5. Troubleshooting

Warning: Only qualified personnel should attempt to test this instrument. 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 Chapter 2, Installation, for ESD details.

Quick-Check Troubleshooting

At this point, observe the system setup to verify operation. Use Table 5-1 as a quick check of problems and solutions. More in-depth discussions follow this table.

Table 5-1. Quick Check Troubleshooting

PROBLEM	SOLUTION
No Output	Check power application, check power supply fuse.
Flashing LED	Set SW2 on the control board to the total number of sensing points.
Unexpected Outputs	Check all connectors for proper seating. Switches SW1-1 through 1-3 should be open, 1-4 is a temp. comp. switch, that is open when temp. comp. is used and closed when temp. comp. is not used. Check jumper positions (factory set positions are jumpers 1, 3, 5 and 7 installed). The above switches and jumpers are on the control board. Check the flow elements FLAT and FLOW ARROW versus the flow media.

Troubleshooting Equipment

2 each, Digital Multi-Meter (DMM) capable of measuring ohms, milliamps, and AC or DC voltage with a 4 1/2 digit resolution.

3 each, precision decade resistance boxes (however they are optional if fixed precision resistors are used).

1 each, 1K ohm resistor for model MT86 or 100 ohms for model MT86HT.

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 elements and the flow transmitter are a matched set and cannot be operated independently of each other. See Chapter 2 for a complete explanation of serial numbers.

Check Input Power

Verify that the correct power source is turned on and connected.

Check Instrument Installation

Review the instrument installation information given in Chapter 2 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.)

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 will drive the flow measurement higher than the true measurement.

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 Flow Element Placement

If there are measurement errors check for process flow irregularities. A swirling or pulsating flow can exist near valves, elbows and other obstructions. The flow element should be placed in a straight pipe run with 20 pipe diameters upstream of the flow element, and 10 pipe diameters down stream of the flow element.

Check Flow Element Orientation

Verify that the FLAT on the flow element is parallel to the pipe and the FLOW ARROW points in the direction of the flow stream. If the FLAT and the FLOW ARROW are not correct, the flow measurement will not be correct. See Chapter 2 for the instructions on proper installation.

Check Proper Flow Element Insertion Depth

The flow element's sensing points must be located at the center line of the pipe unless the factory specifies otherwise. Improper insertion depth may cause error in the flow measurement. See Chapter 2 for the instructions on proper installation.

Check Flowmeter Switch Positions

Switches SW1-1, SW1-2 and SW1-3 should be in the open position. Switch SW1-4 should be in the open position if the temperature compensation mode is used. Switch SW1-4 should be in the closed position if temperature compensation is not being used. An easy way to verify temp. comp. is used is to see if the top of the null and gain potentiometers have been sealed. If they are sealed the flowmeter is setup to use temperature compensation. If they are not then no temperature compensation is used. (An open switch is the switch depressed on the left or lower side of the switch bank.

Verify that the head-select switch SW2 is set on the number that corresponds to the last sensing point that is connected to the flow transmitter.

Verify that the switch SW4 is in the OP position.

Troubleshooting Process

Verify Delta " R" Sheets

Verify that the Delta "R" sheets in the rear of this manual match the flowmeter's serial number. If there is a miss-match the calibration could be incorrect. Contact FCI if the proper Delta "R" Sheets are missing.

Verify Faulty Flow Elements

Caution: Inform all personnel involved with monitoring the flow media that the flowmeter output readings may change. The change of output could affect the plant peripheral equipment and or alarms.

To identify a bad flow element rotate the Head-Select switch, SW2, through its numbered positions. Pause at each position to monitor a red Light Emitting Diode (LED), CR1. CR1 is located on the MT86 Control Board. If a problem exists with a sensing point, the LED will flash. The LED may also flash if there is no sensing point that corresponds to the switch position. If the Head-Select switch is pointing to a valid sensing point and the LED is flashing the sensing point is bad.

Verify Resistance Readings

Use Figure 5-1 and Table 5-2 to determine if the flow elements are wired incorrectly or have failed. Turn the power OFF to the flow transmitter. Unplug the problem flow element at the Input Board. Measure the resistances described below by touching the DMM test leads to the terminal screws. (Remember to reconnect the flow element when the troubleshooting is finished.)

Note: If the system process does not allow the flowmeter power to be disconnected or the flow elements to be unplugged then proceed to the section, In-Depth Troubleshooting - Voltage Measurements.

All resistances in Table 5-2 are based on a temperature of 32°F (0°C). Resistances across the ACT and the REF RTDs for an MT86 are approximately 1000 ohms, resistances for an MT86HT are approximately 100 ohms. The resistances will continue to increase for higher temperatures at the sensing points. Resistance values will vary with temperature.

