

# Kotron® Model 810 RF Point Level Sensor

Installation and Operating Manual



*RF*

*Capacitance*

*Level*

*Measurement*

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## Read this Manual Before Installing

This manual provides information on the Kotron Model 810 RF Point Level Sensor. 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

The Kotron Model 810 system may be properly installed in Category II, Pollution Degree 2 installations. Follow all standard industry procedures for servicing electrical and computer equipment when working with or around high voltage. Always shut off the power supply before touching any components. Although high voltage is not present in this system, it may be present in other systems.

Electrical components are sensitive to electrostatic discharge. To prevent equipment damage, observe safety procedures when working with electrostatic sensitive components.

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

## Low Voltage Directive

For use in Installation Category II, Pollution Degree 2. If equipment is used in a manner not specified by the manufacturer, protection provided by the equipment may be impaired.

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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.

Magnetrol/STI shall not be liable for misapplication, labor claims, direct or consequential damage or expense arising from the installation or use of equipment. There are no other warranties expressed or implied, except special written warranties covering some Magnetrol/STI products.

## 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 810 RF Point Level Sensor

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## 1.0 Introduction

The Kotron Model 810 RF Point Level Sensor can be utilized in liquid or bulk material applications. There are no moving parts in contact with the medium. These units are integral systems with the sensing probe mounted with the electronics. Guarded probes are utilized to minimize effect of build up on the probe.

### 1.1 Principle of Operation

As the medium covers the probe, the amount of capacitance developed between the probe and ground changes. This change in capacitance is converted into a relay action. As the medium drains from the sensing probe, the relay position reverses.

## 2.0 Installation

This section provides detailed procedures for properly installing point level sensors.

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

### 2.1 Unpacking

Unpack the instrument carefully. Inspect all components for damage. Report any concealed damage to carrier within 24 hours. Check the contents of the packing slip against purchase order. Check and record the model number against serial number for future reference when ordering parts.

**Model Number:** \_\_\_\_\_

**Serial Number:** \_\_\_\_\_

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## 2.2 Electrostatic Discharge (ESD) Handling Procedure

Magnetrol's electronic instruments are manufactured to the highest quality standards. These instruments use electronic components that 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.

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

## 2.3 Installation

### 2.3.1 Installation Location

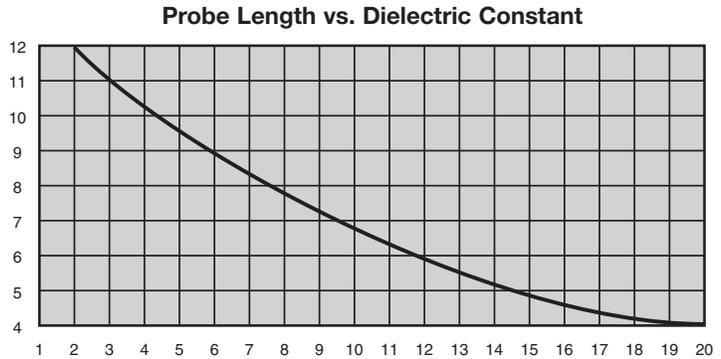
Kottron point sensors should be located in areas allowing easy access for service, calibration and monitoring. Units should not be exposed to ambient temperatures above +160° F (+71° C) or below -40° F (-40° C). Special precaution should be taken to prevent exposure to corrosive atmosphere, excessive vibration, shock or physical damage.

Sensing probes should be located close to the tank wall for greatest sensitivity in non-conductive media. Probes should be isolated from severe motion in the tank, because surface turbulence may cause signal deviation.

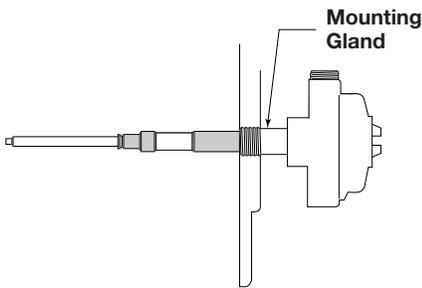
NOTE: Do not attempt to disassemble probe from housing until the wires have been disconnected and the electronic module has been removed. Consult *Section 3.1, Troubleshooting* on page 8.

### 2.3.2 Probe Length

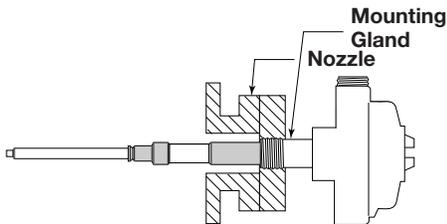
If the geometry of your application requires a probe shorter than 12" (305 mm) of active length, refer to Figure 1 below to determine the minimum dielectric constant in which it can be used.



