Kotron®
Model 80/81

Installation and Operating Manual

RF Point

Level

Switches

Magnetrol®

STI®

Read this Manual Before Installing

This manual provides information on Kotron Model 80/81 RF Point Level Switches. It is important that all instructions are read carefully and followed in sequence. Detailed instructions are included in the Installation section of this manual.

Conventions Used in this Manual

Certain conventions are used in this manual to convey specific types of information. General technical material, support data, and safety information are presented in narrative form. The following styles are used for notes, cautions, and warnings.

Notes

Notes contain information that augments or clarifies an operating step. Notes do not normally contain actions. They follow the procedural steps to which they refer.

Cautions

Cautions alert the technician to special conditions that could injure personnel, damage equipment, or reduce a component's mechanical integrity. Cautions are also used to alert the technician to unsafe practices or the need for special protective equipment or specific materials. In this manual, a caution box indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Warnings

Warnings identify potentially dangerous situations or serious hazards. In this manual, a warning indicates an imminently hazardous situation which, if not avoided, could result in serious injury or death.

Safety Messages

Follow all standard industry procedures for servicing electrical equipment when working with or around high voltage. Always shut off the power supply before touching any components.

Low Voltage Directive

For use in Category II installations. If equipment is used in a manner not specified by manufacturer, protection provided by equipment may be impaired.

WARNING! Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

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Performance specifications are effective with date of issue and are subject to change without notice. Magnetrol/STI reserves the right to make changes to the product described in this manual at any time without notice. Magnetrol/STI makes no warranty with respect to the accuracy of the information in this manual.

Warranty

All Magnetrol/STI electronic level and flow controls are warranted free of defects in materials or workmanship for one full year from the date of original factory shipment.

If returned within the warranty period; and, upon factory inspection of the control, the cause of the claim is determined to be covered under the warranty; then, Magnetrol/STI will repair or replace the control at no cost to the purchaser (or owner) other than transportation.

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Quality Assurance

The quality assurance system in place at Magnetrol/STI guarantees the highest level of quality throughout the company. Magnetrol/STI is committed to providing full customer satisfaction both in quality products and quality service.

Magnetrol's quality assurance system is registered to ISO 9001 affirming its commitment to known international quality standards providing the strongest assurance of product/service quality available.

Kotron Model 80/81
RF Point Level Switches

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1.0 Introduction

1.1 Principle of Operation

The amount of capacitance developed in any vessel is determined by the size (surface area) of the probe, the distance from the probe to its ground, and the dielectric of the medium being measured. Considering that the probe's mounting position is fixed, and that the dielectric value of the medium is constant, then the amount of capacitance developed in any vessel becomes dependent upon the probe's total surface area.

A probe's diameter, together with its length, determine its surface area. Adjusting the combination of probe diameter, length, and proximity to ground, the necessary capacitance required by the electronic circuitry can generate.

As media rises and falls in the tank, the amount of capacitance developed between the sensing probe and the ground also rises and falls. This change in capacitance is sensed by the electronics.

The capacitance-controlled oscillator circuit, mounted on the probe, changes the capacitance signal to a variable frequency. This stabilized signal can then be sent to the main electronics located up to 5000 feet (1500 meters) away via standard shielded, twisted pair cable. This eliminates the 150 feet (45 meters) maximum distance limitation, using costly coaxial or triaxial cable utilized by other manufacturers.

1.2 Description

Kotron RF Point Level Switchescan be utilized in level control applications with either liquid or dry bulk materials. They can also be used to sense and control viscous, sticky, highly conductive materials. The electronic amplifier may be either mounted directly on the sensing probe or located remote from the probe. In remote applications, the sensing probe is furnished with a housing.

2.0 Installation

Caution: Please read the entire installation section carefully prior to starting installation.

2.1 Unpacking

Unpack the instrument carefully. Make sure all components have been removed from the packing material. Inspect all components for damage. Report any concealed damage to the carrier within 24 hours. Check the contents against the packing slip and report any discrepancies to the factory. Check the nameplate model number to be sure it agrees with the packing slip and purchase order. Check and record the serial number for future reference when ordering parts.

2.2 Installation Location

Kotron RF Point Level Switches should be located for easy access for service, calibration and monitoring. Switches should not be exposed to ambient temperatures below -40° F (-40° C) or above +160° F (+71° C). Special precaution should be made to prevent exposure to corrosive atmosphere, excessive vibration, shock or physical damage.

It is common practice to use the metal tank wall as the reference electrode. In such cases, it is required that the probe housing makes a good electrical connection to the tank wall. If there is any doubt about this connection due to the use of PTFE thread tape, gaskets, paint, rust, or any other reason, a separate strap should be installed between the probe housing and the tank.

Caution: This unit contains CMOS electronics which may be damaged by static electricity. Do not touch any semiconductor devices unless you are properly grounded.

2.2.1 Metal Walled Tanks

On water-based liquids, there should be no problem with sensitivity or linearity. With non-conductive, low dielectric media, sensitivity can be enhanced by locating the probe close to and parallel with the tank wall. If this is not practical, a concentric ground tube surrounding the probe, sometimes called a stilling well, may be a solution.

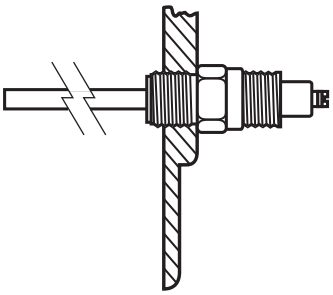


Figure 1
Recommended Horizontal Mounting

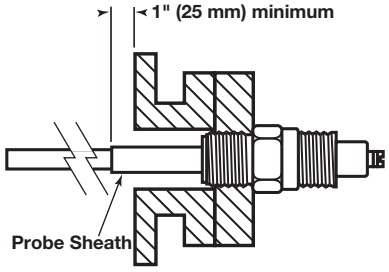


Figure 2
Recommended Mounting with Nozzle

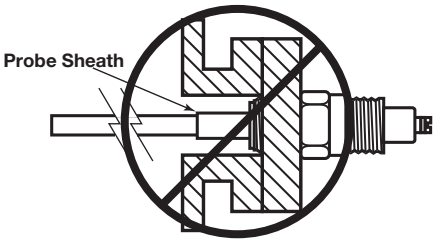


Figure 3
Not Recommended

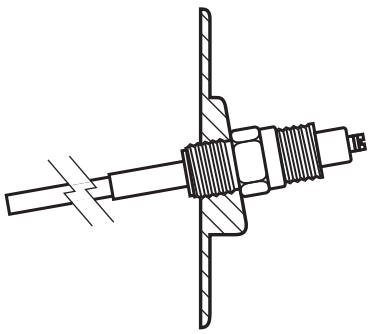


Figure 4
Alternate Horizontal Mounting
for Viscous Materials

2.2.2 Tanks/Silos w/Non-Conductive Materials of Construction

With plastic, concrete, wood, or any other non-conductive walled vessels, the reference electrode mentioned above needs clarification. Most commonly, this electrode will be in the form of a concentric ground tube (i.e. stilling well). In questionable circumstances, consult the factory. In all cases, a good electrical connection must be made between the ground surface and the probe housing.

