

2. Installation

Receiving/Inspection

- Unpack carefully.
- Verify that all items in the packing list are received and are correct.
- Inspect all instruments for damage or contaminants prior to installation.

If the above three items are satisfactory, proceed with the installation. If not, then stop and contact a customer service representative.

Packing/Shipping/Returns

These issues are addressed in Appendix C - Customer Service.

Factory Calibration Note

The instrument 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 instrument in service.

Pre-Installation Procedure



Caution: Only qualified personnel should install this instrument. Install and follow safety procedures in accordance with the current National Electrical Code. Ensure that power is off during installation. Any instances where power is applied to the instrument will be noted in this manual. Where the instructions call for the use of electrical current, the operator assumes all responsibility for conformance to safety standards and practices.



Alert: The instrument is not designed for weld-in-place applications. Never weld to process connection or a structural support.

Damage resulting from moisture penetration of the enclosure(s) is not covered by product warranty.

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

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.

Prepare or Verify Flow Element Location

Prepare the process pipe for installation or inspect the already prepared location to ensure that the instrument will fit into the system.

Mount the flow element at least 20 diameters downstream and 10 diameters upstream from any bends or interference in the process pipe or duct to achieve the greatest accuracy.

Verify Dimensions

The ST98 Insertion Models have an adjustable insertion length ferrule until it is locked into position. Verify all dimensions before locking the fitting in place. See the appropriate figures in Appendix A.

Note: Two types of ferrules are available. One type of ferrule is made from Teflon. This can be tightened and loosened repeatedly at different places on the flow element. The other type of ferrule is made from Stainless Steel. This ferrule can only be tightened in one place on the flow element. The Stainless Steel Ferrule makes an indentation into the flow element for a more firm fit.

The ST98 In-Line Model's flow element has a tube or pipe length and diameter that is specified at the time of order. This dimension should be double checked with the process line.

Verify Flow Direction for Flow Element Orientation and Placement

The insertion ST98 flow element comes with flat areas machined on the flow element near the enclosure end of the flow element. Etched on the flow element is a flow arrow indicating the direction of flow. See Figure 2-1.

Align the ST98 flow element during installation so the flat areas are parallel to the direction of the process media flow, and the flow arrow points in the direction of process media flow.

A flow direction arrow is etched on the in-line ST98 tube or pipe and should be pointing in the direction of flow.

Failing to install the flow element correctly will reduce the accuracy of the flow meter.

Verify The Serial Number Of The Flow Element and the Electronics

The ST98 flow element has a serial number near the flat machined area or flow arrow. The same number is on the main electronics circuit board, and on the tag of the electronics enclosure. These numbers have to match because the flow element and the electronics are a matched set. Failure to observe serial numbers will cause inaccurate readings.

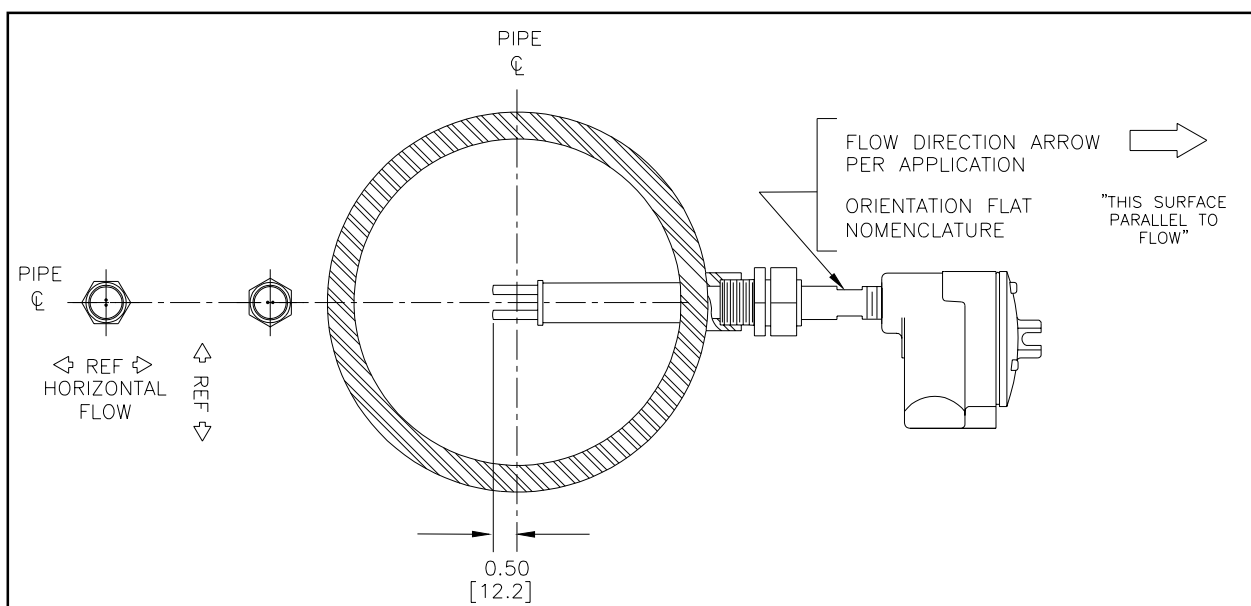


Figure 2-1. Model ST98 Insertion Flow Element (Remote) Showing Orientation

Install Insertion Flow Element



Note: The instrument accuracy will be reduced if the media flow is reversed from the flow direction of the flow arrow machined on the flow element or if the flats are not parallel, within $\pm 1^\circ$ of the flow direction.