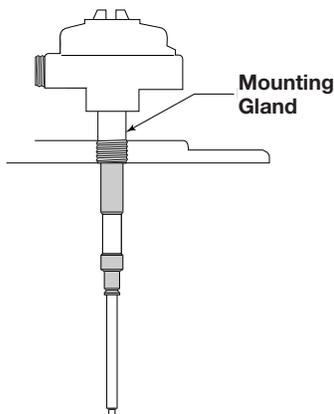
**Figure 1**  
Minimum dielectric constant of material



**Figure 2**  
Horizontal Mounting



**Figure 3**  
Horizontal Mounting in Nozzle



**Figure 4**

## 2.4 Mounting

When installing, apply wrench to mounting gland only. Guard element should be located free of nozzle.

**Caution:** When a probe is used in an abrasive medium, inspect the probe at least annually for visible surface wear. In case any wear is found, replace the probe or consult the factory.

### 2.4.1 Horizontal Mounting

Unit will signal at probe level. Refer to Figures 2 and 3.

**Caution:** Do NOT horizontally mount the unit in a nozzle deeper than 3" (75 mm). Refer to Figures 2 and 3. The medium may build up in the nozzle and cause false actuation.

### 2.4.2 Vertical Mounting

As medium rises on the probe, the unit will signal at a point determined by the calibration of the unit and the dielectric constant of the medium. In conductive media, the actuation point will be at the tip of the probe over a wide range of adjustment. Refer to Figure 4.

### INSTALLATION INSTRUCTIONS

1. Thread amplifier assembly into mounting bushing on tank using suitable pipe compound or thread tape. Assembly may also be attached to a flange and bolted to the vessel using a suitable gasket.
2. Tighten securely, being certain that the wrench is applied ONLY to the mounting gland. Refer to Figures 2 through 4.

## 2.5 Wiring

All power and control connections are made at the terminal strip within the amplifier enclosure, EXCEPT GROUNDING. Power grounding must be made at green ground screw on the housing base. 16AWG wire is recommended for power and control circuits.

**NOTE:** There are special wiring requirements for intrinsic safety. Observe all local electrical codes and proper wiring procedures.

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

### PROCEDURE:

1. Make sure the power source is turned off.
2. Unscrew and remove housing cover.
3. Pull power supply and control wires through conduit ground connection.
4. Connect green ground wire to green ground screw located in the base of the housing.

**NOTE:** If separate I.S. ground is required in this application, then I.S. ground (conventionally, blue #12 wire) should be connected to the barrier at this time. Refer to NEC and agency guidelines.

5. After grounding is complete, connect AC power leads to the HOT and COM terminals as marked. Refer to Figure 6.

**NOTE:** For DC supply voltage connect DC+ to HOT and DC- to COM.

6. Connect control circuit leads to relay terminals. Refer to Figure 6. Make sure the load to be controlled is within the relay's rated capacity.
7. Prevent moisture seepage into housing by installing an approved seal-drain fitting in the conduit run leading to the unit.
8. Select operating mode. (Refer to **OPERATING MODE SELECTION** on page 5 for detailed information.) Make sure that the fail-safe switches are in the correct position for your selection. Refer to Figure 7 and the **RELAY WIRING CHART** on page 5.

**Caution:** In hazardous areas, do NOT power the unit until the conduit is sealed and the enclosure cover is screwed down securely.

9. Installation is complete. Replace housing cover.

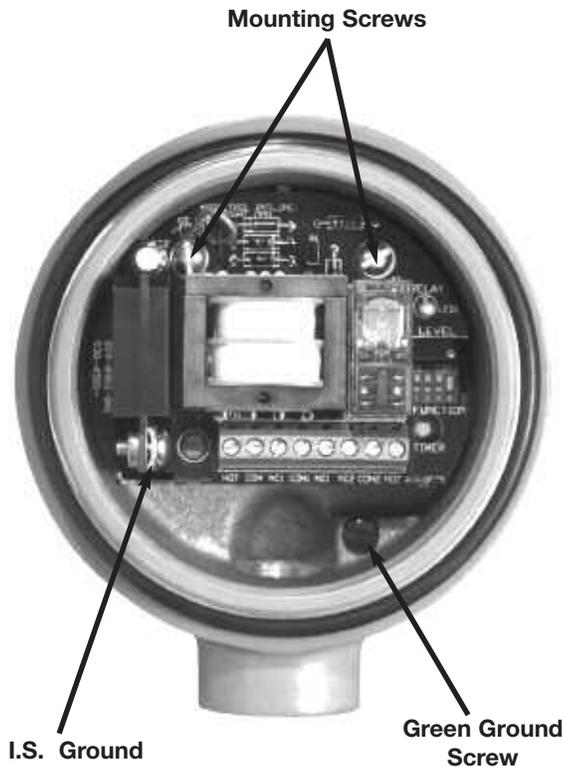


Figure 5



Figure 6

## OPERATING MODE SELECTION

The chart below is provided to aid in the proper choice of relay wiring and calibration. Please note:

