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# 5. Troubleshooting

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**Warning:** Only qualified personnel should attempt to test this instrument. The operator assumes all responsibilities for safe practices while troubleshooting.



**Caution:** The control circuit contains electrostatic discharge (ESD) sensitive devices. Use standard ESD precautions when handling the control circuit. See Chapter 2, Installation for ESD details.

## Tools Needed

Digital Multimeter (DMM)

## Quick Check

Check the jumper positions of J12, J13, J16 and J17. Jumper J12 and J17 energize the relays at flow or wet. Jumpers J13 and J16 energize the relays at no flow.

Check that the control circuit is firmly seated into it's socket.

Check if power is present and customer fuses are good, if they are used.

Follow the trouble shooting flow chart in Figure 5-1 near the end of this chapter.

## 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 and the control circuit are the same when the instrument is used with the remote enclosure option. The flow element and the control circuit are a matched set and cannot be operated independently of each other.

### Check Input Power

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

### Check the Instrument Installation

Review the information on instrument installation in Chapter 2 to verify correct mechanical and electrical installation.

At the time of order the flow element placement should have been determined. However, if not, the flow element should be mounted at least 20 diameters downstream and 20 diameters upstream from any bends or interference in the process pipe or duct.

### Check for Moisture

Check for moisture on the control circuit. Moisture on the control circuit may cause intermittent operation.

Check for moisture on the flow element. If a component of the process media is near its saturation temperature it may condense on the flow element. Place the flow element where the process media is well above the saturation temperature of any of the process gases.

## Check Application Design Requirements

Application design problems may 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.

## Control Circuit Dash Number Specification

Verify that wiring is connected per the correct wiring diagram. To find the correct diagram look at the control circuit dash number printed on the instrument name plate. Compare the dash number to Appendix A, Figure A-10. The figure will then guide the user to find the appropriate wiring diagrams. If there is a space within the dash number there is a standard option associated with the blank. See Note 4 in Figures A-10.

## Verification of Flow Element Resistance

The measurements are based on a standard (4K ohm RTD at 70°F, or 21°C) flow element. Variation of  $\pm 100$  ohms from nominal is to be expected, depending on temperature. The maximum allowable difference in resistance between matched RTD's is 1% at ambient temperature (immersed in water). The heater resistance should be  $430 \pm 5$  ohms for each heater. The heaters are connected in parallel, therefore the combined parallel resistance is 215 ohms. Be sure to subtract the cable resistance to get the true resistance.



**Note:** When the flow element is connected to a remote enclosure control circuit, a shielded cable is to be used. Be sure that the cable shield is ONLY connected to the control circuit socket, terminal number 7. The other end of the shield should be left floating.

1. Turn off the operating power to the instrument.
2. Gently remove (pull straight out) the control circuit from the socket. Using a DMM, measure the resistance of sensor A and sensor B sensing elements.
3. Measure the resistances as found in Table 5-1 to determine if the flow element is functional.

For remote instruments, if there is a faulty reading at the control circuit socket, (control circuit pulled out) make the resistance measurements found in Table 5-2.

For the remote configuration (the control circuit is in a separate enclosure from the flow element), if an open circuit exists for one RTD and a value of twice the resistance exists for the other RTD then there is probably a miswiring or mislabeling problem.

For the local configuration (the control circuit is in the same enclosure as the flow element), if there is an indication of an open or short in the RTD, the flow element will need to be replaced.

After replacing the flow element, it will be necessary to follow the set point adjustment procedures found in the Operation Chapter before returning the instrument to service. If a millivolt output option is provided on the control circuit, the zero adjustment procedure must be performed.

If the flow element resistance is correct, proceed to the voltage verification test.

**Table 5-1. Local Flow Element Resistances In Ohms  
(control circuit enclosure)**

From Terminal (Pin)	To Terminal (Pin)	Expected Ohms*
Heater (7)	Heater (10)	215
Sen A (9)	Com Sen (8)	4000
Sen A (9)	Sen B (7)	8000
Sen B (7)	Com Sen (8)	4000

**Table 5-2. Remote Flow Element Resistances in Ohms  
(flow element enclosure when separate from the control circuit enclosure)**

From Terminal (Pin)	To Terminal (Pin)	Expected Ohms*
At Local Enclosure For Remote Option (3)	At Local Enclosure For Remote Option (4)	5000
At Local Enclosure For Remote Option (3)	At Local Enclosure For Remote Option (5)	10000
At Local Enclosure For Remote Option (5)	At Local Enclosure For Remote Option (4)	5000
At Local Enclosure For Remote Option (1)	At Local Enclosure For Remote Option (2)	215

\*Resistance varies with temperature. These values should be ±5 ohms at 70 °F (21 °C).

### Verification of Flow Element Voltage

If the above resistance checks are good, plug in the control circuit and apply power. Measure the voltages in Tables 5-3 and 5-4. If the voltages are not correct, then remove and replace the control circuit.

