Installation

WARNING: Your warranty will be voided if your unit is not installed in accordance with this user's guide. Make sure you read and thoroughly understand the installation portion of this guide before you attempt to install your unit. If you have any questions, contact your Kurz customer service representative before attempting installation.

Mounting

The 454FTB insertion flow transmitter is generally mounted with a compression fitting into a duct or on a flange (See Figure A-1). See the product brochure (DCN 367521) for Kurz mounting accessories. It is important for the mounting design to consider the force that will be exerted on the probe support or flange when the process fluid is under pressure. The insertion depth depends on the duct size and sensor size. Duct or pipe reinforcement may be necessary depending on the probe mass and application vibration to prevent cracks and leaks at the sensor port.

Sensor Placement Criteria:

Our recommended placement criteria is generally to center mount the sensing element as the middle of the duct has the most stable flow profile, minimum thermal gradients when the process fluid is cooler or hotter than the ambient. When using the duct center, the peak velocity will be observed so the meter correction factors must be used

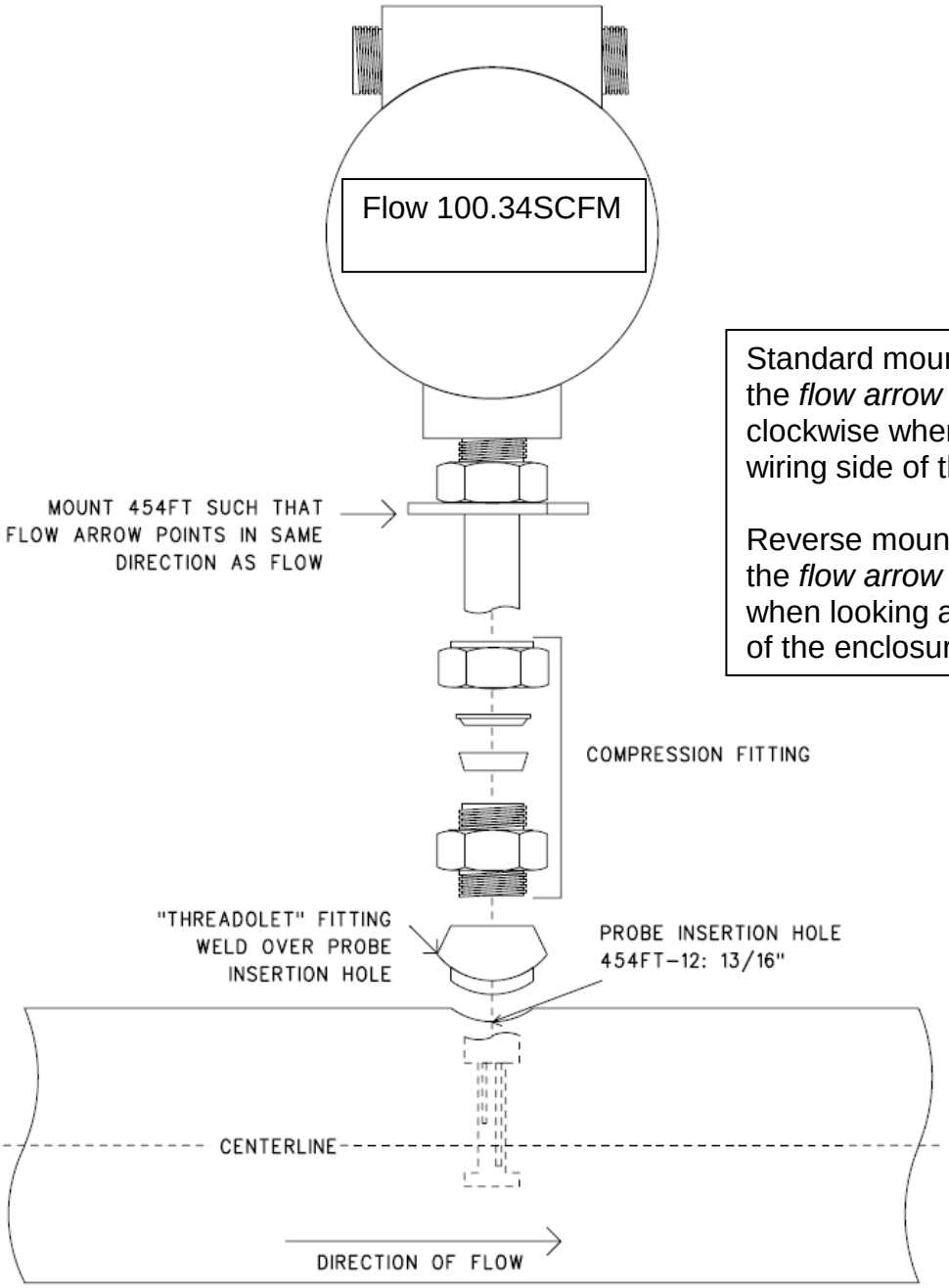
to reduce this observed peak velocity to the true duct average. Establishing the correction factors is discussed in the field calibration section of the manual.

Sensor placement, things to watch out for:

- If the process being monitored has moving valves or other flow profile disturbances the meter should be installed away from them to obtain the best performance. About 30 duct diameters are needed to have the profile within about 1% of a long run velocity profile based on a single sensor velocity measurement. Less length is needed for multi-point arrays like the K-BAR.