1. Equipment controlled by the relay is assumed to be powered from one source, while the Model 810 itself is assumed to be powered from a different source.
2. There are fail-safe switches on the switch which may be set in either a High or Low position. Refer to Figure 7.
3. "Fail" means a loss of power to the 810 unit.
4. HL (High Level) means a material level in the tank which is equal to or above the set point.
5. LL (Low Level) means a material level in the tank which is equal to or below the set point.
- 6a. When relay coil is de-energized (fail-safe) the circuit between common (COM) and the normally open (NO) terminal is open and a connection is made between common (COM) and the normally closed (NC) terminals. The LED is off.
- 6b. When the relay coil is energized the NO contact is closed and the NC contact is open. The LED is on. Refer to the Relay Wiring Chart below.

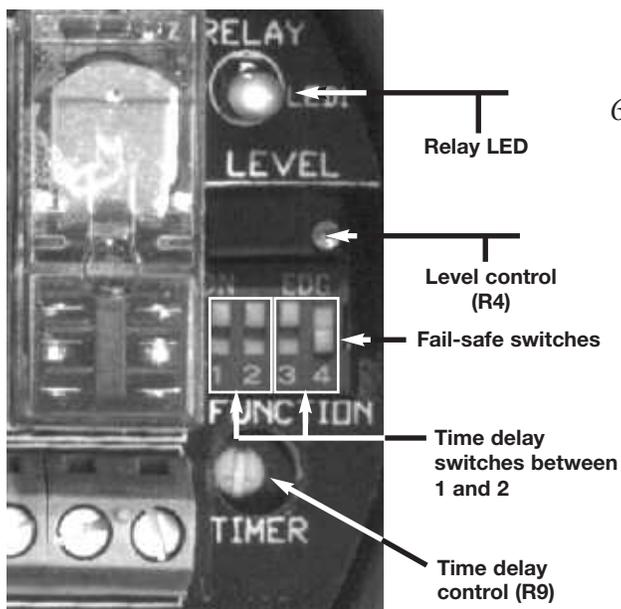


Figure 7

### RELAY WIRING CHART

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

---

## 2.6 Calibration

**Caution:** In hazardous areas, do not remove housing cover until power is disconnected and atmosphere is determined to be safe. Hazardous environments must be declared safe by the local safety authority.

### 2.6.1 Calibration Procedure

1. Turn on power to the instrument.
2. Remove housing cover.
3. Set point location:
  - a. Conductive media: The set point is located at the tip of the probe. Calibration is not required for most conductive liquids. If the unit does not switch on alarm test, then proceed to Step 4.
  - b. Non-conductive media: The set point is located on the probe at a point determined by the set point adjustment. Minimum probe coverage is 4 inches (100 mm). Calibration is required. Proceed to Step 4.
4. The LED shows the status of the relay coil:  
LED on = relay energized  
LED off = relay de-energized
5. Initial Settings
  - a. Turn the LEVEL control (R4) clockwise a full twenty turns or until a ratcheting sound is heard.
  - b. Set the DIP switch with positions 1 and 2 ON.
  - c. Turn the TIMER control (R9) fully counterclockwise.
  - d. Note that if DIP switch positions 3 and 4 are both ON the LED will remain on. Set DIP switches based on the following information:

### 2.6.2 Calibration Conditions

Complete calibration by utilizing the following conditions that best suits your application:

1. **Fail-safe Low**
  - a. Set DIP switch position 3 ON and position 4 OFF.
  - b. Turn the LEVEL control counterclockwise until the LED turns on.
  - c. Turn the LEVEL control clockwise until the LED turns off.
  - d. If media is on probe, slowly turn the LEVEL control counterclockwise until the LED comes on.

---

## 2. **Fail-safe High**—

- a. Set DIP switch position 3 OFF and position 4 ON.
- b. Turn the LEVEL control counterclockwise until the LED turns off.
- c. Turn the LEVEL control clockwise until the LED turns on.
- d. If media is on probe, slowly turn the LEVEL control counterclockwise until the LED turns off.