Install the flow element as specified for the process connection type used.

Compression Fitting Mounting (Insertion Mounting Only)

1. Determine the inside diameter of the process pipe at the predetermined location. Calculate 1/2 of the inside diameter. Add 0.50 inch (12.7 mm) to the dimension. Add the pipe wall thickness. Mark the flow element at this length.
2. Insert the flow element fitting into the process pipe and tighten per ANSI B16.5 torque specifications. Use appropriate sealants as required. Measure the length of the ferrule that is above the pipe. Mark this dimension above the first mark on the flow element.
3. Position the flow element in the process pipe so that the last mark is above the ferrule. The flow element is now placed at 0.50 inch (12.7 mm) past the center of the process pipe as shown in Figure 2-1.
4. Adjust the flow element so the flats are parallel to flow $\pm 1^\circ$, and the flow arrow is in the direction of flow.
5. Ensure that the insertion length is correct before tightening the compression fitting. Readjustment of the metal ferrule is not possible after tightening because the fitting crimps onto the flow element pipe. The Teflon ferrule is readjustable.
6. Hold the fitting body steady with a backup wrench and tighten the nut one and one-quarter turns past what is hand tight. Now the flow element is sealed and locked into place.



Caution: Be sure there is no pressure in the process line before the instrument is removed.

To remove the flow element, loosen the nut (Step 6) and unscrew the ferrule (Step 2).

NPT Pipe Thread Mounting (Insertion Mounting Only)



Alert: DO NOT change the orientation of the flow element in the enclosure more than 180° as the interconnecting RTD and heater wiring could be stressed and damaged. DO NOT apply any torque to the flow element enclosure - only apply to NPT pipe surface itself.



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

The pipe thread configuration is similar to what is shown in Figure 2-1. Apply sealant compatible with the process media to male threads. Carefully insert into process mount. Threads are right-handed. Tighten with an open-end wrench on the hexagonal surface provided. Rotate until snug and continue to turn until flat is horizontal to process flow.

Flanged Ferrule Mounting (Insertion Mounting Only)

1. One of the configurations that can be ordered is a flange that has NPT threads. The flange can be screwed onto the instrument's ferrule. If the flange is separate from the ferrule screw on the flange and apply a lubricant/sealant to the male threads and torque using ANSI B16.5 specifications. If the flange is already present, proceed to the next step.
2. Measure the U-Length of the flow element (from the flange face to the end of the flow element). Subtract 0.50 inch (12.7 mm) from the U-Length. The process' flanged mating surface for the flow element should be high enough above the pipe for proper mounting of the flow element as follows: Measure the inside diameter

of the process pipe at the predetermined location. Calculate 1/2 of the inner diameter. Add the pipe wall thickness. Add the length the customer's flange is above the pipe. The length above the pipe should be adjusted to match the U-Length minus the 0.50 inch (12.7 mm) dimension.

3. Apply the appropriate gasket and/or sealant to flange mount faces as required.
4. Attach the process mating flange with care. The mating surface should be oriented so the flow element flats are parallel to flow, within $\pm 1^\circ$, and the flow arrow on the flow element should be pointing in the same direction as the flow.
5. Attach with a bolt, two flat washers, lock washer and nut for each bolt hole; apply lubricant/sealant to the male threads and torque. Refer to ANSI B16.5 specifications.

In-Line Mounting

There are several different ways the in-line model ST98 instrument can be mounted into the process line. The different ways the flow element can be mounted are as follows:

- Threaded male NPT mount
- Threaded female NPT mount
- Raised face flange mount
- Butt Weld mount

Figure 2-2 shows a Butt Weld, 2 inch Schedule 40 pipe, in-line model ST98:

