

ST98 Installation, Operation and Troubleshooting Guide

Step 1. Pre-Installation

- A. To get the best results from the instrument, the sensor should be located 20 pipe diameters downstream from any flow disturbance (valve, pipe elbow, etc.) and 10 pipe diameters upstream from any disturbance.

The instrument tags show the model number, tag number (if noted on the customer's order), serial number along with other important safety information. Compare this information with the appropriate pipe installation drawings and calibration sheets to verify the instrument is the correct configuration.



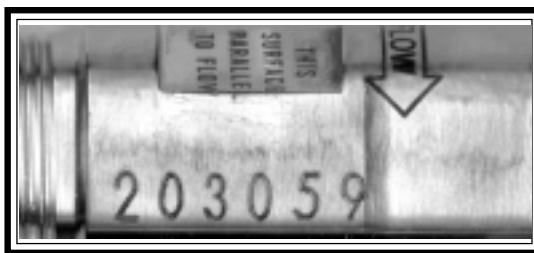
Tag Location - Between Conduit Ports
On Integral or Local Enclosure



Tag Location - Top Side of
Remote Enclosure Option

If the instrument is a remote configuration, the serial number on the enclosure tags must match. The recommended tag number on the local enclosure will have an FT in the tag number. The recommended tag number on the remote enclosure will have an FE in the tag number. (Tags are specified by the customer, "FE/FT" is a recommended naming convention.)

- B. Verify the serial numbers on the enclosure(s), flow element and electronics match. The instrument may not work if the serial numbers are miss-matched. (The remote option has a remote transmitter enclosure (FT) and a local flow element enclosure (FE). The integral option has one enclosure.)



Flow Element Serial Number
Also Showing Flow Arrow
(Located near the FE enclosure.
It is also on the enclosure tag.)



Electronics Serial Number
(Located on the circuit board with the larger I.C. chips. It is also on the transmitter's (FT) enclosure tag.)

- C. Recommended installation/troubleshooting tools are an open-ended wrench to fit the NPT connection, an open-ended wrench to fit the flanged fitting nuts and bolts, a small flat blade screw driver for manipulating potentiometers, both a medium flat blade screwdriver and a medium phillips head screwdriver for tightening connections, 3 mm allen wrench for CENELEC approved instruments, a measuring tape for proper flow element placement, and a DVM for Ohm/Voltage measurements.

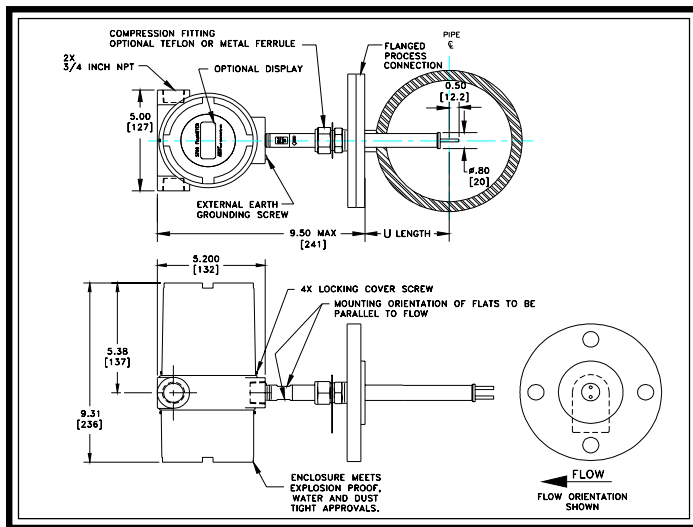
Step 2. Flow Element Installation

Install the flow element, with the flow arrow (shown on Page 1) in the direction of media flow. The element should be in the center line of the process pipe or rectangular duct. The flow arrow flat area is to be parallel $\pm 2^\circ$ with the media flow. If the remote transmitter option is used, the serial number of the flow element is to match the serial number of the electronic enclosure.

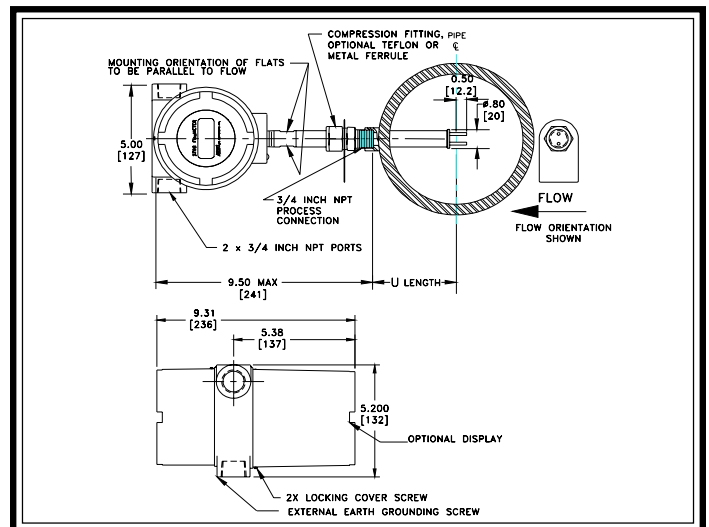
Compression fitting option: Metal Ferrules (hard seal) can not be readjusted after the fitting has been tightened. Teflon ferrules (soft seal) may be readjusted after the fitting has been tightened (but not overtightened).

