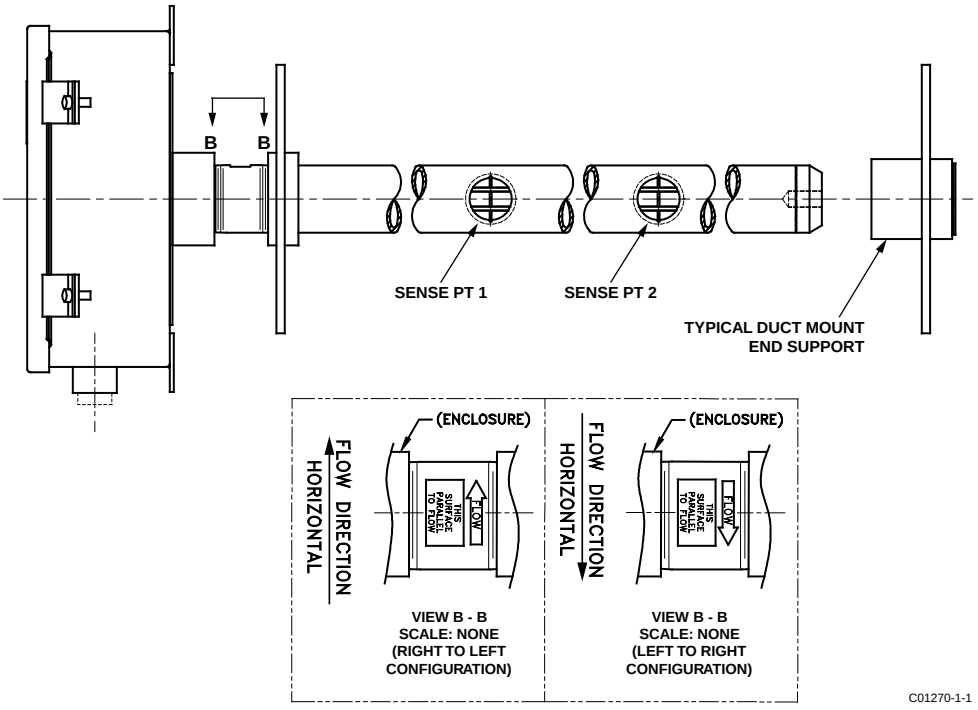


Figure 1 – MT100M: Multipoint Flow Element Showing Flat Area, Duct Mount (Side Mounted Horizontal Configuration Shown)

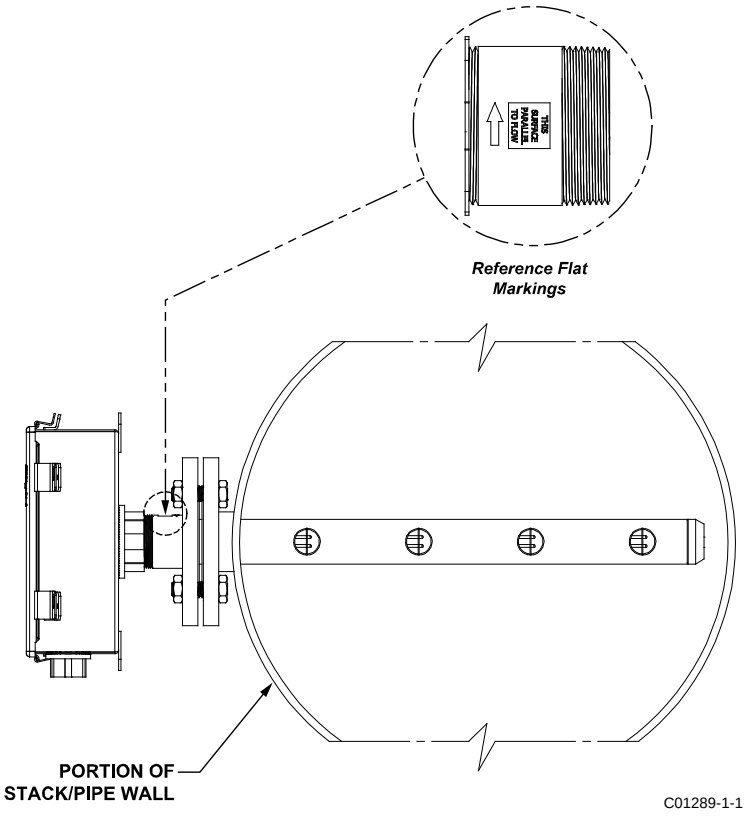


Figure 2 – MT100M: Multipoint Flow Element Showing Flat Area, Flange Mount

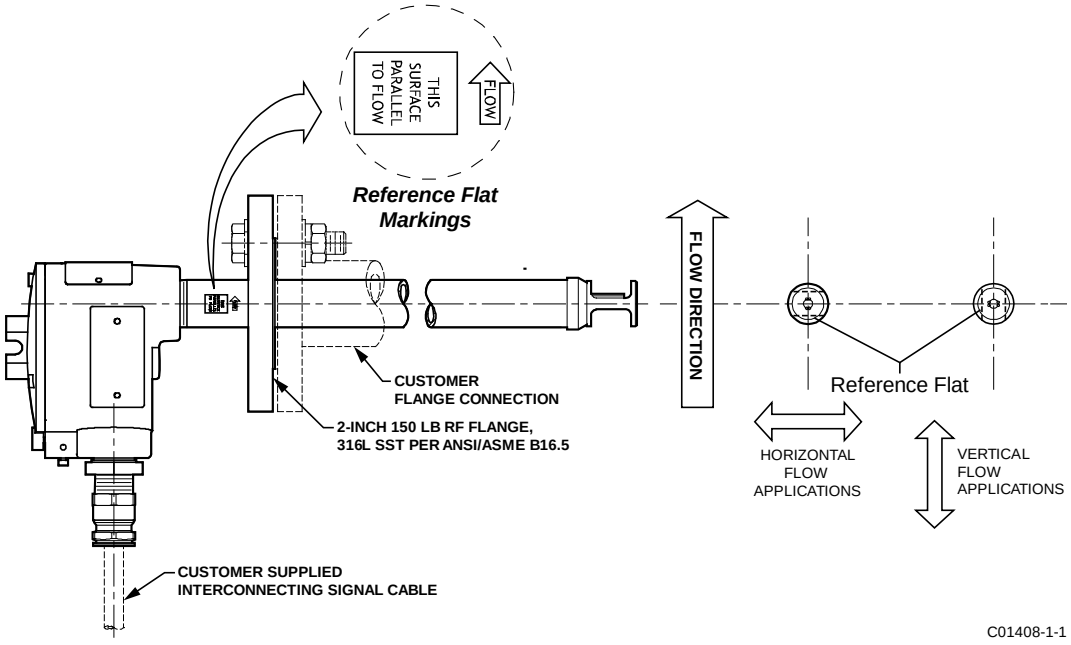


Figure 3 – MT100S: Single Point Flow Element Showing Flat Area, Flange Mount

Install Flow Element

Duct Flange Installation (MT100M)

Install the duct mount flow element assembly as appropriate to its configuration. Refer to APPENDIX A, page 101 for configuration information specific to the unit's serial/tag number.

Follow these steps to install the flow element.

1. The exact placement of the flow element is typically predetermined at the time of order. Use hole pattern and hole sizes as shown in Figure 4, page 9 to drill holes for flow element duct mount flange. On opposite side of duct use hole pattern and hole sizes as shown in Figure 5, page 10 to drill holes for flow element duct mount end support.

   Note: End support is secured to duct via anchor nuts supplied in end support mounting kit.

2. Using supplied end support mounting kit hardware, install flow element's end support as shown in Figure 5. Loosely torque end support securing bolts (6 ea. 5/16-24UNF x .875 lg).
3. Carefully place flow element in process duct with flow arrow pointing in direction of process media flow and with reference flat parallel to flow. Insert end of flow element assembly standpipe into end support sleeve.
4. Using supplied duct flange mounting kit hardware, install flow element to process duct as shown in Figure 4. Using star pattern bolt torque sequence shown in Figure 4 gradually torque duct flange securing bolts (6 ea. 5/16-24UNF x .875 lg) with final bolt torque at 10 ft-lbs (13.6 N-m).
5. With flow element assembly standpipe captured within end support sleeve loosely install 1/2-13UNF x 2-inch long bolt (included in optional end support mounting kit) into end support sleeve, engaging flow element standpipe (see Figure 5). (Note: Use the alternative installation method that uses a reinforcement plate if the supplied anchor nuts are not adequate for the application.) Using star pattern bolt torque sequence shown in Figure 4 gradually torque end support securing bolts (6 ea. 5/16-24UNF x 1.0 lg) with final bolt torque at 10 ft-lbs (13.6 N-m).
6. Torque end support sleeve bolt to 37 ft-lbs (50.2 N-m).

   Note: For the alternative installation method, the reinforcement plate with drilled, tapped holes is customer-supplied. Refer to Figure 6 and Figure 7. Longer bolts (typically 1-inch long) may be needed when the reinforcement plate is used.

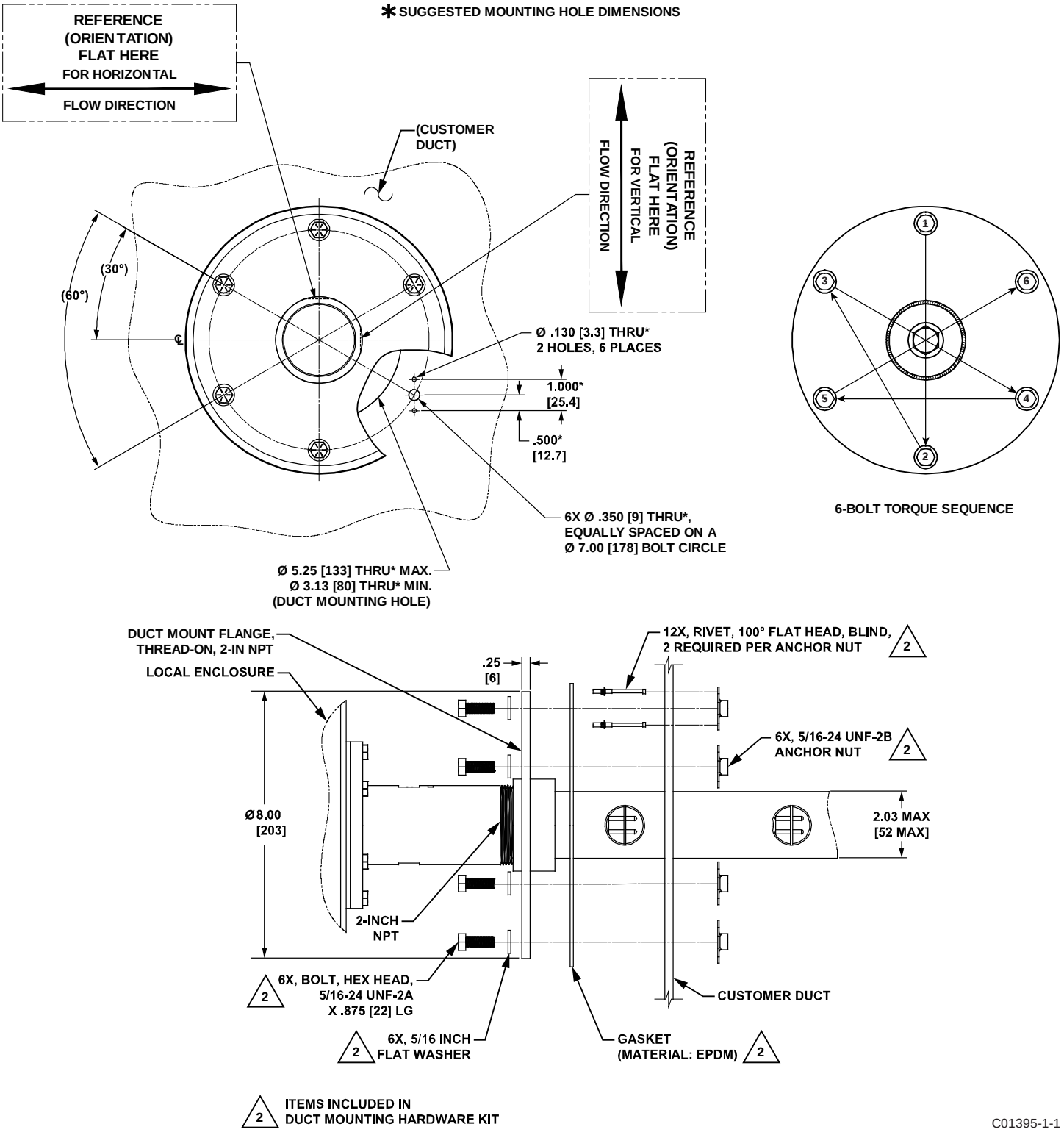


Figure 4 – Duct Flange Mounting, Dimensions, and Mounting Hardware

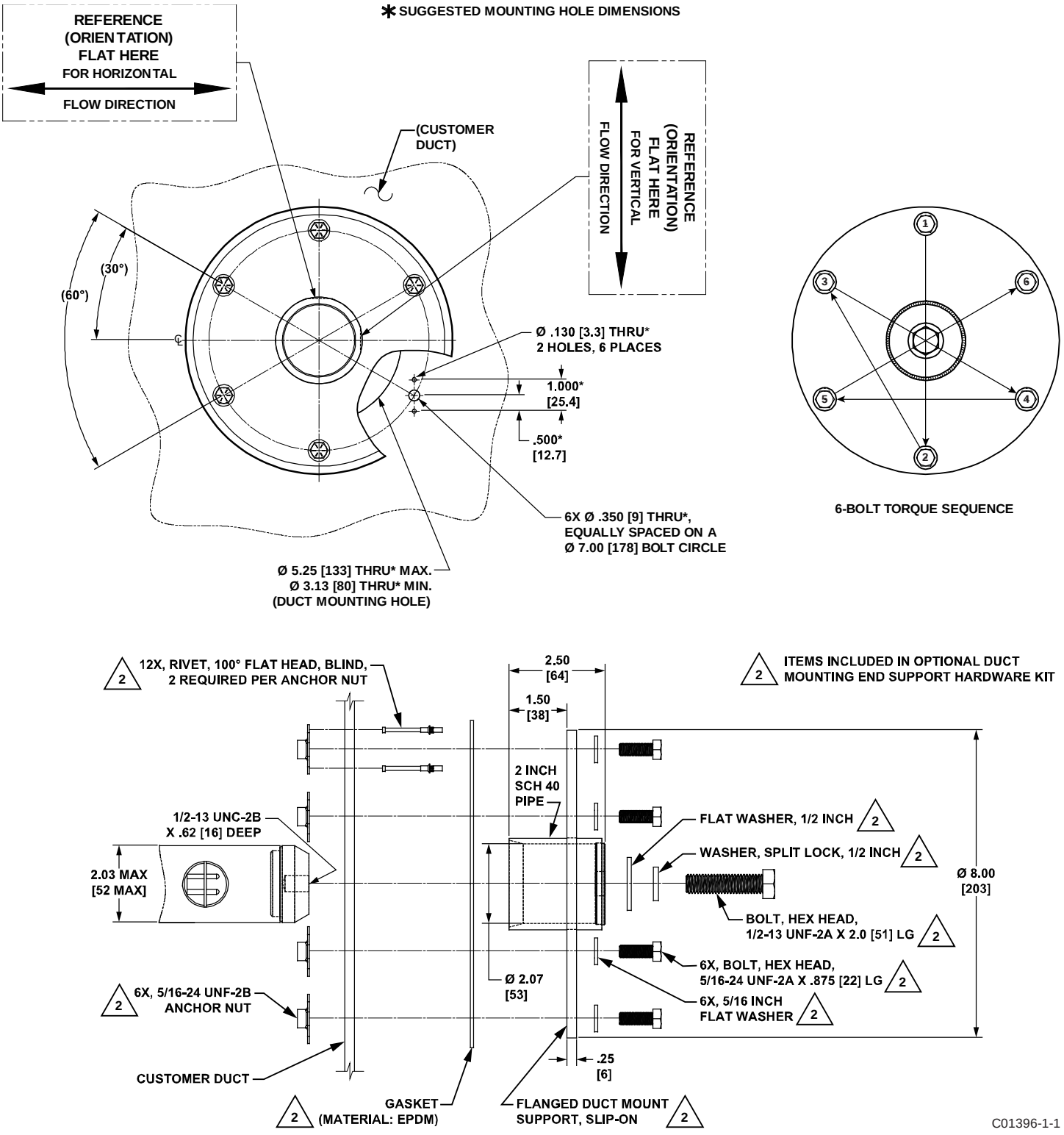


Figure 5 – Duct Flange Mounting, End Support Hardware (Optional)

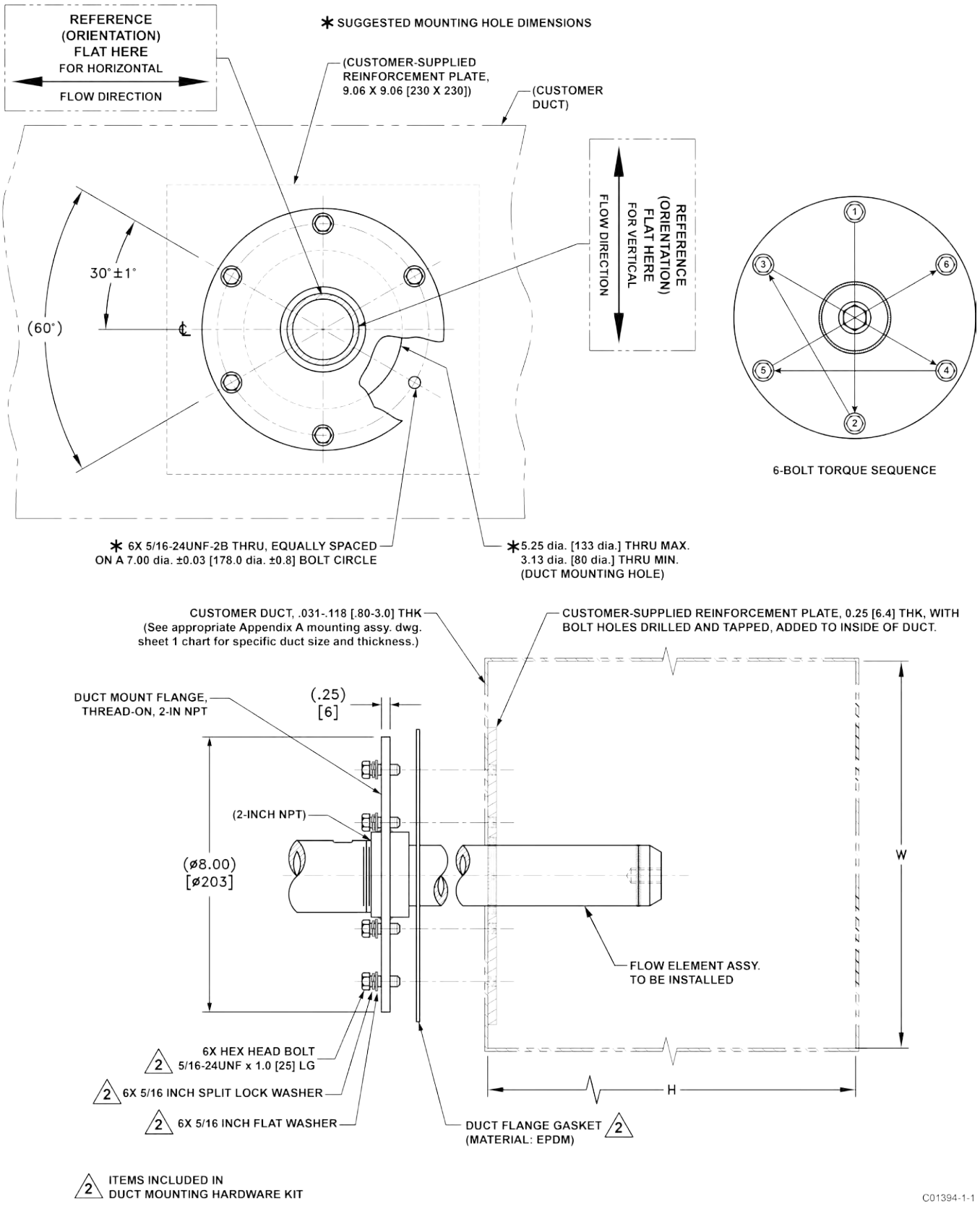


Figure 6 – Alternative Duct Flange Mounting, Dimensions and Mounting Hardware

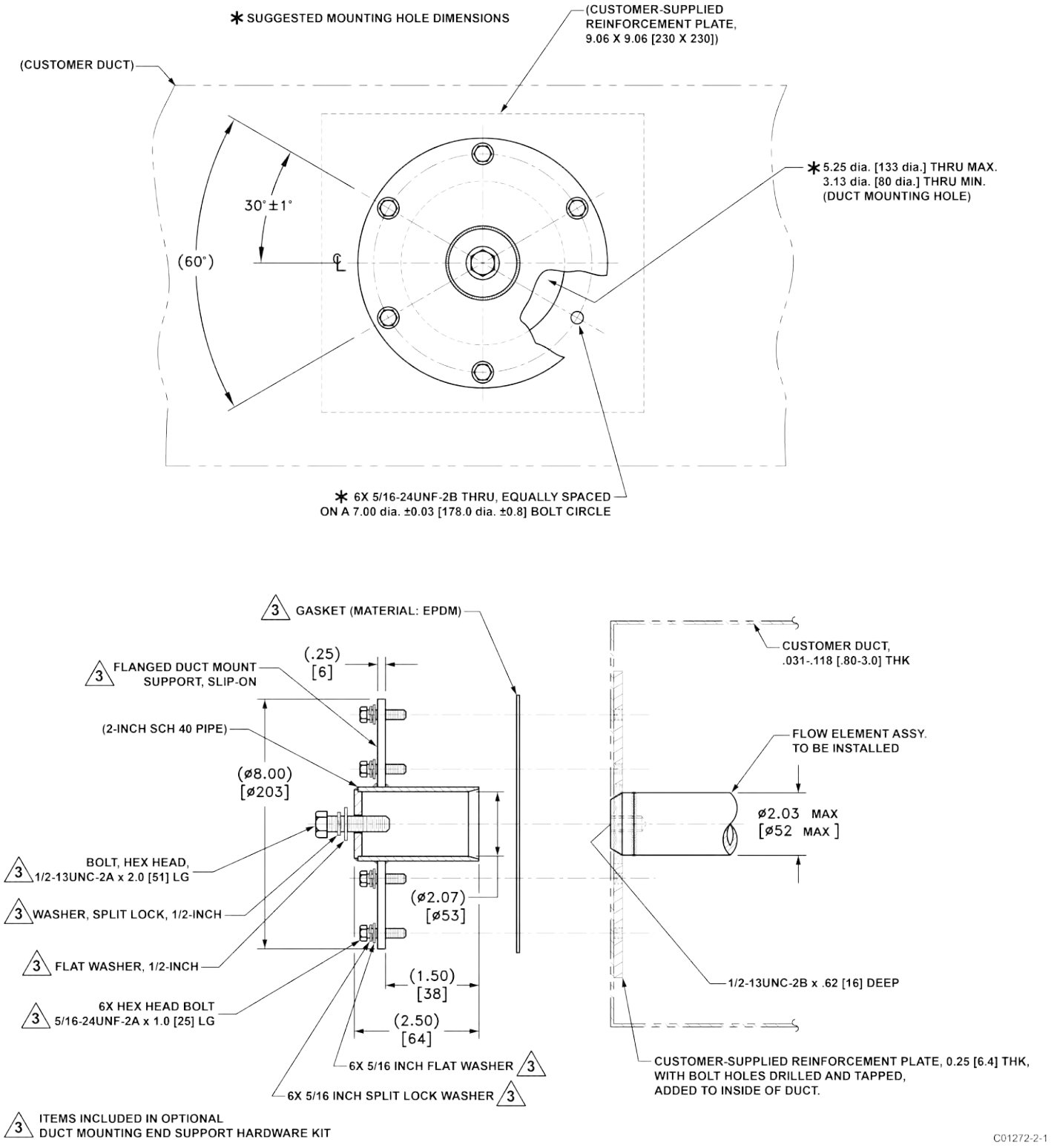


Figure 7 – Alternative Duct Flange Mounting, End Support Hardware (Optional)

RF Flange Installation (MT100S, MT100M)

The flange mount flow element is shown in Figure 8 and Figure 9 below. Attach the process mating flange with care. The correct orientation of the flow element must be maintained to ensure the calibrated accuracy.

- Verify the process media flow matches the flow direction arrow on the flow element.
- Apply appropriate gasket and/or sealant to flange mount as required.
- Mate flow element flange to process flange keeping reference flat oriented properly.
- Secure flanges with appropriate mounting hardware.

Note: Mounting gaskets and hardware (nuts and bolts) shall meet the requirements of ASME B16.5. The bolt torque shall meet the gasket specification requirements.

Note: Depending on the application/length, some flanged multisensor probes will require additional end support hardware. See Figure 10 and Figure 11 on page 15.

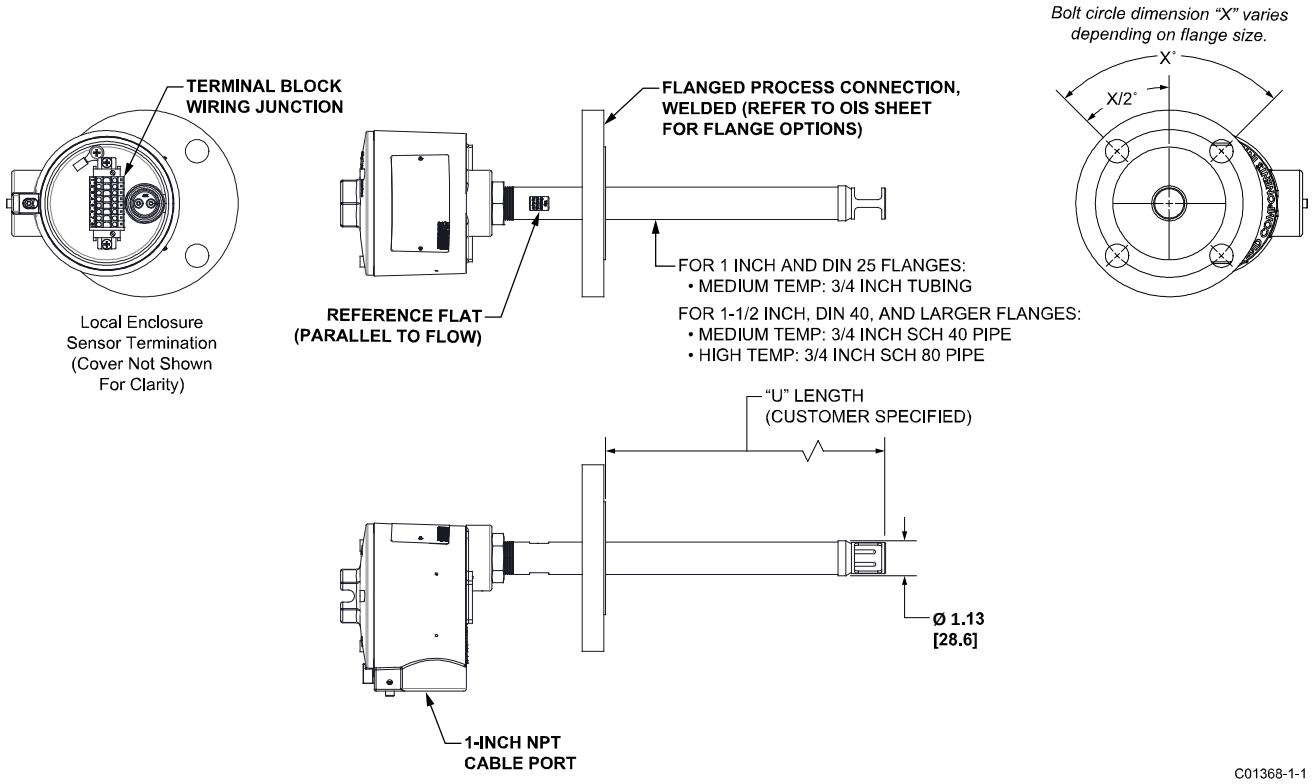


Figure 8 – Single Point, Fixed RF Flange Process Connection

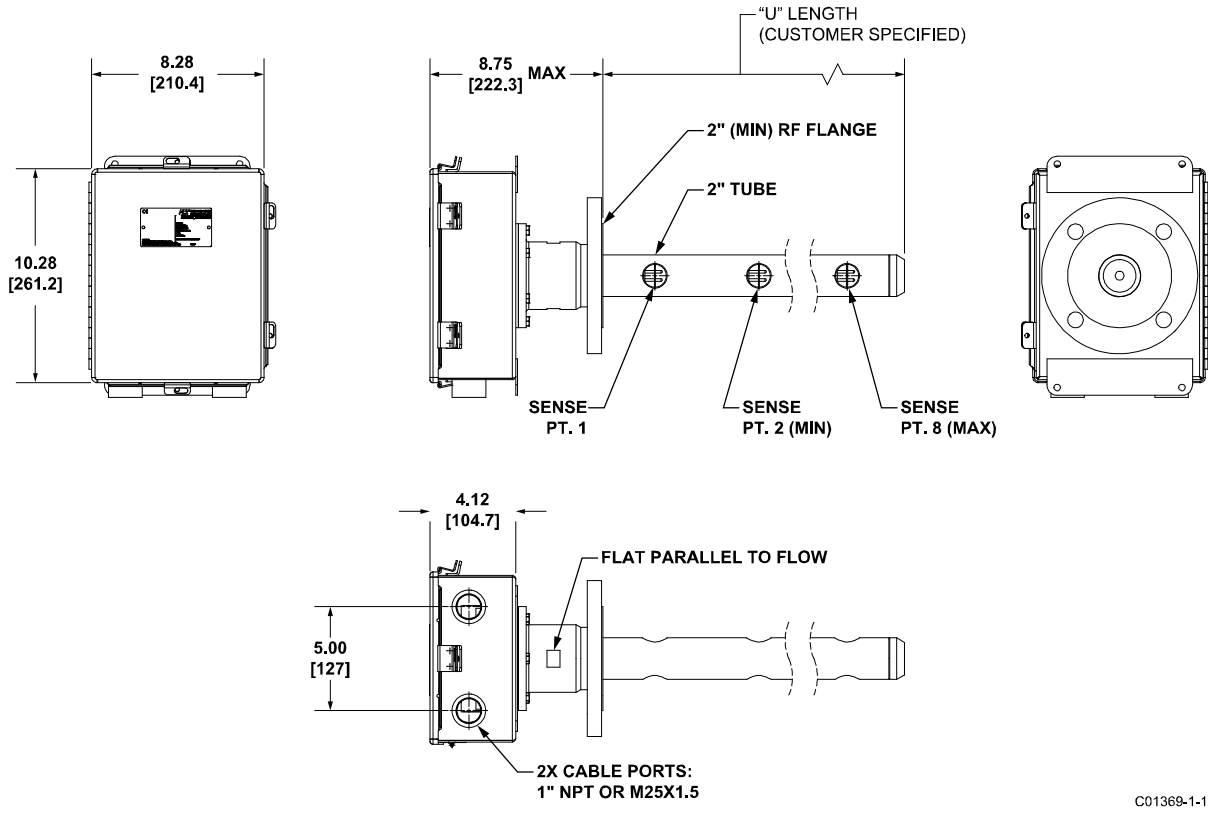


Figure 9 – Multipoint, RF Flange Process Connection (High Temp Shown)

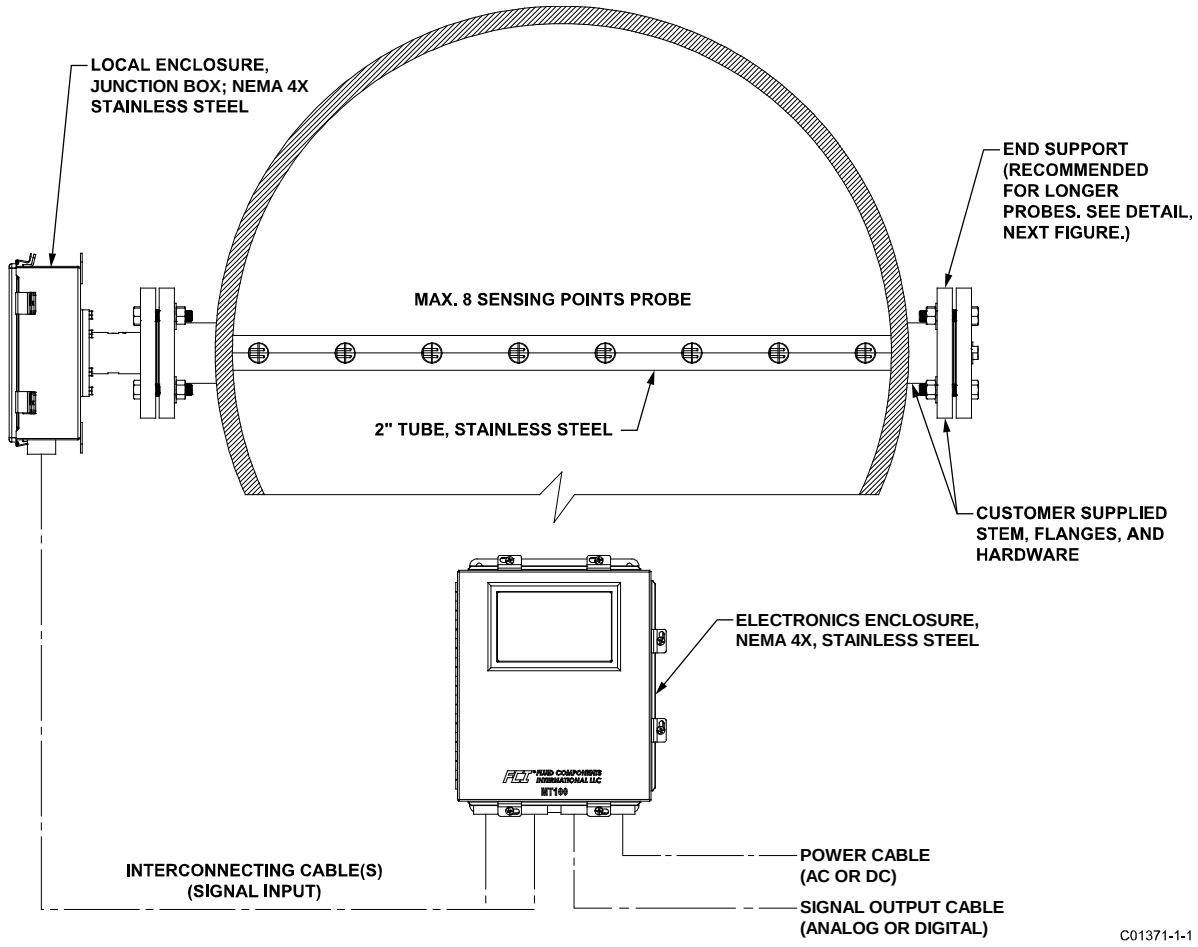


Figure 10 – Multipoint Flanged Sensor Probe Example Installation

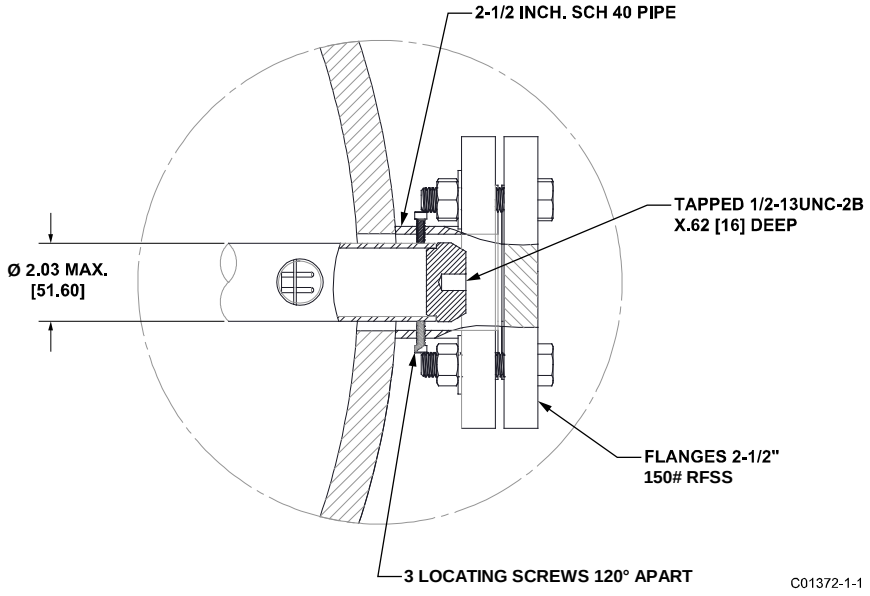


Figure 11 – Multipoint Flanged Probe End Support Detail

NPT Installation (MT100S, MT100M)

Single and multipoint NPT pipe thread sensor assemblies are shown in Figure 12 and Figure 13 below. Apply sealant compatible with the process media to male threads. Carefully insert process mounting coupling. Tighten the flow element until snug and continue until flat and flow direction arrow are aligned with process flow.

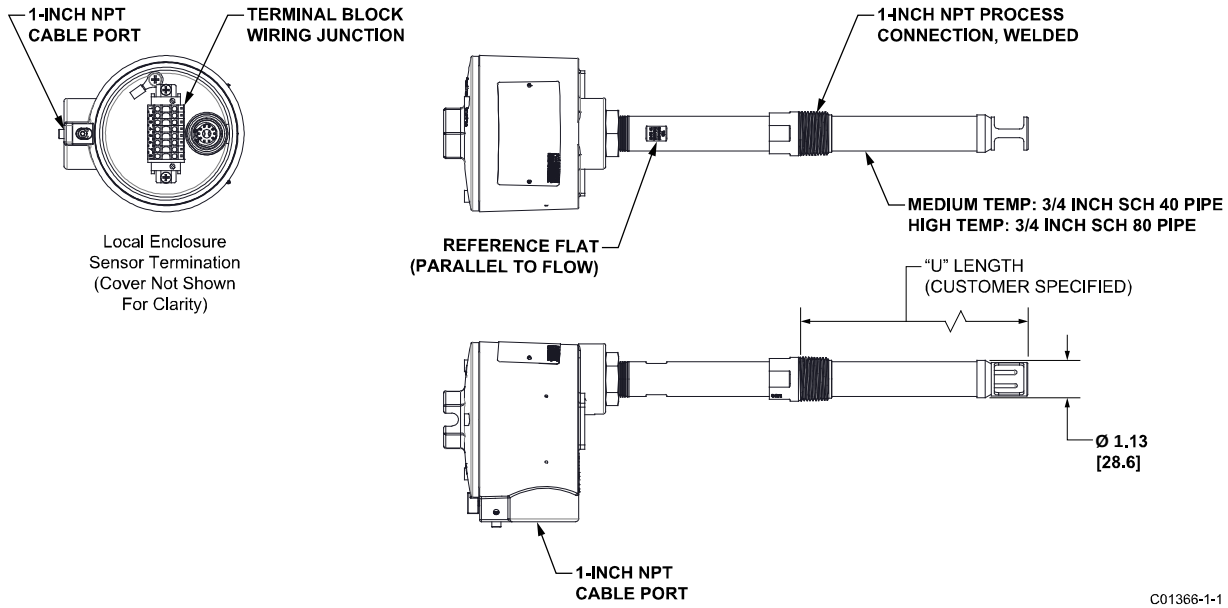


Figure 12 –Single Point, Fixed 1" Welded NPT Process Connection

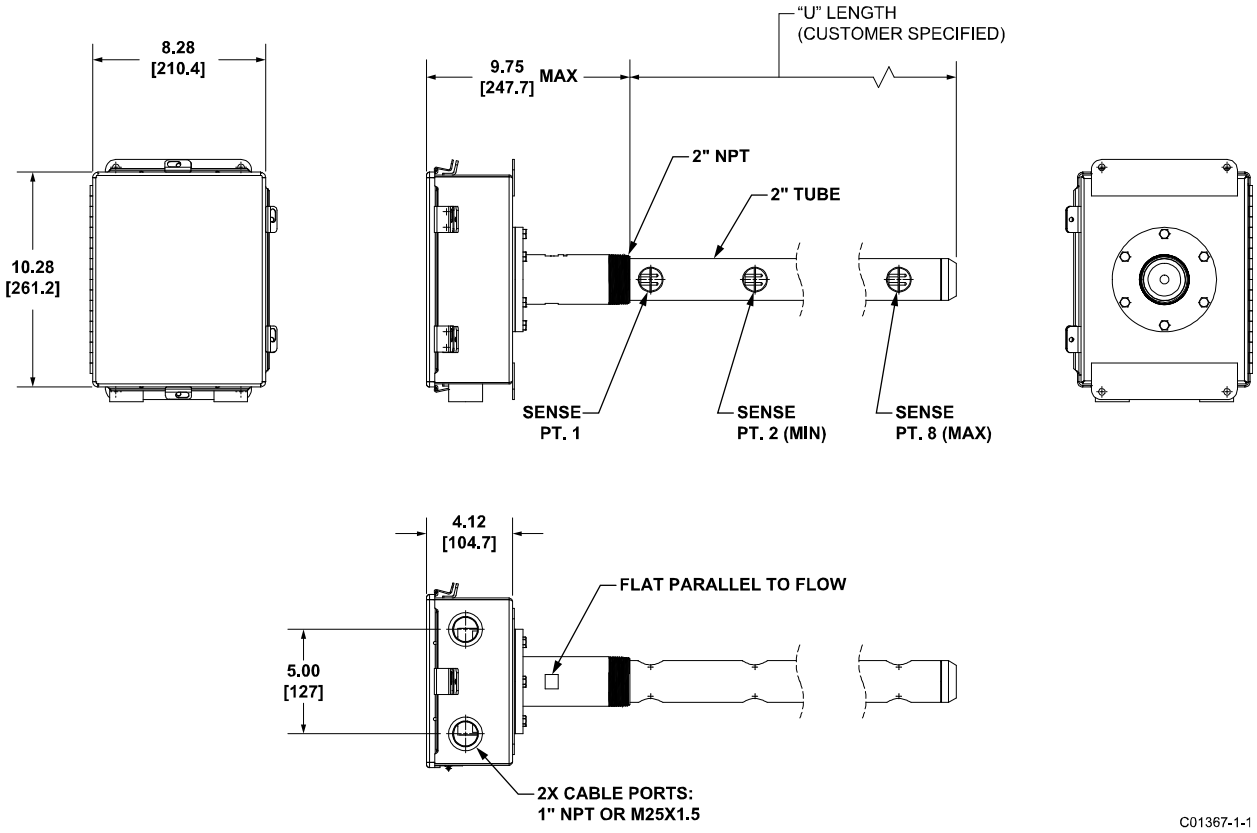


Figure 13 – Multipoint, 2" NPT Process Connection (Low Temp Shown)

Compression Fitting Installation (MT100S)

A compression fitting flow element sensor is used for multi-single point insertion applications. The adjustable length of the compression fitting allows for precise sensor placement inside the pipe. The flow element is properly mounted when the center of the sensor head divides the pipe into equal areas as shown in Figure 14 below. The scale etched on the side of the insertion pipe indicates the length to the tip of the flow element.

1. Ascertain the insertion depth of the flow element probes as shown in Figure 14 below.
2. Mark the insertion pipe at the calculated insertion depth.
3. Apply proper thread sealant to the tapered pipe thread on the compression fitting and secure into pipe mounting coupling.
4. Insert the flow element to the insertion depth mark making sure the reference flat is aligned parallel to the flow direction. Hand tighten the compression nut. Compression fitting manufacturer recommends 1-1/4 turns past hand tight.
5. Tighten the compression nut to the torque specified for the corresponding ferrule material. See Table 1 below.

Table 1 – Compression Fitting Material

Ferrule	Torque
Teflon	65 in - lbs
316 SST	65 ft - lbs

Note: The metal ferrule configuration can only be tightened one time. Once tightened, the insertion length is no longer adjustable.

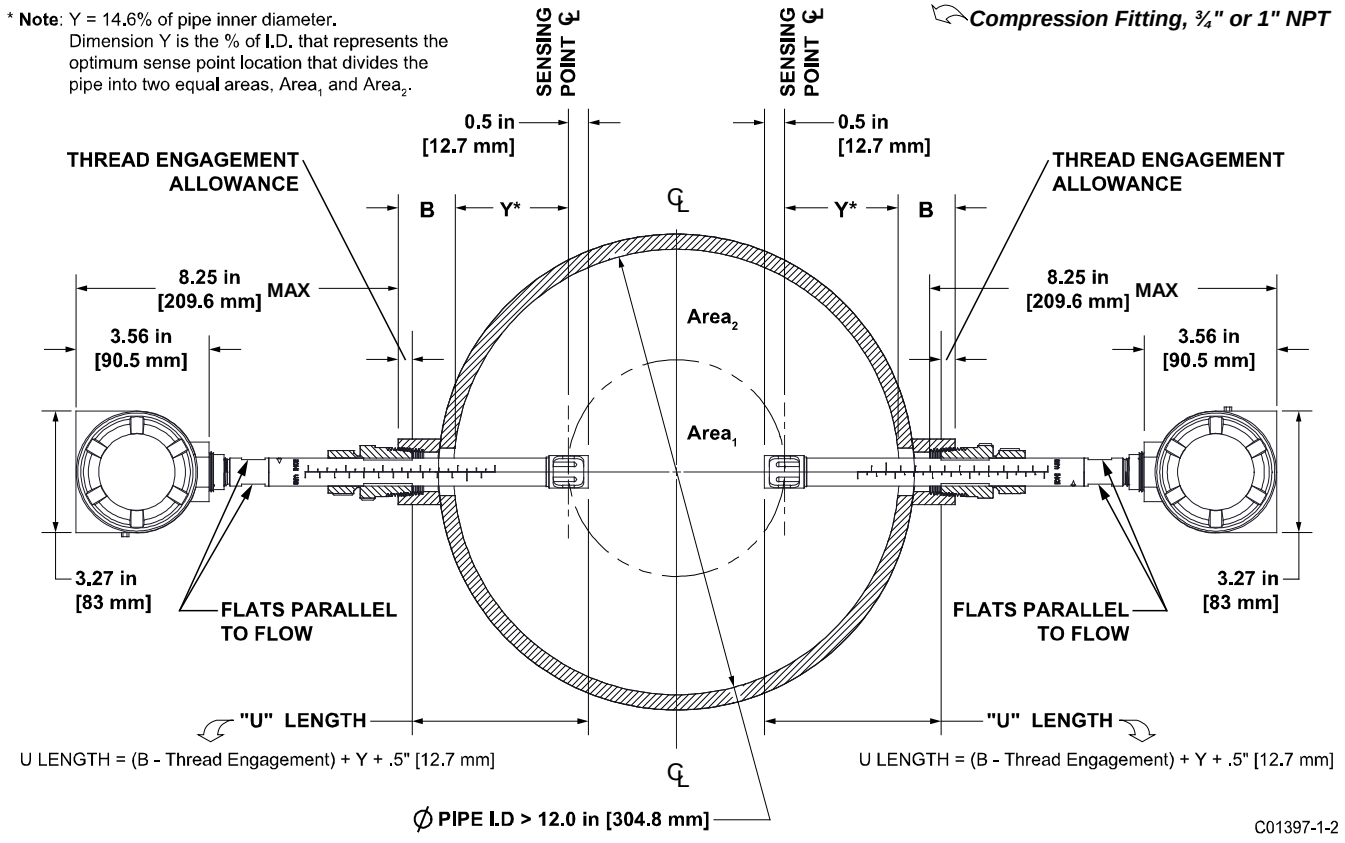


Figure 14 – Compression Fitting Mounting Dimensions

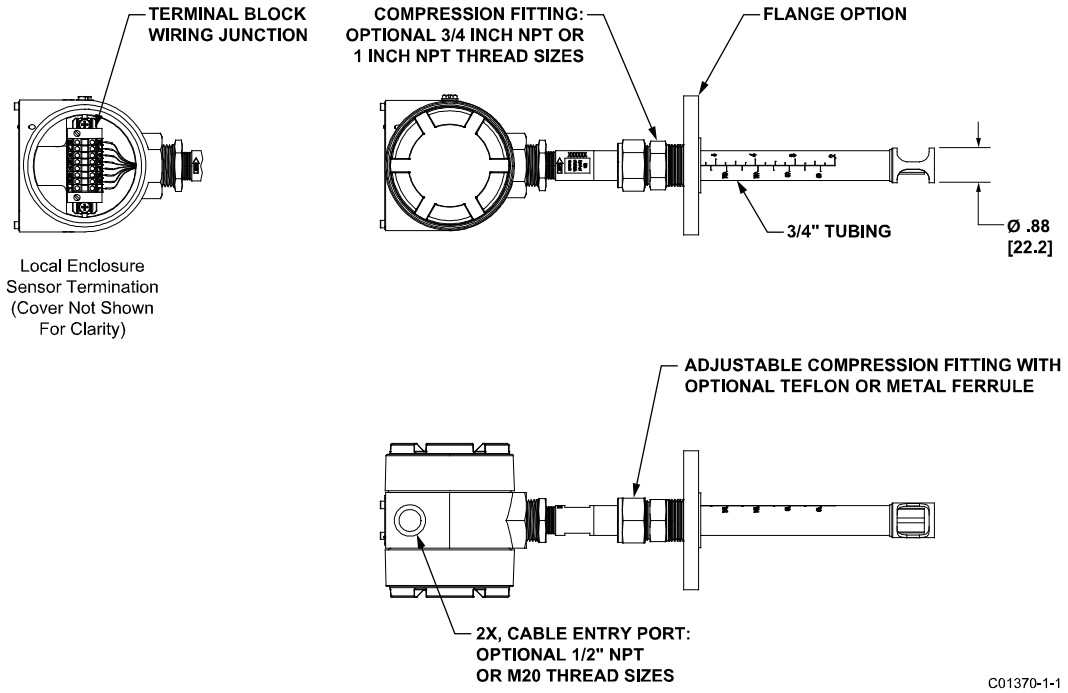


Figure 15 – Compression Fitting Process Connection (Optional Flange Shown)

Adjustable/Retractable Packing Gland Installation (MT100S)

Refer to drawings located in Appendix A for additional detail on packing gland probe installation. NPT and flange mounted gland are available. Isolation valves are typically used in packing gland applications.

1. Apply proper sealant to packing thread and secure into customer process connection. Adjust the packing nut until the internal packing is just tight enough to prevent excess process leakage but also allow the insertion pipe to be inserted into place. Orient the flat and flow arrow properly.
2. For the medium pressure packing gland, secure elements by tightening nuts on threaded rods.
3. Tighten the packing nut another ½ to 1 turn until tight (approximately 65 – 85 ft-lbs).
4. Align the locking collar with connecting strap on packing nut. Tighten the two ¼-28 cap screws on the locking collar.

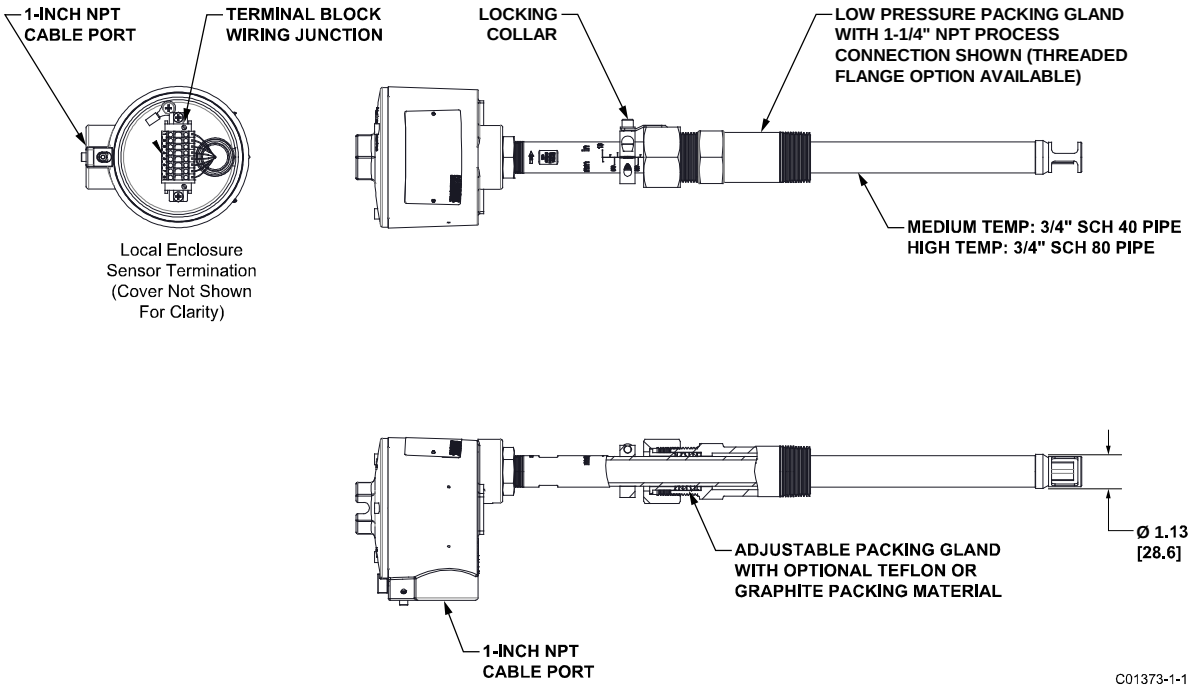


Figure 16 – Low Pressure Retractable Packing Gland, NPT Process Connection Shown

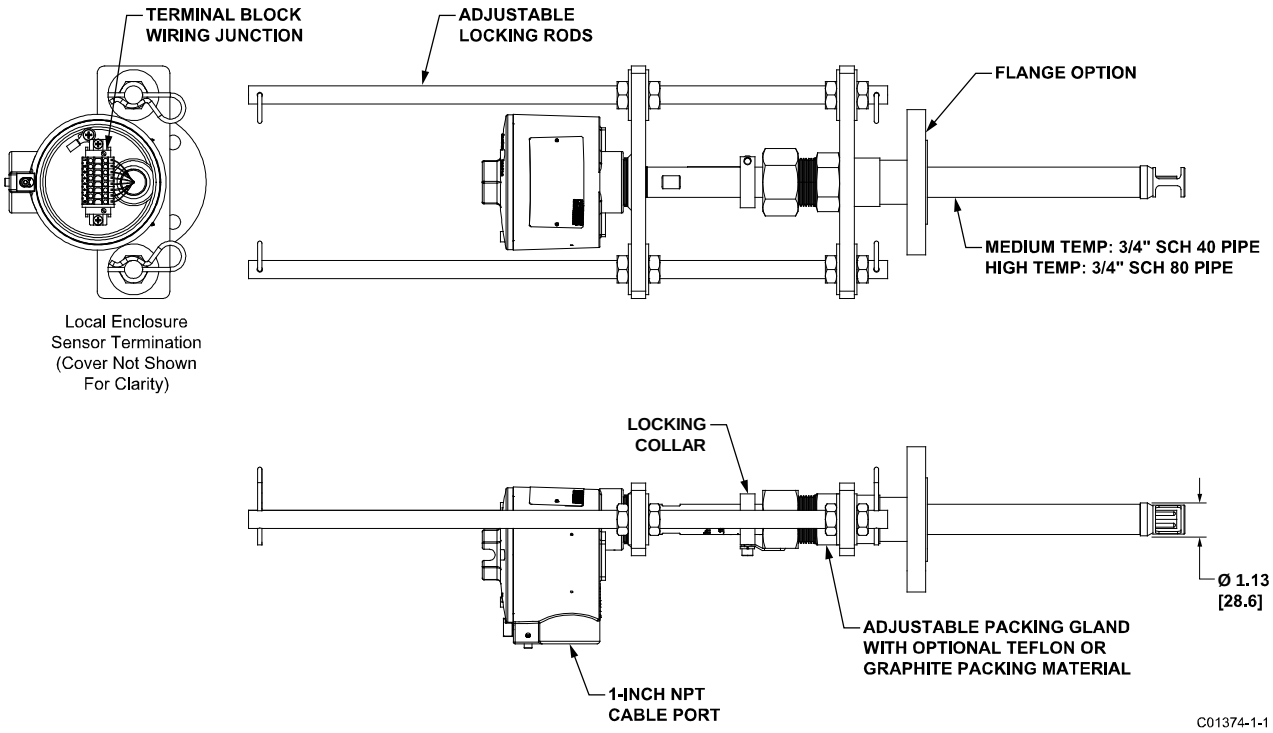


Figure 17 – Medium Pressure Retractable Packing Gland, Flange Process Connection Shown

Installing Multiple Single Point Probes (MT100S)

Two or more single point probes provide multiple flow measurement points to an MT100S system. For best results install the probe so that the centers of all sensor heads are located 14.6% of the pipe/stack inside diameter. Figure 18 below shows this and other key measurements for multi-probe installation. Note that FCI's AVAL program that is run at order time provides the required measurements as a result of customer-entered parameters that define the instrument's application. Refer to the AVAL information for site-specific information.

Note: The drawing below shows two different kinds of packing gland process connections, NPT and raised face flange. This is done for illustrative purposes only. Normally, all sensor probes are of the same type process connection.

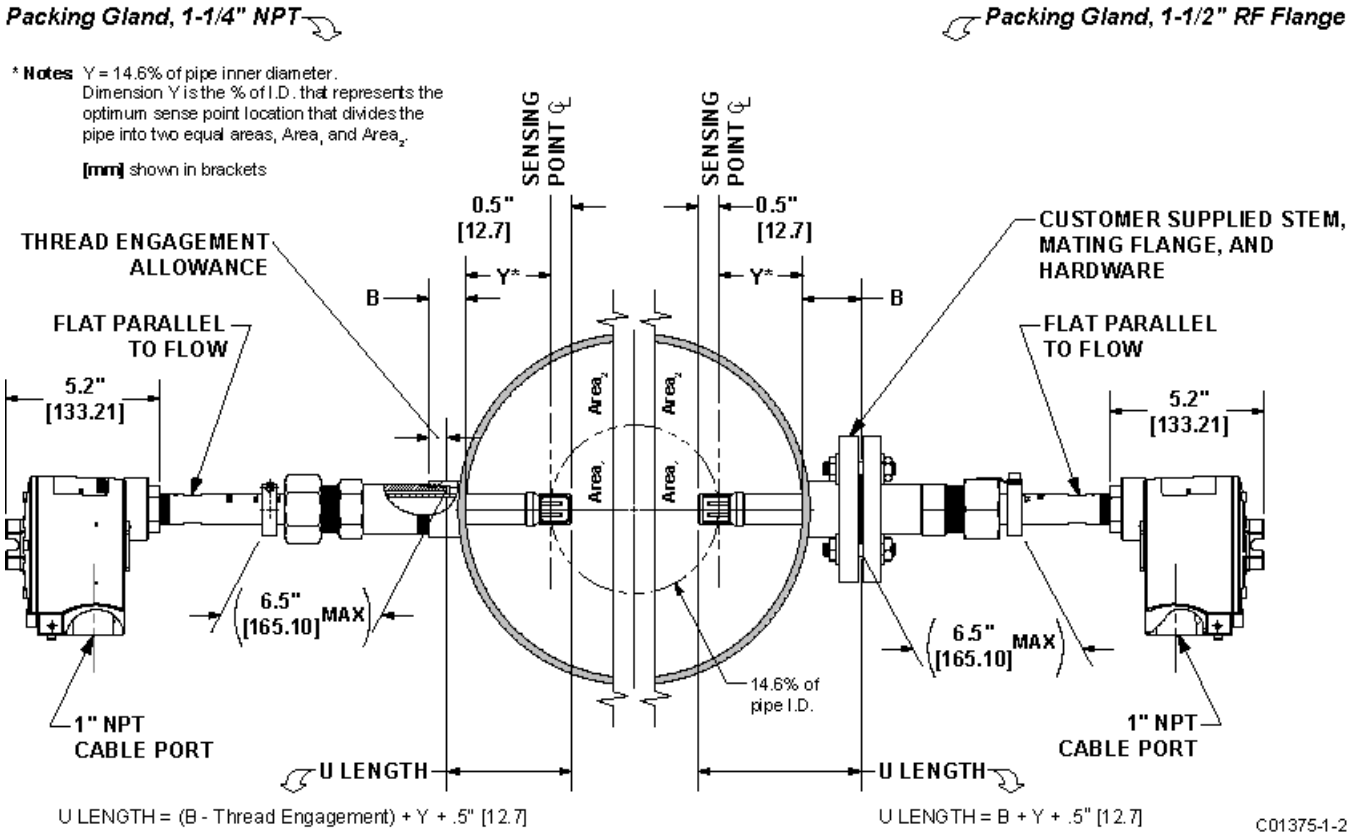


Figure 18 – Multiple Single Point Probe Installation (Packing Gland Shown)

Install Flow Transmitter

Caution: Separate sense and excitation wires must be used. Reversing the Active and Reference wires will cause the instrument to malfunction.

In applications where the flow element is located in an explosive environment and conduit is used, isolate the conduit before it leaves the environment. A silicone encapsulant/potting compound may be used to provide the isolation.

Note: FCI recommends installing an AC power disconnect switch and fuse near the flow transmitter to interrupt power during installation, maintenance, calibration, and troubleshooting procedures.

Remote Hardware

Figure 19 below shows the remote electronics enclosure along with physical dimensions to properly mount the flow transmitter. Select a location for the flow transmitter within 1000 feet of the flow element. Make sure that the chosen location is easily accessible with enough room to open the remote enclosure cabinet door at any time. Secure the flow transmitter solidly to a vertical surface capable of providing support. Use the appropriate hardware to secure the flow transmitter as required.

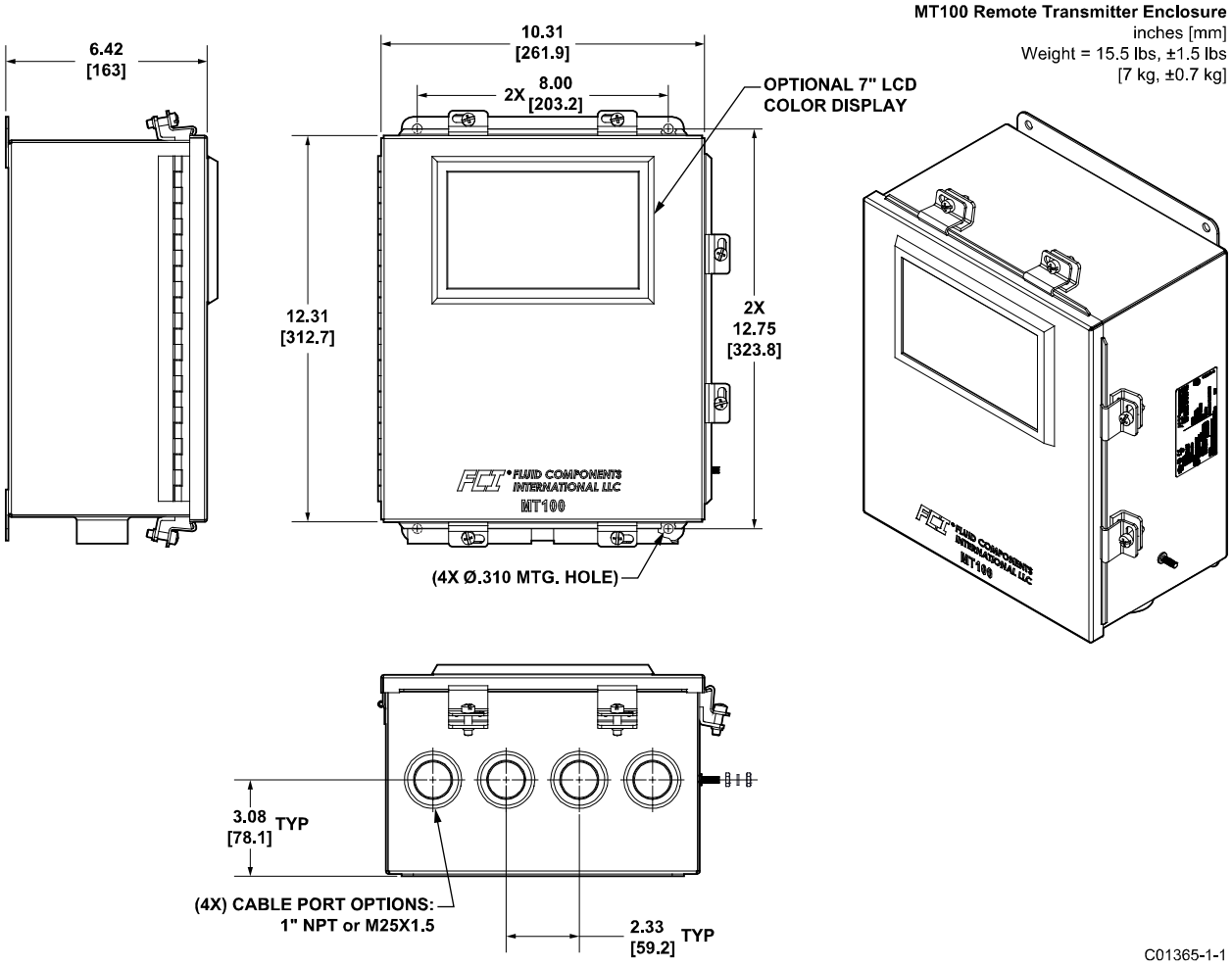


Figure 19 – MT100 Remote Transmitter Enclosure Outline Drawing

Wiring

Table 2 below shows the smallest copper wire (maximum AWG number) that can be used for the listed cabling. Contact FCI concerning greater distances than those listed in the chart. Refer to APPENDIX A, page 101 for specific wiring/cabling information.