- When the dew point is close to your operation temperature, and/or you have a saturated gas in un-insulated ducting and condensation occurs on the walls, do not mount the sensor pointing in a downward angle. Pointing the sensor up or horizontally will prevent condensation from reaching the sensor element and causing false high flow readings as the heated element evaporates the condensate.

- Locating a sensor at the inlet of a fan which is pulling ambient air can result in extra sensor cleaning schedules to remove dirt build up. The fan inlet will tend to be below atmospheric pressure and when the humidity is near 100% there will be condensation and mist formed at these locations. The condensate will allow dirt to stick to the sensor more than in the absence of condensate. Moisture vapor (humidity less than 100%) which is dissolved in the air simply contributes to the total mass flow measured by the sensor. A discussion of the wet vs. dry flow in Air and converting between them are in the Kurz technical report 364018.



Standard mounted heads have the *flow arrow* direction clockwise when looking at the wiring side of the enclosure.

Reverse mounted heads have the *flow arrow* counterclockwise when looking at the wiring side of the enclosure.

Figure A-1 Model 454FT installation with compression fitting.

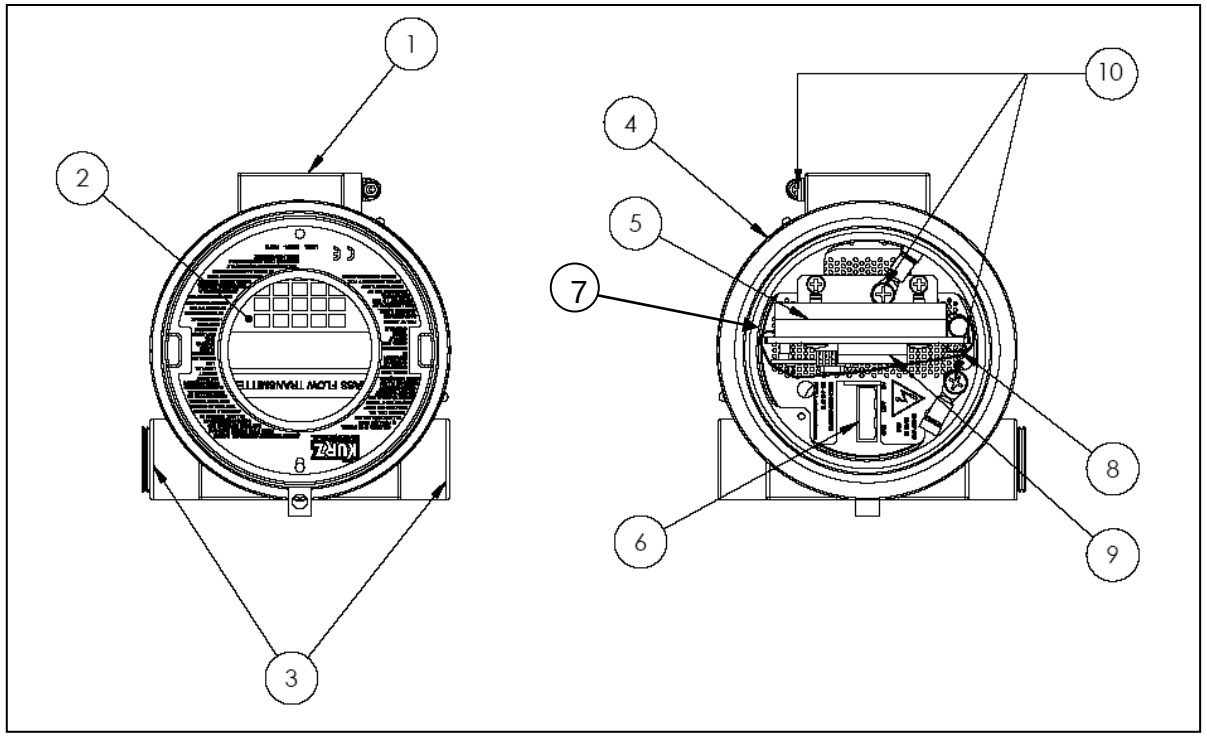


Figure A-2. Location of major components

1. ¾" FNPT Sensor support port (TA or Transmitter Attached version)
   Conduit or cable port (TS or Transmitter Separate version)
2. Backlit 2x16 LCD and 20 key button interface
3. ¾" FNPT signal and power conduit ports.
4. Safety Label and Product ID tag.
5. Main I/O wiring terminal block for sensor, power, RS-485 and 4-20 mA outputs, TB1
6. AC power input. 85 to 265 VAC 50/60 Hz. 1 phase.
7. Power indicator: Green LED, right side of TB1
8. USB mini-B connector
9. Optional hardware, AI, DO, DI, Purge valve, I/O connector TB6
10. External and internal ground lug locations. Shielded wire pig-tail termination location.

Electronics Head Orientation

The electronics head is provided in two standard orientations compared to the sensor flow arrow or flow direction. When looking at the display and the flow or *flow arrow* is to the right, this is the normal configuration (see figure A-1) and flowing to the left is reverse. This option is selected in the model part number when the unit is ordered.

> *Rotating the head in the field can damage the sensor wires and result in a loose connection which results in water leakage or other warranty and hazardous area safety violations.*

TS Version

For transmitter separate versions (TS) there are two enclosure groups. The sensor enclosure mounts as described above and contains just a sensor wire terminal board.