To insert a compression fitted flow element into the process, measure the inner pipe or duct diameter. Divide the measurement by 2, then add 1 inch (25 mm). Add the pipe wall/fitting thickness to the measurement. Mark the flow element with this measurement. Insert the element into the process, up to this mark. Tighten the male portion of the fitting into the process. Use appropriate thread sealants. Tighten the female part of the fitting until the element doesn't move and there are no leaks. Torque varies per application.

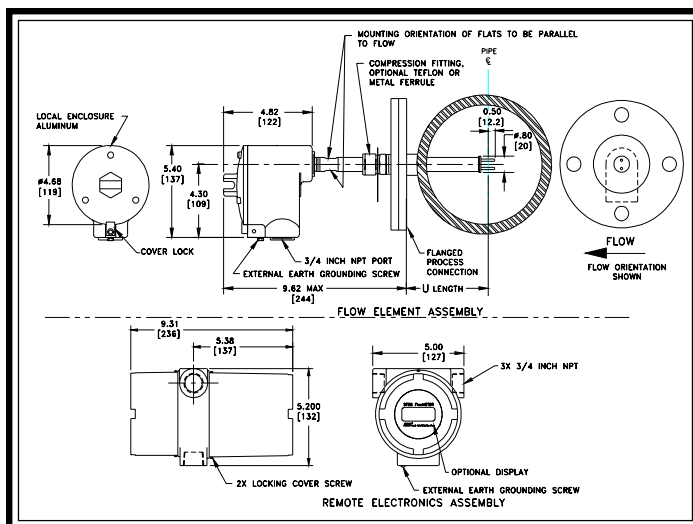
Below are the most common instrument mounting options shown in a typical customer process. See the Installation Section in the ST98 Manual, Document Number 06EN003291 for more details.



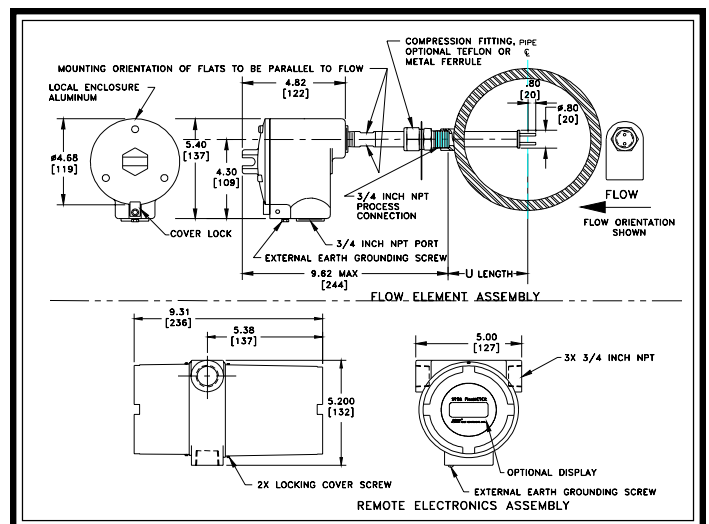
Flanged Integral Instrument (Cylindrical Enclosure)



NPT Integral Instrument (Cylindrical Enclosure)

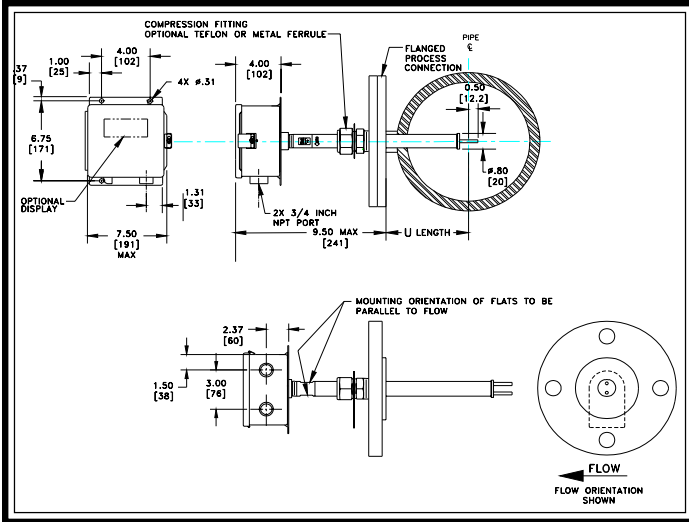


Flanged Remote Instrument (Cylindrical Enclosure)