NOTE: These comments also apply for glass-lined metal walled tanks.

Caution: When an insulated probe is used in a hazardous and/or abrasive medium, the probe should be inspected annually for any nicks, cuts or abrasions which may ruin the integrity of the insulation. In the event that wear is found, replace the probe or consult the factory for further instructions. This procedure is critical in vessels containing hazardous media.

2.3 Horizontal Mounting

2.3.1 Narrow Differential Single Point Units Only

Horizontally mounted probes provide a high degree of sensitivity for use with non-conductive liquids as only approximately 0.625" of level change is required to completely cover (or uncover) the probe.

Horizontally mounted probe rods should be installed so that the rod is parallel to and at the level at which control point is desired. Refer to Figure 1.

Avoid any installation method in which the material may become trapped in the mounting nozzle, thus preventing probe from signaling when level recedes. Refer to Figure 2.

NOTE: If nozzle mounting is unavoidable, probe must be installed with an inactive metal sheath having a length at least 1 inch (25 mm) greater than length of nozzle. Sheath is required to render length of probe within nozzle insensitive to capacitance change. Refer to Figure 3.

On applications involving viscous liquids or materials which tend to cling or buildup, horizontal mounting probes should be installed at a slight downward angle to allow material to drain from probe rod. With this type installation, packing gland face of probe assembly should extend into the tank (or vessel). Refer to Figure 4.

2.4 Vertical Mounting

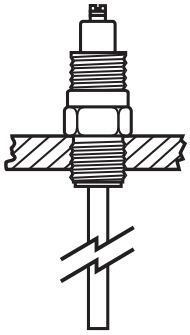


Figure 5
Recommended Vertical Mounting

Vertically mounted probes provide the capability to adjust the control point up or down a section of probe rod by means of calibration adjustments within the unit's amplifier. The vertical mounting of a probe rod is the preferred method for application involving coating conductive type liquids or conductive solids.

Vertically mounted probes should be installed so that the end of the probe rod is at least 2 inches (51 mm) below the desired level control point with conductive materials or 4 inches (102 mm) below with non-conductive materials. Refer to Figure 5.

2.5 Mounting Procedure

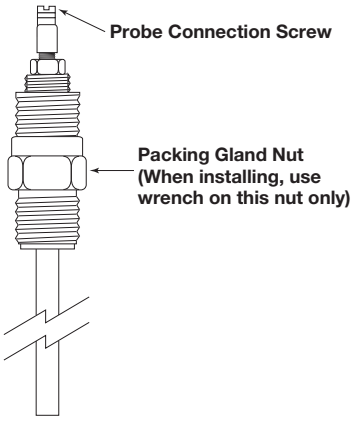


Figure 6
Rigid Probe Assembly

Kotron RF Point Level Switches with probes up to and including 12 inches (305 mm) in length are shipped pre-assembled. Units with probes over 12 inches (305 mm) in length are shipped unassembled to avoid damage during transit. They must be assembled before mounting. Follow the mounting procedure for your particular case.

NOTE: Before beginning mounting procedures, make sure the power source to the unit is turned off.

2.5.1 Integral Mount with Rigid Probe

1. Thread probe into mounting bushing on tank.
2. Tighten securely, being certain that the wrench is applied ONLY to the lower probe nut.
3. Screw the amplifier housing onto the probe.
5. Remove housing cover.
6. Locate the white wire which is fastened to the (+) Probe Terminal. Connect the free end of this wire to the Probe Connection Screw.
7. Proceed to Section 2.7, *Wiring* on page 8.

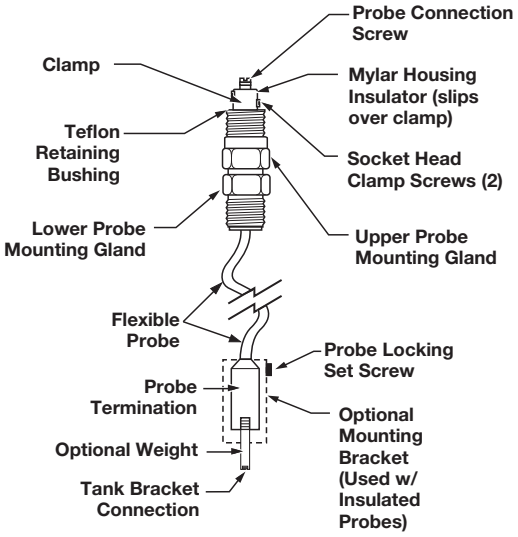


Figure 7
Flexible Probe Assembly

2.5.2 Integral Mount with Flexible Probe

Caution: Flexible probes are shipped with the cable clamp and the probe nut hand tightened. The end of a flexible probe MUST be secured to the bottom of the tank by either attachment to a bracket or to a heavy weight in order to keep the probe taut.

1. Unscrew probe from probe housing. Remove Mylar® housing insulator located over the clamp. Refer to Figure 7.

Caution: Do not discard Mylar housing insulator.

2. Attach weight (if used) to probe end.
3. Insert probe end through tank mounting bushing and feed cable into the tank. Do not allow probe insulation to be damaged by scraping against the bushing threads.

Caution: Probe cable must not be in contact with anything metallic in its final installation position.

4. Secure lower end of probe (or optional weight) to tank bracket if one is used. Refer to Figure 7.
5. Apply thread sealant to mounting nut.
6. Screw mounting nut into tank bushing until tight.

Caution: Apply wrench to lower probe nut only.

NOTE: Do not allow the probe to fall in the tank while following steps 7 through 11.

7. Loosen both socket clamp screws.
8. Pull clamp and Teflon® retaining bushing off probe.
9. While holding probe cable, loosen upper probe nut.
10. Pull excess cable up through probe nuts until cable is taut.
11. Tighten the probe nuts.
12. Cut off cable 1.35 inches (34 mm) above top of upper probe nut and strip off 1.25 inches (32 mm) of insulation.
13. Slide Teflon retaining bushing onto cable and seat it into the upper probe nut.
14. Slide clamp onto cable and seat it in the Teflon retaining bushing.
15. Tighten both socket head clamp screws to approximately 35 in./lbs. torque.
16. Slip Mylar housing insulator over clamp.
17. Screw housing onto probe and tighten. Make sure conduit connection is properly aligned for wire entry.

