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 applications as specified at the time of order. There is no need to perform any verification or calibration steps prior to installing and placing the instrument in service unless the application has been varied.

Pre-Installation Procedure

Warning: 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.

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

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

Damage resulting from moisture penetration of the control circuit or flow element enclosure is not covered by product warranty.

Use Standard ESD Precautions

Use standard ESD precautions when opening an instrument enclosure or handling the control circuit. 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 Sensing Element Location

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

Review the requirement for the supply power and alarm circuit connections.

Verify Dimensions

Verify the instrument's dimensions versus the process location to be sure of a correct fit. Also see Appendix A for dimensions.

Verify Sensing Element Flow Direction and Placement Orientation (Flow Application)

For flow detection, the sensing element surface marked with direction arrows should be oriented parallel to the process flow. The flow can be from either direction. See the appropriate figure in Appendix A for the flow arrow marking.

Mount the sensing 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.

For liquid flow service, the sensing element should be located in the process pipe so that the thermowells are always completely wet.

When mounted in a tee or section of pipe larger than the normal process pipe, position in a vertical run of pipe with flow upward. This will prevent air or gas bubbles from becoming trapped at the sensor assembly.

Vertical positioning with flow downward is only recommended for higher flow rate applications (consult FCI).

Verify Sensing Element Flow Direction and Placement Orientation (Level Application)

If the sensing element is side-mounted on the process vessel, then the surface marked with direction arrows should be vertically oriented.

If the sensing element is top- or bottom-mounted on the process vessel, the orientation of the surface marked with direction arrows does not matter.

Install the Sensing Element

Male NPT Mounting

When mounting the sensing element to the process pipe, it is important that a lubricant/sealant be applied to the male threads of all connections. Be sure to use a lubricant/sealant compatible with the process environment. All connections should be tightened firmly. To avoid leaks, do not overtighten or cross-thread connections. See Figure 2-1 and the appropriate figure in Appendix A for proper mounting.

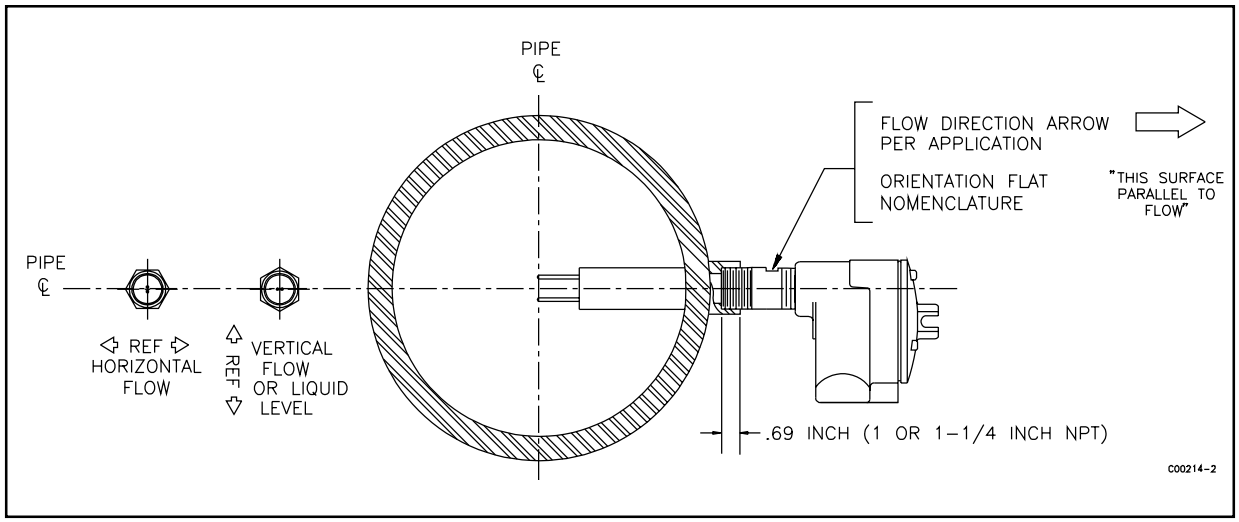

Figure 2-1. NPT Pipe Thread Mount

Flange Mounting

For flange mounted sensing elements, attach the process mating flange with care. The correct orientation of the sensing element must be maintained to ensure optimum performance or calibration. See Figure 2-2 and the appropriate drawings in Appendix A.