Table 2 – Interconnecting Cable Minimum Conductor Size

Connection	Maximum Distance for AWG [mm²]					
	10 ft. (3 m)	50 ft. (15 m)	100 ft. (31 m)	250 ft. (76 m)	500 ft. (152 m)	1000 ft. (305 m)
AC Power	22 [0.3255]	22 [0.3255]	22 [0.3255]	20 [0.5176]	18 [0.8230]	16 [1.3087]
Flow Element Wires[1]	24 [0.2047]	24 [0.2047]	24 [0.2047]	22 [0.3255]	22 [0.3255]	18 [0.8230]
Analog Out (HART), Analog In	16-30 [1.3087-0.0509]	16-30 [1.3087-0.0509]	16-30 [1.3087-0.0509]	16-30 [1.3087-0.0509]	16-30 [1.3087-0.0509]	16-30 [1.3087-0.0509]
Modbus	RS-485 (14-30 AWG) [2.0809-0.0509]					
FOUNDATION Fieldbus	FF-844 H1 (14-30 AWG) [2.0809-0.0509]					
Profibus[2]	RS-485 (14-30 AWG) [2.0809-0.0509]					

Notes: 1. Requires a shielded cable. The shield is connected to the GND in the transmitter enclosure. The other end of the shield is left floating (no connection to the flow element enclosure).

2. Transmission speed determines maximum cable length and vice versa:
9.6 kbps = 3940 ft/1200 m, 19.2 kbps = 3940 ft/1200 m, 45.45 kbps = 3940 ft/1200 m, 93.75 kbps = 3940 ft/1200 m, 187.5 kbps = 3280 ft/1000 m, 500 kbps = 1310 ft/400 m, 1500 kbps = 656 ft/200 m, 3000 kbps = 328 ft/100 m, 6000 kbps = 328 ft/100 m, 12000 kbps = 328 ft/100 m.

Routing and Configuration

Conduit Routing (If applicable)

Caution: Working with conduit and pulling cables after installation can cause damage to the electronic components. Disconnect both ends of cabling before moving conduit.

Protection of the flow transmitter from moisture is important. Keep the entry of the conduit into the enclosures in the downward direction so condensed moisture that collects in the conduit will not drain into the enclosure. FCI recommends sealing off the conduit with a silicone encapsulant/potting compound to prevent moisture from entering the enclosures.

See APPENDIX A for specific information on cable entry type(s) and locations for sensors, power input and 4-20 mA output.

Configuration Jumpers (Modbus/Fieldbus/PROFIBUS)

When wiring the instrument for Modbus/Fieldbus/PROFIBUS make sure the instrument is properly configured as shown in Figure 20 below. Refer to Modbus on page 28 and Foundation Fieldbus/PROFIBUS (Option) on page 29 for details.

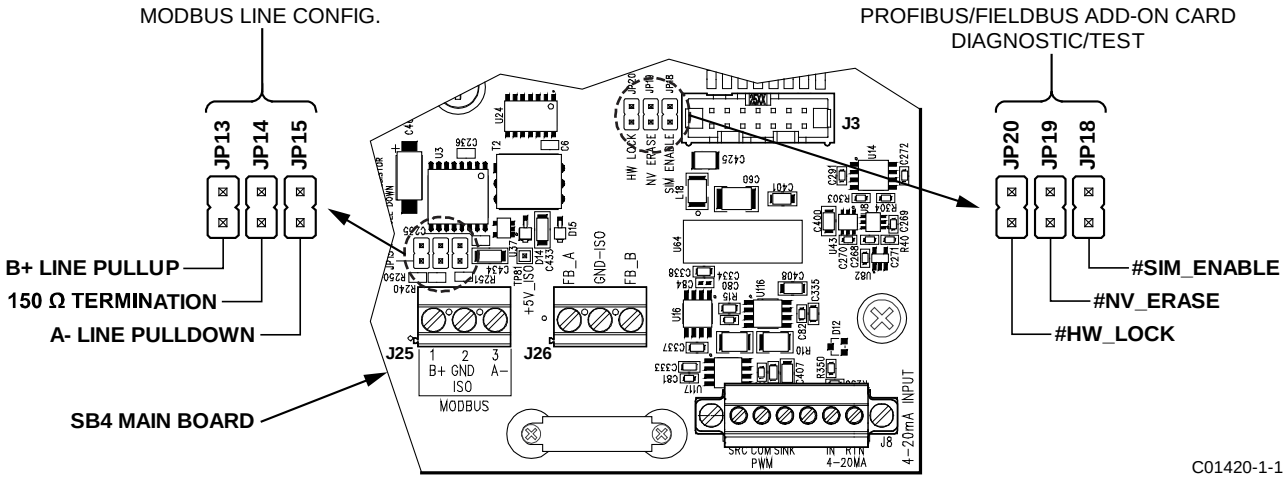
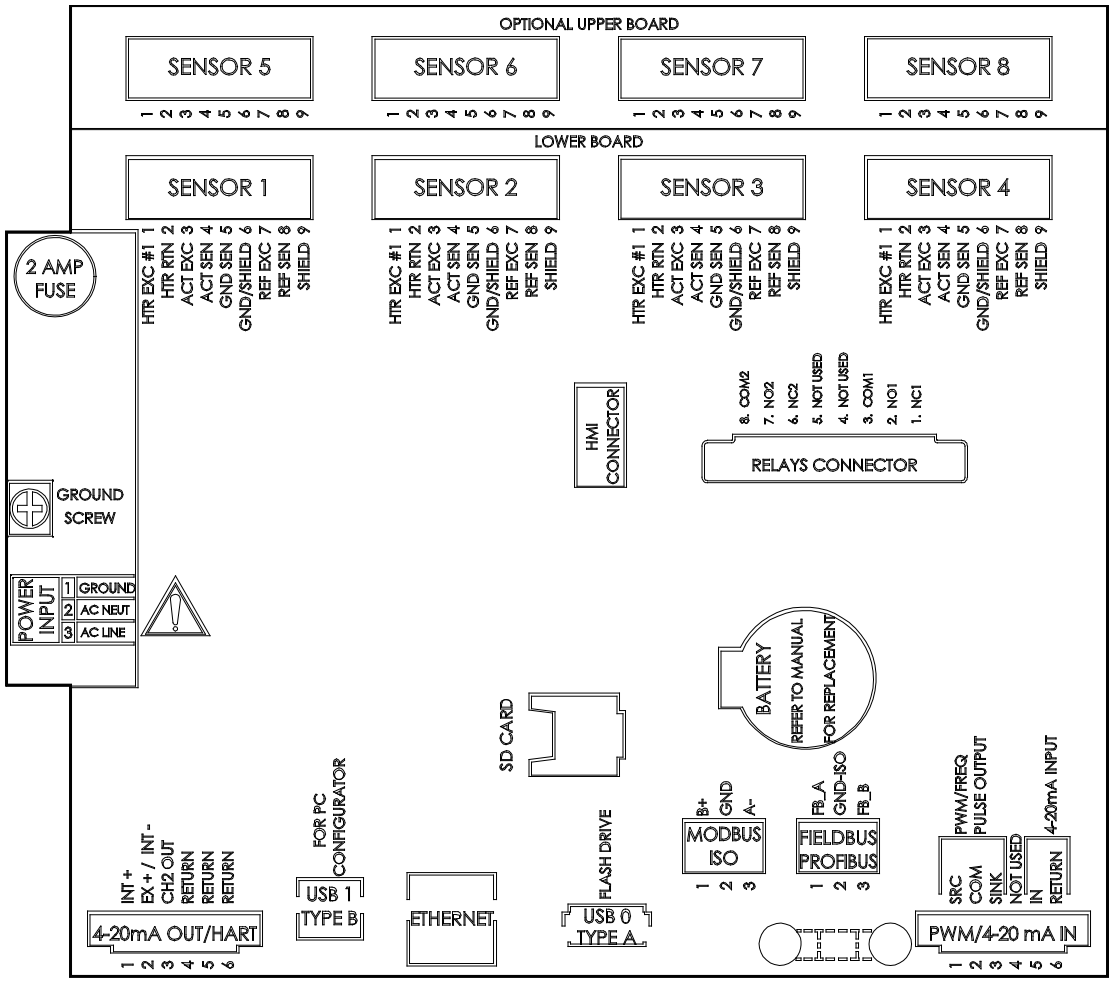


Figure 20 – Bus Configuration 0.100" Jumper Headers

Electronics Enclosure Label

Affixed to the inside enclosure door below the display window is a label that identifies various connectors and features on the MT100 main board and optional extension (upper) board, as well as the visible part of the power supply board. See Figure 21 below. Use this label as a guide to locating the SD card socket, the battery holder, input power fuse, and connectors (shown with function and terminal assignments). Note that the board silkscreen also provides component identification.



C01405-1-1

Figure 21 – MT100 Electronics Enclosure Label

Connections

Flow Element Connections

See the appropriate wiring diagram in APPENDIX A for interconnect wiring between the flow element and remote electronics. Run separate 8-conductor shielded cable per sensing element. The flow meter will not operate properly without these connections. If the ACT and REF wires are reversed the flow meter will not function properly (inaccurate flow/temperature readings). Use shielded cable with all signal applications. For the flow element wiring (non-QDC application), connect the shield to GND in the transmitter enclosure. The other end of the shield is left floating (no connection to the flow element enclosure).

As shown in Figure 22 below the MT100 flow element sensors connect to detachable 9-position connector plugs (8 total) on the SB4 main board and the optional SB8 extension board (on standoffs). The connector plug accepts 28-16 AWG (0.14 mm^2-1.5 mm^2) wire (refer to Table 2, page 23 for wire size vs. length info). Connect a flow element sensor to the appropriate plug as follows:

1. Remove connector plug from board (pull straight out).
2. Route sensor wires through remote enclosure's conduit opening/cable gland.
3. Strip wire ends (0.27 in [7 mm]) and connect to appropriate connector terminals as shown in Figure 22.
4. Plug connector block back into its pin socket on the board.
5. Gather sensor wires into a bundle (use tie-wraps as required) and push them into the nearest cable guide bushing.
6. Repeat steps 1-5 for remaining flow element sensors.

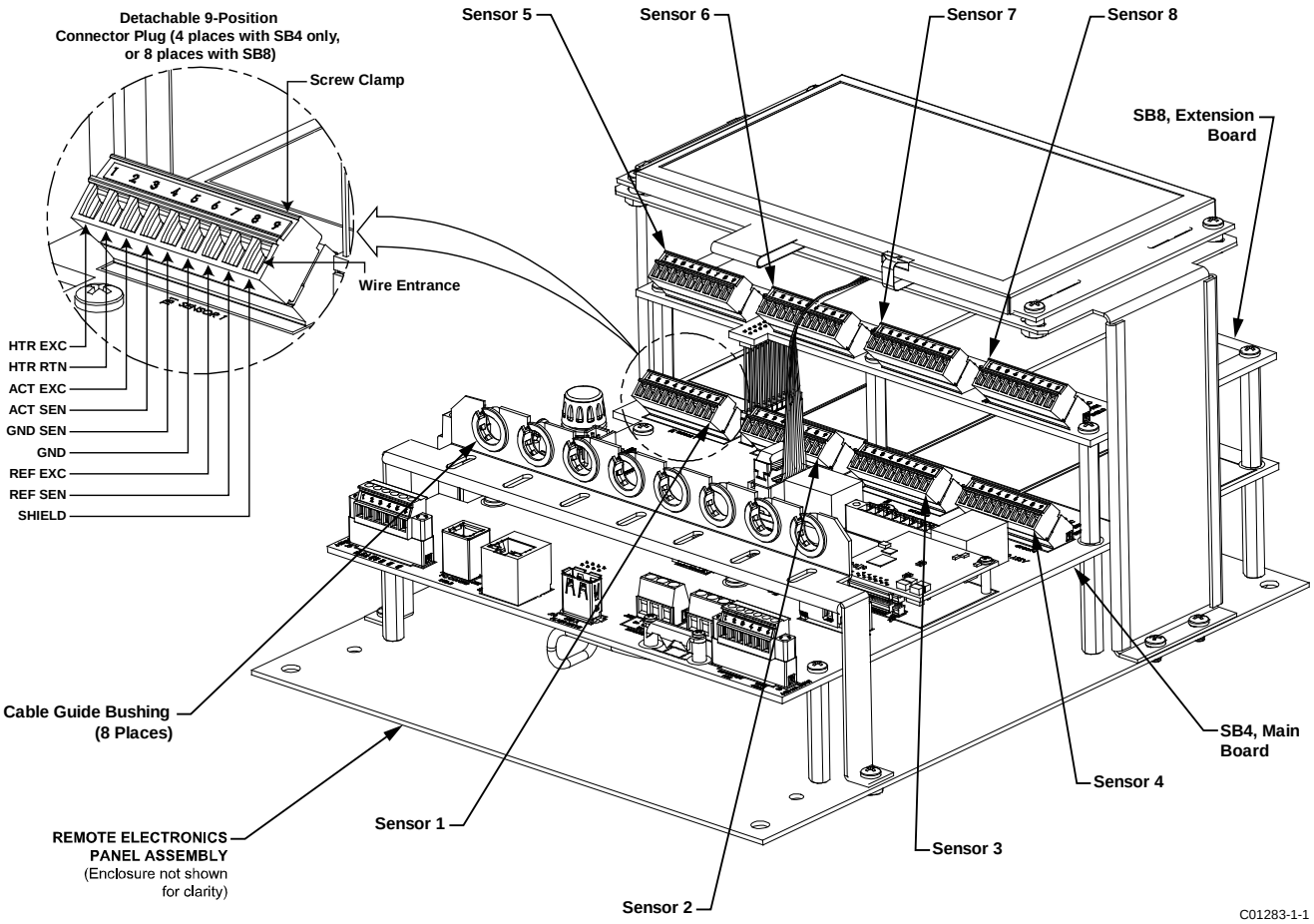


Figure 22 – Flow Element Connections

Input Power

Warning: Install an AC line disconnect switch with fuse or breaker between the power source and the flow meter. Always disconnect power before performing maintenance on wiring.

As shown in Figure 23 below connect input power to the remote transmitter's 3-position Phoenix connector P1 on the power supply board. The power connector accepts 24-12 AWG (0.2 mm^2-2.5 mm^2) wire (refer to Table 2, page 23 for wire size vs. length info). Route the power cabling through a conduit opening/cable gland at the bottom of the transmitter's NEMA 4X enclosure. A socketed radial lead fuse provides input power overload protection. Refer to Power Fuse Replacement, page 90 (MAINTENANCE section) for fuse replacement details.

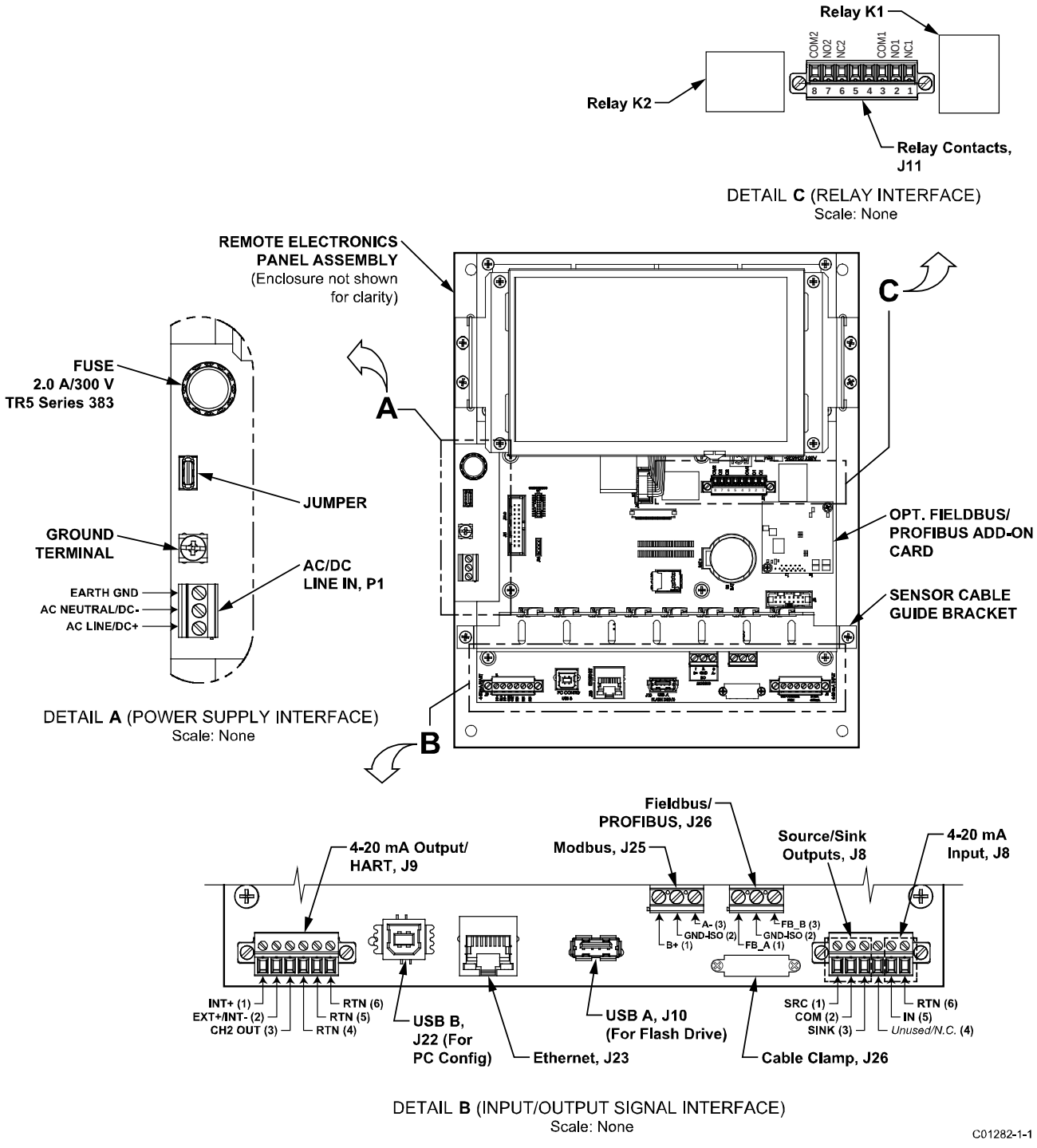


Figure 23 – Input Power and I/O Connections

I/O Connections

As shown in Figure 23 the SB4 main board provides an input/output signal interface for connection to various peripheral interfaces. For these interfaces, route the cable/wires through a conduit opening at the enclosure bottom and connect to the appropriate connector/terminals.

HART

Connect the installation HART wiring to the appropriate **J9** Phoenix connector terminals depending on the application. The connector accepts 28-16 AWG (0.14 mm^2-1.5 mm^2) wire (refer to Table 2, page 23 for wire size vs. length info).

- Single Connection – The instrument supplies power to the loop and controls the current as well. For this application connect HART+ to J9-1 (INT+) and HART- to J9-2 (INT-).
- Network (Multidrop) Connection – The instrument receives loop power from the network, and controls the current. For this application connect external HART+ to J9-2 (EXT+) and external HART- to J9-4 (RTN).

The block diagram in Figure 24 below shows the single connection and multidrop HART setups. Use a 250 Ω 1%, ≥ 0.3 W resistor as shown in the diagram below ***only*** if the external HART interface/wiring does not have this resistance built-in (HART requires a minimum loop resistance of 230 Ω).

CABLING RECOMMENDATION

Use a shielded, twisted-pair instrument grade wire (min. 24 AWG for runs less than 5000 ft/1500 m; min. 20 AWG for longer distances). The RC value of the wire (*Total Resistance* x *Total Capacitance*) must be less than 65 µs (not a concern for point-to-point topology with a run less than 328 ft/100 m). A cable designed for HART/RS-485 such as Belden 3105A is recommended for complex setups and/or particularly long runs.

Note: The HART communications digital signals are superimposed on top of the channel #1 current loop (4-20 mA) output. When HART communications is in use, the HART current loop channel #1 MUST be configured as FLOW to comply with the HART protocol. The channel #1 current loop output is configured as FLOW by default at the factory.

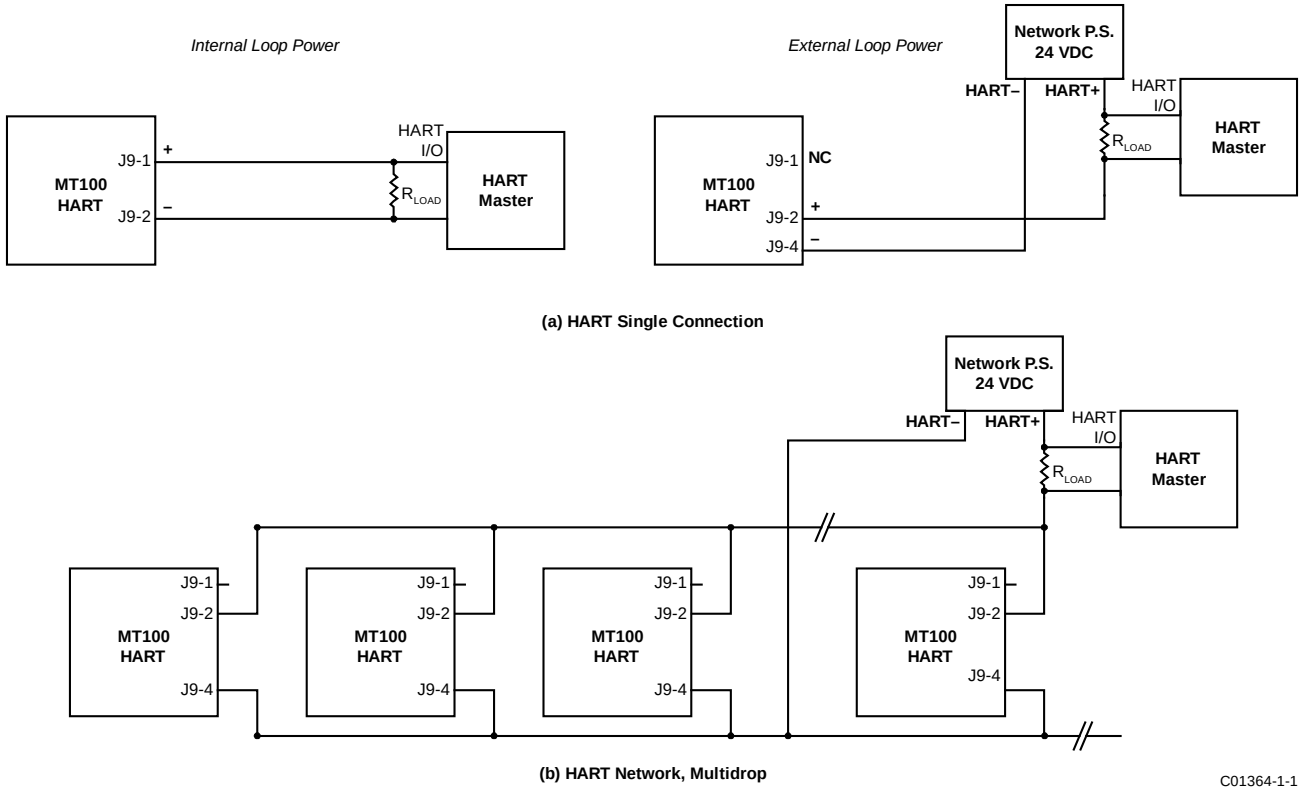


Figure 24 – Single Connection and Multidrop HART Setups

4-20 mA Output

The MT100 is provided with two 4-20 mA current loop channels via the **J9** Phoenix connector terminals. The connector accepts 28-16 AWG (0.14 mm^2-1.5 mm^2) wire (refer to Table 2, page 23 for wire size vs. length info). Ch. 1 is dedicated to HART. See above for connection details. Connect the instrument's second 4-20 mA output (CH2, J9-3) as required for your application. Use any RTN terminal (e.g., J9-5) for the current loop return.

Modbus

The MT100 Modbus interface is provided by the **J25** Phoenix connector terminals. The connector accepts 26-14 AWG (0.14 mm^2-1.5 mm^2) wire (refer to Table 2, page 23 for wire size vs. length info). Connect the MT100 to a Modbus device/network using a 2-wire RS-485 connection scheme as shown in Figure 25 below. For details on Modbus operation refer to Modbus Operation, page 81.

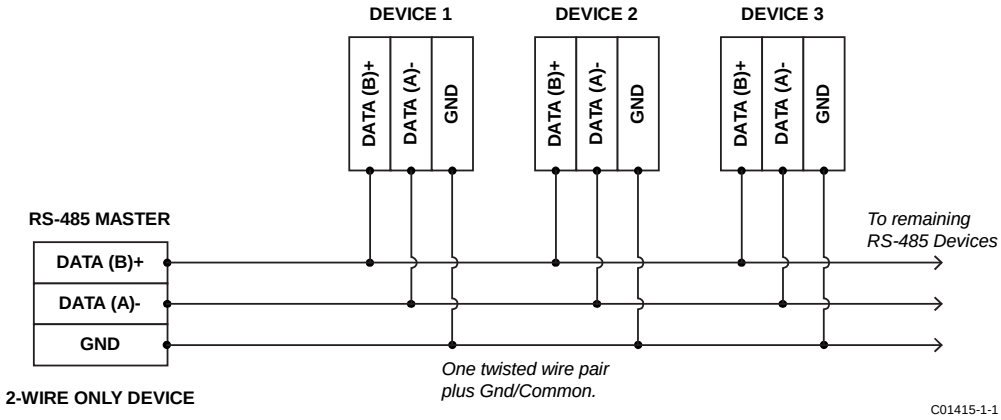


Figure 25 – Modbus Wiring

MODBUS LINE CONFIGURATION

Refer to Figure 20 on page 23.

Use the 0.100" line configuration jumper shunts JP13, JP14, and JP15 on the SB4 main board as needed for your specific application. (Remove sensor cable guide bracket if necessary.)

- **Termination (End of Line)** is typically required for applications with faster data rates or long cable lengths or both. Enable the instrument's terminator as required for your application.
- **Line biasing** is used to ensure that lines are at a known state (noise can cause a false trigger on a floating line). Check first that the RS-485 network is not already biased before enabling line biasing. Only use one of these jumpers, JP13 or JP15, not both.

The Modbus line configuration jumpers are summarized in Table 3 below.

Table 3 – Modbus Line Configuration Jumpers

	JP13	JP14	JP15
Line Biasing (pullup)	●	—	—
150 **Ω Termination**	—	●	—
Line Biasing (pulldown)	—	—	●

Note: 1. ● = Jumper Installed

FOUNDATION Fieldbus/PROFIBUS (Option)

The optional MT100 FOUNDATION Fieldbus/PROFIBUS interface is provided by the J26 Phoenix connector terminals. The connector accepts 26-14 AWG (0.14 mm²-1.5 mm²) wire (refer to Table 2, page 23 for wire size vs. length info). Connect the MT100 to a Fieldbus/PROFIBUS device/network as shown in Figure 26 below. Use the provided cable clamp to secure the wires to the board. Note that devices are connected in parallel (star fashion). For Fieldbus, a terminator (1 µF capacitor and 100 Ω resistor in series) is used on farthest ends of the trunk (i.e., at each end of the segment cable). For details on PROFIBUS operation refer to the MT100 PROFIBUS PA manual 06EN003474. For details on FOUNDATION Fieldbus operation refer to the MT100 FOUNDATION Fieldbus manual 06EN003472.

FIELDBUS/PROFIBUS ADD-ON CARD DIAGNOSTICS/TEST JUMPERS

As shown in Figure 20 on page 23, a bank of 0.100" jumpers control the optional Fieldbus/PROFIBUS add-on card's #SIM_ENABLE (JP18), #NV_ERASE (JP19), and #HW_LOCK (JP20) test signals. This provides a means to activate a "simulate mode" for Fieldbus conformance testing and for add-on card testing/diagnostics. Enable a particular signal by installing a 0.100" jumper shunt over the appropriate header pins. For normal use none of these jumpers are installed.

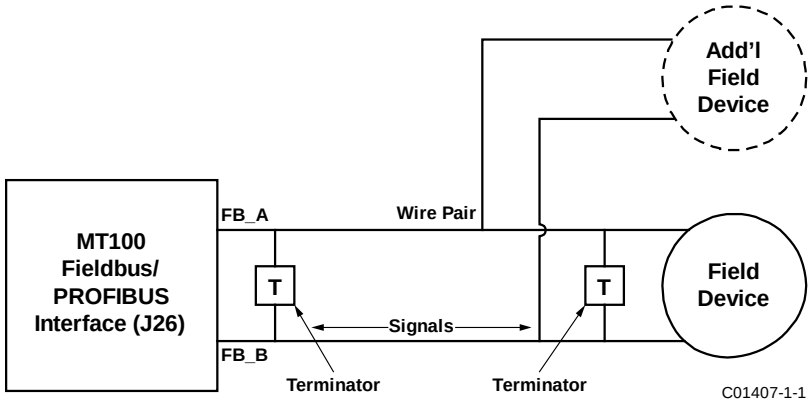


Figure 26 – Fieldbus/PROFIBUS Wiring

Relay Outputs

The MT100 relay interface is provided by the J11 Phoenix connector terminals. The relay connector accepts 28-16 AWG (0.14 mm²-1.5 mm²) wire. Using J11 connect the SPDT relay outputs to the appropriate external circuits as shown in Table 4 below. Relay Contact Rating: 6 A (resistive load).

Table 4 – J11 Relay Contacts Pinout

	Common	Normally Open	Normally Closed
Relay 1 (K1) Terminal (Pin Label)	J11-3 (COM1)	J11-2 (NO1)	J11-1 (NC1)
Relay 2 (K2) Terminal (Pin Label)	J11-8 (COM2)	J11-7 (NO2)	J11-6 (NC2)

Note: 1. J11 terminals 4 and 5 are unused/no connection.

Source/Sink Outputs

Wire the source/sink outputs via the J8 Phoenix connector terminals as required for your device (using sink and/or source output as appropriate) as shown in Figure 27 and Figure 28 below. The connector accepts 28-16 AWG (0.14 mm^2-1.5 mm^2) wire. The source/sink outputs provide a pulse (frequency) output. Observe the output power limits listed below.

- Sink Output: 40 VDC maximum, 150 mA maximum (external, user-supplied power source)
- Source Output: 22 ±2 VDC output, 25 mA maximum (supplied by the flow meter)

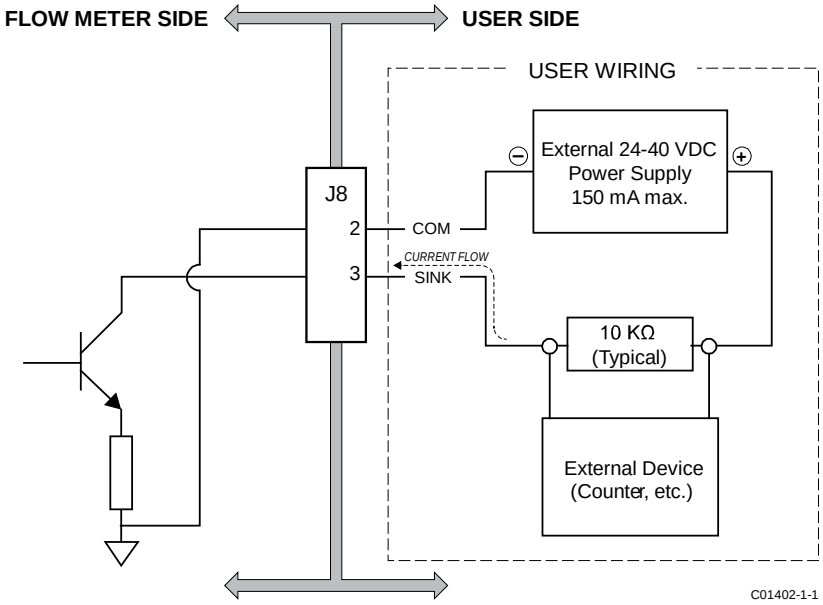


Figure 27 – Sink Output

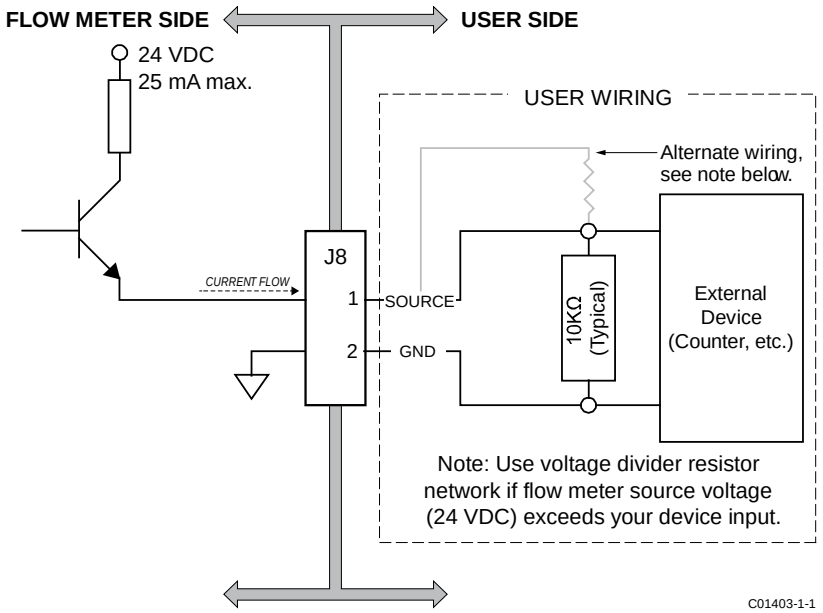


Figure 28 – Source Output

4-20 mA Input

The MT100 is provided with a 4-20 mA input on J8. The connector accepts 28-16 AWG (0.14 mm^2-1.5 mm^2) wire (refer to Table 2, page 23 for wire size vs. length info). Connect the external current loop input to J8-5 (IN) and J8-6 (RTN). The 4-20 mA input is used for the following functions:

- External Input Flow Adjust
- External MT100 Flow Input
- External Control Group Switching

Refer to Extended Operation Modes, page 79 (OPERATION section) for extended operation mode details.

Service Port Connection, USB & Ethernet

Listed below are the MT100 service ports, which are used to configure/monitor the instrument via a PC. See also Configuring the MT100, page 34.

- USB 2.0 – USB Type B connector J22: Use the USB port for local host PC connection to the instrument.
- Ethernet (100Base-T) – modular RJ-45 jack J23: Use the Ethernet port for remote applications in which the host PC communicates with the instrument over an Ethernet (100Base-T) network.

Cabling Entry

Cable entries for flow element and remote electronics enclosures are made via cable glands. Refer to APPENDIX A for specific information.

Cable Gland

A cable gland provides cable strain relief as well as a barrier against moisture. Follow the instructions below for cable gland installation.

Note: The following applies to applications using the Capri ADE 1F2 model cable gland with NPT thread and 316L stainless steel construction. Use only cable glands and/or conduit fittings that meet or exceed the approval rating of the area in which the instrument is installed.

1. Remove perforated center of sealing ring, shown in Figure 29 below, by pushing through with a blunt object. Do not use cable to remove silicone center as this may damage cable or cable gland assembly. Cable gland may be completely assembled during this step.
2. Loosen cable gland and apply plant approved thread lubricant to tightening nut threads as shown in Figure 29 below. FCI recommends use of HTL4 or similar thread lubricant. Use sparingly.
3. Ensure correct orientation of skid washer shown in Figure 29 detail below. This is necessary for proper seal on cable.
4. Hand thread tightening nut but do not tighten fully.
5. Clean and degrease cable gland assembly with plant approved cleaning solution/solvent so that all outer surfaces are free of any lubricant or grease.
6. Thread cable through cable gland.
7. Ensure an adequate length of cable wires are within the enclosure, then tighten cable gland finger-tight.
8. After all enclosure connections are made, torque cable gland tightening nut to about 44.3 in-lb (5 N-m).
9. Clean off any excess lubricant.

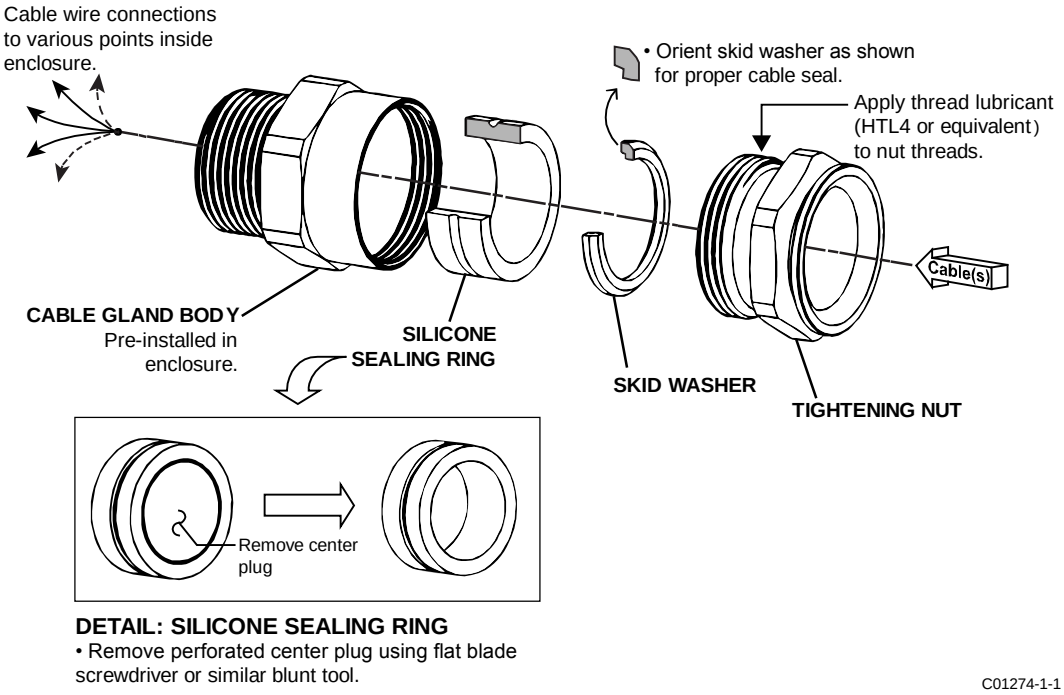


Figure 29 – Cable Gland Installation

3 OPERATION

Introduction

The flow meter has been configured and calibrated to custom specifications. Each flow meter contains distinct operating limits and units of measurement. This section shows how to determine and manipulate the configuration of the flow meter.

Caution: The flow transmitter contains electrostatic discharge (ESD) sensitive devices. Use standard ESD precautions when handling the flow transmitter. Refer to the Use Standard ESD Precautions discussion, page 5.

Startup and Commissioning

Verify the wiring and then apply power to the flow meter. As the instrument boots the LCD shows the FCI logo with a progress bar below it that fills up from left to right. After the progress bar completes (about 30 seconds) a screen similar to that shown in Figure 30 below is displayed.

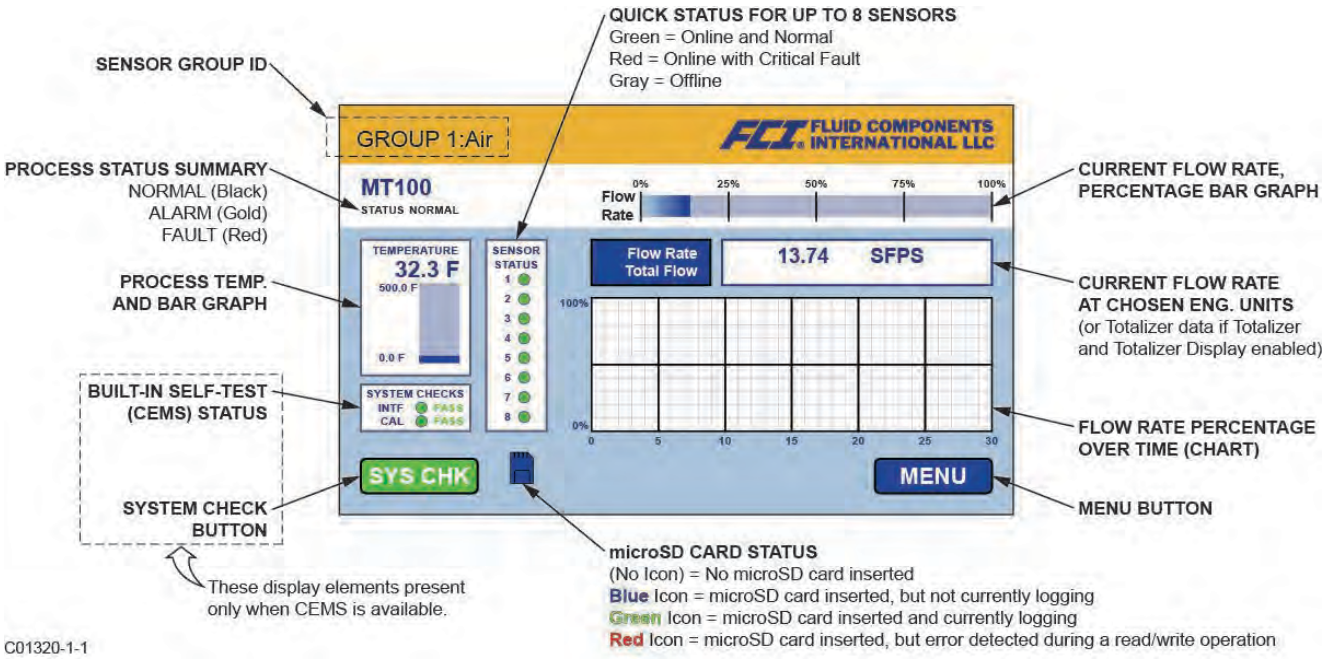


Figure 30 – Parts of the MT100 Normal Process Display Screen

The process display screen shows key information at a glance. Moreover, the instrument LCD touchscreen functions as a basic HMI (Human-machine Interface) setup tool. Open the enclosure door and tap MENU to access the HMI setup menu (refer to Using the Touchscreen Display, page 34). See APPENDIX C, page 145 for an overview of the system's hierarchal menu structure.

Wait a minimum of 10 minutes for flow meter to stabilize. The output signal indicates the media flow. There is no operator action needed because the flow meter operates from the factory settings. There are no special instructions for shutdown of the flow meter; just remove the operating power.

If the output signal is zero, is out-of-range for the expected values or is obviously not right then turn power OFF and refer to TROUBLESHOOTING, page 91 for help with finding the problem.

Operator Interaction

Once set up, there is little need for interaction between the operator and flow meter. The flow meter is fully automatic when it operates in the normal monitor mode. FCI advises the use of factory default settings with which the flow meter was ordered. Do not reset the flow meter's operating values by trial and error. A slow, blinking green LED on the SB4 main board in front of the Sensor 2 connector block provides a quick status check that all is normal.

The output signal provides an instant readout of mass flow. The output signal shows only the flow rates between the upper and lower limits of the calibrated range. For zero-based instruments the output signal will indicate zero flow (4 mA) whenever the flow rate is below the calibrated lower limit. For non-zero-based instruments the output signal will read the minimum specified flow rate.

Using the Touchscreen Display

The MT100's touchscreen display is a resistive type display that relies on deflection of screen layers to register an input. The touch response of a resistive type display is different from the more sensitive capacitive type display that is commonly used in cellphones. For consistent results operate the MT100 touchscreen by tapping firmly using the tip of your fingernail, or use a stylus made for touchscreen use.

Configuring the MT100

There are two ways to configure the MT100:

- HMI Front Panel Menu – Open the enclosure door and tap MENU on the HMI front panel display to access the instrument's Service menu. Refer to APPENDIX C, page 139 for an overall view of the menu structure. Note that the front panel menu provides a small subset of the instrument's settings, which makes the front panel menu an ideal tool for quick adjustments.
- MT100 Configuration Software application – The MT100 comes with software (PC only) that provides comprehensive programming of the MT100 settings via a PC connection to the instrument's USB or Ethernet service port (refer to Service Port Connection, USB & Ethernet, page 31). Configure the MT100 to your application using the MT100 configuration software. Refer to the MT100 Configuration Software manual 06EN003461 for full instructions on the use of the application.

Note: Make sure the MT100 is up and running **before** connecting to USB and/or launching the MT100 configuration software application.

Process Data Logging

The MT100 can record process data (date and time, flow rate, temperature, totalized flow rate, and fault codes) on a microSD memory card. The data stored on the memory card is in comma separated values (.csv) format.

Removing/Inserting Memory Card

Refer to Figure 31 below. The MT100 comes with an 8 MB microSD card. Use a microSD card of up to 32 GB capacity, Class 2 or higher.

1. Tap MENU on the front panel display.
2. Tap LoggerSDcard (under *Service*). This brings up two menu choices: Remove and Inserted.

3a. Removing the microSD card – Tap Remove. After the front panel display shows OK to Remove SD Card carefully slide the microSD card out of its J7 socket. When picking up the card avoid having the card's gold edge contacts touch any metal part or exposed trace or pad on the board.

3b. Installing the microSD card – With the card's gold edge contacts facing down carefully slide the microSD card into its J7 socket and then tap Inserted. Observe that the front panel display shows SD Card Ready For Use followed by the amount of space available on the card. If the system detects an issue the message Error: SD Card Insert Failed is shown.

4. Tap QUIT when done.

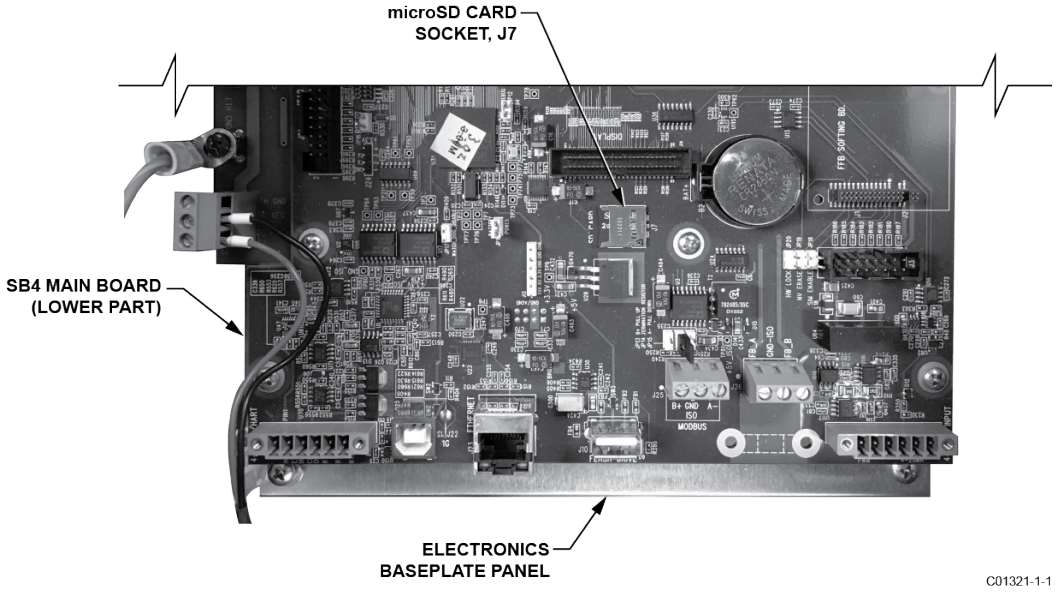


Figure 31 – microSD Card Socket J7 Location

Note: Equivalent memory card insert (Insert SD Card) and remove (Remove SD Card) commands are also provided under the SD Card Logging tab in the MT100 Configuration Software application. Refer to MT100 Configuration Software manual 06EN003461 for more information.

Programming Data Logging

After installing the microSD card in the system use the MT100 Configuration Software application to configure and start/stop data logging. An example SD Card Logging tab screen is shown in Figure 32 below. Configure the *Logging* section of this screen to set up data logging.

- Start Logging: Specifies start time of the first log file. Choose "Start Now" (immediately) or "Date/Time" (future).
- Sample Period: Specifies how often a log file is generated. Period ranges from once every 10 seconds to once every 24 hours.
- Duration: Specifies how long the logging feature remains activated. Duration ranges from 1 minute to 90 days.
- Cancel Logging (button): Click to cancel MT100 logging-in-progress or pending log.

Click Send to Device to send the programming to the instrument. Refer to the MT100 Configuration Software manual 06EN003461 for details.

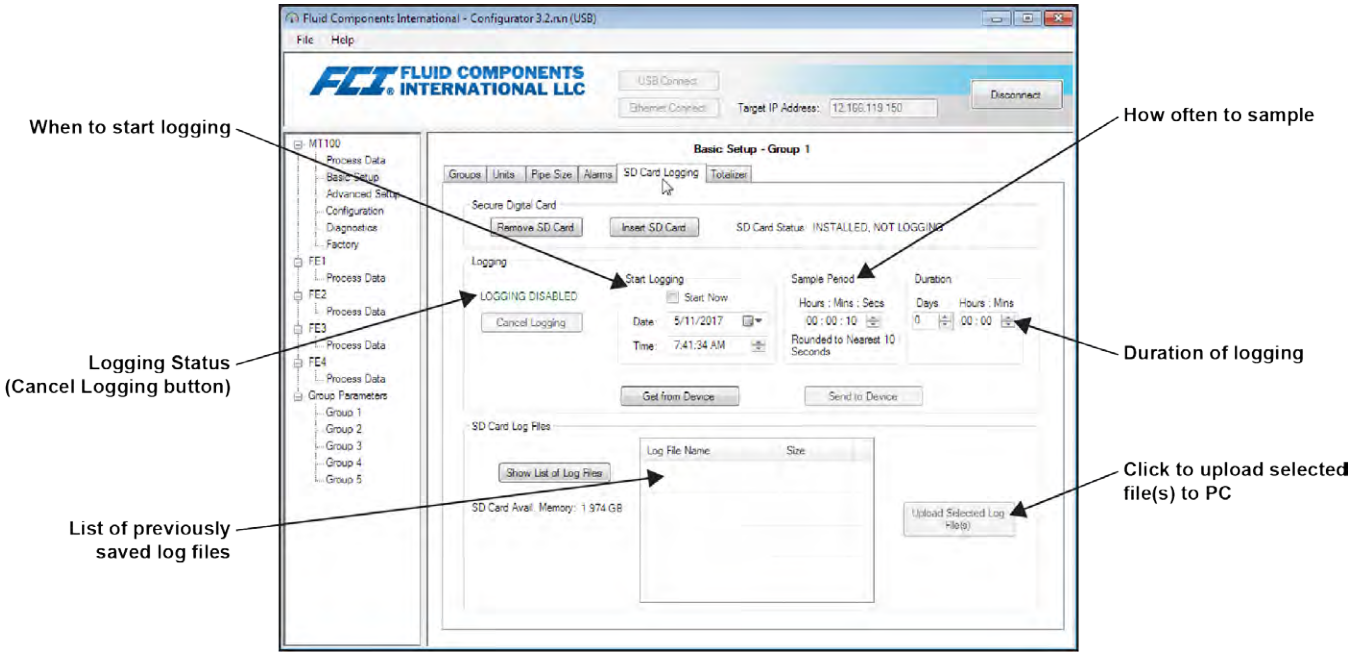


Figure 32 – SD Card Data Logging Example Screen (MT100 Configuration Software)

Data Log File Naming Convention

The .csv (comma separated values) data log file has an "8.3" filename format of: *LGabcdxx*.csv

Where:

LG = fixed ID prefix indicating "Log"
a = year (letter code)
b = month (letter code)
c = day (alphanumeric code 1-9/0/A-U → 1-9/10/11-31)
d = hour (letter code)
xx = minutes (00-59)

Table 5 below summarizes the log file's filename format.

Table 5 – Log File Filename Format LG*abcdxx*.csv

YEAR[1] *(a)* Letter → Year		MONTH *(b)* Letter → Month		DAY *(c)* Alphanumeric → Day		HOUR *(d)* Letter → Hour		MINUTE *(xx)* (00-59)
A	2016	A	Jan	1	1	A	Midnight	00-59
B	2017	B	Feb	2	2	B	1 a.m.	—
C	2018	C	Mar	3	3	C	2 a.m.	—
D	2019	D	Apr	4	4	D	3 a.m.	—
E	2020	E	May	5	5	E	4 a.m.	—
F	2021	F	Jun	6	6	F	5 a.m.	—
G	2022	G	Jul	7	7	G	6 a.m.	—
H	2023	H	Aug	8	8	H	7 a.m.	—
I	2024	I	Sep	9	9	I	8 a.m.	—
J	2025	J	Oct	0	10	J	9 a.m.	—
K	2026	K	Nov	A	11	K	10 a.m.	—
L	2027	L	Dec	B	12	L	11 a.m.	—
M	2028	—	—	C	13	M	12 noon	—
N	2029	—	—	D	14	N	1 p.m.	—
O	2030	—	—	E	15	O	2 p.m.	—
P	2031	—	—	F	16	P	3 p.m.	—
Q	2032	—	—	G	17	Q	4 p.m.	—
R	2033	—	—	H	18	R	5 p.m.	—
S	2034	—	—	I	19	S	6 p.m.	—
T	2035	—	—	J	20	T	7 p.m.	—
U	2036	—	—	K	21	U	8 p.m.	—
V	2037	—	—	L	22	V	9 p.m.	—
W	2038	—	—	M	23	W	10 p.m.	—
X	2039	—	—	N	24	X	11 p.m.	—
Y	2040	—	—	O	25	—	—	—
Z	2041	—	—	P	26	—	—	—
A	2042[1]	—	—	Q	27	—	—	—
—	—	—	—	R	28	—	—	—
—	—	—	—	S	29	—	—	—
—	—	—	—	T	30	—	—	—
—	—	—	—	U	31	—	—	—

Note: 1. After 26 years starting at year 2042, the alphabetical order starts again at "A," repeating up to 4 times for a 104-year span.

Table 6 below lists example log file entries for a log file with the filename: LGDH0I58.CSV.

Table 6 – Log File Entry Example

Year	Month	Day	Time	Flow Rate	Temperature	Pressure	Totalizer	Faults Code
2019	8	10	8:58:00	89.198631	0.028174	0	69269.365	0x00000000
2019	8	10	8:58:10	89.185516	0.027597	0	69269.613	0x00000000
2019	8	10	8:58:20	89.178818	0.029547	0	69269.861	0x00000000
2019	8	10	8:58:30	89.183357	0.027222	0	69270.109	0x00000000

Process Data Log File Handling

There are two ways to access the files stored on the microSD card:

- Remove the microSD card from the instrument (see Removing/Inserting Memory Card on page 34) and insert it into a PC's card reader to access/transfer its files for further analysis/processing. Refer also to Memory Card Log Files on page 49.
- Upload selected log file(s) to a PC using a USB cable and the MT100 configuration software: Start the MT100 configuration software. Click **USB Connect** on the home screen. Select the *Basic Setup* branch from the menu tree on the window's left side. Select the **SD Card Logging** tab. Refer to Figure 32 on page 35. In the *SD Card Log Files* frame click **Show List of Log Files**. Select the desired file(s) from the list displayed. Click **Upload Selected Log File(s)**. A Windows Explorer file dialog pops up showing the host computer file locations. Select the desired location to store the file and click **OK**. The file is then copied to the specified host computer location.

Flow Filtering

Use the configuration software to adjust flow filtering (*Advanced Setup/Flow FIltering*) as required for your application. Refer to the MT100 Configuration Software manual 06EN003461 for software details. The **Flow Filtering** setup screen is shown in Figure 33 below. Two types of flow filtering are available: *Flow Output Damping* and *Flow Input Moving Average Filter*.

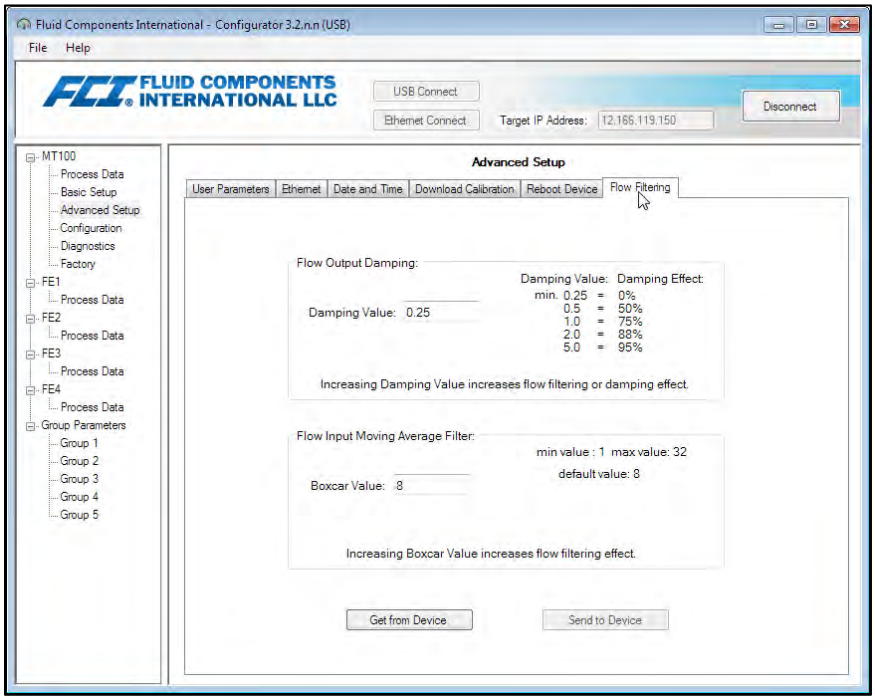


Figure 33 – Flow Filtering Setup Screen

Flow Output Damping

The flow meter has a flow damping setting that is used to smooth out the flow signal output for applications in which process conditions are erratic. Use the configurator software to adjust the flow damping setting (*Advanced Setup/User Parameters*) as required for your application. Refer to the MT100 Configuration Software manual 06EN003461 for details.

As shown in Figure 34 below, an increase in flow damping value results in an output that is increasingly resistant to change (amplitude variations). Compare the chart's blue curve (value = 0.25 for 0% flow damping) with the chart's black curve (value = 5.00 for 95% flow damping). The black curve shows signal excursions that are much more constrained relative to the blue curve.

The minimum value that can be entered is 0.25 (0% flow damping). It is possible to enter a number greater than 5.0 (95% flow damping). The practical limit, however, is 5.0 since 100% flow damping will never be attained regardless of the entered value.

Caution: High flow damping values results in reduced flow response. Make sure that alarm conditions are not affected when using the flow damping feature.

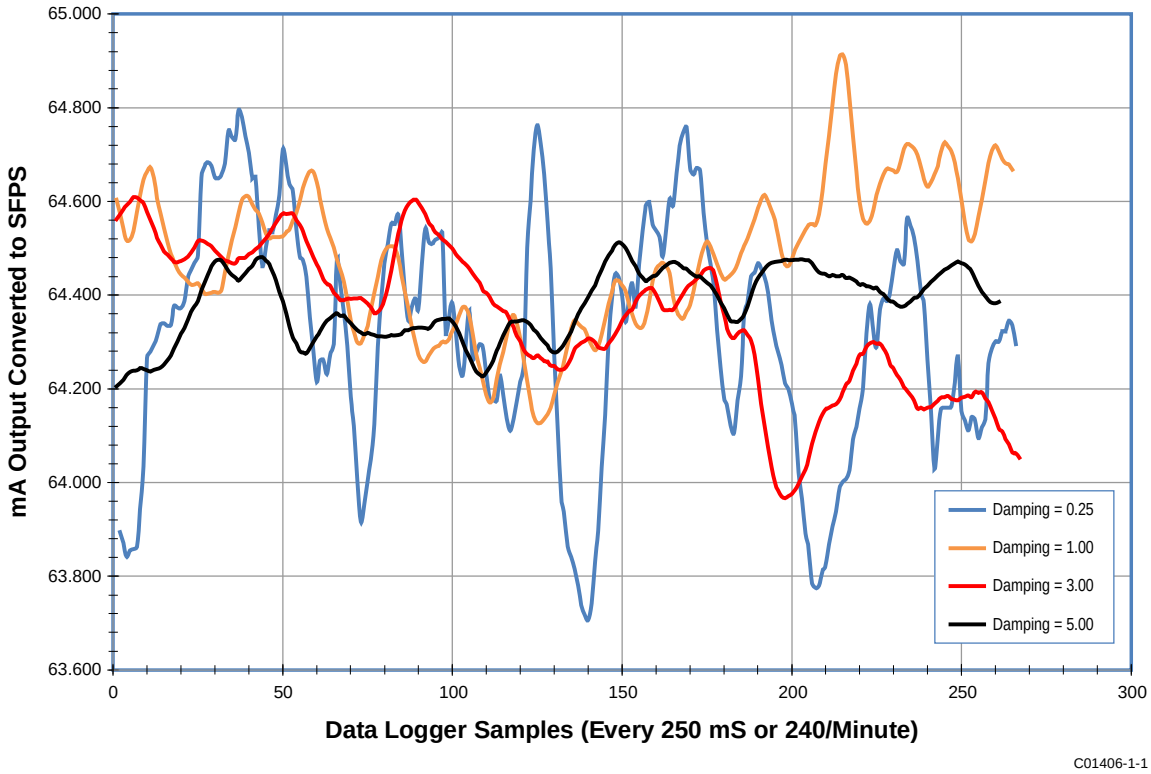


Figure 34 – Chart: Flow Output Over Time with Various Flow Damping Values

Flow Input Moving Average (Boxcar) Filter

Use the *Flow Input Moving Average Filter* field to smooth out the input flow signal using a moving average (boxcar) filter. The boxcar filter averages the last X number of readings. A larger boxcar value does a better job of averaging at the expense of a slower response time. The factory default boxcar value is 8 (readings). With readings occurring at 5 times a second, the factory boxcar setting is an average of the last 1.6 seconds.

Caution: High boxcar values reduce the flow response time. Make sure that alarm conditions are not affected when using the moving average filter.

NAMUR Setup

NAMUR NE43 is a German fault detection standard that lets the user know if there is a fault within the instrument by forcing the 4-20 mA output current outside the normal operating range of the instrument.

Figure 35 – NAMUR Fault

Use the MT100 configuration software to enable/configure the NAMUR feature. The HMI cannot access NAMUR.

Click **USB Connect** on the home screen. Select the *Configuration* branch from the menu tree on the window's left side. Select the **4-20mA User** tab. Tick the desired channel's **NAMUR Enabled** checkbox.

In the window's NAMUR field, define the NAMUR output level by clicking either **Set NAMUR @ 3.6 mA** or **Set NAMUR @ 21.0 mA**. Click **Send to Device** to save the settings to the instrument. To discard changes just exit the screen (do not click **Send to Device**).

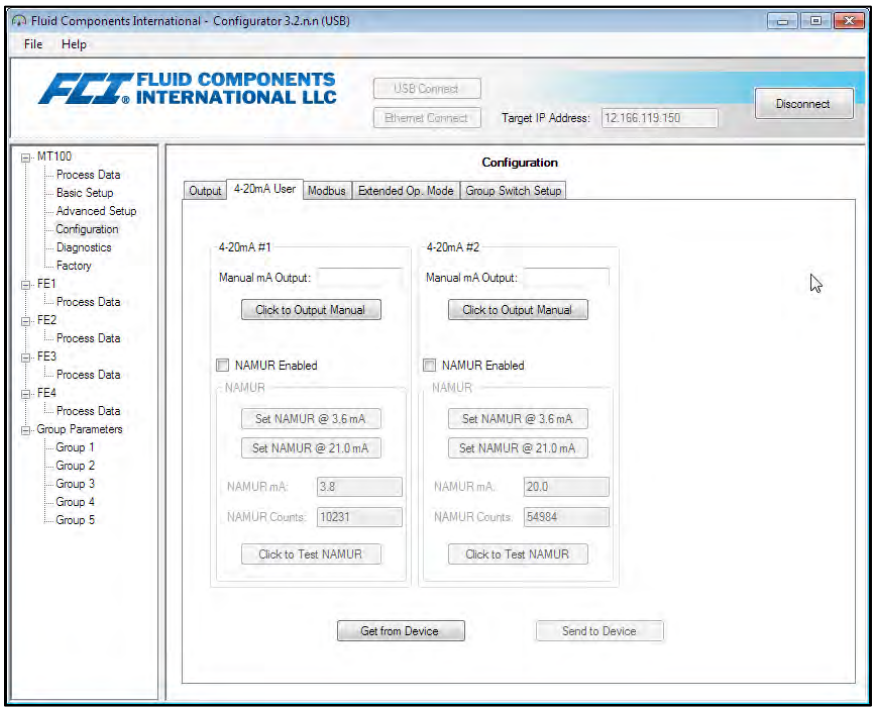


Figure 36 – NAMUR Output Level Selection

When NAMUR is enabled, and a fatal fault is detected, the 4-20 mA output is forced to the preselected NAMUR output level. Use the **Click to Test NAMUR** button (forces NAMUR output) as needed to verify the system setup and wiring.