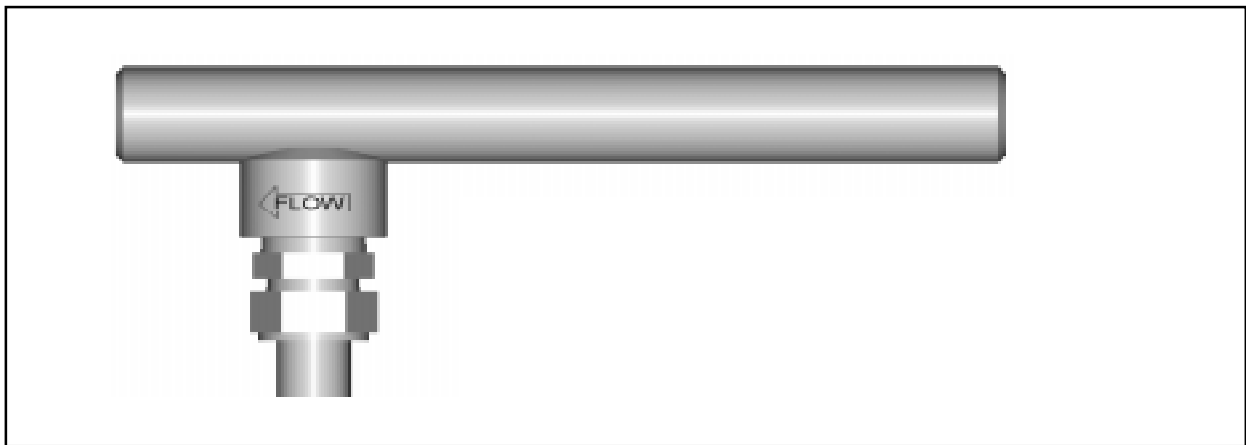


Figure 2-2. Model ST98 In-Line Butt Weld Mount

Mount the in-line Model ST98 as follows:

1. Verify that the process media flow is in the same direction as the flow arrow (see Figure 2-2).
2. For flange mounted instruments, apply the appropriate gasket and / or sealant to flange mounts as required.
3. For NPT mounted instruments, apply the appropriate sealant to the threads as required.
4. Mate (or weld the Butt Weld instrument) the instrument to the process line.
5. For flange mounts, attach the instrument with a bolt, two flat washers, lock washer and a nut for each bolt hole. Apply lubricant/sealant to the male threads of bolts or to the NPT threads and torque. Refer to ANSI B16.5 torque specifications.

Install Flow Transmitter



Alert: In applications where the flow element is located in an explosive environment, isolate the conduit before it leaves the environment. A potting Y may be used to provide the isolation.



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

Make all electrical connections through the 3/4 inch NPT ports in the enclosure. Run all electrical cables through appropriate conduit or protective sheathing.



Caution: Ensure that all power is off before wiring any circuit.

Minimum Wire Size

If the instrument is used in the remote configuration, a shielded, 8 conductor cable should be used between the local and remote enclosure. Table 2-1 shows the smallest (maximum AWG number) copper wire that should be used in the cable and in other wiring. Use a lower gauge of wire for less of a voltage drop. Contact FCI concerning greater distances than those listed in the table. The sensing element cable for the remote option must be shielded. The maximum wire size of the non-power connectors in the instrument is 16 AWG. The maximum wire size of the power connectors in the instrument is 12 AWG.



Note: All 8 conductors for the sensing element must be used for proper operation of the flow meter.

Table 2-1. Maximum AWG Number

Connection	Maximum Distance for AWG					
	10 ft. (3 m)	50 ft. (15 m)	100 ft. (31 m)	250 ft. (76 m)	500 ft. (152 m)	1000 ft. (310 m)
Input Power	20	18	18	16	16	14
Sensing Element Cable (Remote Instrument)	24	24	24	18	16	16
Analog Output	24	24	24	18	16	16

Aluminum Enclosure Installation (Cylindrical Enclosure)

1. To wire the instrument remove the customer connection cover from the instrument by loosening the Allen head screw at the base of the cover. Unscrew the cover shown in Figure 2-3.
2. Install conduit between the local (if used) and the remote enclosure, the power source and customer monitoring circuits. Provide watertight hardware and apply thread sealant to all connections to prevent water damage.
3. Connect the milliamp and/or DC voltage output to the termination (customer connection) board as required. Refer to Figure 2-4 for connection information.
4. Connect the operating power to the customer termination board by removing the input wiring kit from the strain relief bracket (see Figure 2-4 for the bracket location). This kit contains a filter bead and three cable ties. For remote instruments only, the kit also contains 2 wire terminals for a ground wire to be placed between the flow element enclosure and the electronics enclosure.
5. Strip the incoming power wires to approximately 5/16 of an inch.
6. Attach the filter bead over the safety ground wire as shown in Figure 2-4 using 2 cable ties to secure the bead on the wire. The last cable tie should be about 3 inches from the end of the wire.
7. Attach the power wires to Terminal Strip TS1 (for AC) or TS4 (for DC) as shown in Figure 2-4. Secure the wires going to the Terminal Strip with a cable tie, secured to the cable tie bracket on the customer connection board.
8. For remote instruments only, (the flow element is in a separate enclosure from the electronics): Loosen the Allen head screw on the electronics cover. Unscrew the cover.