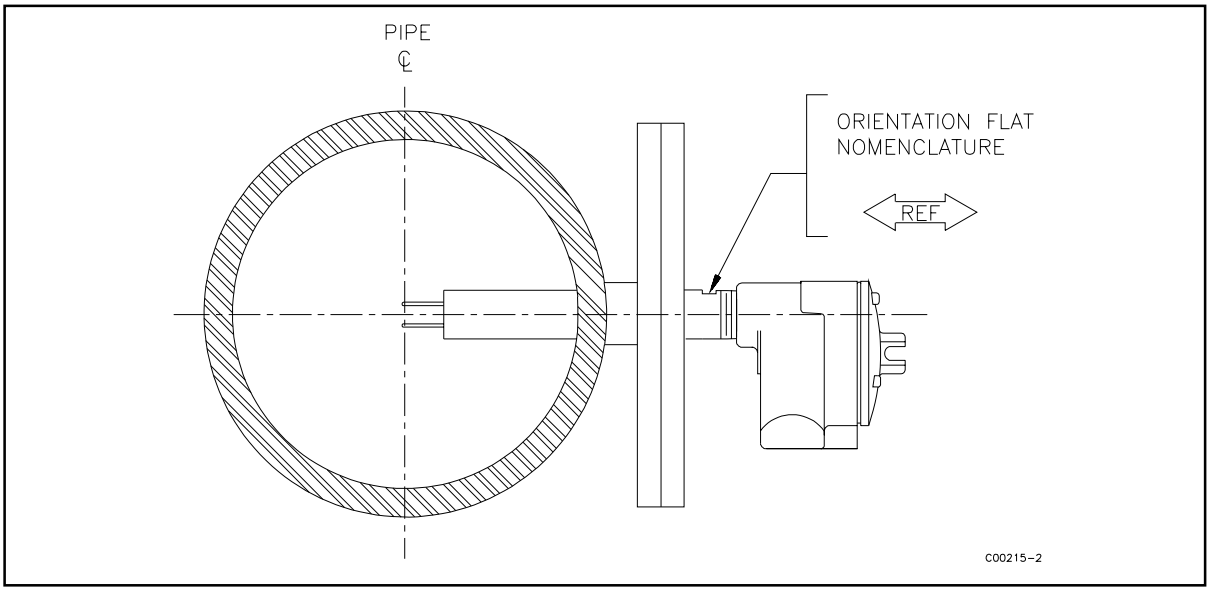

Figure 2-2. Flange Mount

Packing Gland Assembly

Applications involving the use of a packing gland (low or medium pressure) should refer to the drawings in Appendix A for additional detail.

1. Threaded or flanged packing gland mounts are available. The valve assembly with appropriate connections are customer supplied. Follow the male NPT mounting procedure above to attach the pipe thread portion or flange mounting portion as applicable.
2. Tighten the packing nut until the internal packing is tight enough so that the friction fit on the shaft is adequate to prevent leakage but not prevent the shaft from sliding. Position the etched flow arrow parallel with the flow (±1° of level) and position the flow arrow so it is pointing in the direction of the flow.
3. Proceed to insert the probe into the process media line. Use the adjusting nuts on the all-thread to pull the sensing element into proper predetermined depth position.
4. Tighten the opposing lock nuts on the all-threads. Tighten the packing nut another half to full turn until tight (approximately 65 to 85 ft-lbs [88 to 115 N-m] torque).
5. Rotate the split ring locking collar to line up with the connecting strap welded to the packing nut. Tighten the two 1/4-28 hex socket cap screws on the split ring locking collar.