Table 7 – Fatal Faults That Trigger NAMUR

Fault Bit	Fatal Fault Error Or Status Descriptions
0	CORE: any of these errors: I2C error, UART error, Mutex error or Watchdog Reset.
3	CORE: unable to update process data (PD_NO_FE_DATA). Unable to obtain/use data from any active FEs.
5	CORE: detects FRAM/SPI error.
10	(Any) FE Board Temperature Out of Limits
13	CORE: unable to communicate with one or more FEs (PD_COMM_ERROR).
19	CORE: averaged temperature above “Temperature Max.”
20	CORE: averaged temperature above “Temperature Min.”
21	(Any) FE reports SENSOR_HEATER_SHORTED_FAULT.
23	(Any) FE reports SENSOR_HEATER_OPEN_FAULT.
26	(Any) FE reports SENSOR_ ADC_BELOW_ MIN_FAULT.
29	(Any) FE reports SENSOR_ ABOVE_ MAX_TEMPERATURE_FAULT.
30	(Any) FE reports SENSOR_ UNDER_ MIN_TEMPERATURE_FAULT.
31	(Any) FE reports TMP100_TEMPERATURE_ADC_FAULT.
32	(Any) FE reports LTC2654_DAC_FAULT.
34	(Any) FE reports REFERENCE-R ABOVE ABSOLUTE MAX VALUE FAULT.
35	(Any) FE reports I2C0_FAULT.
36	(Any) FE reports HEATER_MONITOR_ADC_FAULT.
37	(Any) FE reports PORT_EXPANDER_FAULT.
38	(Any) FE reports DELTA-R_ADC_FAULT.
39	(Any) FE reports REF-R_ADC_FAULT.
40	(Any) FE reports FE_FRAM_FAULT.
41	(Any) FE reports ACT_EXC_CURRENT_FAULT.
42	(Any) FE reports REF_EXC_CURRENT _FAULT.
44	(Any) FE reports REFERENCE-R BELOW ABSOLUTE MIN VALUE FAULT.
45	(Any) FE reports DR ABOVE ABSOLUTE VALUE FAULT.
46	(Any) FE reports DR BELOW ABSOLUTE MIN VALUE FAULT.

CEMS Operation (Option)

CEMS (Continuous Emissions Monitoring System) is an optional MT100 safety feature that combines robust self-checks (with corresponding onboard relay actions) with data acquisition and handling. Figure 37 below shows the HMI front panel display elements specific to the CEMS option.

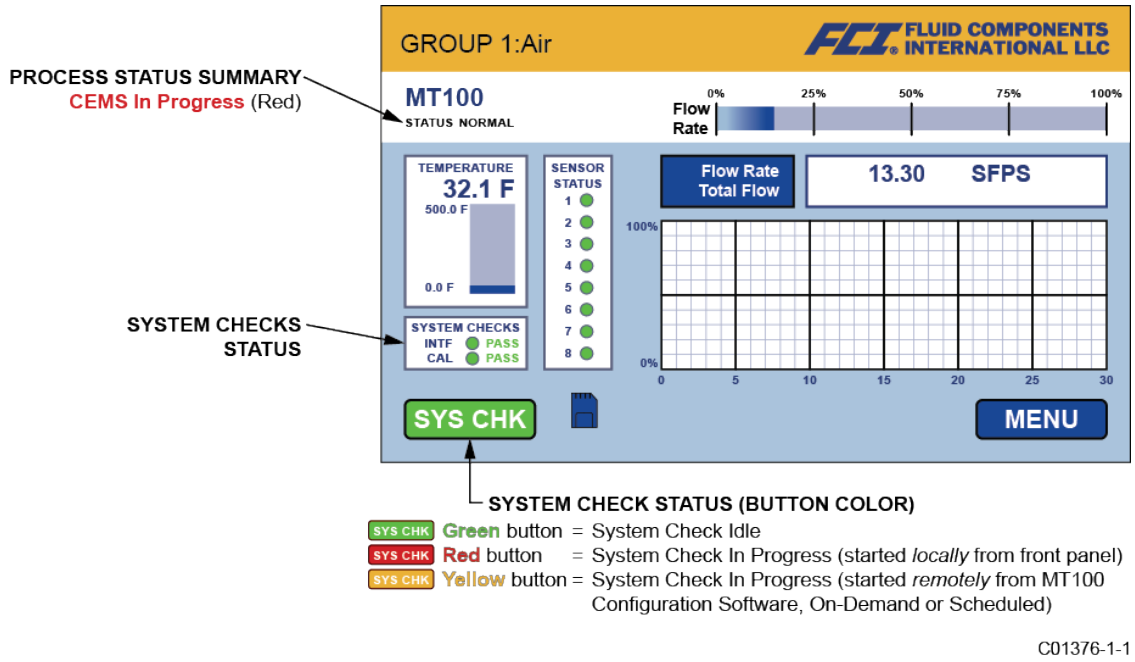


Figure 37 – CEMS Option, Specific HMI Front Panel Display Elements

Perform the MT100 CEMS system checks in one of two ways:

- *On-Demand System Check* – System checks are done on demand by the user using either the HMI front panel display SYS CHK button or the MT100 Configuration Software application.

  From the front panel display:

  Start Test: Tap SYS CHK. Observe that the button color turns red and that the System Checks status box shows "In Progress" and that the Process Status Summary shows "CEMS In Progress" in red.

  Note: With the factory default settings, CEMS takes 10 minutes to complete.

  Results: When CEMS completes, the overall test results are displayed in the System Checks status box. If no issues are detected for either flow element (FE) or calibration, the System Checks status box shows PASS (in green) status for INTF (interference) and CAL (calibration) respectively (see Figure 37 above). If, however, an issue is detected in the FE and/or calibration FAIL (in red) is shown for INTF and/or CAL respectively.

  From the MT100 Configuration Software application:

  Start Test: Go to the CEMS On-Demand tab (from Diagnostics branch from menu tree on the window's left side). Click Start On-Demand CEMS Test. In the window's *On-Demand Test Status* field, observe that the CEMS Progress bar shows the test in progress as it grows in length (left to right) and that *CEMS Test Status* shows "In Progress" in red. Other information shown in the Test Status field includes relay ON/OFF status. Observe also that the front panel SYS CHK button turns yellow and the Process Status Summary shows "CEMS In Progress" in red. Refer to the MT100 Configuration Software manual 06EN003461 for details.

  Note: With the factory default settings, CEMS takes 10 minutes to complete.

  Results: When CEMS completes, the overall test results are displayed in the front panel display System Checks status box. If no issues are detected for either flow element (FE) or calibration, the System Checks status box shows PASS (in green) status for INTF (interference) and CAL (calibration) respectively (see Figure 37 above). If, however, an issue is detected in the FE and/or calibration FAIL (in red) is shown for INTF and/or CAL respectively.

- *Automatic/Scheduled System Check* – System checks are done automatically at a user-specified time. This is set up using the MT100 Configuration Software application only.

  Start Test: Go to the CEMS Scheduled tab (from Diagnostics branch from menu tree on the window's left side). Set the desired start time using the Start Time spinner buttons. Then click Send to Device to transmit the programming to the instrument. When the start time is reached the test starts. In the window's *Scheduled Test Status* field, observe that the CEMS Progress bar shows the test in progress as it grows in length (left to right) and that *CEMS Test Status* shows "In Progress" in red. Other information shown in the Test Status field includes relay ON/OFF status. Observe also that the front panel SYS CHK button turns yellow and the Process Status Summary shows "CEMS In Progress" in red upon start of test. Refer to the MT100 Configuration Software manual 06EN003461 for details.

  Results: After 10 minutes (with default CEMS settings) the overall test results are displayed in the front panel display System Checks status box. If no issues are detected for either flow element (FE) or calibration, the System Checks status box shows PASS (in green) status for INTF (interference) and CAL (calibration) respectively (see Figure 37 above). If, however, an issue is detected in the FE and/or calibration FAIL (in red) is shown for INTF and/or CAL respectively.

  Note: With default CEMS settings, 10 minutes is the absolute minimum start time difference between idR Scheduled Tests and CEMS Scheduled. If CEMS default time(s) have changed make sure that the start time for CEMS Scheduled as well as the overall duration of CEMS Scheduled do not overlap with idR Scheduled Tests. Refer to the MT100 Configuration Software manual 06EN003461 for details. (Changing CEMS settings, and configuring CEMS Scheduled and idR Scheduled Tests can only be done using the configuration software application.)

System Checks Overview

The test sequence for on-demand and scheduled system checks are summarized below. The on-demand and scheduled tests are done for FE1-FE4 and FE5-FE8 and results in 43 bytes of data for each FE group. View the data using the front panel HMI menu display (Service/Diagnostics) or MT100 Configuration Software application. Download the data using the MT100 Configuration Software application.

Note: Test parameters such as heater ON/OFF time, relay ON time, 4-20 mA output duration, and idR and dR Ω max. error are defined in the CEMS Settings tab in the MT100 Configuration Software application. CEMS takes 10 minutes to complete with the factory default parameter settings. Refer to the MT100 Configuration Software manual 06EN003461 for details.

1. Get the time stamp for the test.
2. Energize Relay1.
3. Turn all heaters OFF (with default value of 2 minutes).
4. Set the 4-20 mA output to 4 mA (with default value of 2 minutes).
5. Check to see if the Heater-OFF timer has elapsed.
6. When the Heater OFF timer has elapsed, read (External) delta-Rs, set the Interference error flag if out of tolerance or the head is not properly connected, switch the ADC input to Low Internal Delta-Rs, and start the 4-20 mA output timer (with default value of 2 minutes).
7. Check to see if the 4-20 mA output timer has elapsed.
8. When the 4-20 mA output timer has elapsed, read Low Internal Delta-Rs, set the Calibration error flag if out of tolerance, switch the ADC input to Middle Internal Delta-Rs, set the 4-20 mA output to 12 mA, and restart the 4-20 mA output timer.
9. When the 4-20 mA output timer has elapsed, read Middle Internal Delta-Rs, set the Calibration error flag if out of tolerance, switch the ADC input to High Internal Delta-Rs, set the 4-20 mA output to 20 mA, and restart the 4-20 mA output timer.
10. Check to see if the 4-20 mA output timer has elapsed.
11. When the 4-20 mA output timer has elapsed, read Internal High Delta-Rs, set the Calibration error flag if out of tolerance, switch the ADC input to (External) Delta-Rs, set the 4-20 mA output to 4 mA, turn all heaters ON (with default value of 2 minutes).
12. If there is an error (or more), turn Relay2 ON (with default value of 2 minutes).
13. If there has been an error, check to see if the longer timer (the Relay2 ON timer or the Heater ON timer) has elapsed. If it has, turn Relay1 and Relay2 OFF and end the test.
14. If there has not been an error, check to see if the Heater ON timer has elapsed. If it has, turn Relay1 OFF and end the test.

When the test completes, the 4-20 mA output follows the actual process data (flow) value.

Touch Screen Calibration

The MT100 front panel touch screen is calibrated at the factory. The MT100 display shows a touch screen calibration problem (lost/corrupted) with the message **Press and hold (10 sec) anywhere on screen to enter Touch Screen Calibration**. See Figure 38 below.

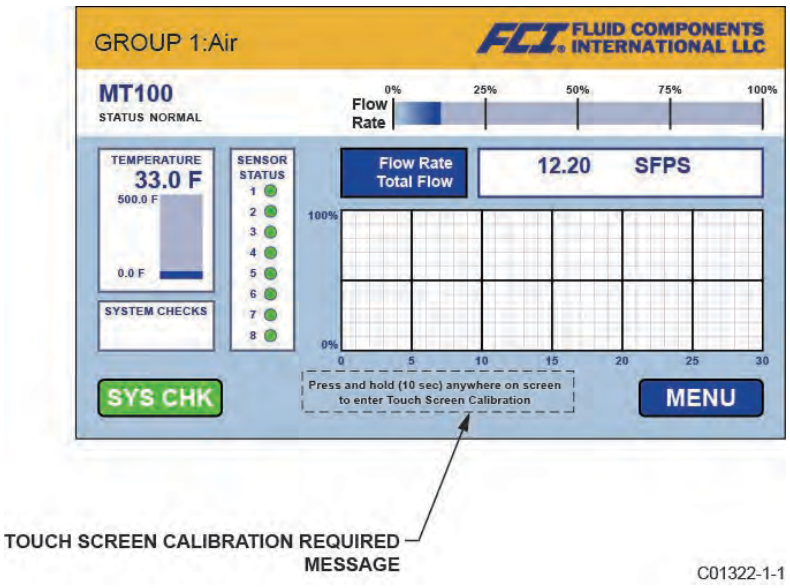


Figure 38 – Process Screen Showing Touch Screen Calibration Required

Should the "calibration required" message appear, press anywhere on the process data screen for 10 seconds. This brings up the touch screen calibration screen, which shows three green button targets. See Figure 39 below. Tap each button in the indicated sequence (button turns red when tapped) to calibrate the touch screen. Touch screen calibration can be done at any time using the front panel MENU (MENU/Set-up/Display/Screen Calibration) or pressing anywhere on the process data screen for 10 seconds.

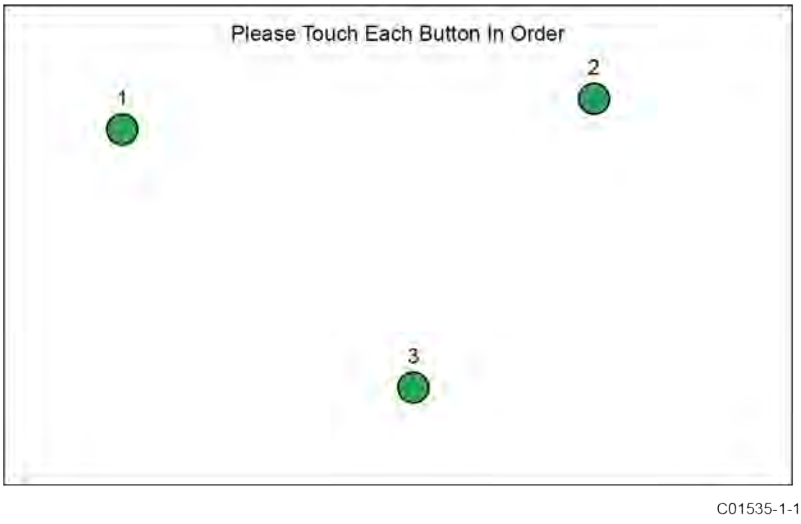


Figure 39 – Button Targets on Touch Screen Calibration Screen

Multi-Input Flow Element (FE) Processing

The MT100 has a **50% Rule** setting that determines how the system processes multiple flow elements (FEs) in the event of flow element failure. Use the MT100 Configuration Software application to adjust this setting. Refer to the MT100 Configuration Software manual 06EN003461 for details.

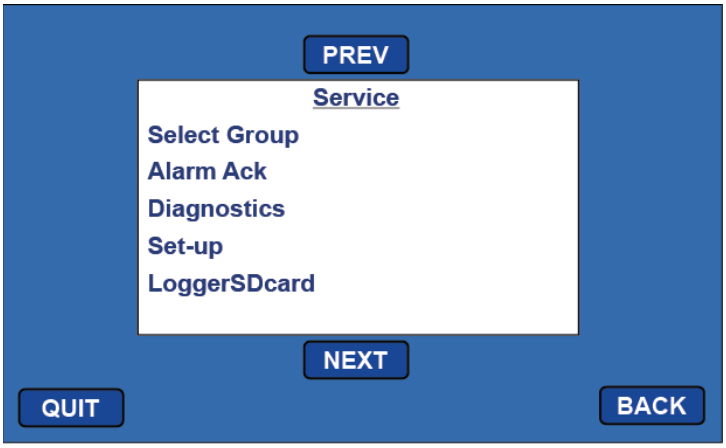
50% Rule Enabled (Default): When 50% or more of the total enabled flow elements (FEs) are functioning, the MT100 system outputs the averaged flow and temperature values of the functional FEs. When less than 50% of the enabled FEs are functioning, the MT100 system outputs zeros for flow and temperature.

50% Rule Disabled: The MT100 system outputs the averaged values of any working FE in the system, even if it is down to one functional FE.

Turning ON or OFF a Specific Flow Element

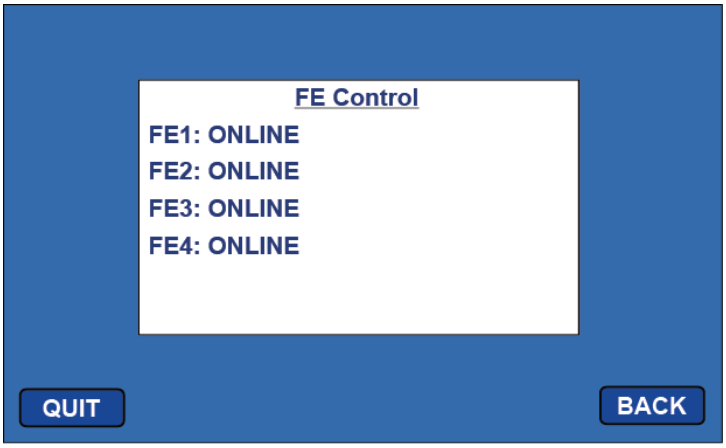
A specific flow element can be turned ON (online) or OFF (offline) as needed via the front panel HMI display.

1. Tap **MENU** on the front panel HMI display. This brings up a list of items under the heading **Service**.



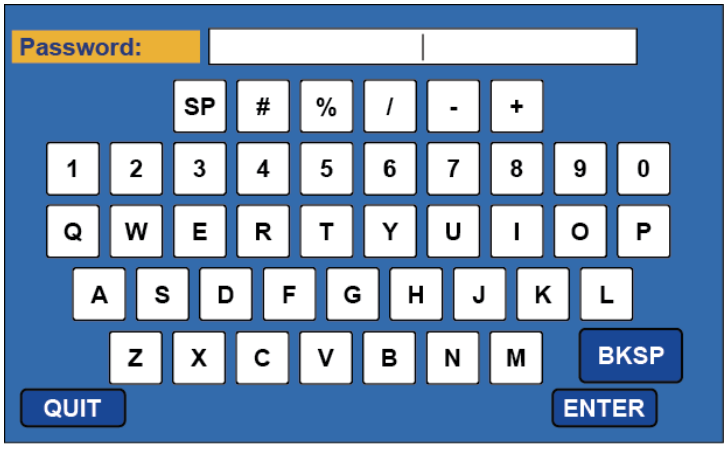
C01382-1-1

2. Tap **NEXT**, and then tap **FE CONTROL**. This brings up the FE Control screen showing the ON/OFF status of the FEs in the system.



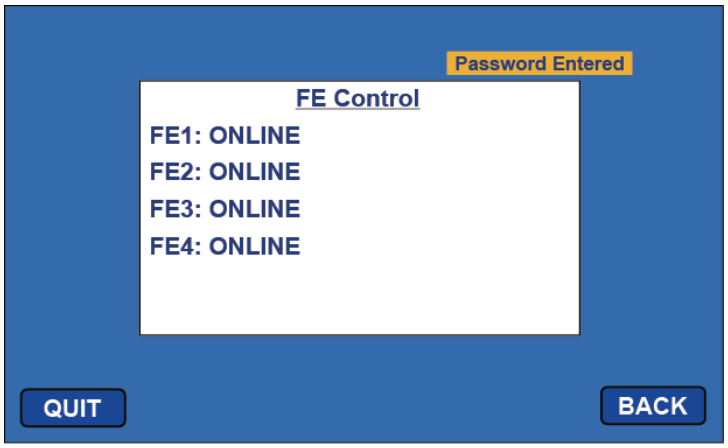
C01383-1-1

3. Tap on the FE that you want changed to the other state. This brings up the password entry screen if the password wasn't entered earlier in the menu session.



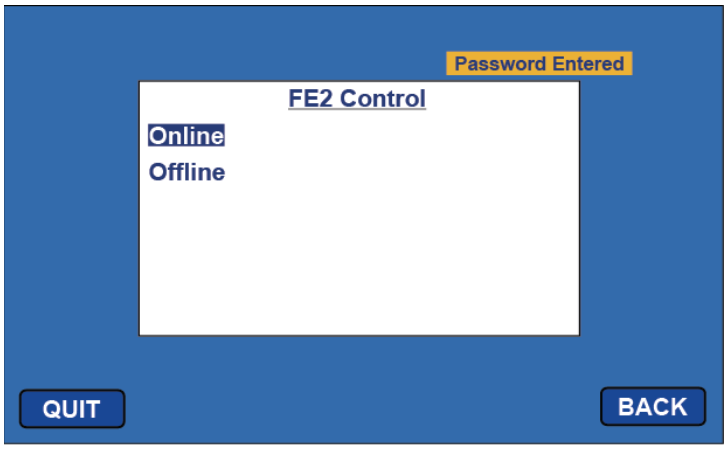
C01384-1-1

4. With the password entry screen on display tap in 8FE# followed by ENTER. The FE Control screen displays again, this time with "Password Entered" showing on the upper right.



C01385-1-1

5. Tap on the FE that you want changed to the other state. This brings up a screen showing Online and Offline. Current status is the one shaded. Tap on the unshaded item to change the FE's ON/OFF status and to return to the FE Control screen. Tap QUIT to exit the menu.



C01386-1-1

Internal Delta-R Resistor (idR) Check

The Internal Delta-R Resistor (idR) Check is a routine designed to assess the MT100 internal normalization. The normalization process fine tunes the instrument's ability to accurately measure resistance. Proper normalization also allows FCI electronics to be interchangeable for replacements, spares or repaired boards. If the unit's normalization shifts, the accuracy of the meter may be compromised.

By passing the same sensor excitation current used to power the RTDs across three high precision idR resistors (60 Ω, 100 Ω, and 150 Ω) trendng patterns can be established. Periodically run the idR check to verify proper operation of the MT100 electronics. Use the idR check as a troubleshooting tool to isolate a fault between the sensor and the electronics.

Running the idR Check Using the HMI Display

Tap MENU on the HMI front panel display to access the instrument's Service menu. Select (tap) Diagnostics and then Self Test. Select a sensor either FE 1 IDR through FE 4 IDR or FE 1 IDR through FE 8 IDR, depending on system configuration. Enter the User Level password: 8FE#. After successful password entry, the display shows the Self Test list again. Select (again) the desired FE. Observe that Test in Progress displays along with a timer counting down the seconds. See Figure 41, page 48 for the idR check display sequence.

When the idR check completes, the expected and measured values for each idR resistor are shown on the HMI display as shown in the example in Figure 40 below. The screen's leftmost column numbers show the expected resistor values (ohms). The middle column numbers show the actual measured resistor values. The rightmost column shows the idR check PASS/FAIL result for each resistor. If all three checks pass, PASSED displays at the bottom. Should any one of the three checks fail, FAILED displays at the bottom. Data from an HMI-initiated idR check is not saved; therefore, record the data by hand as required.

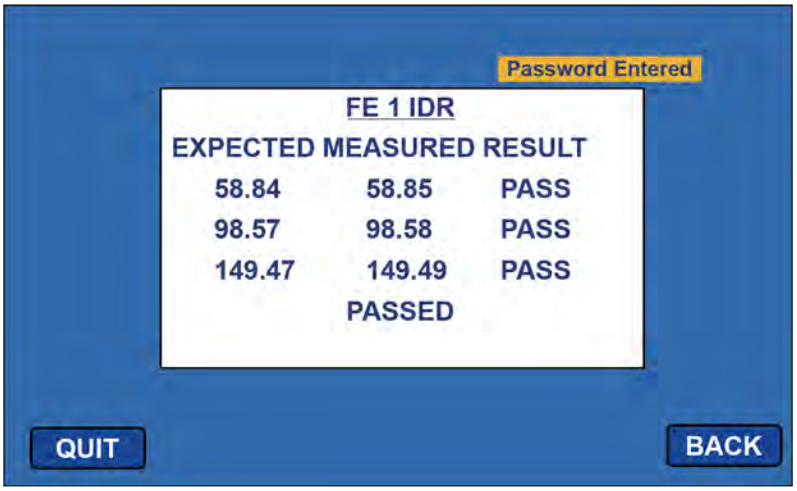
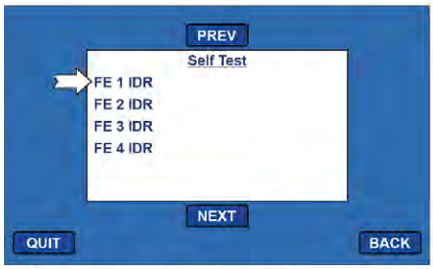


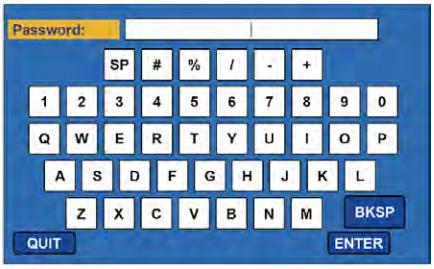
Figure 40 – Example idR Check Results Display

1 Tap **MENU**. Then select **Diagnostics** from the Service menu.

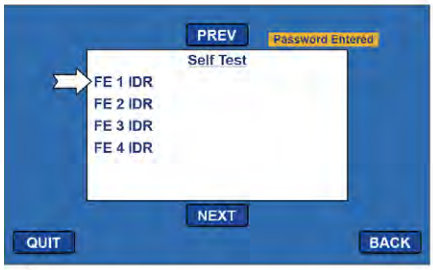
2 From **Diagnostics**, select **Self Test**.



3 Choose an FE to check (example: **FE 1 IDR**).

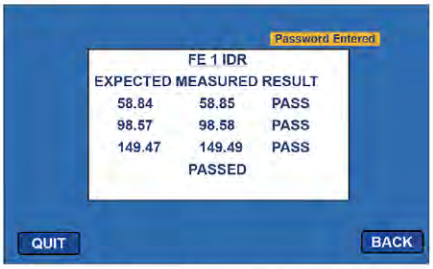


4 Enter the user password: 8FE#



5 With password entered, choose the FE again.

6 Observe idR check in progress (seconds countdown).



7 The idR check is complete. Record values for comparison.

C01536-1-1

Figure 41 – Internal Delta-R (idR) Resistor Check HMI Display Sequence

Running the idR Check Using the MT100 Configuration Software

Click **USB Connect** on the home screen. Select the *Diagnostics* branch from the menu tree on the window's left side. Select the **idR Scheduled Tests** tab. Select the "FE #" desired from the **Selected FE** drop-down list. Two settings that affect scheduled and on-demand idR tests are provided on this screen: *FEx Internal Delta-R Pass Fail Criteria*, **Maximum Allowed Error** (default = 0.5 ohms) and *FEx Output Mode During Test*, **Mode** (default = Freeze Flow During Test). Make changes to the default settings as required for your application.

In the *FEx Scheduled Internal Resistor Check* field, use the **Mode** drop-down list to select a schedule mode: Disabled (default), Day of Month (1-28), Day of Week (0=Sun), or Every(Day). Use the **Day, #days, DOW** spinner control to define the selected schedule mode. Use the **Time** spinner control to enter the desired scheduled check start time. Alternatively, click **Run test now on FEx** to run the idR check on demand.

After clicking **Run test now on FEx** the *FEx idR Test Results* field displays the expected and the measured resistance values. These instant checks are not logged to the FRAM and not displayed under the **Test Logs** tab as the Scheduled Tests files. Furthermore, they cannot be added to the SD card logs.

Each FE can have its own unique **idR Scheduled Tests** settings as shown by the **Selected FE** drop-down list selection. To make all FEs use the same settings displayed on-screen, tick the **Set All FEs to This Selection** checkbox.

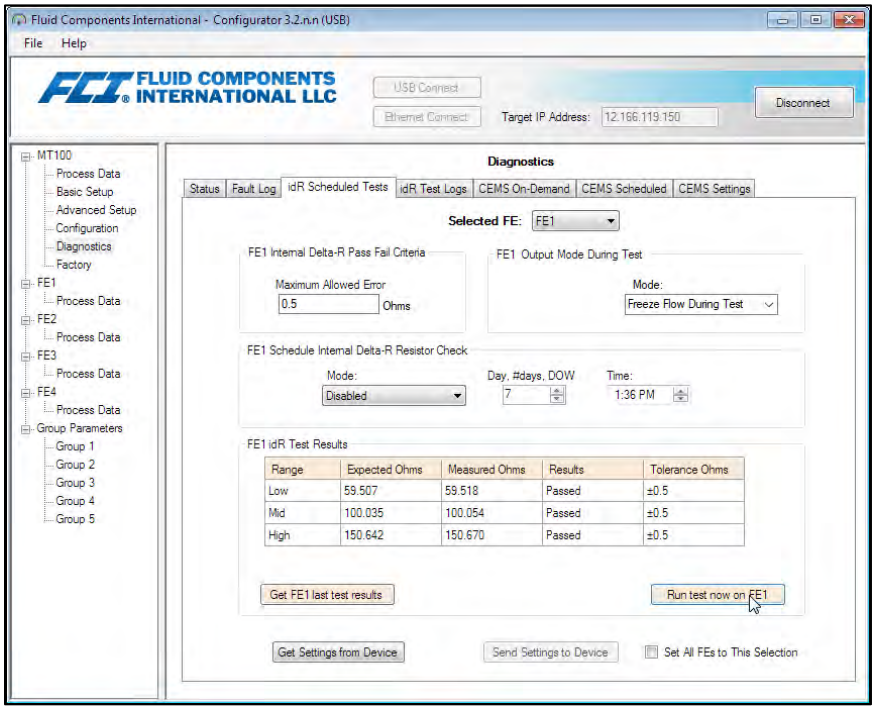


Figure 42 – Example Internal Delta R Scheduled Tests Screen (After Clicking "Run test now...")

View idR files using the **idRTest Logs** tab. Add these files to the microSD card for further analysis by clicking **Add to SD Card Logs**. Manually remove the microSD card to transfer these idR log files to a PC via a card reader. See Removing/Inserting Memory Card on page 34.

Memory Card Log Files

The log files stored on the microSD card are .csv (comma separated values) files, of which there are three types.

The idR log file is always named "DLTRLOG," which is amended every time a new scheduled test is initiated. Process data log files are always a new file with a unique file name (see Data Log File Naming Convention, page 36). The fault log is always named FAULTLOG. See Figure 43 below for an example of how these files appear in Windows Explorer.

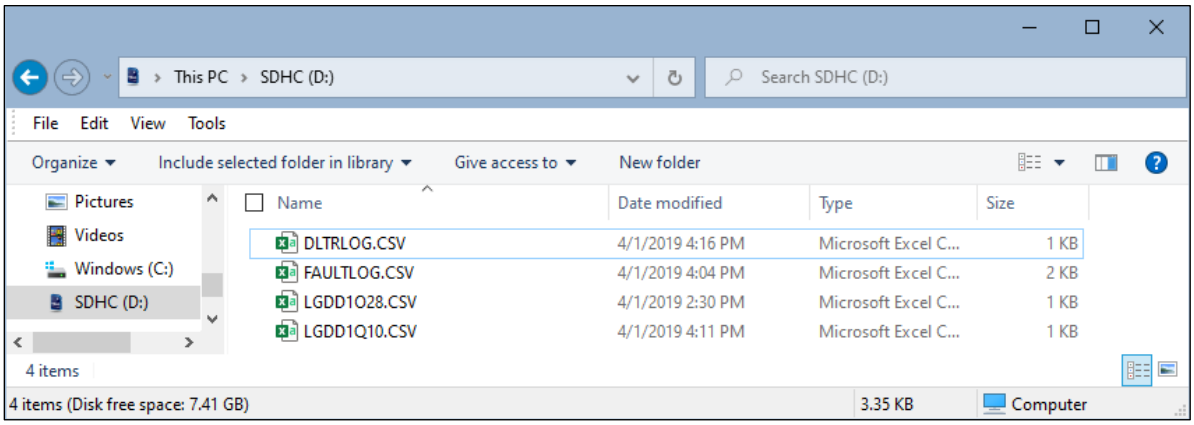


Figure 43 – Example microSD Card Log Files in Windows Explorer: idR Log, Process Data Log, and Fault Log

Year	Month	Day	Time	FE	Act Ohms	Exp Ohms	Act Ohms	Exp Ohms	Act Ohms	Exp Ohms
2020	6	24	12:00:10	0	59.96	60	99.79	100	149.78	150
2020	6	24	12:00:20	1	59.94	60	99.81	100	149.77	150
2020	6	24	12:00:30	2	59.97	60	99.78	100	149.77	150
2020	6	24	12:00:40	3	59.98	60	99.78	100	149.78	150
2020	6	25	12:00:10	0	59.96	60	99.79	100	149.78	150
2020	6	25	12:00:20	1	59.94	60	99.81	100	149.77	150
2020	6	25	12:00:30	2	59.96	60	99.78	100	149.77	150
2020	6	25	12:00:40	3	59.97	60	99.78	100	149.78	150

Figure 44 – Example Internal Delta-R Log File Results (Data Formatted and Titles Added using Microsoft Excel)

Using Digital Outputs

Digital busses (includes HART, Modbus, and FOUNDATION Fieldbus/PROFIBUS) are mutually exclusive, meaning only one can be active at a time. When a particular digital output is specified at order time the unit is configured appropriately at the factory. Use the MT100 configuration software (*Configuration*/*Output*) to change the digital output selection. Refer to the MT100 Configuration Software manual 06EN003461 for details.

FOUNDATION Fieldbus/PROFIBUS operation requires the optional Fieldbus/PROFIBUS add-on card. See Figure 23, page 26 for the add-on card location.

Explanation of Non-Zero Based and Zero Based Calibration

Non-Zero Based Calibration

In a non-zero based calibration, the low-limit output signal (4 mA) is equal to the minimum calibrated flow. The minimum calibrated flow is a value greater than zero. The flow meter's output signal indicates the low-limit flow signal (4 mA) from zero flow up to the low-flow limit parameter. Use a non-zero based calibration when the minimum flow rate does not approach zero and the turndown ratios are small.

At no-flow the output signal indicates the minimum calibrated flow (4 mA).

Zero Based Calibration

In a zero-based calibration, the slope of the output signal is shifted so the low-limit flow output signal (4 mA) is equal to zero flow. See Figure 45 below for details. Flow meters cannot measure zero flow accurately. The flow meter reads out the low-limit signal (4 mA) from zero flow up to the minimum calibrated flow at which point the output signal steps up to the proper signal value of the mass flow.

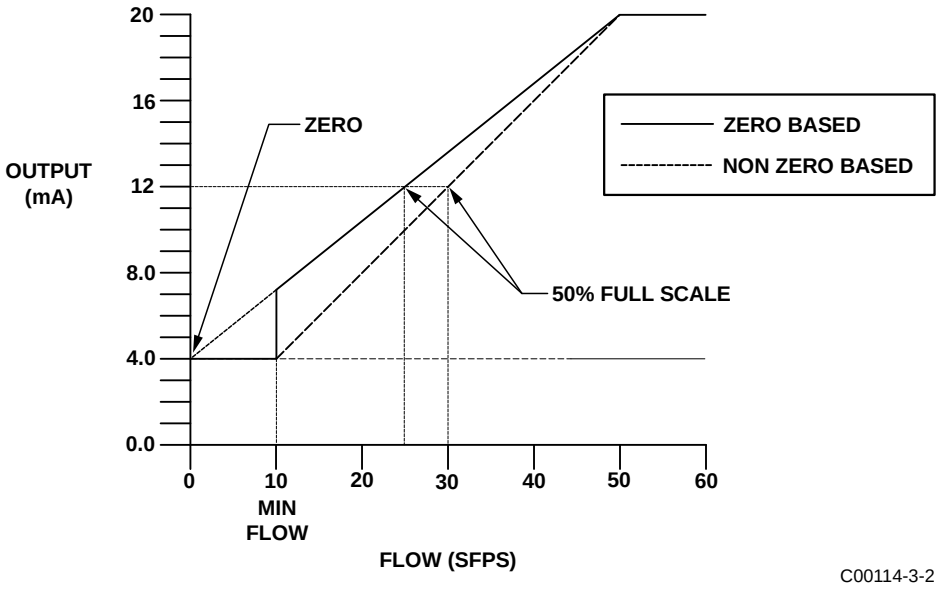


Figure 45 – Zero Based Calibration

The output signal is easier to interpolate when milliamp output is interfaced with control room 0 to 100% gauges; 50% of the signal will correspond to 50% of the maximum flow rate.

Zero-based flow meters have less signal to resolve over full scale. A zero-based flow meter with a turndown ratio of 10:1 will have 10% less output range to resolve flow (5.6 mA to 20 mA instead of 4 mA to 20 mA in a non-zero-based flow meter).

Zero-based calibration is the factory default.

Delta R Table

The Delta R sheet included with the instrument contains simulated sensor data for the flow meter. The Delta R portion of this sheet relates calibration measurement points of the differences (delta) between the reference and active RTDs at certain flow rates.

These parameters are used at the factory to determine the linearization coefficients (parameters) over the flow range in question to correct for non-linearity. The corresponding current and voltage output readings are also shown (again at factory default settings) changes to range and zero will only affect the output signals. Flow versus Delta R relationship is fixed for a given set of flow elements and the coefficients should not be changed except in special circumstances as the overall accuracy of the system is tied to these numbers. Call Customer Service if there is a problem in this area.

The Calibration Table is a printout (at factory default settings for zero and offset) of the relationship of displayed mass flow readings related to the current output when calculated over the entire flow range using the fitting equation and its respective coefficients.

HART Operation

HART (Highway Addressable Remote Transducer) is a communication protocol that superimposes a low level digital data signal on a 4-20 mA current loop. The primary function of the instrument's HART interface is to present process data via process data commands 1, 3 and 9.

The MT100 does not implement the HART Burst mode. A HART master that supports HART 7.0 and higher is required. If using a HART communicator, a unit that supports HART 7.0 or higher is required (i.e. Emerson 475 Communicator). Connect the installation (factory/plant) HART wiring to the instrument as described in HART, page 27.

Process Data Operation

The MT100 implements HART 7.0 while maintaining compatibility with earlier versions of the HART protocol. However, HART commands 1 and 3 have been simplified to only report the primary variable Flow. Use command 9 to access the full suite of available dynamic variables including temperature, totalizer, and others.

MT100 HART Process Data Organization

This section describes how the instrument process data is organized under the HART command 9. For details on command 9 see the HART Specification "Universal Commands Specification" HCF_SPEC-127, Revision 7.1 and the command 9 description on page 62.

MT100 Process Variable Slots

Table 8 below lists the instrument's 6 process variables that are read by HART command 9, with each process variable assigned a slot number.

Not all the variables described in this section are available in all configurations of the flow meter. For example, the Flow Totalizer may be turned on or off.

The process variables include 3 flow classes or types of which only one class of flow is active at a time.

Table 8 – MT100 HART Process Variables

Slot #	Process Variable	HART Variable Code Description	Device Variable Code	Device Variable Classification
0	Volumetric Flow[1]	Primary Variable	0	66
1	Volume (Totalizer)	Secondary Variable	1	68
2	Mass Flow[1]	Primary Variable	2	72
3	Mass (Totalizer)	Secondary Variable	3	71
4	Velocity Flow[1]	Primary Variable	4	67
5	Temperature	Tertiary Variable	5	64

Note: 1. Only one active at a time.

Primary Variable Classifications

The instrument can provide flow data in unit types that span several HART classifications. Commands 50 and 51 are used to read and set, respectively, which flow variable will be mapped to the primary variable. The PV *device variable classification* can only be one of the following:

- 0: Volumetric Flow
- 2: Mass Flow
- 4: Velocity Flow

Since only PV is used in this manner, command 50 returns 250 for SV, TV, and QV. The setting of the *device variable classification* determines which class of flow-related variables is valid, and therefore displayed as implemented when variable slots are read by command 9.

Device Description Files

A Device Description (DD) file lets the HART handheld or host software application fully configure any HART device for which it has a DD installed. The MT100 DD files are available for download (*pending*) from the HART Communication Foundation website:

http://www.hartcommproduct.com/inventory2/index.php?action=list

Browse by Member (*FCI – Fluid Components International*) to find the instrument's files under device type: a679 (MT100 Series)

Refer to the following HART Communication Foundation web page for guidelines on using a DD file:

http://www.hartcommproduct.com/using_dd.html

Table 9 below summarizes the instrument's HART Communication Foundation device registration information.

Table 9 – MT100 HART Device Registration Information

Product Name	Product Type	HART Version	Mfgr. ID	Device Type	Device Revision
MT100 Series	Flow	7	0000A6	0xA679	01

EDDL Files

The MT100 Series EDDL (Electronic Device Description Language) files are support files that provide an extended description of each object in the Virtual Field Device (VFD), and provide information needed for a control system or host to understand the meaning of the data in the VFD including the human interface. The EDDL file can be thought as a "driver" for the device.

Loading the DD Files to the 475 Field Communicator

Use the "Easy Upgrade Utility" from EMERSON to load the DDPs into the Field Communicator. Below is the procedure for how to load DD files into the 475-Field communicator.

Open the **Field Communicator Easy Upgrade Utility** program and click *Utilities* on the left hand menu. Select *Import DDs from a local source*. In the resulting dialog, click **Browse** and navigate to the directory containing the FCI files. Select the FCI file from the list and click **OK**. See Figure 46 below. Refer to the program's instructions for details on how to use the program.

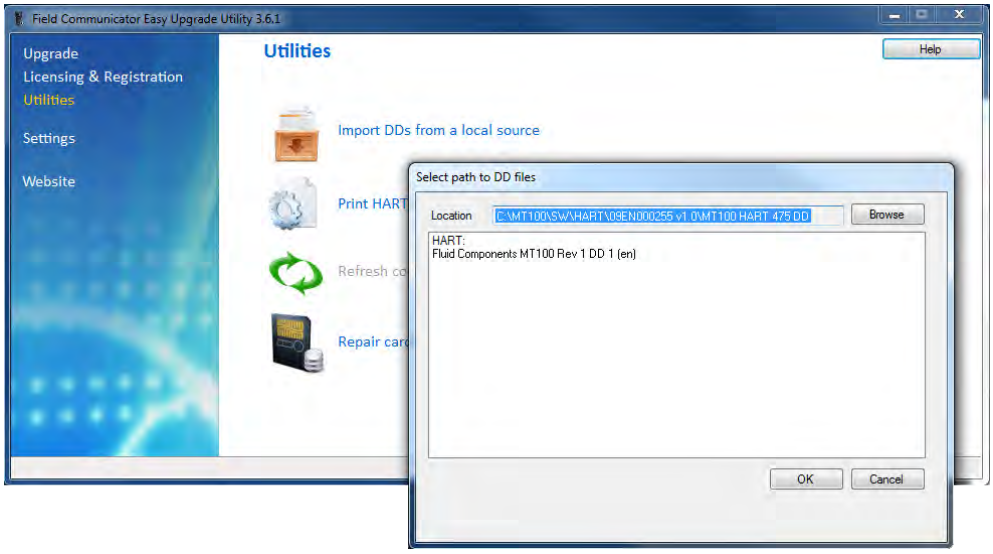


Figure 46 – Field Communicator Easy Upgrade Utility, Import DD

Service Data Operation

Shown below is example service information as provided by the Emerson 475 HART communicator with FCI's DD files loaded. The same information seen by the 475 is shown in the DCS (Distributed Control System) when the MT100 Series HART DD files are loaded. Listed below are the screens described in this section. They are a subset of the MT100's 475 HART communicator information. The numbers refer to a screen's menu level relative to Root (0). For example, Basic Setup (Level 0-1.5) is the 5th item in Settings, which in turn is the 1st menu item in Root (0).

- Root (Level 0)
- Settings (Level 0-1)
- Basic Setup (Level 0-1.5)
- Advanced Setup (Level 0-1.6)
- Device Config. (Level 0-1.7)

Root (Level 0, items 1-5)

The Root menu's 1st level items are shown below. The PV and PV Loop current (Level 0, items 2 and 3) screens are read-only for status check. The remaining items (1, 4, and 5) are displayable as well as programmable.

Level 0-0

Level 0-1

Level 0-4

Level 0-5

Settings (Level 0-1, items 1-8)

The Settings Menu provides a gateway to MT100 device information, process data, and setup, both basic and advanced.

Level 0-1.3

Level 0-1.4

Level 0-1.5

Level 0-1.6

Level 0-1.7

Level 0-1.8

Basic Setup (Level 0-1.5, items 1-9)

The Basic Setup menu items provide display/adjustment of engineering units, pipe parameters, totalizer reset, factory reset, write protect, process data time, and PV setup. Also provided is read-only FE data in two groups of four (FE1-4, FE5-8).

Level 0-1.5.1

Level 0-1.5.2

Level 0-1.5.3

Level 0-1.5.4

Level 0-1.5.5

Level 0-1.5.6

Level 0-1.5.7

Level 0-1.5.8

Level 0-1.5.9

Advanced Setup (Level 0-1.6, items 1-4)

The Advanced Setup menu items provide display/adjustment of the 4-20 mA current loop channels, factory calibration, K Factor, and customer flow limits.

Caution: Use caution when changing parameter values in this group. Using incorrect values can adversely affect operation of the unit. Use the Factory Reset option in the Basic Setup menu to go back to factory defaults if necessary.

Level 0-1.6.1

Level 0-1.6.2

Level 0-1.6.3

Level 0-1.6.4

Device Config. (Level 0-1.7, item 1)

Use the Device Config menu to select the active calibration group (out of five). Group ID 1 is always valid (default active calibration group). If the instrument is ordered to accommodate different process media (a different type gas), an additional calibration slot; i.e.; Group ID 2, is available for switching. Use this menu only if multiple calibration groups are used.

Level 0-1.7.1

HART Command List Reference

The HART commands are divided into three classes.

- Universal Commands
- Common Practice Commands
- Device Specific Commands

Barring no communication error, a field or slave device returns a response code as part of the 2-byte status response to a command. Refer to Command Status Bytes on page 75. The MT100 command-specific response codes are a subset of the response codes listed in the HART specification. Refer to Table 15 on page 76.

MT100 HART Universal Commands

The MT100 HART supports Universal Commands 0 through 22 and 38 and 48. Commands 4 and 5 are reserved under Universal Command Specification Rev. 7.1 (HCF_SPEC-127, Revision 7.1) and not implemented in this specification. There is no HART command 10. Table 10 below summarizes the instrument's HART Universal command set and the data associated with each command.

Table 10 – HART Universal Commands

Command 0: Read Unique Identifier			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0	Unsigned-8	254
	1–2	Enum	Expanded Device Type
	3	Unsigned-8	Minimum number of preambles from master to slave
	4	Unsigned-8	HART Protocol Revision Number: 7
	5	Unsigned-8	Device Revision Number
	6	Unsigned-8	Software Revision Number
	7	Unsigned-5	(Most Significant 5 Bits) Hardware Revision Level
	7	Enum	Physical Signaling Code: 00 = Bell 202 Current (4-20 mA)
	8	Bits	Flags: (Unused)
	9–11	Unsigned-24	Device ID
	12	Unsigned-8	Minimum number of preambles from the slave to master
	13	Unsigned-8	Maximum Number of Device Variables
	14–15	Unsigned-16	Configuration Change Counter
	16	Bits	Extended Field Device Status
	17–18	Enum	Manufacturer ID Code: 166_{DEC}/$00A6_{HEX}$ (FCI)
	19–20	Enum	Private Label Distributor Code
	21	Enum	Device Profile = 1 "HART Process Automation Device"
Response Codes	See Table 15, page 76, for response code list.		

Command 1: Read Primary Variable (Flow Units, & Flow Value)			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0	Enum	Primary Variable Units Code
	1–4	Float	Primary Variable Value
Response Codes	See Table 15, page 76, for response code list.		

Command 2: Read Primary Variable Loop Current and Percent of Range			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–3	Float	Primary Variable Loop Current (mA)
	4–7	Float	Primary Variable Percent of Range (%)
Response Codes	See Table 15, page 76, for response code list.		

Command 3: Read Dynamic Variable (Flow) and Loop Current			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–3	Float	PV Loop Current: 4-20 mA
	4	Enum	PV HART Unit Code, Flow
	5–8	Float	PV Flow Value
Response Codes	See Table 15, page 76, for response code list.		

Command 6: Write Polling Address			
	Byte	Format	Description
Request Data Bytes	0	Unsigned-8	Polling Address of Device
	1	Enum	Loop Current Mode
Response Data Bytes	0	Unsigned-8	Polling Address of Device
	1	Enum	Loop Current Mode
Response Codes	See Table 15, page 76, for response code list.		

Command 7: Read Loop Configuration			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0	Unsigned-8	Polling Address of Device
	1	Enum	Loop Current Mode
Response Codes	See Table 15, page 76, for response code list.		

Command 8: Read Dynamic Variable Classifications			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0	Enum	Primary Variable Classification
Response Codes	See Table 15, page 76, for response code list.		

Command 9: Read Device Variables with Status[1]			
	Byte	Format	Description
Request Data Bytes	0	Unsigned-8	Slot 0: Device Variable Code
	1	Unsigned-8	Slot 1: Device Variable Code
	2	Unsigned-8	Slot 2: Device Variable Code
	3	Unsigned-8	Slot 3: Device Variable Code
	4	Unsigned-8	Slot 4: Device Variable Code
	5	Unsigned-8	Slot 5: Device Variable Code
	6	Unsigned-8	Slot 6: Device Variable Code
	7	Unsigned-8	Slot 7: Device Variable Code
Response Data Bytes	0	Bits	Extended Field Device Status
	1	Unsigned-8	Slot 0: Device Variable Code
	2	Enum	Slot 0: Device Variable Classification
	3	Enum	Slot 0: Units Code
	4–7	Float	Slot 0: Device Variable Value
	8	Bits	Slot 0: Device Variable Status
	9	Unsigned-8	Slot 1: Device Variable Code
	10	Enum	Slot 1: Device Variable Classification
	11	Enum	Slot 1: Units Code
	12–15	Float	Slot 1: Device Variable Value
	16	Bits	Slot 1: Device Variable Status
	17	Unsigned-8	Slot 2: Device Variable Code
	18	Enum	Slot 2: Device Variable Classification
	19	Enum	Slot 2: Units Code
	20–23	Float	Slot 2: Device Variable Value
	24	Bits	Slot 2: Device Variable Status
	25	Unsigned-8	Slot 3: Device Variable Code
	26	Enum	Slot 3: Device Variable Classification
	27	Enum	Slot 3: Units Code
	28–31	Float	Slot 3: Device Variable Value
	32	Bits	Slot 3: Device Variable Status
	33	Unsigned-8	Slot 4: Device Variable Code
	34	Enum	Slot 4: Device Variable Classification
	35	Enum	Slot 4: Units Code
	36–39	Float	Slot 4: Device Variable Value
	40	Bits	Slot 4: Device Variable Status
	41	Unsigned-8	Slot 5: Device Variable Code
	42	Enum	Slot 5: Device Variable Classification
	43	Enum	Slot 5: Units Code
	44–47	Float	Slot 5: Device Variable Value
	48	Bits	Slot 5: Device Variable Status
	49	Unsigned-8	Slot 6: Device Variable Code
	50	Enum	Slot 6: Device Variable Classification
	51	Enum	Slot 6: Units Code
	52–55	Float	Slot 6: Device Variable Value
	56	Bits	Slot 6: Device Variable Status
	57	Unsigned-8	Slot 7: Device Variable Code
	58	Enum	Slot 7: Device Variable Classification
	59	Enum	Slot 7: Units Code
	60–63	Float	Slot 7: Device Variable Value
	64	Bits	Slot 7: Device Variable Status
	65–68	Time	Slot 0: Data Time Stamp
Response Codes	See Table 15, page 76, for response code list.		

Note: 1. Command 9 takes in a variable list of parameters and similarly returns a variable length response.

Command 11: Read Unique Identifier Associated with Tag			
	Byte	Format	Description
Request Data Bytes	0–5	Packed	Tag, Packed ASCII
Response Data Bytes	0	Unsigned-8	254
	1–2	Enum	Expanded Device Type
	3	Unsigned-8	Minimum number of preambles from master to slave
	4	Unsigned-8	HART Protocol Revision Number: 7
	5	Unsigned-8	Device Revision Number
	6	Unsigned-8	Software Revision Number
	7	Unsigned-5	(Most Significant 5 Bits) Hardware Revision Level: 1
	7	Enum	Physical Signaling Code: 00 = Bell 202 Current (4-20 mA)
	8	Bits	Flags: (Unused)
	9–11	Unsigned-24	Device ID
	12	Unsigned-8	Minimum number of preambles from the slave to master
	13	Unsigned-8	Maximum Number of Device Variables
	14–15	Unsigned-16	Configuration Change Counter
	16	Bits	Extended Field Device Status
	17–18	Enum	Manufacturer ID Code: 166_{DEC}/$00A6_{HEX}$ (FCI)
	19–20	Enum	Private Label Distributor Code
	21	Enum	Device Profile = 1 “HART Process Automation Device”
Response Codes	See Table 15, page 76, for response code list.		

Command 12: Read Message Contained Within Device			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–11	Bitstring	Device ID No.
Response Codes	See Table 15, page 76, for response code list.		

Command 13: Read Tag, Descriptor, Date			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–5	Packed	Tag
	6–17	Packed	Descriptor
	18–20	Date	Date Code: Day, Month, Year
Response Codes	See Table 15, page 76, for response code list.		

Command 14: Read Primary Variable (Flow) Transducer Information			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–2	Unsigned-24	Transducer Serial Number
	3	Enum	Transducer Limits and Minimum Span Units Code
	4–7	Float	Upper Transducer Limit
	8–11	Float	Lower Transducer Limit
	12–15	Float	Minimum Span
Response Codes	See Table 15, page 76, for response code list.		

Command 15: Read Device Information			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0	Enum	Flow Alarm Selection Code
	1	Enum	Flow Transfer Function Code (not supported)
	2	Enum	Flow Upper and Lower Range Value Units Code
	3–6	Float	Flow Upper Range Value
	7–10	Float	Flow Lower Range Value
	11–14	Float	Flow Damping Value
	15	Enum	Write Protect Code (not supported)
	16	Enum	Reserved
	17	Bits	Flow Analog Channel Flags (not supported)
Response Codes	See Table 15, page 76, for response code list.		

Command 16: Read Final Assembly Number			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–2	Unsigned-24	STAK ELECT ASSY #
Response Codes	See Table 15, page 76, for response code list.		

Command 17: Write Message Into Device			
	Byte	Format	Description
Request Data Bytes	0–23	Packed	Message String Used by Master
Response Data Bytes[1]	0–23	Packed	Message String
Response Codes	See Table 15, page 76, for response code list.		

Note: 1. The value returned in the response data bytes reflects the value actually used by the field device.

Command 18: Write Tag, Descriptor, Date			
	Byte	Format	Description
Request Data Bytes	0–5	Packed	Tag
	6–17	Packed	Descriptor Used by Master
	18–20	Date	Date Code Used by Master
Response Data Bytes[1]	0–5	Packed	Tag
	6–17	Packed	Descriptor
	18–20	Date	Date Code: Day, Month, Year
Response Codes	See Table 15, page 76, for response code list.		

Note: 1. The value returned in the response data bytes reflects the value actually used by the field device.

Command 19: Write Final Assembly Number			
	Byte	Format	Description
Request Data Bytes	0–2	Unsigned-24	STAK ELECT ASSY #
Response Data Bytes[1]	0–2	Unsigned-24	STAK ELECT ASSY #
Response Codes	See Table 15, page 76, for response code list.		

Note: 1. The value returned in the response data bytes reflects the value actually used by the field device.

Command 20: Read Long Tag			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–31	Latin-1	Long Tag
Response Codes	See Table 15, page 76, for response code list.		

Command 21: Read Unique Identifier Associated with Long Tag			
	Byte	Format	Description
Request Data Bytes	0–31	Latin-1	Long Tag
Response Data Bytes	0	Unsigned-8	254
	1–2	Enum	Expanded Device Type
	3	Unsigned-8	Minimum Number Of Preambles From Master to Slave
	4	Unsigned-8	HART Protocol Revision Number: 7
	5	Unsigned-8	Device Revision Number
	6	Unsigned-8	Software Revision Number
	7	Unsigned-5	(Most Significant 5 Bits) Hardware Revision Level: 1
	7	Enum	Physical Signaling Code: 00 = Bell 202 Current (4-20 mA)
	8	Bits	Flags: (Unused)
	9–11	Unsigned-24	Device ID
	12	Unsigned-8	Minimum Number Of Preambles From Slave to Master
	13	Unsigned-8	Maximum Number of Device Variables
	14–15	Unsigned-16	Configuration Change Counter
	16	Bits	Extended Field Device Status
	17–18	Enum	Manufacturer ID Code: 166_{DEC}/$00A6_{HEX}$ (FCI)
	19–20	Enum	Private Label Distributor Code
	21	Enum	Device Profile = 1 “HART Process Automation Device”
Response Codes	See Table 15, page 76, for response code list.		

Command 22: Write Long Tag			
	Byte	Format	Description
Request Data Bytes	0–31	Latin-1	Long Tag
Response Data Bytes	0–31	Latin-1	Long Tag
Response Codes	See Table 15, page 76, for response code list.		

Command 38: Reset Configuration Changed Flag			
	Byte	Format	Description
Request Data Bytes	0–1	Unsigned-16	Configuration Change Counter
Response Data Bytes	0–1	Unsigned-16	Configuration Change Counter
Response Codes	See Table 15, page 76, for response code list.		

Command 48: Read Additional Device Status			
	Byte	Format	Description
Request Data Bytes	0–5	Bits	Device-Specific Status (only first 6 bytes used, see page 77 for additional info)
	6	Bits	Extended Device Status. Normally “0”; set to “1” (0x01) if maintenance is required.
	7	Bits	Device Operating Mode (not used, bit cleared to 0)
	8	Bits	Standardized Status 0 (not used, bit cleared to 0)
	9	Bits	Standardized Status 1 (not used, bit cleared to 0)
	10	Bits	Analog Channel Saturated (not used, bit cleared to 0)
	11	Bits	Standardized Status 2 (not used, bit cleared to 0)
	12	Bits	Standardized Status 3 (not used, bit cleared to 0)
	13	Bits	Analog Channel Fixed
	14–24	Bits	Device-Specific Status2 (not used, bit cleared to 0)
Response Data Bytes	0–5	Bits	Device-Specific Status (only first 6 bytes used, see page 77)
	6	Bits	Extended Device Status. Normally “0”; set to “1” (0x01) if maintenance is required.
	7	Bits	Device Operating Mode (not used, bit cleared to 0)
	8	Bits	Standardized Status 0 (not used, bit cleared to 0)
	9	Bits	Standardized Status 1 (not used, bit cleared to 0)
	10	Bits	Analog Channel Saturated (not used, bit cleared to 0)
	11	Bits	Standardized Status 2 (not used, bit cleared to 0)
	12	Bits	Standardized Status 3 (not used, bit cleared to 0)
	13	Bits	Analog Channel Fixed
	14–24	Bits	Device-Specific Status2 (not used, bit cleared to 0)
Response Codes	See Table 15, page 76, for response code list.		

MT100 HART Common Practice Commands

The MT100 supports Common Practice commands 35, 40, 42, 44, 45, 46, 50 and 51. Table 11 below summarizes the instrument's HART Common Practice command set and the data associated with each command.

Table 11 – HART Common Practice Commands

Command 40: Enter/Exit Fixed Current Mode			
	Byte	Format	Description
Request Data Bytes[1]	0–3	Float	PV Fixed Current Level (mA units); "0" to Exit Fixed Current
Response Data Bytes	0–3	Float	Actual PV Current Level
Response Codes	See Table 15, page 76, for response code list.		

Notes: 1. Specify a value (in mA) to drive Ch. 1 to a particular output value. Specify "0" to exit the fixed current mode.

Command 42: Perform Device Reset (Soft Reset of Flow Meter)[1]			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	None		
Response Codes	See Table 15, page 76, for response code list.		

Note: 1. Send Command 42 (no data) to reset the instrument. No response is returned due to reboot.

Command 44: Write Primary Variable Units			
	Byte	Format	Description
Request Data Bytes	0	Enum	PV Units Code
Response Data Bytes[1]	0	Enum	PV Units Code
Response Codes	See Table 15, page 76, for response code list.		

Note: 1. The value returned in the response data bytes reflects the value actually used by the device.

Command 45: Trim DAC Zero – Measured Current Chan #1 (in mA)			
	Byte	Format	Description
Request Data Bytes	0–3	Float	Ext. Measured Current Ch. #1 Level (mA units)
Response Data Bytes[1]	0–3	Float	Actual Measured Current Ch. #1 Level (mA units)
Response Codes	See Table 15, page 76, for response code list.		

Note: 1. The value returned in the response data bytes reflects the rounded or truncated value actually used by the device.

Command 46: Trim DAC Gain – Measured Current Chan #1 (in mA)			
	Byte	Format	Description
Request Data Bytes	0–3	Float	Ext. Measured Current Ch. #1 Level (mA units)
Response Data Bytes[1]	0–3	Float	Actual Measured Current Ch. #1 Level (mA units)
Response Codes	See Table 15, page 76, for response code list.		

Note: 1. The value returned in the response data bytes reflects the rounded or truncated value actually used by the device.

Command 50: Read Dynamic Variable Assignments			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0	Unsigned-8	Device Variable assigned to the primary variable.
	1	Unsigned-8	Device Variable assigned to the secondary variable.
	2	Unsigned-8	Device Variable assigned to the tertiary variable.
	3	Unsigned-8	Device Variable assigned to the quaternary variable.
Response Codes	See Table 15, page 76, for response code list.		

Command 51: Write Dynamic Variable Assignments			
	Byte	Format	Description
Request Data Bytes	0	Unsigned-8	Device Variable assigned to the primary variable.
	1	Unsigned-8	Device Variable assigned to the secondary variable.
	2	Unsigned-8	Device Variable assigned to the tertiary variable.
	3	Unsigned-8	Device Variable assigned to the quaternary variable.
Response Data Bytes[1]	0	Unsigned-8	Device Variable assigned to the primary variable.
	1	Unsigned-8	Device Variable assigned to the secondary variable.
	2	Unsigned-8	Device Variable assigned to the tertiary variable.
	3	Unsigned-8	Device Variable assigned to the quaternary variable.
Response Codes	See Table 15, page 76, for response code list.		

Note: 1. The value returned in the response data bytes reflects the value actually used by the device.

Command 35: Write Primary Variable (PV) Range Values			
	Byte	Format	Description
Request Data Bytes	0	Unsigned-8	PV Upper and Lower Range Values Units Code
	1–4	Float	PV Upper Range Value (Customer Max. Flow Limit)
	5–8	Float	PV Lower Range Value (Customer Min. Flow Limit)
Response Data Bytes[1]	0	Unsigned-8	PV Upper and Lower Range Values Units Code
	1–4	Float	PV Upper Range Value
	5–8	Float	PV Lower Range Value
Response Codes	See Table 15, page 76, for response code list.		

Note: 1. The value returned in the response data bytes reflects the rounded or truncated value actually used by the device.

MT100 HART Device Specific Commands

The MT100 Manufacturer Specific or Device Specific commands start at command 137. Use the device specific commands to setup and configure the MT100 Series instrument via HART. The MT100 device specific commands are grouped in functional categories as summarized in Table 12 below.

Table 12 – MT100 HART Device Specific Command Groupings

Group No.	Description	Command Numbers
Group 1	Commands to set up and configure the instrument.	137, 138, 139, 140, 145, 146, 148, 149, 150, 159
Group 2	Commands to set up 4–20 mA output channels including the OUTZ, and OUTF parameters.	160, 161, 163, 164, 166, 167
Group 3	Commands to view individual FE process. The view is a snapshot of sensor data at the time of the request; i.e., it does not update.	170, 172
Group 4	Commands to display the factory-set calibrated limit of the instrument for flow, process temperature and pressure variables.	151, 154, 157
Group 5	Other Category – Commands outside the above listed groups.	179, 180, 181, 182, 183, 184, 185,186, 187, 191. 193, 195

Table 13 below summarizes the instrument's HART Device Specific command set and the data associated with each command.

Table 13 – HART Device Specific Commands

Command 137: Read Totalizer And Rollover Values			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–3	Float	Totalizer
	4–7	Integer	Rollover
Response Codes	See Table 15, page 76, for response code list.		

Command 138: Read Totalizer State			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0	Unsigned-8	Totalizer State: 0 = OFF; 1 = ON
Response Codes	See Table 15, page 76, for response code list.		

Command 139: Write Totalizer State			
	Byte	Format	Description
Request Data Bytes	0	Unsigned-8	Totalizer State: 0 = OFF; 1 = ON
Response Data Bytes	0	Unsigned-8	Totalizer State: 0 = OFF; 1 = ON
Response Codes	See Table 15, page 76, for response code list.		

Command 140: Read Device Information			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–9	Bits	Device CO
	10–19	Bits	Device Serial Number
	20–23	Bits	Device Software Version
Response Codes	See Table 15, page 76, for response code list.		

Command 145: Read Customer Engineering Units			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0	Unsigned-8	Units Code for Flow
	1	Unsigned-8	Units Code for Temperature
	2	Unsigned-8	Units Code for Totalizer
	3	Unsigned-8	Units Code for Pressure
Response Codes	See Table 15, page 76, for response code list.		