Caution: Check probe terminal connection carefully to be certain lug will not short to packing gland or interfere with assembly of amplifier housing to probe.

18. Proceed to Section 2.7, *Wiring* on page 8.

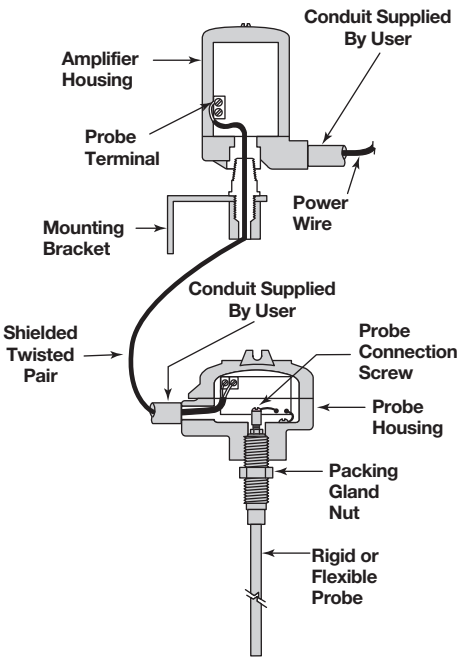


Figure 8
Side View Remote Mount Models with Rigid or Flexible Probe

2.5.3 Remote Mount with Rigid Probe

2.5.3.1 Main Amplifier

Remote amplifier assemblies are normally shipped from the factory assembled into an "L" mounting bracket. Refer to Figure 8 while following instructions.

1. Remove amplifier from mounting bracket.
2. Install bracket in a location which will isolate unit from temperatures below -40° F (-40° C) and over +160° F (+71° C) or vibration/mechanical damage. Unit can be mounted up to 5000 feet (1500 meters) from probe assembly. Location should also offer easy access for wiring, calibration and maintenance.
3. Re-install amplifier onto mounting bracket.
4. Screw housing on mounting bracket until hand tight. Housing can be wrench tightened to align conduit connection with conduit.

2.5.3.2 Preamplifier

1. Thread probe into mounting bushing on tank.
2. Tighten securely being certain that the wrench is applied ONLY to the lower probe nut. Refer to Figure 8.
3. Screw the preamplifier housing onto the probe. Refer to Figure 8.
4. Screw housing on probe until hand tight. Housing can be wrench-tightened to align conduit connection with conduit. Proceed to Section 2.7, *Wiring* on page 8.

2.5.4 Remote Mount with Flexible Probe

2.5.4.1 Main Amplifier

Remote amplifier assemblies are normally shipped from the factory assembled into an "L" mounting bracket. Refer to Figure 8 while following instructions.

1. Remove amplifier from mounting bracket.
2. Install bracket in a location which will isolate unit from temperatures below -40° F (-40° C) and over +160° F (+71° C) or vibration/mechanical damage. Unit can be mounted up to 5000 feet (1500 meters) from probe assembly. Location should also offer easy access for wiring, calibration and maintenance.
3. Re-install amplifier onto mounting bracket.
4. Screw housing on mounting bracket until hand tight. Housing can be wrench-tightened to align conduit connection with conduit.

2.5.4.2 Preamplifier

Caution: Flexible probes are shipped with the cable clamp and the probe nut hand tightened. The end of a flexible probe MUST be secured to the bottom of the tank by either attachment to a bracket or to a heavy weight in order to keep the probe taut.

1. Unscrew probe from probe housing. Remove Mylar housing insulator located over the clamp. Refer to Figure 7 on page 5.

Caution: Do not discard Mylar housing insulator.

2. Attach weight (if used) to probe end.
3. Insert probe end through tank mounting bushing and feed cable into the tank. Do not allow probe insulation to be damaged by scraping against the bushing threads.

Caution: Probe cable must not be in contact with anything metallic in its final installation position.

4. Secure lower end of probe (or optional weight) to tank bracket if one is used.
5. Apply thread sealant to mounting nut.
6. Screw mounting nut into tank bushing until tight.

Caution: Apply wrench to lower probe nut only.

NOTE: Do not allow the probe to fall in the tank while following steps 7 through 11.

7. Loosen both socket clamp screws.
8. Pull clamp and Teflon retaining bushing off probe.
9. While holding probe cable, loosen upper probe nut.
10. Pull excess cable up through probe nuts until cable is taut.
11. Tighten the probe nuts.
12. Cut off cable 1.35 inches (34 mm) above top of upper probe nut and strip off 1.25 inches (32 mm) of insulation.
13. Slide Teflon retaining bushing onto cable and seat it into the upper probe nut.
14. Slide clamp onto cable and seat it in the Teflon retaining bushing.
15. Tighten both socket head clamp screws to approximately 35 in./lbs. torque.
16. Slip Mylar housing insulator over clamp.
17. Screw housing onto probe and tighten. Make sure conduit connection is properly aligned for wire entry.
18. Locate the white wire which is fastened to the (+) Probe Terminal on the circuit board. Connect the free end of this wire to the Probe Connection Screw. Refer to Figure 7 on page 5.

Caution: Check probe terminal connection carefully to be certain lug will not short to packing gland or interfere with assembly of amplifier housing to probe.

19. Proceed to Section 2.7, *Wiring*.

2.6 Electrostatic Discharge (ESD) Handling Procedure

Magnetrol's electronic instruments are manufactured to the highest quality standards. These instruments utilize electronic components which may be damaged by static electricity present in most work environments. The following steps are recommended to reduce the risk of component failure due to electrostatic discharge:

1. Ship and store circuit boards in anti-static bags. If an anti-static bag is not available, wrap board in aluminum foil. Do not place boards on foam packing materials.
2. Use a grounding wrist strap when installing and removing circuit boards. A grounded workstation is also recommended.
3. Handle printed circuit boards only by the edges. Do not touch components or connector pins.
4. Ensure that all electrical connections are completely made and none are partial or floating. Ground all equipment to a good, earth ground.

2.7 Wiring

2.7.1 Integral Mount Models

Light gauge (16 AWG or 18 AWG) stranded wire should be used for connection of power and control circuits.

2.7.1.1 Relay Wiring

See Section 2.7.3, *Relay Wiring Chart* on page 10 for different relay wiring options.