Reverse these steps for removal.

In-line NPT Assembly (FLT93-L)

The body length of the in-line assembly should be verified to be sure the assembly will fit into the process line. See the appropriate figure in Appendix A to determine the assemblies length. The direction of flow is important for proper operation. There is a flow direction arrow on the in-line pipe that is to point in the direction of flow. See Figure 2-3 for the correct orientation.

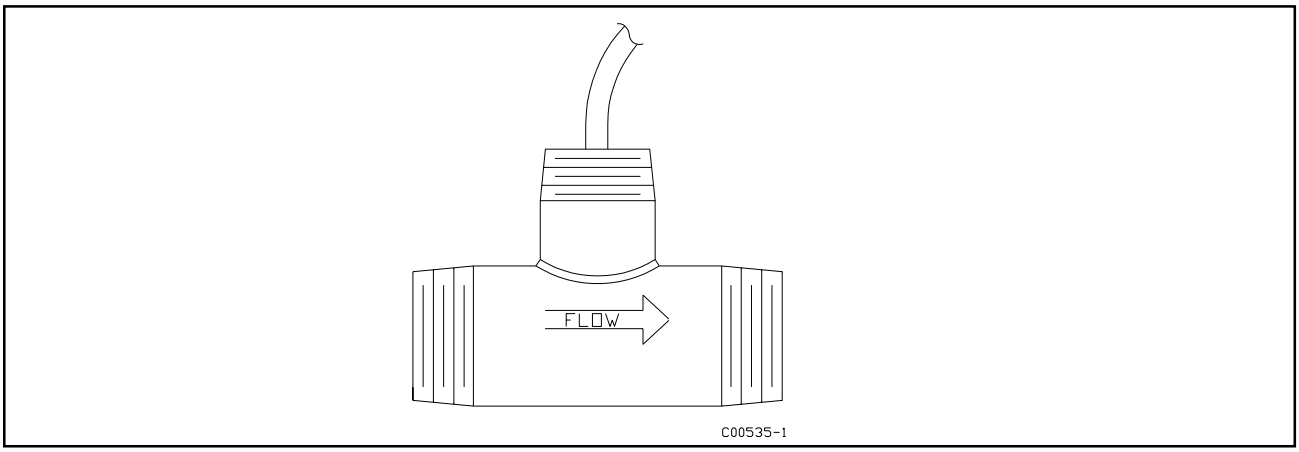

Figure 2-3. FLT93-L In-line Flow Element

Sanitary Assembly (FLT93-C)

The instrument is inserted into the process connection with a removable clamp fittings. The Removable Clamp (RC) sanitary assembly contains a removable clamp connection to the flow element. The Clean-In-Place (CIP) sanitary assembly has the flow element directly welded into the process stand pipe. Otherwise these instruments function exactly the same as an FLT93-F or FLT93-S. See Appendix A for an outline dimensions of the instruments. Figure 2-4 also shows the sanitary assemblies.