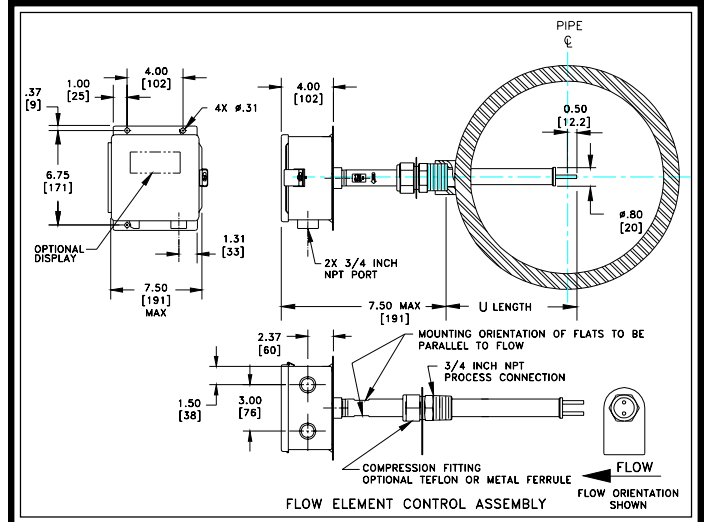


NPT Remote Instrument (Cylindrical Enclosure)

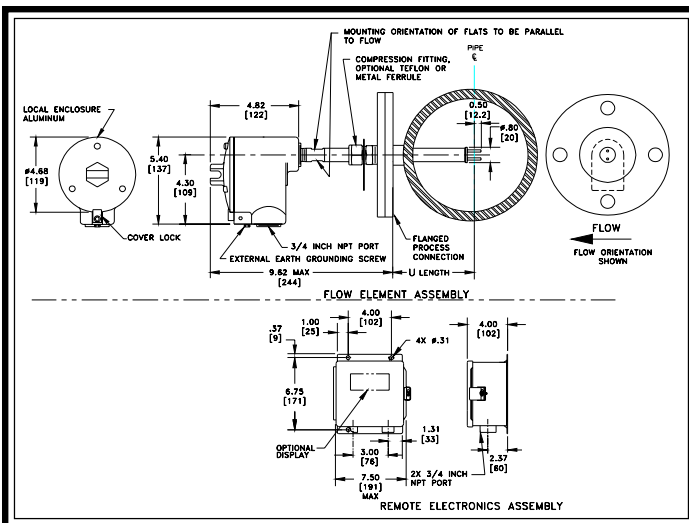
Step 2. Flow Element Installation (Continued)



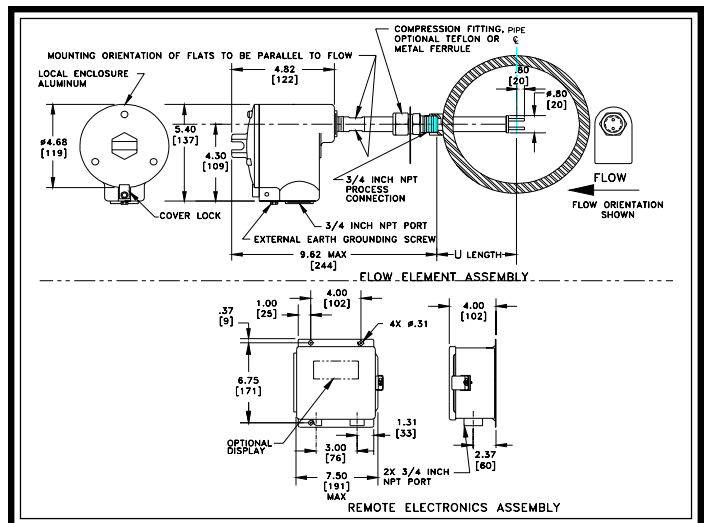
Flanged Integral Instrument (Box Enclosure)



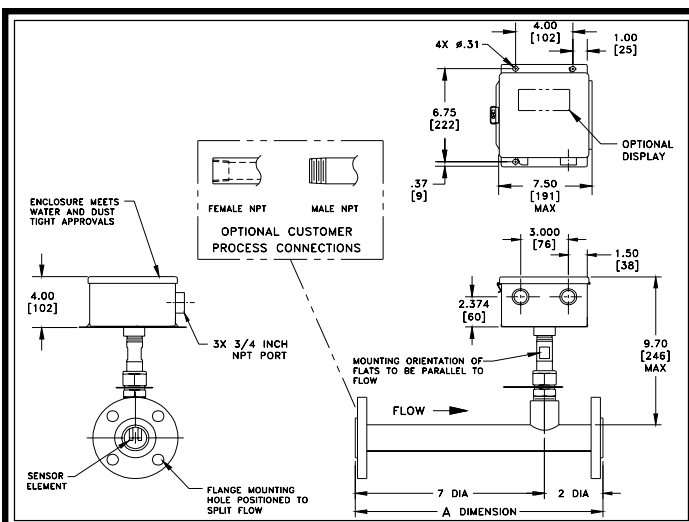
NPT Integral Instrument (Box Enclosure)