2.7.1.2 Power Wiring

1. Make sure power source is turned off.
2. Pull power supply wires through conduit connection.
3. Connect AC power to AC(+), AC(–) and GND terminals. Connect DC power to DC(+) and GND terminals. Refer to Section 3.4, *Terminal Connections* on page 21.
4. Dress the wires together neatly and securely with cable ties. Be certain that adequate clearance exists for replacement of housing cover.

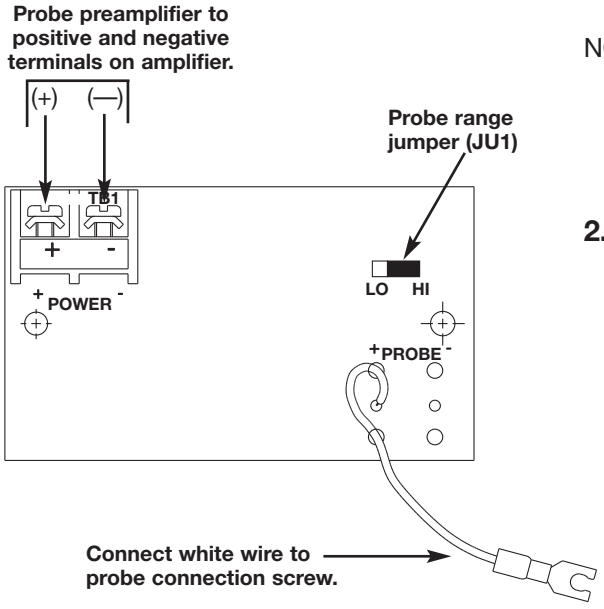


Figure 9
Probe preamplifier circuit board

Caution: Observe all applicable electrical codes and proper wiring procedures.

5. Replace housing cover.
6. Power up unit and proceed with calibration of instrument as described in instructions following.

NOTE: Be certain to route all power and control wires through conduit outlet only and run probe wire up through center hole in amplifier housing base. Supply voltage and signal wires **should not** be run in the same conduit.

2.7.2 Remote Mount Models

Remote type units are furnished with a preamplifier housing having a circuit board with preamplifier-to-amplifier terminals. Preamplifier connection terminals are located at the upper left side of the preamplifier circuit board. Refer to Figure 9.

Locate the white wire which is fastened to the (+) Probe Terminal on the circuit board. Connect the free end of this wire to the Probe Connection Screw. Refer to Figure 6 on page 4.

2.7.2.1 Probe Preamplifier Wiring

1. Strip approximately .75 inch of outer jacket insulation from each end of the conductor.
2. At the probe preamplifier end, twist the black wire and shield together to form a single conductor. Crimp on solderless connectors securely to both red and black leads.
3. Connect the red lead to the positive (+) terminal on the probe preamplifier board. Refer to Figure 9.
4. Connect the black wire and shield to the negative (–) terminal on the probe preamplifier board.
5. At the main amplifier location, twist the black wire and shield together to form a single conductor.
6. Crimp on solderless connectors securely to both the red and black leads.
7. Connect red lead to positive (+) terminal on the amplifier. Refer to Section 3.4, *Terminal Connections* on page 21.
8. Connect black wire and shield to the negative (–) terminal on the amplifier.

2.7.2.2 Relay Wiring

Refer to Section 2.7.3, *Relay Wiring Chart* for different relay wiring options. Refer to Section 3.4, *Terminal Connections* on page 21 for terminal locations.

2.7.2.3 Power Wiring

1. Make sure power source is turned off.
2. Pull power supply wires through conduit connection. Refer to Figure 8 on page 6.
3. Connect AC power to AC(+), AC(–) and GND terminals. Connect DC power to DC(+) and GND terminals. Refer to Section 3.4, *Terminal Connections* on page 21.
4. Dress the wires together neatly and securely with cable ties. Be certain that adequate clearance exists for replacement of housing cover.

Caution: Observe all applicable electrical codes and proper wiring procedures.

5. Replace housing cover.
6. Power up unit and proceed with calibration of instrument as described in instructions following.

NOTE: Be certain to route all power and control wires through conduit outlet only and run probe wire up through center hole in amplifier housing base. Supply voltage and signal wires **should not** be run in the same conduit.

2.7.3 Relay Wiring Chart

Kotron Power	Material Level	Fail-safe Position	Relay Coil	Relay Terminal	
				COM to NC	COM to NO
On	High	HL	De-energized	Closed	Open
		LL	Energized	Open	Closed
	Low	HL	Energized	Open	Closed
		LL	De-energized	Closed	Open
OFF (Fail)	High	HL	De-energized	Closed	Open
		LL	De-energized	Closed	Open
	Low	HL	De-energized	Closed	Open
		LL	De-energized	Closed	Open

2.7.4 Wiring Notes and Definitions

1. Equipment controlled by the Kotron relays is assumed to be powered from one source, while the Kotron unit itself is assumed to be powered from a different source.
2. There is a fail-safe switch on the Kotron unit, which may be set in either a HL or LL position.
3. "Fail" means a loss of power to the Kotron unit.
4. HL (high level) means a material level in the tank, which is equal to or above:
   a. The setting of a narrow differential point.
   b. The higher setting of a wide differential point.
5. LL (low level) means a material level in the tank, which is equal to or below:
   a. The setting of a narrow differential point.
   b. The lower setting of a wide differential point.
6. When the relay coil is de-energized (fail-safe), a connection is made between common (COM) and the normally closed (NC) and there is no connection between common (COM) and the normally open (NO) terminals.
7. When the relay coil is energized, a connection is made between the terminals COM and NO, and there is no connection between CM and NC.

2.8 Calibration

Caution: When instrument calibration is to be done in a hazardous location, extra steps and precautions must be taken. Power must be turned off before housing cover is removed from unit amplifier.

All pre-installation checks on the instrument should be done in a non-hazardous area in order to minimize the amount of work required on the unit after installation.

Instrument can be checked on the bench, preferably with the process material, by temporarily connecting power and performing the steps outlined in the calibration adjustment instructions.

2.8.1 Level Range Selection

The preamplifier circuit board has a range jumper (JU1), see Figure 9 on page 9. For remote units, this board is located in the probe enclosure.

The position of the jumper is dependent upon the fluid being measured. Locate this jumper in the "LO" position if the fluid is non-conductive (dielectric less than 10); for conductive fluids, position this jumper in the "HI" position.

For narrow differential units, always place the jumper in the "LO" position.

2.8.2 Fail-safe Mode Selection

The fail-safe mode is selected for the particular level detection application to provide for relay contact closure upon any loss of electrical power.