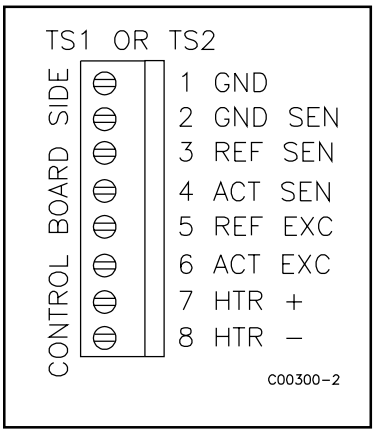

Figure 5-1. Terminal Plug

Table 5-2. Terminal Plug Resistances

Pin Number	Approximate Resistances
2 to 3	1000 Ohms*
2 to 4	1000 Ohms*
2 to 5	1000 Ohms*
2 to 6	1000 Ohms*
8 to 7	220 Ohms

*For the MT86HT flow element divide by 10.

The resistance of the active RTD will be greater than the resistance of the reference RTD whenever the heater is on and the flow rate is below the high-limit flow. Also if the flowmeter has been on for some time, the resistance of the active RTD will be greater than the reference until it cools down.

The flow element cable has a shield that ONLY connects to the flow transmitter side of the cable. There is no shield connected to the flow element.

If one sensing point appears to be an open circuit and the other sensing point appears to be twice the resistance, a wiring problem probably exists.

Voltage and current checks can be made on the flow elements. Before checking the flow element voltages and current, other voltages need to be verified first. See the following paragraphs for the proper sequence of checks to make.

If the flow element is bad, replace it with a spare flow element. Return the bad flow element to FCI for repair and, or replacement. See Appendix C for the Customer Service return procedure.

Troubleshooting Process - Voltage Measurements

Verify the use of the correct power source. Verify the power source is on and that the wiring matches the wiring diagram in Figure 2-2 of Chapter 2.

If the flow element resistance and wiring check out, recheck the power supply; the fuse and the AC and DC voltages. The power supply should be suspect when there seems to be multiple failures in the flowmeter.

Perform the following voltage checks with power applied to the flowmeter. The flowmeter should be put in normal operating conditions. Make all measurements with the use of a DMM that has a differential (non-grounded) input.

Note: The flow element sensing point voltage readings are for 1000 ohm RTDs.

Power Supply Source Voltages

Measure the power source at the power supply terminal block TS1 to be sure the correct power is applied.

Check the power supply voltages, using the test points provided. See Table 5-3 and Figure 5-2 for the proper operating voltages. If the voltage checks are correct, the power supply is functioning properly.

Table 5-3. Power Supply Voltages - Power Supply Board

POSITIVE LEAD (+)	NEGATIVE LEAD (-)	MEASURED VALUE
TP1	TP4	28 Vdc ±1 Vdc
TP2	TP4	15 Vdc ±.6 Vdc
TP3	TP4	5 Vdc ±.3 Vdc
TP5	TP4	-5 Vdc ±.3 Vdc
TP6	TP4	-15 Vdc ±.6 Vdc
VC6	VGND	-26.43 Vdc ±1 Vdc*
VC1	VGND	43.4 Vdc ±2 Vdc*

*Measurement points are not available on some power supplies.

If operating power is at terminal block TS1 and the test points do not have power, check fuse F1 on the power supply board.

Remove power and unplug the power supply from the control board. Apply power to the power supply and re-measure the voltages as shown in Table 5-4. If the voltage is still missing, then remove and replace the power supply.

Make the following measurements at the control board terminal strip. See Figure 5-3 and Table 5-4 for the measurements.

Table 5-4. Power Supply Voltages - Control Board

Positive Lead (+)	Negative Lead (-)	Measured Value
TP15	TP16	10 Vdc ±.02 Vdc
RN1 PIN 3	TP16	5 Vdc ±.04 Vdc
U5 PIN 7	TP16	-10 Vdc ±.06 Vdc