## 3. **Time Delay**

If Time Delay is required (i.e., surface waves causing relay chatter), two choices must be made:

- a. Delay Function:
  - Delay on FILL (rising Level) switch 1 OFF, 2 ON
  - Delay on EMPTY (falling Level) switch 1 ON, 2 OFF
- b. Delay Duration:
  - 0 to approximately 45 seconds (Timer R9)
  - CW rotation increases duration (approximately 270° stop to stop)

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## 3.0 Reference Information

### 3.1 Troubleshooting

#### 3.1.1 No Signal with Level Change

1. Check power and control circuit wiring.
2. Check fail-safe switch position.
3. Check calibration.
4. Check for proper ground reference particularly in non-metal tanks.

**If removal of electronic module is necessary:**

1. Loosen mounting screws. Refer to Figure 5.
2. Slowly raise electronic module exposing probe wiring.
3. Disconnect probe and guard leads. Remove electronic module.

#### 3.1.2 Switch Chatter

1. Check for turbulence. If turbulence is present, increase time delay.
2. Check for low voltage.
3. Check for proper ground reference.
4. Check for proper DIP switch position.

NOTE: If these suggestions prove unsuccessful, consult factory.

## 3.2 Agency Approvals

AGENCY	APPROVED MODEL	PROTECTION METHOD	AREA CLASSIFICATION
<b>FM</b> 	All models	Explosion Proof	Explosion proof with intrinsically safe probe circuit Class I, Div. 1, Groups C & D Class II, Div. 1, Groups E, F, & G General purpose NEMA 4X
<b>CSA</b> 	All models	Explosion Proof	Explosion proof with intrinsically safe probe circuit Class I, Div. 1, Groups C & D Class II, Div. 1, Groups E, F, & G General purpose TYPE 4X



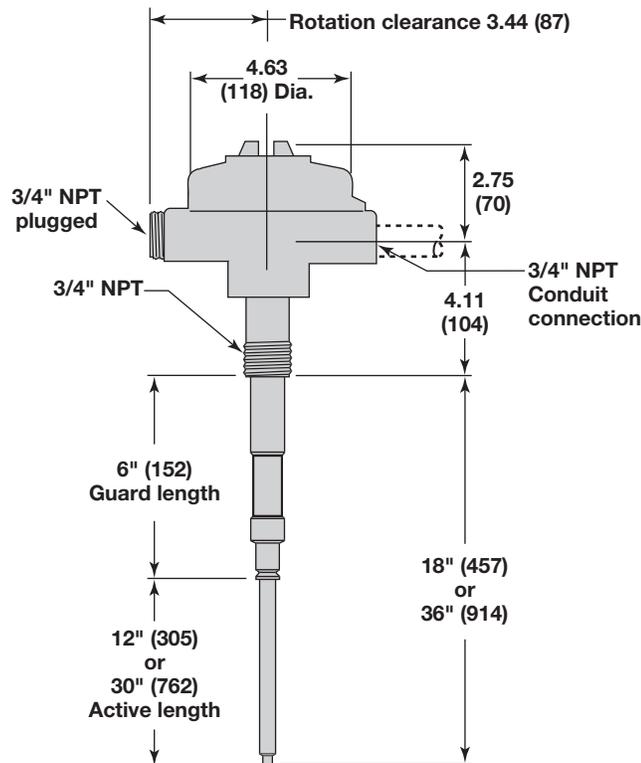
These units have been tested to EN 50081-2 and EN 50082-2 and are in compliance with the EMC Directive 89/336/EEC.