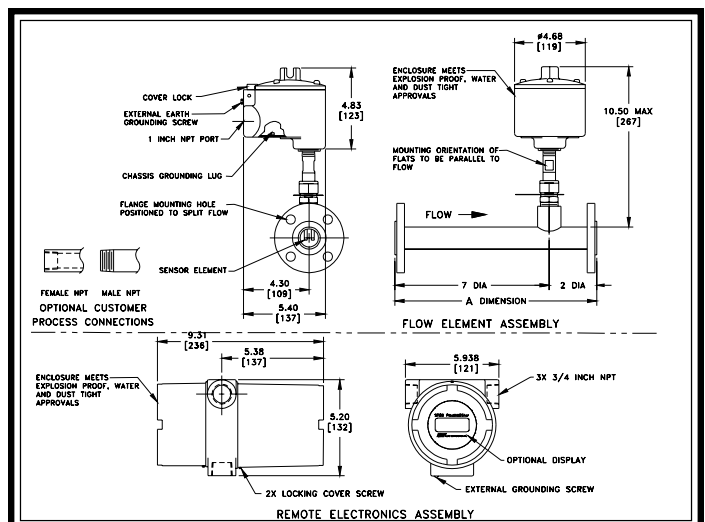
Flanged Remote Instrument (Box Enclosure)



NPT Remote Instrument (Box Enclosure)



In-Line Integral Instrument (Box Enclosure)



In-Line Remote Instrument (Cylindrical Enclosure)

Note: Not shown; In-line Remote Carbon Steel Enclosure or In-Line Integral Aluminum Enclosure.

Step 3a. Wiring Preparation (Cylindrical Enclosure Option)

Before the instrument is opened to install the wiring, FCI recommends that the following ESD precautions be observed:

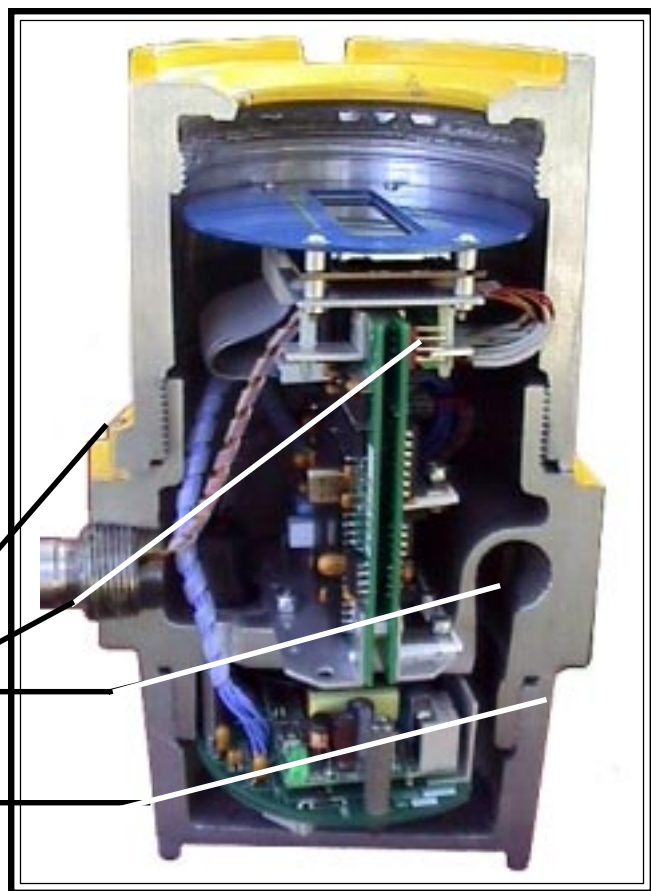
Use a wrist band or heel strap with a 1 megohm resistor connected to ground. If the instrument is in a shop setting there should be static conductive mats on the work table and floor with a 1 megohm resistor connected to ground. Connect the instrument to ground. Apply antistatic agents such as Static Free made by Chemtronics (or equivalent) 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.

Open the instrument as shown to wire the instrument:

- A. Loosen 1 Allen Screw and unscrew the bottom cover. The customer termination board is uncovered.
- B. Route conduit to the enclosure. Wire the termination board per the wiring information on the next pages.
- C. For Remote Installations Only: Loosen 1 Allen Screw and unscrew the top cover. Access to plug TS2 will be required to wire the instrument per the remote installation information on the Page 7.