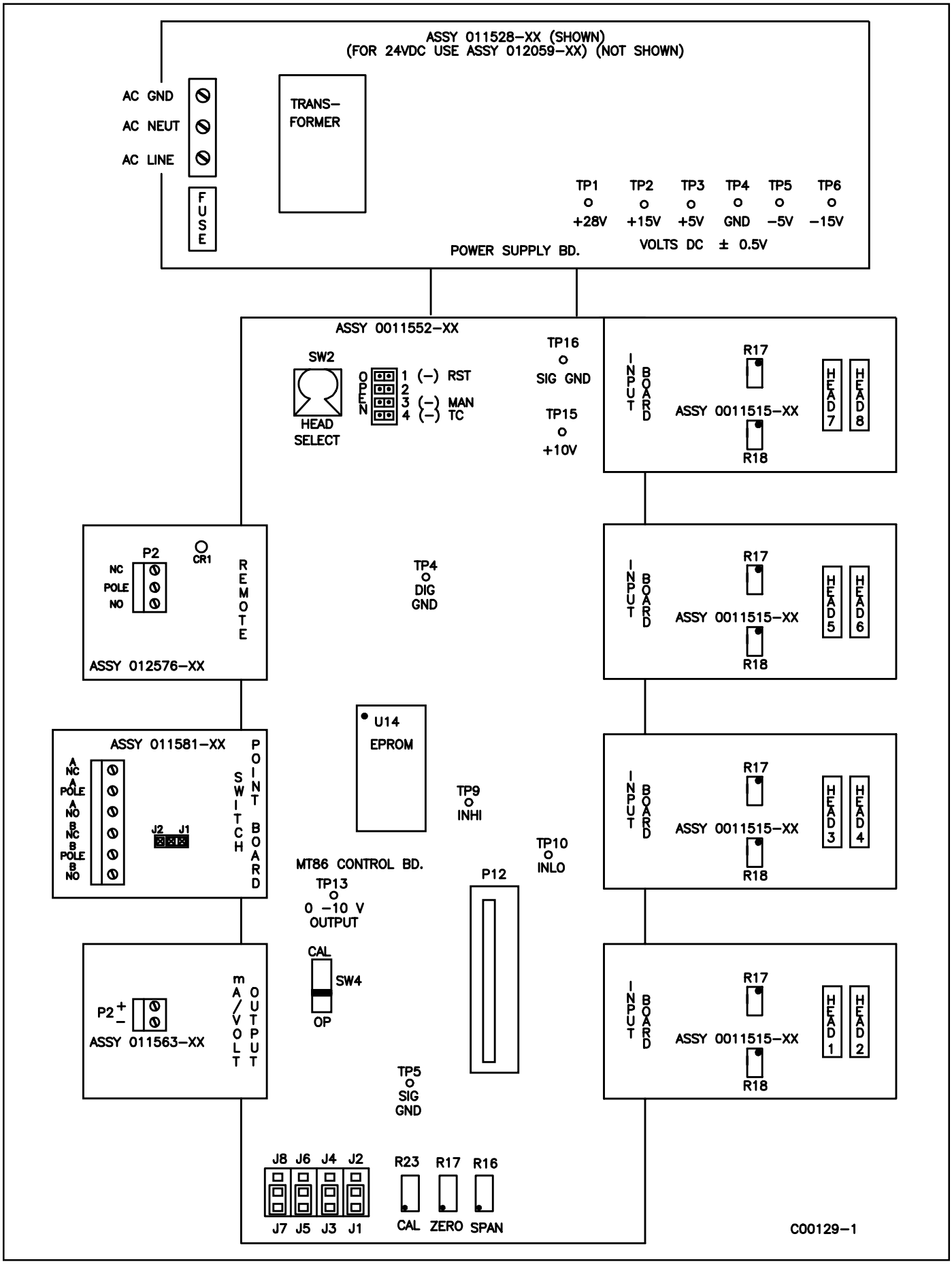

Figure 5-2. Electrical Assembly Layout

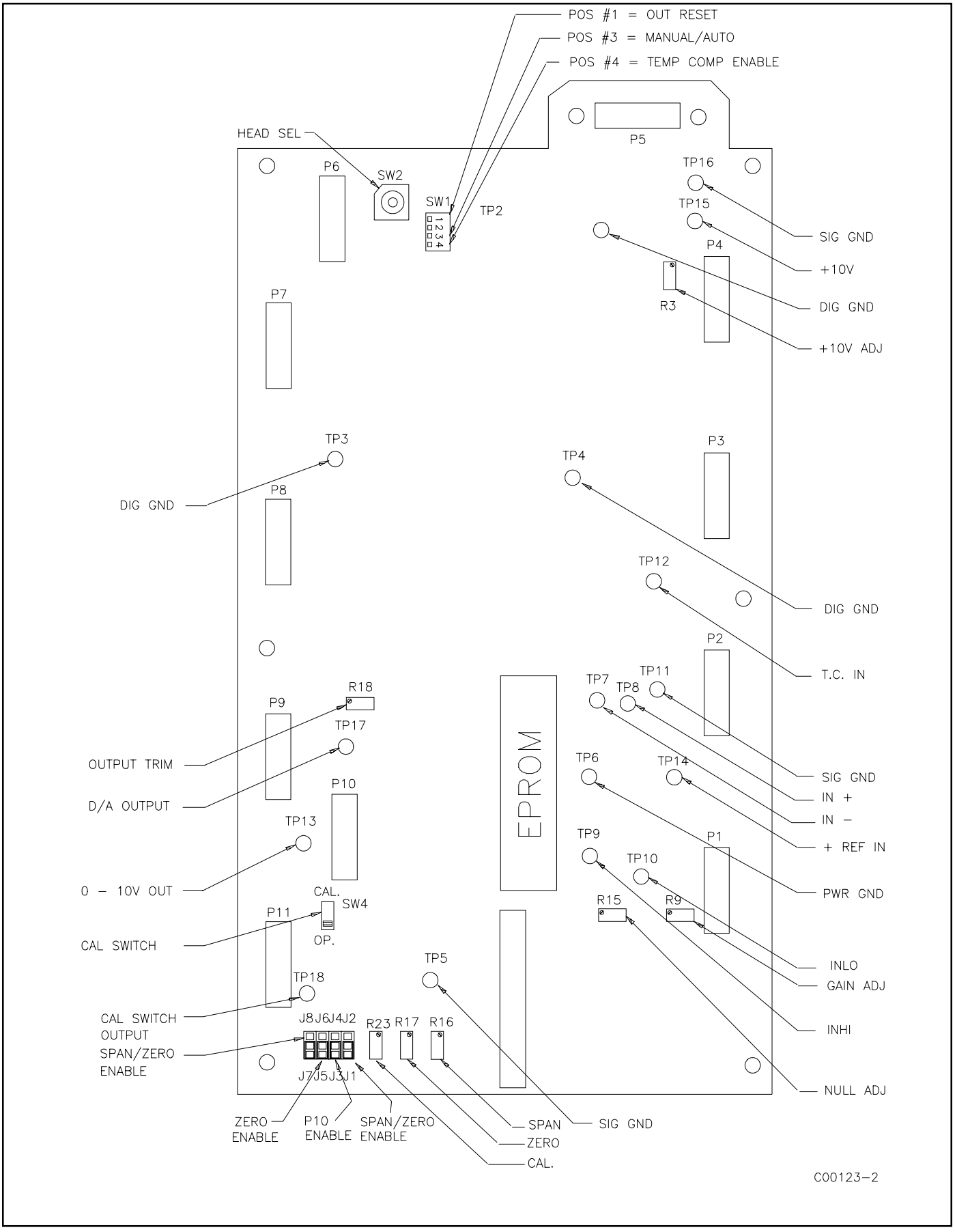

Figure 5-3. Control Board Layout

If a voltage is missing, unplug all the input and output boards. Measure the voltage again to see if the voltage has returned. If it has returned plug in the boards one at a time until the board is found that is loading the circuit. Remove and replace the board. If the voltage does not return, replace the control board.

Flow Element Operating Voltages

Close switch SW1-1. All output signals should go to the minimum signal level. Return switch SW1-1 to the open position after testing. Make the following measurements at the input board terminal strip. See Table 5-5 and Figure 5-1 for the measurements.

Table 5-5. Input Board Terminal Voltage Check

Positive Lead (+)	Negative Lead (-)	Measured Value	
		MT86	MT86HT
HTR +	HTR -	16.5 Vdc	16.5 Vdc ±1%
REF SEN	GND SEN	1.10 Vdc	0.275 Vdc*
REF EXC	GND SEN	1.10 Vdc	0.275 Vdc*
ACT SEN	GND SEN	1.25 Vdc	0.275 Vdc*
ACT EXC	GND SEN	1.25 Vdc	0.275 Vdc*

*The above readings are at 80°F (27°C) and 14.7 PSIA and at no-flow. The readings will vary with temperature and flow. However, the reference voltages should always match and the active voltages should always match. The active voltages should be higher than the reference voltages.

Troubleshooting Process - Flow Element Current

To measure the currents put a DMM in series with the desired lead. See Table 5-6 for the measurements.

Table 5-6. Current Measurements

Component	Measured Value (mA DC)	
	MT86	MT86HT
REF SEN	0.00	0.00
ACT SEN	0.00	0.00
REF EXC	1.00	2.50
ACT EXC	1.00	2.50
HTR +	75.0 ±5%	75.0

If there are no problems, the flow elements are good. Further trouble shooting must concentrate outside of this area. Go to the following sections.

Field Calibration Techniques

The flowmeter circuit cards and the flow element can be replaced as separate items. A field calibration is needed after the replacement of the parts.

Warning: Only qualified personnel should test or repair the instrument. The operator assumes all responsibilities for safe practices while trouble shooting. Damage due to negligence or lack of technician skill is not covered by the warranty.

Note: If field repair is attempted, replacement parts must be of the same part, type and number.