Command 146: Write Customer Engineering Units			
	Byte	Format	Description
Request Data Bytes	0	Unsigned-8	Units Code for Flow
	1	Unsigned-8	Units Code for Temperature
	2	Unsigned-8	Units Code for Totalizer
	3	Unsigned-8	Units Code for Pressure
Response Data Bytes	0	Unsigned-8	Units Code for Flow
	1	Unsigned-8	Units Code for Temperature
	2	Unsigned-8	Units Code for Totalizer
	3	Unsigned-8	Units Code for Pressure
Response Codes	See Table 15, page 76, for response code list.		

Command 148: Read Plenum Information (Pipe Size)			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–3	Float	Pipe Height Value
	4–7	Float	Pipe Width (Diameter) Value
	8	Unsigned-8	Plenum Units Code
Response Codes	See Table 15, page 76, for response code list.		

Command 149: Write Plenum Information (Pipe Size)			
	Byte	Format	Description
Request Data Bytes	0–3	Float	Pipe Height Value
	4–7	Float	Pipe Width (Diameter) Value
	8	Unsigned-8	Plenum Units Code
Response Data Bytes	0-3	Float	Pipe Height Value
	4–7	Float	Pipe Width (Diameter) Value
	8	Unsigned-8	Plenum Units Code
Response Codes	See Table 15, page 76, for response code list.		

Command 150: Write “Write Protect Mode”			
	Byte	Format	Description
Request Data Bytes	0	Unsigned-8	Write Protect Mode: 0x00 = Disable; 0x01 = Enable
Response Data Bytes	0	Unsigned-8	Write Protect Mode: 0x00 = Disable; 0x01 = Enable
Response Codes	See Table 15, page 76, for response code list.		

Command 151: Read Calibration Flow Limits			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–3	Float	Flow Lower Limit Value
	4–7	Float	Flow Upper Limit Value
Response Codes	See Table 15, page 76, for response code list.		

Command 154: Read Calibration Temperature Limits			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–3	Float	Temperature Lower Limit Value
	4–7	Float	Temperature Upper Limit Value
Response Codes	See Table 15, page 76, for response code list.		

Command 157: Read Calibration Pressure Limits			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–3	Float	Pressure Lower Limit Value
	4–7	Float	Pressure Upper Limit Value
Response Codes	See Table 15, page 76, for response code list.		

Command 155: Read KFactors			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–3	Float	KFactor1
	4–7	Float	KFactor2
	8–11	Float	KFactor3
	12–15	Float	KFactor4
Response Codes	See Table 15, page 76, for response code list.		

Command 159: Write Factory Restore			
	Byte	Format	Description
Request Data Bytes[1]	0	Unsigned-8	0x00 for Factory Restore
Response Data Bytes	0	Unsigned-8	0x00 for Factory Restore
Response Codes	See Table 15, page 76, for response code list.		

Note: 1. Send Command 159 with a “0” byte to reload the instrument’s factory default programming.

Command 160: Write (4-20 mA) Output Channel #1 Parameters			
	Byte	Format	Description
Request Data Bytes	0–1	Unsigned-16	D/A Setting for 4 mA Out (OUTZ1)
	2–3	Unsigned-16	D/A Setting for 4 mA Out (OUTF1)
	4	Unsigned-8	Channel #1 Out Variable
Response Data Bytes	0–1	Unsigned-16	D/A Setting for 4 mA Out (OUTZ1)
	2–3	Unsigned-16	D/A Setting for 4 mA Out (OUTF1)
	4	Unsigned-8	Channel #1 Out Variable
Response Codes	See Table 15, page 76, for response code list.		

Command 161: Read (4-20 mA) Output Channel #1 Parameters			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–1	Unsigned-16	D/A Setting for 4 mA Out (OUTZ1)
	2–3	Unsigned-16	D/A Setting for 4 mA Out (OUTF1)
	4	Unsigned-8	Channel #1 Out Variable
Response Codes	See Table 15, page 76, for response code list.		

Command 163: Write (4-20 mA) Output Channel #2 Parameters			
	Byte	Format	Description
Request Data Bytes	0–1	Unsigned-16	D/A Setting for 4 mA Out (OUTZ2)
	2–3	Unsigned-16	D/A Setting for 4 mA Out (OUTF2)
	4	Unsigned-8	Channel #2 Out Variable
Response Data Bytes	0–1	Unsigned-16	D/A Setting for 4 mA Out (OUTZ2)
	2–3	Unsigned-16	D/A Setting for 4 mA Out (OUTF2)
	4	Unsigned-8	Channel #2 Out Variable
Response Codes	See Table 15, page 76, for response code list.		

Command 164: Read (4-20 mA) Output Channel #2 Parameters			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–1	Unsigned-16	D/A Setting for 4 mA Out (OUTZ2)
	2–3	Unsigned-16	D/A Setting for 4 mA Out (OUTF2)
	4	Unsigned-8	Channel #2 Out Variable
Response Codes	See Table 15, page 76, for response code list.		

Command 166: Write (4-20 mA) Output Channel #3 Parameters			
	Byte	Format	Description
Request Data Bytes	0–1	Unsigned-16	D/A Setting for 4 mA Out (OUTZ3)
	2–3	Unsigned-16	D/A Setting for 4 mA Out (OUTF3)
	4	Unsigned-8	Channel #3 Out Variable
Response Data Bytes	0–1	Unsigned-16	D/A Setting for 4 mA Out (OUTZ3)
	2–3	Unsigned-16	D/A Setting for 4 mA Out (OUTF3)
	4	Unsigned-8	Channel #3 Out Variable
Response Codes	See Table 15, page 76, for response code list.		

Command 167: Read (4-20 mA) Output Channel #3 Parameters			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–1	Unsigned-16	D/A Setting for 4 mA Out (OUTZ3)
	2–3	Unsigned-16	D/A Setting for 4 mA Out (OUTF3)
	4	Unsigned-8	Channel #3 Out Variable
Response Codes	See Table 15, page 76, for response code list.		

Command 170: Read Bank #1 Sensor Variables			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–3	Float	Flow Value Sensor #1
	4–7	Float	Temperature Value Sensor #1
	8–11	Float	Pressure Value Sensor #1
	12–15	Float	Flow Value Sensor #2
	16–19	Float	Temperature Value Sensor #2
	20–23	Float	Pressure Value Sensor #2
	24–27	Float	Flow Value Sensor #3
	28–31	Float	Temperature Value Sensor #3
	32–35	Float	Pressure Value Sensor #3
	36–39	Float	Flow Value Sensor #4
	40–43	Float	Temperature Value Sensor #4
	44–47	Float	Pressure Value Sensor #4
Response Codes	See Table 15, page 76, for response code list.		

Command 172: Read Bank #2 Sensor Variables			
	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0–3	Float	Flow Value Sensor #5
	4–7	Float	Temperature Value Sensor #5
	8–11	Float	Pressure Value Sensor #5
	12–15	Float	Flow Value Sensor #6
	16–19	Float	Temperature Value Sensor #6
	20–23	Float	Pressure Value Sensor #6
	24–27	Float	Flow Value Sensor #7
	28–31	Float	Temperature Value Sensor #7
	32–35	Float	Pressure Value Sensor #7
	36–39	Float	Flow Value Sensor #8
	40–43	Float	Temperature Value Sensor #8
	44–47	Float	Pressure Value Sensor #8
Response Codes	See Table 15, page 76, for response code list.		

Command 179: Write/Set Calibration Group			
	Byte	Format	Description
Request Data Bytes	0	Unsigned-8	Write/Set Calibration Group
Response Data Bytes	0	Unsigned-8	Write/Set Calibration Group
Response Codes	See Table 15, page 76, for response code list.		

Command 180: Read Calibration Group			
	Byte	Format	Description
Request Data Bytes	0	Unsigned-8	Read Calibration Group
Response Data Bytes	0	Unsigned-8	Read Calibration Group
Response Codes	See Table 15, page 76, for response code list.		

Command 181: Write KFactor1			
	Byte	Format	Description
Request Data Bytes	0–3	Float	Write KFactor1
Response Data Bytes	0–3	Float	Write KFactor1
Response Codes	See Table 15, page 76, for response code list.		

Command 182: Write KFactor2			
	Byte	Format	Description
Request Data Bytes	0–3	Float	Write KFactor2
Response Data Bytes	0–3	Float	Write KFactor2
Response Codes	See Table 15, page 76, for response code list.		

Command 183: Write KFactor3			
	Byte	Format	Description
Request Data Bytes	0–3	Float	Write KFactor3
Response Data Bytes	0–3	Float	Write KFactor3
Response Codes	See Table 15, page 76, for response code list.		

Command 184: Write KFactor4			
	Byte	Format	Description
Request Data Bytes	0–3	Float	Write KFactor4
Response Data Bytes	0–3	Float	Write KFactor4
Response Codes	See Table 15, page 76, for response code list.		

Command 185: Read KFactor1			
	Byte	Format	Description
Request Data Bytes	0–3	Float	Read KFactor1
Response Data Bytes	0–3	Float	Read KFactor1
Response Codes	See Table 15, page 76, for response code list.		

Command 186: Read KFactor2			
	Byte	Format	Description
Request Data Bytes	0–3	Float	Read KFactor2
Response Data Bytes	0–3	Float	Read KFactor2
Response Codes	See Table 15, page 76, for response code list.		

Command 187: Read KFactor3			
	Byte	Format	Description
Request Data Bytes	0–3	Float	Read KFactor3
Response Data Bytes	0–3	Float	Read KFactor3
Response Codes	See Table 15, page 76, for response code list.		

Command 188: Read KFactor4			
	Byte	Format	Description
Request Data Bytes	0–3	Float	Read KFactor4
Response Data Bytes	0–3	Float	Read KFactor4
Response Codes	See Table 15, page 76, for response code list.		

Command 191: Totalizer Reset			
	Byte	Format	Description
Request Data Bytes	0	Unsigned-8	Reset Key = 0x00
Response Data Bytes	0	Unsigned-8	Reset Key = 0x00
Response Codes	See Table 15, page 76, for response code list.		

Command 193: Read Process Variable and Time Stamp			
	Byte	Format	Description
Request Data Bytes	0–13	Float	Read PV and Timestamp
Response Data Bytes	0–13	Float	Read PV and Timestamp
Response Codes	See Table 15, page 76, for response code list.		

Command 195: Read Flow Element (FE) Faults			
	Byte	Format	Description
Request Data Bytes	0–31	Enum	Read FE Faults
Response Data Bytes	0–31	Enum	Read FE Faults
Response Codes	See Table 15, page 76, for response code list.		

HART Command Bit Assignments

Command Status Bytes

The HART command response data field includes a status message in the first two bytes. The first byte (0) is the Comm Error/Response code. The second byte (1) is the Device status. Depending on the status of bit 7, Byte 0 indicates either a **communication error** (b7 = 1) or, if no communication error exists, a **command-specific response code** (b7 = 0). Table 14 summarizes the command status bytes. Table 15 summarizes the command-specific response codes.

Table 14 – Command Status Bytes, Bit Assignments

Byte-bit	Error/Status Description
0-0	*Comm error:* Reserved – Bit cleared to zero.
0-1	*Comm error:* Buffer Overflow – The message was too long for the received buffer of the device.
0-2	*Comm error:* Reserved – Bit cleared to zero.
0-3	*Comm error:* Longitudinal Parity Error – The longitudinal parity calculated by the device did not match the check byte at the end of the message.
0-4	*Comm error:* Framing Error – The stop bit of one or more bytes received by the device was not detected by the UART (i.e., a mark or 1 was not detected when a stop bit should have occurred).
0-5	*Comm error:* Overrun Error – At least one byte of data in the receive buffer of the UART was overwritten before it was read (i.e. the slave did not process incoming byte fast enough).
0-6	*Comm error:* Vertical Parity Error – The parity of one or more of the bytes received by the device was not odd.
0-7	1: Set bit means Byte 0 represents communications error as listed above. 0: Cleared bit means Byte 0 represents response code as listed in Table 15 below.
1-0	*Device status:* Primary Variable Out of Limits – The PV is beyond its operating limit.
1-1	*Device status:* Non-Primary Variable Out of Limits – A device variable not mapped to the PV is beyond its operating limits.
1-2	*Device status:* Loop Current Saturated – The loop current has reached its upper (or lower) endpoint limit and cannot increase (or decease) any further.
1-3	*Device status:* Loop Current Fixed – The loop current is being held at a fixed value and is not responding to process variations.
1-4	*Device status:* More Status Available – More status information is available via Command 48, Additional Device Status Bytes. See Table 16.
1-5	*Device status:* Cold Start – A power failure or device reset has occurred.
1-6	*Device status:* Configuration Changed – An operation was performed that changed the device's configuration.
1-7	*Device status:* Device Malfunction – The device detected a serious error or failure that compromises device operation.

Table 15 – Command-Specific Response Codes

Code	(Class) Description	Code	(Class) Description
00	(Success) No command-specific errors	12	(Error) Upper Range value too low/Invalid mode
02	(Error) Invalid selection/Invalid Poll Address	13	(Error) Upper and Lower Range values out of limit
03	(Error) Passed parameter too large	14	(Warning) Span too small/Status byte mismatch
04	(Error) Passed parameter too small	16	(Mode Error) Access restricted
05	(Error) Too few data bytes received	18	(Error) Invalid units code
06	(Misc Error) Device-specific command error	29	(Error) Invalid Span
07	(Mode Error) In Write-Protect mode	30	(Error) Command response truncated
09	(Error) Invalid date code/Configuration change counter mismatch/Lower range value too high/Incorrect loop current mode or value	32	(Error) Busy
10	(Error) Lower Range value too low	64	(Error) Command not implemented
11	(Error) Upper Range value too high/Loop current not active (device in multidrop mode)	—	—

Command 48, Additional Device Status Bytes

Table 16 below summarizes the Command 48 Additional Device Status bytes. This is a 6-byte field. The remaining status bytes are reserved for future use. A status bit is cleared (0) for no error. A status bit is set (1) when an error (or condition) is detected.

Table 16 – Command 48, Additional Device Status Bytes Bit Assignments

Byte-bit	Error/Status Description	Class	Device Status Bits Set
0-0	CORE: any of these errors: I2C error, UART error, Mutex error or Watchdog Reset.	Hardware	4
0-1	Electronics Hardware Failure	Hardware	4
0-2	Memory Error	Hardware	4
0-3	CORE: unable to update process data (PD_NO_FE_DATA). Unable to obtain/use data from any active FEs	Hardware	4, 7
0-4	Maintenance Required	Hardware	4
0-5	CORE: detects FRAM/SPI error.	Hardware	4
0-6	Power Supply Failure	Hardware	4
0-7	Configuration Invalid	Hardware	4
1-0	Device Initialization Failed	Hardware	4
1-1	Device Not Initialized	Hardware	4
1-2	(Any) FE Board Temperature Out of Limits	Hardware	4
1-3	Flow Sensor Failure	Hardware	4, 7
1-4	Flow Sensor Not Connected	Hardware	4,7
1-5	CORE: unable to communicate with one or more FEs (PD_COMM_ERROR)	Hardware	4
1-6	Totalizer Overflow	Hardware	4
1-7	Flow Is Out Of Range	Hardware	4
2-0	Ethernet Communication Failure	Hardware	4
2-1	USB Communications Failure	Hardware	4
2-2	Industrial Communication Protocol Fail	Hardware	4
2-3	CORE: averaged temperature above “Temperature Max”	Hardware	4
2-4	CORE: averaged temperature above “Temperature Min”	Hardware	4
2-5	(Any) FE reports SENSOR_HEATER_SHORTED_FAULT	Hardware	4
2-6	Not Used	—	—
2-7	(Any) FE reports SENSOR_HEATER_OPEN_FAULT	Hardware	4
3-0	Not Used	—	—
3-1	Not Used	—	—
3-2	(Any) FE reports SENSOR_ ADC_BELOW_ MIN_FAULT	Hardware	4
3-3	Flow Sensor Delta-R Below Min Limit	Hardware	4
3-4	FE Flow Above Limit	Hardware	4
3-5	(Any) FE reports SENSOR_ ABOVE_ MAX_TEMPERATURE_FAULT	Hardware	4
3-6	(Any) FE reports SENSOR_ UNDER_ MIN_TEMPERATURE_FAULT	Hardware	4
3-7	(Any) FE reports TMP100_TEMPERATURE_ADC_FAULT	Hardware	4
4-0	(Any) FE reports LTC2654_DAC_FAULT	Hardware	4
4-1	Component Error – CORE 4-20 mA Input ADS1100 (non-fatal)	Hardware	4
4-2	(Any) FE reports REFERENCE-R ABOVE ABSOLUTE MAX VALUE FAULT	—	—
4-3	(Any) FE reports I2C0_FAULT	Hardware	4
4-4	Component Error – Heater Monitor A/D	Hardware	4
4-5	(Any) FE reports PORT_EXPANDER_FAULT	Hardware	4
4-6	(Any) FE reports DELTA-R_ADC_FAULT	Hardware	4
4-7	(Any) FE reports REF-R_ADC_FAULT	Hardware	4
5-0	(Any) FE reports FE_FRAM_FAULT	Hardware	4
5-1	(Any) FE reports ACT_EXC_CURRENT_FAULT	Hardware	4
5-2	(Any) FE reports REF_EXC_CURRENT _FAULT	Hardware	4
5-3	STACK in Self Check Mode No Process Data Available	—	—
5-4	(Any) FE reports REFERENCE-R BELOW ABSOLUTE MIN VALUE FAULT	—	—
5-5	(Any) FE reports DR ABOVE ABSOLUTE VALUE FAULT	—	—
5-6	(Any) FE reports DR BELOW ABSOLUTE MIN VALUE FAULT	—	—
5-7	FE in Internal Delta-R Check – process data not reliable (non-fatal)	—	—

HART Engineering Units Codes

Table 17 below summarizes the HART codes used to represent the instrument's engineering units.

Table 17 – HART Engineering Units Codes

Temperature

HART Code	Unit Description	HART Code	Unit Description
32	degrees Celsius	33	degrees Fahrenheit

Volumetric Flow

HART Code	Unit Description	HART Code	Unit Description
186	Standard Cubic Feet per Second (SCFS)	121	Normal Cubic Meters per Hour (NCMH)
123	Standard Cubic Feet per Minute (SCFM)	181	Normal Cubic Meters per Day (NCMD)
185	Standard Cubic Feet per Hour (SCFH)	176	Normal Liter per Second (NLPS)
184	Standard Cubic Feet per Day (SCFD)	175	Normal Liter per Minute (NLPM)
183	Normal Cubic Meters per Second (NCMS)	122	Normal Liter per Hour (NLPH)
182	Normal Cubic Meters per Minute (NCMM)	174	Normal Liter per Day (NLPD)

Mass Flow

HART Code	Unit Description	HART Code	Unit Description
80	Pounds per Second (LBPS)	75	Kilograms per Hour (KGPH)
81	Pounds per Minute (LBPM)	76	Kilograms per Day (KGPD)
82	Pounds per Hour (LBPH)	246	Metric Tonnes Per Second (TNPS)
83	Pounds per Day (LBPD)	77	Metric Tonnes Per Minute (TNPM)
73	Kilograms per Second (KGPS)	78	Metric Tonnes Per Hour (TNPH)
74	Kilograms per Minute (KGPM)	79	Metric Tonnes Per Day (TNPD)

Velocity Flow

HART Code	Unit Description	HART Code	Unit Description
20	Standard Feet per Second (SFPS)	21	Normal Meters per Second (NMPS)
116	Standard Feet per Minute (SFPM)	242	Normal Meters per Minute (NMPM)
240	Standard Feet per Hour (SFPH)	120	Normal Meters per Hour (NMPH)
241	Standard Feet per Day (SFPD)	243	Normal Meters per Day (NMPD)

Totalizer

HART Code	Unit Description	HART Code	Unit Description
43	Standard Cubic Meter (SCM)	168	Standard Cubic Feet (SCF)
63	Pound (LB)	166	Normal Cubic Meter (NCM)
61	Kilogram (KG)	41	Standard Liter (SL)
62	Metric Tonnes (TN)	167	Normal Liter (NL)

Plenum

HART Code	Unit Description	HART Code	Unit Description
47	inches	49	millimeters

Extended Operation Modes

The measurement capabilities of the MT100 are expanded with the following extended operating modes:

- External Input Flow Adjust (EIA)
- External MT100 Flow Input (EFI)
- External Control Group Switching (EGS)

Use the MT100 Configuration Software application to set up an extended operating mode. The front panel HMI menu cannot be used to program this feature.

Once the MT100 is set up with an extended operating mode, the mode's initials (EIA, EFI, or EGS) are shown on the front panel HMI display to show that the mode is active. See Figure 47 below.

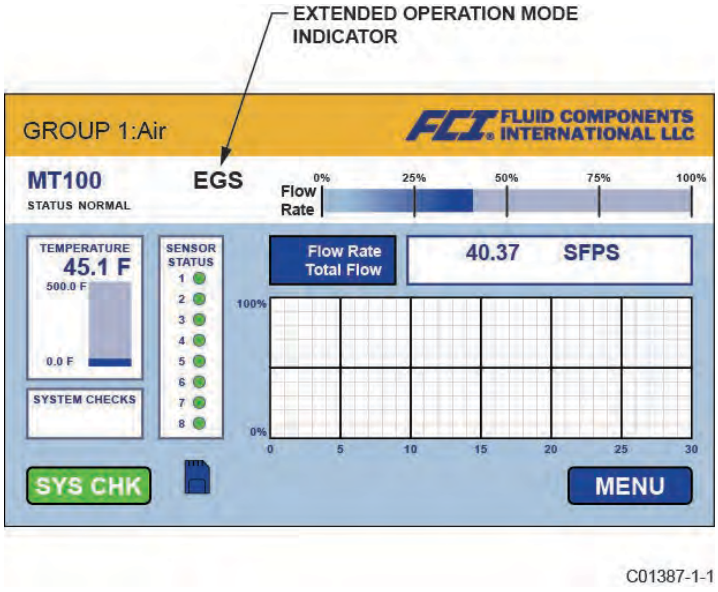


Figure 47 – Extended Operating Mode Status on HMI Front Panel Display (EGS Shown)

External Input Flow Adjust (EIA)

This mode corrects the flow rate of an MT100 flow meter when an external 4-20 mA current is fed into the 4-20 mA input port. Four polynomial factors are used to determine the correction applied to the flow rate and corresponding 4-20 mA output. The equation that defines this correction is as follows:

$$\text{Corrected Flow Rate} = \text{Starting Flowrate x } [(\text{Factor 1}) + (\text{Factor 2 x mA Input}) + (\text{Factor 3 x mA Input}^2) + (\text{Factor 4 x mA Input}^3)]$$

Make all necessary connections as shown in the wiring diagram in Figure 48 below.

Start the application. Click USB Connect on the home screen. Select the *Configuration* branch from the menu tree on the window's left side. Select the Extended Op. Mode tab. Click Toggle System Mode. Enter user level password *2772* at the prompt. Verify instrument is in the service state with *Setup* showing in *System Mode* field. Click External Input Flow Adjust (EIA) radio button. In the window's *Ext. Input Flow Adjust Setup* field enter the four polynomial factors in the text box for *Factor1*, *Factor2*, *Factor3,* and *Factor4*.

At window bottom click *Set System Mode to 'Running' when Send* check box. Click Send to Device near check box to send the EIA programming to the instrument. Observe return to normal operation with *Running* showing in *System Mode* field.

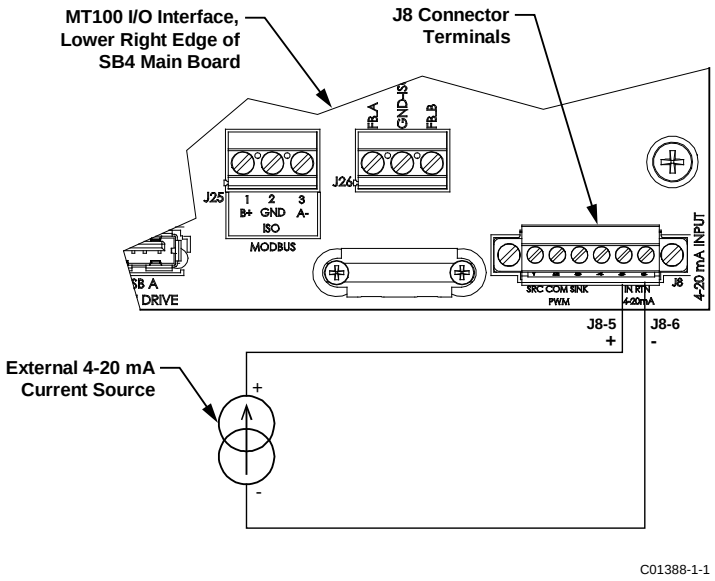


Figure 48 – Connections for External Input Flow Adjust (EIA)

External MT100 Flow Input (EFI)

This mode connects two separate MT100 flow meters for continuous flow averaging. This is done by sending the CH2 4-20 mA output current (relative to flow rate) from one MT100 (Slave) to the 4-20 mA input port of the other MT100 (Master). In this manner the Master displays the average flow rate and corresponding 4-20 mA output current.

Make all necessary connections as shown in the wiring diagram in Figure 49 below.

Start the application. Click USB Connect on the home screen. Select the *Configuration* branch from the menu tree on the window's left side. Select the Extended Op. Mode tab. Click Toggle System Mode. Enter user level password *2772* at the prompt. Verify that instrument is in the service state with *Setup* showing in the *System Mode* field. Click External MT100 Flow Input (EFI) radio button. In the window's *Ext. ST/MT Flow Input Setup* field, select the Slave MT100 flow units from the drop-down list. Enter the flow rate equal to 4 mA into the *(Ext. ST/MT) Flow Min (4mA)* text box. Enter the flow rate equal to 20 mA into the *(Ext. ST/MT) Flow Max (20mA)* text box.

At window bottom click *Set System Mode to 'Running' when Send* check box. Click Send to Device near check box to send the EFI programming to the instrument. Observe return to normal operation with *Running* showing in *System Mode* field.

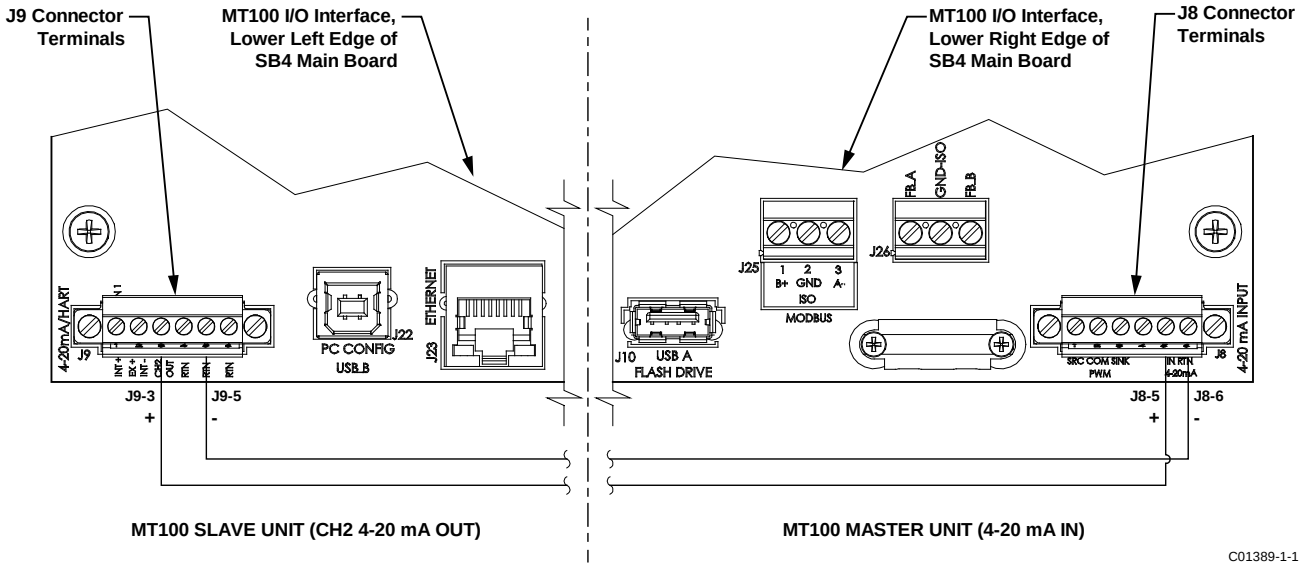


Figure 49 – Connections for External MT100 Flow Input (EFI)

External Control Group Switching (EGS)

This mode automatically changes the MT100 calibration group based on a 4-20 mA output current from another device fed into the MT100 4-20 mA input port. Start the application. Click **USB Connect** on the home screen. Select the *Configuration* branch from the menu tree on the window's left side. Select the **Extended Op. Mode** tab. Click **Toggle System Mode**. Enter user level password *2772* at the prompt. Verify that instrument is in the service state with *Setup* showing in *System Mode* field. Click **External Control Group Switching (EGS)** radio button.

Select the **Group Switch Setup** tab. In the window's *External Control Group Switching Setup* field, specify a 4-20 mA input value in the text box and its calibration group assignment via the associated *Group* drop-down list (define up to 5 points starting with the lowest value at the bottom). These entries determine which calibration group is active as the 4-20 mA input current varies. The EGS setup field's **Reset** button provides a quick way to clear out all programming entries (mA value/calibration group assignment).

Click **Send to Device** to send the EGS programming to the instrument. Return to normal operation by selecting the **Extended Op. Mode** tab and clicking the **Toggle System Mode** button (observe that *System Mode* field shows *Running*).

Modbus Operation

The MT100 offers Modbus as one of its digital communication protocol, but unlike the other digital communication protocols Modbus only offers set up and configuration for the totalizer variable.

The MT100 Modbus physical layer uses the asynchronous RS-485 serial port of the MT100. There is no high speed Modbus over Ethernet. The MT100 offers the two basic traditional transmission serial interface modes: RTU and ASCII message coding.

The MT100 offers the process variable parameters (value) in floating point form, which are organized as single or double precision floating point registers. These registers are the 4000 and the 5000 group registers, both of which are accessed using Modbus 03 and 04 function codes. Refer to Table 19, page 83, for an overview of the registers.

Setting the MT100 for Modbus Operation

The MT100 Configuration Software application is used to select the instrument's digital communication protocol.

Connect the MT100 USB port to a USB port on the PC on which the MT100 configurator software is installed using the supplied USB cable.

Launch the MT100 Configurator (with the PC already running and connected to the MT100). Select *Configuration* branch from the menu tree on the window's left side. Observe that the **Output** tab is selected. In the window's *Digital Output Selection* field, check whether or not **Modbus** is shown for *Digital Bus*. If not, use the *Digital Bus* pulldown menu to select **Modbus**. Then click **Send to Device** to program the MT100 (enter "2772" user password).

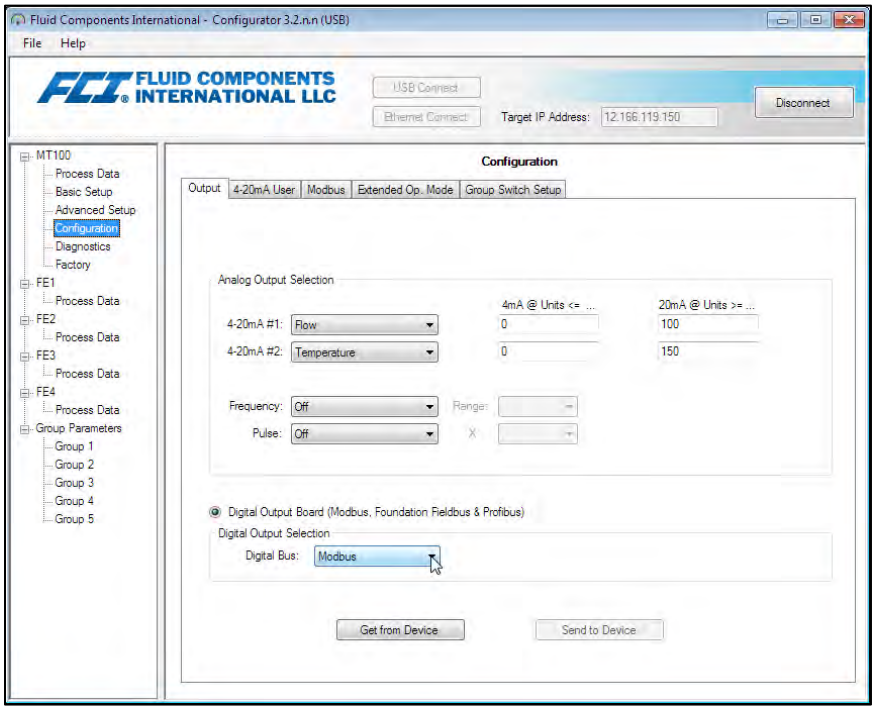


Figure 50 – MT100 Configuration Software Output Tab with Modbus Selected

Click the Modbus tab and configure the serial interface parameters (Node ID, Mode, Baud, Data Bits, Parity, and Stop Bits) as required for your application. Then click Send to Device to program the MT100 (enter "2772" user password). Refer to the MT100 Configuration Software manual 06EN003461 for details on digital bus configuration and general operation information.

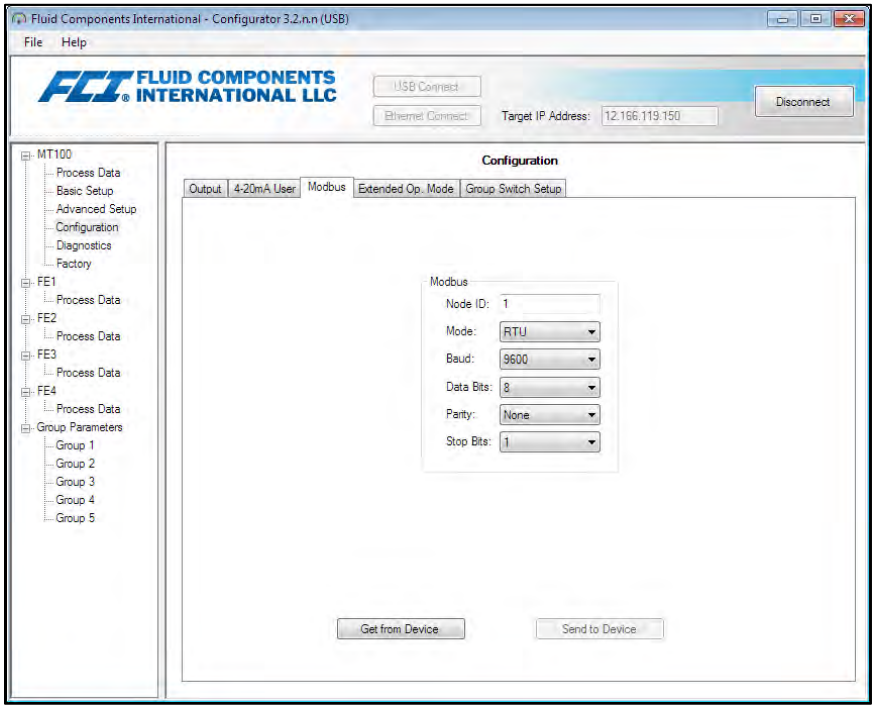


Figure 51 – MT100 Configuration Software Modbus Tab, Serial Interface Configuration

MT100 Modbus Commands

With the Modbus protocol the instrument data is read and written via multiple register access. The following public function numbers are defined for communication with the MT100: 03 and 04.

Table 18 – MT100 Modbus Function Codes

Function Code	Function Description
03	Holding Register Read Only – Process Data
	Holding Register Read/Write – Service Data
04	Read Input Register for all Process Data
	Read Input Register for all Service "Start/Stop" Totalizer

MT100 Process Data Registers

Two data type registers are set up in the MT100 to access the process data. One uses integer data registers (4000) and the other uses the Daniel extension data registers (5000).

All designated registers must be read for each variable value to extract the floating-point number. Conversion must be started manually with the 4000 registers. The Daniel extension handles the read and conversion automatically. To use the Daniel extension the master must support the Daniel extension function.

Totalizer Description

The MT100 through the Modbus channel offers the flow Totalizer value through three different register groups organized into two forms of floating point data types. Registers 5103 and 5104, offer the flow Totalizer as a double precision floating point value in the Modbus Daniel extension protocol. Registers 4105, 4106, 4107, and 4108 offer the flow Totalizer as a double precision floating point value in the Modbus standard integer register form. And lastly registers 4111, 4112, 4113, and 4114 offer the flow totalizer as a single precision floating point value in the Modbus standard register form. Because the Totalizer values can become a very large number, the single precision floating point presents the data as two register groups. Group 1 called TOTALIZER 1 holds the lower count with a defaulted count limit of

65,535.996. TOTALIZER 1 resets back to zero when the count limit is reached. Group 2 called TOTALIZER 2 holds the upper count and it increments by 1 every time the group 1 registers reach the 65,535.996 count or the set “Totalizer Max Limit” count. TOTALIZER 2 has a maximum count of 4,294,967,295, after which it resets back to zero.

The TOTALIZER 1 group maximum count value can be set to a lower value of the default value by the user. This is controlled by service registers 4115 and 4116 for which values above 65,535.996 are not permitted. The default value of 65,535.996 for TOTALIZER 1 provides a resolution 0.01 to the MT100 Totalizer value.

To reconstruct the double precision floating point value of the Totalizer using the single precision floating point registers do the following:
$Totalizer\ (DPFP) = Totalizer\ 2\ value \times Totalizer\ 1\ Max\ Value + Totalizer\ 1\ value$

Table 19 – MT100 Modbus Process Data

Process Variable Values – Daniel Extension

Variable/Parameter	Modbus Slave Register	Data Type	Access
Flow (Value)	5101	Float	Read
Temp (Value)	5102	Float	Read
Totalizer (Value) MS	5103	Float (D)[1]	Read
Totalizer (Value) LS	5104	Float (D)[1]	Read
Pressure (Value)[3]	5105	Float	Read

Process Variable Values – Integral Registers

Variable/Parameter	Modbus Slave Register	Data Type[2]	Access
Flow MS (Value)	4101	Special1	Read
Flow LS (Value)	4102	Special1	Read
Temperature MS (Value)	4103	Special1	Read
Temperature LS (Value)	4104	Special1	Read
Totalizer MS (Value)	4105	Special2 (D)[1]	Read
Totalizer MS2 (Value)	4106	Special2 (D)[1]	Read
Totalizer LS2 (Value)	4107	Special2 (D)[1]	Read
Totalizer LS (Value)	4108	Special2 (D)[1]	Read
Pressure MS (Value)[3]	4109	Special1	Read
Pressure LS (Value)[3]	4110	Special1	Read

Totalizer Value – Single Precision Floating Point (16 Bits)

Variable/Parameter	Modbus Slave Register	Data Type	Access
Totalizer 1 MS (Value)	4111	Float	Read
Totalizer 1 LS (Value)	4112	Float	Read
Totalizer 2 MS (Value)	4113	Float	Read
Totalizer 2 LS (Value)	4114	Float	Read

Process Variables – Engineering Unit Codes

Variable/Parameter	Modbus Slave Register	Data Type	Access
Flow Eng. Units Code	4020	Integer	Read
Temp Eng. Units Code	4021	Integer	Read
Totalizer Eng. Units Code	4022	Integer	Read
Pressure Eng Units Code[3]	4023	Integer	Read

Instrument Status Codes

Variable/Parameter	Modbus Slave Register	Data Type	Access
Device (Sensor 1) Status Code #1	4025	Integer	Read
Device (Sensor 1) Status Code #2	4026	Integer	Read

Notes:
1. (D) indicates double precision (64 bits).
2. Data Type: *Special1* is a collection of discrete registers that contain a single precision (32-bit) floating point value, and must be treated and interpreted as a single precision floating point number by the DCS or the PLC. *Special2* is a collection of discrete registers that contain a double precision (64-bit) floating point value, and must be treated and interpreted as a double precision floating point number by the DCS or the PLC.
3. Pressure variable is not applicable to the MT100.

MT100 Modbus Service Registers

The MT100 Modbus supports service registers **Totalizer Reset** and **Totalizer Start/Stop**.

- Reset Command for Totalizer – Use the Function 03 holding command via 4117 integer register to manually reset the MT100 totalizer count. This is a write only command. If another master has control on write, the function returns a "write protected" error message.
- Start/Stop Command for Totalizer – Use the Function 03 holding command via 4118 integer register to manually start or stop the totalizer count. This is a read/write command. If another master has control on write, the function returns a "write protected" error message.

Table 20 – Modbus Service Data

Service and Setup Functions

Variable/Parameter	Modbus Slave Register	Data Type	Access
Totalizer Reset To reset the totalizer write 0xABCD	4117	Integer	Write Only (Function 03)
Totalizer Start/Stop To start the totalizer write 0x01 To stop the totalizer write 0x00	4118	Integer	Read/Write (Function 03) Read (Function 04)
Totalizer 1 Max MS	4115	Float	Read/Write (Function 03)
Totalizer 1 Max LS	4116	Float	Read/Write (Function 03)

Examples of Totalizer Service Register Access using ModScan32

ModScan32 is a Windows-based utility by WinTECH Software that lets a PC operate as a Modbus master device for testing Modbus systems. Connect the instrument's Modbus terminals to one of the host PC's COM/USB port (a USB connection will require a USB to RS-485 Serial Adapter).

Setting Up ModScan32, Checking the Totalizer 1 (Lower Count) Value

1. Start the ModScan32 program and set the data definition (register #4111 and #4112) as shown in the figure below. (Set *Length* to "2" to include the 2nd subsequent register, 4112.)

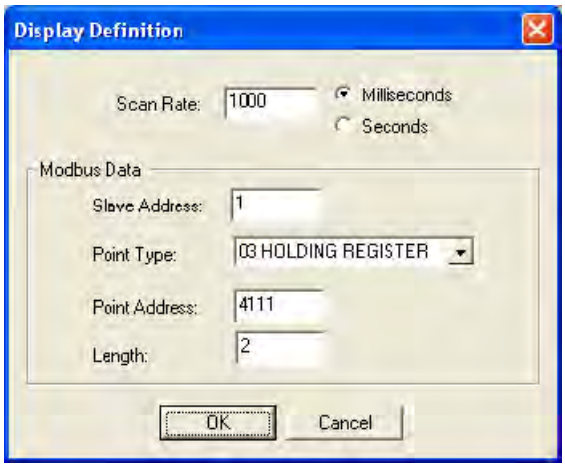


Figure 52 – ModScan32, Data Definition

2. Once data is defined, select **Connect** from the *Connection* pull-down menu. Below window is displayed. Set the serial parameters and protocol as required for your application.

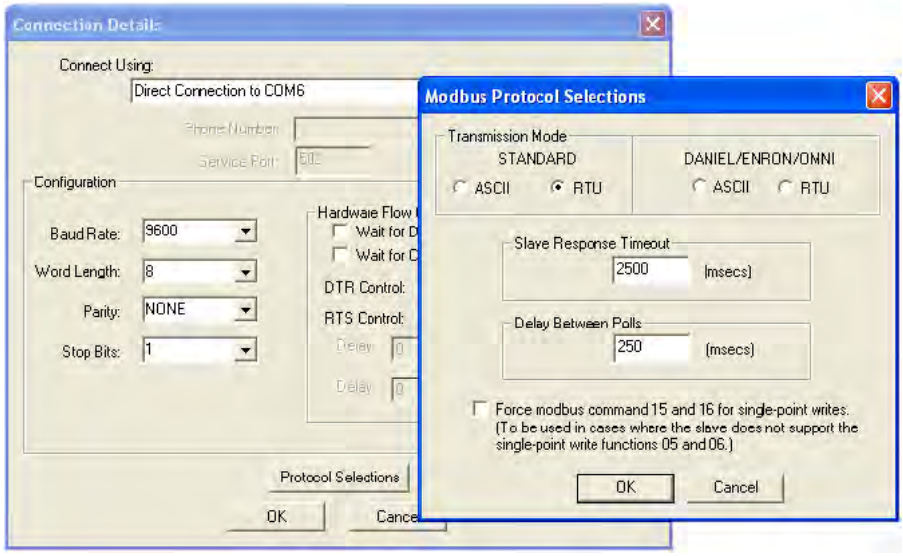


Figure 53 – ModScan32, Serial Interface and Transmission Mode Configuration

3. After entering the appropriate connection details the ModScan32 master then attaches itself to the Modbus device (MT100) as shown in the figure below. The register value displays in the bottom, gray part of the window.

Figure 54 – ModScan32 Connected to Modbus Device with Registers 4111 and 4112 on Display (Totalizer 1 Count)

Checking the Totalizer 2 (Upper Count/Rollover Count) Value

- Repeat step 1 above, but specifying register #4113 (and #4114) instead.
- Repeat step 2 above (no need to change serial configuration if already configured).
- See figure below for a "Rollover count" number example.

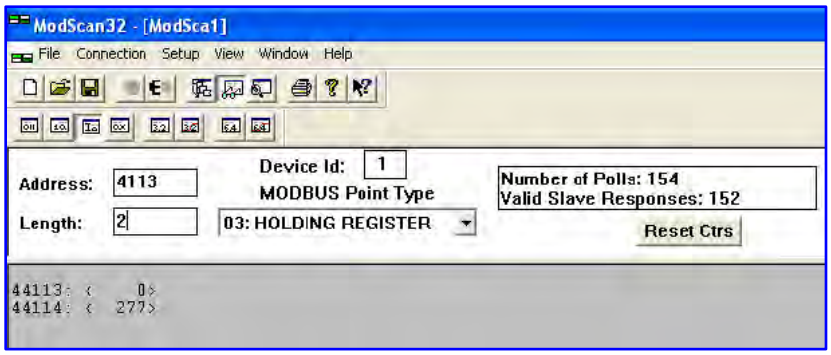


Figure 55 – ModScan32 Connected to Modbus Device with Registers 4113 and 4114 on Display (Rollover Count)

Checking/Setting the Totalizer Max. Value

- Repeat step 1 above, but specifying register #4115 (and #4116) instead.
- Repeat step 2 above (no need to change serial configuration if already configured).
- See figure below for a "Ceiling value" number example.

Figure 56 – ModScan32 Connected to Modbus Device with Register 4115 on Display (Ceiling Value)

Resetting the Totalizer Count

- Repeat step 1 above, but specifying register #4117 instead (*Length* = 1).
- Repeat step 2 above (no need to change serial configuration if already configured).
- Double click on the register number (see pointer in the figure below). A pop-up *Write Register* window displays. Enter the defined hex value, 0xABCD, in the window's value field, and then click Update.

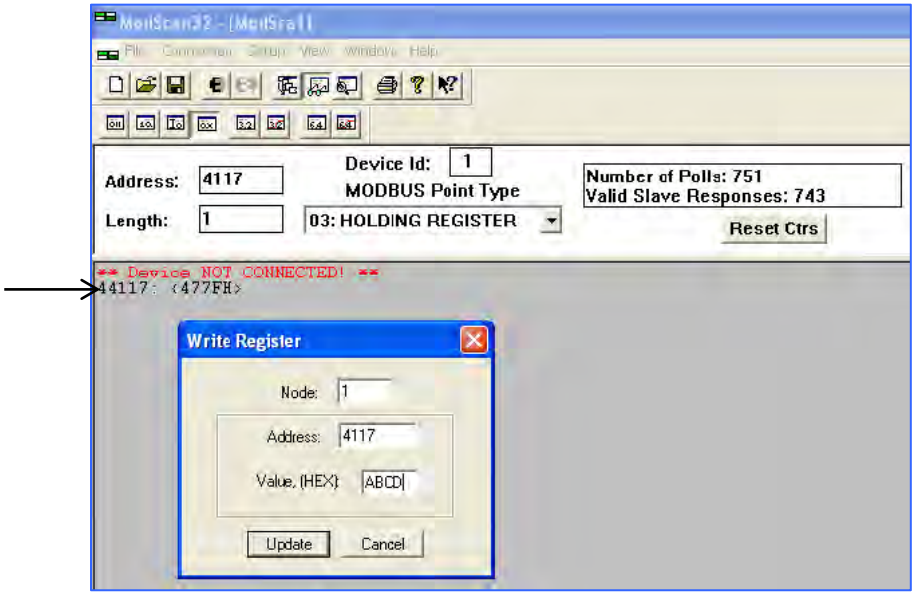


Figure 57 – ModScan32 Connected to Modbus Device with Register 4117 on Display (Totalizer Reset)

Starting/Stopping the Totalizer Count

- Repeat step 1 above, but specifying register #4118 instead (*Length* = 1).
- Repeat step 2 above (no need to change serial configuration if already configured).
- Double click on the register number (see pointer in the figure below). A pop-up *Write Register* window displays. Enter the defined value (1 = start or 0 = stop) in the window's value field, and then click Update.

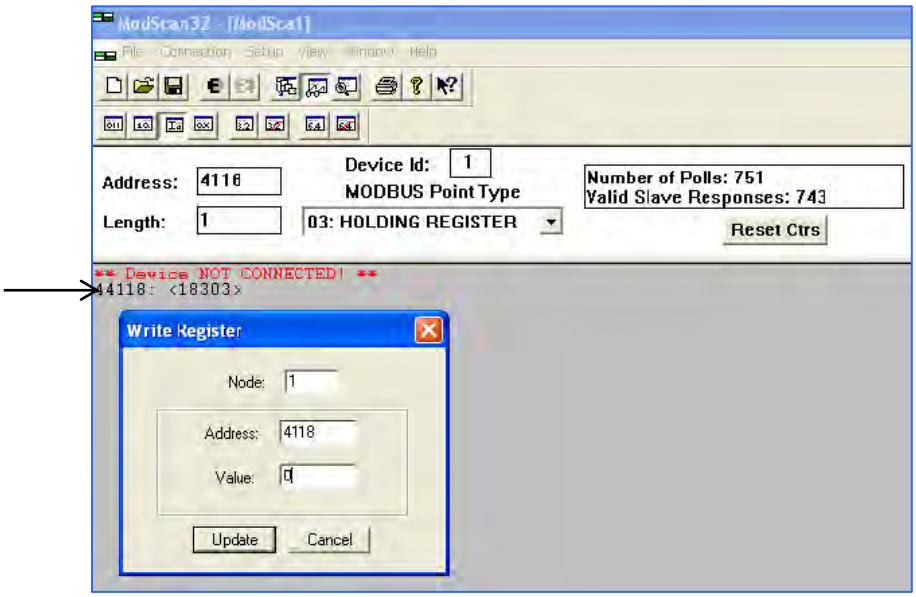


Figure 58 – ModScan32 Connected to Modbus Device with Register 4118 on Display (Totalizer Start/Stop)

Modbus Engineering Units Codes

Table 21 below summarizes the Modbus codes used to represent the instrument's engineering units.

Table 21 – Modbus Engineering Units Codes

Temperature

Modbus Code	Unit Description	Modbus Code	Unit Description
66	degrees Celsius	71	degrees Fahrenheit

Volumetric Flow

Modbus Code	Unit Description	Modbus Code	Unit Description
90	Standard Cubic Feet per Second	78	Normal Cubic Meters per Hour
67	Standard Cubic Feet per Minute	95	Normal Cubic Meters per Day
72	Standard Cubic Feet per Hour	68	Normal Liter per Second
91	Standard Cubic Feet per Day	96	Normal Liter per Minute
94	Normal Cubic Meters per Second	97	Normal Liter per Hour
79	Normal Cubic Meters per Minute	98	Normal Liter per Day

Mass Flow

Modbus Code	Unit Description	Modbus Code	Unit Description
80	Pounds per Second	75	Kilograms per Hour
65	Pounds per Minute	93	Kilograms per Day
76	Pounds per Hour	99	Metric Tonnes per Second
92	Pounds per Day	100	Metric Tonnes per Minute
73	Kilograms per Second	101	Metric Tonnes per Hour
74	Kilograms per Minute	102	Metric Tonnes per Day

Velocity Flow

Modbus Code	Unit Description	Modbus Code	Unit Description
70	Standard Feet per Second	86	Standard Meters per Second
83	Standard Feet per Minute	87	Standard Meters per Minute
84	Standard Feet per Hour	88	Standard Meters per Hour
85	Standard Feet per Day	89	Standard Meters per Day

Totalizer

Modbus Code	Unit Description	Modbus Code	Unit Description
190	Normal Cubic Feet	180	Pounds
194	Normal Cubic Meters	173	Kilograms
168	Normal Liters	199	Metric Tonnes

4 MAINTENANCE

Warning: To avoid hazards to personnel, ensure that all environmental isolation seals are properly maintained.

Warning: AC mains wiring is exposed when remote electronics enclosure is opened. Exercise caution when calibrating the instrument or opening the enclosure door.

Caution: The flow transmitter contains electrostatic discharge (ESD) sensitive devices. Use standard ESD precautions when handling the flow transmitter. See Use Standard ESD Precautions, page 5 for details.

Introduction

The flow meter needs very little maintenance. There are no moving parts or mechanical parts subject to wear in the flow meter. The flow element that is exposed to the process media is all welded stainless steel construction. The flow element is only subject to chemical attack based on the corrosion relationship between the RTD thermowell material and process media.

General Maintenance

General maintenance procedures are summarized below.

Calibration

Every 18 months as a minimum, verify the calibration of the flow meter and re-calibrate if necessary (contact the factory).

Electrical Connections

Periodically inspect the cable connections, the terminal strips and the terminal blocks for good connections. Verify that terminal connections are tight and physically sound with no sign of corrosion.

Enclosures

Verify that the moisture barriers and seals that protect the local and remote enclosures are intact.

Electrical Cables

Periodically inspect the power cable, flow element cable(s) and output cable. Check for deterioration of the cable's insulation.

Flow Element Mounting Connections

Verify that all seals are performing properly and that there is no leakage of the process media. Check for deterioration of the gaskets and environmental seals used.

Flow Element Assembly

Periodically remove the flow element for inspection based on historical evidence of debris, foreign matter, or scale build-up. Also the flow element can be removed at appropriate plant shutdown schedules. Check for corrosion, stress cracking, and/or build-up of oxides, salts, or foreign substances. The thermowells must be free of excessive contaminants and be physically intact. Any build-up could cause faulty readings. Clean the flow element as needed with a soft brush and available solvents (compatible with stainless steel).

Power Fuse Replacement

Warning: Make sure system power is OFF before replacing the fuse.

Input power overload protection is provided by a socketed radial lead fuse. Table 22 below summarizes the power fuse used in the MT100 Series. Figure 23 on page 26 shows the fuse location on the power supply board in the remote electronics enclosure.

To check the integrity of a radial lead fuse first turn instrument power OFF. Unscrew the fuse socket's clear plastic cap and pull out the fuse. Measure the fuse resistance. Any reading other than a short (i.e., open circuit) indicates a blown fuse. Replace with the appropriate Littelfuse TR5, Series 383 fuse as listed in Table 22 below.

Table 22 – Power Fuse Summary

Qty	FCI Assembly P/Ns	Description	Fuse Mfgr P/N	FCI Fuse P/N
1	024539-01 (DC-DC Power Supply) 024555-01 (AC-DC Power Supply)	Radial lead fuse, Littelfuse TR5 Series 383, 2 A/300 V, time-lag	3831200000	022499-01

Lithium Battery Replacement

Warning: Make sure system power is OFF before replacing the battery.

A 3-volt lithium coin cell battery powers the MT100 real time clock (RTC). Typical service life of the battery is two years. Replace the battery every two years with a type CR2450 coin cell battery. Figure 59 below shows the location of the lithium battery on the SB4 (main) board. Install the battery in the coin cell holder with the positive (+) side facing up.

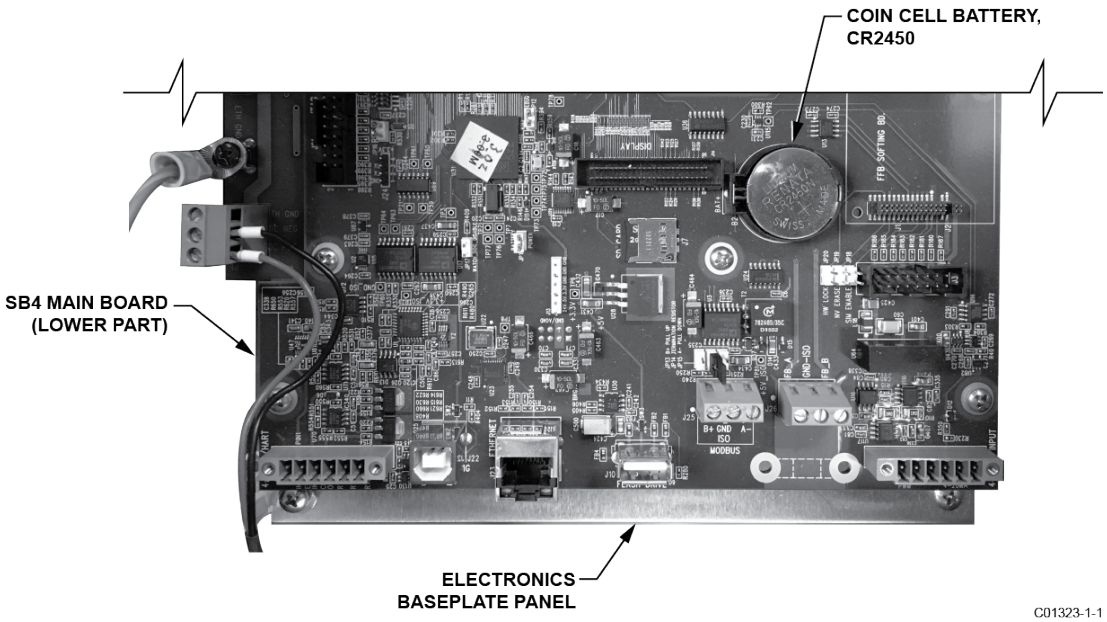


Figure 59 – Lithium Coin Cell Battery (CR2450) Location

5 TROUBLESHOOTING

Warning: Instrument testing/troubleshooting limited to qualified personnel only. The operator assumes all responsibilities for safe practices while troubleshooting.

Caution: The flow transmitter contains electrostatic discharge (ESD) sensitive devices. Use standard ESD precautions when handling the flow transmitter. See Use Standard ESD Precautions, page 5 for details.

Troubleshooting Equipment

- 250 Ω 0.01% resistor
- 2 decade resistance boxes with resolution from 0.01 to 9999.99 ohms
- 2 digital multimeters (DMM)
- Delta R table matched to the instrument by serial number
- FES-200 flow element simulator with cable (cable part no. 022610-12 for MT100)

Non-Maintenance Observations

At this point, observe the system setup to verify operation. No disassembly or testing is required at this time.

Check Serial Numbers

Verify that the serial number of the flow element(s) and the flow transmitter are the same. The flow element(s) and the flow transmitter are a matched set. Neither can work independently of the other nor can they be swapped with similar units from another system.

Check Input Power

Check for intact fuses. Verify that the AC power source is connected and turned on.

Check Instrument Installation

Review the instrument installation information given in the Installation section to verify correct mechanical and electrical installation. Be sure the connectors are firmly mated, and the wires are firmly attached to the connector. (Be sure the wires are inserted between the metal clamps and not between the clamp and plastic connector enclosure.) Verify correct wiring per wiring diagram in APPENDIX A, page 101.

Check for Moisture

Check for moisture in the enclosures. Moisture on the electronics can cause faulty operation.

If a component of the process media is near its saturation temperature, then the component may condense on the sensing points. Liquid on the sensing points can cause measurement errors.

Check Application Design Requirements

Application design problems usually occur with first time application instruments, although the design should also be checked on instruments that have been in operation for some time. If the application design does not match field conditions, errors occur.

1. Review the application design with plant operation personnel and plant engineers.
2. Ensure that plant equipment such as pressure and temperature instruments conform to the actual conditions.
3. Verify operating temperature, operating pressure, line size, and gas medium.

Check the General Process

Check all inputs and outputs to the system. Verify pump ratings and check damper or valves that might be open or closed causing the flow to be different from that which would be expected.

Verify Standard vs. Actual Process Conditions

The flow meter measures the mass flow rate. The mass flow rate is the mass of the gas flowing through a pipe per time. Other flow meters, such as an orifice plate or a pitot tube, measure the volumetric flow rate. The volumetric flow rate is the volume of gas per time. If the readings displayed do not agree with another instrument, some calculations may be necessary before comparing them. To calculate the mass flow rate and the volumetric flow rate the pressure and temperature at the point of measurement must be known. Use the following equation to calculate the mass flow rate (Standard Volumetric Flow rate) for the other instrument.

Equation:

$$Q_S = Q_A \times \frac{P_A}{T_A} \times \frac{T_S}{P_S}$$

Where:

Q_A	=	Volumetric Flow	Q_S	=	Standard Volumetric Flow
P_A	=	Actual Pressure	T_A	=	Actual Temperature
P_S	=	Standard Pressure	T_S	=	Standard Temperature

Pressure in PSIA and Temperature is in degrees Rankine

Example:

Q_A = 1212.7 ACFM Q_S = 1485 SCFM
P_A = 19.7 PSIA T_A = 120°F (580°R)
P_S = 14.7 PSIA T_S = 70°F (530°R)

$$1212.7 ACFM \times \left(\frac{19.7\ PSIA}{580°R}\right) \times \left(\frac{530°R}{14.7\ PSIA}\right) = 1485\ SCFM$$

General Function Check

Tools Needed

- Digital Multimeter (DMM)
- MT100 Configuration Software Application
- USB Cable Type B (male) to Type A (male); passive, straight-through type as supplied with instrument
- Two Decade Resistance Boxes with resolution from 0.01 to 9999.99 ohms
- Small size flat blade screwdriver (for sensor wiring connection)

Verifying Setup

Connect the flow meter via USB to a computer or laptop running the MT100 configuration software supplied with the instrument. Refer to MT100 Configuration Software manual 06EN003461 for details.

Confirm the setup of the flow meter by reviewing the setup windows in the configurator. Verify that the displayed information matches the parameters printed on the dR sheet parameter table. Contact your local representative or FCI for instructions if setup doesn't match.

Checking NAMUR Fault Indication

If the instrument's flow output is set up for NAMUR, check the output to see if it is driven to a NAMUR level. Refer to NAMUR Setup, page 40 for NAMUR information. Refer to Table 7 on page 41 for the list of faults that trigger NAMUR.

Troubleshooting the Flow Element

Check the Resistance of the Flow Element

Turn flow transmitter power OFF. Remove the TBx connector plug from all sensor wiring pin sockets in the remote enclosure (pull plug straight out).

- TB1 (Sensor 1), TB2 (Sensor 2), TB3 (Sensor 3), TB4 (Sensor 4) → on main SB4 board
- TB1 (Sensor 5), TB2 (Sensor 6), TB3 (Sensor 7), TB4 (Sensor 8) → on extension SB8 board

Refer to the appropriate wiring diagram in APPENDIX A, page 101. With the TBx connector plugs still removed measure the resistance between the terminals of terminal block TBx and compare with the values shown in Table 23 below.

Table 23 – Flow Element Resistance Measurements (In Ohms) Taken From Remote Electronics

Term Number	TBx-1 (Htr Exc)	TBx-2 (Htr Rtn)	TBx-3 (Act Exc)	TBx-4 (Act Sen)	TBx-5 (Gnd Sen)	TBx-6 (Gnd)	TBx-7 (Ref Exc)	TBx-8 (Ref Sen)
TBx-1 (Htr Exc)	N/A	115[3]	∞	∞	∞	∞	∞	∞
TBx-2 (Htr Rtn)	115[3]	N/A	∞	∞	∞	∞	∞	∞
TBx-3 (Act Exc)	∞	∞	N/A	0[1]	1080[2]	1080[2]	2160[2]	2160[2]
TBx-4 (Act Sen)	∞	∞	0[1]	N/A	1080[2]	1080[2]	2160[2]	2160[2]
TBx-5 (Gnd Sen)	∞	∞	1080[2]	1080[2]	N/A	0[1]	1080[2]	1080[2]
TBx-6 (Gnd)	∞	∞	1080[2]	1080[2]	0[1]	N/A	1080[2]	1080[2]
TBx-7 (Ref Exc)	∞	∞	2160[2]	2160[2]	1080[2]	1080[2]	N/A	0[1]
TBx-8 (Ref Sen)	∞	∞	2160[2]	2160[2]	1080[2]	1080[2]	0[1]	N/A

Notes: 1. Theoretical zero-ohm table values are influenced by sensor cable length, which typically adds <2 Ω.
2. Resistances are approximate for a sensor temperature of 70 °F (21 °C).
3. Heater resistance tolerance is ±10 Ω.

Note: There is added resistance to consider when measuring the flow element from the remote transmitter. The cable adds extra resistance. The added resistance can be found by measuring the ACT SEN wire to the ACT EXC wire (for example: TB3-4 to TB3-6, orTB4-4 to TB4-6 etc.).

If the measured values do not match the above tables unplug the cabling connecting TBx to the flow element assembly and measure the resistance between the terminals of flow element assembly terminal strip TSx (x=1, 2, 3 or 4). Compare the measured values with the values shown in Table 24 or Table 25 as applicable to your installation.

Table 24 – Flow Element Resistance (in Ohms) at the Local Enclosure (MT100S, Single Sensor Application)

Terminal Number	1	2	3	4	5
1	N/A	115[1]	∞	∞	∞
2	115[1]	N/A	∞	∞	∞
3	∞	∞	N/A	1080[2]	2160[2]
4	∞	∞	1080[2]	N/A	1080[2]
5	∞	∞	2160[2]	1080[2]	N/A

Notes: 1. Heater resistance tolerance is ±10 Ω.
2. Resistances are approximate for a sensor temperature of 70 °F (21 °C).