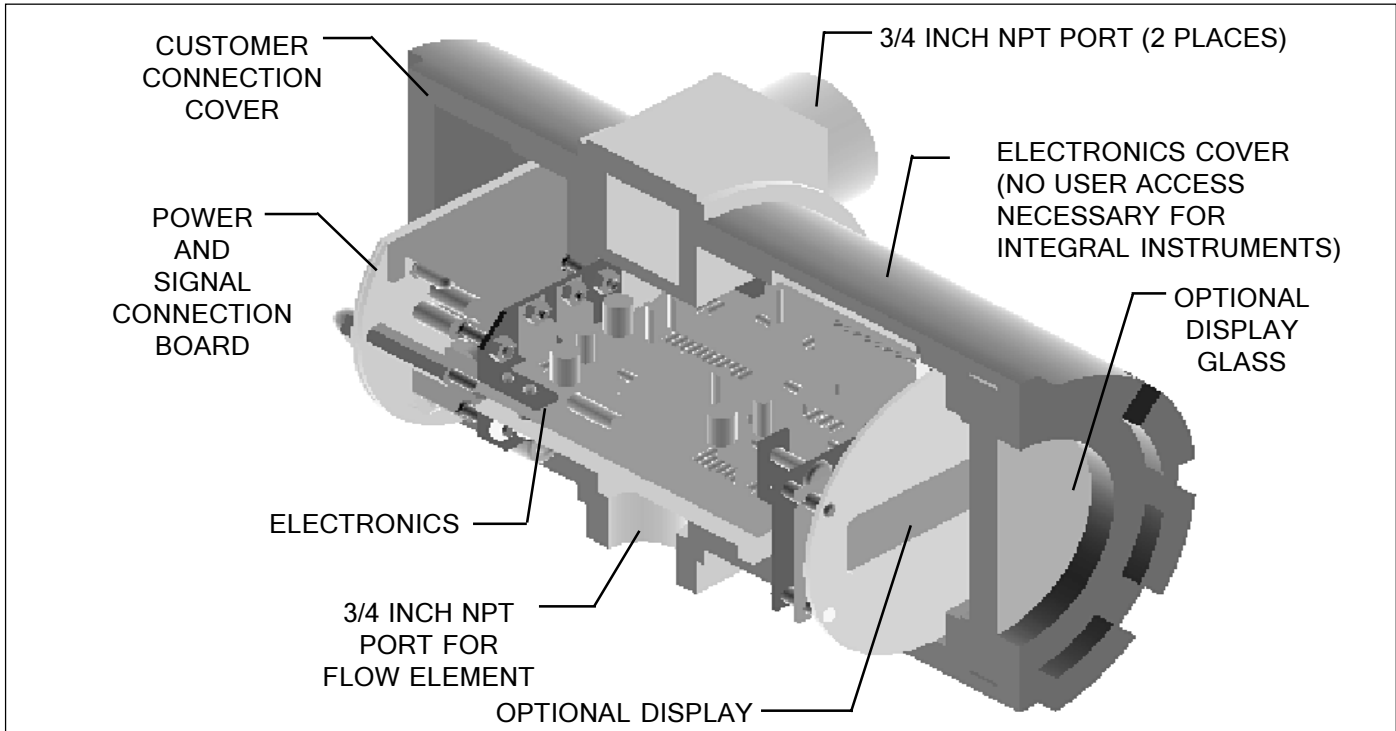


Figure 2-3. Circuit Board Placement

9. For remote instruments only: The flow element wires should be routed through the 3/4 inch NPT port for the flow element as shown in Figure 2-3. Connect the flow element wires to TS2 on the electronics assembly according to Figure 2-5. Connect the cable shield to HTR RTN. Leave the other end of the shield floating. A 14 AWG ground wire should also be routed between the enclosures (wire terminals are supplied in the kit).



Note: Connecting the shield in any other way will decrease the accuracy of the instrument. See Figure 2-4 for the wiring diagram.