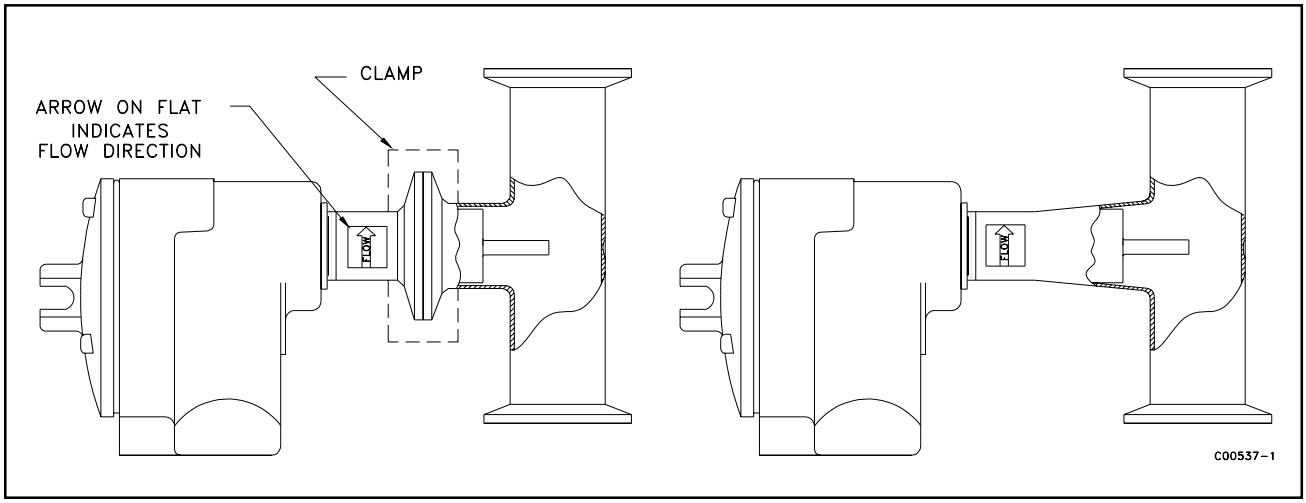

Figure 2-4. FLT93-C Sanitary Flow Elements (RC and CIP Respectively)

Install and Wire the Enclosure(s)

Caution: In applications where the sensing 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.

Pulling wires can cause damage to the control circuit. Therefore, remove the control circuit from the enclosure and use extreme care when pulling wires into the enclosure.

Mount and wire the control circuit either locally or remotely (option) by following the local or remote enclosure procedure below.

Minimum Wire Size

Table 2-1 shows the smallest (maximum AWG number) copper wire that is used in the electrical cables. 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 must be shielded. If the cable is spliced the shield wire must be continued through the splice. If a terminal block is used, the shield must have its own terminal.

Table 2-1. Maximum AWG Number

Connection	Maximum Distance for AWG					
	10 ft. (3m)	50 ft. (15m)	100 ft. (31m)	250 ft. (76m)	500 ft. 152m)	1000 ft. (305m)
AC Power	22	22	22	20	18	16
Relay (2A)	28	22	20	16	12	10
Flow Element Wires*	22	20	20	18	18	18
*Requires a shielded cable with the shield wire connected to the control socket only.						

Wiring the Local Enclosure

This procedure is for instruments with the control circuit located in the sensing element enclosure.

1. Remove the control circuit from its socket. Do not remove the control circuit socket. Removal of the control circuit socket may cause damage to the instrument.
2. Install conduit between the local enclosure and the power source and monitoring circuit. Provide watertight hardware and apply thread sealant to all connections to prevent water damage.

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

3. When connecting the relay wiring, do so with complete understanding of what the process requires of the instrument. The instrument has dual SPDT or single DPDT relay output contacts dependent on the jumper configuration for each alarm switch point. For the relay logic, refer to Figure 2-5. Also refer to Table 3-5 and Table 3-6 in Chapter 3 - Operation. Relay contacts are shown with the relays de-energized. Wire in accordance with the system requirements.