Table 25 – Flow Element Resistance (In Ohms) at the Local Enclosure (MT100M, Multipoint Sensor Application)

Term Number	1	2	3	4	5	6	7	8
1	N/A	0[1]	1080[2]	1080[2]	1080[2]	1080[2]	∞	∞
2	0[1]	N/A	1080[2]	1080[2]	1080[2]	1080[2]	∞	∞
3	1080[2]	1080[2]	N/A	2160[2]	0[1]	2160[2]	∞	∞
4	1080[2]	1080[2]	2160[2]	N/A	2160[2]	0[1]	∞	∞
5	1080[2]	1080[2]	0[1]	2160[2]	N/A	2160[2]	∞	∞
6	1080[2]	1080[2]	2160[2]	0[1]	2160[2]	N/A	∞	∞
7	∞	∞	∞	∞	∞	∞	N/A	115[3]
8	∞	∞	∞	∞	∞	∞	115[3]	N/A

Notes: 1. Theoretical zero-ohm table values are influenced by sensor cable length, which typically adds <2 Ω.
2. Resistances are approximate for a sensor temperature of 70 °F (21 °C).
3. Heater resistance tolerance is ±10 Ω.

If the instrument has been on for some time, the resistance of the active RTD will be greater than the reference RTD.

If the instrument has been off for some time, the resistance of the active RTD will be the same as the reference RTD.

If the measured resistances correspond to Table 24 or Table 25, but not to Table 23, then the cable is probably defective. Replace the cable and recheck resistances. If the resistances are still off, contact Customer Service. Plug in the TS2 connectors and reattach the cables when troubleshooting is complete.

If the measured values do not correspond to Table 23, Table 24 or Table 25, then the flow element is defective. Contact Customer Service.

Verification of the Electronics

Transmitter Power Supply

Using a DMM set to DC volts (V) check the voltages shown in the table below. Take the readings from J13, a white 1 x 6 header pin connector on the SB4 main board near the microSD card socket. Silkscreen markings on the board identify the J13 pins.

Caution: Be careful not to short the J13 header pins when taking the voltage readings.

Table 26 – Instrument Power Supply Voltages

Pin Number	Expected Power Supply Voltage
Digital 5 VDC: J13-2 to J13-5[1] (Gnd)	+4.75 V to +5.25 V
Analog 24 VDC: J13-1 to J13-5[1] (Gnd)	+23.75 V to +24.25 V

Note: 1. J13-4, J13-5, and J13-6 are all ground pins.

If the voltage measurements are within the range shown in the table, the power supply is functioning properly.

Transmitter Circuit Calibration Check (Delta R Verification)

Equipment Needed:

- FES-200 Flow Element Simulator with MT100-specific cable
- Digital Multimeter
- Delta R Calibration Data Sheet (serial number specific by instrument and group)
- Precision 250 Ω resistor (recommended)

Alternate Tool for FES-200:

- 2 ea. Precision Decade Resistance Box, 0.1% (1 kΩ large step, 0.01 Ω small step)

Note: If the flow meter's parameters have been changed, calibrations may be inaccurate or factory authorized changes have been made. Consult a factory service representative.

Each flow meter is provided with a Delta R data sheet which is a table listing the differential resistance values that correlate to the flow meter's calibration. Resistance substitution instruments like the FES-200 can be used to check instrument calibration and verify correct operation of the flow transmitter using the Delta R data sheet.

To verify the transmitter is working properly, the sensor head must be disconnected and precision resistance (Delta R) values from the FES-200 are substituted. Then by measuring the transmitter output and display it can be determined whether the transmitter is still within factory specification.

Safety Instructions

Warning: Explosion Hazard. Do not disconnect equipment when flammable or combustible atmosphere is present. Operator assumes responsibility for all safety concerns relating to interrupting and reapplying power to their instrumentation.

Delta R Check

1. Verify the Delta R data sheet has the same serial number and group number as the flow meter calibration that is being verified.
2. Turn transmitter power OFF.
3. Disconnect a flow element sensor from the MT100 transmitter (TBx) and connect the FES-200 cable connector in its place. See Figure 61. Precision decade boxes can be used in place of the FES-200. See Figure 62 for decade box wiring.
4. Connect a DMM to the transmitter 4-20 mA output by either method A or B as shown in Figure 60 below.
   a. To read 1 to 5 volts, disconnect both output loop wires and connect a precision 250 Ω resistor across the output terminal. Then connect the DMM, set to DC volts (V), across the resistor to read its voltage drop.
   b. To read 4 to 20 mA current, disconnect the output loop and connect the DMM, set to milliamps (mA), in series with the output circuit to read the current flow.

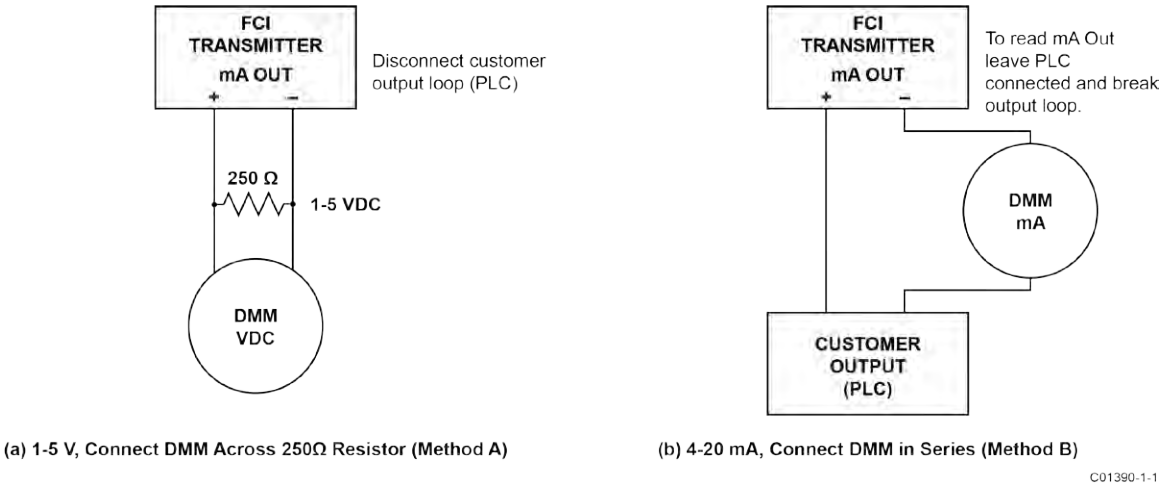


Figure 60 – DMM Hookup to Measure 4-20 mA Output

5. Turn transmitter power ON and allow the instrument 10 minutes to stabilize.
6. Verify the transmitter is in the calibration group matching the Delta R data sheet.
7. On the FES-200, dial in a Delta R value with the thumbwheel from the column marked Delta R (ohms) on the Delta R data sheet. Compare to the output value column (*VDC Across 250 Ohms* or *mA Output* as applicable) and/or the *Indicated Display* column. Verify that the meter reading is within the stated tolerance of the flow transmitter. See examples 1, 2 and 3 at the end of this section, as applicable.
8. Repeat for each point on the Delta R table, except for the step value and zero value.
9. Turn power OFF and disconnect the FES-200 and DMM. Reconnect the sensor element connector.
10. Close the enclosure, making sure none of the wires are strained. Ensure any seals and gaskets are properly installed.
11. Restore power to the meter.

If you are troubleshooting the flow meter and the readings are good, the flow transmitter is good and the problem may involve the flow element or interconnecting cable. If the readings are off, a flow element calibration may be required or the flow transmitter needs to be setup. Contact FCI Customer Service.

Heater Current Check

The heater current can be checked at TP1 on the FES-200. Set the DMM to DC volts (V).

1. Connect the positive lead of the DMM to TP1 on the FES-200.
2. Connect the negative lead of the DMM to the HTR EXC terminal of the flow transmitter.

The measured mV value of heater current will be 10x larger than the actual mA heater current. For example, 750 mV indicates 75 mA heater current. The measured value of heater current must be within ±0.15 mA of the factory set value. See Table 27 below.

Table 27 – Heater Current

FCI Transmitter Model	Factory-set Heater Current	DMM Reading
MT100S, S-type sensor probe	90 mA	900 mV
MT100S, F-type sensor probe MT100M, mast style probe	75 mA	750 mV

Allowable Limits

Example 1 – 4-20 mA output check using 1-5 VDC measurement.

Accuracy: ±(0.75% reading + 0.5% full scale) from GF90 Manual

Example Delta R Table entry:

Delta R (ohms)	VDC Across 250 ohms	mA Output	Unit dR	Indicated Display
71.08	2.995	11.98	71.197	154.8 SCFM

- Measure VDC with FES-200 thumbwheel set to 071.08 = 3.011 VDC measured on DMM.
- Determine allowable VDC limits for the 2.995 VDC table value:

  Note: Since the 1-5 VDC range starts at 1 VDC, account for this offset by subtracting 1 VDC from both the "reading" of 2.995 VDC and the "full scale" of 5 VDC.

- Allowable VDC limits = 0.0075 x (2.995 – 1) + 0.005 x (5 – 1) = ±0.035 VDC

The measured value of 3.011 VDC is within the allowable limits of 2.995 ±0.035 VDC.

Example 2 – 4-20 mA output check (using example 1 sample data)

- Measure mA with FES-200 thumbwheel set to 071.08 = 12.04 mA measured on DMM.
- Determine allowable mA limits for the 11.98 mA table value:

  Note: Since the 4-20 mA range starts at 4 mA, account for this offset by subtracting 4 mA from both the "reading" of 11.98 mA and the "full scale" of 20 mA.

- Allowable mA limits = 0.0075 x (11.98 – 4) + 0.005 x (20 – 4) = ±0.139 mA

The measured value of 12.04 mA is within the allowable limits of 11.98 ±0.139 mA.

Example 3 – Indicated Display Check (using information from above examples)

- Record the indicated display value with FES-200 thumbwheel set to 071.08 = 156 SCFM indicated on display.
- Determine allowable limits for the 154.8 SCFM table value:

  Note: The full scale display value is 310 SCFM in this example.

- Allowable Indicated flow limits = 0.0075 x 154.8 SCFM + 0.005 x 310 SCFM = ± 2.71 SCFM

The indicated value of 156 SCFM is within the allowable limits of 154.8 ±2.71 SCFM.

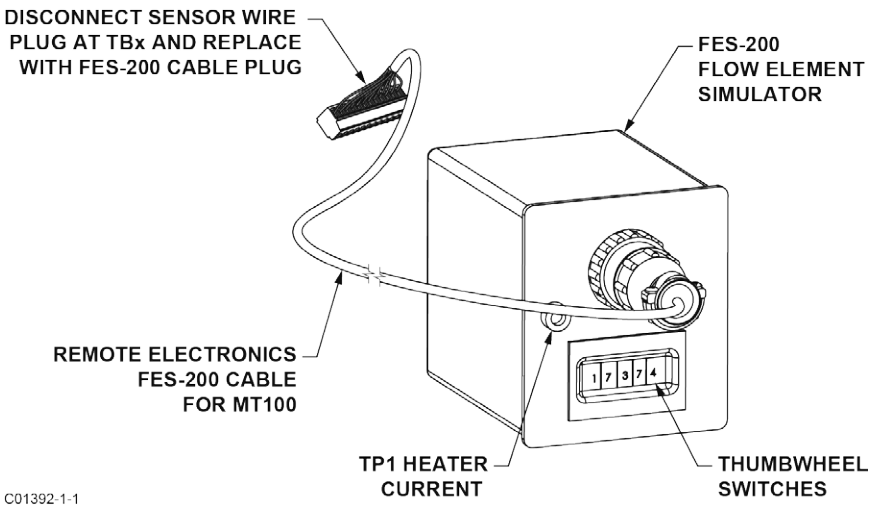


Figure 61 – Connecting FES-200 to MT100 Transmitter

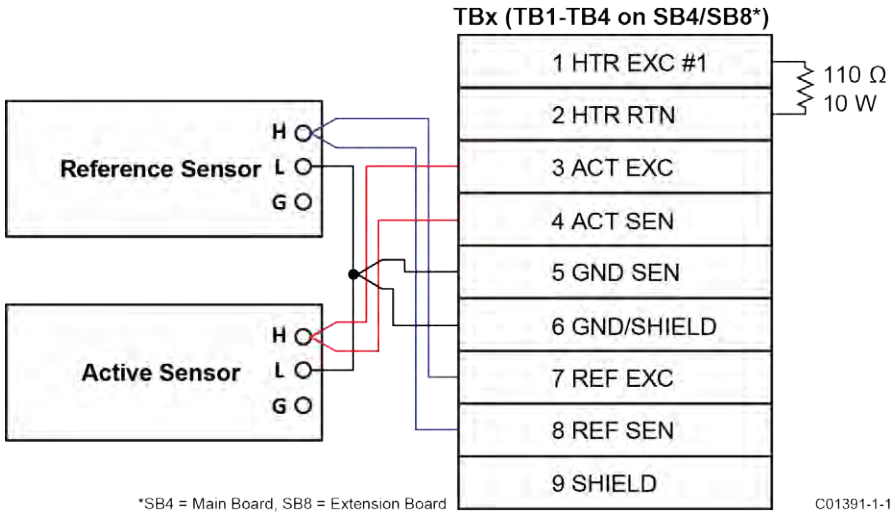


Figure 62 – MT100 Decade Box Wiring

Defective Parts

Before returning any equipment to FCI, obtain an RA number for authorization, tracking, and repair/replacement instructions. If a return is required, remove the defective part, replace with a spare, calibrate, then return defective part to FCI, freight prepaid, for disposition.

Customer Service

1. In the event of problems or inquiries regarding the instrument, contact an authorized FCI field agent for the region or country. Refer to the FCI website: http://www.fluidcomponents.com/ for a list of field service representatives (which includes phone and email contact information) and a list of service centers around the world.
2. Before contacting the FCI representative make sure that all the applicable information is near so that a more effective, efficient and timely response can be provided.
3. Refer to APPENDIX C, page 139 for specific Customer Service policy provisions.

Reference: Error/Status Register Information

Summarized in the tables below are various registers that provide the instrument with error/status information. This information is normally presented in the configuration software's *Fault Log* tab. Digital busses (such as HART) can also access this information via a read operation using the appropriate register address.

Instrument Fault Codes Tables

The basic CORE fault register (4 bytes) provides basic CORE and FE fault indication. Detailed faults are given in the 6-byte detailed CORE fault register and the 4-byte FE fault register. The latter two registers provide specific error status for a fault indicated by the basic CORE fault register.

Table 28 – Basic CORE Fault Register (CORE CY Command)

Octet-Bit	Fault Name	Fault Description	Fault Type[1]	Hex Bit Map
0-0	FE_01_FAULT	FE1 is reporting a fault or an error	Fatal/Non-Fatal	0x00000001
0-1	FE_02_FAULT	FE2 is reporting a fault or an error	Fatal/Non-Fatal	0x00000002
0-2	FE_03_FAULT	FE3 is reporting a fault or an error	Fatal/Non-Fatal	0x00000004
0-3	FE_04_FAULT	FE4 is reporting a fault or an error	Fatal/Non-Fatal	0x00000008
0-4	FE_05_FAULT	FE5 is reporting a fault or an error	Fatal/Non-Fatal	0x00000010
0-5	FE_06_FAULT	FE6 is reporting a fault or an error	Fatal/Non-Fatal	0x00000020
0-6	FE_07_FAULT	FE7 is reporting a fault or an error	Fatal/Non-Fatal	0x00000040
0-7	FE_08_FAULT	FE8 is reporting a fault or an error	Fatal/Non-Fatal	0x00000080
1-1 to 1-8	FCI Reserved (Not Used)			0x00000100 to 0x00008000
2-0	PD_FATAL_FAULT	At least one FE has a fatal error or fault	Fatal	0x00010000
2-1	FCI Reserved (Not Used)			0x00020000
2-2	PD_NON_OP	At least one FE was non-operational (self-test)	Non-Fatal	0x00040000
2-3	PD_SYSTEM_ERROR	System (Core) error	Non-Fatal	0x00080000
2-4	FCI Reserved (Not Used)			0x00100000
2-5	PD_NO_PD_UPDATE	All FEs reported a fatal error	Fatal	0x00200000
2-6	PD_SD_CARD_ERROR	SD Card error	Non-Fatal	0x00400000
2-7	FCI Reserved (Not Used)			0x00800000
3-0 to 3-1	FCI Reserved (Not Used)			0x01000000 to 0x02000000
3-2	Process Alarm #1	Alarm #1 Status (1 = Tripped)	Non-Fatal	0x04000000
3-3	Process Alarm #2	Alarm #2 Status (1 = Tripped)	Non-Fatal	0x08000000
3-4	Process Alarm #3	Alarm #3 Status (1 = Tripped)	Non-Fatal	0x10000000
3-5	Process Alarm #4	Alarm #4 Status (1 = Tripped)	Non-Fatal	0x20000000
3-6	Process Alarm #5	Alarm #5 Status (1 = Tripped)	Non-Fatal	0x40000000
3-7	Process Alarm #6	Alarm #6 Status (1 = Tripped)	Non-Fatal	0x80000000

Note: 1. *Fault Type* reflects factory default programming. The Fatal/Non-Fatal designation is programmable via the Configurator software's Core Faults tab (*Factory* branch menu tree – requires entry of appropriate level password).

Table 29 – Detailed CORE Fault Register (CORE 2V Command)

Octet-Bit	Status Description	Fault Type	Hex Bit Map
0-0	Device Error: If any of these errors occurs: I2C error, UART error, Mutex error, watchdog reset	Fatal	0x000000000001
0-1	FCI Reserved (Not Used)	Non-Fatal	0x000000000002
0-2	FCI Reserved (Not Used)	Non-Fatal	0x000000000004
0-3	CORE unable to update process data (PD_NO_FE_DATA). Unable to obtain/use data from any Active FEs	Fatal	0x000000000008
0-4	FCI Reserved (Not Used)	Non-Fatal	0x000000000010
0-5	CORE detects FRAM/SPI error	Fatal	0x000000000020
0-6	CORE reports SD card error. Either initialization (corrupt card) error or card became full (error while writing).	Non-Fatal	0x000000000040
0-7	FCI Reserved (Not Used)	Non-Fatal	0x000000000080
1-0	FCI Reserved (Not Used)	Non-Fatal	0x000000000100
1-1	FCI Reserved (Not Used)	Non-Fatal	0x000000000200
1-2	FCI Reserved (Not Used)	Non-Fatal	0x000000000400
1-3	FCI Reserved (Not Used)	Non-Fatal	0x000000000800
1-4	FCI Reserved (Not Used)	Non-Fatal	0x000000001000
1-5	CORE unable to communicate with one or more FEs (PD_COMM_ERROR)	Fatal	0x000000002000
1-6	FCI Reserved (Not Used)	Non-Fatal	0x000000004000
1-7	CORE: averaged flow out of range of “Flow Min” or “Flow Max”	Non-Fatal	0x000000008000
2-0	FCI Reserved (Not Used)	Non-Fatal	0x000000010000
2-1	FCI Reserved (Not Used)	Non-Fatal	0x000000020000
2-2	FCI Reserved (Not Used)	Non-Fatal	0x000000040000
2-3	CORE: averaged temperature above “Temperature Max”	Fatal	0x000000080000
2-4	CORE: averaged temperature below “Temperature Min”	Fatal	0x000000100000
2-5	FE Heater is shorted or below operating limit.	Fatal	0x000000200000
2-6	FE Heater monitoring ADC fails to respond.	Fatal	0x000000400000
2-7	FE Heater is open or above operating limit.	Fatal	0x000000800000
3-0	The Reference-R ADC converter fails to respond.	Fatal	0x000001000000
3-1	FCI Reserved (Not Used)	Non-Fatal	0x000002000000
3-2	The Reference-R ADC’s count number is below the minimum.	Non-Fatal	0x000004000000
3-3	FCI Reserved (Not Used)	Non-Fatal	0x000008000000
3-4	Process flow is above the maximum limit.	Non-Fatal	0x000010000000
3-5	FCI Reserved (Not Used)	Non-Fatal	0x000020000000
3-6	FCI Reserved (Not Used)	Non-Fatal	0x000040000000
3-7	The ADC for monitoring the temperature inside the unit fails to respond.	Non-Fatal	0x000080000000
4-0	The Delta-R ADC fails to respond.	Fatal	0x000100000000
4-1	4-20mA Input / Pressure Input ADC fails to respond (Not Used for MT100)	Non-Fatal	0x000200000000
4-2	Reference-R value is above operating limit.	Non-Fatal	0x000400000000
4-3	The Inter-Integrated Circuit channel 0 bus fails to communicate.	Non-Fatal	0x000800000000
4-4	The ADC for monitoring heater’s conditions fails to respond.	Fatal	0x00100000000
4-5	The port expansion integrated chip fails to respond.	Non-Fatal	0x00200000000
4-6	FCI Reserved (Not Used)	Non-Fatal	0x00400000000
4-7	FCI Reserved (Not Used)	Non-Fatal	0x00800000000
5-0	FRAM reports FE failed to respond.	Non-Fatal	0x01000000000
5-1	The Active excitation current Integrated Circuit (IC) fails.	Fatal	0x02000000000
5-2	The Reference excitation current Integrated Circuit (IC) fails.	Non-Fatal	0x04000000000
5-3	CORE: process data are not updated because (all) FE's are in self-test mode, or the system is in non-operating mode.	Non-Fatal	0x08000000000
5-4	FE reports REFERENCE-R BELOW ABSOLUTE MIN VALUE FAULT	Fatal	0x10000000000
5-5	FE reports DR ABOVE ABSOLUTE VALUE FAULT	Fatal	0x20000000000
5-6	FE reports DR BELOW ABSOLUTE MIN VALUE FAULT	Fatal	0x40000000000
5-7	The unit is performing a (diagnostic) test.	Non-Fatal	0x80000000000

Notes: 1. *Fault Type* reflects factory default programming. The Fatal/Non-Fatal designation is programmable via the Configurator software’s FE Faults tab (*Factory* branch menu tree – requires entry of appropriate level password).

Table 30 – FE Fault Register (FE DF Command)

Octet-Bit	Fault Name	Fault Description	Fault Type[1]	Hex Bit Map
0-0	FCI Reserved (Not Used)	—	—	0x00000001
0-1	FCI Reserved (Not Used)	—	—	0x00000002
0-2	HTR_CURR_ADC_OVER_RANGE_FAULT	The heater current analog-to-digital converter shows saturation at its input.	Fatal	0x00000004
0-3	FCI Reserved (Not Used)	—	—	0x00000008
0-4	FCI Reserved (Not Used)	—	—	0x00000010
0-5	FCI Reserved (Not Used)	—	—	0x00000020
0-6	SENSOR_ABOVE_MAX_FLOW_FAULT	Process flow is above the maximum limit.	Fatal	0x00000040
0-7	SENSOR_OVER_TEMP_FAULT	Process temperature is above the maximum limit.	Fatal	0x00000080
1-0	SENSOR_UNDER_TEMP_FAULT	Process temperature is below the minimum limit.	Fatal	0x00000100
1-1	HEATER_SHORTED_FAULT	The heater is shorted or its value is below the normal operating value.	Fatal	0x00000200
1-2	HEATER_OPEN_FAULT	The heater is open or its value is above the normal operating value.	Fatal	0x00000400
1-3	HTR_CURR_ADC_FAULT	The heater current analog-to-digital converter (ADC) fails to respond.	Non-Fatal	0x00000800
1-4	dR_ADC_FAULT	The Delta-R ADC fails to respond.	Fatal	0x00001000
1-5	REF_ADC_FAULT	The Reference-R ADC converter fails to respond.	Fatal	0x00002000
1-6	BRD_TEMP_LIMITS_FAULT	Temperature inside the unit is outside the limits (above or below the operating limits).	Fatal	0x00004000
1-7	I2C0_FAULT	The Inter-Integrated Circuit (I2C) channel 0 bus fails to communicate.	Fatal	0x00008000
2-0	SENSOR_BELOW_MIN_ADC_FAULT	The Reference-R ADC's count number is below the minimum.	Fatal	0x00010000
2-2	FCI Reserved (Not Used)	—	—	0x00020000
2-2	PORT_EXPANDER_FAULT	The port expansion integrated chip fails to respond.	Non-Fatal	0x00040000
2-3	BELOW_dR_MIN_FAULT	Delta-R value is below minimum limit.	Fatal	0x00080000
2-4	TMP100_ADC_FAULT	The ADC for monitoring the temperature inside the unit fails to respond.	Non-Fatal	0x00100000
2-5	LTC2654_DAC_FAULT	The digital-to-analog converter fails to respond.	Non-Fatal	0x00200000
2-6	FE_FRAM_FAULT	The FRAM of the Flow Element fails to respond.	Non-Fatal	0x00400000
2-7	FCI Reserved (Not Used)	—	—	0x00800000
3-0	HTRS_MON_ADC_FAULT	The ADC for monitoring heater's conditions fails to respond.	Non-Fatal	0x01000000
3-1	ACT_EXC_CURR_FAULT	The Active excitation current Integrated Circuit (IC) fails.	Non-Fatal	0x02000000
3-2	REF_EXC_CURR_FAULT	The Reference excitation current Integrated Circuit (IC) fails.	Non-Fatal	0x04000000
3-3	SENSOR_REFR_ABOVE_ABS_MAX	Reference-R value is above operating limit.	Fatal	0x08000000
3-4	SENSOR_REFR_BELOW_ABS_MIN	Reference-R value is below operating limit.	Non-Fatal	0x10000000
3-5	SENSOR_DR_ABOVE_ABS_MAX	Delta-R value is above operating limit.	Non-Fatal	0x20000000
3-6	SENSOR_DR_BELOW_ABS_MIN	Delta-R value is below operating limit.	Fatal	0x40000000
3-7	FE_AUTO_CHECK	The unit is performing a (diagnostic) test.	Fatal	0x80000000

Notes: 1. *Fault Type* reflects factory default programming. The Fatal/Non-Fatal designation is programmable via the Configurator software's **FE Faults** tab (*Factory* branch menu tree – requires entry of appropriate level password).

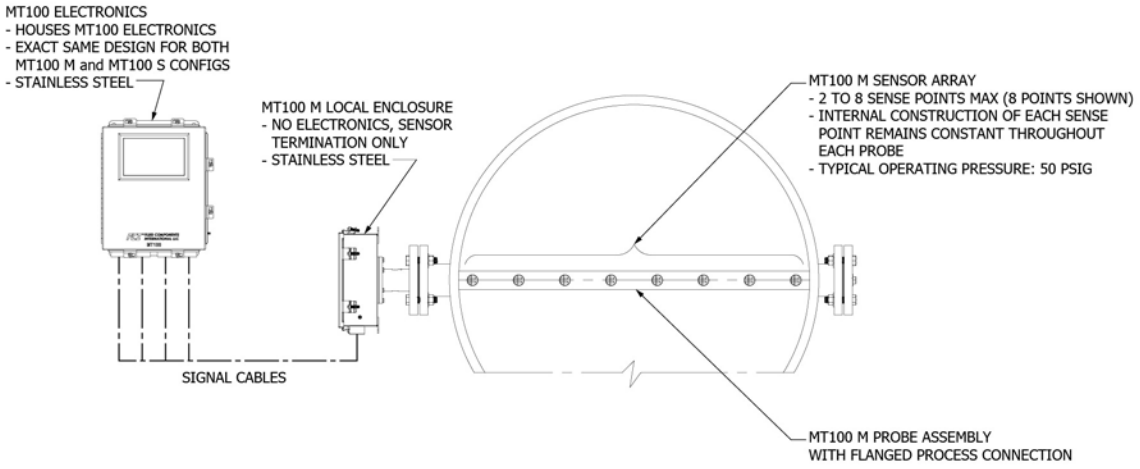
APPENDIX A DRAWINGS

This appendix contains MT100 technical drawings. Table 31 below summarizes the drawings.

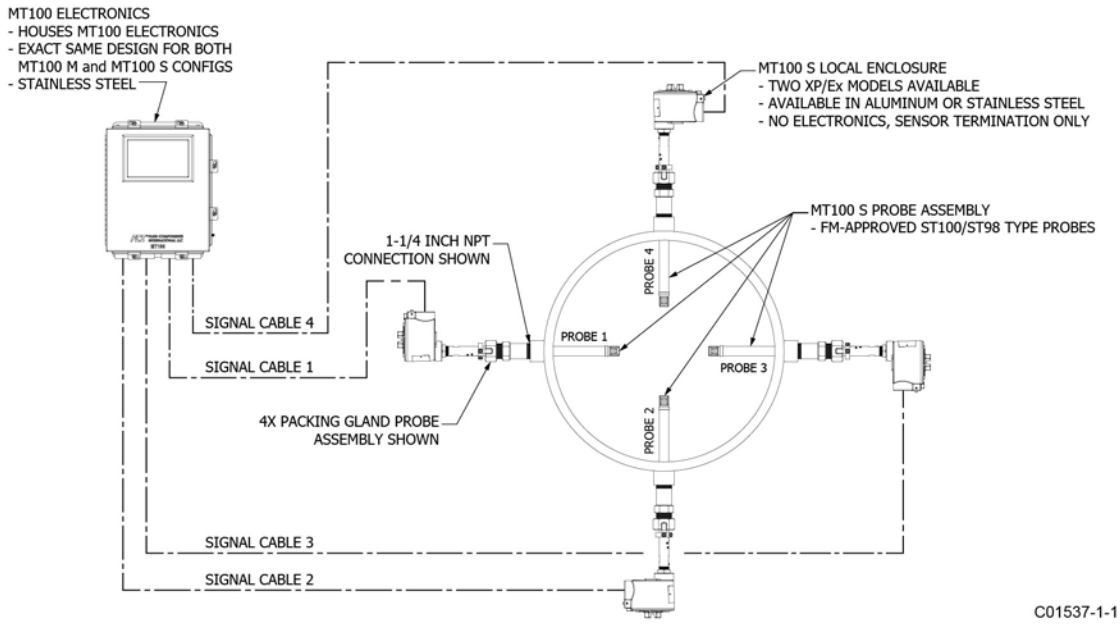
Table 31 – MT100 Drawings in Appendix A

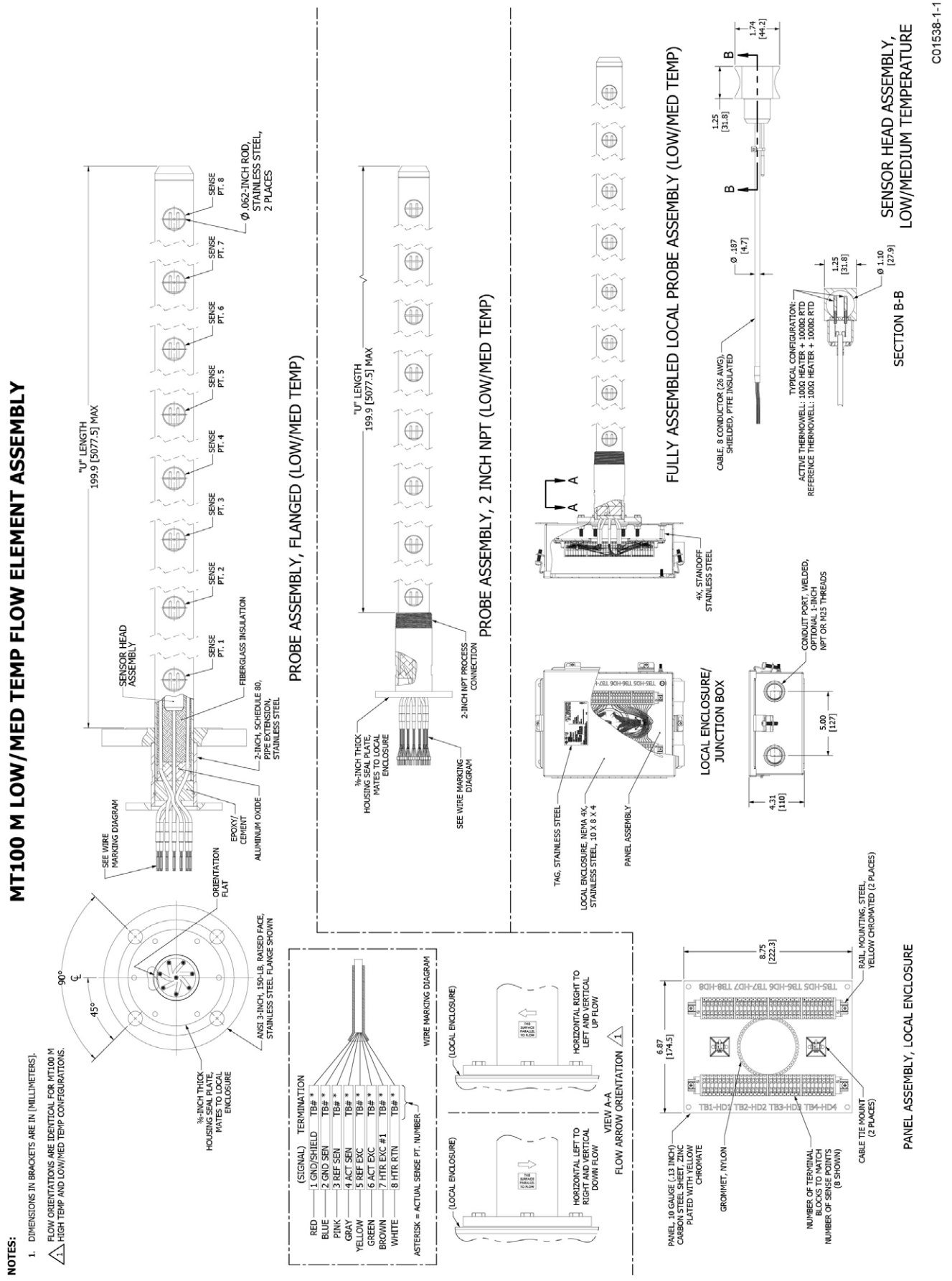
Dwg. No.	Dwg. Type	Page No.	Description
C01537-1	System	102	MT100 M Multi-Point And Mt100 S Single-Point Insertion Configurations
C01538-1	System	103	MT100 M Low/Med Temp Flow Element Assembly
C01539-1	System	104	MT100 M High Temp Flow Element Assembly
C01540-1	System	105	MT100 S Flow Element Assembly Options
C01541-1	System	106	MT100 S And MT100 M Local Enclosure Options
C01542-1	System	107	MT100 Series Remote Electronics Enclosure With Display Window
C01543-1	System	108	MT100 Series Remote Electronics Enclosure With Blind Lid (No Display)
C01544-1	System	109	MT100 Series Electronics Assembly
C01545-1	System	110	MT100 Series Electronics Assembly, Parts List
405037	Outline Instl.	111	MT100M: Flanged Process Connection, Hazardous Locations, Local And Remote
405038	Outline Instl.	113	MT100M: 2" NPT Process Connection, Hazardous Locations, Local And Remote
405039	Outline Instl.	115	MT100M: Duct Flange Process Connection, Hazardous Locations, Local And Remote
405040	Outline Instl.	119	MT100S: Compression Fitting, Hazardous Locations, Local And Remote
405041	Outline Instl.	121	MT100S: Flanged Compression Fitting, Hazardous Locations, Local And Remote
405042	Outline Instl.	123	MT100S: Low Press. Packing Gland, 1-¼" NPT, Hazardous Locations, Local And Remote
405043	Outline Instl.	125	MT100S: Low Press. Packing Gland, Flanged, Hazardous Locations, Local And Remote
405044	Outline Instl.	127	MT100S: Med. Press. Packing Gland, 1-¼" NPT, Hazardous Locations, Local And Remote
025993	Wiring Dgm.	129	MT100M Wiring Diagram
025994	Wiring Dgm.	133	MT100S Wiring Diagram

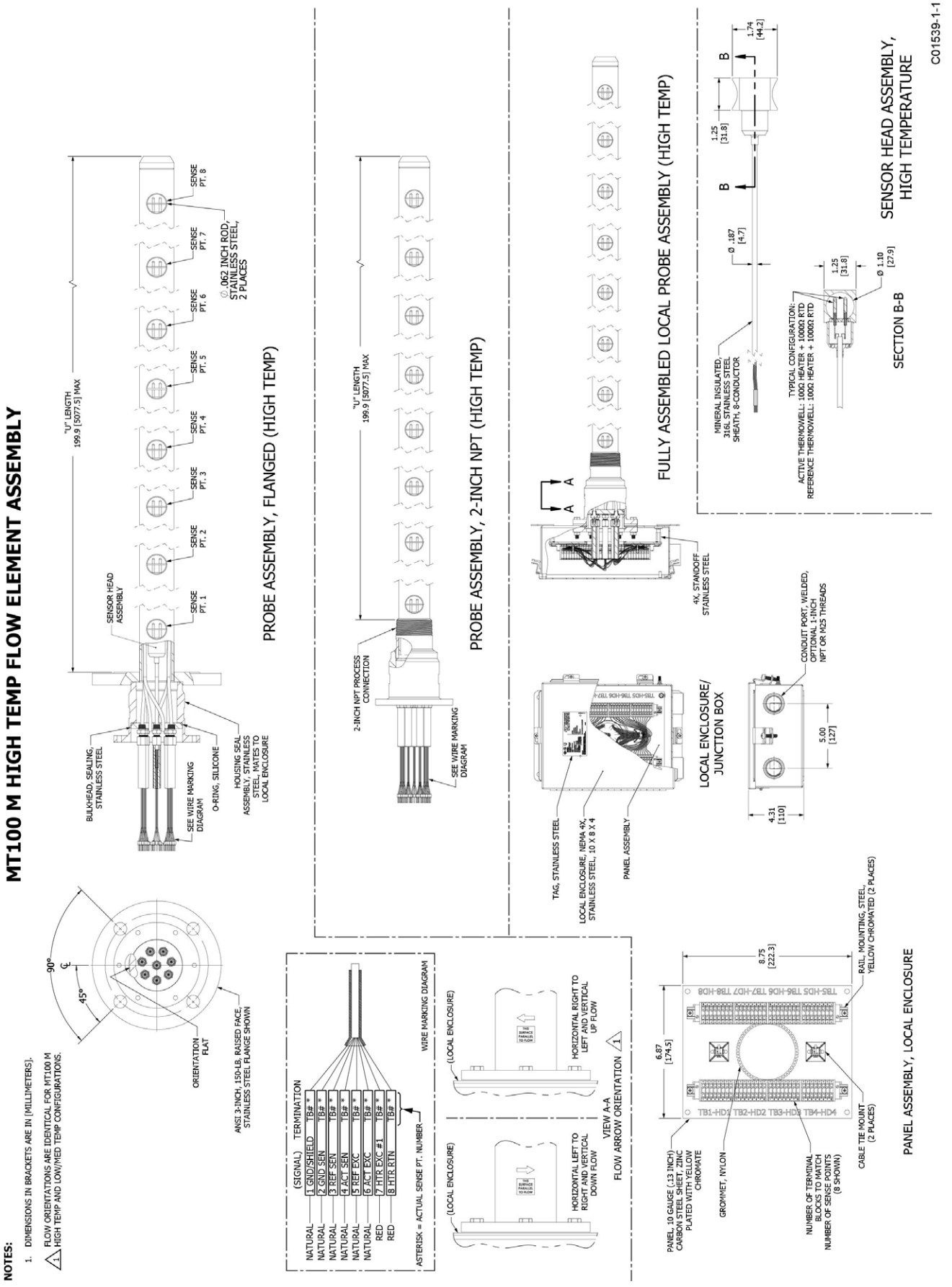
MT100 M, MULTI-POINT INSERTION CONFIGURATION

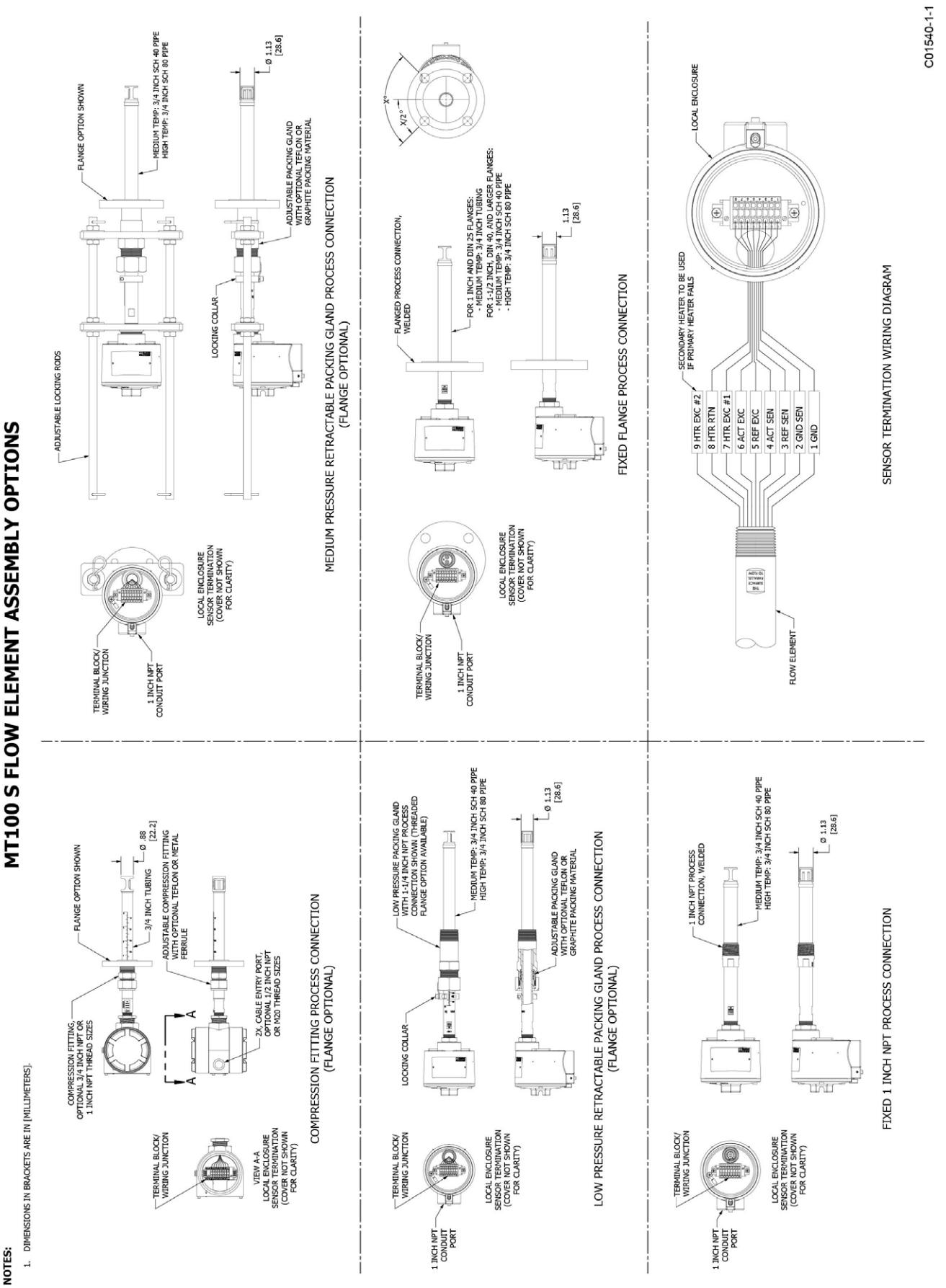


MT100 S, SINGLE-POINT INSERTION CONFIGURATION




MT100 M LOW/MED TEMP FLOW ELEMENT ASSEMBLY
NOTES:
1. DIMENSIONS IN BRACKETS ARE IN [MILLIMETERS].
⚠1 FLOW ORIENTATIONS ARE IDENTICAL FOR MT100 M HIGH TEMP AND LOW/MED TEMP CONFIGURATIONS.
PROBE ASSEMBLY, FLANGED (LOW/MED TEMP)
PROBE ASSEMBLY, 2 INCH NPT (LOW/MED TEMP)
"U" LENGTH 199.9 [5077.5] MAX
SENSOR HEAD ASSEMBLY
SENSE PT. 1
SENSE PT. 2
SENSE PT. 3
SENSE PT. 4
SENSE PT. 5
SENSE PT. 6
SENSE PT. 7
SENSE PT. 8
Ø .062-INCH ROD, STAINLESS STEEL, 2 PLACES
FIBERGLASS INSULATION
2-INCH, SCHEDULE 80, PIPE EXTENSION, STAINLESS STEEL
ALUMINUM OXIDE
EPOXY/ CEMENT
SEE WIRE MARKING DIAGRAM
ORIENTATION FLAT
90°
45°
ANSI 3-INCH, 150-LB, RAISED FACE, STAINLESS STEEL FLANGE SHOWN
⅜-INCH THICK HOUSING SEAL PLATE, MATES TO LOCAL ENCLOSURE
2-INCH NPT PROCESS CONNECTION
SEE WIRE MARKING DIAGRAM
FULLY ASSEMBLED LOCAL PROBE ASSEMBLY (LOW/MED TEMP)
4X, STANDOFF STAINLESS STEEL
CABLE, 8 CONDUCTOR (26 AWG), SHIELDED, PTFE INSULATED
TYPICAL CONFIGURATION:
ACTIVE THERMOWELL: 100Ω HEATER + 1000Ω RTD
REFERENCE THERMOWELL: 100Ω HEATER + 1000Ω RTD
SECTION B-B
SENSOR HEAD ASSEMBLY, LOW/MEDIUM TEMPERATURE
C01538-1-1
LOCAL ENCLOSURE/ JUNCTION BOX
TAG, STAINLESS STEEL
LOCAL ENCLOSURE, NEMA 4X, STAINLESS STEEL, 10 X 8 X 4
PANEL ASSEMBLY
CONDUIT PORT, WELDED, OPTIONAL 1-INCH NPT OR M25 THREADS
(SIGNAL) TERMINATION
RED 1 GND/SHIELD TB# *
BLUE 2 GND SEN TB# *
PINK 3 REF SEN TB# *
GRAY 4 ACT SEN TB# *
YELLOW 5 REF EXC TB# *
GREEN 6 ACT EXC TB# *
BROWN 7 HTR EXC #1 TB# *
WHITE 8 HTR RTN TB# *
ASTERISK = ACTUAL SENSE PT. NUMBER
WIRE MARKING DIAGRAM
(LOCAL ENCLOSURE)
HORIZONTAL LEFT TO RIGHT AND VERTICAL DOWN FLOW
(LOCAL ENCLOSURE)
HORIZONTAL RIGHT TO LEFT AND VERTICAL UP FLOW
VIEW A-A
FLOW ARROW ORIENTATION ⚠1
PANEL, 10 GAUGE (.13 INCH) CARBON STEEL SHEET, ZINC PLATED WITH YELLOW CHROMATE
GROMMET, NYLON
NUMBER OF TERMINAL BLOCKS TO MATCH NUMBER OF SENSE POINTS (8 SHOWN)
CABLE TIE MOUNT (2 PLACES)
RAIL, MOUNTING, STEEL, YELLOW CHROMATED (2 PLACES)
TB1-HD1 TB2-HD2 TB3-HD3 TB4-HD4
TB5-HD5 TB6-HD6 TB7-HD7 TB8-HD8
PANEL ASSEMBLY, LOCAL ENCLOSURE


MT100 M HIGH TEMP FLOW ELEMENT ASSEMBLY
NOTES:
1. DIMENSIONS IN BRACKETS ARE IN [MILLIMETERS].
⚠1 FLOW ORIENTATIONS ARE IDENTICAL FOR MT100 M HIGH TEMP AND LOW/MED TEMP CONFIGURATIONS.
PROBE ASSEMBLY, FLANGED (HIGH TEMP)
"U" LENGTH 199.9 [5077.5] MAX
SENSOR HEAD ASSEMBLY
SENSE PT. 1
SENSE PT. 2
SENSE PT. 3
SENSE PT. 4
SENSE PT. 5
SENSE PT. 6
SENSE PT. 7
SENSE PT. 8
Ø.062 INCH ROD, STAINLESS STEEL, 2 PLACES
BULKHEAD, SEALING, STAINLESS STEEL
SEE WIRE MARKING DIAGRAM
O-RING, SILICONE
HOUSING SEAL ASSEMBLY, STAINLESS STEEL, MATES TO LOCAL ENCLOSURE
90°
45°
ORIENTATION FLAT
ANSI 3-INCH, 150-LB, RAISED FACE, STAINLESS STEEL FLANGE SHOWN
PROBE ASSEMBLY, 2-INCH NPT (HIGH TEMP)
"U" LENGTH 199.9 [5077.5] MAX
2-INCH NPT PROCESS CONNECTION
SEE WIRE MARKING DIAGRAM
FULLY ASSEMBLED LOCAL PROBE ASSEMBLY (HIGH TEMP)
4X, STANDOFF STAINLESS STEEL
MINERAL INSULATED, 316L STAINLESS STEEL SHEATH; 8-CONDUCTOR
Ø .187 [4.7]
1.25 [31.8]
1.74 [44.2]
TYPICAL CONFIGURATION:
ACTIVE THERMOWELL: 100Ω HEATER + 100Ω RTD
REFERENCE THERMOWELL: 100Ω HEATER + 100Ω RTD
Ø 1.10 [27.9]
SECTION B-B
SENSOR HEAD ASSEMBLY, HIGH TEMPERATURE
C01539-1-1
(SIGNAL) TERMINATION
NATURAL 1 GND/SHIELD TB# *
NATURAL 2 GND SEN TB# *
NATURAL 3 REF SEN TB# *
NATURAL 4 ACT SEN TB# *
NATURAL 5 REF EXC TB# *
NATURAL 6 ACT EXC TB# *
RED 7 HTR EXC #1 TB# *
RED 8 HTR RTN TB# *
ASTERISK = ACTUAL SENSE PT. NUMBER
WIRE MARKING DIAGRAM
(LOCAL ENCLOSURE)
HORIZONTAL LEFT TO RIGHT AND VERTICAL DOWN FLOW
(LOCAL ENCLOSURE)
HORIZONTAL RIGHT TO LEFT AND VERTICAL UP FLOW
VIEW A-A
⚠1 FLOW ARROW ORIENTATION
TAG, STAINLESS STEEL
LOCAL ENCLOSURE, NEMA 4X, STAINLESS STEEL, 10 X 8 X 4
PANEL ASSEMBLY
LOCAL ENCLOSURE/ JUNCTION BOX
CONDUIT PORT, WELDED, OPTIONAL 1 INCH NPT OR M25 THREADS
5.00 [127]
4.31 [110]
PANEL ASSEMBLY, LOCAL ENCLOSURE
6.87 [174.5]
8.75 [222.3]
TB1-HD1 TB2-HD2 TB3-HD3 TB4-HD4
TB5-HD5 TB6-HD6 TB7-HD7 TB8-HD8
RAIL MOUNTING, STEEL, YELLOW CHROMATED (2 PLACES)
PANEL, 10 GAUGE (.13 INCH) CARBON STEEL SHEET, ZINC PLATED WITH YELLOW CHROMATE
GROMMET, NYLON
NUMBER OF TERMINAL BLOCKS TO MATCH NUMBER OF SENSE POINTS (8 SHOWN)
CABLE TIE MOUNT (2 PLACES)

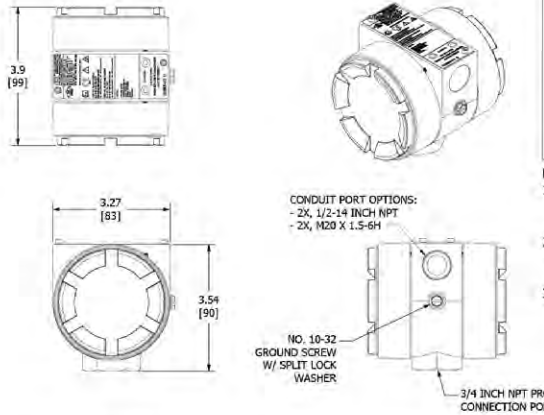

MT100 S FLOW ELEMENT ASSEMBLY OPTIONS
NOTES:
1. DIMENSIONS IN BRACKETS ARE IN [MILLIMETERS].
COMPRESSION FITTING PROCESS CONNECTION (FLANGE OPTIONAL)
MEDIUM PRESSURE RETRACTABLE PACKING GLAND PROCESS CONNECTION (FLANGE OPTIONAL)
FIXED FLANGE PROCESS CONNECTION
LOW PRESSURE RETRACTABLE PACKING GLAND PROCESS CONNECTION (FLANGE OPTIONAL)
FIXED 1 INCH NPT PROCESS CONNECTION
SENSOR TERMINATION WIRING DIAGRAM
C01540-1-1

NOTES:

1. DIMENSIONS IN BRACKETS ARE IN [MILLIMETERS].

MT100 S LOCAL ENCLOSURE OPTIONS

(ALUMINUM OR STAINLESS STEEL)

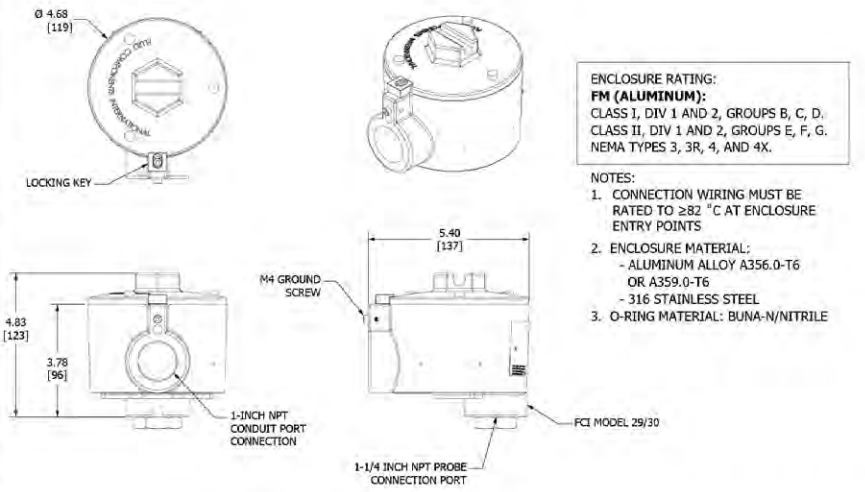


ENCLOSURE RATING:
FM:
XP CLASS I, DIV I, GROUPS B, C, D.
DIP CLASS II, III, DIV I, GROUPS E, F, G.
Ta = 60 °C
TYPE 4X, IP66.

ATEX:
II 2 G Ex db IIC Gb; IP66/IP67
II 2 D Ex tb IIIC Db

IECEx:
Ex db IIC Gb; IP66/IP67
Ex tb IIIC Db

NOTES:
1. CONNECTION WIRING MUST BE RATED TO ≥82 °C AT ENCLOSURE ENTRY POINTS
2. ENCLOSURE MATERIAL:
   - ALUMINUM ADC10 OR ADC12
   - 316L STAINLESS STEEL
3. O-RING MATERIAL: NITRILE OR VITON

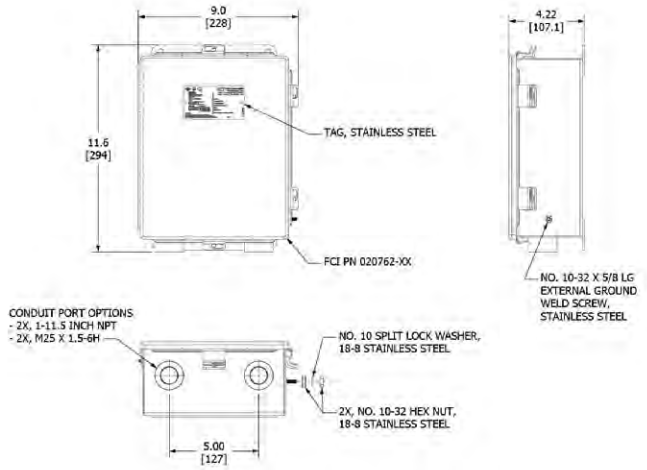


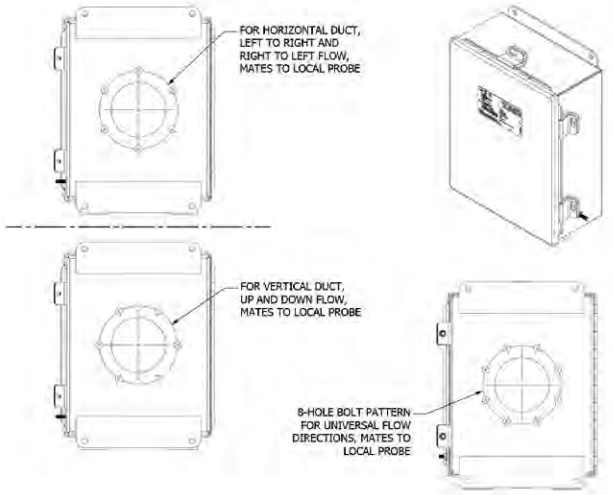
ENCLOSURE RATING:
FM (ALUMINUM):
CLASS I, DIV 1 AND 2, GROUPS B, C, D.
CLASS II, DIV 1 AND 2, GROUPS E, F, G.
NEMA TYPES 3, 3R, 4, AND 4X.

NOTES:
1. CONNECTION WIRING MUST BE RATED TO ≥82 °C AT ENCLOSURE ENTRY POINTS
2. ENCLOSURE MATERIAL:
   - ALUMINUM ALLOY A356.0-T6 OR A359.0-T6
   - 316 STAINLESS STEEL
3. O-RING MATERIAL: BUNA-N/NITRILE

MT100 M LOCAL ENCLOSURE OPTIONS

(STAINLESS STEEL ONLY)





CONFIGURATION 2 ENCLOSURE
BASED ON FCI PART NO. 026283

NOTES:
1. CONNECTION WIRING MUST BE RATED TO ≥82 °C AT ENCLOSURE ENTRY POINTS.
2. ENCLOSURE MATERIAL: 304 STAINLESS STEEL
3. GASKET MATERIAL: 1/4" THICK BISCO HT-800 MEDIUM CELLULAR SILICONE FOAM (-55 °C TO 200 °C) WITH DLA-200-78/PP POLYESTER-SUPPORTED ACRYLIC ADHESIVE BACKING (-37 °C TO 121 °C)

CONFIGURATION 1 ENCLOSURE

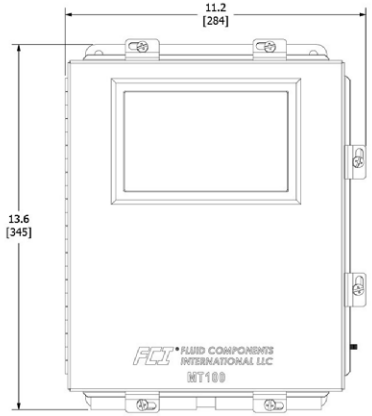
NOTES:
1. CONNECTION WIRING MUST BE RATED TO ≥82 °C AT ENCLOSURE ENTRY POINTS.
2. ENCLOSURE MATERIAL: 304 STAINLESS STEEL
3. GASKET MATERIAL: 1/4" THICK BISCO HT-800 MEDIUM CELLULAR SILICONE FOAM (-55 °C TO 200 °C) WITH DLA-200-78/PP POLYESTER-SUPPORTED ACRYLIC ADHESIVE BACKING (-37 °C TO 121 °C)

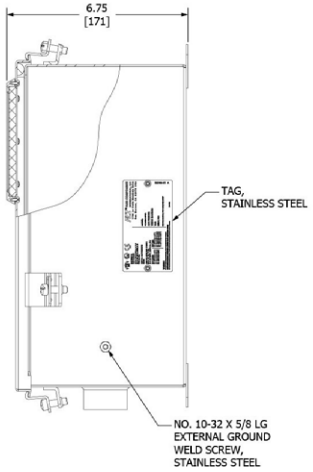
C01541-1-1

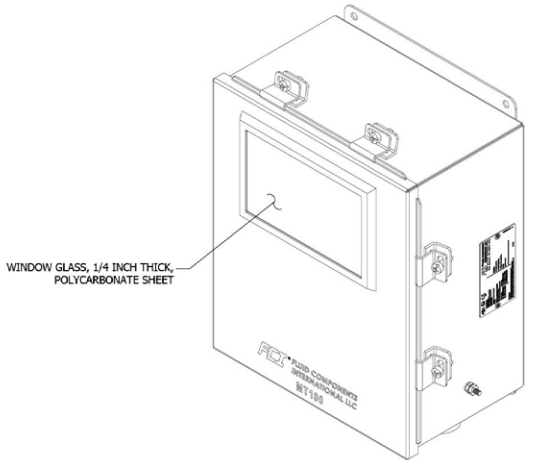
NOTES:

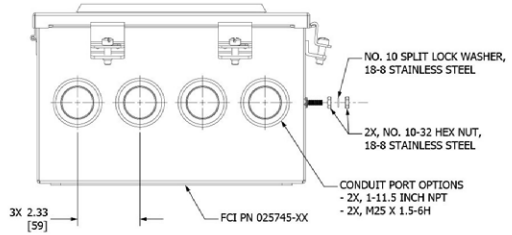
1. DIMENSIONS IN BRACKETS ARE IN [MILLIMETERS].

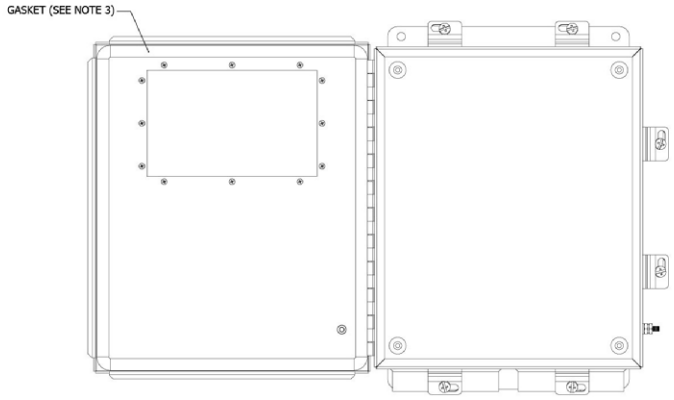
MT100 SERIES REMOTE ELECTRONICS ENCLOSURE WITH DISPLAY WINDOW











CONFIGURATION 2 ENCLOSURE

BASED ON FCI PART NO. 026264

NOTES:
1. CONNECTION WIRING MUST BE RATED TO ≥82 °C AT ENCLOSURE ENTRY POINTS.
2. ENCLOSURE MATERIAL: 304 STAINLESS STEEL
3. GASKET MATERIAL: 1/4" THICK BISCO HT-800 MEDIUM CELLULAR SILICONE FOAM (-55 °C TO 200 °C) WITH DLA-200-78/PP POLYESTER-SUPPORTED ACRYLIC ADHESIVE BACKING (-37 °C TO 121 °C)

CONFIGURATION 1 ENCLOSURE

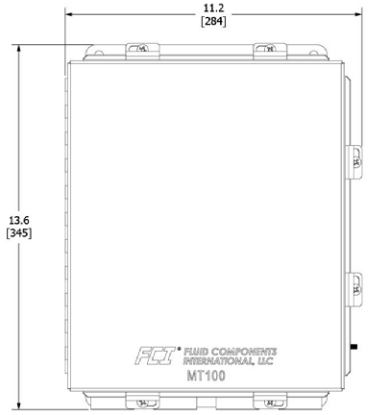
NOTES:
1. CONNECTION WIRING MUST BE RATED TO ≥82 °C AT ENCLOSURE ENTRY POINTS.
2. FCI ENCLOSURE ONLY DESIGN TEMP: -40 °C TO 107 °C
3. GASKET MATERIAL: 1/4" THICK BISCO HT-800 MEDIUM CELLULAR SILICONE FOAM (-55 °C TO 200 °C) WITH DLA-200-78/PP POLYESTER-SUPPORTED ACRYLIC ADHESIVE BACKING (-37 °C TO 121 °C)

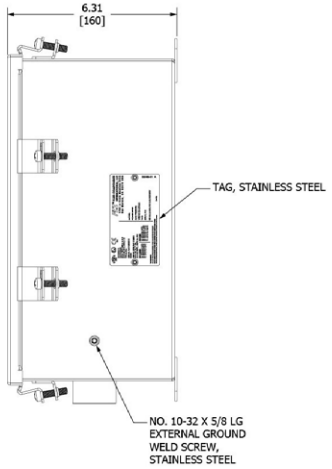
C01542-1-1

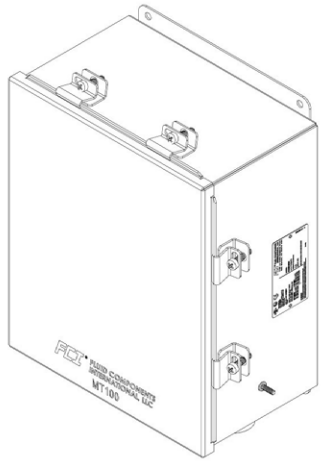
NOTES:

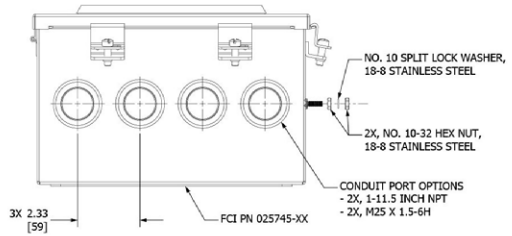
1. DIMENSIONS IN BRACKETS ARE IN [MILLIMETERS].