(Connector TS2)



- D. When finished wiring, replace the cover(s) and tighten the Allen screw(s). See the Installation Section in the ST98 Manual, Document Number 06EN003291 for more details.

Step 3b. Wiring Preparation (Box Enclosure Option)

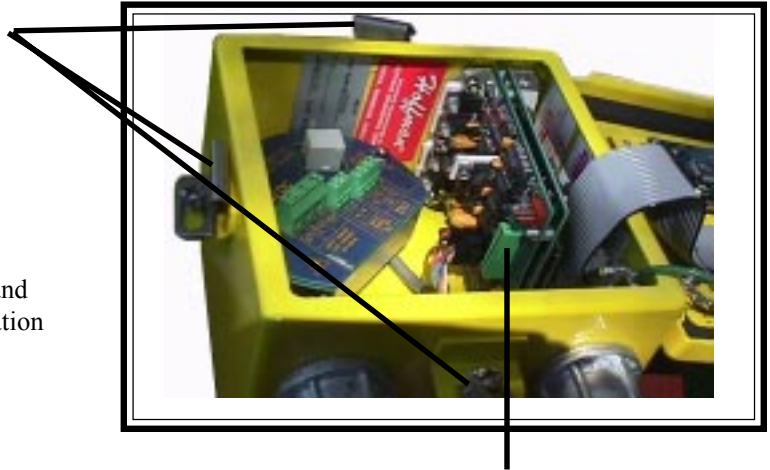
Before the instrument is opened to install the wiring, FCI recommends that the following ESD precautions be observed:

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 such as Static Free made by Chemtronics (or equivalent) 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.

Open the instrument as shown on the next page to wire the instrument:

- A. Loosen the hold down tabs on the square (carbon steel) enclosure (3 places) and open the lid. This gains access to the instrument's electronics.
- B. Route conduit to the enclosure. Wire the customer termination board per the wiring information on the next pages.
- C. When finished wiring, close the enclosure and tighten the hold down tabs. See the Installation Section in the ST98 Manual, Document Number 06EN003291 for more details.



(Connector TS2 For Wiring the Remote Option)

Step 4. Wiring the Instrument

Caution: Only qualified personnel are to wire or test this instrument. The operator assumes all responsibilities for safe practices while wiring or troubleshooting.

Alert: The instrument contains electrostatic discharge (ESD) sensitive devices. Use standard ESD precautions when handling the flow transmitter.

Wiring the Instrument into the Customer Application:

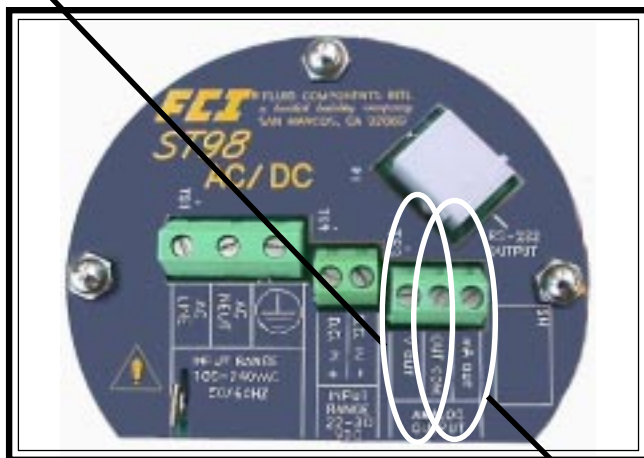
This section describes proper wiring to the transmitter inputs, outputs and interconnection cabling for the optional remote configuration. For best results route the output wiring through the opposite port from the power wiring. See the table below to determine the size of wiring to be used versus the length of the wire.

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

Wiring the Instrument's Analog Signal Output to the Customer Application:

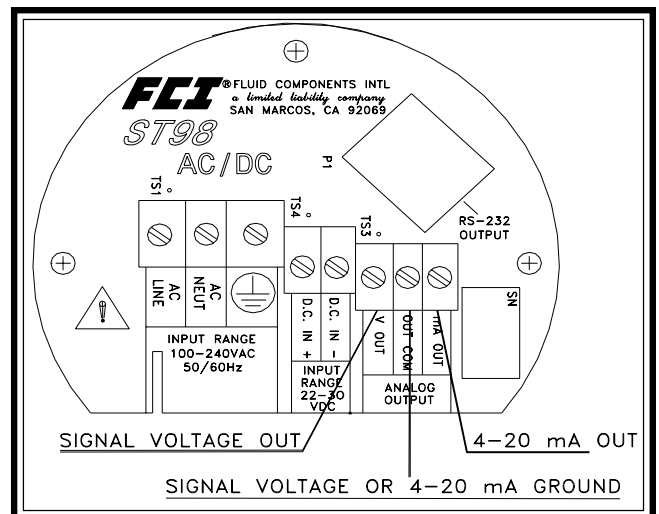
VOLTAGE OUTPUT OPTION

For Voltage Output: 0 - 5 Volts, or 0 - 10 Volts.
Connect the positive output wire to V OUT and the common output wire to OUT COM.