Sensor Wires

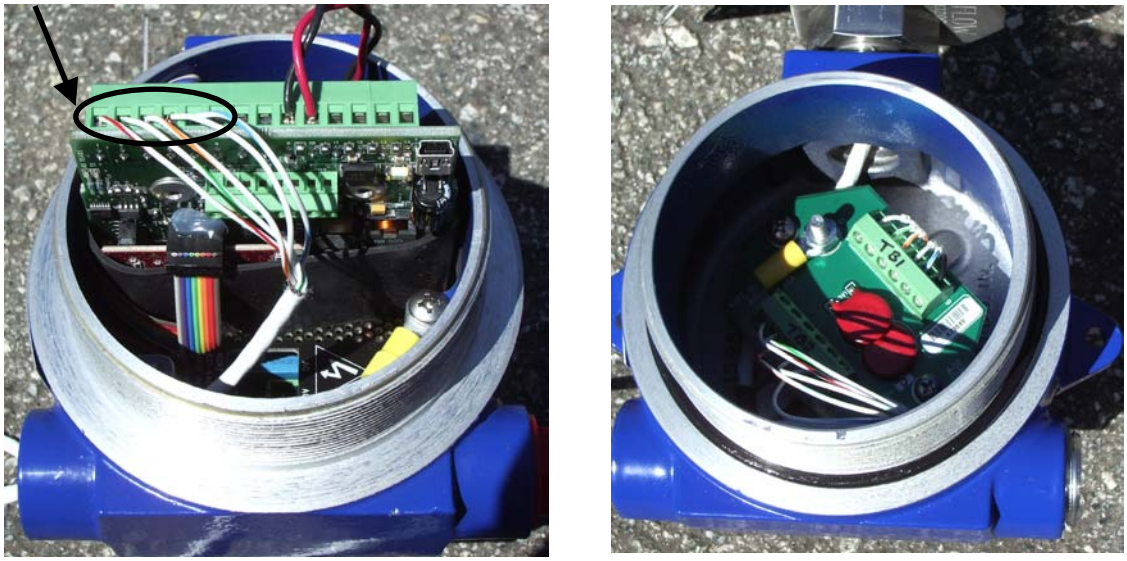


Figure A-3. Sensor electronics enclosure and sensor J-box with covers removed. Note *flow arrow* is clockwise to the sensor wiring side of the enclosure (standard orientation).

The electronics enclosure contains the sensor control board, optional AC power supply and LCD/keypad and is mounted via the pipe nipple as shown in Figure A-4. Two U

clamps around the pipe nipple to a metal mounting adaptor (Optional Kurz part # 700494-) frame or pipe stand are sufficient. It is important to note that the serial number on the sensor enclosure must match the serial number on the electronics enclosure. These two parts are not interchangeable with another TS flow meter.