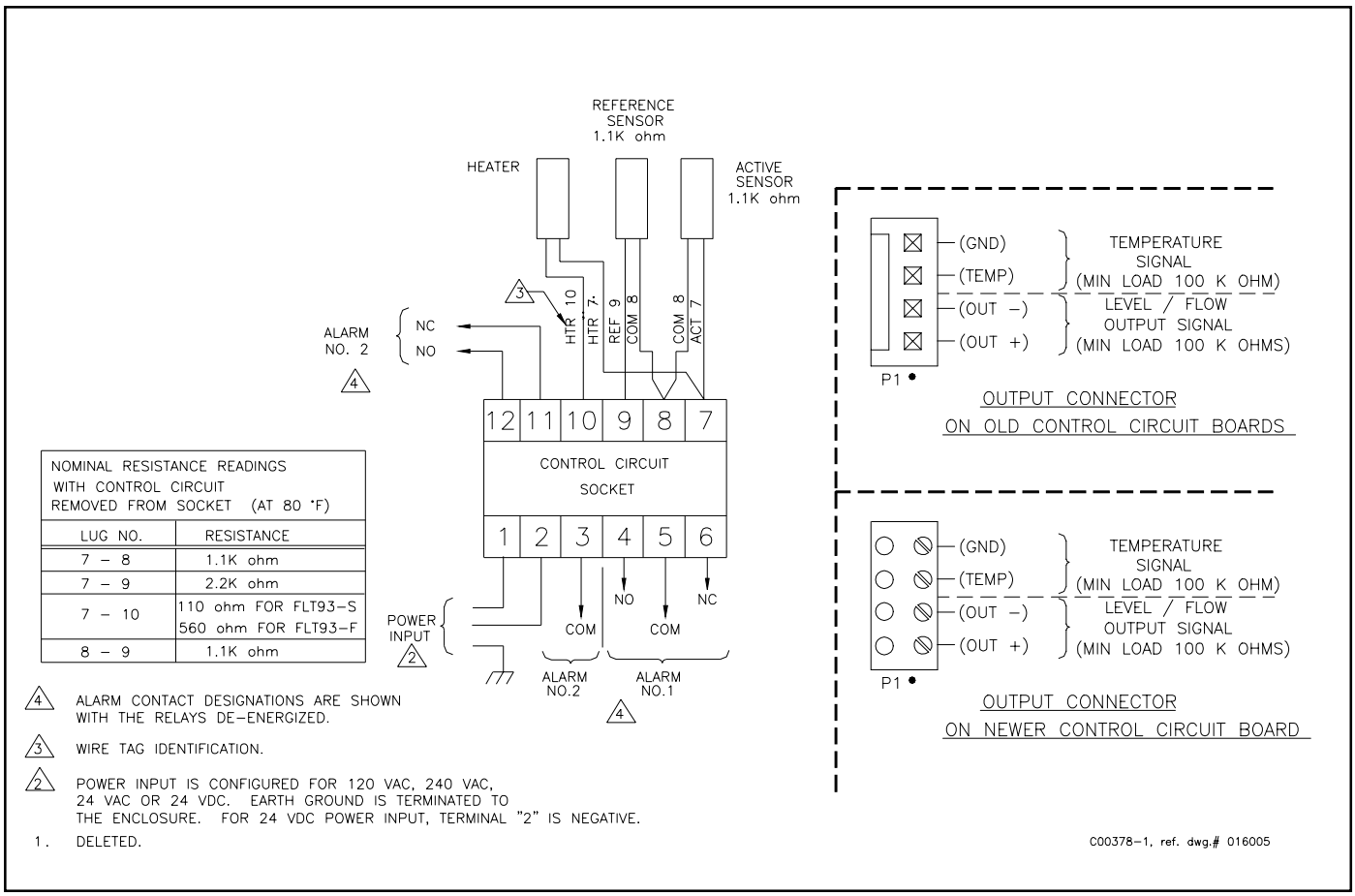

Figure 2-5. Local Wiring Diagram

Wiring The Remote Enclosure

This procedure is for instruments with the control circuit located remotely from the sensing element.

Locate the Remote Hardware Location

Appendix A shows the remote enclosure along with the physical dimensions to properly mount it. Select a location for the remote enclosure within a 1000 feet (305 m) of the sensing element. Pigtail sensing elements can not be located more than 10 feet (3 m) from the enclosure unless the pigtail is extended with the proper size cable listed in Table 2-1. If the cable is extended the cable connections should be located in a junction box with a 6 position terminal block. All 5 conductors and the shield must have its own termination. The remote enclosure should be easily accessible with enough room to open the enclosure cabinet cover at any time. Secure the remote enclosure solidly to a vertical surface capable of providing support. Use appropriate hardware to secure the enclosure.

