

# **INSTRUCTION MANUAL**

**for**  
**LEVEL-TEK**  
**MODEL 310**

**Robertshaw**

**Industrial Products Division**

Robertshaw Industrial Products Division

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**Instruction Manual Number**

**909GF109H**

**P-2408**

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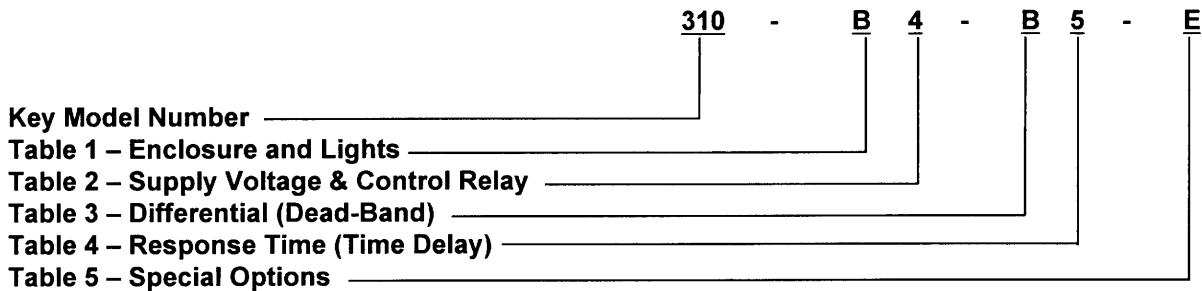
## SECTION I – DESCRIPTION

### 1.1 GENERAL

The Robertshaw Model 310 Level-Tek is a capacitance-sensing ON-OFF control instrument used for detecting or controlling product level changes in vessels or containers. The instrument is supplied with built-in alarm lights. The Model 310 Level-Tek is designed for mounting at a location remote from the Robertshaw Probe assembly up to 150 feet from the vessel. The probe assembly senses the change in product or material level as a function of the capacitance change between the probe and the vessel wall.

### 1.2 MODEL IDENTIFICATION

Identify instrument models in accordance with the description and variations listed in each table. Dashes are used in the model number only in those spaces as indicated in the example below.



#### Key Model Number

Model No.	Description
310	Capacitance actuated Level-Tek for remotely mounted probe assembly. Unit has on-off electric control contacts. See Accessory items for probe conduit outlet box and connecting cable. Refer to Robertshaw catalog for probes.

**Table 1 – Enclosure and Lights**

Designation	Description
B	Weatherproof Case, Aluminum Enclosure with lights, meets NEMA 4 locations & CSA enclosure 5, has red and green signal lights in cover.
D	Explosion-proof enclosure suitable for Class I, Division I, Groups C & D, and Class II, Division I, Groups E, F & G, has red and green signal lights in cover.

**Table 2 – Supply Voltage**

<b>Designation</b>	<b>Description</b>
2	26.5 VDC $\pm$ 10%
4	120 VAC $\pm$ 10%, 50/60 Hz
6	240 VAC $\pm$ 10%, 50/60 Hz

**Table 3 – Differential (Dead-Band)**

<b>Designation</b>	<b>Description</b>
B	Adjustable dead-band. Differential adjustable from 0.2 to 200 pf.