To select the appropriate relay state, locate the small toggle switch on upper right portion of circuit board and switch to HL for high level mode or LL for low level mode. Refer to Section 3.4, *Terminal Connections* on page 21.

2.8.2.1 High Level Mode

In this mode, an electrical power failure will de-energize the relay causing the contacts to assume a position as if product level were at or above the set point.

2.8.2.2 Low Level Mode

In this mode, an electrical power failure will de-energize the relay causing the contacts to assume a position as if product level were at or below the set point.

2.8.3 Calibration Adjustments

Adjustments should be performed with unit under actual operating temperature and pressure conditions. Zero and span adjustments are located at upper left on amplifier circuit board. A level range select jumper is also provided. It is located on the preamplifier board of single point integral units and all remote units. Be sure that the proper range has been selected. Refer to Section 2.8.1, *Level Range Selection* on previous page.

2.8.4 Zero Adjustment

1. With the probe installed in the vessel and the process material at or below the desired set point, turn ZERO adjustment potentiometer on the left hand side of the printed circuit assembly clockwise (CW) a minimum of twenty full turns or until a clicking sound is detected.

NOTE: Be sure Fail-safe Mode Selection has been set correctly. Refer to **Fail-safe Mode Selection** above and **Relay Wiring Chart** on page 10.

2. Set the fail-safe mode for the alarm relays:
   a. In low level fail-safe mode, the alarm relay will be de-energized when the material level is BELOW the alarm set point.
   b. In high level fail-safe mode, the alarm relay will be de-energized when the material level is ABOVE the alarm set point.
3. Energize the instrument. The calibrate LEDs will be on regardless of the settings of the fail-safe switches or time delay setting. Relays set in the low level fail-safe (LLFS) mode will be energized and there will be continuity between the common (CM) and normally open (NO) relay terminations. This can be checked with an ohmmeter or other suitable continuity checking device. Relays set in the high level fail-safe (HLFS) mode will be de-energized and there will be continuity between the common (CM) and normally closed (NC) relay terminations.
4. If the vessel is not filled to the desired set point, increase level of material to the required set point.
5. Turn the zero adjustment counterclockwise (CCW) until LED indicator goes off (the relay will change state), then turn the control slowly in the CW direction until the LED indicator again comes on. Repeat this on–off procedure several times and leave the LED indicator on. The narrow differential alarm point is now calibrated.

2.8.5 Zero and Span Adjustment

2.8.5.1 Wide Differential — Vertical Probe Mount Only

1. With the probe installed in the vessel and the process material at the desired low level, turn both the zero and span adjustment on the left hand side of the printed circuit board clockwise a minimum of twenty full turns or until a clicking sound is detected. If the process material is not at this point, the material level must be changed until this point is reached.
2. Set the fail-safe mode for the relay: (Be sure Fail-safe Mode Selection has been set correctly).
   a. In low level fail-safe (LLFS) mode, relay is de-energized on rising level and remains de-energized until upper span point is reached.
   b. In high level fail-safe (HLFS) mode, relay is de-energized on falling level and remains de-energized until lower zero point is reached.
3. Energize the instrument. The calibrate LED will be on regardless of the position of the fail-safe switch.

4. Turn the zero adjustment counterclockwise until the LED indicator goes off (the relay will change state), then turn the control slowly in the clockwise direction until the indicator again comes on. Repeat this on-off operation several times and *leave the LED indicator OFF*. This completes the zero calibration of the wide differential point.

   Prior to increasing the level of material in the tank to the span point, *turn the span control twenty full turns CCW*. THE LED CALIBRATION INDICATOR WILL REMAIN OFF.

6. Raise the level of the material in the vessel to the desired high level set point.

7. Slowly rotate the span adjustment in a CW direction until the LED calibration indicator turns ON. The relay will change state and the wide differential span is now calibrated. Do not change setting after LED is ON.

NOTE: A second span adjustment check can be made by moving the span adjustment two (2) turns CCW, then removing the probe (P) wire momentarily to break the contact. With the probe reconnected, slowly turn the span adjustment screw in CW direction until the LED calibration indicator again comes ON.

2.8.6 Time Delay Adjustment

2.8.6.1 Narrow Differential Only

Narrow differential amplifiers are equipped with an adjustable (0 to 3 sec) time delay. With the time delay calibration fully CCW, the delay is at minimum and in the fully CW position, it is at maximum. On standard units, the delay is effective on rising level, i.e., as the material level goes above the set point, a time delay will occur between the LED indicator coming ON and the relay operating and will eliminate contact chatter in agitated fluids.

3.0 Reference Information

3.1 Troubleshooting

3.1.1 Probe

Caution: When an insulated probe is used in a hazardous and/or abrasive medium, the probe should be inspected annually for any nicks, cuts or abrasions which may ruin the integrity of the insulation. In the event that wear is found, replace the probe or consult the factory for further instructions. This procedure is critical in vessels containing hazardous media.

To check for malfunctioning sensing probe:

1. Remove the white probe lead form the sensing probe and isolate it from ground.
2. Connect an ohmmeter between the sensing probe terminal and ground. (stainless steel probe nut or housing base).
3. Measure the resistance between the probe and the stainless steel probe nut, or probe electronic housing with an ohmmeter. (Select the highest resistance scale available). If the resistance measures infinity, the probe is operating correctly. If the resistance measures less than infinity, there may be a problem with the probe. Call the factory for additional assistance.
4. Inspect a malfunctioning probe for a cut in the insulating sheath or looseness in the seal at the probe mounting nut. If neither is apparent, check for heavy conductive buildup between probe and mounting nut.

NOTE: When performing checks 3 and 4 in conductive media, take resistance reading when medium is at maximum level.

5. If probe test is working properly, check for insufficient ground, loose or broken wiring, including white probe wire. Also check continuity between probe mounting nut and metal tank — there should be continuity (zero resistance). If there is resistance, check for excessive Teflon tape used on probe threads.

3.1.2 Electronics

Refer to the following procedure to test the pre-amplifier P.C. boards, the amplifier and the shielded twisted cable between the probe and the amplifier.

NOTE: Refer to Figure 14 on page 21 for location of potentiometer.

Caution: This procedure changes any previous calibration of the amplifier. If the unit checks out as operational, it will have to be recalibrated before being used in the process.