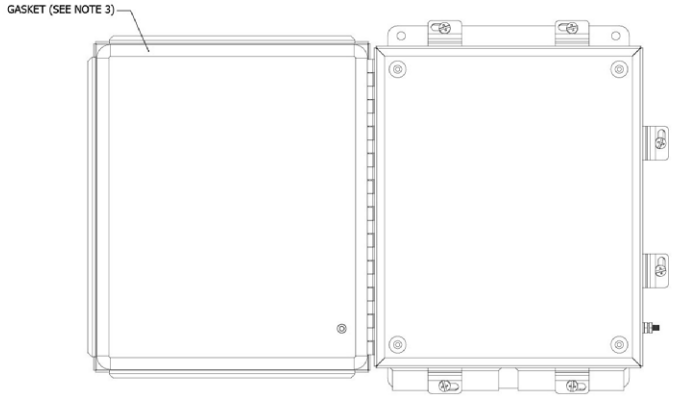
MT100 SERIES REMOTE ELECTRONICS ENCLOSURE WITH BLIND LID (NO DISPLAY)











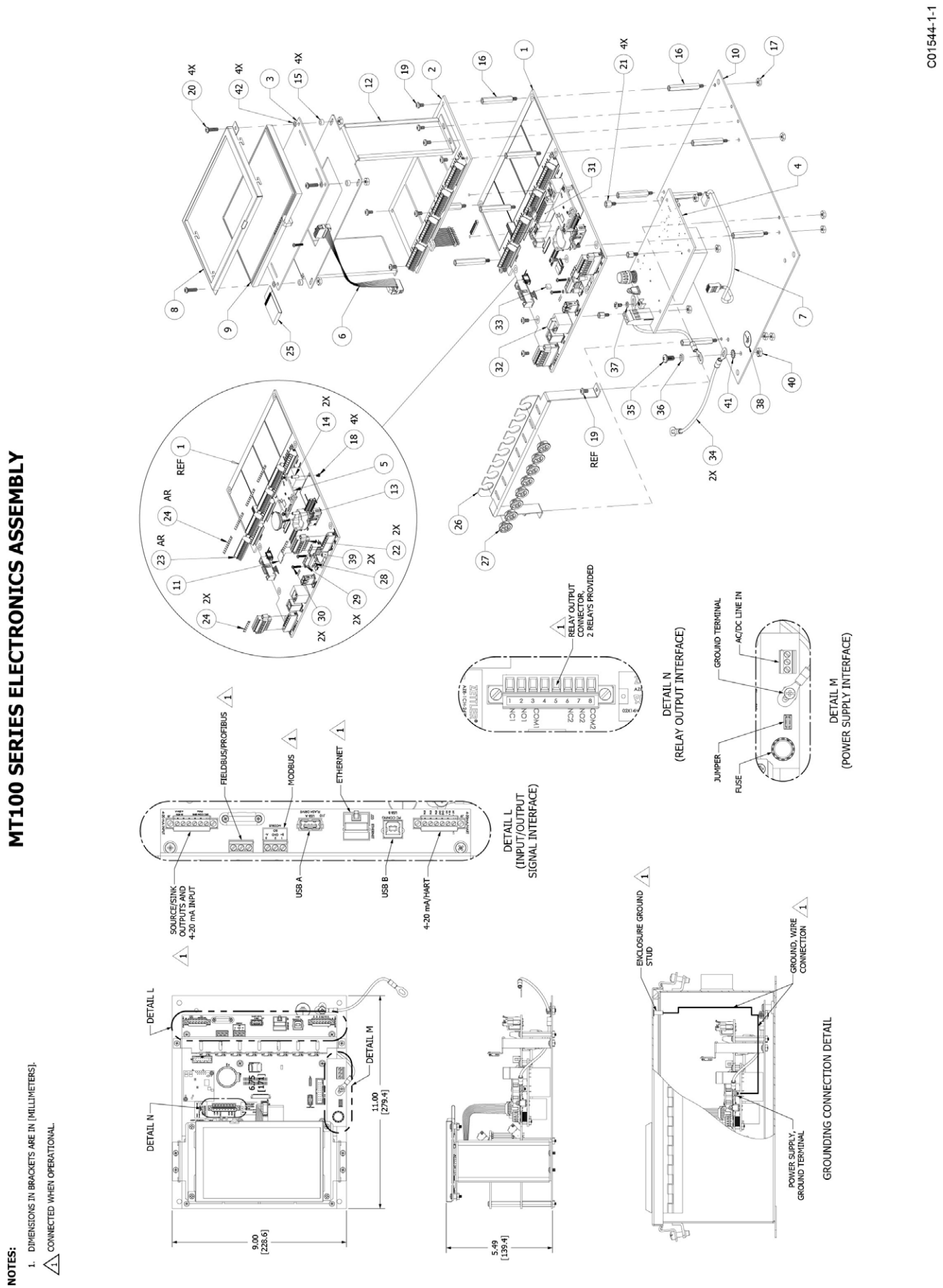
CONFIGURATION 2 ENCLOSURE
BASED ON FCI PART NO. 026264

NOTES:
1. CONNECTION WIRING MUST BE RATED TO ≥82 °C AT ENCLOSURE ENTRY POINTS.
2. ENCLOSURE MATERIAL: 304 STAINLESS STEEL
3. GASKET MATERIAL: 1/4" THICK BISCO HT-800 MEDIUM CELLULAR SILICONE FOAM (-55 °C TO 200 °C) WITH DLA-200-78/PP POLYESTER-SUPPORTED ACRYLIC ADHESIVE BACKING (-37 °C TO 121 °C)

CONFIGURATION 1 ENCLOSURE

NOTES:
1. CONNECTION WIRING MUST BE RATED TO ≥82 °C AT ENCLOSURE ENTRY POINTS.
2. FCI ENCLOSURE ONLY DESIGN TEMP: -40 °C TO 107 °C
3. GASKET MATERIAL: 1/4" THICK BISCO HT-800 MEDIUM CELLULAR SILICONE FOAM (-55 °C TO 200 °C) WITH DLA-200-78/PP POLYESTER-SUPPORTED ACRYLIC ADHESIVE BACKING (-37 °C TO 121 °C)

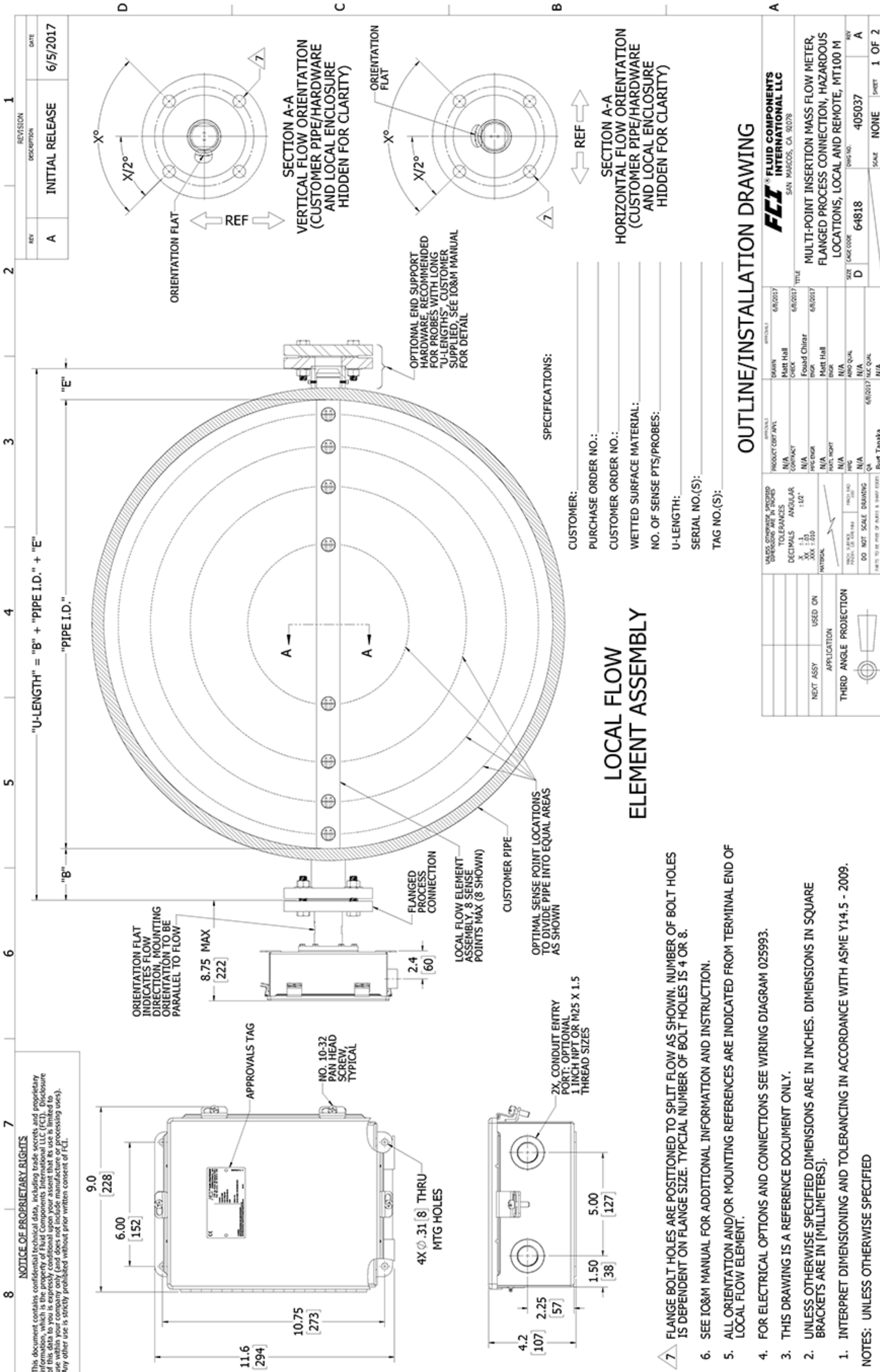
C01543-1-1


MT100 SERIES ELECTRONICS ASSEMBLY
NOTES:
1. DIMENSIONS IN BRACKETS ARE IN [MILLIMETERS].
1 CONNECTED WHEN OPERATIONAL.
C01544-1-1
DETAIL L
(INPUT/OUTPUT SIGNAL INTERFACE)
SOURCE/SINK OUTPUTS AND 4-20 mA INPUT
FIELDBUS/PROFIBUS
MODBUS
ETHERNET
USB A
USB B
4-20 mA/HART
DETAIL N
(RELAY OUTPUT INTERFACE)
RELAY OUTPUT CONNECTOR, 2 RELAYS PROVIDED
DETAIL M
(POWER SUPPLY INTERFACE)
GROUND TERMINAL
AC/DC LINE IN
JUMPER
FUSE
GROUNDING CONNECTION DETAIL
ENCLOSURE GROUND STUD
GROUND WIRE CONNECTION
POWER SUPPLY GROUND TERMINAL
9.00 [228.6]
6.75 [171.5]
11.00 [279.4]
5.49 [139.4]

MT100 SERIES ELECTRONICS ASSEMBLY, PARTS LIST

ITEM NO.	PART NUMBER	NOMENCLATURE OR DESCRIPTION
1	024525-01	PWB ASSEMBLY, MT100 - SB4
2	024881-01	PWB ASSEMBLY, SB8, MT100
3	025068-01	PWB ASSEMBLY, HMI CPU BOARD, MT100
4	024555-01 024539-01	PWB ASSEMBLY, POWER SUPPLY, AC-DC, MT100 PWB ASSEMBLY, POWER SUPPLY, DC-DC, MT100
5	022063-01	MODULE FOUNDATION FIELDBUS
6	025829-01	10 POSITION CABLE ASSEMBLY, RECTANGULAR (6 INCHES)
7	025723-01	WIRE HARNESS ASSEMBLY, POWER SUPPLY TO MAIN BOARD, MT100
8	025084-01	BEZEL, LCD MT100
9	025700-01	LCD, 800X480 COLOR, MT100
10	024763-01	PANEL, ELECTRONICS, MT100
11	022500-02	MICRO SD CARD 8GB W/O ADAPTER
12	025873-01	BRACKET, 7 INCH LCD, MT100
13	022038-01	BATT LiTH COIN CR2450N
14	022481-01	STANDOFF HEX 2-56THR .375"L ALUM
15	025721-01	SPACER, THRU HOLE SIZE 1/4" O.D X #6-32 CLEARANCE SCREW, SST
16	025702-06	HEX STANDOFF, MALE/FEMALE, #6-32 X 1.5"L, ALUMINUM
17	H61-0107	NUT, HEX, #6-32, 18-8 SST
18	022105-01	SCREW, MACHINE, PHILLIPS HEAD, NO. 2-56 X 1/4 LG
19	H10-010704	SCREW, PAN HEAD PHILLIPS, #6-32 X 1/4", 18-8 SST
20	H10-010708	SCREW, PAN HEAD, PHILLIPS, #6-32 X 1/2 LG, 18-8 SST
21	025702-01	HEX STANDOFF, MALE/FEMALE, #6-32 X .25"L, ALUMINUM
22	025267-01	TERM BLOCK PLUG, 6 POS, 3.81MM
23	023715-02	TERMINATION BLOCK, CONNECTOR PLUG (9 POS)
24	025786-01	MARKER STRIP (1TO 9)
25	025720-01	CABLE JUMPER, FFC, 40 POS, 0.50mm
26	025083-01	BRACKET, CABLE GUIDE, ELECTRONICS, MT100
27	025707-01	BUSHING SPLIT, .362" NYLON BLACK
28	020557-01	CLAMP CABLE, ST98 PROFIBUS
29	H51-0103	WASHER, SPLIT LOCK, #2 ,18-8 SST
30	H10-010307	SCREW, PAN HD PHILLIPS, #2-56 X 7/16L, 18-8 SST
31	026004-01	TERMINAL BLOCK PLUG, 8 POS STR 3.81 MM.
32	026005-01	BLIND PLUG DUST COVER FOR 8 POSITION MODULAR RJ45 JACK
33	000456-03	PLUG, SHORTING
34	025515-03	WIRE HARNESS, GROUNDING, (12" LONG)
35	H10-011106	SCREW, PAN HD, PHILLIPS, #10-32 X 3/8" LG, 18-8 SST
36	H51-0110	WASHER, SPLIT LOCK, #10, 18-8 SST
37	H51-0107	WASHER, SPLIT LOCK, #6, 18-8 SST
38	017525-01	LABEL, GROUND
39	020554-03	STANDOFF, SWAGE, NO. 2-56
40	H61-0111	NUT, HEX, #10-32, 18-8 SST
41	H53-0110	LOCK WASHER, EXTERNAL-TOOTH, #10, 18-8 SST
42	026050-01	WASHER, FLAT, NYLON (NO. 6)

C01545-1-1


OUTLINE/INSTALLATION DRAWING
LOCAL FLOW ELEMENT ASSEMBLY
SECTION A-A VERTICAL FLOW ORIENTATION (CUSTOMER PIPE/HARDWARE AND LOCAL ENCLOSURE HIDDEN FOR CLARITY)
SECTION A-A HORIZONTAL FLOW ORIENTATION (CUSTOMER PIPE/HARDWARE AND LOCAL ENCLOSURE HIDDEN FOR CLARITY)
ORIENTATION FLAT
REF
"U-LENGTH" = "B" + "PIPE I.D." + "E"
"PIPE I.D."
OPTIONAL END SUPPORT HARDWARE, RECOMMENDED FOR PROBES WITH LONG "U-LENGTHS". CUSTOMER SUPPLIED, SEE IO&M MANUAL FOR DETAIL
OPTIMAL SENSE POINT LOCATIONS TO DIVIDE PIPE INTO EQUAL AREAS
CUSTOMER PIPE
LOCAL FLOW ELEMENT ASSEMBLY, 8 SENSE POINTS MAX (8 SHOWN)
FLANGED PROCESS CONNECTION
ORIENTATON FLAT INDICATES FLOW DIRECTION, MOUNTING ORIENTATION TO BE PARALLEL TO FLOW
8.75 MAX [222]
2.4 [60]
APPROVALS TAG
NO. 10-32 PAN HEAD SCREW, TYPICAL
2X, CONDUIT ENTRY PORT; OPTIONAL 1 INCH NPT OR M25 X 1.5 THREAD SIZES
4X ∅.31 [8] THRU MTG HOLES
9.0 [228]
6.00 [152]
5.00 [127]
1.50 [38]
2.25 [57]
4.2 [107]
10.75 [273]
11.6 [294]
SPECIFICATIONS:
CUSTOMER:
PURCHASE ORDER NO.:
CUSTOMER ORDER NO.:
WETTED SURFACE MATERIAL:
NO. OF SENSE PTS/PROBES:
U-LENGTH:
SERIAL NO.(S):
TAG NO.(S):
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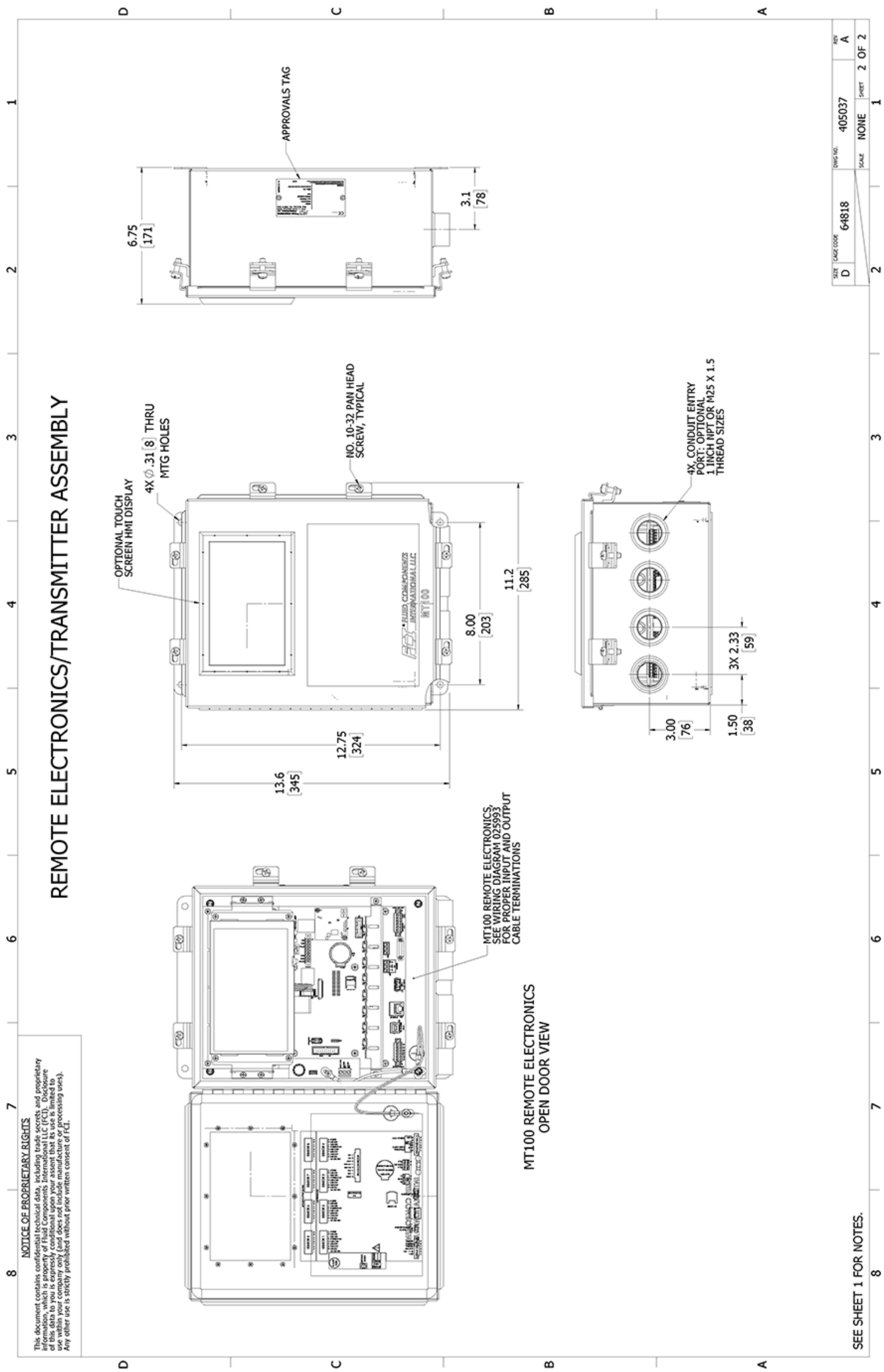
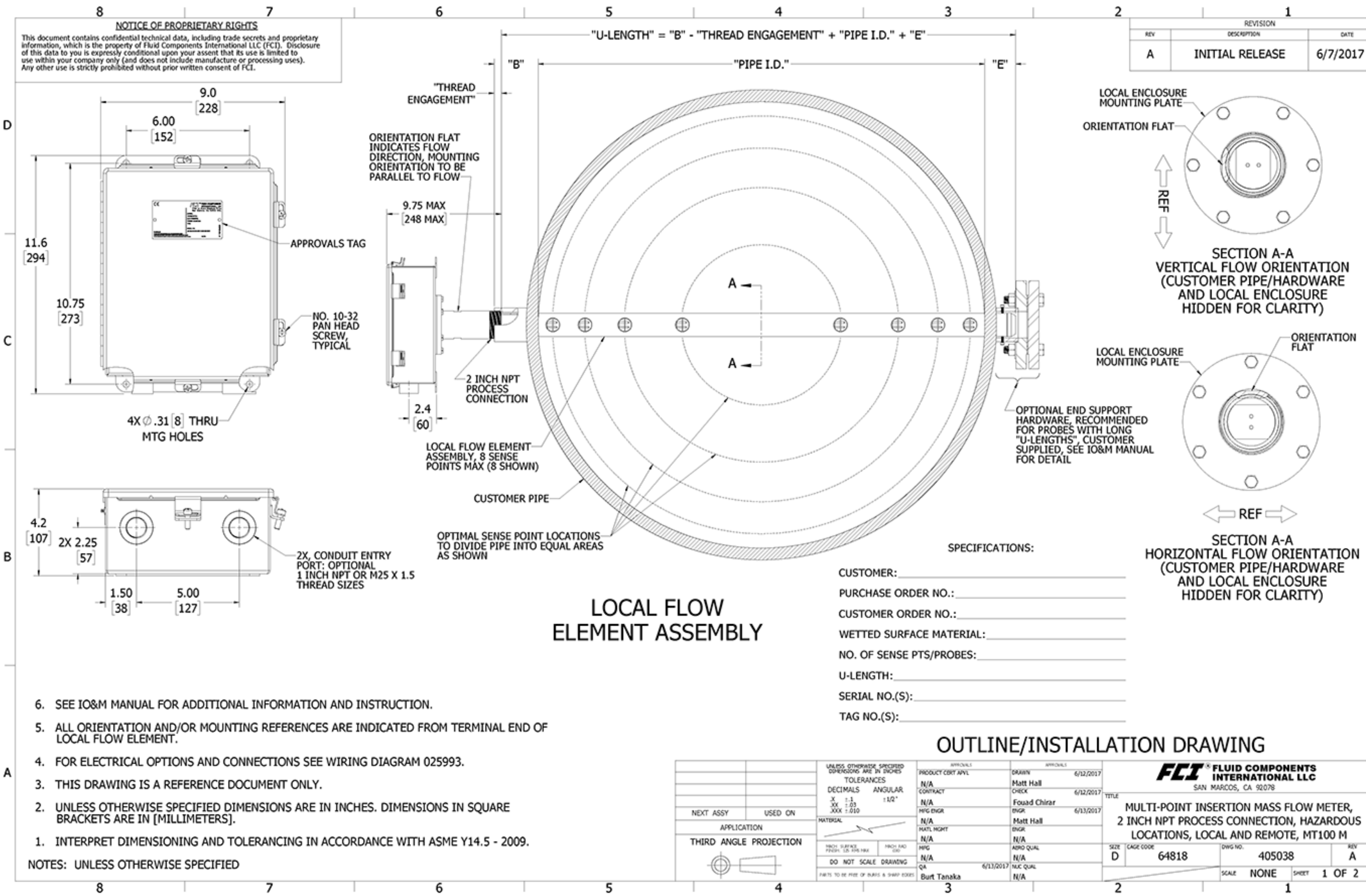
NOTES: UNLESS OTHERWISE SPECIFIED
1. INTERPRET DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5 - 2009.
2. UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DIMENSIONS IN SQUARE BRACKETS ARE IN [MILLIMETERS].
3. THIS DRAWING IS A REFERENCE DOCUMENT ONLY.
4. FOR ELECTRICAL OPTIONS AND CONNECTIONS SEE WIRING DIAGRAM 025993.
5. ALL ORIENTATION AND/OR MOUNTING REFERENCES ARE INDICATED FROM TERMINAL END OF LOCAL FLOW ELEMENT.
6. SEE IO&M MANUAL FOR ADDITIONAL INFORMATON AND INSTRUCTION.
7. FLANGE BOLT HOLES ARE POSITIONED TO SPLIT FLOW AS SHOWN. NUMBER OF BOLT HOLES IS DEPENDENT ON FLANGE SIZE. TYPCIAL NUMBER OF BOLT HOLES IS 4 OR 8.
REVISION
REV A INITIAL RELEASE 6/5/2017
FLUID COMPONENTS INTERNATIONAL LLC
SAN MARCOS, CA 92078
MULTI-POINT INSERTION MASS FLOW METER, FLANGED PROCESS CONNECTION, HAZARDOUS LOCATIONS, LOCAL AND REMOTE, MT100 M
SIZE D CAGE CODE 64818 DWG NO. 405037 REV A
SCALE NONE SHEET 1 OF 2
DRAWN Matt Hall 6/8/2017
CHECK Fouad Chirar 6/8/2017
ENGR Matt Hall 6/8/2017
THIRD ANGLE PROJECTION
DO NOT SCALE DRAWING
QA Burt Tanaka 6/8/2017


REMOTE ELECTRONICS/TRANSMITTER ASSEMBLY
APPROVALS TAG
6.75 [171]
3.1 [78]
OPTIONAL TOUCH SCREEN HMI DISPLAY
4X ∅ .31 [8] THRU MTG HOLES
NO. 10-32 PAN HEAD SCREW, TYPICAL
4X CONDUIT ENTRY PORT: OPTIONAL 1 INCH NPT OR M25 X 1.5 THREAD SIZES
11.2 [285]
8.00 [203]
3X 2.33 [59]
1.50 [38]
3.00 [76]
12.75 [324]
13.6 [345]
MT100 REMOTE ELECTRONICS, SEE WIRING DIAGRAM 025993 FOR PROPER INPUT AND OUTPUT CABLE TERMINATIONS
MT100 REMOTE ELECTRONICS OPEN DOOR VIEW
NOTICE OF PROPRIETARY RIGHTS
SEE SHEET 1 FOR NOTES.
D 64818 405037 A
NONE 2 OF 2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"U-LENGTH" = "B" - "THREAD ENGAGEMENT" + "PIPE I.D." + "E"
"B"
"PIPE I.D."
"E"
"THREAD ENGAGEMENT"
9.0 [228]
6.00 [152]
11.6 [294]
10.75 [273]
APPROVALS TAG
NO. 10-32 PAN HEAD SCREW, TYPICAL
4X ∅.31 [8] THRU MTG HOLES
ORIENTATION FLAT INDICATES FLOW DIRECTION, MOUNTING ORIENTATION TO BE PARALLEL TO FLOW
9.75 MAX [248 MAX]
2.4 [60]
2 INCH NPT PROCESS CONNECTION
LOCAL FLOW ELEMENT ASSEMBLY, 8 SENSE POINTS MAX (8 SHOWN)
CUSTOMER PIPE
OPTIMAL SENSE POINT LOCATIONS TO DIVIDE PIPE INTO EQUAL AREAS AS SHOWN
A
A
OPTIONAL END SUPPORT HARDWARE, RECOMMENDED FOR PROBES WITH LONG "U-LENGTHS", CUSTOMER SUPPLIED, SEE IO&M MANUAL FOR DETAIL
4.2 [107]
2X 2.25 [57]
1.50 [38]
5.00 [127]
2X, CONDUIT ENTRY PORT: OPTIONAL 1 INCH NPT OR M25 X 1.5 THREAD SIZES
LOCAL FLOW ELEMENT ASSEMBLY
REVISION
REV | DESCRIPTION | DATE
A | INITIAL RELEASE | 6/7/2017
LOCAL ENCLOSURE MOUNTING PLATE
ORIENTATION FLAT
REF
SECTION A-A
VERTICAL FLOW ORIENTATION
(CUSTOMER PIPE/HARDWARE AND LOCAL ENCLOSURE HIDDEN FOR CLARITY)
LOCAL ENCLOSURE MOUNTING PLATE
ORIENTATION FLAT
REF
SECTION A-A
HORIZONTAL FLOW ORIENTATION
(CUSTOMER PIPE/HARDWARE AND LOCAL ENCLOSURE HIDDEN FOR CLARITY)
SPECIFICATIONS:
CUSTOMER:
PURCHASE ORDER NO.:
CUSTOMER ORDER NO.:
WETTED SURFACE MATERIAL:
NO. OF SENSE PTS/PROBES:
U-LENGTH:
SERIAL NO.(S):
TAG NO.(S):
6. SEE IO&M MANUAL FOR ADDITIONAL INFORMATION AND INSTRUCTION.
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4. FOR ELECTRICAL OPTIONS AND CONNECTIONS SEE WIRING DIAGRAM 025993.
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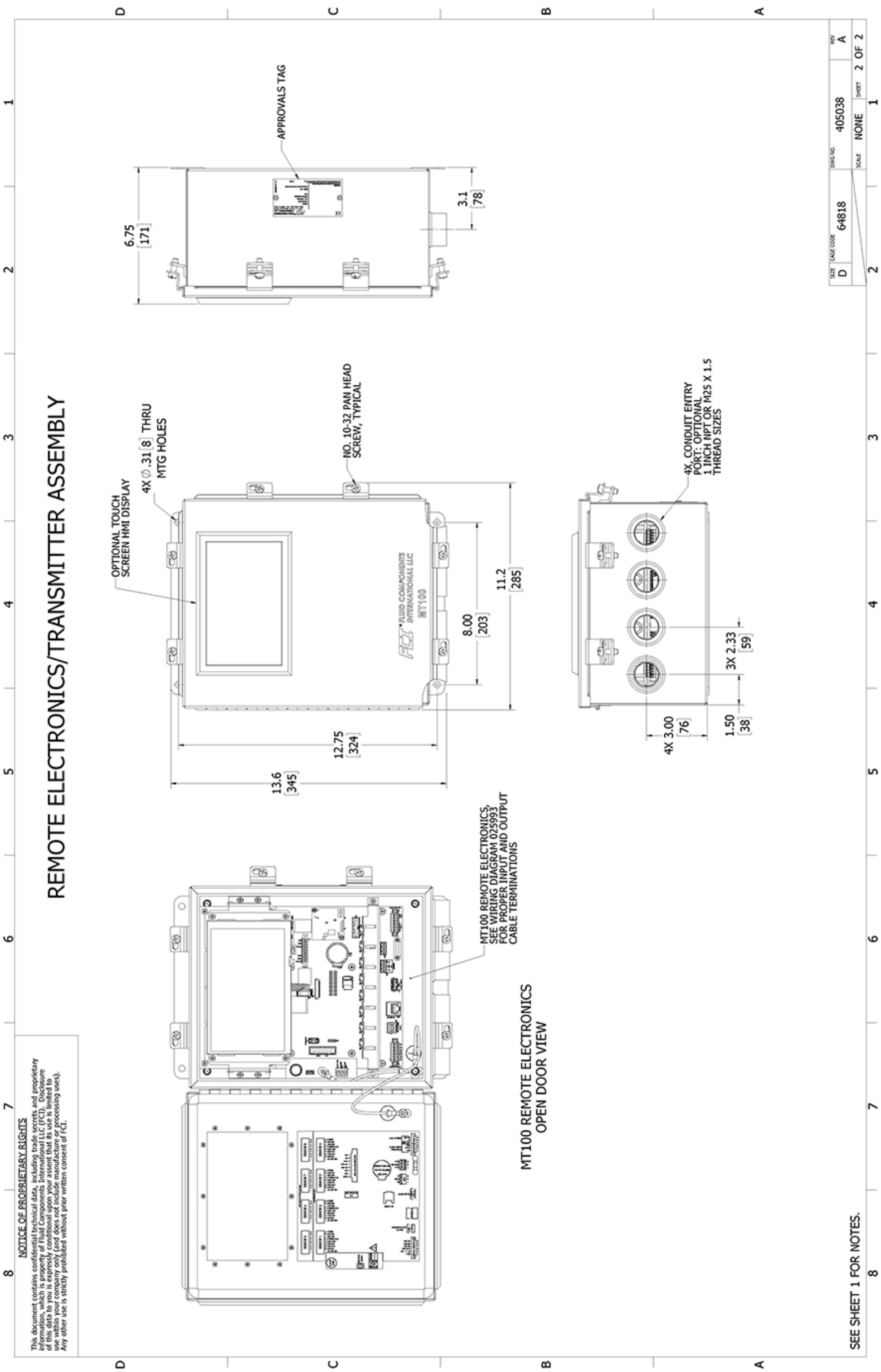
2. UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DIMENSIONS IN SQUARE BRACKETS ARE IN [MILLIMETERS].
1. INTERPRET DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5 - 2009.
NOTES: UNLESS OTHERWISE SPECIFIED
OUTLINE/INSTALLATION DRAWING
NEXT ASSY | USED ON
APPLICATION
THIRD ANGLE PROJECTION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS ANGULAR
.X ±.1 .XX ±.03 .XXX ±.010 ±1/2°
MATERIAL
DO NOT SCALE DRAWING
PRODUCT CERT APVL N/A
CONTRACT N/A
MFG ENGR N/A
MATL MGMT N/A
MFG N/A
QA Burt Tanaka 6/13/2017
DRAWN Matt Hall 6/12/2017
CHECK Fouad Chirar 6/12/2017
ENGR Matt Hall 6/13/2017
ENGR N/A
AERO QUAL N/A
NUC QUAL N/A
FCI FLUID COMPONENTS INTERNATIONAL LLC
SAN MARCOS, CA 92078
TITLE
MULTI-POINT INSERTION MASS FLOW METER, 2 INCH NPT PROCESS CONNECTION, HAZARDOUS LOCATIONS, LOCAL AND REMOTE, MT100 M
SIZE D
CAGE CODE 64818
DWG NO. 405038
REV A
SCALE NONE
SHEET 1 OF 2


REMOTE ELECTRONICS/TRANSMITTER ASSEMBLY
APPROVALS TAG
6.75 [171]
3.1 [78]
OPTIONAL TOUCH SCREEN HMI DISPLAY
4X ∅ .31 [8] THRU MTG HOLES
NO. 10-32 PAN HEAD SCREW, TYPICAL
4X CONDUIT ENTRY PORT: OPTIONAL 1 INCH NPT OR M25 X 1.5 THREAD SIZES
11.2 [285]
8.00 [203]
12.75 [324]
13.6 [345]
3X 2.33 [59]
4X 3.00 [76]
1.50 [38]
MT100 REMOTE ELECTRONICS, SEE WIRING DIAGRAM 025993 FOR PROPER INPUT AND OUTPUT CABLE TERMINATIONS
MT100 REMOTE ELECTRONICS OPEN DOOR VIEW
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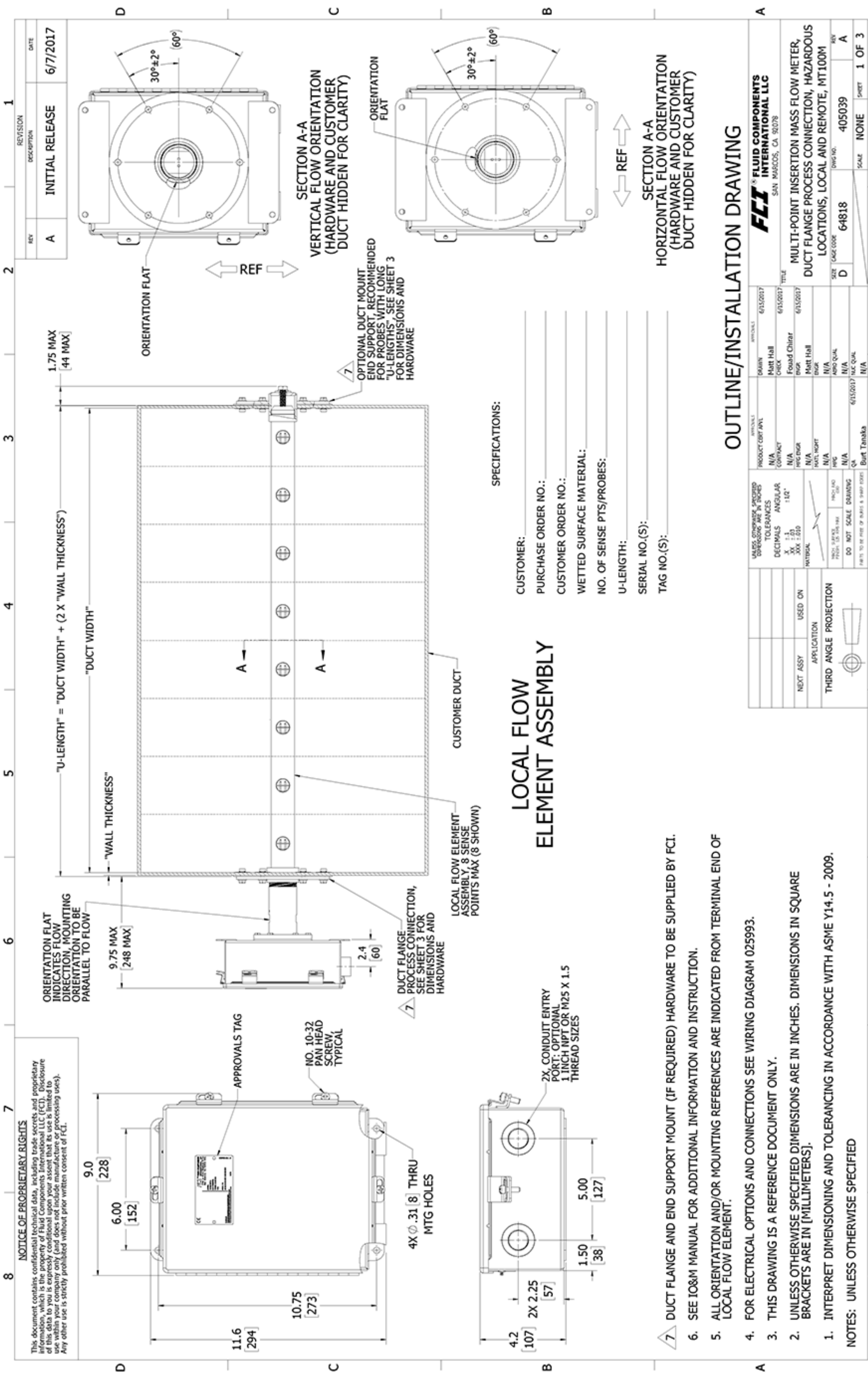
SEE SHEET 1 FOR NOTES.
SIZE D
CAGE CODE 64818
DWG NO. 405038
REV A
SCALE NONE
SHEET 2 OF 2


OUTLINE/INSTALLATION DRAWING
LOCAL FLOW ELEMENT ASSEMBLY
SECTION A-A VERTICAL FLOW ORIENTATION (HARDWARE AND CUSTOMER DUCT HIDDEN FOR CLARITY)
SECTION A-A HORIZONTAL FLOW ORIENTATION (HARDWARE AND CUSTOMER DUCT HIDDEN FOR CLARITY)
ORIENTATION FLAT
REF
30°±2°
60°
1.75 MAX [44 MAX]
OPTIONAL DUCT MOUNT END SUPPORT, RECOMMENDED FOR PROBES WITH LONG "U-LENGTHS", SEE SHEET 3 FOR DIMENSIONS AND HARDWARE
"U-LENGTH" = "DUCT WIDTH" + (2 X "WALL THICKNESS")
"DUCT WIDTH"
"WALL THICKNESS"
CUSTOMER DUCT
A
LOCAL FLOW ELEMENT ASSEMBLY, 8 SENSE POINTS MAX (8 SHOWN)
ORIENTATION FLAT INDICATES FLOW DIRECTION, MOUNTING ORIENTATION TO BE PARALLEL TO FLOW
9.75 MAX [248 MAX]
2.4 [60]
DUCT FLANGE PROCESS CONNECTION, SEE SHEET 3 FOR DIMENSIONS AND HARDWARE
SPECIFICATIONS:
CUSTOMER:
PURCHASE ORDER NO.:
CUSTOMER ORDER NO.:
WETTED SURFACE MATERIAL:
NO. OF SENSE PTS/PROBES:
U-LENGTH:
SERIAL NO.(S):
TAG NO.(S):
APPROVALS TAG
NO. 10-32 PAN HEAD SCREW, TYPICAL
4X Ø.31 [8] THRU MTG HOLES
2X, CONDUIT ENTRY PORT: OPTIONAL 1 INCH NPT OR M25 X 1.5 THREAD SIZES
9.0 [228]
6.00 [152]
10.75 [273]
11.6 [294]
5.00 [127]
1.50 [38]
2X 2.25 [57]
4.2 [107]
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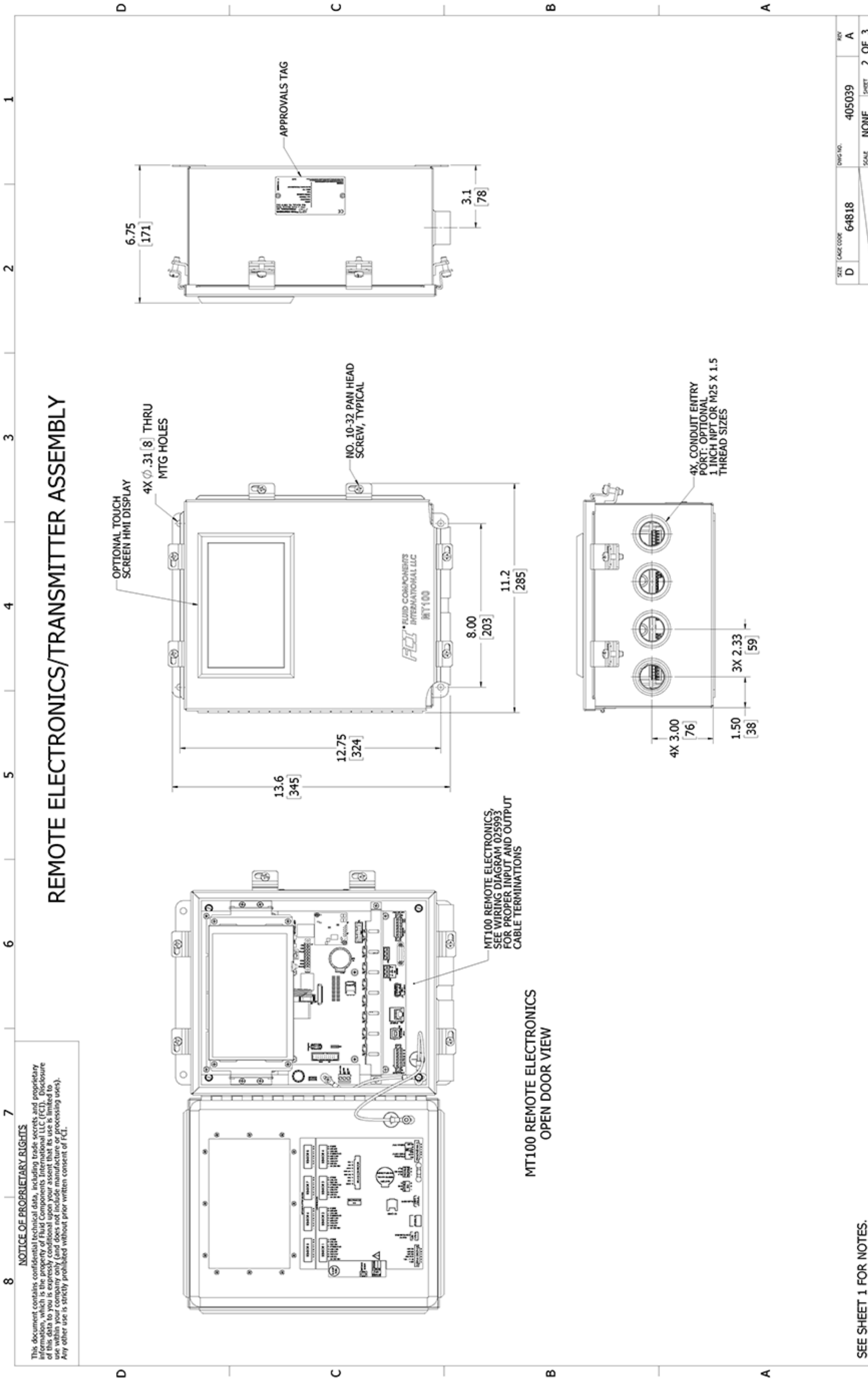
4. FOR ELECTRICAL OPTIONS AND CONNECTIONS SEE WIRING DIAGRAM 025993.
5. ALL ORIENTATION AND/OR MOUNTING REFERENCES ARE INDICATED FROM TERMINAL END OF LOCAL FLOW ELEMENT.
6. SEE IO&M MANUAL FOR ADDITIONAL INFORMATON AND INSTRUCTION.
7. DUCT FLANGE AND END SUPPORT MOUNT (IF REQUIRED) HARDWARE TO BE SUPPLIED BY FCI.
REVISION
REV A
INITIAL RELEASE
6/7/2017
FCI FLUID COMPONENTS INTERNATIONAL LLC
SAN MARCOS, CA 92078
MULTI-POINT INSERTION MASS FLOW METER, DUCT FLANGE PROCESS CONNECTION, HAZARDOUS LOCATIONS, LOCAL AND REMOTE, MT100M
SIZE D
CAGE CODE 64818
DWG NO. 405039
REV A
SCALE NONE
SHEET 1 OF 3
DRAWN Matt Hall 6/15/2017
CHECK Fouad Chirar 6/15/2017
ENGR Matt Hall 6/15/2017
Burt Tanaka 6/15/2017
NEXT ASSY
USED ON
APPLICATION
THIRD ANGLE PROJECTION
DO NOT SCALE DRAWING


REMOTE ELECTRONICS/TRANSMITTER ASSEMBLY
APPROVALS TAG
6.75 [171]
3.1 [78]
OPTIONAL TOUCH SCREEN HMI DISPLAY
4X ∅ .31 [8] THRU MTG HOLES
NO. 10-32 PAN HEAD SCREW, TYPICAL
4X CONDUIT ENTRY PORT: OPTIONAL 1 INCH NPT OR M25 X 1.5 THREAD SIZES
11.2 [285]
8.00 [203]
12.75 [324]
13.6 [345]
3X 2.33 [59]
4X 3.00 [76]
1.50 [38]
MT100 REMOTE ELECTRONICS, SEE WIRING DIAGRAM 025993 FOR PROPER INPUT AND OUTPUT CABLE TERMINATIONS
MT100 REMOTE ELECTRONICS OPEN DOOR VIEW
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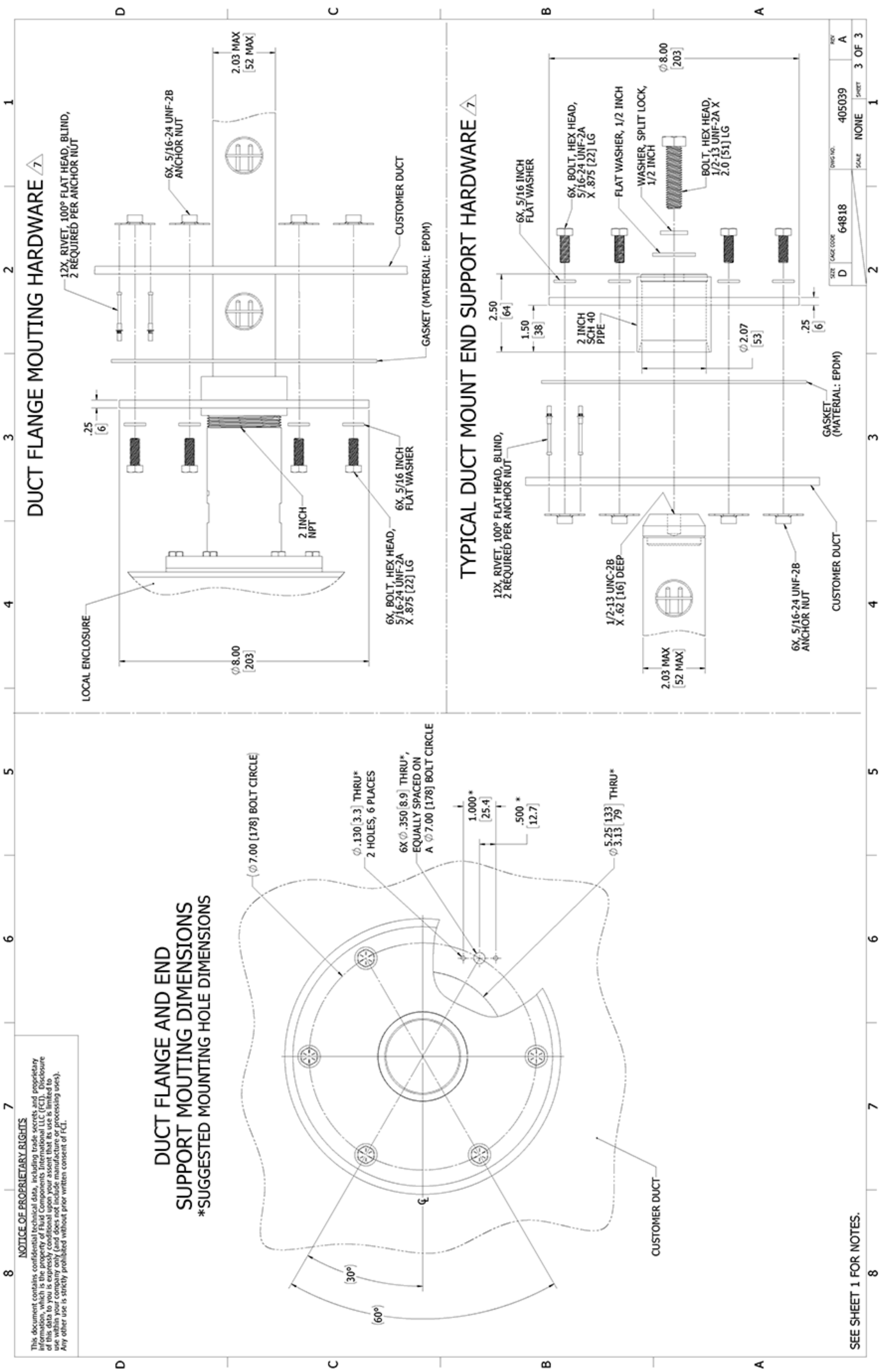
SEE SHEET 1 FOR NOTES.
SIZE D
CAGE CODE 64818
DWG NO. 405039
REV A
SCALE NONE
SHEET 2 OF 3


DUCT FLANGE MOUTING HARDWARE
12X, RIVET, 100° FLAT HEAD, BLIND, 2 REQUIRED PER ANCHOR NUT
6X, 5/16-24 UNF-2B ANCHOR NUT
2.03 MAX [52 MAX]
CUSTOMER DUCT
GASKET (MATERIAL: EPDM)
.25 [6]
2 INCH NPT
6X, 5/16 INCH FLAT WASHER
6X, BOLT, HEX HEAD, 5/16-24 UNF-2A X .875 [22] LG
LOCAL ENCLOSURE
⌀8.00 [203]
TYPICAL DUCT MOUNT END SUPPORT HARDWARE
6X, 5/16 INCH FLAT WASHER
6X, BOLT, HEX HEAD, 5/16-24 UNF-2A X .875 [22] LG
FLAT WASHER, 1/2 INCH
WASHER, SPLIT LOCK, 1/2 INCH
BOLT, HEX HEAD, 1/2-13 UNF-2A X 2.0 [51] LG
⌀8.00 [203]
2.50 [64]
1.50 [38]
2 INCH SCH 40 PIPE
⌀2.07 [53]
.25 [6]
GASKET (MATERIAL: EPDM)
12X, RIVET, 100° FLAT HEAD, BLIND, 2 REQUIRED PER ANCHOR NUT
1/2-13 UNC-2B X .62 [16] DEEP
6X, 5/16-24 UNF-2B ANCHOR NUT
CUSTOMER DUCT
2.03 MAX [52 MAX]
DUCT FLANGE AND END SUPPORT MOUTING DIMENSIONS
*SUGGESTED MOUNTING HOLE DIMENSIONS
⌀7.00 [178] BOLT CIRCLE
⌀.130 [3.3] THRU* 2 HOLES, 6 PLACES
6X ⌀.350 [8.9] THRU*, EQUALLY SPACED ON A ⌀7.00 [178] BOLT CIRCLE
1.000* [25.4]
.500* [12.7]
⌀5.25 [133] ⌀3.13 [79] THRU*
30°
60°
CUSTOMER DUCT
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SEE SHEET 1 FOR NOTES.
SIZE D
CAGE CODE 64818
DWG NO. 405039
REV A
SCALE NONE
SHEET 3 OF 3

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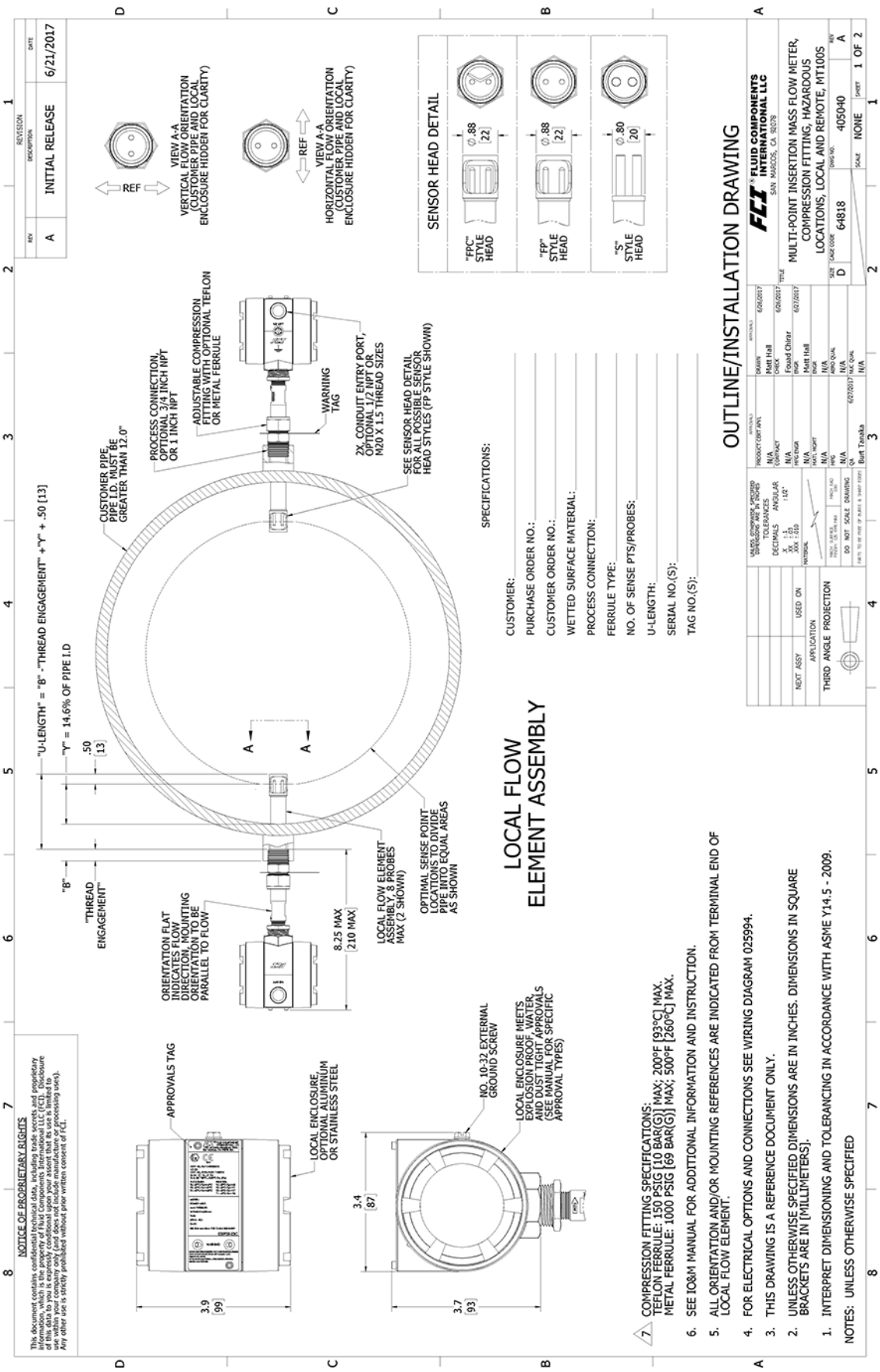
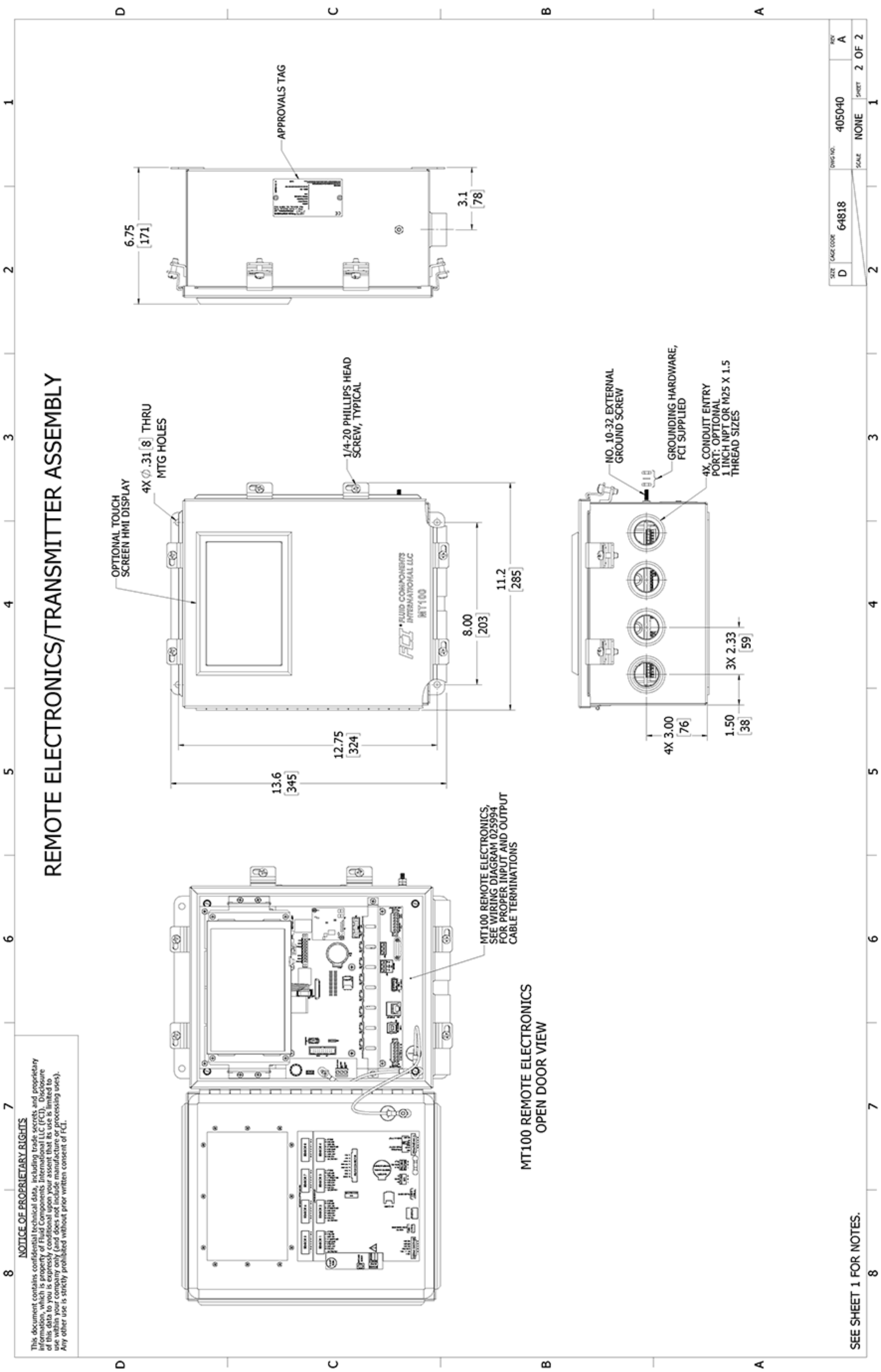

OUTLINE/INSTALLATION DRAWING
LOCAL FLOW ELEMENT ASSEMBLY
SENSOR HEAD DETAIL
"FPC" STYLE HEAD
"FP" STYLE HEAD
"S" STYLE HEAD
VIEW A-A VERTICAL FLOW ORIENTATION (CUSTOMER PIPE AND LOCAL ENCLOSURE HIDDEN FOR CLARITY)
VIEW A-A HORIZONTAL FLOW ORIENTATION (CUSTOMER PIPE AND LOCAL ENCLOSURE HIDDEN FOR CLARITY)
"U-LENGTH" = "B" -"THREAD ENGAGEMENT" +"Y" + .50 [13]
"Y" = 14.6% OF PIPE I.D
CUSTOMER PIPE, PIPE I.D. MUST BE GREATER THAN 12.0"
PROCESS CONNECTION, OPTIONAL 3/4 INCH NPT OR 1 INCH NPT
ADJUSTABLE COMPRESSION FITTING WITH OPTIONAL TEFLON OR METAL FERRULE
WARNING TAG
2X, CONDUIT ENTRY PORT, OPTIONAL 1/2 NPT OR M20 X 1.5 THREAD SIZES
SEE SENSOR HEAD DETAIL FOR ALL POSSIBLE SENSOR HEAD STYLES (FP STYLE SHOWN)
ORIENTATION FLAT INDICATES FLOW DIRECTION, MOUNTING ORIENTATION TO BE PARALLEL TO FLOW
LOCAL FLOW ELEMENT ASSEMBLY, 8 PROBES MAX (2 SHOWN)
OPTIMAL SENSE POINT LOCATIONS TO DIVIDE PIPE INTO EQUAL AREAS AS SHOWN
APPROVALS TAG
LOCAL ENCLOSURE, OPTIONAL ALUMINUM OR STAINLESS STEEL
NO. 10-32 EXTERNAL GROUND SCREW
LOCAL ENCLOSURE MEETS EXPLOSION PROOF, WATER, AND DUST TIGHT APPROVALS (SEE MANUAL FOR SPECIFIC APPROVAL TYPES)
SPECIFICATIONS:
CUSTOMER:
PURCHASE ORDER NO.:
CUSTOMER ORDER NO.:
WETTED SURFACE MATERIAL:
PROCESS CONNECTION:
FERRULE TYPE:
NO. OF SENSE PTS/PROBES:
U-LENGTH:
SERIAL NO.(S):
TAG NO.(S):
NOTICE OF PROPRIETARY RIGHTS
REV A INITIAL RELEASE 6/21/2017
FLUID COMPONENTS INTERNATIONAL LLC
SAN MARCOS, CA 92078
MULTI-POINT INSERTION MASS FLOW METER, COMPRESSION FITTING, HAZARDOUS LOCATIONS, LOCAL AND REMOTE, MT100S
SIZE D CAGE CODE 64818 DWG NO. 405040 REV A
SCALE NONE SHEET 1 OF 2
1. INTERPRET DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5 - 2009.
2. UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DIMENSIONS IN SQUARE BRACKETS ARE IN [MILLIMETERS].
3. THIS DRAWING IS A REFERENCE DOCUMENT ONLY.
4. FOR ELECTRICAL OPTIONS AND CONNECTIONS SEE WIRING DIAGRAM 025994.
5. ALL ORIENTATION AND/OR MOUNTING REFERENCES ARE INDICATED FROM TERMINAL END OF LOCAL FLOW ELEMENT.
6. SEE IO&M MANUAL FOR ADDITIONAL INFORMATION AND INSTRUCTION.
7. COMPRESSION FITTING SPECIFICATIONS:
TEFLON FERRULE: 150 PSIG [10 BAR(G)] MAX; 200°F [93°C] MAX.
METAL FERRULE: 1000 PSIG [69 BAR(G)] MAX; 500°F [260°C] MAX.