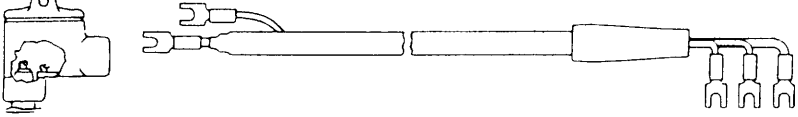
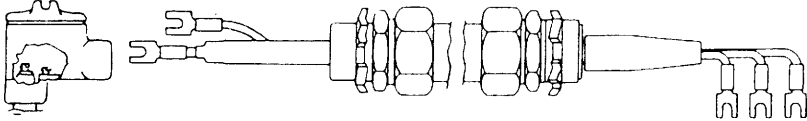
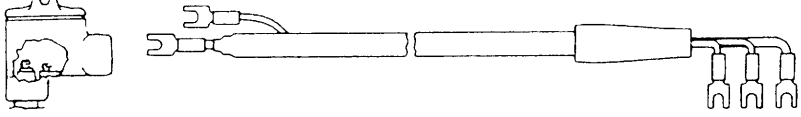
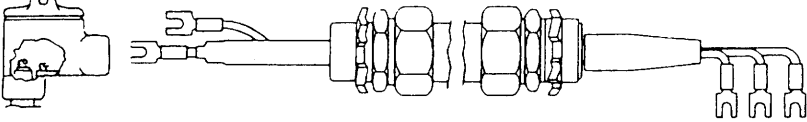
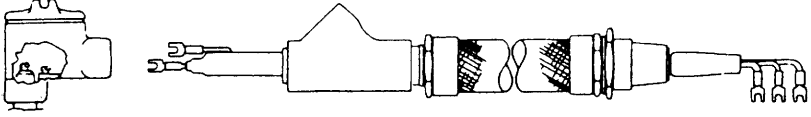
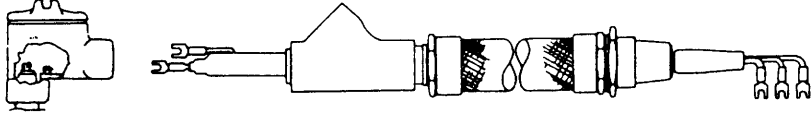
**Table 4 – Response Time (Time Delay)**

<b>Designation</b>	<b>Description</b>
5	Adjustable Time delay from 0.5 to 20 seconds.

**Table 5 – Special Options**

<b>Designation</b>	<b>Description</b>
Omitted	None
E	Enclosure painted with gray epoxy enamel.

Table 6 – Triaxial Cable Accessory Items

Part Number	Description
032KE03X-XX	<p>GENERAL PURPOSE Triax Cable with terminations and Probe connection Conduit Outlet Box. (Recommended for use with customer supplied rigid or flexible conduit.) Maximum temperature 185°F. Specify length in feet for XXX in part number.</p> 
032KE05X-XX	<p>Same as above but with flexible conduit (protective armor). Specify length in feet for XXX in part number.</p> 
032KE04X-XX	<p>HIGH TEMP Triax (Teflon insulated) Cable with terminations and probe connection Conduit Outlet Box. (Recommended for use with customer supplied rigid or flexible conduit.) Maximum temperature 350°F. Specify Length in feet for XXX in part number.</p> 
032KE06X-XX	<p>Same as above but with flexible conduit (protective armor). Specify length in feet for XXX in part number.</p> 
032KE090-XX	<p>GENERAL PURPOSE Triax Cable with terminations in Explosion-proof Flexible conduit with seal fitting and probe connection Conduit Outlet Box. Max. Temp. 185°F. Specify either -05 or -10 for XX in part number.</p> 
032KE100-XX	<p>Same as above except with High Temp (Teflon insulated) Triax. Max. Temp. 350°F. Specify either -05 or -10 for XX in part number.</p> 

## SECTION II – SPECIFICATIONS

### 2.1 ENVIRONMENTAL

Operating Temperature Limits .....	-40°F to +160°F
Storage Temperature Limits .....	-55°F to +225°F
Vibration Limits .....	2 g's 10 to 100 Hz
Enclosure Classification .....	WATERTIGHT/DUSTTIGHT: Designed for NEMA 4 and CSA certified for Enclosure 5.  EXPLOSION-PROOF: For Class I, Div. 1, Groups C & D, Class II, Div. 1, Groups E, F and G hazardous locations.
Intrinsic Safety .....	When used with the Models 310-(B,D)(2,4)-B5, Robertshaw probes are intrinsically safe for Class I, Div. 1, Group C & D; Class II, Division 1, Group E, F & G hazardous locations. When used with the Models 310-B (2,4)-B5 probe models 702, 728, 729, 736, 738, 739, 740 & 741 are CSA Certified as intrinsically safe for Class I, Div. 1, Group C & D; Class II, Div. 1, Group E, F & G hazardous locations.
Operating Humidity Range .....	0% to 90% RH

### 2.2 ELECTRICAL

Supply voltage .....	26.5 VDC $\pm$ 10%, 120 VAC $\pm$ 10%, 240 VAC $\pm$ 10%
Supply Power .....	26.5 VDC $\pm$ 10%, (Without lights) 5 watts max. 26.5 VDC $\pm$ 10%, (With lights) 10 watts max. 120 VAC $\pm$ 10%, 240 VAC $\pm$ 10% (Without lights) 5 watts 7 VA max. (With lights) 10 watts 12 VA max.
Output Relay .....	Electromechanical Relay: Form: DPDT Rating: 5 A 120 VAC/28 VDC Non-inductive
Agency Certifications .....	Models 310-B (2,4)-B5 are CSA Certified.