1. Remove the control circuit from the remote enclosure.
2. Run a five-conductor, shielded cable from the local enclosure to the remote enclosure. Use Table 2-1 to determine which wire gauge to use.
3. Wire between the local and remote enclosures according to Figure 2-6.

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

4. When connecting the relay wiring, do so with complete understanding of what the process requires of the instrument. The instrument has dual SPDT or single DPDT relay output contacts dependent on the jumper configuration for each alarm switch point. For the relay logic, refer to Figure 2-6. Also refer to Table 3-5 and Table 3-6 in Chapter 3 - Operation. Relay contacts are shown with the relays de-energized. Wire in accordance with the system requirements.

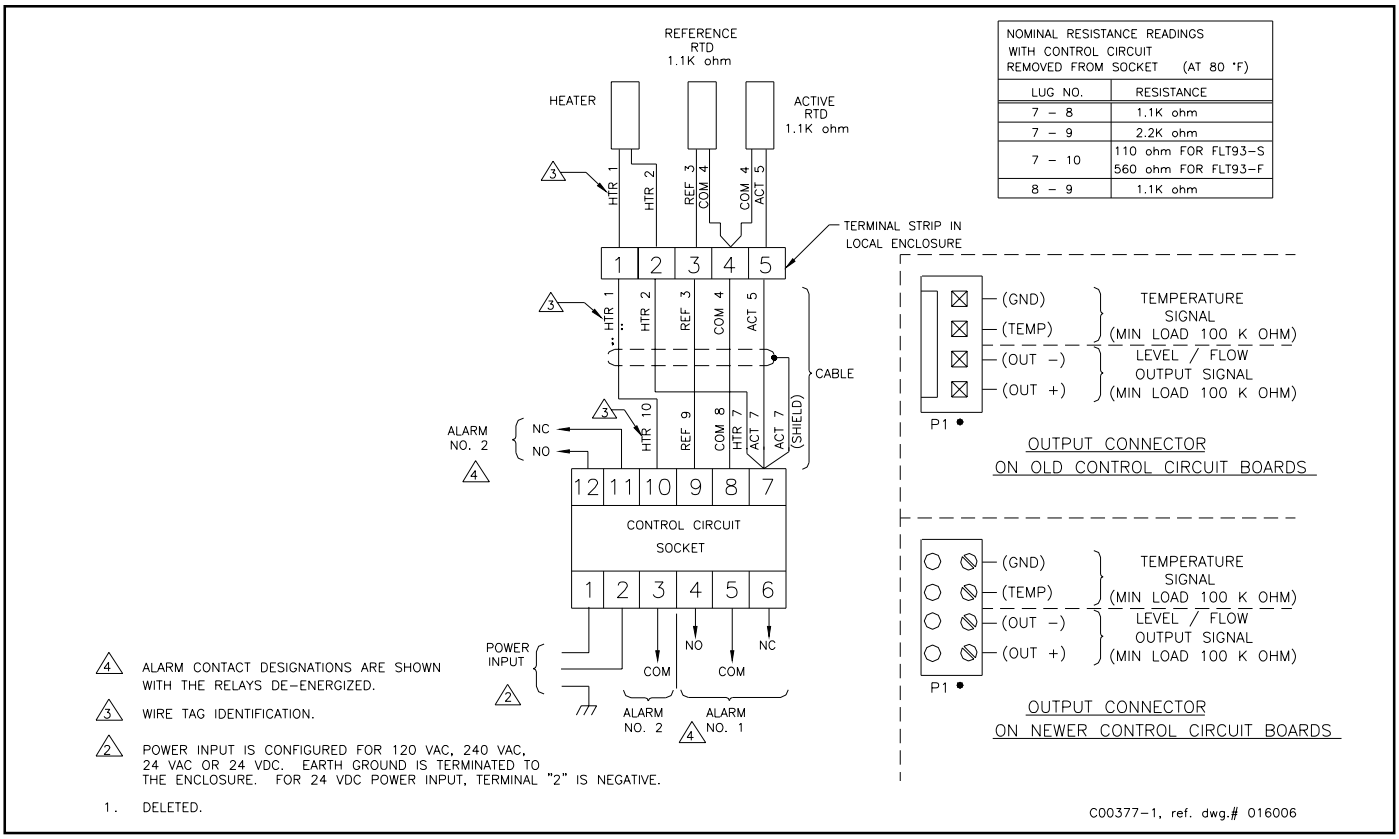

Figure 2-6. Remote Wiring Diagram

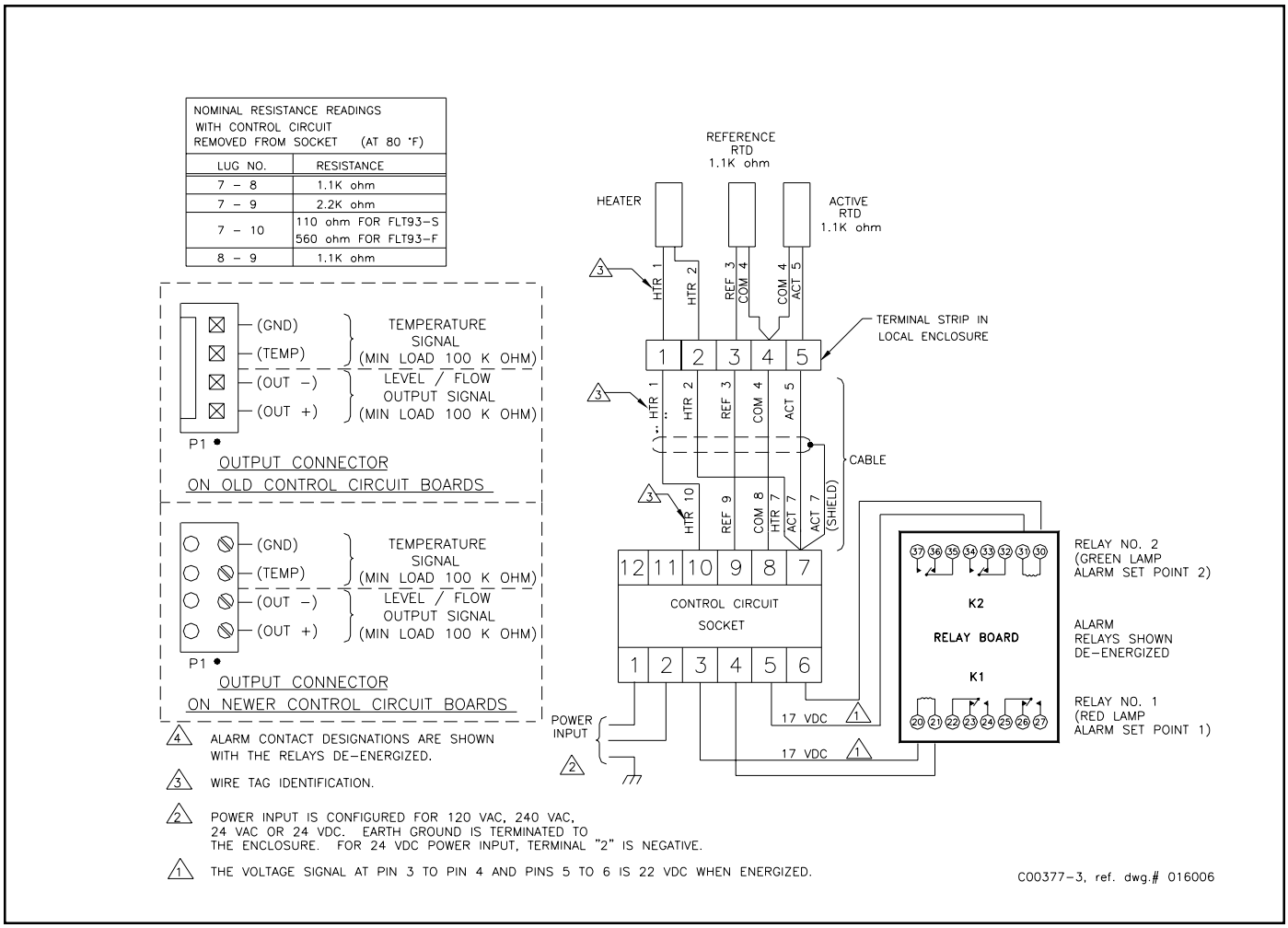

Figure 2-7. Auxiliary Relay Board Wiring Diagram

Wiring Remote Enclosure with Auxiliary Relay

Refer to the "Wiring the Remote Enclosure" section to run the cable between the local and remote enclosures. In most cases the auxiliary relay board is in the same enclosure as the control circuit. Both boards are mounted on the same panel and have been wired together at the factory. This configuration can be ordered without an enclosure which can be supplied by the customer.

The alarm connections are made at the auxiliary relay board where each alarm is driving a DPDT relay.

Caution: Do not connect any loads to the control circuit socket. Damage will occur to the control circuit if the alarm circuit is energized.