Calibration Verification Procedure (Using Decade Boxes)

Note: ALL MT86 flowmeters have 1000 ohm RTD sensing points.
ALL MT86HT flowmeters (high temperature flow elements) have 100 ohm RTD sensing points.
Determine which MT86 model type is present and use the ohm value that corresponds to the model type.

Verify each sensing point one at a time. Select the manual operation mode of the flow transmitter by closing switch SW1-3. When the flowmeter is in the manual mode, the flow transmitter monitors only the sensing point that the head-select switch SW2 selects.

Refer to the Delta "R" table for:

1. Delta "R" value in ohms
2. Vdc across 250 ohms
3. Milliamp output signal values
4. Raw signal (un-linearized)
5. 0-10 Vdc analog output signal
6. Display flow rate reading (in customer units) for each signal

Apply the recorded Delta "R" input values to the selected input terminal on the input board. Having the correct data sheet for the correct input terminal is important.

Procedure

If an FC81 Field Calibrator is used, then go to the verification with a field calibrator procedure.

1. Turn OFF the power to the instrument. Disconnect the flow element cable from the input board terminal block TS1.
2. Connect two decade boxes or one decade box and a fixed resistor to terminal block TS1 (or TS2 as applicable) on the input board as shown in the diagram of Figure 5-4.
3. Connect the positive lead of the DMM to the jumper J8 or to test point TP13 located at the bottom of the control board. Connect the negative lead to the signal ground TP5(-). This readout is the analog signal, 0-10 Vdc, that is before the span and zero activation circuitry.
4. Close switch SW1-3 that puts the flow transmitter in the manual mode; this enables the head-select switch SW2 to select and monitor one sensing point.
5. Verify that switch SW4 near the bottom of the control board is in the OP (OPerate) position.
6. Set the head-select switch SW2 to position number one; this selects the terminal block TS1 input where the decade boxes are connected.
7. Set the decade box for the reference sensing point to 1000.00 ohms (100.00 ohms for HT).
8. Refer to the Delta "R" Data Sheet and set the decade box for the active sensing point to 1000.00 ohms (100.00 ohms for HT) plus the recorded Delta "R" resistance value for each sensing point that is designated by SN - #.