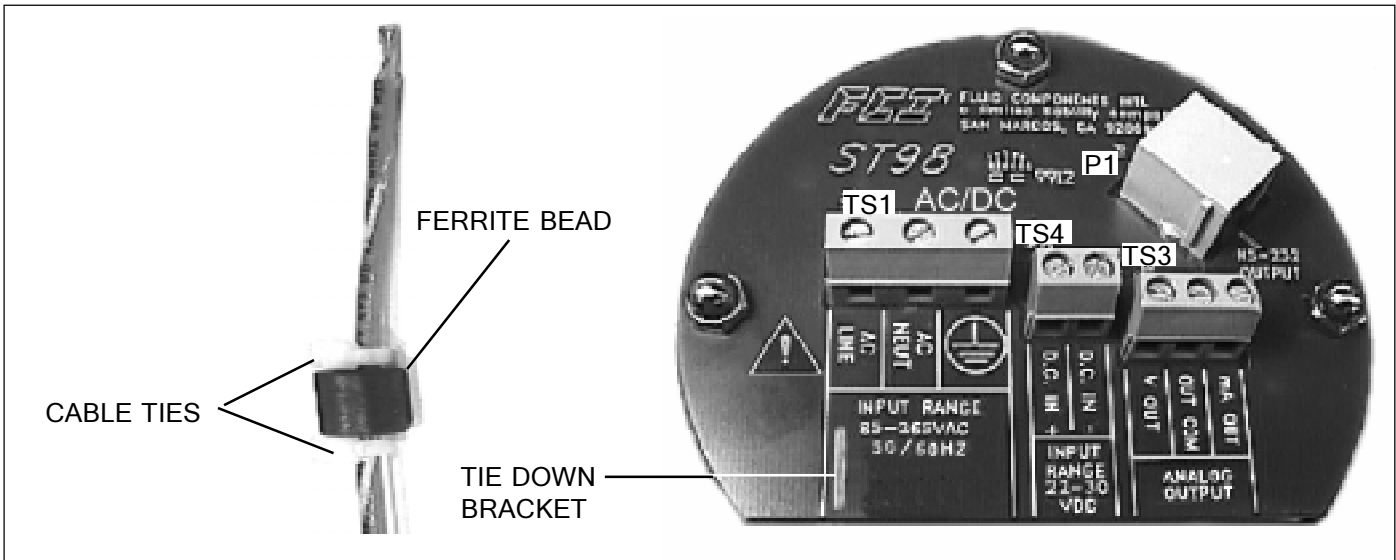


Figure 2-4. Customer Connection Board



Caution: Be sure an earth ground wire is connected to the ground terminal (see Figure 2-4). On a remote configuration, connect an earth ground wire to the ground screw in the local enclosure. This is for the purpose of safety.

10. If a wire comes loose from the instrument during installation, refer to Chapter 5 - Troubleshooting for a complete instrument wiring diagram.

11. For remote instruments only: Screw on the electronics cover and tighten the Allen head screw.
12. Screw on the customer connection cover and tighten the Allen head screw.
13. There are enough threads on the flow element so the flow transmitter enclosure can be rotated for ease of viewing the display LCD if the option is present. Be sure the flow arrow still points in the direction of flow and the flat is parallel to the flow.
14. Verify proper installation. Ensure that the assemblies are secure and the wiring is correct.