### 2.3 PERFORMANCE

Zero Adjustment (Control Point) Range .....	20 to 225 pf
Differential (Dead-Band) .....	0.2 pf to 200 pf
Response Time (Time Delay) .....	0.5 to 20.0 seconds
Connecting Cable Length .....	Any length up to 150 feet

## SECTION III – INSTALLATION

### 3.1 GENERAL

Examine the instrument for possible shipping damages. **IMPORTANT:** If for any reason it is determined that parts should be returned to the factory, please notify the nearest Robertshaw sales representative prior to shipment. Each unit must be properly packaged to prevent damage. Robertshaw assumes no responsibility for equipment damaged in shipment due to improper packaging.

Choose the location in accordance with good instrument practice, avoiding extremes of temperature, humidity and vibration. (See Specifications, Section II).

### 3.2 PROBE MOUNTING (See Figure 1)

Robertshaw probes are purchased separately in a variety of sizes and types for specific applications involving liquids or granular materials. Insulated rod-type probes are used for liquid solutions or liquid interface detection where the product is electrically conductive. Bare type probes can be used on nonconductive materials only.

The face of the packing gland on rod-type probes must be installed so that it is nearly flush with the vessel wall. When installing the probe in a nozzle, recess, or open end well, a sheathed probe should be used, with the straight sheathed length equal to the nozzle, recess, or well length.

#### CAUTION

When installing an insulated probe, care should be taken to prevent accidental puncture of the probe insulation.

#### 3.2.1 Horizontal

Horizontally mounted rod-type probes must be installed in the vessel at the desired point of level detection. Horizontally mounted probes provide the closest control (smallest deadband) in that a small level change at or near the probe will produce a large capacitance change.

On applications involving viscous liquids or materials that have a tendency to "cling" or "build-up", it is recommended that the probe be mounted on a slight downward angle to permit draining of the material from the probe.

#### 3.2.2 Vertical

Vertically mounted rod-type probes should be installed in either the top or bottom of the vessel with the mid-point on the probe corresponding to approximately the desired level detection point. Vertically installed probes allow a variation in the level detection point up and down the length of the probe by means of the instrument zero adjustment.