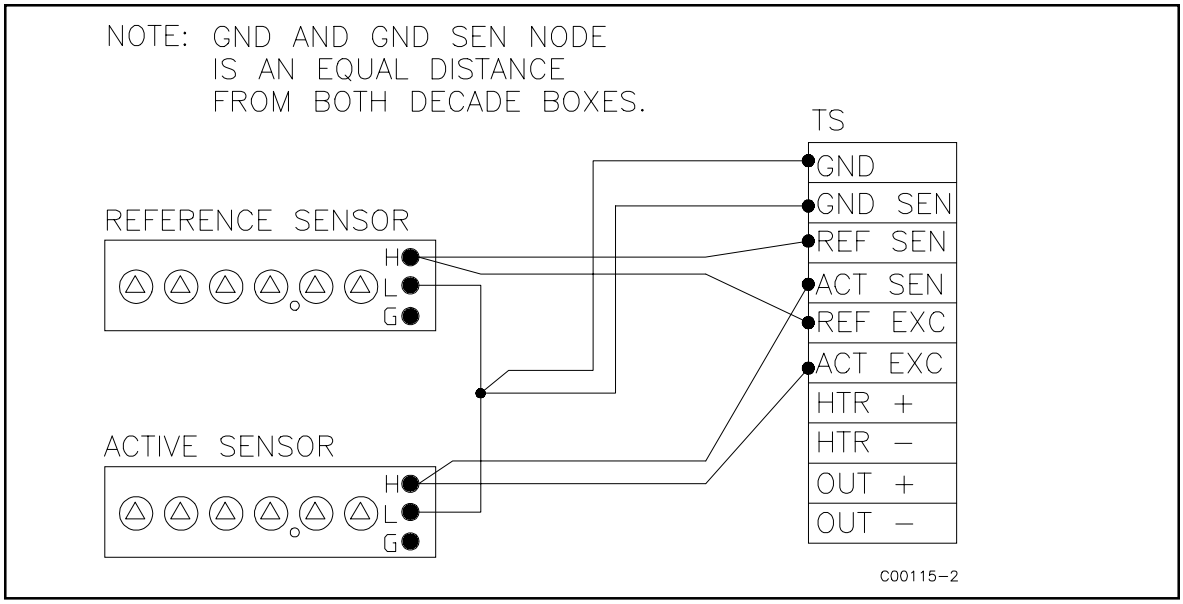

Figure 5-4. Decade Box Wiring Diagram

9. Turn the power ON and let the system stabilize for 1 minute. If the LED (CR1) is flashing, recheck the wiring per Chapter 2.
10. Read the signal displayed on the DMM. It should be equal to the signal value recorded on the Delta "R" Data Sheet ± 0.20 Vdc.
11. Repeat the above steps for other values on the Delta "R" Data Sheet. Adjust the active decade box to give one of the recorded output signals. Then, determine what the Delta "R" value setting is and compare it with the recorded value from the Delta "R" Data Sheet. The Delta "R" values should be equal to within ± 1.25%.
12. Repeat this verification procedure for each of the sensing points in the system. Be sure to use the proper Delta "R" Data Sheet for each sensing point being verified.
13. Upon completion of the verification procedure, set the head-select switch SW2 to the number of sensing points present in the system. The flow transmitter only scans the number of flow elements set on head-select switch SW2. Open SW1-3 for the automatic mode. Leaving these switches set in the wrong positions will cause an operation error.

Calibration Verification Procedure (Using an FC81 Field Calibrator)

Note: All output modules and display options operate from the same 0-10 Vdc analog output signal. If the optional span and zero activation circuitry has been added to the output signal, then the Delta "R" Data for the output modules and displays will not match the values recorded on the Delta "R" Data Sheet. See the jumper listing in Table 3-1 to determine if the span and zero activation circuitry option has been added to the output signal circuitry.

The FC81 Field Calibrator replaces the decade resistance boxes and the DMM that are used in the verification procedure. The field calibrator can switch its readout between the Delta "R" resistance values and the output signal. The use of the field calibrator requires having the correct Delta "R" Data Sheets for each flow element. The field calibrator is ideal for the field verification of MT86 and MT86HT installations.

Model FC81-8 is used for the MT86 with 1000 ohm flow element sensing point RTDs.

Model FC81-7 is used for the MT86HT with 100 ohm flow element sensing point RTDs.

FC81 Field Calibrator Control Functions

The display shows the Delta "R" values or the output signal level depending on the position of the function switch. The function switch, is a 2 position push-button switch, located on the left front panel of the FC81 field calibrator.

When the function switch is pressed to the in position the Delta "R" input resistance is displayed in ohms.

When the function switch is pressed to the out position the output signal is displayed in volts (0-10 Vdc).

Note: Follow the instructions on the front panel of the FC81 field calibrator to read the digital display.

Ohms Adjust

On the right side of the front panel is a 10-turn potentiometer that is used to input the desired Delta "R" resistance values.