CURRENT OUTPUT OPTION

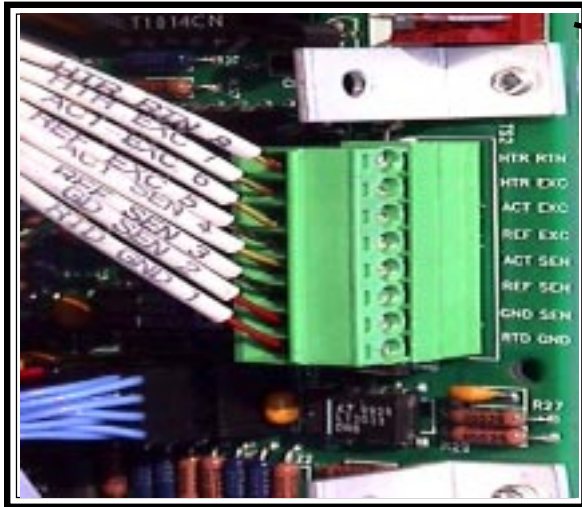
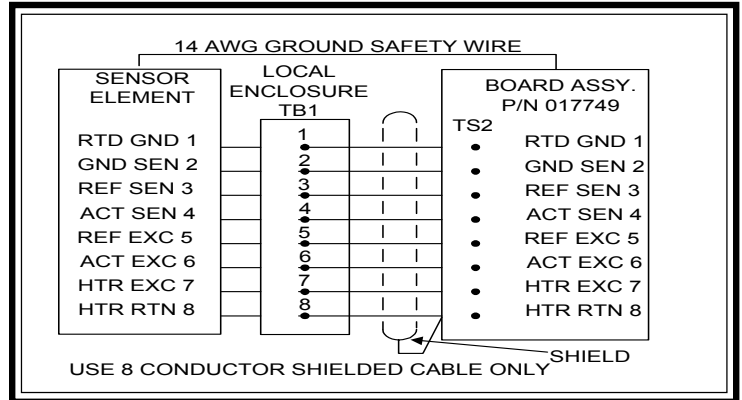
For Current Output: 4 - 20 mA.
Connect the positive output wire to mA OUT and the common output wire to OUT COM.



Customer Connection Board
Terminal Block TS3 Wiring Diagram

Wiring the Remote Instrument (Option):

Install a shielded, 8 wire cable between the remote enclosure and the local enclosure as shown. The Shield wire and the Heater Return wire must be connected together and inserted into the connector. The connector is plugged into the connector (TS2) at the top of the board as shown. Use the schematic representations of the mechanical assemblies as a wiring guide.



TOP EDGE OF CIRCUIT BOARD IN REMOTE ENCLOSURE

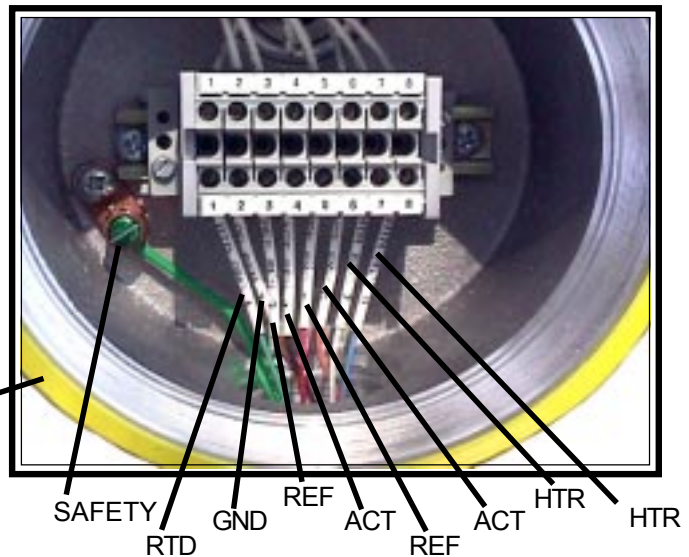
CABLE FROM LOCAL ENCLOSURE (Shield and HTR RTN are connected here)

FLOW ELEMENT WIRES

TERMINAL BLOCK

WIRING TO REMOTE ENCLOSURE

LOCAL ENCLOSURE



NOTE: The Shield Is Not Connected To Or In The Local Enclosure.