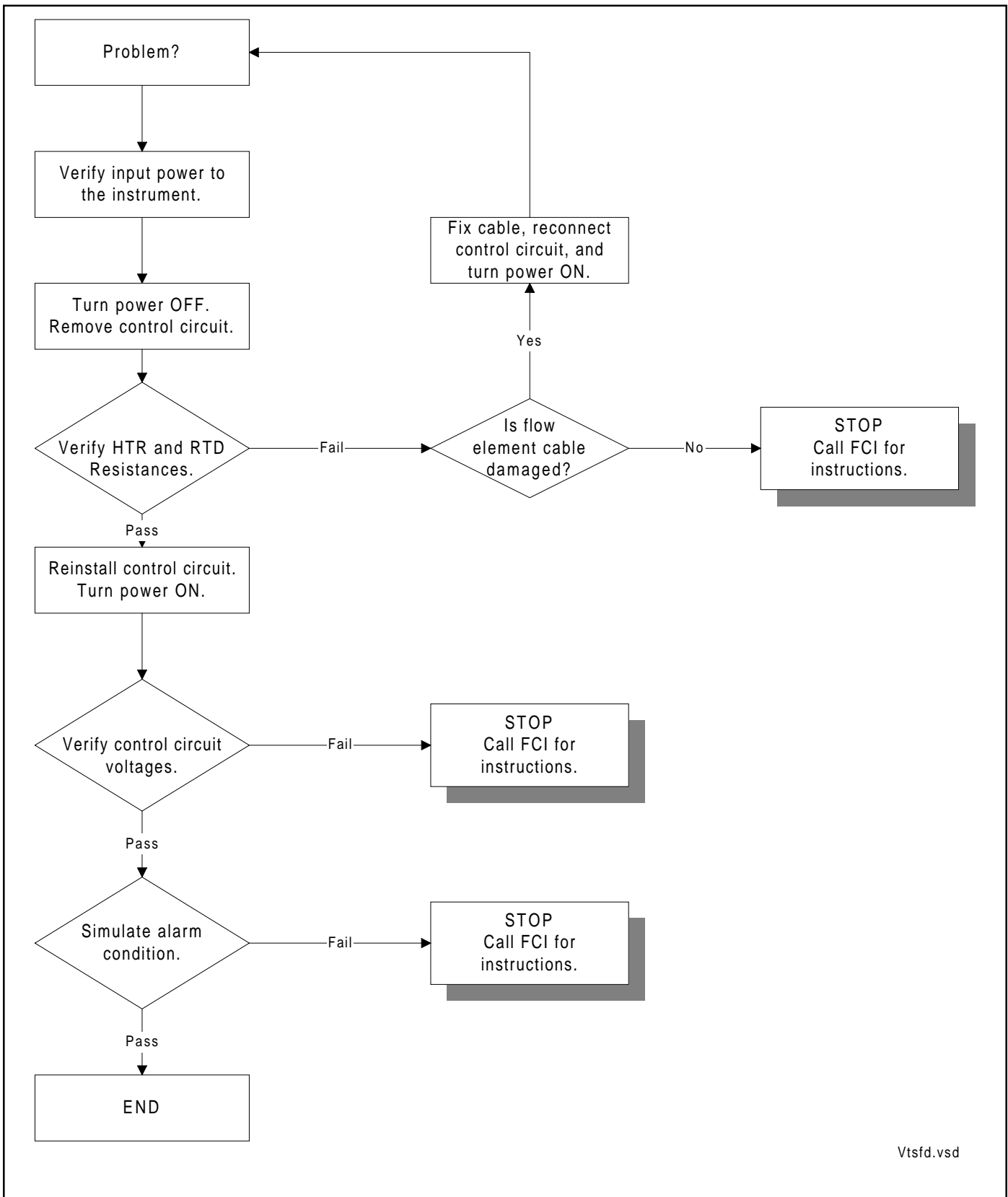
**Table 5-3. Local Flow Element Voltages  
(control circuit enclosure)**

From Terminal Pin	To Terminal Pin	Voltage Expected**
9 (+)	7 (-)	22VDC
7 (+)	8 (-)	12VDC
9 (+)	8 (-)	10VDC
10 (+)	7 (-)	22VDC (2 Watt Heater) 15VDC (1 Watt Heater) 19VDC (1.5 Watt Heater) 11VDC (0.5 Watt Heater)

**Table 5-4. Remote Flow Element Voltages  
(flow element enclosure when separate from the control circuit enclosure)**

From Terminal Pin	To Terminal Pin	Voltage Expected**
At Local Enclosure For Remote Option 3 (+)	At Local Enclosure For Remote Option 5 (-)	22VDC
At Local Enclosure For Remote Option 5 (+)	At Local Enclosure For Remote Option 4 (-)	12VDC
At Local Enclosure For Remote Option 3 (+)	At Local Enclosure For Remote Option 4 (-)	10VDC
Heater Option 1 (+)	Heater Option 2 (-)	22VDC (2 Watt Heater) 15VDC (1 Watt Heater) 19VDC (1.5 Watt Heater) 11VDC (0.5 Watt Heater)

\*\*Voltages are dependent on temperature.



Vtsfd.vsd

Figure 5-1. Troubleshooting Flow Chart

## Spares

FCI recommends that one control circuit be kept as a spare. Check the Order Information Sheet that was filled out at the time of order for the correct part and dash number. Contact FCI for specific recommendations.

## Defective Parts

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

## Customer Service

1. In the event of problems or inquiries regarding the instrument, 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, 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.