Add Ohms Switch

A Delta "R" value may be more than the maximum value of the ohms adjust potentiometer. If this happens, there is another push-button switch on the right hand side of the panel that adds a fixed resistance to the displayed value.

If an MT86HT has a Delta "R" value greater than 10 ohms, use the add ohm switch.

If an MT86 has a Delta "R" value greater than 100 ohms, use the add ohm switch.

The display's readout does not show the ohms added. The ohms added MUST be added to the displayed resistance for determination of the actual applied Delta "R". The ohms added and the displayed value MUST be combined to get the actual Delta "R" value.

Connector Receptacle

On the rear panel of the field calibrator is an AMP brand receptacle with round post connectors for the test cable.

FC81 Field Calibrator Operating Procedure

1. This procedure adjusts the Delta "R" values to give a recorded output signal. Then Delta "R" value reading is compared to the recorded value. This procedure verifies the proper operation of the flow transmitter. Be sure to have the correct Delta "R" Data Sheet by checking the serial number of the flow element and the serial number on the sheet.
2. Turn OFF the power to the flowmeter. Record where the jumpers are on the control board before the testing begins. Remove the connector from the input board's terminal block TS1. Remove jumpers J2 and J8 if they are present on the control board. If jumpers J1 and J3 are not installed, then install them at this time.
3. Connect the cable from the FC81 field calibrator to the input board terminal block TS1. Connect the ribbon cable to any available output module connector; P7, P8, P9 or P11.
4. Turn the power ON and allow 5 minutes for the control circuits to stabilize.
5. Close switch SW1-3 that puts the flow transmitter in the manual mode; this enables the head-select switch SW2 to select and monitor one sensing point. Select the sensing point to be tested with the head-select switch, SW2.
6. With the FC81 field calibrator function switch in the out position, to readout the output signal, turn the ohms adjust potentiometer to give a recorded voltage out.
7. Push the function switch in and read the Delta "R" (in ohms) that produced the recorded voltage out reading. Record the measured signal.
8. Repeat Steps 6 and 7 for all values listed on the Delta "R" Data Sheet. The Delta "R" Data should repeat the recorded value within 1.25% of full scale.
9. If all the measurements are within the limits, turn the power OFF and move the FC81 field calibrator to the next sensing point to be verified. Repeat the procedure for the next sensing point to be verified. When the procedure is finished, open switch SW1-3, and position the head-select switch SW2 to the number of sensing points in the flowmeter.

Switch Point Calibration Procedure

The flowmeter has field adjustable switch point relays. Relay energization is changed by moving a plug-jumper on the circuit board. Each switch point circuit has an LED which indicates the relative condition of the flow signal. In all cases, the LED is illuminated when the flow signal is below the set point. Jumper positions J1 and J2 select the energization state of the switch point relay number 1 (K1). With J1 in place, the relay is energized when the signal is above the set point. With J2 in place, the relay is energized when the signal is below the set point.

1. Connect an appropriate meter to TP13 and TP5 on the main circuit board.
2. Set the calibration switch (SW4) on the main circuit board to the CAL position. See Figure 5-2.
3. Adjust the CAL potentiometer (R23) on the main circuit board until the meter readout shows the desired switch point signal level (select the desired signal level form the calibration table).
4. If the red LED is lit, turn potentiometer R3 counterclockwise until the LED turns off. With the LED off, turn R3 very slowly clockwise, just until the LED turns on, then stop.
5. Vary the set point by turning the potentiometer (R23) clockwise and counterclockwise through the set point to see that the relay changes at the desired point.
6. Remove the meter from the test points. Seal the adjusted potentiometer (R3).
7. Set the calibration test switch to OP, the operate position.

Switch Point Verification Procedure

Note: Switch point relay boards can be located on any of the output buss connectors P7 through P9 and P11. All switch points are totally independent of each other and may be set to actuate at any flow signal.

1. Connect an appropriate meter to TP13 and TP5 on the main circuit board.
2. Set the calibration switch (SW4) on the main circuit board to the CAL position. See Figure 5-2.
3. Adjust the CAL potentiometer (R23) on the main circuit board until the test signal level passes through the switch point setting. Observe the LED to determine exactly where the set point is.
4. If the red LED is lit, within 2% of the full-scale signal range, the set point is properly adjusted. If the set point is out of tolerance, go the switch point calibration procedure above. If the set point is within tolerance go to the next step.
5. Remove the meter from the test points.
6. Set the calibration test switch to OP, the operate position.

Analog Output Test Procedure

To verify operation of the output modules and related circuitry, a convenient test signal is applied to the analog output. Use this test signal to sweep through the full signal range (0-10 Vdc) and observe operation of the output modules and customer interface circuitry.

1. Place switch SW4 in the CAL (CALibrate) position.
2. Connect a DMM between test point TP13(+) and TP5(-) signal ground.
3. Potentiometer R23 adjusts the test signal level through the full scale 0-10 Vdc operating range.
4. Observe the operation of the output modules and the customer interface circuitry.
5. When the testing is complete, return the switch SW4 to the OP (OPerate) position.

Check Procedure for Totalizer and Rate Display

Note: Setting the rate display automatically sets the totalizer.