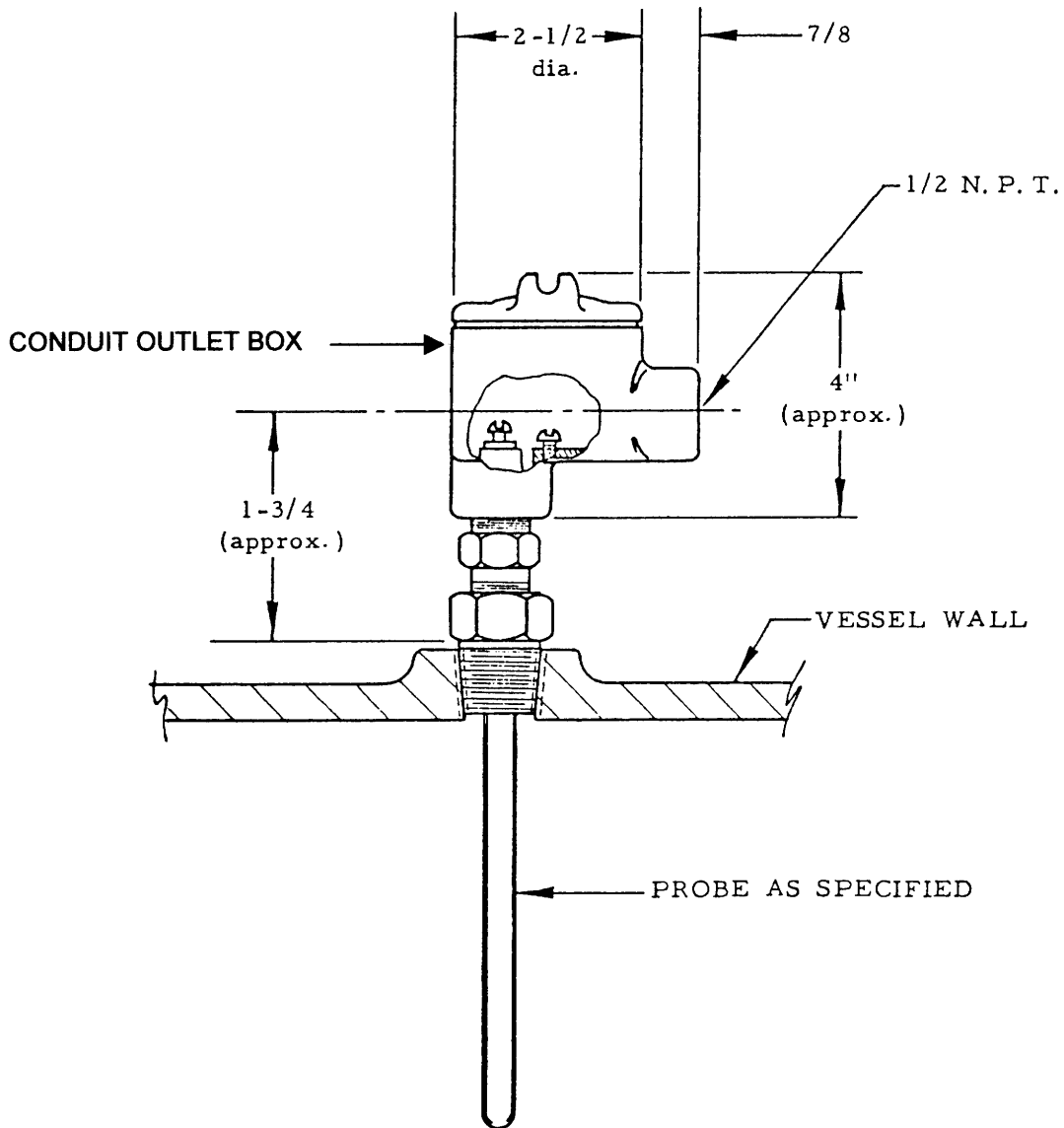


Figure 1. Probe Mounting and Conduit Outlet Box Dimensions.



### 3.4 ELECTRICAL CONNECTIONS

All electrical connections should be made in accordance with Figure 4. (See Specifications for control relay contact ratings).

If an Intrinsically Safe installation is desired, the 3-connection probe terminal block shown in Figure 4 provides an Intrinsically Safe connection, without the use of barriers, for Robertshaw probes only when connected to the variations of the Model 310 specified in paragraph 2.1 of this manual. Only the probe circuit is Intrinsically Safe, so the unit itself must be mounted in the environment for which is approved as specified in paragraph 2.1. It is suggested that the line connecting the probe connection terminal block to the probe conduit outlet box be run through metal conduit to maintain the intrinsically Safe integrity to the circuit.

The instrument chassis assembly may be removed from the housing for wiring installation by loosening the four chassis mounting screws and withdrawing chassis straight out.

#### CAUTION:

When connecting the triaxial cable to the conduit outlet box, **verify** that the outer shield is connected to the conduit outlet box ground, the center conductor to the probe and that the inner shield is not connected at the conduit outlet box end.

## SECTION IV – OPERATION

### 4.1 SELECTING THE OPERATING MODE

The Model 310 Level-Tek is designed with field-changeable operational mode provisions to allow for fail-safe relay contact closure upon loss of electrical power.

Applications for high level detection should utilize the High Level Fail Safe (HLFS) mode which is defined as an increase in capacitance or level to cause the control relay to become de-energized. Loss of electrical power or other failures would cause the control relay to become de-energized indicating a high level or unsafe condition.