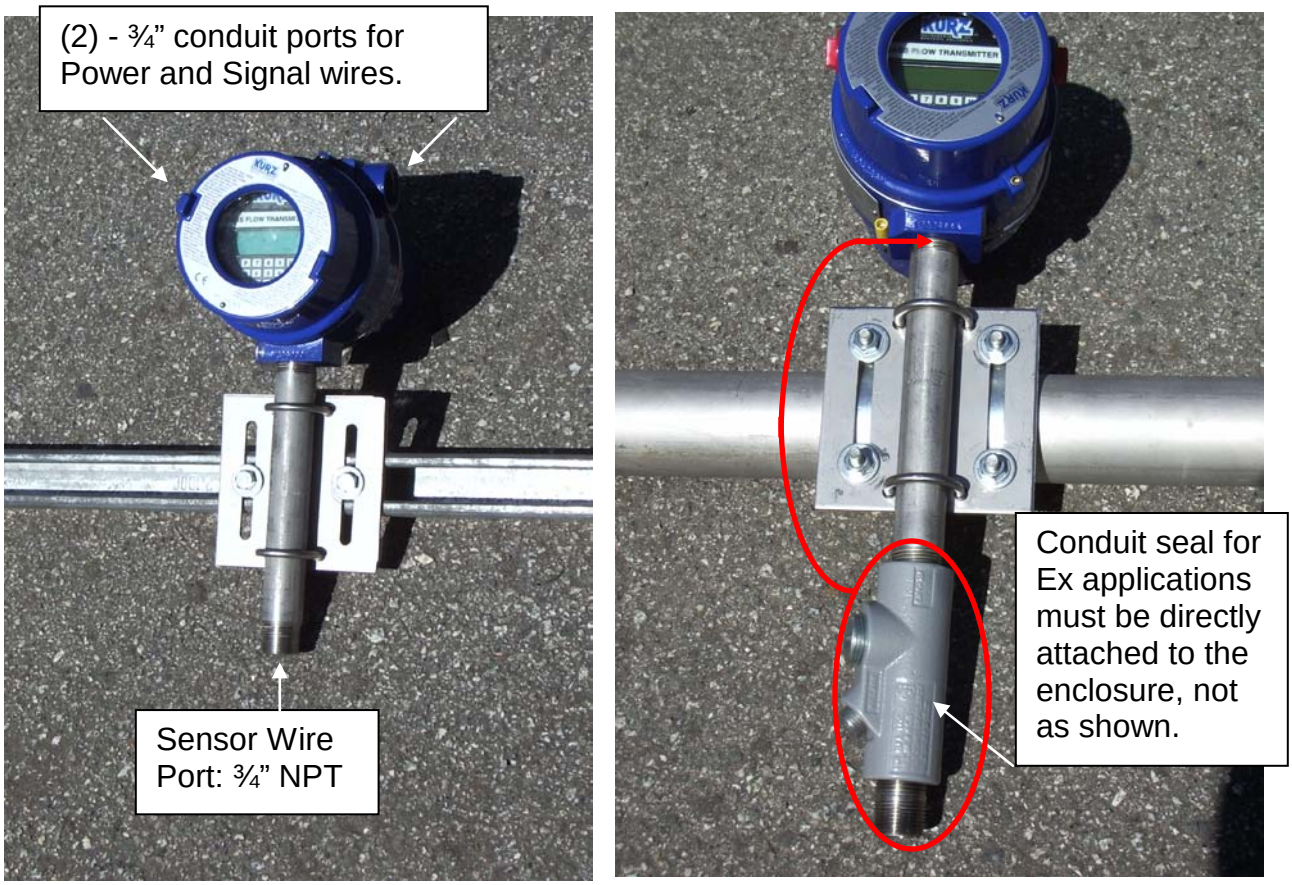


Figure A-4. Examples of Unistrut and Pipe mounting of the TS configured electronics using the optional mounting kit, 700494-.

Field Wiring

Proper wiring installation of the MFT B-Series flow transmitters should address some or all of the following issues:

- Safety Grounding and Explosion-Proof enclosure connections.
- Water ingress protection

- DC or AC power requirements and connection.
- Analog Output configuration and wiring of the 4-20 mA signals.
- Discrete Alarms
- Purge sensor air solenoid
- Zero/Mid/Span daily drift test (EPA 40 CFR part 60 or 75 support)
- Serial Digital Interface
- 5-wire sensor connection for the TS configuration
- Clip-on Ferrite for all signal wires if not in shielded conduit
- Flex service connection to sensor probe support.

Please read the complete text of the sections and study the wiring diagram examples which are relevant to your model before performing the installation.

Safety

To ensure compliance with general safety requirements the metal enclosures must be grounded to minimize the chance of electrical shock. For Explosive Atmospheres, proper grounding minimizes the chance of sparks occurring, potential ignition sources outside an enclosure at its mechanical interfaces if a fault current was to flow. Both internal and external grounds are available; see the wiring diagrams DCN 342038 and 342039.

For hazardous gas areas, wiring going into and out of the explosion-proof enclosures must be done through a conduit seal or cable gland rated for explosion-proof applications (Class 1 Div. 1 or Zone 1) attached directly to the enclosure. See Figure A-4. These seals are not needed for non-incendiary designs (Class 1 Div. 2 or Zone 2) except where extra protection from water damage is wanted.

> **For hazardous areas it is important to not connect or disconnect any wiring when the circuits are energized, the resulting spark could cause ignition.**
>
> **For hazardous areas: Do not open the enclosure when potentially explosive atmosphere is present.**

Three 3/4" FNPT fittings are provided on the electronics enclosure. The one pointing out radially is used for the sensor probe support or its wiring in a TS configuration. The other two ports exiting opposite the sensor port are for power and signal wiring. One port is typically used for AC power and the other for the signal wires. DC powered

models can use both ports for signal/power wiring. Consult your local electrical code for installation requirements.

For hazardous areas, if there is an unused conduit port, then an approved Ex d plug (3/4") must be used on that port and fully threaded in.

The safety labels and ratings for CSA, and ATEX Ex n and Ex d applications along with the T-code for both the enclosure ambient environment and the sensor process environment are shown in section AM of the manual.

The electronics board used for the Ex applications is certified as the -01, -03 and -04 for the FD sensors (used in 454 and larger 5xx models) and -06 and -07 on the MD sensors (2" and smaller 5xx models). This configuration is provided at the factory when the equipment is ordered but if a field replacement of the SC board is done, it is important to ensure the board is compatible with the sensor. See section I for more detail on this.

The HART versions of the product which uses the following boards: -11, -13, -14, -16 and -17 whose sensors are the same as described above (-01 and -11 are the same board and sensor except for HART).

Water Ingress Protection

The leading cause of a malfunctioning flow transmitter is water penetration in to the sensor electronics or wiring terminals. The electronics enclosures have a NEMA 4X or IP66 rating but the transmitters are still subject to water damage if not properly installed and maintained.

Protective measures for keeping water out of the flow transmitter components.

- Installation of conduit seals (Ex type potting Y work well) near the enclosures on all ports.
- Most cable gland designs not only provide for shielded cable termination but an environmental seal against dirt and water.
- Routing of conduit or cable using a water loop and drain near the enclosure ports
- Keep the enclosure lids on tight using the supplied o-rings.
- Positive pressure dry purge air to the enclosure will keep condensation out (few PSI from a regulator).

Conformal coating of the circuit boards is standard but this only protects against

condensation of trapped water vapor which forms from cooling inside the enclosures/conduit. Every 10 minutes a sensor and wiring leakage test is performed. This will set an alarm (Modbus, LCD, NE-43 and HART) when excessive leakage is observed.