1. Remove the rate totalizer circuit board from it's mounting position in the cabinet door.
2. Connect the ribbon cable from connector P6 on the MT86 control board to connector P1 on the rate totalizer.
3. Turn the operating power ON.
4. Examine the full scale value of the measured units to be displayed. Set the decimal point on the display to use the highest resolution available (use as many digits as possible).

Note: The Liquid Crystal Display (LCD) shows six places, however, the right two zeros of the LCD are dummy zeros that make easier decimal point placement.

5. Select the rate decimal point by installing a jumper to give the decimal point. With the jumper in position number one (far right), there is no decimal displayed.
6. Set the period jumper for the period of the rate being displayed; SEC, MIN, HR, or DAY.
7. Refer to Table 5-7 for the correct position of the totalizer decimal point.

Table 5-7. Totalizer Decimal Point Position

RATE	SEC	MIN	HR	DAY
6	2	3	5	6
5	1	2	4	5
4	3*	1	3	4
3	2*	3*	2	3
2	1*	2*	1	2
1	3**	1*	3*	1
* Use label reading thousand "XXX"				
** Use label reading milliion "XXX"				

Note: "XXX" is the Mass or Volume unit used in the Rate Display.

Check Procedure for Flowmeter Displays with Zero and Non-Zero Based Calibration

See the discussion on zero and non-zero based calibration in Chapter 3 - Operation.

1. Install jumpers in positions J1 and J4.
2. Place switch SW4 in the CAL (CALibrate) position and adjust the cal potentiometer, R23 to full scale output; 10 Vdc, 20 mA, etc,.
3. Adjust the span potentiometer (R16) to give a displayed value of full scale.
4. Adjust R23 to 0 Vdc or 4 mA.
5. Adjust the zero potentiometer (R17) to give a displayed value of the low limit.

6. Return switch SW4 to the OP (OPerate) position.

If additional technical assistance is needed, contact the customer service department at 1 (800) 854-1993.

Repair

There are no field-repairable items at the component level other than fuses.

Note: Any unauthorized repairs that are done at the component level will void the warranty.

Contact the authorized FCI field representative (see the list of regional territories and the respective agents) or the factory (see the telephone and FAX numbers at the front of this manual) to determine the best course of action.

EPROM Replacement Procedure

1. Turn the operating power OFF.

Caution: EPROMS are Electro-static Sensitive Devices (ESD). Use approved ESD procedures.

2. On the control board, remove the original EPROM from its socket (U14).
3. Store the original EPROM on Electro-Static safe foam or in an Electro-Static safe bag for possible future use.
4. Do not remove the new EPROM from its chip carrier. Install the chip carrier and EPROM as a single unit into the control board. The serial number on the new EPROM MUST match the serial number on the control board.
5. Verify the following switch positions on the control board:

   SW1-1 open
   SW1-2 open
   SW1-3 open
   SW1-4 open if temp. comp. is used. closed if temp. comp. not used
   SW2 set on the position that corresponds to the maximum number of sensing points
   SW4 OP (OPerate) position

6. If the flowmeter has a local display and the new EPROM changes the calibration range, then the display will need to be re-spanned to the new range.
7. Turn the operating power ON, and then allow five minutes for the flowmeter to stabilize.
8. Make a new Delta "R" Data Sheet for each flow element when the flowmeter is operating correctly. The new sheets will be useful when future calibration and verification checks are made.

General Circuit Board Replacement Procedure

For matching equipment, 100 ohm or 1000 ohm, see Table 5-8. Table 5-8 covers the control board and input boards. The power supply, output board, and display are interchangeable regardless of flowmeter type.

The control board is interchangeable for same type call-out. In other words, a control board for a 1000 ohm sensing element is interchangeable with another control board for a 1000 ohm sensing element, adjustments may be needed.

Table 5-8. Components for 100 and 1000 Ohm Flowmeters

CONTROL BOARD		
Adj. Pot.	**100 Ohm**	**1000 Ohm**
R8	4.99K, 1%	21.5K, 1%
Gain	20X	10X
INPUT BOARD		
Adj. Pot.	**100 Ohm**	**1000 Ohm**
R1, R7	6.65K	Not Used
RN3	1K	10K
JUMPERS INSTALLED, INPUT BOARD		
Dash No.	**100 Ohm**	**1000 Ohm**
001	N/A	J1, 2, 4, 6, 7, 8, 10, 12
002	N/A	J1, 2, 4, 6
003	J3, 5, 9, 11	N/A
004	J3, 5	N/A
JUMPERS INSTALLED, OUTPUT BOARD		
4-20 mA Output		**Jumper**
Non Zero-Based		J1, 4
Zero-Based		J1, 5

Input Board Replacement Procedure

Spare input boards MUST be factory pre-adjusted for the specific flowmeter and flow element sensing points. See Figure 5-5 for the PWB parts placement.