REMOTE ELECTRONICS/TRANSMITTER ASSEMBLY
APPROVALS TAG
6.75 [171]
3.1 [78]
OPTIONAL TOUCH SCREEN HMI DISPLAY
4X ∅ .31 [8] THRU MTG HOLES
1/4-20 PHILLIPS HEAD SCREW, TYPICAL
NO. 10-32 EXTERNAL GROUND SCREW
GROUNDING HARDWARE, FCI SUPPLIED
4X, CONDUIT ENTRY PORT: OPTIONAL 1 INCH NPT OR M25 X 1.5 THREAD SIZES
FLUID COMPONENTS INTERNATIONAL LLC
MT100
8.00 [203]
11.2 [285]
3X 2.33 [59]
12.75 [324]
13.6 [345]
4X 3.00 [76]
1.50 [38]
MT100 REMOTE ELECTRONICS, SEE WIRING DIAGRAM 025994 FOR PROPER INPUT AND OUTPUT CABLE TERMINATIONS
MT100 REMOTE ELECTRONICS OPEN DOOR VIEW
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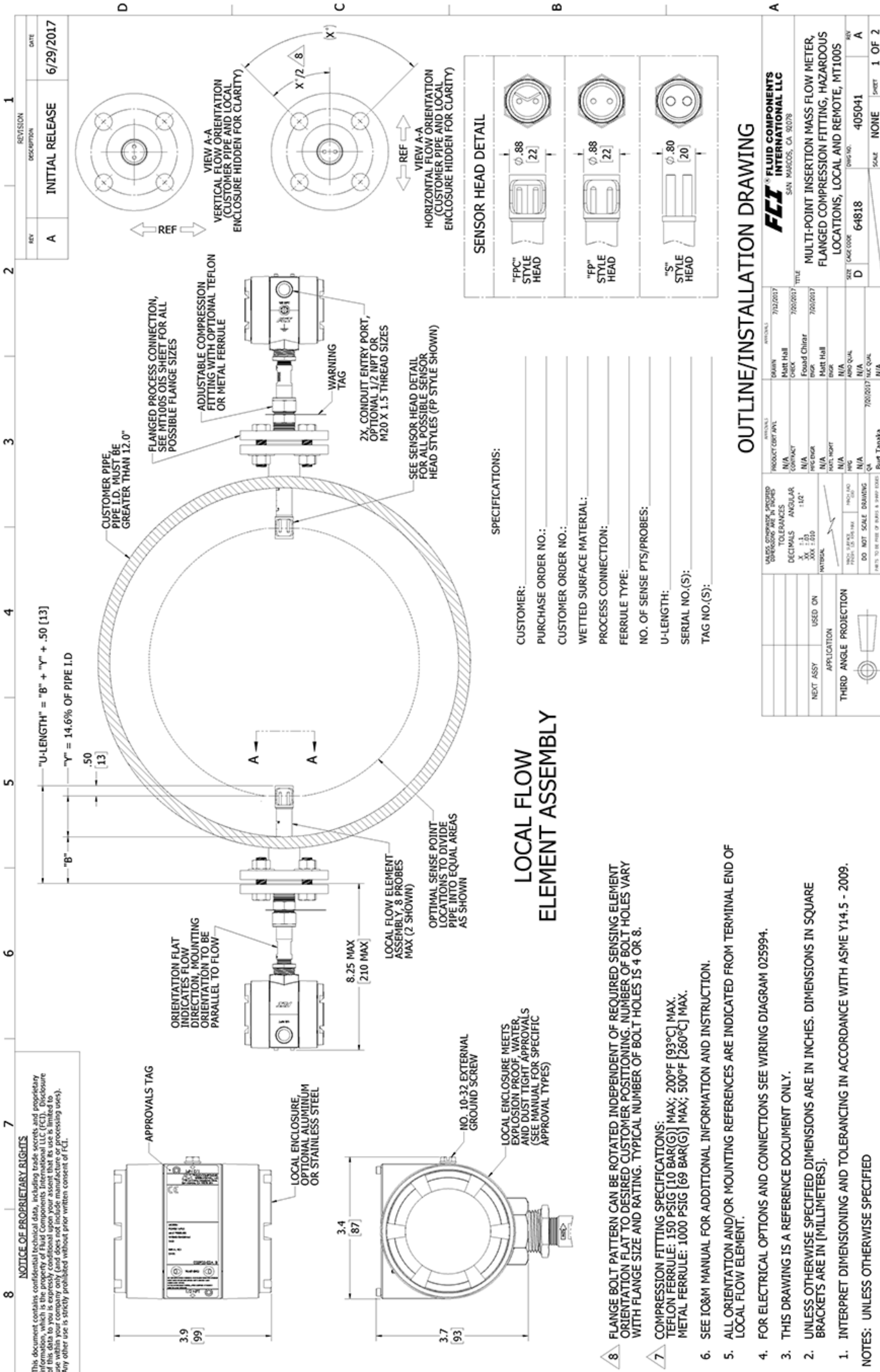
SEE SHEET 1 FOR NOTES.
SIZE D
CAGE CODE 64818
DWG NO. 405040
REV A
SCALE NONE
SHEET 2 OF 2


OUTLINE/INSTALLATION DRAWING
LOCAL FLOW ELEMENT ASSEMBLY
SENSOR HEAD DETAIL
"FPC" STYLE HEAD
"FP" STYLE HEAD
"S" STYLE HEAD
VIEW A-A VERTICAL FLOW ORIENTATION (CUSTOMER PIPE AND LOCAL ENCLOSURE HIDDEN FOR CLARITY)
VIEW A-A HORIZONTAL FLOW ORIENTATION (CUSTOMER PIPE AND LOCAL ENCLOSURE HIDDEN FOR CLARITY)
FLANGED PROCESS CONNECTION, SEE MT100S OIS SHEET FOR ALL POSSIBLE FLANGE SIZES
ADJUSTABLE COMPRESSION FITTING WITH OPTIONAL TEFLON OR METAL FERRULE
WARNING TAG
2X, CONDUIT ENTRY PORT, OPTIONAL 1/2 NPT OR M20 X 1.5 THREAD SIZES
SEE SENSOR HEAD DETAIL FOR ALL POSSIBLE SENSOR HEAD STYLES (FP STYLE SHOWN)
CUSTOMER PIPE, PIPE I.D. MUST BE GREATER THAN 12.0"
"U-LENGTH" = "B" + "Y" + .50 [13]
"Y" = 14.6% OF PIPE I.D
ORIENTATION FLAT INDICATES FLOW DIRECTION, MOUNTING ORIENTATION TO BE PARALLEL TO FLOW
8.25 MAX [210 MAX]
LOCAL FLOW ELEMENT ASSEMBLY, 8 PROBES MAX (2 SHOWN)
OPTIMAL SENSE POINT LOCATIONS TO DIVIDE PIPE INTO EQUAL AREAS AS SHOWN
APPROVALS TAG
LOCAL ENCLOSURE, OPTIONAL ALUMINUM OR STAINLESS STEEL
NO. 10-32 EXTERNAL GROUND SCREW
LOCAL ENCLOSURE MEETS EXPLOSION PROOF, WATER, AND DUST TIGHT APPROVALS (SEE MANUAL FOR SPECIFIC APPROVAL TYPES)
SPECIFICATIONS:
CUSTOMER:
PURCHASE ORDER NO.:
CUSTOMER ORDER NO.:
WETTED SURFACE MATERIAL:
PROCESS CONNECTION:
FERRULE TYPE:
NO. OF SENSE PTS/PROBES:
U-LENGTH:
SERIAL NO.(S):
TAG NO.(S):
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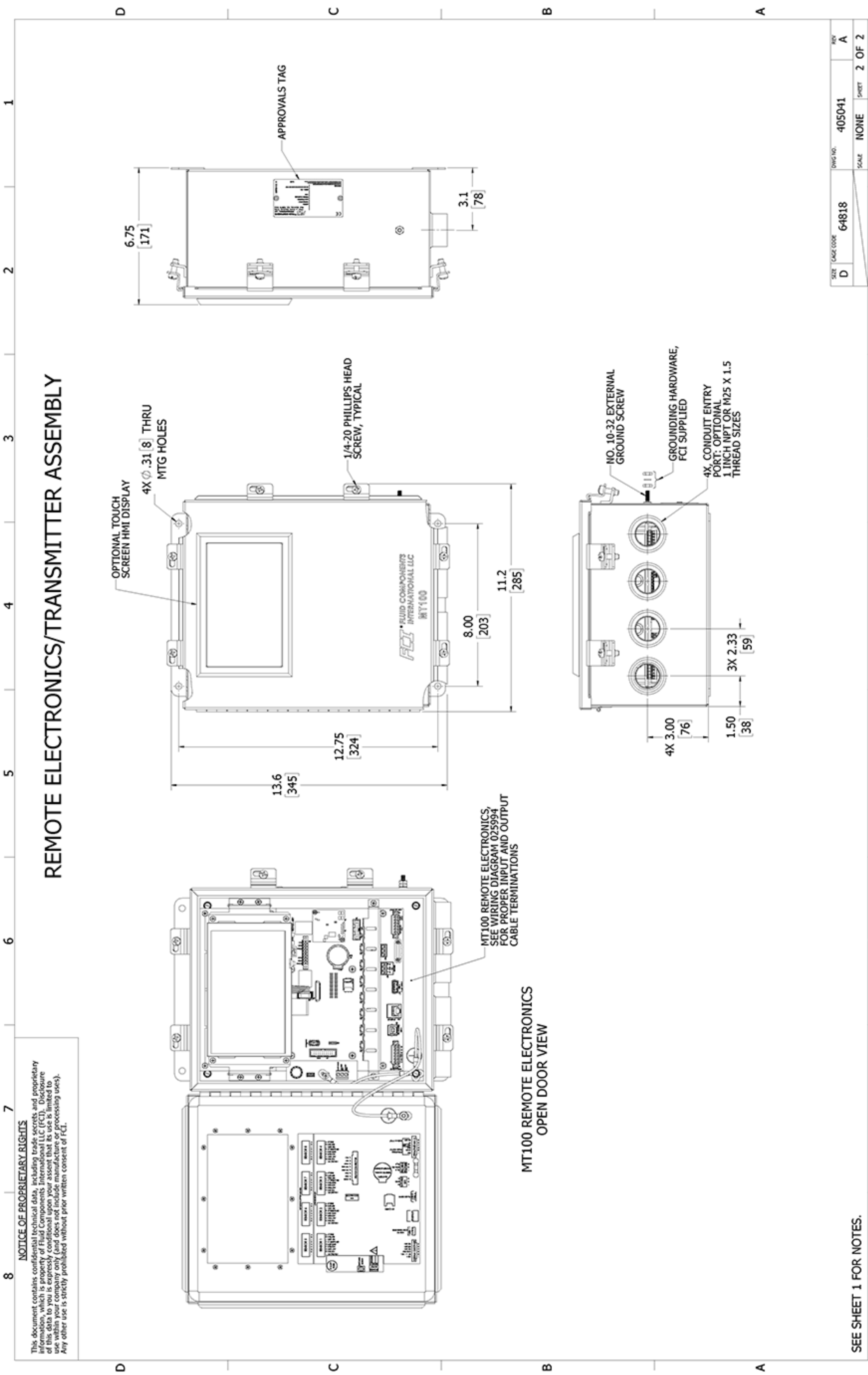
5. ALL ORIENTATION AND/OR MOUNTING REFERENCES ARE INDICATED FROM TERMINAL END OF LOCAL FLOW ELEMENT.
6. SEE IO&M MANUAL FOR ADDITIONAL INFORMATION AND INSTRUCTION.
7. COMPRESSION FITTING SPECIFICATIONS: TEFLON FERRULE: 150 PSIG [10 BAR(G)] MAX; 200°F [93°C] MAX. METAL FERRULE: 1000 PSIG [69 BAR(G)] MAX; 500°F [260°C] MAX.
8. FLANGE BOLT PATTERN CAN BE ROTATED INDEPENDENT OF REQUIRED SENSING ELEMENT ORIENTATION FLAT TO DESIRED CUSTOMER POSITIONING. NUMBER OF BOLT HOLES VARY WITH FLANGE SIZE AND RATING. TYPICAL NUMBER OF BOLT HOLES IS 4 OR 8.
REV A INITIAL RELEASE 6/29/2017
FLUID COMPONENTS INTERNATIONAL LLC SAN MARCOS, CA 92078
MULTI-POINT INSERTION MASS FLOW METER, FLANGED COMPRESSION FITTING, HAZARDOUS LOCATIONS, LOCAL AND REMOTE, MT100S
SIZE D CAGE CODE 64818 DWG NO. 405041 REV A
SCALE NONE SHEET 1 OF 2
DRAWN Matt Hall 7/12/2017
CHECK Fouad Chirar 7/20/2017
ENGR Matt Hall 7/20/2017
QA Burt Tanaka 7/20/2017
THIRD ANGLE PROJECTION
DO NOT SCALE DRAWING


REMOTE ELECTRONICS/TRANSMITTER ASSEMBLY
APPROVALS TAG
6.75 [171]
3.1 [78]
OPTIONAL TOUCH SCREEN HMI DISPLAY
4X ⌀ .31 [8] THRU MTG HOLES
1/4-20 PHILLIPS HEAD SCREW, TYPICAL
11.2 [285]
8.00 [203]
12.75 [324]
13.6 [345]
FCI FLUID COMPONENTS INTERNATIONAL LLC MT100
NO. 10-32 EXTERNAL GROUND SCREW
GROUNDING HARDWARE, FCI SUPPLIED
4X, CONDUIT ENTRY PORT: OPTIONAL 1 INCH NPT OR M25 X 1.5 THREAD SIZES
3X 2.33 [59]
4X 3.00 [76]
1.50 [38]
MT100 REMOTE ELECTRONICS, SEE WIRING DIAGRAM 025994 FOR PROPER INPUT AND OUTPUT CABLE TERMINATIONS
MT100 REMOTE ELECTRONICS OPEN DOOR VIEW
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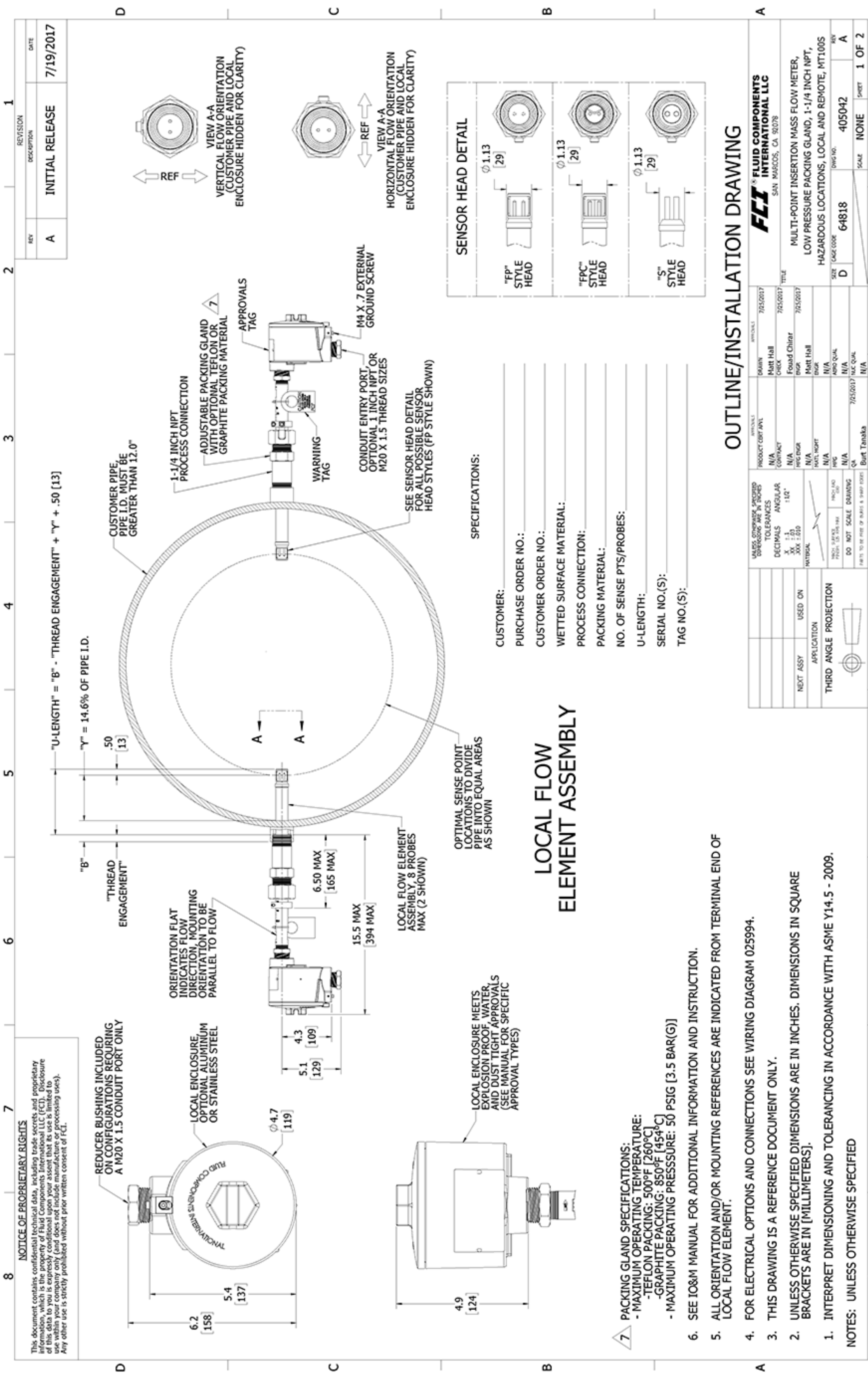
SEE SHEET 1 FOR NOTES.
SIZE D
CAGE CODE 64818
DWG NO. 405041
REV A
SCALE NONE
SHEET 2 OF 2


OUTLINE/INSTALLATION DRAWING
LOCAL FLOW ELEMENT ASSEMBLY
SENSOR HEAD DETAIL
"FP" STYLE HEAD
"FPC" STYLE HEAD
"S" STYLE HEAD
Ø 1.13 [29]
REVISION
REV A INITIAL RELEASE 7/19/2017
VIEW A-A VERTICAL FLOW ORIENTATION (CUSTOMER PIPE AND LOCAL ENCLOSURE HIDDEN FOR CLARITY)
VIEW A-A HORIZONTAL FLOW ORIENTATION (CUSTOMER PIPE AND LOCAL ENCLOSURE HIDDEN FOR CLARITY)
REF
"U-LENGTH" = "B" - "THREAD ENGAGEMENT" + "Y" + .50 [13]
"Y" = 14.6% OF PIPE I.D.
CUSTOMER PIPE. PIPE I.D. MUST BE GREATER THAN 12.0"
1-1/4 INCH NPT PROCESS CONNECTION
ADJUSTABLE PACKING GLAND WITH OPTIONAL TEFLON OR GRAPHITE PACKING MATERIAL
APPROVALS TAG
M4 X .7 EXTERNAL GROUND SCREW
CONDUIT ENTRY PORT OPTIONAL 1 INCH NPT OR M20 X 1.5 THREAD SIZES
WARNING TAG
SEE SENSOR HEAD DETAIL FOR ALL POSSIBLE SENSOR HEAD STYLES (FP STYLE SHOWN)
OPTIMAL SENSE POINT LOCATIONS TO DIVIDE PIPE INTO EQUAL AREAS AS SHOWN
LOCAL FLOW ELEMENT ASSEMBLY, 8 PROBES MAX (2 SHOWN)
ORIENTATION FLAT INDICATES FLOW DIRECTION, MOUNTING ORIENTATION TO BE PARALLEL TO FLOW
"THREAD ENGAGEMENT"
"B"
6.50 MAX [165 MAX]
15.5 MAX [394 MAX]
4.3 [109]
5.1 [129]
REDUCER BUSHING INCLUDED ON CONFIGURATIONS REQUIRING A M20 X 1.5 CONDUIT PORT ONLY
LOCAL ENCLOSURE, OPTIONAL ALUMINUM OR STAINLESS STEEL
LOCAL ENCLOSURE MEETS EXPLOSION PROOF, WATER, AND DUST TIGHT APPROVALS (SEE MANUAL FOR SPECIFIC APPROVAL TYPES)
Ø 4.7 [119]
5.4 [137]
6.2 [158]
4.9 [124]
SPECIFICATIONS:
CUSTOMER:
PURCHASE ORDER NO.:
CUSTOMER ORDER NO.:
WETTED SURFACE MATERIAL:
PROCESS CONNECTION:
PACKING MATERIAL:
NO. OF SENSE PTS/PROBES:
U-LENGTH:
SERIAL NO.(S):
TAG NO.(S):
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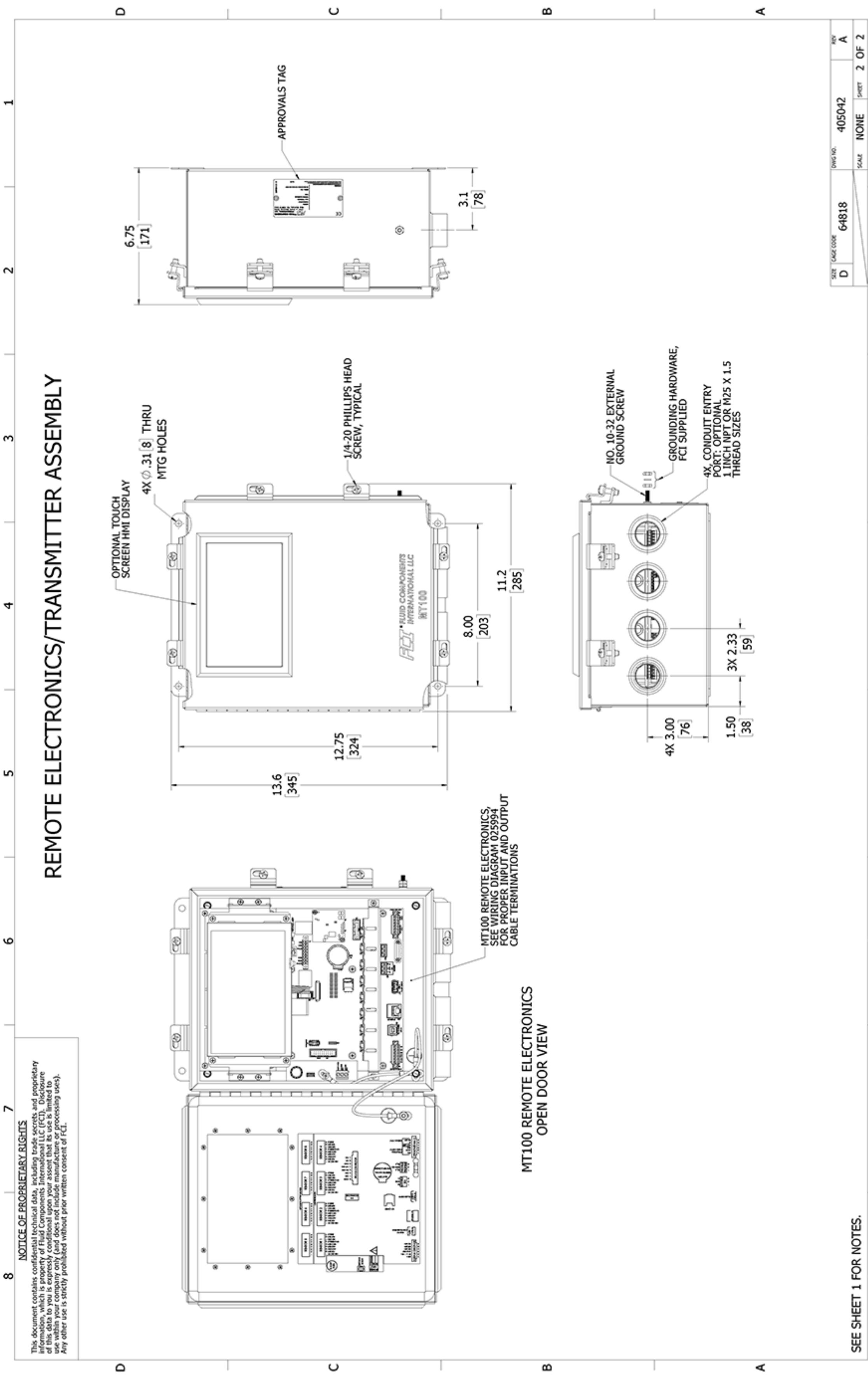
7 PACKING GLAND SPECIFICATIONS:
- MAXIMUM OPERATING TEMPERATURE:
-TEFLON PACKING: 500°F [260°C]
-GRAPHITE PACKING: 850°F [454°C]
- MAXIMUM OPERATING PRESSSURE: 50 PSIG [3.5 BAR(G)]
6. SEE IO&M MANUAL FOR ADDITIONAL INFORMATION AND INSTRUCTION.
5. ALL ORIENTATION AND/OR MOUNTING REFERENCES ARE INDICATED FROM TERMINAL END OF LOCAL FLOW ELEMENT.
4. FOR ELECTRICAL OPTIONS AND CONNECTIONS SEE WIRING DIAGRAM 025994.
3. THIS DRAWING IS A REFERENCE DOCUMENT ONLY.
2. UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DIMENSIONS IN SQUARE BRACKETS ARE IN [MILLIMETERS].
1. INTERPRET DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5 - 2009.
NOTES: UNLESS OTHERWISE SPECIFIED
FCI FLUID COMPONENTS INTERNATIONAL LLC SAN MARCOS, CA 92078
MULTI-POINT INSERTION MASS FLOW METER, LOW PRESSURE PACKING GLAND, 1-1/4 INCH NPT, HAZARDOUS LOCATIONS, LOCAL AND REMOTE, MT100S
SIZE D
CAGE CODE 64818
DWG NO. 405042
REV A
SCALE NONE
SHEET 1 OF 2
DRAWN Matt Hall 7/25/2017
CHECK Fouad Chirar 7/25/2017
ENGR Matt Hall 7/25/2017
QA Burt Tanaka 7/25/2017
THIRD ANGLE PROJECTION
NEXT ASSY
USED ON
APPLICATION
DO NOT SCALE DRAWING


REMOTE ELECTRONICS/TRANSMITTER ASSEMBLY
APPROVALS TAG
6.75 [171]
3.1 [78]
OPTIONAL TOUCH SCREEN HMI DISPLAY
4X ∅ .31 [8] THRU MTG HOLES
1/4-20 PHILLIPS HEAD SCREW, TYPICAL
FLUID COMPONENTS INTERNATIONAL LLC
MT100
11.2 [285]
8.00 [203]
12.75 [324]
13.6 [345]
NO. 10-32 EXTERNAL GROUND SCREW
GROUNDING HARDWARE, FCI SUPPLIED
4X, CONDUIT ENTRY PORT: OPTIONAL 1 INCH NPT OR M25 X 1.5 THREAD SIZES
3X 2.33 [59]
4X 3.00 [76]
1.50 [38]
MT100 REMOTE ELECTRONICS, SEE WIRING DIAGRAM 025994 FOR PROPER INPUT AND OUTPUT CABLE TERMINATIONS
MT100 REMOTE ELECTRONICS OPEN DOOR VIEW
NOTICE OF PROPRIETARY RIGHTS
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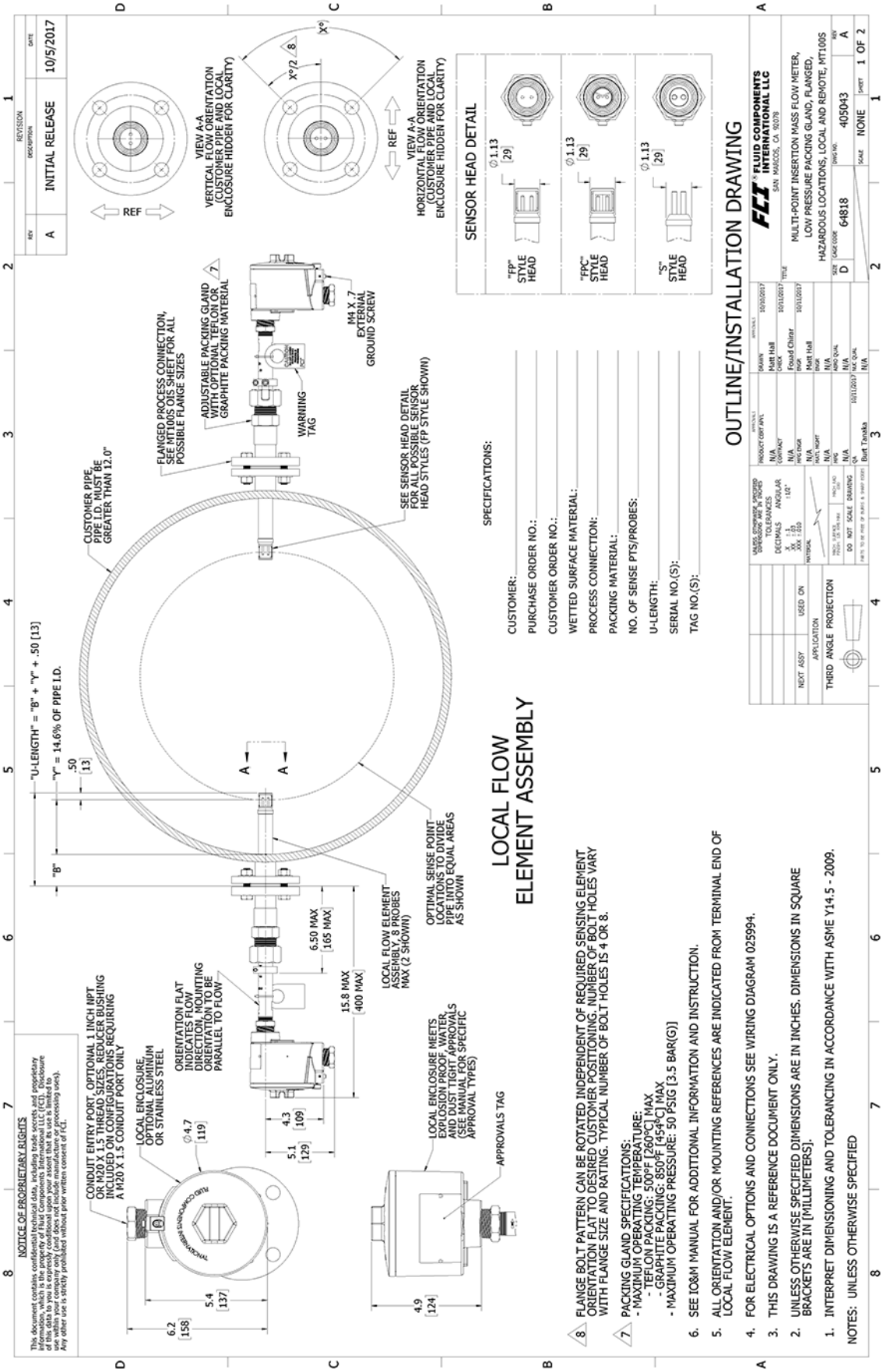
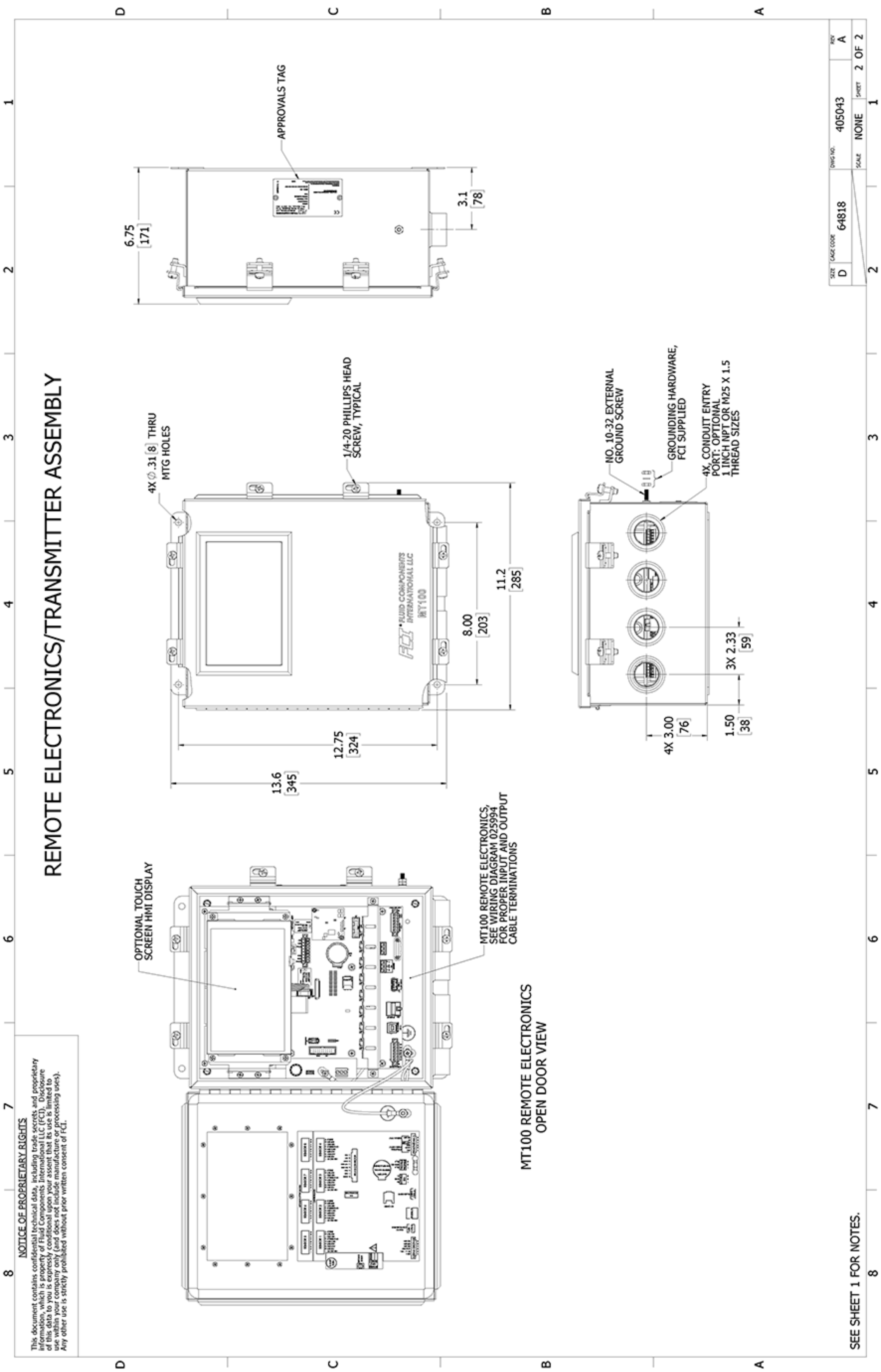
SEE SHEET 1 FOR NOTES.
SIZE D
CAGE CODE 64818
DWG NO. 405042
REV A
SCALE NONE
SHEET 2 OF 2



1. INTERPRET DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5 - 2009.
2. UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DIMENSIONS IN SQUARE BRACKETS ARE IN [MILLIMETERS].
3. THIS DRAWING IS A REFERENCE DOCUMENT ONLY.
4. FOR ELECTRICAL OPTIONS AND CONNECTIONS SEE WIRING DIAGRAM 025994.
5. ALL ORIENTATION AND/OR MOUNTING REFERENCES ARE INDICATED FROM TERMINAL END OF LOCAL FLOW ELEMENT.
6. SEE IO&M MANUAL FOR ADDITIONAL INFORMATION AND INSTRUCTION.
7. PACKING GLAND SPECIFICATIONS:
   - MAXIMUM OPERATING TEMPERATURE:
     - TEFLON PACKING: 500ºF [260ºC] MAX
     - GRAPHITE PACKING: 850ºF [454ºC] MAX
   - MAXIMUM OPERATING PRESSURE: 50 PSIG [3.5 BAR(G)]
8. FLANGE BOLT PATTERN CAN BE ROTATED INDEPENDENT OF REQUIRED SENSING ELEMENT ORIENTATION FLAT TO DESIRED CUSTOMER POSITIONING. NUMBER OF BOLT HOLES VARY WITH FLANGE SIZE AND RATING. TYPICAL NUMBER OF BOLT HOLES IS 4 OR 8.


REMOTE ELECTRONICS/TRANSMITTER ASSEMBLY
APPROVALS TAG
6.75 [171]
3.1 [78]
4X ∅.31 [8] THRU MTG HOLES
1/4-20 PHILLIPS HEAD SCREW, TYPICAL
NO. 10-32 EXTERNAL GROUND SCREW
GROUNDING HARDWARE, FCI SUPPLIED
4X, CONDUIT ENTRY PORT: OPTIONAL 1 INCH NPT OR M25 X 1.5 THREAD SIZES
11.2 [285]
8.00 [203]
3X 2.33 [59]
4X 3.00 [76]
1.50 [38]
12.75 [324]
13.6 [345]
OPTIONAL TOUCH SCREEN HMI DISPLAY
MT100 REMOTE ELECTRONICS, SEE WIRING DIAGRAM 025994 FOR PROPER INPUT AND OUTPUT CABLE TERMINATIONS
MT100 REMOTE ELECTRONICS OPEN DOOR VIEW
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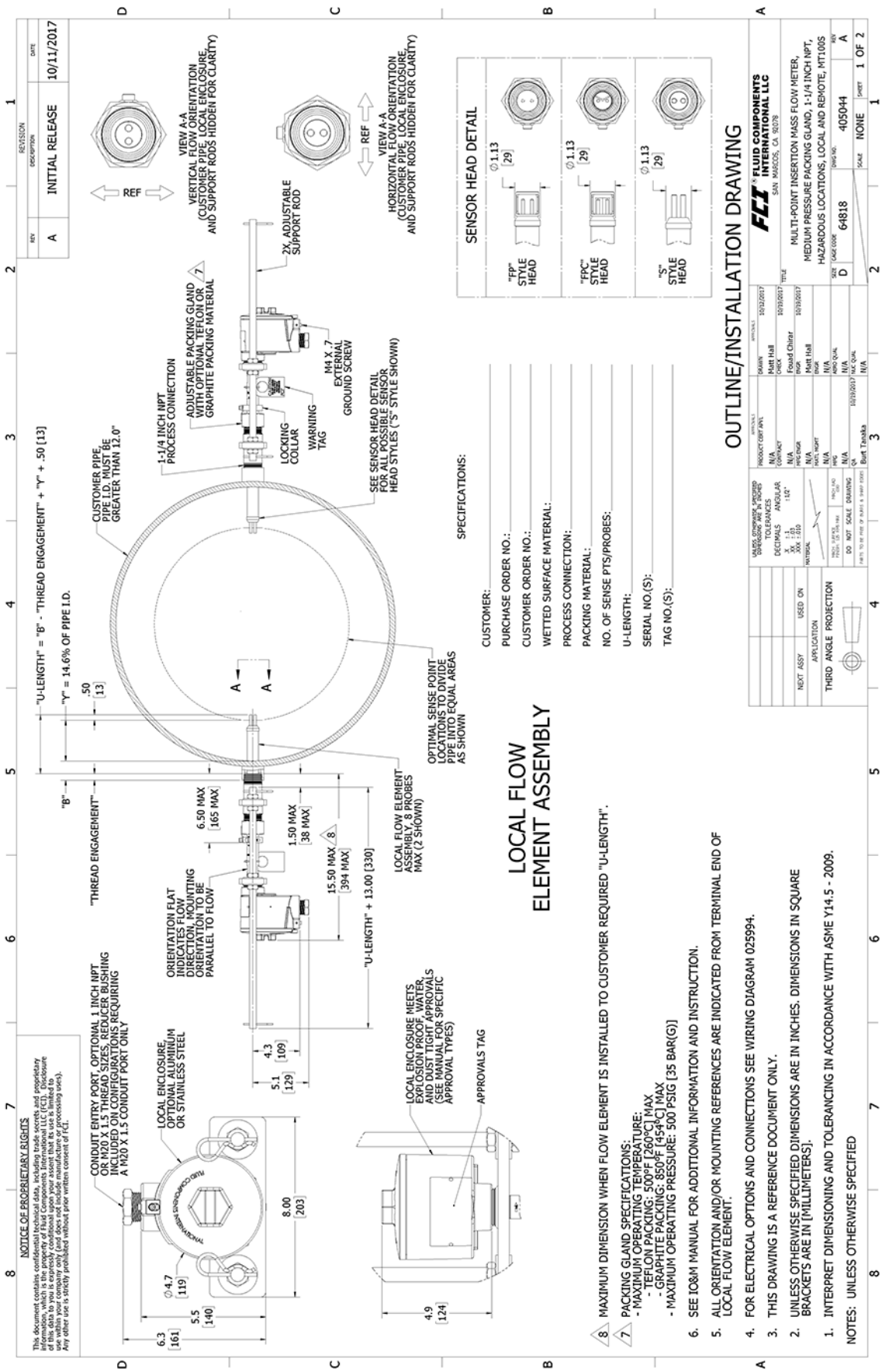
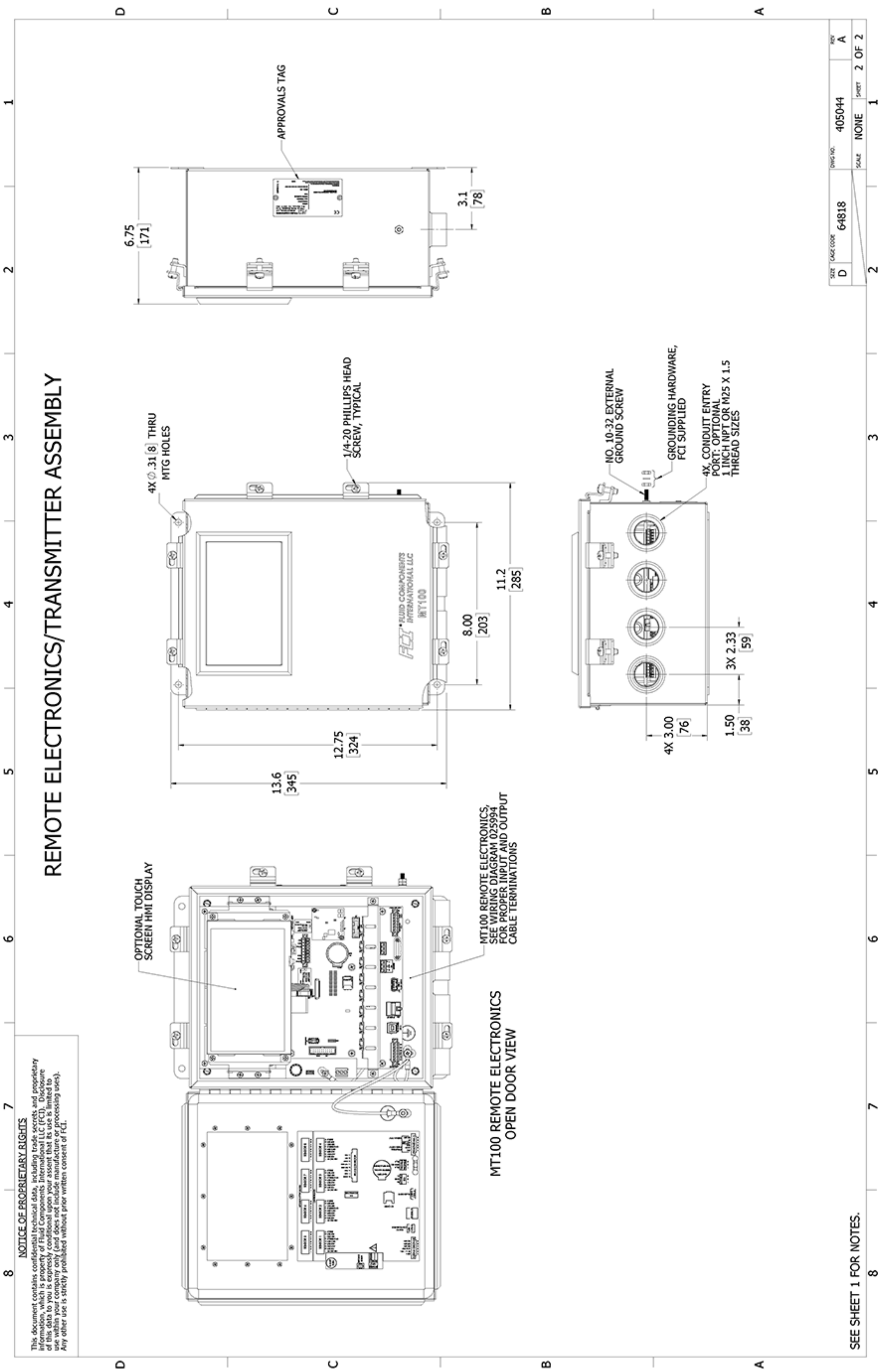
SEE SHEET 1 FOR NOTES.
SIZE D
CAGE CODE 64818
DWG NO. 405043
REV A
SCALE NONE
SHEET 2 OF 2


OUTLINE/INSTALLATION DRAWING
LOCAL FLOW ELEMENT ASSEMBLY
SENSOR HEAD DETAIL
"FP" STYLE HEAD
"FPC" STYLE HEAD
"S" STYLE HEAD
SPECIFICATIONS:
CUSTOMER:
PURCHASE ORDER NO.:
CUSTOMER ORDER NO.:
WETTED SURFACE MATERIAL:
PROCESS CONNECTION:
PACKING MATERIAL:
NO. OF SENSE PTS/PROBES:
U-LENGTH:
SERIAL NO.(S):
TAG NO.(S):
FLUID COMPONENTS INTERNATIONAL LLC
SAN MARCOS, CA 92078
MULTI-POINT INSERTION MASS FLOW METER, MEDIUM PRESSURE PACKING GLAND, 1-1/4 INCH NPT, HAZARDOUS LOCATIONS, LOCAL AND REMOTE, MT100S
64818
405044
A
NONE
1 OF 2
INITIAL RELEASE
10/11/2017
NOTICE OF PROPRIETARY RIGHTS
1. INTERPRET DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5 - 2009.
2. UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DIMENSIONS IN SQUARE BRACKETS ARE IN [MILLIMETERS].
3. THIS DRAWING IS A REFERENCE DOCUMENT ONLY.
4. FOR ELECTRICAL OPTIONS AND CONNECTIONS SEE WIRING DIAGRAM 025994.
5. ALL ORIENTATION AND/OR MOUNTING REFERENCES ARE INDICATED FROM TERMINAL END OF LOCAL FLOW ELEMENT.
6. SEE IO&M MANUAL FOR ADDITIONAL INFORMATION AND INSTRUCTION.
7. PACKING GLAND SPECIFICATIONS:
- MAXIMUM OPERATING TEMPERATURE:
- TEFLON PACKING: 500ºF [260ºC] MAX
- GRAPHITE PACKING: 850ºF [454ºC] MAX
- MAXIMUM OPERATING PRESSURE: 500 PSIG [35 BAR(G)]
8. MAXIMUM DIMENSION WHEN FLOW ELEMENT IS INSTALLED TO CUSTOMER REQUIRED "U-LENGTH".


REMOTE ELECTRONICS/TRANSMITTER ASSEMBLY
APPROVALS TAG
6.75 [171]
3.1 [78]
4X ∅.31 [8] THRU MTG HOLES
1/4-20 PHILLIPS HEAD SCREW, TYPICAL
FCI FLUID COMPONENTS INTERNATIONAL LLC MT100
11.2 [285]
8.00 [203]
12.75 [324]
13.6 [345]
NO. 10-32 EXTERNAL GROUND SCREW
GROUNDING HARDWARE, FCI SUPPLIED
4X, CONDUIT ENTRY PORT: OPTIONAL 1 INCH NPT OR M25 X 1.5 THREAD SIZES
3X 2.33 [59]
4X 3.00 [76]
1.50 [38]
OPTIONAL TOUCH SCREEN HMI DISPLAY
MT100 REMOTE ELECTRONICS, SEE WIRING DIAGRAM 025994 FOR PROPER INPUT AND OUTPUT CABLE TERMINATIONS
MT100 REMOTE ELECTRONICS OPEN DOOR VIEW
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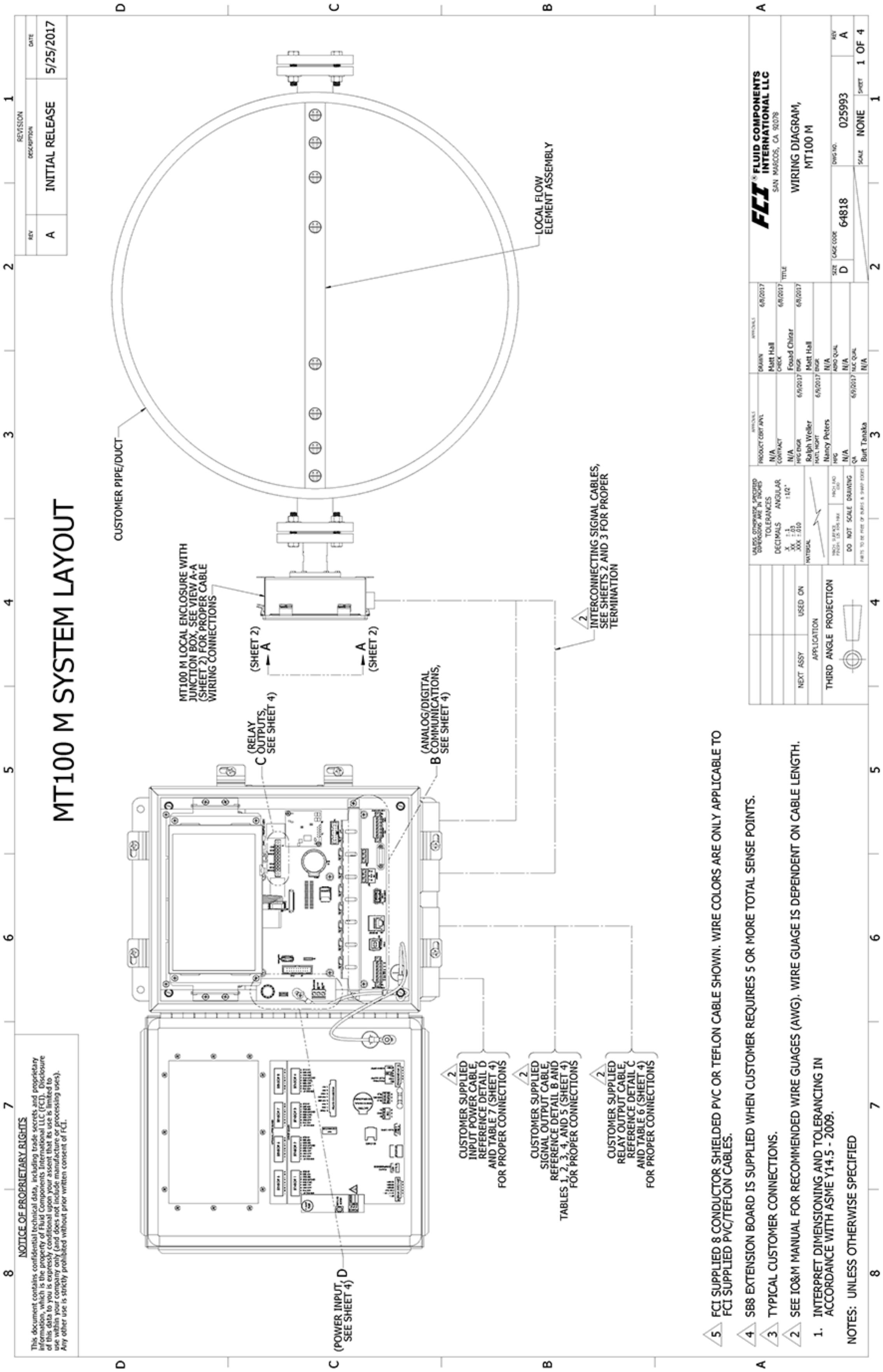
SEE SHEET 1 FOR NOTES.
SIZE D
CAGE CODE 64818
DWG NO. 405044
REV A
SCALE NONE
SHEET 2 OF 2


MT100 M SYSTEM LAYOUT
REV A INITIAL RELEASE 5/25/2017
LOCAL FLOW ELEMENT ASSEMBLY
CUSTOMER PIPE/DUCT
MT100 M LOCAL ENCLOSURE WITH JUNCTION BOX, SEE VIEW A-A (SHEET 2) FOR PROPER CABLE WIRING CONNECTIONS
(SHEET 2) A
A (SHEET 2)
INTERCONNECTING SIGNAL CABLES, SEE SHEETS 2 AND 3 FOR PROPER TERMINATION
C (RELAY OUTPUTS, SEE SHEET 4)
B (ANALOG/DIGITAL COMMUNICATIONS, SEE SHEET 4)
D (POWER INPUT, SEE SHEET 4)
CUSTOMER SUPPLIED INPUT POWER CABLE, REFERENCE DETAIL D AND TABLE 7 (SHEET 4) FOR PROPER CONNECTIONS
CUSTOMER SUPPLIED SIGNAL OUTPUT CABLE, REFERENCE DETAIL B AND TABLES 1, 2, 3, 4, AND 5 (SHEET 4) FOR PROPER CONNECTIONS
CUSTOMER SUPPLIED RELAY OUTPUT CABLE, REFERENCE DETAIL C AND TABLE 6 (SHEET 4) FOR PROPER CONNECTIONS
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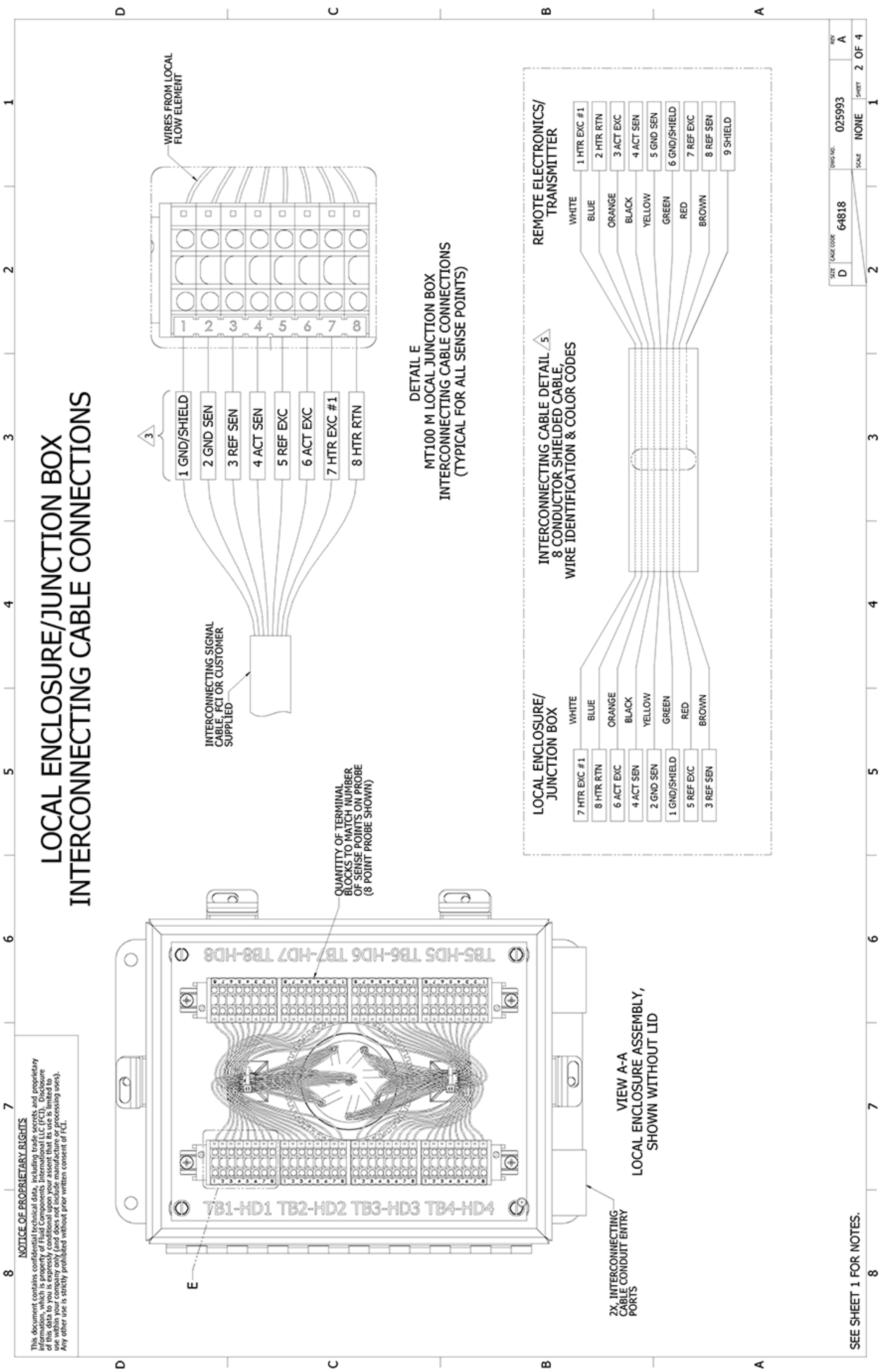
NOTES: UNLESS OTHERWISE SPECIFIED
1. INTERPRET DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5 - 2009.
2 SEE IO&M MANUAL FOR RECOMMENDED WIRE GUAGES (AWG). WIRE GUAGE IS DEPENDENT ON CABLE LENGTH.
3 TYPICAL CUSTOMER CONNECTIONS.
4 SB8 EXTENSION BOARD IS SUPPLIED WHEN CUSTOMER REQUIRES 5 OR MORE TOTAL SENSE POINTS.
5 FCI SUPPLIED 8 CONDUCTOR SHIELDED PVC OR TEFLON CABLE SHOWN. WIRE COLORS ARE ONLY APPLICABLE TO FCI SUPPLIED PVC/TEFLON CABLES.
FCI FLUID COMPONENTS INTERNATIONAL LLC SAN MARCOS, CA 92078
WIRING DIAGRAM, MT100 M
SIZE D CAGE CODE 64818 DWG NO. 025993 REV A
SCALE NONE SHEET 1 OF 4
DRAWN Matt Hall 6/8/2017
CHECK Fouad Chirar 6/8/2017
ENGR Matt Hall 6/8/2017
MFG ENGR Ralph Weller 6/9/2017
MATL MGMT Nancy Peters 6/9/2017
QA Burt Tanaka 6/9/2017
THIRD ANGLE PROJECTION
NEXT ASSY USED ON APPLICATION
DO NOT SCALE DRAWING


LOCAL ENCLOSURE/JUNCTION BOX
INTERCONNECTING CABLE CONNECTIONS
WIRES FROM LOCAL FLOW ELEMENT
1 GND/SHIELD
2 GND SEN
3 REF SEN
4 ACT SEN
5 REF EXC
6 ACT EXC
7 HTR EXC #1
8 HTR RTN
DETAIL E
MT100 M LOCAL JUNCTION BOX
INTERCONNECTING CABLE CONNECTIONS
(TYPICAL FOR ALL SENSE POINTS)
INTERCONNECTING SIGNAL CABLE, FCI OR CUSTOMER SUPPLIED
QUANTITY OF TERMINAL BLOCKS TO MATCH NUMBER OF SENSE POINTS ON PROBE (8 POINT PROBE SHOWN)
REMOTE ELECTRONICS/TRANSMITTER
WHITE 1 HTR EXC #1
BLUE 2 HTR RTN
ORANGE 3 ACT EXC
BLACK 4 ACT SEN
YELLOW 5 GND SEN
GREEN 6 GND/SHIELD
RED 7 REF EXC
BROWN 8 REF SEN
9 SHIELD
INTERCONNECTING CABLE DETAIL 5
8 CONDUCTOR SHIELDED CABLE,
WIRE IDENTIFICATION & COLOR CODES
LOCAL ENCLOSURE/JUNCTION BOX
7 HTR EXC #1 WHITE
8 HTR RTN BLUE
6 ACT EXC ORANGE
4 ACT SEN BLACK
2 GND SEN YELLOW
1 GND/SHIELD GREEN
5 REF EXC RED
3 REF SEN BROWN
TB5-HD5 TB6-HD6 TB7-HD7 TB8-HD8
TB1-HD1 TB2-HD2 TB3-HD3 TB4-HD4
VIEW A-A
LOCAL ENCLOSURE ASSEMBLY,
SHOWN WITHOUT LID
2X, INTERCONNECTING CABLE CONDUIT ENTRY PORTS
E
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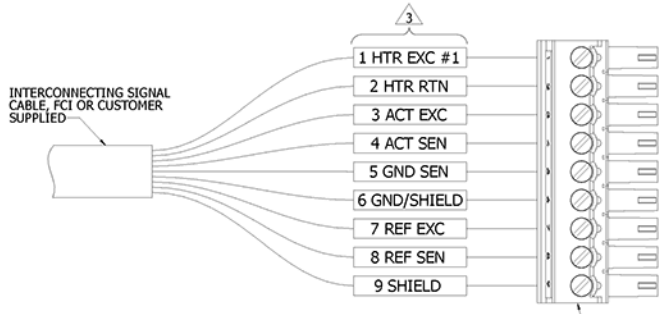
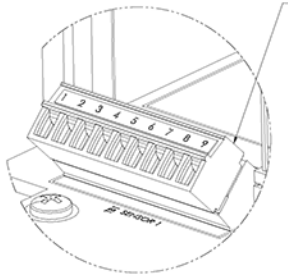
SEE SHEET 1 FOR NOTES.
SIZE D CAGE CODE 64818 DWG NO. 025993 REV A
SCALE NONE SHEET 2 OF 4

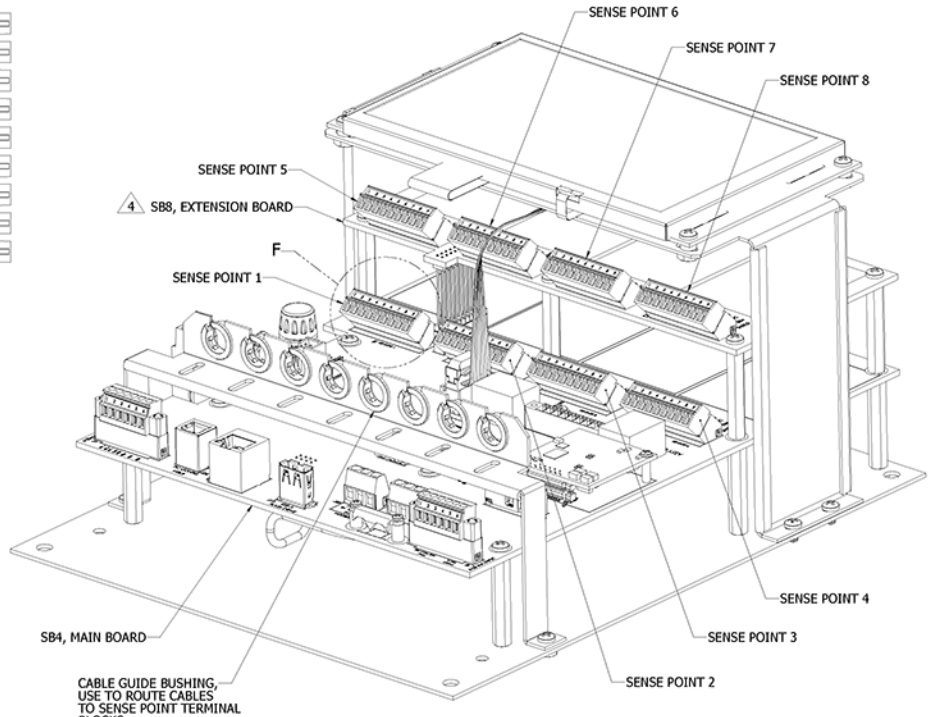
REMOTE ENCLOSURE/TRANSMITTER INTERCONNECTING CABLE CONNECTIONS



WIRING DETAIL
MT100 REMOTE ELECTRONICS
INTERCONNECTING CABLE CONNECTIONS
(TYPICAL FOR ALL SENSE POINTS)



DETAIL F
MT100 REMOTE ELECTRONICS
SENSE POINT TERMINATION BLOCK,
SEE WIRING DETAIL ABOVE FOR
PROPER INTERCONNECTING CABLE
TERMINATION TO REMOTE ELECTRONICS
(TYPICAL FOR ALL SENSE POINTS)



SEE SHEET 1 FOR NOTES.