Flex Wiring Connection for Sensor Inspections

To support periodic and preventative maintenance, the sensor electrical connections should be done with extra cable or flex conduit length. This allows the sensor to be removed from the process for inspection and or cleaning without disconnecting the wiring. The transmitter attached (TA) versions have power and 4-20 mA wires routed out and use standard electrical wring practice as shown in Figure A-5.

However, the trouble is maintaining the **EMC requirements** on the wiring at the same time. If we are using a transmitter separate (TS) version, the sensor is remote from its electronics, therefore, we must use an approved shielding method. The 5-wire sensor connections are described in a later section.

Figure A-5. Flex sensor connection for service loop, TA version using Liquid Tight Conduit.

Approved EMC tight flexible, electrical shield for the **TS 5-wire sensor** wiring include

- Braided reinforced pneumatic hose, hydraulic line hose
- Corrugated Stainless Steel tubing, with compression fitting at each end. Gas appliance flex fittings may be long enough and are available at local home improvement outlets.

- Braided Shielded cable with peripheral bonded shield cable glands

Figure A-6 shows an example of each of the EMC shielding recommended above.

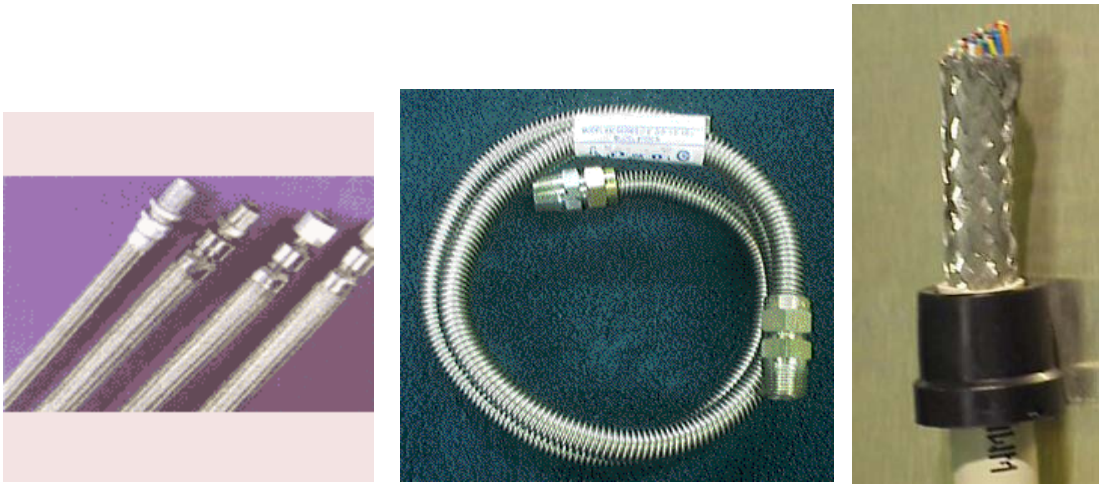


Figure A-6. Metal Braid Hydraulic Lines, corrugated gas appliance line and braided shielded cable all work well for EMC shielding of 5-wire sensor connections.

> ***Do not*** *use standard Liquid tight Flex conduit for 5-wire sensor connections, EMC shielding is not effective.*

Typical Hook-Up Wiring Diagrams

For both the AC & DC powered versions of the MFT B-Series, typical summarized wiring diagrams for most applications are available as defined in DCN 342038. This covers the TS and transmitter attached (TA) configurations. Examples for 4-20 mA connections and Modbus are shown along with the terminal definitions and cable wiring notes.

For the transmitter separated (TS) enclosure configuration, the 5-wire sensor connections must be made as shown in DCN 342039. The connection between the enclosure groups must be shielded to maintain the CE, EMC rating.

24 VDC Powered Flow Transmitters

The 24 VDC power is a nominal voltage since all circuits have a regulated supply and will work between 18 and 30 VDC. You may also use an unregulated power supply with 50 to 60 Hz ripple as long as the instantaneous voltage is between 18 and 30 VDC.

Surge currents during sensor warm up could require up to 1 A and will fall off after it warms up in about 20 seconds. At no-flow the current will be about 0.1 A and about 0.3 A for high flow rates (60 SMPS). The power is protected against reverse polarity so if no current flows or there is no output signal you may want to check the polarity against the wiring diagram, DCN 342038.

The flow transmitter is grounded to its chassis. The 24 VDC power and 4-20 mA signal have MOVs (metal oxide varistors) to clamp voltage spikes going into the unit. These are 56 V nominal (voltage level at 1 mA) and do not conduct significant current below about +/- 36 VDC relative to ground. Consequently, the isolated 4-20 mA signals, alarms etc., can not have a significant common mode or bias voltage to prevent leakage currents on the MOVs, which can cause an error in the flow measurement if occurring on the 4-20 mA output.