1. Turn the operating power OFF.
2. Disconnect the flow element cable from the input board.
3. Remove the four hold-down screws from the input board being replaced. Grasp the PWB and lift while gently rocking the board from side to side.
4. Position new PWB in the same orientation as the old PWB. Gently press down over the connector to seat it.
5. Install the four hold-down screws in the new PWB.
6. Reconnect the flow element cables to the PWB. Remove the "HTR+" and "HTR-" wires from the connectors and continue with the next procedure.
7. Perform a sensing point balancing procedure. Contact FCI customer service for the appropriate procedure.
8. When the sensor balancing procedure is completed, seal all adjusted potentiometers.
9. Turn the operating power OFF. Reconnect the heater circuit wires "HTR+" and "HTR-".

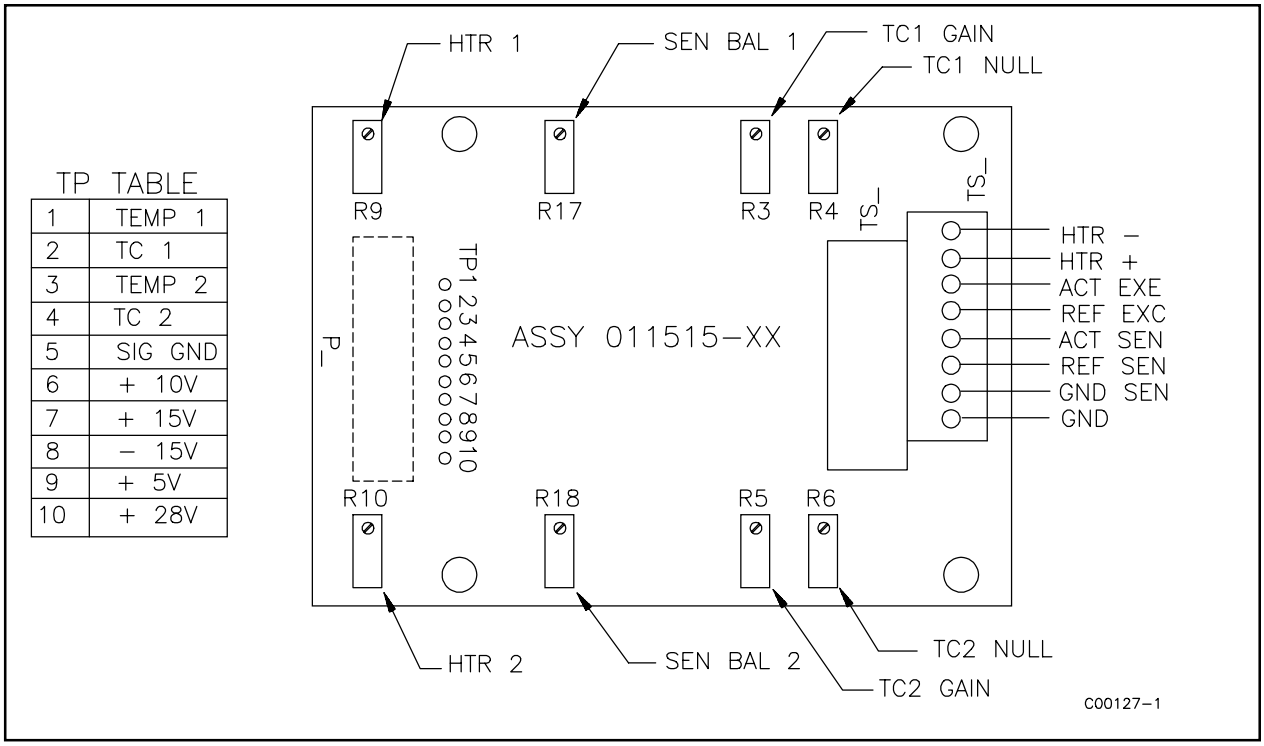

Figure 5-5. Input Board

Spares

FCI typically recommends one or more complete sets of spare PWBs and flow element assemblies depending on how critical the monitoring process is. Also recommended is the FC81 field calibrators for convenience. Contact the field representative or FCI for specific recommendations and part numbers. See Table 5-9 for spare parts and Table 5-10 for the recommended special test equipment. When ordering the PWBs the part dash numbers also need to be given to the factory. The dash numbers can be obtained by looking at the existing hardware or by looking at the Order Information Sheet that was filled out at the time the flowmeter was ordered.

Table 5-9. Recommended Spare Parts

QTY	DESCRIPTION
1	Power supply board P/N 011528-XX or 012059-XX for DC
1	Control Board P/N 01552-XX
1	EPROM with additional calibration (see factory)
1	Optional Output Modules: mA/DC voltage board P/N 011563-XX Switch point board P/N 011581-XX Remote board P/N 012576-XX
1	Input board P/N 011515-XX
1	Lithium Battery (see factory for part number)

Table 5-10. Recommended Special Test Equipment

QTY	DESCRIPTION
1	Model FC81-8 Field Calibrator for MT86 (1000 Ohm RDTs)
1	Model FC81-7 Field Calibrator for MT86HT (100 Ohm RTDs)
1	Document Number 003169 - FC81 Operating Manual

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 flowmeter, please contact the Regional or Country Authorized FCI Field Agent. There is an extensive list of these representatives at the front of this manual.
2. Before contacting the FCI representative, please be sure that all the applicable information is near so that a more effective, efficient and timely response may be provided.
3. Refer to Appendix C for specific Customer Service policy provisions.