SIZE	CAGE CODE	DWG NO.	REV
D	64818	025993	A
		SCALE NONE SHEET 3 OF 4	

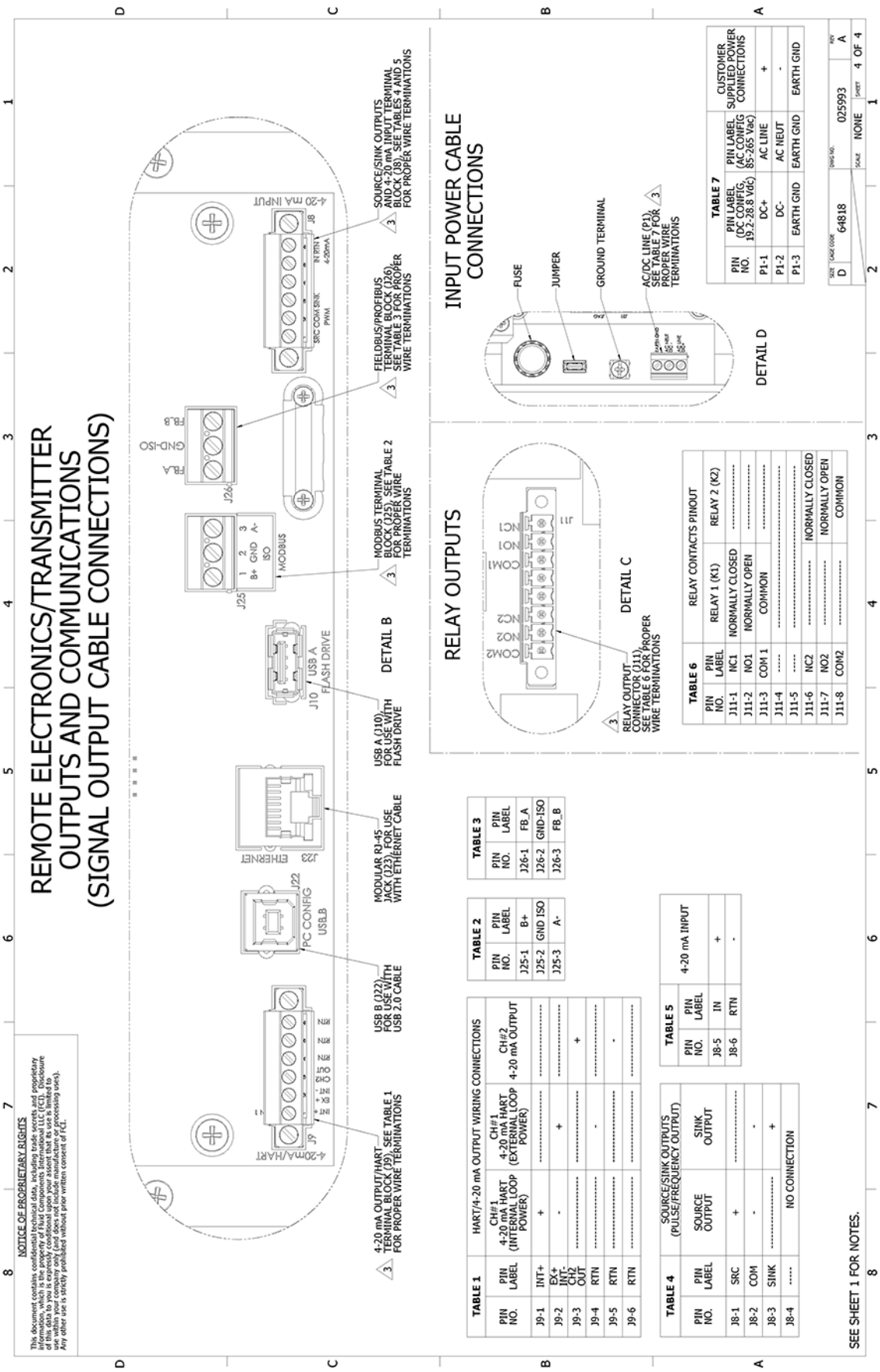


TABLE 1 HART/4-20 mA OUTPUT WIRING CONNECTIONS

PIN NO.	PIN LABEL	CH#1 4-20 mA HART (INTERNAL LOOP POWER)	CH#1 4-20 mA HART (EXTERNAL LOOP POWER)	CH#2 4-20 mA OUTPUT
J9-1	INT+	+	----------	----------
J9-2	EX+ INT- CH2 OUT	-	+	----------
J9-3	----------	----------	----------	+
J9-4	RTN	----------	-	----------
J9-5	RTN	----------	----------	-
J9-6	RTN	----------	----------	----------

TABLE 2

PIN NO.	PIN LABEL
J25-1	B+
J25-2	GND ISO
J25-3	A-

TABLE 3

PIN NO.	PIN LABEL
J26-1	FB_A
J26-2	GND-ISO
J26-3	FB_B

TABLE 4 SOURCE/SINK OUTPUTS (PULSE/FREQUENCY OUTPUT)

PIN NO.	PIN LABEL	SOURCE OUTPUT	SINK OUTPUT
J8-1	SRC	+	----------
J8-2	COM	-	-
J8-3	SINK	----------	+
J8-4	-----	NO CONNECTION	

TABLE 5 4-20 mA INPUT

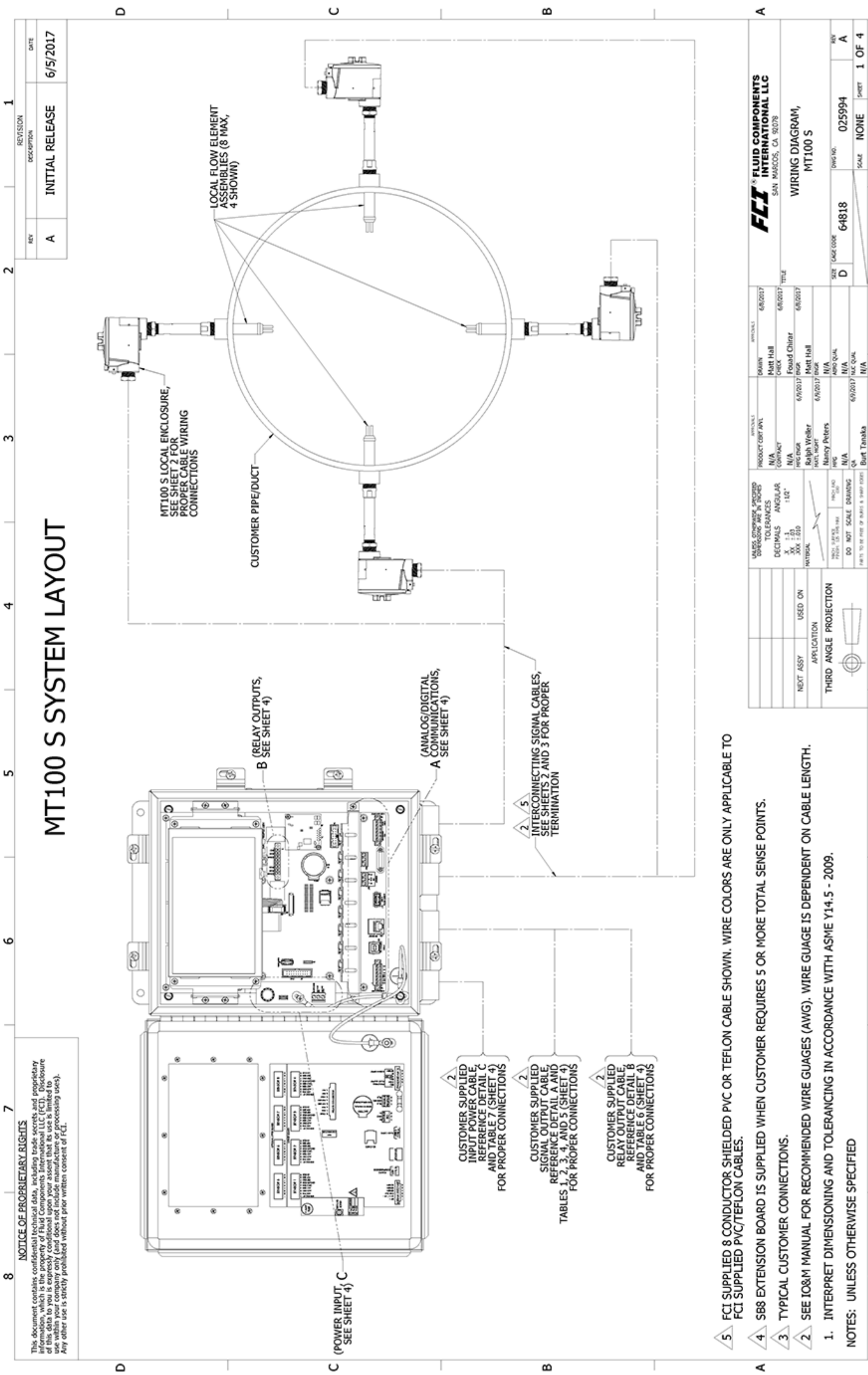
PIN NO.	PIN LABEL	
J8-5	IN	+
J8-6	RTN	-

TABLE 6 RELAY CONTACTS PINOUT

PIN NO.	PIN LABEL	RELAY 1 (K1)	RELAY 2 (K2)
J11-1	NC1	NORMALLY CLOSED	----------
J11-2	NO1	NORMALLY OPEN	----------
J11-3	COM 1	COMMON	----------
J11-4	-----	----------	----------
J11-5	-----	----------	----------
J11-6	NC2	----------	NORMALLY CLOSED
J11-7	NO2	----------	NORMALLY OPEN
J11-8	COM2	----------	COMMON

TABLE 7

PIN NO.	PIN LABEL (DC CONFIG. 19.2-28.8 Vdc)	PIN LABEL (AC CONFIG. 85-265 Vac)	CUSTOMER SUPPLIED POWER CONNECTIONS
P1-1	DC+	AC LINE	+
P1-2	DC-	AC NEUT	-
P1-3	EARTH GND	EARTH GND	EARTH GND


MT100 S SYSTEM LAYOUT
REVISION
REV A INITIAL RELEASE 6/5/2017
LOCAL FLOW ELEMENT ASSEMBLIES (8 MAX, 4 SHOWN)
MT100 S LOCAL ENCLOSURE, SEE SHEET 2 FOR PROPER CABLE WIRING CONNECTIONS
CUSTOMER PIPE/DUCT
(RELAY OUTPUTS, SEE SHEET 4) B
(ANALOG/DIGITAL COMMUNICATIONS, SEE SHEET 4) A
2 5 INTERCONNECTING SIGNAL CABLES, SEE SHEETS 2 AND 3 FOR PROPER TERMINATION
(POWER INPUT, SEE SHEET 4) C
2 CUSTOMER SUPPLIED INPUT POWER CABLE, REFERENCE DETAIL C AND TABLE 7 (SHEET 4) FOR PROPER CONNECTIONS
2 CUSTOMER SUPPLIED SIGNAL OUTPUT CABLE, REFERENCE DETAIL A AND TABLES 1, 2, 3, 4, AND 5 (SHEET 4) FOR PROPER CONNECTIONS
2 CUSTOMER SUPPLIED RELAY OUTPUT CABLE, REFERENCE DETAIL B AND TABLE 6 (SHEET 4) FOR PROPER CONNECTIONS
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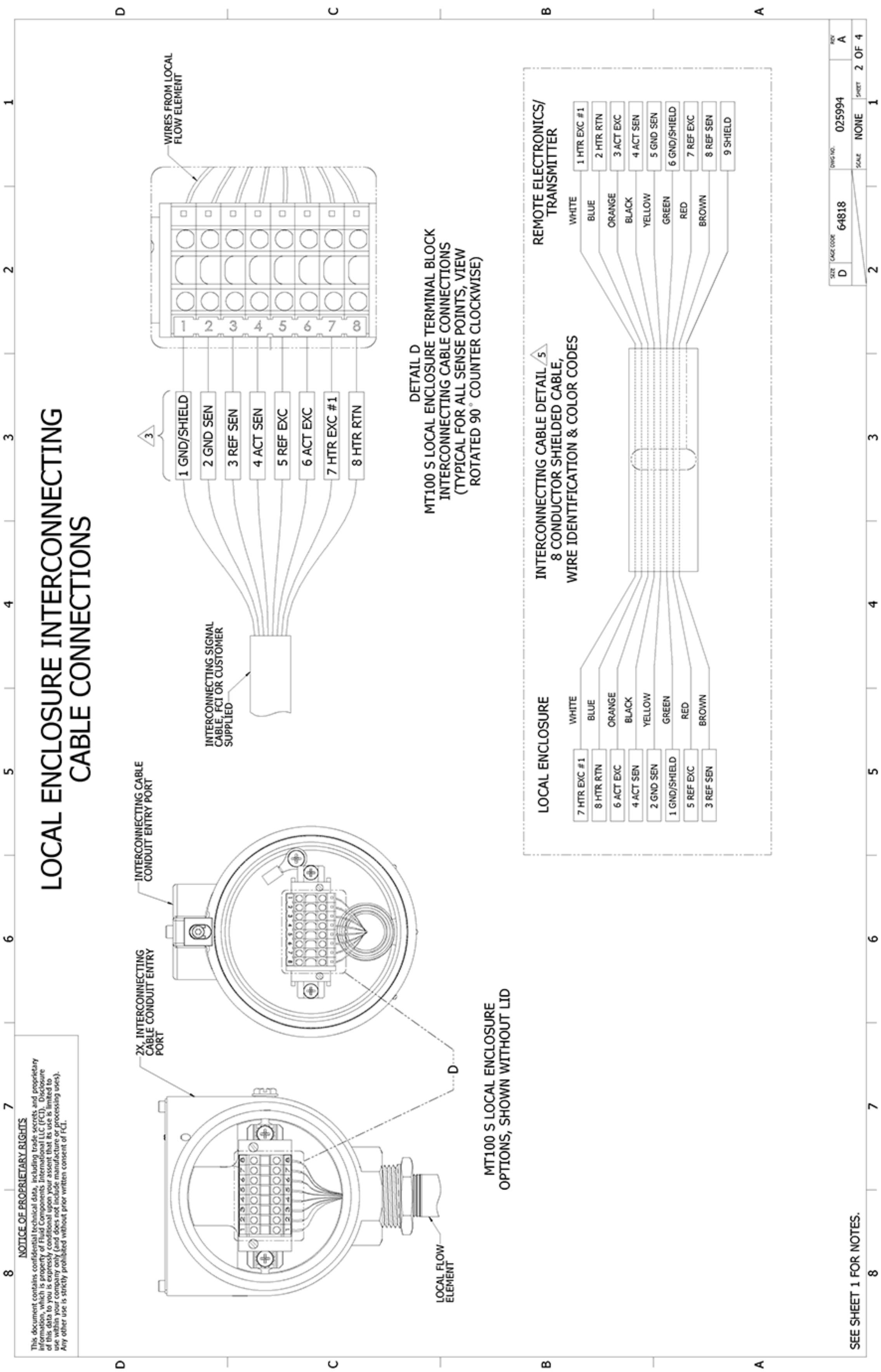
NOTES: UNLESS OTHERWISE SPECIFIED
1. INTERPRET DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5 - 2009.
2 SEE IO&M MANUAL FOR RECOMMENDED WIRE GUAGES (AWG). WIRE GUAGE IS DEPENDENT ON CABLE LENGTH.
3 TYPICAL CUSTOMER CONNECTIONS.
4 SB8 EXTENSION BOARD IS SUPPLIED WHEN CUSTOMER REQUIRES 5 OR MORE TOTAL SENSE POINTS.
5 FCI SUPPLIED 8 CONDUCTOR SHIELDED PVC OR TEFLON CABLE SHOWN. WIRE COLORS ARE ONLY APPLICABLE TO FCI SUPPLIED PVC/TEFLON CABLES.
NEXT ASSY USED ON
APPLICATION
THIRD ANGLE PROJECTION
DO NOT SCALE DRAWING
DRAWN Matt Hall 6/8/2017
CHECK Fouad Chirar 6/8/2017
ENGR Matt Hall 6/8/2017
MFG ENGR Ralph Weller 6/9/2017
MATL MGMT Nancy Peters 6/5/2017
QA Burt Tanaka 6/9/2017
FCI FLUID COMPONENTS INTERNATIONAL LLC SAN MARCOS, CA 92078
WIRING DIAGRAM, MT100 S
SIZE D CAGE CODE 64818 DWG NO. 025994 REV A
SCALE NONE SHEET 1 OF 4



LOCAL ENCLOSURE INTERCONNECTING CABLE CONNECTIONS
WIRES FROM LOCAL FLOW ELEMENT
1 GND/SHIELD
2 GND SEN
3 REF SEN
4 ACT SEN
5 REF EXC
6 ACT EXC
7 HTR EXC #1
8 HTR RTN
INTERCONNECTING SIGNAL CABLE, FCI OR CUSTOMER SUPPLIED
DETAIL D
MT100 S LOCAL ENCLOSURE TERMINAL BLOCK INTERCONNECTING CABLE CONNECTIONS (TYPICAL FOR ALL SENSE POINTS, VIEW ROTATED 90° COUNTER CLOCKWISE)
INTERCONNECTING CABLE CONDUIT ENTRY PORT
2X, INTERCONNECTING CABLE CONDUIT ENTRY PORT
LOCAL FLOW ELEMENT
MT100 S LOCAL ENCLOSURE OPTIONS, SHOWN WITHOUT LID
REMOTE ELECTRONICS/ TRANSMITTER
WHITE 1 HTR EXC #1
BLUE 2 HTR RTN
ORANGE 3 ACT EXC
BLACK 4 ACT SEN
YELLOW 5 GND SEN
GREEN 6 GND/SHIELD
RED 7 REF EXC
BROWN 8 REF SEN
9 SHIELD
INTERCONNECTING CABLE DETAIL 5
8 CONDUCTOR SHIELDED CABLE, WIRE IDENTIFICATION & COLOR CODES
LOCAL ENCLOSURE
7 HTR EXC #1 WHITE
8 HTR RTN BLUE
6 ACT EXC ORANGE
4 ACT SEN BLACK
2 GND SEN YELLOW
1 GND/SHIELD GREEN
5 REF EXC RED
3 REF SEN BROWN
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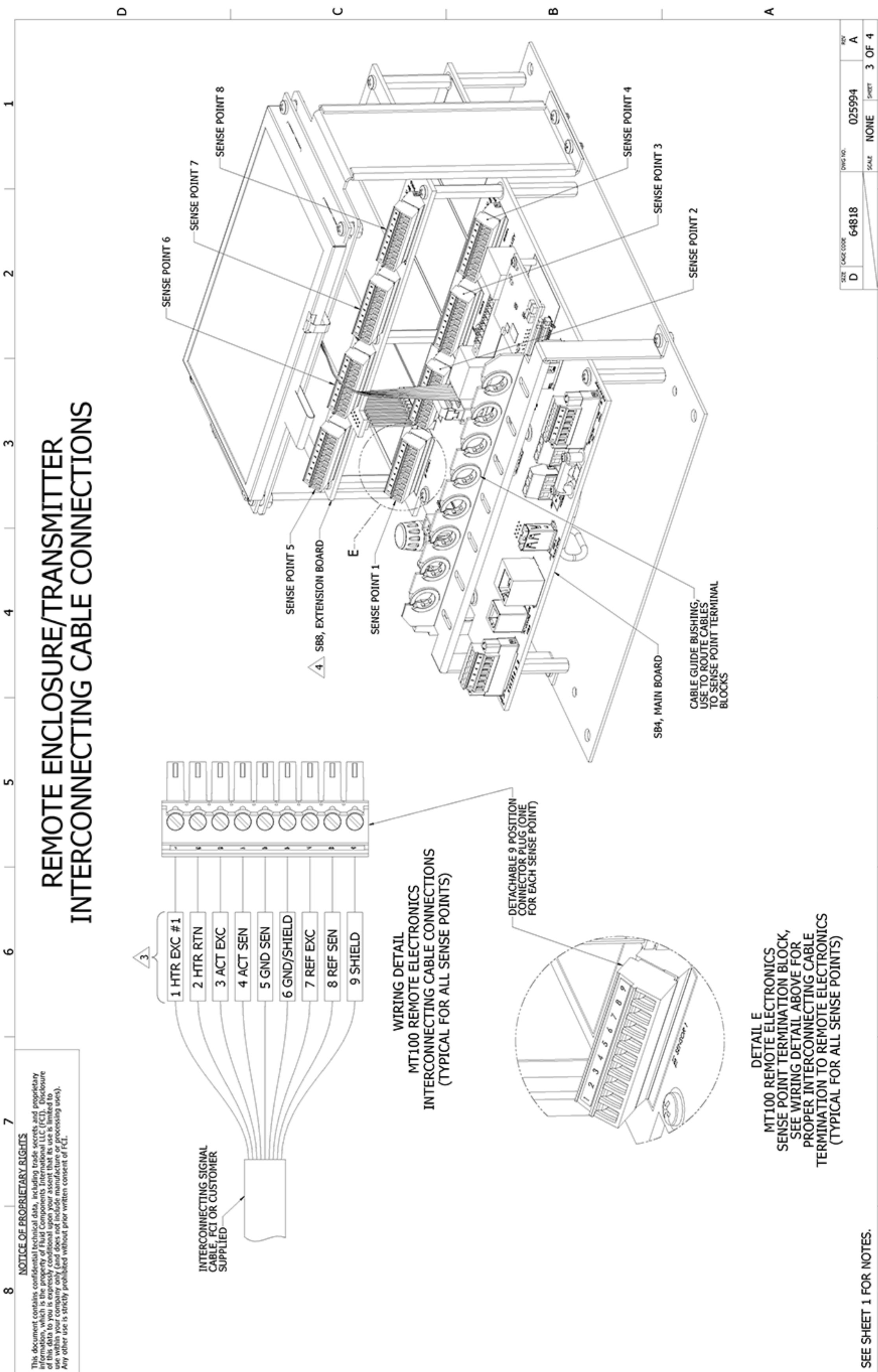
SEE SHEET 1 FOR NOTES.
SIZE D
CAGE CODE 64818
DWG NO. 025994
REV A
SCALE NONE
SHEET 2 OF 4


REMOTE ENCLOSURE/TRANSMITTER
INTERCONNECTING CABLE CONNECTIONS
SENSE POINT 8
SENSE POINT 7
SENSE POINT 6
SENSE POINT 5
SENSE POINT 4
SENSE POINT 3
SENSE POINT 2
SENSE POINT 1
SB8, EXTENSION BOARD
E
SB4, MAIN BOARD
CABLE GUIDE BUSHING, USE TO ROUTE CABLES TO SENSE POINT TERMINAL BLOCKS
1 HTR EXC #1
2 HTR RTN
3 ACT EXC
4 ACT SEN
5 GND SEN
6 GND/SHIELD
7 REF EXC
8 REF SEN
9 SHIELD
DETACHABLE 9 POSITION CONNECTOR PLUG (ONE FOR EACH SENSE POINT)
INTERCONNECTING SIGNAL CABLE, FCI OR CUSTOMER SUPPLIED
WIRING DETAIL
MT100 REMOTE ELECTRONICS
INTERCONNECTING CABLE CONNECTIONS
(TYPICAL FOR ALL SENSE POINTS)
DETAIL E
MT100 REMOTE ELECTRONICS
SENSE POINT TERMINATION BLOCK,
SEE WIRING DETAIL ABOVE FOR
PROPER INTERCONNECTING CABLE
TERMINATION TO REMOTE ELECTRONICS
(TYPICAL FOR ALL SENSE POINTS)
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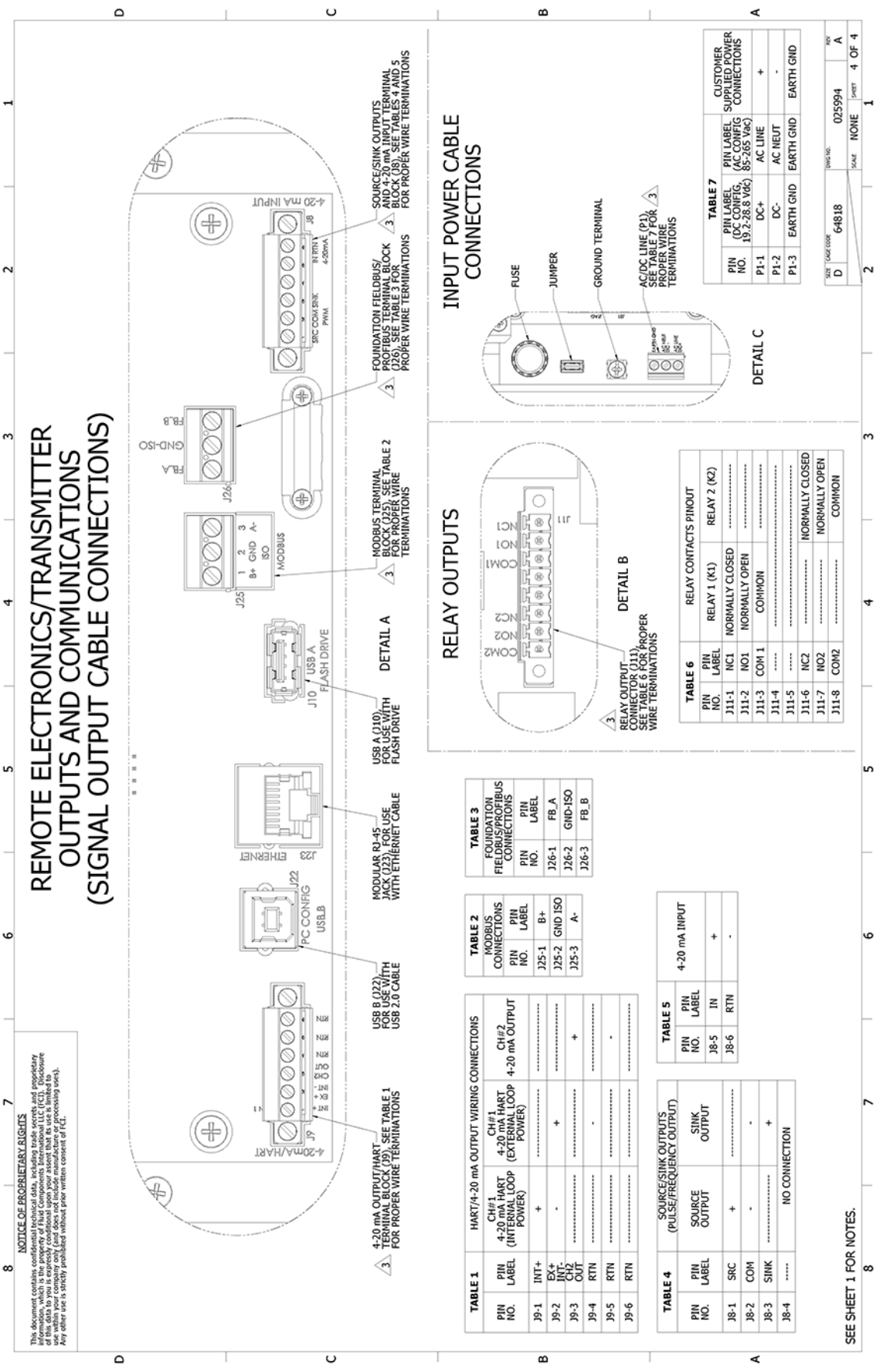
SEE SHEET 1 FOR NOTES.
SIZE D
CAGE CODE 64818
DWG NO. 025994
REV A
SCALE NONE
SHEET 3 OF 4


REMOTE ELECTRONICS/TRANSMITTER
OUTPUTS AND COMMUNICATIONS
(SIGNAL OUTPUT CABLE CONNECTIONS)
NOTICE OF PROPRIETARY RIGHTS
4-20 mA OUTPUT/HART TERMINAL BLOCK (J9), SEE TABLE 1 FOR PROPER WIRE TERMINATIONS
USB B (J22) FOR USE WITH USB 2.0 CABLE
MODULAR RJ-45 JACK (J23), FOR USE WITH ETHERNET CABLE
USB A (J10) FOR USE WITH FLASH DRIVE
DETAIL A
MODBUS TERMINAL BLOCK (J25), SEE TABLE 2 FOR PROPER WIRE TERMINATIONS
FOUNDATION FIELDBUS/ PROFIBUS TERMINAL BLOCK (J26), SEE TABLE 3 FOR PROPER WIRE TERMINATIONS
SOURCE/SINK OUTPUTS AND 4-20 mA INPUT TERMINAL BLOCK (J8), SEE TABLES 4 AND 5 FOR PROPER WIRE TERMINATIONS
INPUT POWER CABLE CONNECTIONS
FUSE
JUMPER
GROUND TERMINAL
AC/DC LINE (P1) SEE TABLE 7 FOR PROPER WIRE TERMINATIONS
DETAIL C
RELAY OUTPUTS
RELAY OUTPUT CONNECTOR (J11), SEE TABLE 6 FOR PROPER WIRE TERMINATIONS
DETAIL B
SEE SHEET 1 FOR NOTES.
TABLE 1 HART/4-20 mA OUTPUT WIRING CONNECTIONS
TABLE 2 MODBUS CONNECTIONS
TABLE 3 FOUNDATION FIELDBUS/PROFIBUS CONNECTIONS
TABLE 4 SOURCE/SINK OUTPUTS (PULSE/FREQUENCY OUTPUT)
TABLE 5 4-20 mA INPUT
TABLE 6 RELAY CONTACTS PINOUT
TABLE 7 CUSTOMER SUPPLIED POWER CONNECTIONS
SIZE D CAGE CODE 64818 DWG NO. 025994 REV A
SCALE NONE SHEET 4 OF 4

APPENDIX B GLOSSARY

Abbreviations

Delta-**R (ΔR)**	Resistance differential
Delta-**T (ΔT)**	Temperature differential
ESD	Electrostatic discharge
FCI	Fluid Components International
HTR	Heater
GND	Ground
LCD	Liquid crystal display
LED	Light Emitting Diode
NCMH	Normal Cubic Meter per Hour
RTD	Resistance Temperature Detector
SFPS	Standard Feet per Second

Definitions

Active RTD	The flow element part that senses the fluid flow rate.
Resistance Differential Delta-**R (ΔR)**	The difference in resistance between the active and reference RTDs.
Temperature Differential Delta-**T (ΔT)**	The difference in temperature between the active and reference RTDs.
Flow Transmitter	The portion of the flow meter that conditions, converts and scales the flow signal.
Heater (HTR)	The flow element part that heats the active RTD.
Local Enclosure	The enclosure attached to the flow element (usually contains the wiring terminal block).
Reference Flat	A flat part on the sensor head that helps to orient the sensor head to the flow.
Reference RTD	The flow element part that senses the fluid temperature.
Remote Enclosure	The enclosure that houses the flow transmitter remotely from the sensor head.
Resistance Temperature Detector (RTD)	A sensor whose resistance changes proportionally to temperature changes.
Span	An adjustment that sets the transmitter's flow rate output range. Also, the difference between the upper and lower flow rate values.
Thermowell	The flow element part that protects the heater and RTDs from the process fluid.
Turndown	The ratio of minimum flow rate to maximum flow rate.
Zero	An adjustment that sets the flow transmitter's output at zero flow.

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APPENDIX C HMI MENU OUTLINE (v1.09)

C01382-1-1

Initial Service Menu Screen (Tap "MENU" Button on Front Panel)

C01393-1-1

Menu Screen Continued (Tap 'NEXT' on Initial Service Menu Screen)

Service (Basic Menus)
- Select Group
- Alarm Ack
- Diagnostics
- Set-up
- LoggerSDcard
- Device
- FE Control
- Reset Totalizer

Service (Expanded Menus)
- Select Group
  - (Password)[1]
  - 1. (group 1 name)
  - 2. (group 2 name)
  - 3. (group 3 name)
  - 4. (group 4 name)
  - 5. (group 5 name)
- Alarm Ack
  - (Alarms to acknowledge) or "(No Alarms)"
- Diagnostics
  - Show Faults
    - *(faults) or "(No Faults)"*
  - Self Test
    - *FE 1 IDR*
      - (Password)[1]
      - (Test in Progress countdown)
      - FE 1 IDR
      - 60: <measured value> exp: <expected value> "Pass" or "Fail"
      - 100: <measured value> exp: <expected value> "Pass" or "Fail"
      - 150: <measured value> exp: <expected value> "Pass" or "Fail"
    - *FE 2 IDR*
    - *FE 3 IDR*
    - *FE 4 IDR*
    - *FE 5 IDR*
    - *FE 6 IDR*
    - *FE 7 IDR*
    - *FE 8 IDR*
  - Raw Signal
    - *FE 1*
      - F1 Raw Signal
      - RefR (ohms): <measured value - real time update>
      - dR (ohms): <measured value - real time update>
      - TCdR (ohms): <measured value - real time update>
      - Temp (degF): < measured value - real time update>
      - Flow (SFPS): <measured value - real time update>
    - *FE 2*
    - *FE 3*
    - *FE 4*
    - *FE 5*
    - *FE 6*
    - *FE 7*
    - *FE 8*
  - CEMS Results
    - *Last Automatic CEMS*
      - Interference Check Results
      - Calibration Test Results
    - *Last Manual CEMS*
      - Interference Check Results
      - Calibration Test Results

[1] Password remains in effect for the entire time within the menu even for other items that also require password entry. Password expires on menu exit.

Set-up
- Instrument
  - *Group <Group number>*
  - *Flow: <current flow units>*
    - Flow Type
    - Velocity
      - Vel Flow
      - Std Feet
        - Per Second
        - Per Minute
        - Per Hour
        - Per Day
      - Std Meters
        - [time period options]
    - Volumetric
      - Vol Flow
      - Std Cu Feet
        - [time period options]
      - Nml Cu Meters
        - [time period options]
      - Nml Liters
        - [time period options]
    - Mass
      - Mass Flow
      - Pounds
        - [time period options]
      - Kilograms
        - [time period options]
      - Metric Tonnes
        - [time period options]
  - *Temp: <current temp units>*
    - (Password) [1]
    - Degrees C
    - Degrees F
  - *Pres: psi(a)*
  - *Name: <current group name>*
    - (Password) [1]
    - (Data entry alpha-numeric)
  - *Restore*
    - Restore
    - Group <group number>
    - to Factory
    - Settings ?
  - *Pipe: "Rect." or "Round"*
    - (Password) [1]
    - Pipe Type
    - Round
    - Rectangular
  - *(if Rect:)*
  - *Width: <width> "in" or "mm"*
    - (Password) [1]
    - (Data entry numeric)
  - *Height: <height> "in" or "mm"*
    - (Password) [1]
    - (Data entry numeric)
  - *(if Round:)*
  - *Diameter: <diameter> "in" or "mm"*
    - (Password) [1]
    - (Data entry numeric)
- Display
  - *Screen Calibration*
    - "Please touch each button in order"
  - *Flow History Time Period*
    - 30 Minutes
    - 30 Hours
    - 30 Days
- 4-20mA Channel Setup
  - *4-20mA Channel 1*
    - Flow Maximum: <flow max value> <flow units>
      - (Password) [1]
      - (Data entry numeric)
    - Flow Minimum: <flow min value> <flow units>
      - (Password)
      - (Data entry numeric)
  - *4-20mA Channel 2*
    - Process Data: <process data item>
      - (Password) [1]
      - Off
      - Temperature
      - Flow
    - Maximum: <maximum value>
      - (Password) [1]
      - (Data entry numeric)
    - Minimum: <minimum value>
      - (Password) [1]
      - (Data entry numeric)

LoggerSDcard
- Remove
  - *OK to Remove SD Card*
- Inserted
  - *SD Card Ready For Use*
  - *<free space>GB Avail*
  - *or*
  - *Error: SD Card Insert Failed*

Device
- Device
- Serial No:
- <serial number>
- Sales Ord No:
- <sales order number>
- SW Versions
- CORE: <CORE S/W version number>
- HMI: <HMI S/W version number>

FE Control
- FE 1: "ONLINE" or "offline"
  - *(Password)* [1]
  - *FE1 Control*
  - *Online*
  - *Offline*
- FE 2: "ONLINE" or "offline"
- FE 3: "ONLINE" or "offline"
- FE 4: "ONLINE" or "offline"
- FE 5: "ONLINE" or "offline"
- FE 6: "ONLINE" or "offline"
- FE 7: "ONLINE" or "offline"
- FE 8: "ONLINE" or "offline"

Reset Totalizer
- (Password) [1]
- Reset Totalizer

[1] Password remains in effect for the entire time within the menu even for other items that also require password entry. Password expires on menu exit.

APPENDIX D APPROVAL INFORMATION

Specific Conditions of Use

1. A portion of the enclosure is non-conducting and, under certain extreme conditions, may generate an ignition-capable level of electrostatic charges. The user shall ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment should be done only with a damp cloth.
2. The installer shall consider the relationship between the temperature code, ambient temperature and process temperature and ensure that the maximum service temperature is not exceeded.

Safety Instructions for the use of the MT100 flow meter in Hazardous Areas

The MT100 Series consists of 2 basic models, the MT100S and MT100M. Both model types use a common remote MT100 electronics housed in a stainless steel NEMA Type 4X, IP66 enclosure.

The MT100S model consists of a series of single sensing elements, each using Ex d flameproof enclosures.

The MT100M model consists of a series of sensing elements in a single probe assembly, using a stainless steel NEMA Type 4X, IP66 enclosure.

Relation between ambient temperature, process temperature and temperature class is as follows:

T-code, Gas	T-code, Dust	Ambient Temperature	Process Temperature
T6	T85°C	-40°C to +46°C	-40°C to +19°C
T5	T100°C	-40°C to +57°C	-40°C to +34°C
T4	T135°C	-40°C to +65°C	-40°C to +65°C
T3	T200°C	-40°C to +65°C	-40°C to +115°C
T2	T300°C	-40°C to +65°C	-40°C to +177°C
T1	T450°C	-40°C to +65°C	-40°C to +365°C

Electrical data: Power supply: 85 to 265 VAC, 50/60 Hz, 51 W max; 24 VDC, 26 W max.

Dansk	Sikkerhedsforskrifter	Italiano	Normative di sicurezza
Deutsch	Sicherheitshinweise	Nederlands	Veiligheidsinstructies
English	Safety instructions	Português	Normas de segurança
Ελληνική	Υποδείξεις ασφαλείας	Español	Instrucciones de seguridad
Suomi	Turvallisuusohjeet	Svenska	Säkerhetsanvisningar
Français	Consignes de sécurité		

DK Dansk – Sikkerhedsforskrifter

Disse sikkerhedsforskrifter gælder for Fluid Components, MT100 EF-typeafprøvningsattest-nr. FM17ATEX0001X/FM21UKEX0023X/IECEx FMG 17.0001X (attestens nummer på typeskiltet) er egnet til at blive benyttet i eksplosiv atmosfære kategori II 3 GD.
1) Ex-anlæg skal principielt opstilles af specialiseret personale.
2) MT100 skal jordforbindes.
3) Klemmer for MT100S modeller er monteret i et hus, som er beskyttet af en brandsikre kabinet med følgende noter:
• Gevindspalten mellem huset og låget er på en sådan måde, at ild ikke kan brede sig inden i det.
• Ex-„d“ tilslutningshuset er forsynet med et 1/2" NPT eller M20x1.5 gevind for montering af en Ex-„d“ kabelindføring, der er attesteret iht. IEC/EN 60079-1
• Det er vigtigt at sørge for, at forsyningsledningen er uden spænding eller eksplosiv atmosfære ikke er til stede, før låget åbnes og når låget er åbent på „d” huset (f.eks. ved tilslutning eller servicearbejde).
• Låget på „d” huset skal være skruet helt ind, når apparatet er i brug. Det skal sikres ved at dreje en af låseskruerne på låget ud.

DA Deutsch – Sicherheitshinweise

Diese Sicherheitshinweise gelten für die Fluid Components, MT100 flow meter gemäß der EG-Baumusterprüfbescheinigung Nr. FM17ATEX0001X/FM21UKEX0023X/IECEx FMG 17.0001X (Bescheinigungsnummer auf dem Typschild) der Kategorie II 3 GD.
1) Die Errichtung von Ex-Anlagen muss grundsätzlich durch Fachpersonal vorgenommen werden.
2) Der MT100 muß geerdet werden.
3) Die Klemmen für die Modelle MT100S werden in einem Gehäuse mit dem druckfesten Gehäuse ('d') installiert.
• Der Gewindespalt zwischen dem Gehäuse und dem Deckel ist ein zünddurchschlagsicherer Spalt.
• Das Ex-“d“ Anschlussgehäuse besitzt ein 1/2“ NPT oder M20x1.5 Gewinde für den Einbau einer nach IEC/EN 60079-1 bescheinigten Ex-“d“ Kabeleinführung.
• Es ist sicherzustellen, dass vor dem Öffnen und bei geöffnetem Deckel des „d“ Gehäuses (z.B. bei Anschluss oder Service- Arbeiten) entweder die Versorgungsleitung spannungsfrei oder keine explosionsfähige Atmosphäre vorhanden ist.
• Der Deckel des „d“ Gehäuses muss im Betrieb bis zum Anschlag hineingedreht sein. Er ist durch eine der Deckelarretierungsschrauben zu sichern.

GB IRL English – Safety instructions

These safety instructions are valid for the Fluid Components, MT100 flow meter to the EC type approval certificate no FM17ATEX0001X/FM21UKEX0023X/IECEx FMG 17.0001X (certificate number on the type label) for use in potentially explosive atmospheres in Category II 3 GD.
1) The installation of Ex-instruments must be made by trained personnel.
2) The MT100 must be grounded.
3) The terminals for MT100S models are installed in a flame proof and pressure-tight housing with following notes:
• The gap between the housing and cover is an ignition-proof gap.
• The Ex-“d“ housing connection has a 1/2” NPT or M20x1.5 cable entry for mounting an Ex-d cable entry certified acc. to IEC/EN 60079-1.
• Make sure that before opening the cover of the Ex”d“ housing, the power supply is disconnected or there is no explosive atmosphere present (e.g. during connection or service work).
• During normal operation: The cover of the “d“ housing must be screwed in completely and locked by tightening one of the cover locking screws.

GR Ελληνική – Υποδείξεις ασφαλείας

Αυτές οι οδηγίες ασφαλείας ισχύουν για τα Ροόμετρα της Fluid Components τύπου MT100 που φέρουν Πιστοποιητικό Εγκρίσεως Ευρωπαϊκής Ένωσης, με αριθμό πιστοποίησης FM17ATEX0001X/FM21UKEX0023X/IECEx FMG 17.0001X (ο αριθμός πιστοποίησης βρίσκεται πάνω στην ετικέτα τύπου του οργάνου) για χρήση σε εκρηκτικές ατμόσφαιρες της κατηγορίας II 3 GD.
1) Η εγκατάσταση των οργάνων με αντιεκρηκτική προστασία πρέπει να γίνει από εξειδικευμένο προσωπικό.
2) Το όργανο τύπου MT100S πρέπει να είναι γειωμένο.
3) Οι ηλεκτρικοί ακροδέκτες σύνδεσης (τερματικά) για MT100S μοντέλα εγκατασταθεί σε έκρηξη-απόδειξη και αεροστεγές περίβλημα, σύμφωνα με τις ακόλουθες παρατηρήσεις:
• Το κενό ανάμεσα στο περίβλημα και στο κάλυμμα είναι τέτοιο που αποτρέπει την διάδοση σπινθήρα.
• Το “Ex-d” αντιεκρηκτικό περίβλημα, έχει ανοίγματα εισόδου καλωδίου με διάμετρο ½” NPT ή M20x1.5, κατάλληλα για τοποθέτηση υποδοχής αντιεκρηκτικού καλωδίου πιστοποιημένης κατά IEC/EN 60079-1
• Βεβαιωθείτε ότι πριν το άνοιγμα καλύμματος του του “Ex-d” αντιεκρηκτικού περιβλήματος, η τάση τροφοδοσίας είναι αποσυνδεδεμένη ή ότι δεν υφίσταται στη περιοχή εκρηκτική ατμόσφαιρα (π.χ. κατά τη διάρκεια της σύνδεσης ή εργασιών συντήρησης)
• Κατά τη διάρκεια ομαλής λειτουργίας: Το κάλυμα του “d” καλύμματος αντιεκρηκτικού περιβλήματος πρέπει να είναι εντελώς βιδωμένο και ασφαλισμένο, σφίγγοντας μία από τις βίδες ασφαλείας του περιβλήματος.

FIN Suomi – Turvallisuusohjeet

Nämä turvallisuusohjeet koskevat Fluid Components, MT100 EY-tyyppitarkastustodistuksen nro. FM17ATEX0001X/FM21UKEX0023X/IECEx FMG 17.0001X (todistuksen numero näkyy tyyppikilvestä) käytettäessä räjähdysvaarallisissa tiloissa luokassa II 3 GD.
1) Ex-laitteet on aina asennettava ammattihenkilökunnan toimesta.
2) MT100 on maadoitettava.
3) Tarvittava syöttöjännite liitäntä liittimien varten MT100S asennetaan kotelossa, jonka rakenne kestää räjähdyksen paineen seuraavin lisäyksin:
• Kotelon ja kannen välissä on räjähdyksen purkausväli.
• Ex-d liitäntäkotelossa on 1/2“ NPT tai M20x1.5 kierre IEC/EN 60079-1 mukaisen Ex-d kaapeliläpiviennin asennusta varten
• Kun “d“-kotelon kansi avataan (esim. liitännän tai huollon yhteydessä), on varmistettava, että joko syöttöjohto on jännitteetön tai ympäristössä ei ole räjähtäviä aineita.
• “d“ -kotelon kansi on kierrettävä aivan kiinni käytön yhteydessä ja on varmistettava kiertämällä yksi kannen lukitusruuveista kiinni.

F B L Français – Consignes de sécurité

Ces consignes de sécurité sont valables pour le modèle MT100 de la société Fluid Components (FCI) conforme au certificat d’épreuves de type FM17ATEX0001X/FM21UKEX0023X/IECEx FMG 17.0001X (numéro du certificat sur l’étiquette signalétique) conçu pour les applications dans lesquelles un matériel de la catégorie II 3 GD est nécessaire.
1) Seul un personnel spécialisé et qualifié est autorisé à installer le matériel Ex.
2) Les MT100 doivent être reliés à la terre.
3) Les bornes pour la connexion de la tension d'alimentation des modèles MT100S sont logées dans un boîtier antidéflagrant avec les notes suivantes:
• Le volume entre le boîtier et le couvercle est protégé en cas d’amorçage.
• Le boîtier de raccordement Ex-d dispose d’un filetage1/2’’ NPT ou M20x1.5 pour le montage d’un presse-étoupe Ex-d certifié selon la IEC/EN 60079-1.
• Avant d’ouvrir le couvercle du boîtier « d » et pendant toute la durée où il le restera (pour des travaux de raccordement, d’entretien ou de dépannage par exemple), il faut veiller à ce que la ligne d’alimentation soit hors tension ou à ce qu’il n’y ait pas d’atmosphère explosive.
• Pendant le fonctionnement de l’appareil, le couvercle du boîtier « d » doit être vissé et serré jusqu’en butée. La bonne fixation du couvercle doit être assurée en serrant une des vis d’arrêt du couvercle.

I Italiano – Normative di sicurezza

Queste normative di sicurezza si riferiscono ai Fluid Components, MT100 secondo il certificato CE di prova di omologazione n° FM17ATEX0001X/FM21UKEX0023X/IECEx FMG 17.0001X (numero del certificato sulla targhetta d’identificazione) sono idonei all’impiego in atmosfere esplosive applicazioni che richiedono apparecchiature elettriche della Categoria II 3 GD.
1) L’installazione di sistemi Ex deve essere eseguita esclusivamente da personale specializzato.
2) I MT100 devono essere collegati a terra.
3) I terminali per il collegamento per MT100S modelli sono costruiti in una custodia a prova di esplosione ('D'), con le seguenti note:
• La sicurezza si ottiene grazie ai cosidetti „interstizi sperimentali massimi“, attraverso i quali una eventuale accensione all’interno della custodia non può propagarsi all’esterno oraggiungere altre parti dell’impianto.
• La scatola di collegamento Ex-d ha una filettatura 1/2“ NPT o M20x1.5 per il montaggio di un passacavo omologato Ex-d secondo IEC/EN 60079-1.
• Prima di aprire il coperchio della custodia „d“ (per es. durante operazioni di collegamento o di manutenzione) accertarsi che l’apparecchio sia disinserito o che non si trovi in presenza di atmosfere esplosive.
• Avvitare il coperchio della custodia „d“ fino all’arresto. Per impedire lo svitamento del coperchio é possibile allentare una delle 2 viti esagonali poste sul corpo della custodia, incastrandola nella sagoma del coperchio.

NL B Nederlands – Veiligheidsinstructies

Deze veiligheidsinstructies gelden voor de Fluid Components, MT100 overeenkomstig de EG-typeverklaring nr. FM17ATEX0001X/FM21UKEX0023X/IECEx FMG 17.0001X (nummer van de verklaring op het typeplaatje) voor gebruik in een explosieve atmosfeer volgens Categorie II 3 GD.
1) Installatie van Ex-instrumenten dient altijd te geschieden door geschoold personeel.
2) De MT100 moet geaard worden.
3) De klemmen voor MT100S modellen zijn ingebouwd in een drukvaste behuizing met de volgende opmerkingen:
• De schroefdraadspleet tussen de behuizing en de deksel is een ontstekingsdoorslagveilige spleet.
• De Ex-d aansluitbehuizing heeft een 1/2” NPT of een M20x1.5 schroefdraad voor aansluiting van een volgens IEC/EN 60079-1 goedgekeurde Ex- ‘d’ kabelinvoer.
• Er moet worden veilig gesteld dat vóór het openen bij een geopende deksel van de ‘d’ behuizing (bijv. bij aansluit- of servicewerkzaamheden) hetzij de voedingsleiding spanningsvrij is, hetzij geen explosieve atmosfeer aanwezig is.
• De deksel van de ‘d’ behuizing moet tijdens bedrijf tot aan de aanslag erin geschroefd zijn. Hij moet door het eruit draaien van een van de dekselborgschroeven worden geborgd.

Ⓟ Português – Normas de segurança

Estas normas de segurança são válidas para os Fluid Components, MT100 conforme o certificado de teste de modelo N.º FM17ATEX0001X/FM21UKEX0023X/IECEx FMG 17.0001X (número do certificado na plaqueta com os dados do equipamento) são apropriados para utilização em atmosferas explosivas categoria II 3 GD.

1) A instalação de equipamentos em zonas sujeitas a explosão deve, por princípio, ser executada por técnicos qualificados.
2) Os MT100 Flexmasster precisam ser ligados à terra.
3) Os terminais dos modelos MT100S para a ligação da tensão de alimentação são instalados num invólucro com prova de sobrepressão à prova de ignição com as seguintes notas:

• A fenda entre o envólucro e a tampa deve ser á prova de passagem de centelha.
• O envólucro de conexão Ex-“d“ possui uma rosca 1/2“ NPT ou M20x1.5 para a entrada de cabos Ex-“d“ certificado conforme a norma IEC/EN60079-1.
• Deve-se assegurar que, antes de abrir a tampa do armário „d“ (por exemplo, ao efectuar a conexão ou durante trabalhos de manutenção), o cabo de alimentação esteja sem tensão ou que a atmosfera não seja explosíva.
• Durante a operação, a tampa do envólucro „d“ deve estar aparafusada até o encosto. A tampa deve ser bloqueada, por um dos parafusos de fixação.

Ⓔ Español – Instrucciones de seguridad

Estas indicaciones de seguridad son de aplicación para el modelo MT100 de Fluid Components, según la certificación CE de modelo Nº FM17ATEX0001X/FM21UKEX0023X/IECEx FMG 17.0001X para aplicaciones en atmósferas potencialmente explosivas según la categoría II 3 GD (el número decertificación se indica sobre la placa informativa del equipo).

1) La instalación de equipos Ex tiene que ser realizada por personal especializado.
2) Los MT100 tienen que ser conectados a tierra.
3) Los bornes de conexión para los modelos MT100S están montados dentro de una caja con protección antideflagrante y resistente a la presión, considerándose los siguientes puntos:

• La holgura entre la rosca de la tapa y la propia de la caja está diseñada a prueba contra ignición.
• La caja tiene conexiones eléctricas para entrada de cables con rosca 1/2” NPT o M20x1.5, donde deberán conectarse prensaestopas certificados Exd según IEC/EN 60079-1.
• Antes de la apertura de la tapa de la caja "Exd“ (p. ej. durante los trabajos de conexionado o de puesta en marcha) hay que asegurar que el equipo se halle sin tensión o que no exista presencia de atmósfera explosiva.
• Durante el funcionamiento normal: la tapa de la caja antideflagrante tiene que estar cerrada, roscada hasta el tope, debiendose asegurar apretando los tornillos de bloqueo.

Ⓢ Svenska – Säkerhetsanvisningar

Säkerhetsanvisningarna gäller för Fluid Components, Flödesmätare typ MT100 enligt EG-typkontrollintyg nr FM17ATEX0001X/FM21UKEX0023X/IECEx FMG 17.0001X (intygsnumret återfinns på typskylten) är lämpad för användning i explosiv gasblandning i kategori II 3 GD.

1) Installation av Ex- klassade instrument måste alltid utföras av fackpersonal.
2) MT100 måste jordas.
3) Terminalerna för MT100S modeller är integrerade i en explosion och trycktätt hölje med följande kommentar:

• Spalten mellan kapslingen och lockets gänga är flamsäker.
• Ex-d kapslingen har en 1/2“ NPT eller M20x1.5 gänga för montering av en IEC/EN 60079-1 typkontrollerad Ex- „d“ kabel förskruvning.
• När Ex- „d“-kapslingens lock är öppet (t.ex. vid inkoppling - eller servicearbeten) ska man se till att enheten är spänningslös eller att ingen explosiv gasblandning förekommer.
• Under drift måste Ex - d“-kapslingens lock vara iskruvad till anslaget. För att säkra locket skruvar man i en av lockets insex låsskruvar.

Type Approval Test According to Standard EN 15267-3 (QAL-1)

The MT100 measuring system has been tested in accordance to standard EN 15267-3 by TÜV Rheinland Energy GmbH. This section contains details of the MT100 measuring system which has been used for the EN 15267-3 type approval testing, which mechanical design (U-length, process connection, temperature version) has been configured based on the field test location. The MT100S has been verified and tested by TÜV Rheinland Energy GmbH and the MT100M is also covered by the TÜV type approval test.

Model: MT100S – Single point insertion element / MT100M – Multipoint element with flow and temperature process output

Number of measuring points: 1 (one) up to 8 (eight) – 2 (two) measuring points used during the TÜV type approval test.

Probe length (U-length): 2.6 to 199 inches [66,0 to 5054,6mm] - 21 inches [533,4 mm] used during the TÜV type approval test

Process connection: Flanged low pressure retractable packing glands 50 psig [3,5 bar(g)]

Temperature version: Medium temperature; Operating temperature: -40 °F to 500 °F [-40 °C to 260 °C] – Used during the TÜV type approval test.

Temperature version: High temperature; Operating temperature: -40 °F to 850 °F [-40 °C to 454 °C] – Covered by TÜV type approval test

Certification velocity flow range: 0 to 98.4 ft/s [0 to 30 m/s]

APPENDIX E CUSTOMER SERVICE

Customer Service/Technical Support

FCI provides full in-house technical support. Additional technical representation is also provided by FCI field representatives. Before contacting a field or in-house representative perform the troubleshooting techniques outlined in this document.

By Mail

Fluid Components International LLC
1755 La Costa Meadows Dr.
San Marcos, CA 92078-5115 USA
Attn: Customer Service Department

By Phone

Contact the area FCI regional representative. If a field representative is unable to be contacted or if a situation is unable to be resolved, contact the FCI Customer Service Department toll free at 1 (800) 854-1993.

By Fax

To describe problems in a graphical or pictorial manner, send a fax including a phone or fax number to the regional representative. FCI is available by facsimile if all possibilities have been exhausted with the authorized factory representative. Our fax number is 1 (760) 736-6250; it is available 7 days a week, 24 hours a day.

By Email

FCI Customer Service can be contacted by email at: techsupport@fluidcomponents.com.

Describe the problem in detail making sure a telephone number and best time to be contacted is stated in the email.

International Support

For product information or product support outside the contiguous United States, Alaska, or Hawaii, contact your country's FCI International Representative or the one nearest to you.

After Hours Support

For product information visit FCI at www.fluidcomponents.com. For product support call 1 (800) 854-1993 and follow the prerecorded instructions.

Point of Contact

The point of contact for service, or return of equipment to FCI is your authorized FCI sales/service office. To locate the office nearest you, visit the FCI website at www.fluidcomponents.com.

Warranty Repairs or Returns

FCI prepays ground transportation charges for return of freight to the customer's door. FCI reserves the right to return equipment by the carrier of our choice.

International freight, handling charges, duty/entry fees for return of equipment are paid by the customer.

Non-Warranty Repairs or Returns

FCI returns repaired equipment to the customer either collect or prepaid and adds freight charges to the customer invoice.

Extended Warranty

An extended warranty is available. Contact the factory for details.

Return to Stock Equipment

The customer is responsible for all shipping and freight charges for equipment that is returned to FCI stock from the customer site. These items will not be credited to the customer's account until all freight charges are cleared, along with applicable return to stock charges, from the credit invoice. (Exceptions are made for duplicate shipments made by FCI.)

If any repair or return equipment is received at FCI, freight collect, without prior factory consent, FCI bills the sender for these charges.

Field Service Procedures

Contact an FCI field representative to request field service.

A field service technician is dispatched to the site from either the FCI factory or one of the FCI representative offices. After the work is complete, the technician completes a preliminary field service report at the customer site and leaves a copy with the customer.

Following the service call, the technician completes a formal, detailed service report. The formal report is mailed to the customer after the technician's return to the factory or office.

Field Service Rates

All field service calls are billed at the prevailing rates as listed in the FCI Price Book unless previous arrangements have been made with the FCI Customer Service Manager.

Customers are charged for all travel expenses including airfare, auto rental, meals and lodging. In addition, the customer shall pay all costs of transporting parts, tools or goods to and from the job site. Invoicing travel time, field service work and other expenses will be performed by FCI's Accounting Department.

FLUID COMPONENTS INTERNATIONAL LLC
1755 La Costa Meadows Drive, San Marcos, CA 92078-5115 USA
760-744-6950 / 800-854-1993 / Fax: 760-738-6250
Web Site: www.fluidcomponents.com
E-mail: techsupport@fluidcomponents.com

RA #_____

Return Authorization Request

1. **Return Customer Information**

Returning Company's Name: _____ Phone# _____

Return Contact Name: _____ Fax # _____

Email Address: _____

2. **Return Address**

Bill To: _____ Ship To: _____

_____ _____

_____ _____

_____ _____

3. **Mandatory End User Information**

Contact: _____ Company: _____ Country: _____

4. **Return Product Information**

Model No: _____ Serial No(s): _____

Failure Symptoms *(Detailed Description Required)*: _____

_____

What Trouble Shooting Was Done Via Phone or Field Visit by FCI: _____

_____

FCI Factory Technical Service Contact: _____

5. **Reason For Return** ❑ Sensor Element ❑ Electronics ❑ As Found Testing ❑ Credit
❑ Recalibrate (New Data) ❑ Recalibrate (Most Recent Data) ❑ Other

(Note: A new Application Data Sheet (ADS) must be submitted for all recalibrations and re-certifications)

6. **Payment Via** ❑ Faxed Purchase Order ❑ VISA ❑ MasterCard

(Note: A priced quotation is provided for all Non-Warranty repairs after equipment has been evaluated. All Non-Warranty repairs are subject to a minimum evaluation charge of $250.00)

Factory Return Shipping Address:

Fluid Components International LLC
1755 La Costa Meadows Drive
San Marcos, CA 92078-5115
Attn: Repair Department
RA #_____

FCI Document No. 05CS000004D [U]

FCI FLUID COMPONENTS INTERNATIONAL LLC

The following Return Authorization Request form and Decontamination Statement ***MUST be completed, signed and faxed back to FCI before*** a Return Authorization Number will be issued. The signed Decontamination Statement and applicable MSDS Sheets **must be included with the shipment**. FCI will either fax, email or telephone you with the Return Authorization Number upon receipt of the signed forms.

Packing Procedures

1. **Electronics** should be wrapped in an **anti-static** or **static-resistant** bag, then wrapped in protective bubble wrap and surrounded with appropriate dunnage* in a box. Instruments weighing **more than 50 lbs., or extending more than four feet**, should be secured in wooden crates by bolting the assemblies in place.
2. **The sensor head must be protected** with pvc tubing, or retracted the full length of the probe, locked and secured into the Packing Gland Assembly (cap screws tightened down).
3. FCI can supply crates for a nominal fee.
4. No more than **four (4)** small units packaged in each carton.
5. **FCI will not be held liable for damage caused during shipping.**
6. To ensure immediate processing **mark** the RA number on the outside of the box. Items without an RA number marked on the box or crate may be delayed.
7. Freight **must be "PrePaid"** to FCI receiving door.

* Approriate dunnage as defined by UPS, will protect package contents from a drop of 3 feet.

*** Decontamination Statement *** This Section Must Be Completed ***

Exposure to hazardous materials is regulated by Federal, State, County and City laws and regulations. These laws provide FCI's employees with the "Right to Know" the hazardous or toxic materials or substances in which they may come in contact while handling returned products. Consequently, FCI's employees must have access to data regarding the hazardous or toxic materials or substances the equipment has been exposed to while in a customer's possession. Prior to returning the instrument for evaluation/repair, FCI requires thorough compliance with these instructions. The signer of the Certificate must be either a knowledgeable Engineer, Safety Manager, Industrial Hygenist or of similar knowledge or training and responsible for the safe handling of the material to which the unit has been exposed. **Returns without a legitimate Certification of Decontamination, and/or MSDS when required, are unacceptable and shall be returned at the customer's expense and risk.** Properly executed Certifications of Decontamination must be provided before a repair authorization (RA) number will be issued.

Certification Of Decontamination

I certify that the returned item(s) has(have) been thoroughly and completely cleaned. If the returned item(s) has(have) been exposed to hazardous or toxic materials or substances, even though it (they) has (have) been thoroughly cleaned and decontaminated, the undersigned attests that the attached Material Data Safety Sheet(s) (MSDS) covers said materials or substances completely. Furthermore, I understand that this Certificate, and providing the MSDS, shall not waive our responsibility to provide a neutralized, decontaminated, and clean product for evaluation/repair at FCI. Cleanliness of a returned item or acceptability of the MSDS shall be at the sole discretion of FCI. **Any item returned which does not comply with this certification shall be returned to your location Freight Collect and at your risk.**

This certification must be signed by knowledgeable personnel responsible for maintaining or managing the safety program at your facility.

Process Flow Media _____

Product was or may have been exposed to the following substances: _____

Print Name _____

Authorized Signature _____ Date _____

Company Title _____

Visit FCI on the Worldwide Web: www.fluidcomponents.com
1755 La Costa Meadows Drive, San Marcos, California 92078-5115 USA ‡ Phone: 760-744-6950 ‡ 800-854-1993 ‡ Fax: 760-736-6250

FCI Document No. 05CS000004D [U]

WARRANTIES

Goods furnished by the Seller are to be within the limits and of the sizes published by the Seller and subject to the Seller's standard tolerances for variations. All items made by the Seller are inspected before shipment, and should any of said items prove defective due to faults in manufacture or performance under Seller approved applications, or fail to meet the written specifications accepted by the Seller, they will be replaced or repaired by Seller at no charge to Buyer provided return or notice of rejection of such material is made within a reasonable period but in no event longer than one (1) year from date of shipment to Buyer, and provided further, that an examination by Seller discloses to Seller's reasonable satisfaction that the defect is covered by this warranty and that the Buyer has not returned the equipment in a damaged condition due to Buyer's or Buyer's employees', agents', or representatives' negligence and Buyer has not tampered, modified, redesigned, misapplied, abused, or misused the goods as to cause the goods to fail. In addition, this warranty shall not cover damage caused by Buyer's exposure of the goods to corrosive or abrasive environments. Moreover, Seller shall in no event be responsible for (1) the cost or repair of any work done by Buyer on material furnished hereunder (unless specifically authorized in writing in each instance by Seller), (2) the cost or repair of any modifications added by a Distributor or a third party, (3) any consequential or incidental damages, losses, or expenses in connection with or by reason of the use of or inability to use goods purchased for any purpose, and Seller's liability shall be specifically limited to free replacement, or refund of the purchase price, at Seller's option, provided return or rejection of the goods is made consistent with this paragraph, and the Seller shall in no event be liable for transportation, installation, adjustment, loss of good will or profits, or other expenses which may arise in connection with such returned goods, or (4) the design of products or their suitability for the purpose for which they are intended or used. Should the Buyer receive defective goods as defined by this paragraph, the Buyer shall notify the Seller immediately, stating full particulars in support of his claim, and should the Seller agree to a return of the goods, the Buyer shall follow Seller's packaging and transportation directions explicitly. In no case are the goods to be returned without first obtaining a return authorization from the Seller. Any repair or replacement shall be at Seller's factory, unless otherwise directed, and shall be returned to Seller transportation prepaid by Buyer. If the returned goods shall prove defective under this clause they will be replaced or repaired by Seller at no charge to Buyer provided the return or rejection of such material is made within a reasonable period, but in no event longer than (1) year from the date of shipment of the returned goods or the unexpired terms of the original warranty period whichever is later. If the goods prove to be defective under this paragraph, the Buyer shall remove the goods immediately from the process and prepare the goods for shipment to Seller. Continued use or operation of defective goods is not warranted by Seller and damage occurring due to continued use or operation shall be for Buyer's account. Any description of the goods contained in this offer is for the sole purpose of identifying them, and any such description is not part of the basis of the bargain, and does not constitute a warranty that the goods will conform to that description. The use of any sample or model in connection with this offer is for illustrative purposes only, is not part of the basis of the bargain, and is not to be construed as a warranty that the goods will conform to the sample or model. No affirmation of that fact or promise made by the Seller, whether or not in this offer, will constitute a warranty that the goods will conform to the affirmation or promise. THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES WITH RESPECT TO THE GOODS OR THEIR INSTALLATION, USE, OPERATION, REPLACEMENT OR REPAIR, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS OF PURPOSE; AND THE GOODS ARE BEING PURCHASED BY BUYER "AS IS". SELLER WILL NOT BE LIABLE BY VIRTUE OF THIS WARRANTY OR OTHERWISE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL LOSS OR DAMAGE RESULTING FROM THE USE OR LOSS OF USE OF THE GOODS.

Flow & Level Instrumentation
Solutions for Industrial Processes

FCI's Complete Customer Commitment. Worldwide
ISO 9001 and AS9100 Certified

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