Wiring the Input Power:



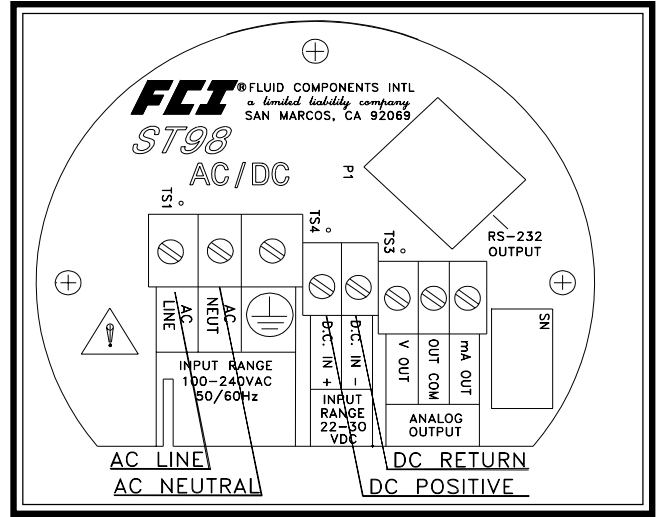
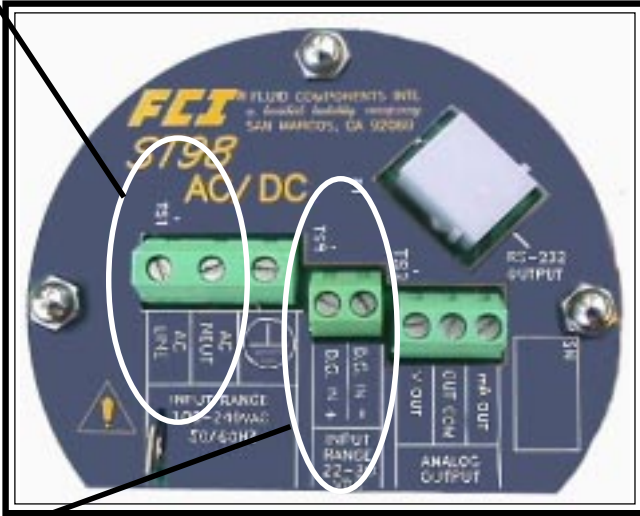
Caution:

FCI recommends placing an ON/OFF switch in line with the power source. When TS1 or TS4 is connected to the power source, the instrument is ON.

AC or DC power (not both) can be used to operate this instrument. For best results route the output signal wiring through the opposite port from the power input wiring. See the wiring table on the previous page to determine the size of wiring to be used versus the length of the wire run to the power source.

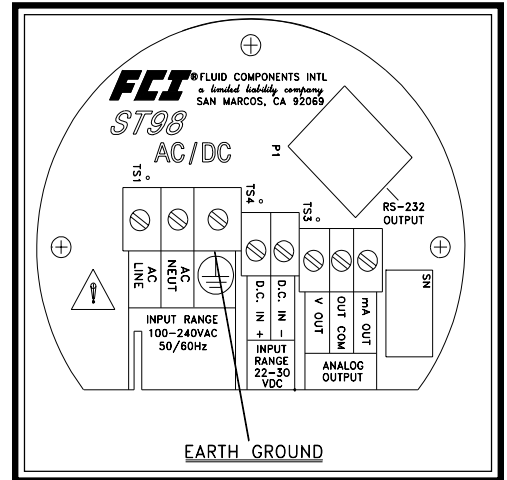
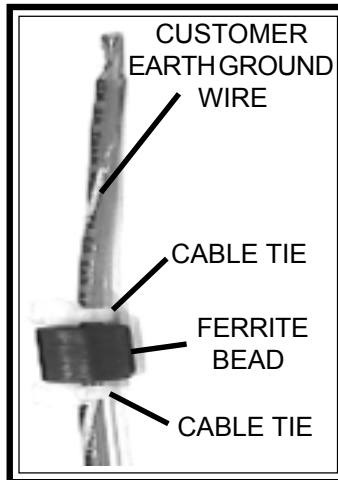
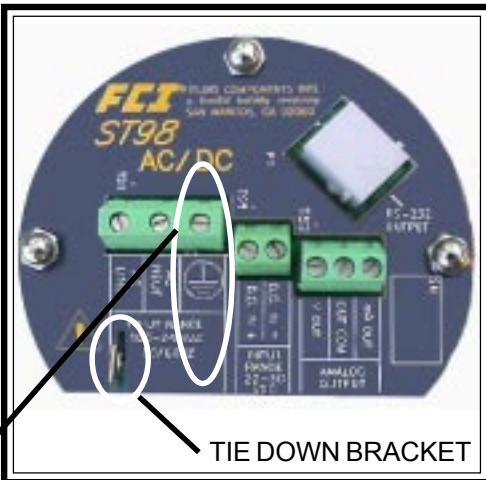
AC Power Option

Connect AC power (100 - 240 VAC, 50 - 60 Hz) to the instrument (TS1). Connect the AC line wire to AC LINE. Connect the AC Neutral wire to AC NEUT.