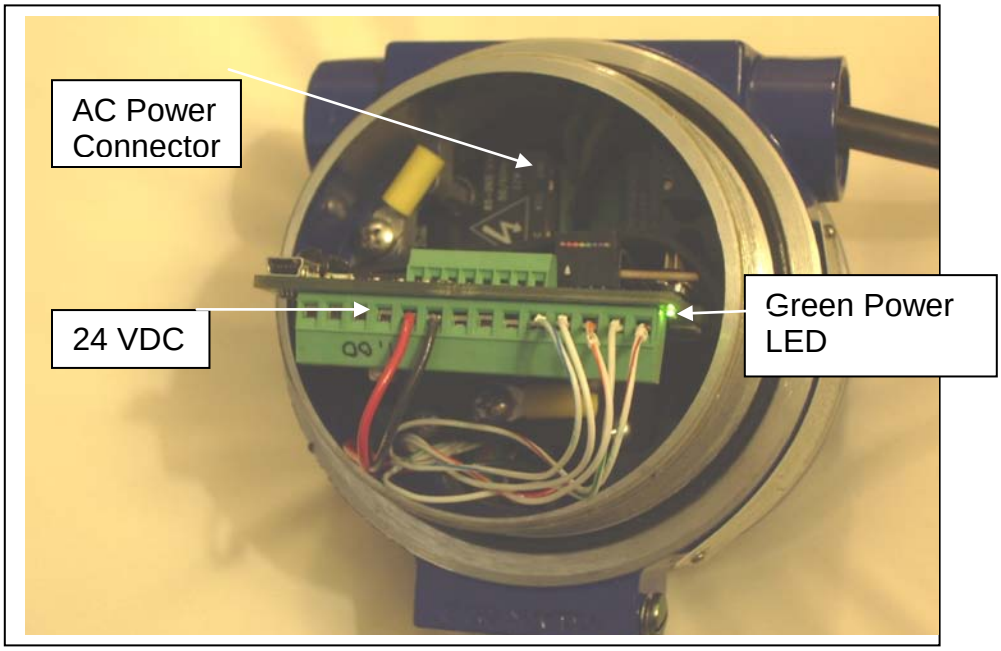


Figure A-7. DC and AC power connection.

AC Powered Units

A universal input 85-265 VAC and 50-60 Hz supply generates a nominal 24 VDC to power the unit. The AC wiring uses one of the two ¾" conduit ports for the signal wiring. The AC powered units have a long pull tab attached to the plug so it is easy to remove the plug and connect the AC wiring with a 1/8" screw driver.

Figure A-8 AC power pull tab to be removed.

Discard the pull tab as the power wiring can be used to guide the plug in/out of the power supply.

These wires must be inside the plastic insulator sleeve or wiring label to prevent the wires from catching in the threads of the explosion proof lid. The internal ground can be made via the AC power plug or a 10-32 stud on the PCB mounting bracket.

There is no means of disconnecting power for this unit. You will need a disconnect per your local electrical code.

Analog Output

Loop powered wiring: The 4-20 mA linear output is a loop powered isolated signal. The positive output terminal is diode protected against reverse voltage. The principle wiring diagrams for these are 342038 and 342039.

Self powered wiring: The output may be self-powered in the non-isolated mode by jumpering +24 VDC to one of the two + 4-20 mA terminals. Then the 4-20 mA output would be taken from the 4-20 mA negative terminal to ground. A simplified AO wiring drawing or this mode of operation is shown in diagram 342045 and one of the examples of the 342038 drawing. To use it in the non-isolated mode, the receiving current (PLC or DCS) should be sensed with an isolated input to avoid ground loop currents.

AO capabilities: The 4-20 mA circuit has an 11 VDC compliance at the full 20 mA current. So, on a 24 VDC 4-20 mA circuit, at least 11 VDC will be dropped across the 4-20 mA output, the balance on the load resistor and wiring. For example, with a 250 ohm load, at 20 mA the voltage drop will be 5 V on the load resistor, 19 V across the 4-20 mA output or AO terminals. With higher voltage supplies, you have correspondingly higher load resistance available. As a loop-powered 4-20 mA output and a 24 VDC power supply, you can drive 600 Ω and still support the 21 mA NE-43 alarm. Do not exceed 36 VDC on the loop-powered interface or you may have leakage current from the protective MOVs causing an error in the measurement. In summary, a loop-powered configuration places a customer provided DC power source, the MFT B-Series output and load resistance(s) all in series.

NE-43 alarm support on the 4-20 mA signal is also provided. This means normal operation is clipped between 3.8 and 20.5 mA. Meter faults are indicated with either a low or high alarm on the 4-20 mA output. See the diagnostic section for more information.

HART: The HART version of the SC board has just one 4-20 mA or AO. See section AQ for full list of HART commands. The DD for this device is usually all you need as it is self documented. The DD user interface will typically be used on a handheld communicator but is also available for a HART Master running on a laptop/PC.

Clip-on Ferrite for all Signal Wires

The I/O connections, 24 VDC, Modbus, analog outputs, or analog inputs (4-20 mA) must be clipped in a ferrite to meet the EMC specifications. Figure A-9 shows and example of this type of wiring. This ferrite has an half inch diameter hole for wires.