Be sure the correct relay board has been ordered for the correct output. See the following paragraph.

This configuration uses a control circuit that provides a switching voltage signal instead of relay contacts. The switch voltage is wired from the control circuit socket to the auxiliary relay board actuating the relays.

The auxiliary relay board has several relay options that can be ordered. The options are as follows:

- Dry to 2 amps at 115 Vac or 28Vdc, Dry to 1 amp at 230 Vac (relay is enclosed in a plastic sealed cover).
- 100mA to 10mA at 115 Vac or 28Vdc, 50mA to 3 amps at 230 Vac (relay is enclosed in a plastic sealed cover).
- Dry to 0.5 amps at 115 Vac, hermetically sealed relay.

Make sure that the proper relays have been selected for the intended load. See Appendix A for the auxiliary relay board configuration drawing.

When connecting the relay wiring, do so with complete understanding of what the process requires of the instrument. The instrument has dual DPDT or single 4PDT relay output contacts dependent on the jumper configuration for each alarm switch point. For the relay logic, refer to Figure 2-5. Also refer to Table 3-5 and Table 3-6 in Chapter 3 - Operation. Relay contacts are shown with the relays de-energized. Wire in accordance with the system requirements.

The control circuit can be ordered with switching voltage outputs without ordering a relay board. This can be used with customer supplied relays or any other device that has a differential input. The output voltage is 17 Vdc and will drive a load as low as 1500 ohms. Refer to Figure 2-7 for the output terminals.