3.1.2.1 Narrow differential point units

1. Turn off the power to the unit.
2. Remove the leadwire from the probe.
3. Turn the setpoint potentiometers fully counterclockwise.
4. Turn all time delay potentiometers fully counterclockwise.
5. Move the probe level range jumper to the HI position. Refer to Figure 9 on page 9.
   a. When the probe range jumper (switch) is in the HI position, a low level is simulated. When it is in the LO position, a high level is simulated.
   b. On remote mounted units, this jumper is located inside the probe housing on the probe preamplifier board.
6. Turn on power to the unit.
7. The red LEDs will be off. Adjust the narrow differential point potentiometer(s) counterclockwise until the LED(s) turn on. Then slowly adjust each potentiometer clockwise until the LED turns off.
8. The probe range jumper (switch) can now be switched between the HI and LO positions and the LEDs will go on and off. The relays will also go on and off accordingly.

   If your unit operates as described above, the probe preamplifier board, the probe preamplifier cable and amplifier are functioning correctly.

   If your unit does **NOT** operate as described above, it is malfunctioning. Perform the following checks:

1. Take DC voltage reading across probe preamplifier terminals – should be approximately 12 VDC.
2. Take AC voltage reading across probe preamplifier terminals – should be .1 to .2 VAC.
3. Consult factory – have test data available for discussion.

NOTE: These values can also be taken at probe preamplifier wiring terminals on remote installations.

3.1.2.2 Wide differential point units

1. Turn off the power to the unit.
2. Remove the lead wire from the probe.
3. Turn the zero and span potentiometers fully clockwise.

NOTE: On wide differential units, the zero potentiometer is located above the span potentiometer.

4. Move the probe level range jumper to the HI position board. Refer to Figure 9 on page 9.
   a. When the probe range jumper (switch) is in the HI position, a low level is simulated. When it is in the LO position, a high level is simulated.
   b. On remote mounted units, this jumper is located inside the probe housing on the probe preamplifier board. Refer to Figure 9 on page 9.
6. Turn on power to the unit.
7. The red LED will be on. Turn the zero potentiometer fully counterclockwise. Refer to Figure 10 on page 19.
8. Move the probe range jumper (switch) to the low level position. Refer to Figure 12 on page 20. The LED will turn off. If not, turn the span potentiometer slowly counterclockwise until the LED turns off. Refer to Figure 10 on page 19.
9. The LED should now turn on and off with movement of the jumper (switch).
10. The probe range jumper (switch) can now be switched between the HI and LO positions and the LEDs will go on and off. The relays will also go on and off accordingly.

    If your unit operates as described above, the probe preamplifier board, the probe preamplifier cable and amplifier are functioning correctly.

    If your unit does **NOT** operate as described above, it is malfunctioning. Perform the following checks:

1. Take DC voltage reading across probe preamplifier terminals – should be approximately 12 VDC.
2. Take AC voltage reading across probe preamplifier terminals – should be .1 to .2 VAC.
3. Consult factory – have test data available for discussion.

NOTE: These values can also be taken at probe preamplifier wiring terminals on remote installations.

3.2 Agency Approvals

AGENCY	MODEL APPROVED	APPROVAL CATEGORY	APPROVAL CLASSES
FM	80-80XXX-3XX	Explosion Proof	Class I, Div. 1; Groups C & D
FM APPROVED	81-80XXX-3XX		Class II, Div. 1; Groups E, F & G (Note: This approval available with rigid insulated probes only
	All Models	Non-Hazardous	TYPE 4X
CSA	80-80XXX-3XX	Explosion Proof	Class I, Groups C & D
	81-80XXX-3XX		Class II, Groups E, F, & G; Type 4X (This approval excludes use with bare probes)
	All Models	Non-Hazardous	TYPE 4X

3.3 Specifications

3.3.1 Electrical

Description		Specification	
Supply voltage		120 VAC (+10%/-15%), 50–60 Hz 240 VAC (+10%/-15%), 50–60 Hz 24 VDC (±10%)	
Power consumption		7 watts maximum	
Zero range		0 pF minimum 3000 pF maximum	
Differential range (wide differential only)		High range	4 pF minimum 1500 pF maximum
		Low range	2 pF minimum 500 pF maximum
Fixed minimum differential (narrow differential only)		0.5 pF minimum	
Output relays DPDT	AC	10 amp @ 120/240 VAC resistive	
	DC	10 amp @ 24 VDC resistive	
Number of relays		One	
Time delay (narrow differential only)		0–3 seconds	
Response time		100 milliseconds	
Ambient temperature at electronics		-40° to +160° F (-40° to +71° C)	
Operating pressure/ temperature		Dependent upon probe selection. Refer to probe bulletin 50-125.	
Temperature coefficient of output -40° to +160° F (-40° to +71° C)		+0.02 pF per degree F (+0.036 pF per degree C)	

3.3 Specifications

3.3.2 Dimensional Specifications – Integral Mounts

Inches (mm)

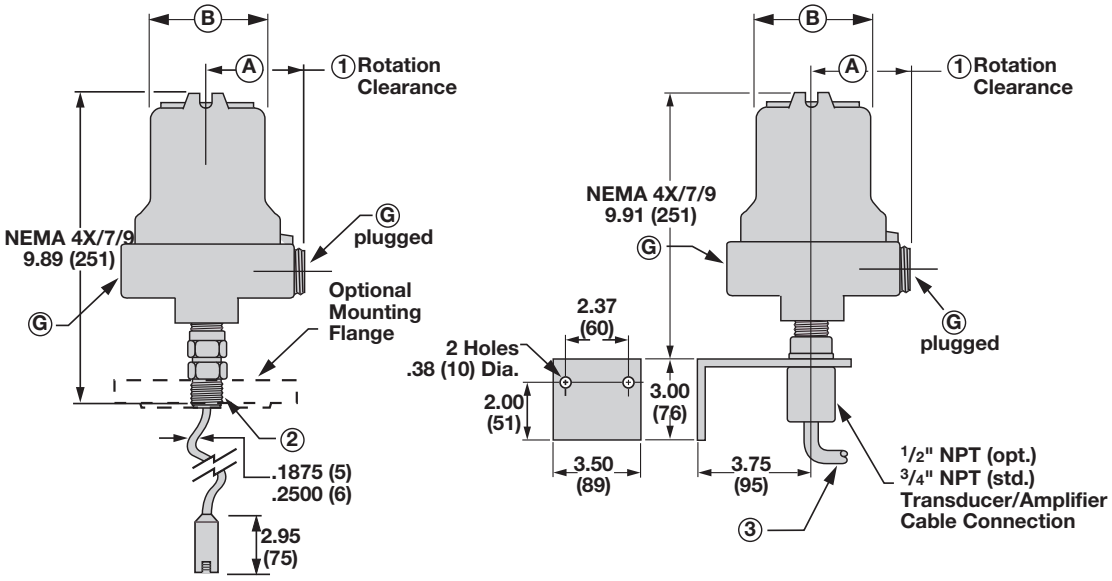


Figure 10
Integral Mount with Flexible Probe
(shown with aluminum sand cast housing)