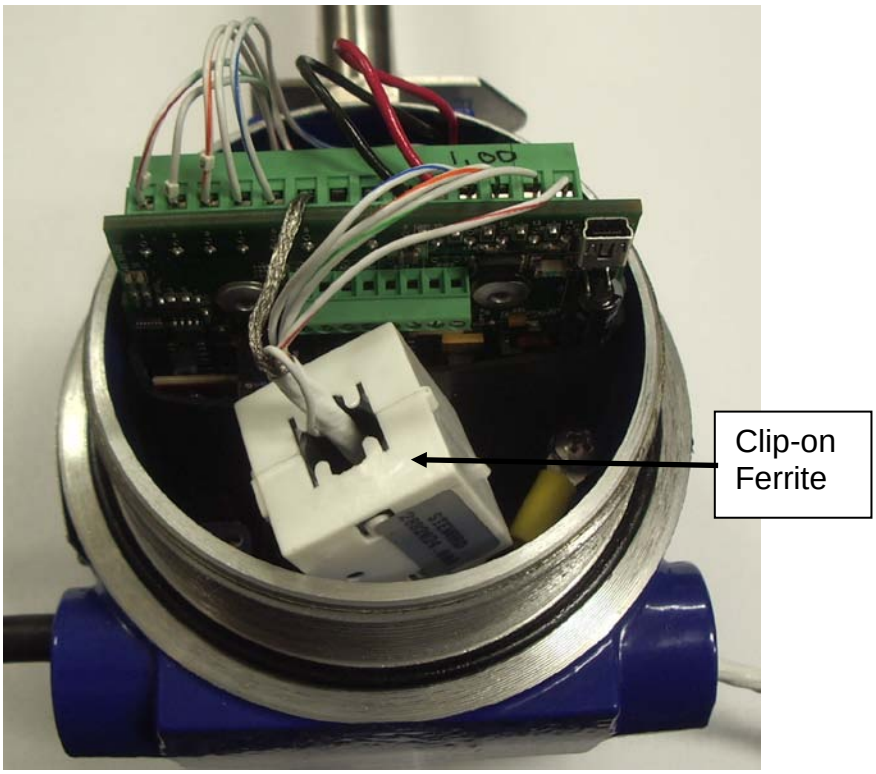


Figure A-9 Clip-on Ferrite for I/O wires to be CE compliant without proper cable or conduit shielding.

The exception for this is if the I/O wiring are in a multi-conductor braded shield cable with peripheral bonded termination or solid conduit (ridged or EMT). Liquid tight flex does not provide shielding.
One Ferrite kit ships with each meter. More can be purchased from Kurz as part number 600029- or from the following manufactures:

Steward 28A2024.0A2
Fair-rite: 0443164151:

Stock available from Kurz or Digi-Key Corporation (www.digikey.com)

Alarms

The two optically coupled solid state relays (SSR), may be used for just about any flow logic you can think of, sensor error output, or totalizer mode pulses. Each SSR is rated for 0.5 A, 24 V AC/DC. As with the other I/O terminals, there are 48 V MOVs for surge protection on this device. You must not exceed 36 V to ground or you will cause leakage and may overheat and damage the MOV which can fail in a short. Again, see the wiring diagram 342038 for the specific alarm terminals.

Serial Communications

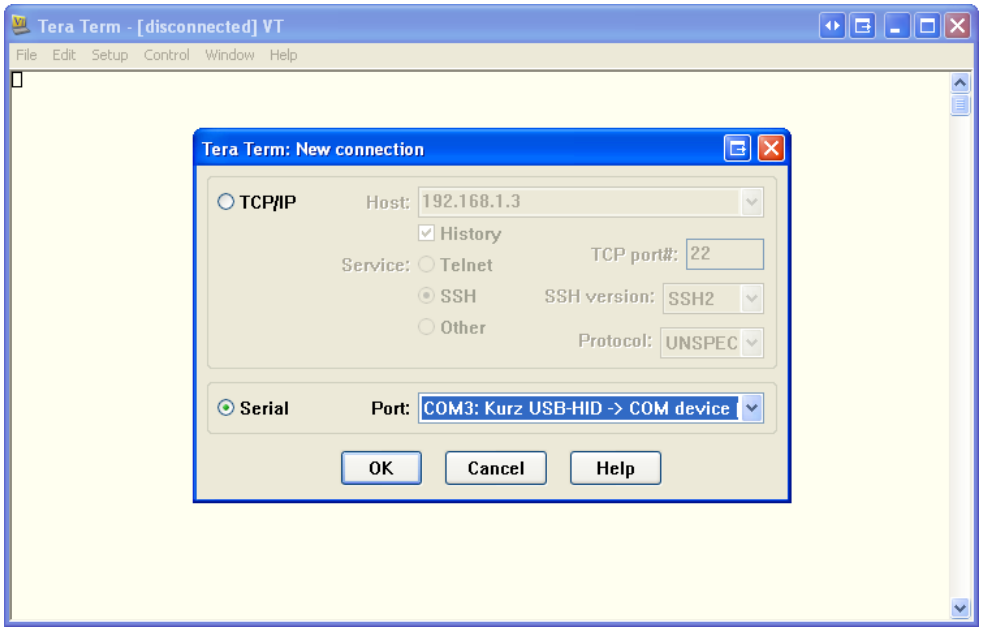
There are two independent serial ports on the MFT B-Series. A mini-type B USB connector with Kurz driver can act as a COM port to make "remote" terminal operations possible. A RS-485 port can be used for the Modbus protocol and multipoint communications. The USB port can be used instead of the optional on-board LCD/keypad to view data, configure the meter or extract diagnostic data. The upload or download of the meter configuration can be done on either the USB or Modbus port using the Kurz provided program KzComm. The advantage of the Modbus port is greatest when you have multiple meters on the bus allowing access to all of them from one location (eg, your heated/cooled office or control room).