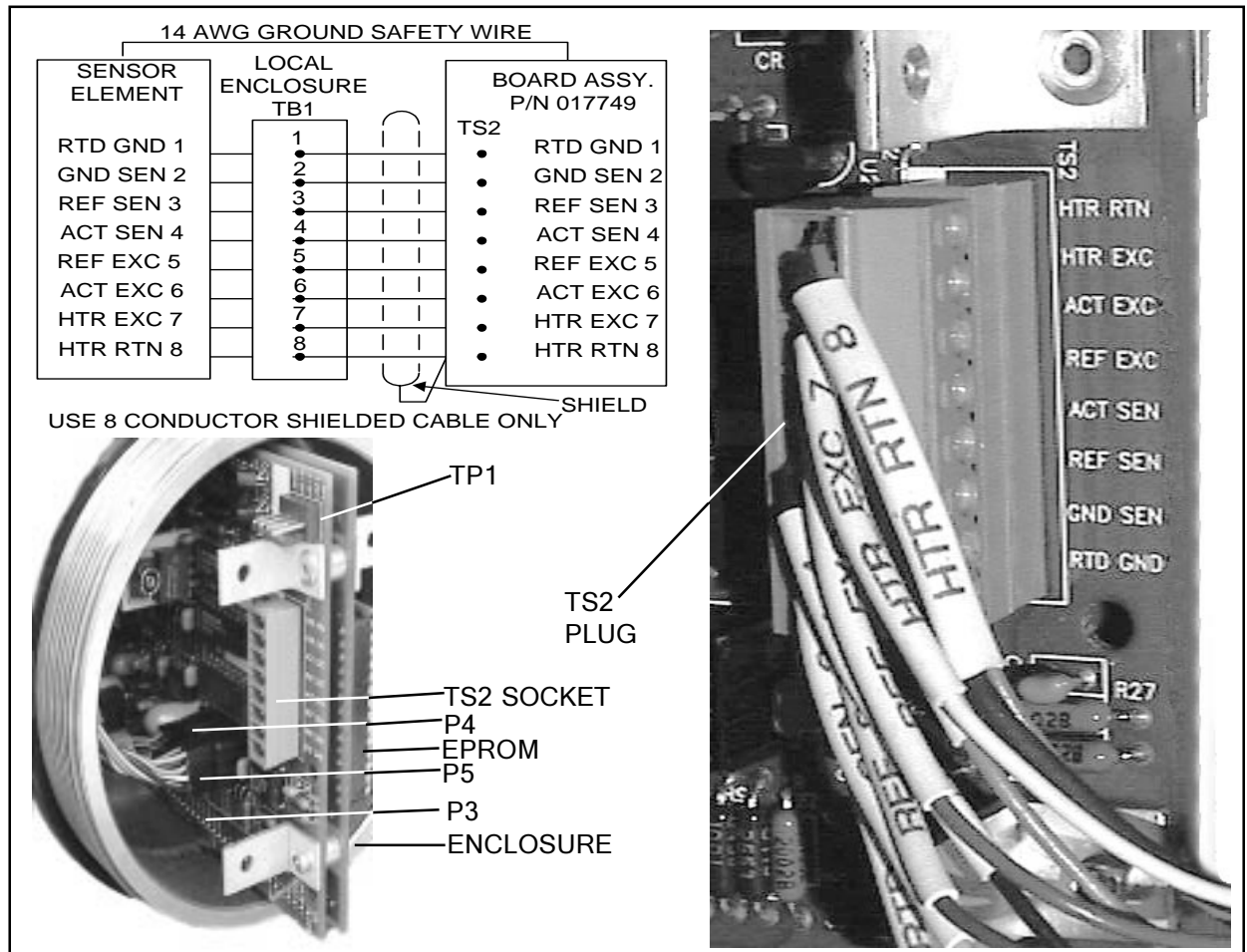


Figure 2-5. Remote Wiring Diagram



Caution: Ensure that all power is off before wiring any circuit.

Carbon Steel Enclosure Installation (6 X 6 Carbon Steel Enclosure)

1. To wire the instrument loosen 3 cover hold down screws and open the cover. See Figure 2-6.
2. Install conduit between the local (if used) and the remote enclosure, the power source and customer monitoring circuits. Provide watertight hardware and apply thread sealant to all connections to prevent water damage.
3. Connect the milliamp and/or DC voltage output to the termination (customer connection) board as required. Refer to Figure 2-4 for connection information.
4. Connect the operating power to the customer termination board by removing the input wiring kit from the strain relief bracket (see Figure 2-4 for the bracket location). This kit contains a filter bead and three cable ties. For remote instruments only, the kit also contains 2 wire terminals for a ground wire to be placed between the flow element enclosure and the electronics enclosure.
5. Strip the incoming power wires to approximately 5/16 of an inch.
6. Attach the filter bead over the safety ground wire as shown in Figure 2-4 using 2 cable ties to secure the bead on the wire. The last cable tie should be about 3 inches from the end of the wire.