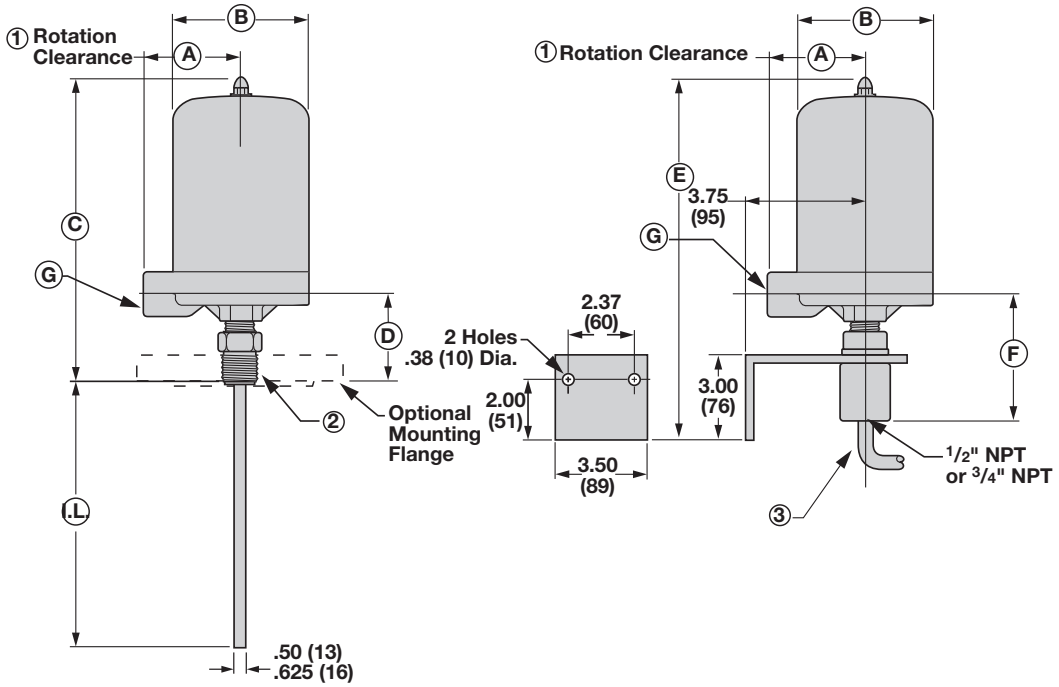


Figure 11
Integral Mount with Standard Rigid Probe
(shown with carbon steel housing)

3.3 Specifications

3.3.3 Dimensional Specifications – Remote Mounts

Inches (mm)

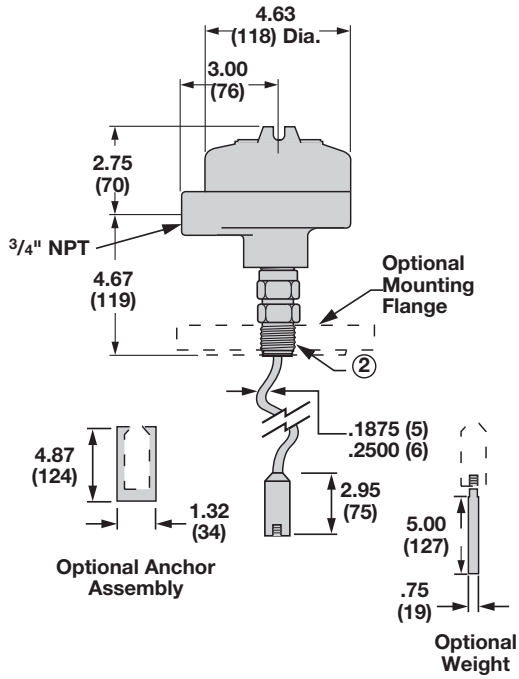


Figure 12
Remote Mount with Flexible Probe
(shown with aluminum sand cast housing)

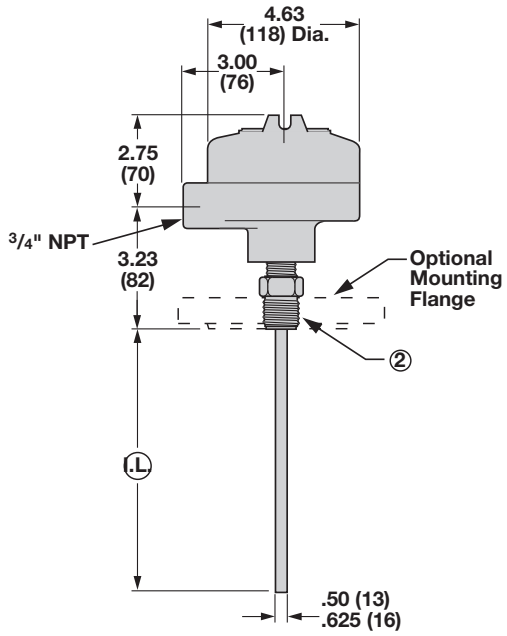


Figure 13
Remote Mount with Standard Rigid Probe
(Shown with carbon steel
or Lexan housing)

Outline Dimensions											
Housing	A	B	Standard Rigid Probe				Flexible Probe				Conduit Connection
			C	D	E	F	C	D	E	F	G
NEMA 4X Carbon steel	3.25 (82)	4.69 (119)	9.04 (230)	2.29 (58)	11.67 (296)	4.04 (103)	10.48 (266)	3.73 (95)	11.67 (296)	4.04 (103)	¾" NPT single conduit
NEMA 4X/7/9 Sand cast aluminum	3.44 (87)	5.81 (148)	11.26 (286)	2.40 (61)	13.81 (351)	4.15 (105)	12.70 (323)	4.67 (119)	13.81 (3.51)	4.15 (105)	¾" NPT dual conduit

NOTES: ① Allow 8" (203 mm) overhead clearance for cover removal.
② Standard process connection is ¾" NPT. Consult probe brochure (50-125) for flange and other probe connections.
③ Probe/amplifier connecting cable should be shielded twisted pair 22 gauge stranded conductors.