DC Power Option

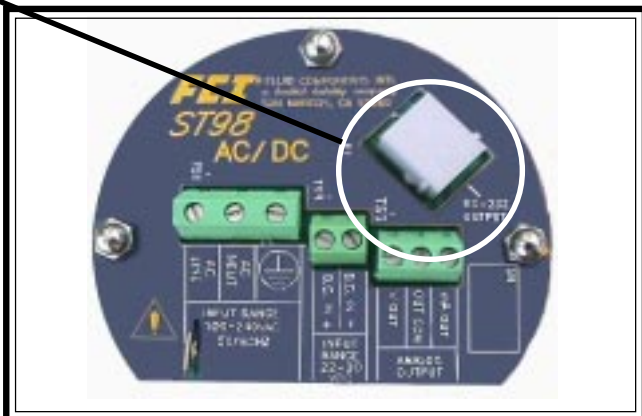
Connect DC power (22 - 30 VDC) to the instrument (TS4). Connect the positive power wire to D.C. IN +. Connect the negative return power wire to D.C. IN -. Connect an Earth Ground wire to the EARTH Ground terminal.



Earth Ground (Safety)

Connect an earth ground wire to TS1 (⊕) terminal. The ground wire is customer supplied. The instrument is supplied with a ferrite bead and cable ties to secure the bead over the wire. A cable tie is provided to tie the wires (power and ground) to the attachment post for the purpose of wire stabilization.

Wiring the Serial Communications (FC88) Connections (If Needed):



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 periodic re-configuration and/or diagnostics. See the left hand figure for the location of P1. This connection is a RJ-12 communication (phone) jack.

Step 5. Operation

Before applying power to the instrument, be sure it is connected properly and that the covers are closed.

Apply power to the instrument. Wait 10 minutes for the instrument to stabilize. During this period the instrument may indicate a high flow condition. After stabilization, the instrument displays an initialization sequence followed by normal operation information.

Step 6. Troubleshooting

Open the bottom enclosure lid to expose the customer connection board.

Connect the FC88 or computer to the RS-232 Jack (P1).

Set the FC88 communicator or computer to display the **T** mode (normal operation).

Turn on the NAMUR fault flag, menu **X** (Press X on the FC88 or computer and follow the menu path).

Compare the fault indication from the **T** mode with table below. Follow the instructions provided in the table.

| Indicated Faults | Possible Causes |
|--|--|
| Nothing displayed on the FC88 or the optional display. No display on the FC88 no display on the optional display. | Power is not applied to the instrument. Power is not correctly applied to the customer connection board. A green LED lights when AC power is applied. It is on the back side of the customer circuit board behind P1 (it is hard to see). If it is blinking remove power and contact customer service. |
| No display on the FC88. There is a display on the optional LCD display. | Press [P] [ENTER] on the FC88 to reset. If no response connect it to another ST98 (if present) to verify operation. Replace the cable between the ST98 and FC88. If no operation contact customer service. |
| No fault indicated. Output mA or Vout operates correctly. | Verify the NAMUR option is activated [X] [ENTER]. If no fault shown, verify the heater is on [H] [ENTER]. If no fault is shown, refer to the ST98 Manual, Document 06EN003291. |
| No fault indicated but the 4-20 mA (or Voltage) output is not transmitting. | Go to the Instrument Output Check procedure in the ST98 Manual, Document Number 06EN003291. |
| Sensor Error. | Sensing element wires may be disconnected, shorted or connected to the wrong place. The active or reference RTD is open or shorted. See the ST98 Manual, Document Number 06EN003291 for further troubleshooting. |
| OverTemp Head!! | The process temp exceeded the max. temperature rating of the flow element (350°F). Verify the process temp. If the temp is over 350°F, damage to the sensor element will occur. Contact customer service. |
| UnderTemp Head!! | Process temp exceeded the min. temp of the sensor element. If the temp. is under -50°F, damage to the flow element occurs. Contact customer service. |
| Open Heater!! | The sensor element's heater exceeded the max resistance (about 170 ohms) or is disconnected. This limit includes the cable resistance in remote installations. The heater fault flag is on when the heater is turned off (using the menu key [H] [ENTER]). Check wiring and sensor resistance. |
| Shorted Heater!! | The sensor element's heater exceeded the minimum resistance (approximately 90 ohms) or it is shorted. This limit includes the cable resistance on remote installation. The heater fault flag comes on in cases when the heater is turned off (using the menu key [H] [ENTER]). Check the wiring and the sensor resistance. |

If there are still problems with the instrument, see the Troubleshooting Section in the ST98 Manual, Document 06EN003291. To acquire a manual call FCI Customer Service at 1 (800) 854-1993.

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