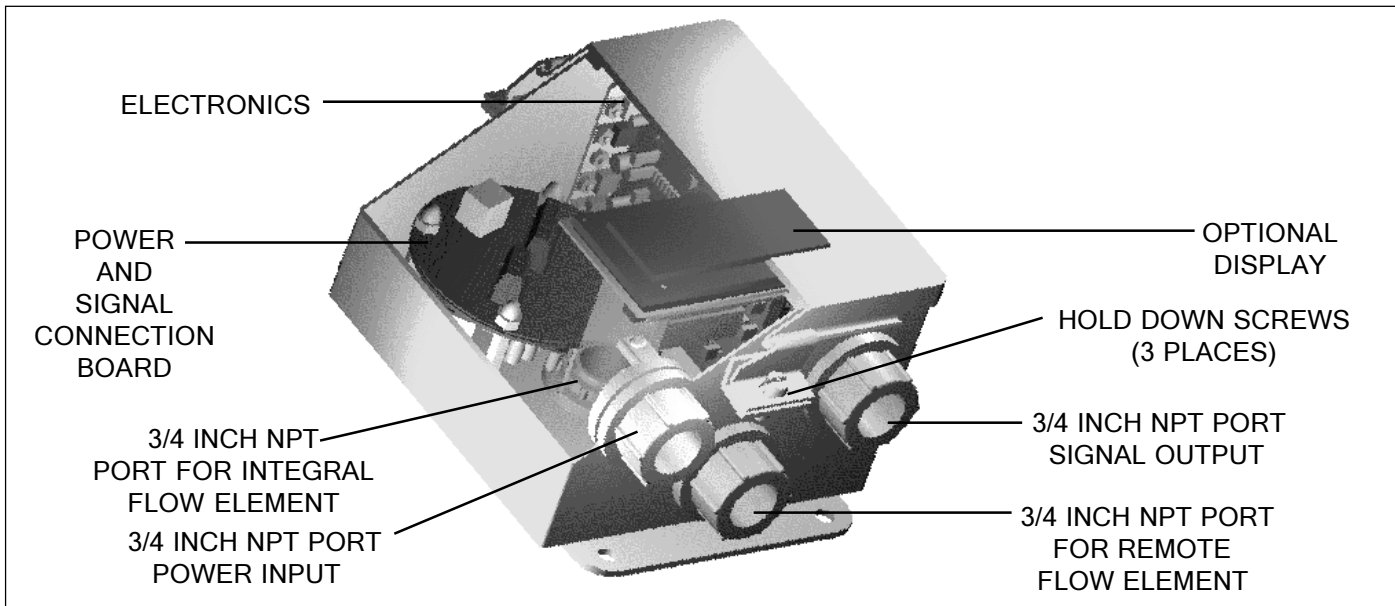


Figure 2-6. Optional Carbon Steel Enclosure

7. Attach the power wires to Terminal Strip TS1 (for AC) or TS4 (for DC) as shown in Figure 2-4. Secure the wires going to the Terminal Strip with a cable tie, secured to the cable tie bracket on the customer connection board.
8. For remote instruments only, (the flow element is in a separate enclosure from the electronics): The flow element wires should be routed through the 3/4 inch NPT port for the flow element as shown in Figure 2-6. Connect the flow element wires to TS2 on the electronics assembly according to Figure 2-5. Connect the cable shield to HTR RTN. Leave the other end of the shield floating.

Note: Connecting the shield in any other way will decrease the accuracy of the instrument. See Figure 2-5 for the wiring diagram.

Caution: Be sure a grounded wire is connected to the ground terminal (see Figure 2-4) or to the enclosure ground screw. This is for the purpose of safety.

9. If a wire comes loose from the instrument during installation, refer to Chapter 5 - Troubleshooting for a complete instrument wiring diagram.
10. Close the cover and tighten the hold down screws.
11. There are enough threads on the flow element so the flow transmitter enclosure can be rotated for ease of viewing the display LCD if the option is present. Be sure the flow arrow still points in the direction of flow and the flat is parallel to the flow.
12. Verify proper installation. Ensure that the assemblies are secure and the wiring is correct.

Remote Hardware Location (Option)

The outline dimensions shown in Appendix A show the physical dimensions for the proper mounting of the flow element and transmitter electronics enclosure. Select a location for the flow transmitter within 1000 feet (310 M) of the flow element. Pigtail flow elements can not be located more than 10 feet (3 M) from the flow transmitter. This location should be easily accessible with enough room to unscrew the enclosure top at any time. Secure the enclosure to a surface capable of providing support. Use appropriate hardware to secure the enclosure.

Note: In cases where a pigtail flow element cable must be extended, a 9 position terminal strip must be used. All 8 conductors and the shield wire must have an exclusive terminal landing for proper operation. See Table 2-1 for the minimum wire gauge to use.

Wiring the In-Line Flow Element (Option)

Electrically the in-line flow element is the same as the model ST98 insertion flow element. Wire the instrument using the local enclosure or remote enclosure and/or the pigtail wiring methods above.

Serial Communication (Hyper Terminal Hook-Up)

The RJ-12 (P1) connector on the customer connection board provides RS-232 communication with the user. An FC88 Communicator can be plugged in for periodical re-configuration and/or diagnostics, or personal computer can be plugged in instead of the FC88 Communicator. See Figure 2-4 for the location of P1. This connection is a RJ-12 communication (phone) jack. Figure 2-7 represents the connection between the serial port and the host device.