3.4 Terminal Connections

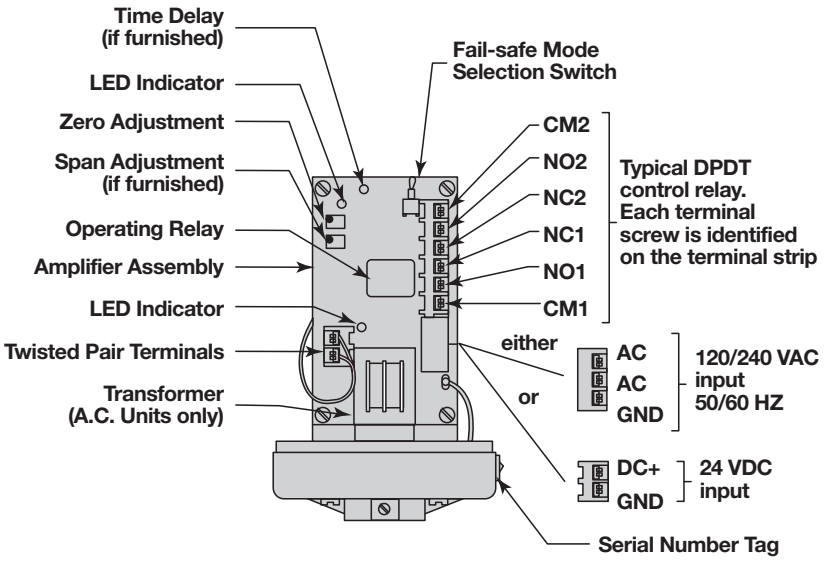


Figure 14
Single Point Amplifier

3.5 Replacement Parts

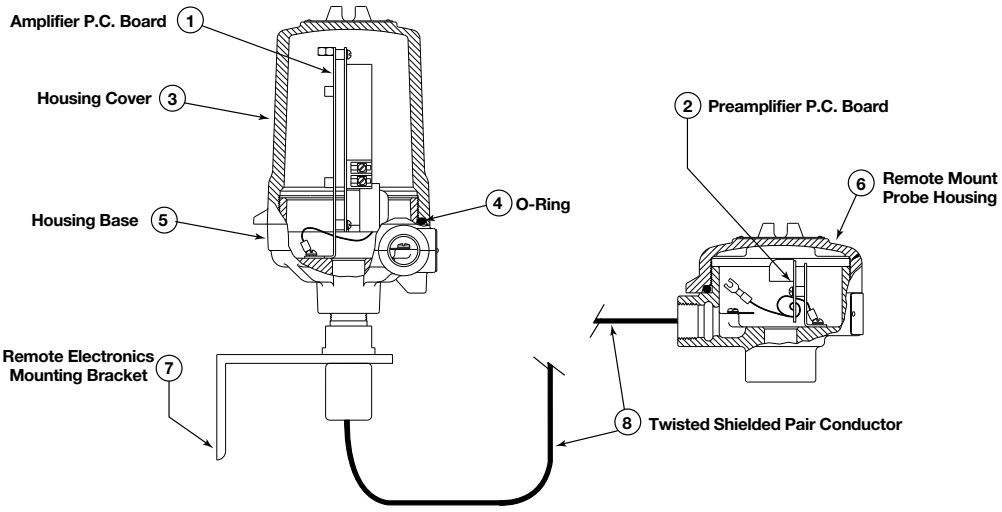


Figure 15

No.	Description		120 VAC	240 VAC	24 VDC
			Integral or Remote	Integral or Remote	Integral or Remote
1	Amplifier PC board	Single point narrow differential	Z30-2124-001	Z30-2124-002	Z30-2127-001
		Single point wide differential	Z30-2123-001	Z30-2123-002	Z30-2128-001
2	Preamplifier	PC board, single point	30-2082-001		
4	Housing cover	NEMA 4X carbon steel	89-6510-003		
		NEMA 4X/7/9 aluminum	89-6554-001		
5	O-ring	NEMA 4X for carbon steel cover	12-1318-001		
		NEMA 4X/7/9 for aluminum cover	12-2101-345		
6	Housing base	NEMA 4X carbon steel, ¾" NPT single conduit	04-9160-002		
		NEMA 4X/7/9 aluminum, ¾" NPT dual conduit	04-9182-002		
7	Remote mount probe housing		89-6585-001		
8	Remote electronics mounting bracket	½" NPT	36-3805-001		
		¾" NPT	36-3805-003		
9	Twisted shielded pair conductor		09-7146-001 (Specify length in feet)		

NOTE: You must recalibrate after changing the preamplifier board.

IMPORTANT: When ordering parts, please specify the serial number of the existing control and the description and part number of the replacement part.

3.6 Model Numbers

MOUNTING CONFIGURATION

0	Integral
1	Remote

HOUSING

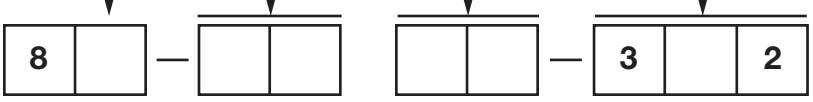
52	NEMA 4X carbon steel, ¾" NPT single conduit
80	NEMA 4X/7/9 aluminum, ¾" NPT dual conduit, single point models

NUMBER OF SET POINTS

12	Single point, alarm control
22	Single point, pump control

INPUT POWER

0	120 VAC
0	240 VAC
2	24 VDC



NOTES

Service Policy

Owners of Magnetrol/STI controls may request the return of a control or any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Controls returned under our service policy must be returned by prepaid transportation. Magnetrol/STI will repair or replace the control at no cost to the purchaser (or owner) other than transportation if:

1. Returned within the warranty period; and
2. The factory inspection finds the cause of the claim to be covered under the warranty.

If the trouble is the result of conditions beyond our control; or, is NOT covered by the warranty, there will be charges for labor and the parts required to rebuild or replace the equipment.

In some cases it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned will be determined on the basis of the applicability of our warranty.

No claims for misapplication, labor, direct or consequential damage will be allowed.

Return Material Procedure

So that we may efficiently process any materials that are returned, it is essential that a "Return Material Authorization" (RMA) number be obtained from the factory, prior to the material's return. This is available through Magnetrol's or STI's local representative or by contacting the factory. Please supply the following information:

1. Company Name
2. Description of Material
3. Serial Number
4. Reason for Return
5. Application

Any unit that was used in a process must be properly cleaned in accordance with OSHA standards, before it is returned to the factory.

A Material Safety Data Sheet (MSDS) must accompany material that was used in any media.

All shipments returned to the factory must be by prepaid transportation.

All replacements will be shipped F.O.B. factory.

NOTE: See Electrostatic Discharge Handling Procedure on page 8.

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