USB

The USB interface requires installation of the Kurz USB driver on the Windows PC. Both 32 and 64 bit Windows drivers are available on our CD/manual which are known to work on Windows 2000 to 7.

Any terminal emulator program may be used to act as a remote terminal to the MFT B-Series. We recommend TeraTerm which works for all Windows versions (95 to 7). The TeraTerm program is available on our CD manual or the internet at http://ttssh2.sourceforge.jp/

Once the program is installed, start TeraTerm and select the communications port by selecting the Serial radio button and then choosing the port number. Under the Setup menu, select 'Serial Port…' and check that the serial port setup is as follows: Baud Rate 9600, 8 Data Bits, No Parity, 1 Stop Bit, No Flow Control. This configuration can be saved for future recall by selecting 'Save Setup…' from the Setup menu.



The program KzComm may also be used on the USB interface if you only need to save/print the configuration files, but it is not a terminal emulator for the LCD/keypad of the meter.

RS-485/Modbus

The RS-485 interface is half duplex and supports baud rates of 9600, 14400, 19200, 38400 and 57600. Wiring is a shielded twisted pair, two signal lines and one shield connection. The signal lines can be connected in any order provided the 485 bus is biased so the flow meter knows which signal is positive. See 342038 for a wiring example of this. A junction tee (see www.turck.com) between the network bus and instrument drop is recommended so instruments may be removed for service without interruption to the network bus.

Desk computers and laptops can interface to the RS-485 devices using a USB dongle converter. We recommend the industrial version from EasySync, available from Kurz (PN 700491) or the manufacture. This device is optically isolated, screw terminal interface with metal enclosure and status LEDs, with a biased bus allowing the auto-polarity detection to work.

The Modbus interface must be set for device address, protocol, baud rate, and byte order. Once properly connected and configured, you will see on the EasySync 485 converter the yellow LED flash for RS-485 receive activity and you will see the green LED flash for transmit or response of the flow transmitter. Also, on the MFT B-Series unit, it has two red LEDs used for receive and transmit, respectively. These should also flash intermittently to indicate activity between the flow transmitter and the Modbus master. The full protocol specification and register variable map is found in the serial communications section of the manual.

5-Wire Sensor Connections

For the TS version you must field install the wiring between the sensor and its electronics enclosures. In addition to the field wiring diagram 342038 you need to refer to 342039 for the TS part. This is a 5-wire connection which must use quality wire whose wire resistance is less than 1 Ω per wire. Each wire must be matched within 0.01 Ω or 10 mΩ so the lead length compensation can work properly. Without this, the Factory calibration and temperature compensation will not hold in the field. If the individual wires do not meet the matching specification, their length must be trimmed or extended until they match. The terminal strip for the sensor wire will accept up to 12 AWG wire (2.05 mm) which is good for 630 feet (192 m) between the sensor and electronics. However, the electronics terminal block TB1 is rated for 14 AWG (1.63 mm) max wire size.

To maintain the CE EMC compliance of the product in the TS configuration, one must maintain a good shield around the 5 wires. This can be done with rigid conduit, EMT or a braided shielded multi-conductor cable between the sensor junction box and the sensor electronics enclosures. Conduit seals directly to the enclosures are still needed to meet the explosion-proof ratings. Peripherally bonded shielded cable glands work well but a simple cable gland and shield pigtail ground connection is sufficient. Hawke America (281 445 7400, www.ehawke.com), makes a whole line of cable glands for shielded cable. Their Model 501 universal is one of many and has Exd safety ratings too, see installation info also. Some of these sizes and cable are also available as accessories from Kurz. See section above with more recommend wiring methods for the 5-wire sensor connections.

Cable Gland Example with Braded Shielded cable on a TS configuration.

Not recommend for CE EMC compliance on the 5-wire sensor connections of the TS configuration:

Type	Reason not to use it.
Unshielded twisted Pair, UTP	No shielding.
Armor Cable	Spiral wrap armor wires are not an EMC shield. Looks like an inductor at RF frequencies.
Flex Conduit	Spiral wrap shell is not an EMI shield.
Liquid Tight Conduit	Better shield than flex conduit but will not hold up well over time due to oxidation of the metal wrap joints that degrade the EMC shield.

Orientation of the LCD Keypad

Turn the power off to the unit before performing this procedure to prevent damage and protect you from explosions ignited from electrical sparks.

Within the electronics head, the LCD keypad can be mounted in any one of four 90 ° rotated positions for best viewing and hand access. It mounts to four standoffs using the screws seen on the keypad. When performing the display rotation, standard electronics handling procedures to prevent ESD must be used. Use a wrist strap between yourself and the enclosure body before taking the display board out to rotate it.

The short ribbon cable between the sensor electronics and display board must have its connectors fully seated in the PCBs before you carefully screw down the board using the provided screws. RTV works as an adhesive to keep the connector attached to the display board. It is applied between the outside of the connector and PCB, not the inside on the electrical pins .The ribbon cable connectors have a pin 1 mark which must match that of the PCB connector at each end. The ribbon cable will route towards the center of each PCB when properly mounted.

There is an LCD contrast adjustment on the back of the LCD/keypad board which can be adjusted with a small flathead screwdriver as needed for best viewing of the screen. However, it is Factory set for equal viewing at 0 and 60 degrees C so it is not optimized at room temperature. When too cold the display is white and when too hot, the display will be dark.

Figure A-10. 90° display rotation options.