### 3.3 Specifications

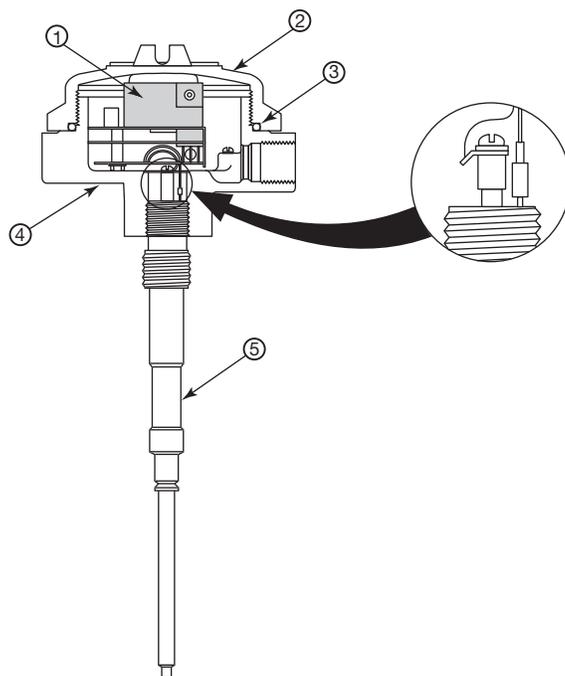
#### 3.3.1 Electrical

Supply voltage	120 VAC, 50–60 Hz (+10%, -15%) 240 VAC, 50–60 Hz (+10%, -15%)	24 VDC (±10%) 12 VDC (±10%)
Power consumption	120 or 240 VAC 12 or 24 VDC	Less than 5 volt-amps 1 watt maximum
Zero range		0 pF minimum to 500 pF maximum
Fixed differential		0.5 pF
Output relays (reversible DPDT)	AC	5 amp @ 250 VAC resistive
	DC	5 amp @ 30 VDC, 0.5 amp @ 125 VDC resistive
Response time		100 milliseconds
Repeatability		Better than 1.0%
Ambient temperature	Electronics	-40° to +160° F (-40° to +70° C)
Operating process pressure/temperature		3500 psig @ +100° F (240 bar @ +40° C) 1750 psig @ +200° F (120 bar @ +95° C)
Temperature coefficient of set point		-40° to +160° F (-40° to +70° C) ± .01% per degree F of setpoint (± .018% per degree C of setpoint)

#### 3.3.2 Dimensional



### 3.4 Replacement Parts



No.	Description	Part Number	
①	Complete Electronic Assembly ①	120 VAC	Z30-9101-001
		240 VAC	Z30-9101-002
		24 VDC	Z30-9101-004
		12 VDC	Z30-9101-003
②	Cover	Aluminum 316 SS	04-9105-001 04-9142-00
③	O-ring		12-2101-345
④	Base	Aluminum 3/4" NPT conduit connection 316 SS, single hub	04-9182-002 04-9140-001
⑤	Probe 18" (457 mm)		8AD-AA1A-018
	Probe 36" (914 mm)		8AD-AA1A-036

① Refer to Section 2.2, *Electrostatic Discharge (ESD) Handling Procedure* on page 2.

### 3.5 Model Numbers

BASIC MODEL

810	Kotron RF Capacitance Level Switch
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INPUT POWER

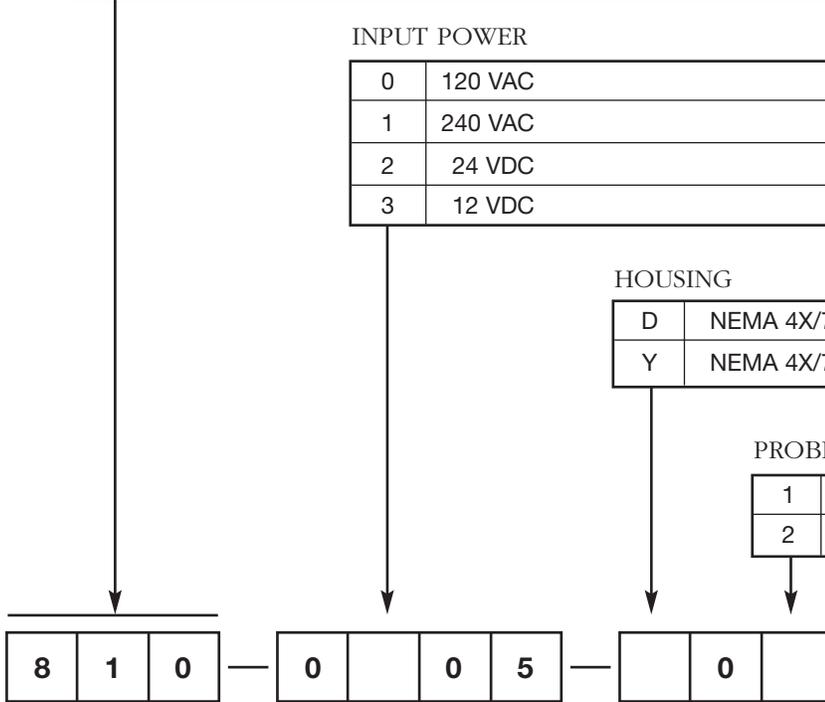
0	120 VAC
1	240 VAC
2	24 VDC
3	12 VDC

HOUSING

D	NEMA 4X/7/9 Groups C & D, aluminum, 3/4" NPT conduit
Y	NEMA 4X/7/9 Groups C & D, 316 SS, 3/4" NPT conduit

PROBE

1	18" (455 mm) guarded probe
2	36" (915 mm) guarded probe



### 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 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 2.



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