Wiring A Remote Control Circuit To An Auxiliary Relay Board

1. Run a four-conductor cable from the control circuit to the auxiliary relay board if the board was not factory installed. Use the wiring diagram in Figure 2-7 to wire the boards together.
2. Attach the customer wiring as desired using Figure 2-7 as a wiring guide.

Wiring for this configuration is the same as the sensing element wiring to the control circuit on a remote instrument.

Wiring Output Signal Terminals

Two output signals are provided on the control circuit at P1. The signal voltage at positions 1 and 2 represents the process change. The signal voltage at positions 3 and 4 is proportional to the temperature at the sensing element. See Figures 2-5 through 2-7. See also Chapter 3 for the physical layout of the control circuit.

Caution: Do not ground terminal 2 of P1. (Terminal 2 is the negative lead of the process signal.) This terminal is 9 volts above the control circuit ground. The peripheral using this signal must have a differential input.

These voltages can be used by other peripherals with a minimum load of 100K ohms. The terminal block can be wired with between gauge 26 and 18 wire (22 gauge wire is normally used). The maximum recommended length of wire is 1000 feet. Shielding is required on any length of cable. The shield must be terminated at position 4 on P1.

Early versions of the FLT93 require a connecting harness that was supplied with each instrument. The harness can be ordered if it is missing. The FCI part number is 015664-01. Newer versions of the FLT93 require a supplied terminal plug.