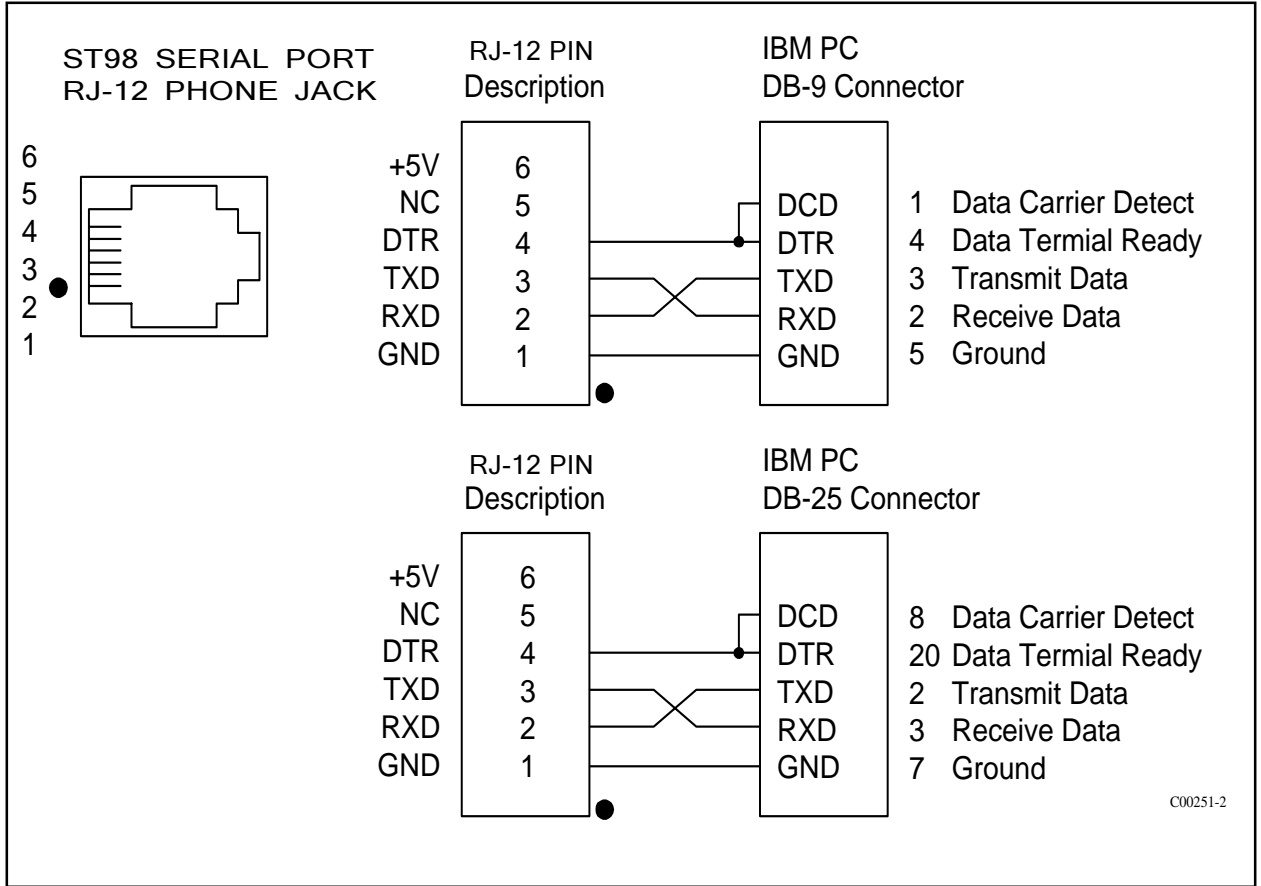


Figure 2-7. Wiring Diagram, DB-9 and DB25 PC Connectors

FCI recommends using the ST98 PC Interface Kit P/N: 014108-01 to connect the flow transmitter to a personal computer. The Kit includes operation instructions and an adaptor for the RJ-12 to serial connection. Connect one end of the interface kit to the RJ-12 port and the other end to a DB pin connector. Plug the connector into the COM1 or COM2 port in the back of the computer terminal.

See instructions on how to use the serial communications in the next chapter.

Remote Enclosure Bracket Installation

The remote enclosure can be rotated at various points around a 360° axis and bolted in place using 1/4-20 hardware. See Figure 2-8.

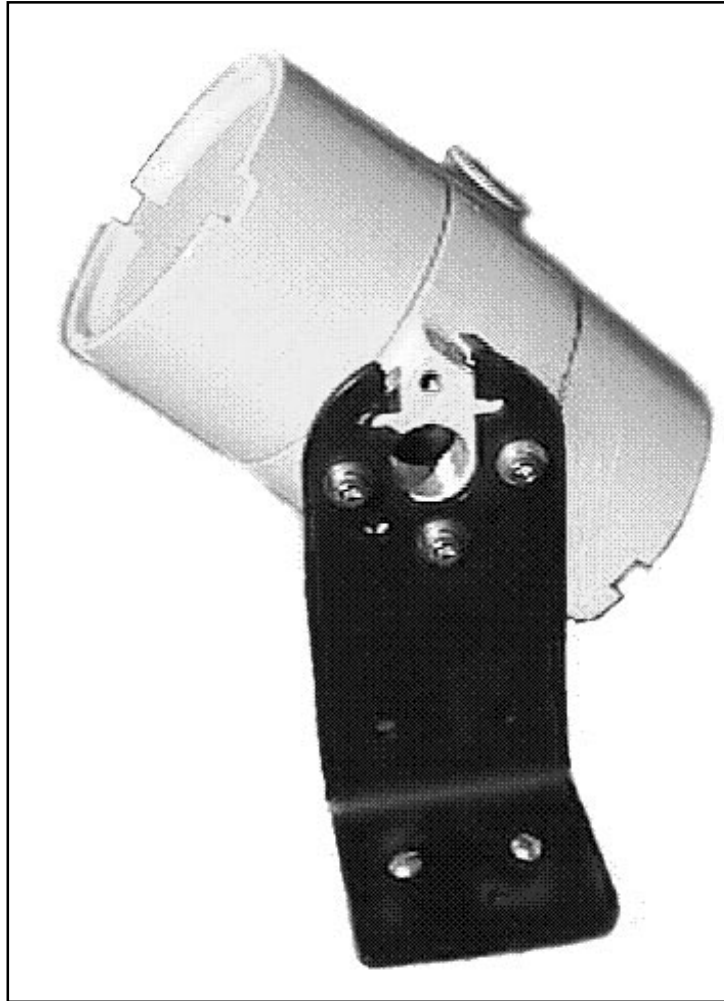


Figure 2-8. Remote Bracket Installation

Apply Power

The input power should not be turned on until the installation has been completed with all connections verified, power and signal connection board assembly screwed down and the instrument ready to operate. Be sure any external circuit breakers are on.