Applications for low level detection should utilize the Low Level Fail Safe (LLFS) mode which is defined as a decrease in capacitance or level to cause the control relay to become de-energized. Loss of electrical power or other failures would cause the control relay to become de-energized indicating a low level or unsafe condition.

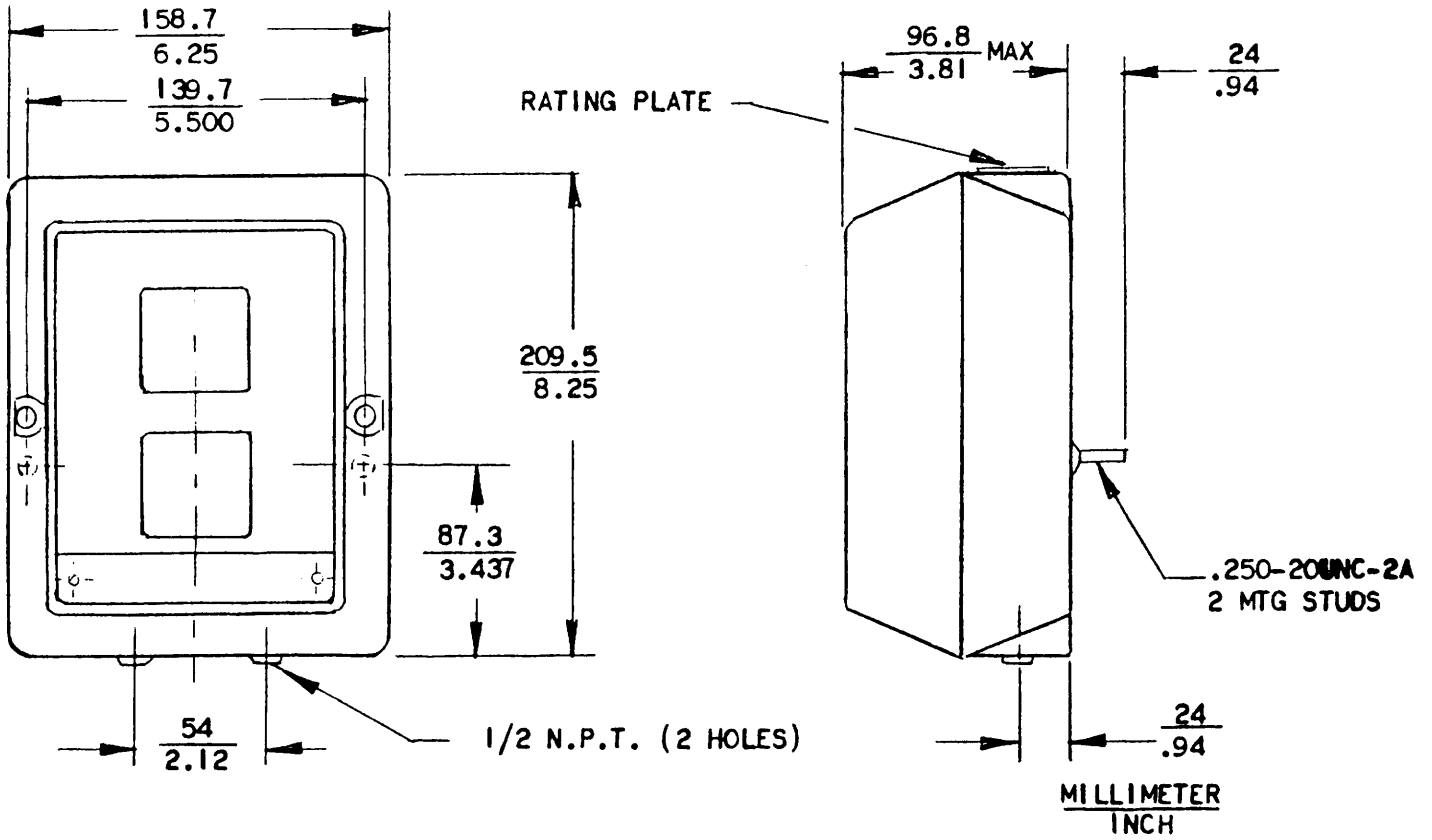


Figure 2. Mounting Dimensions for Model 310 Level-Tek with Weather-Resistant Display Unit.

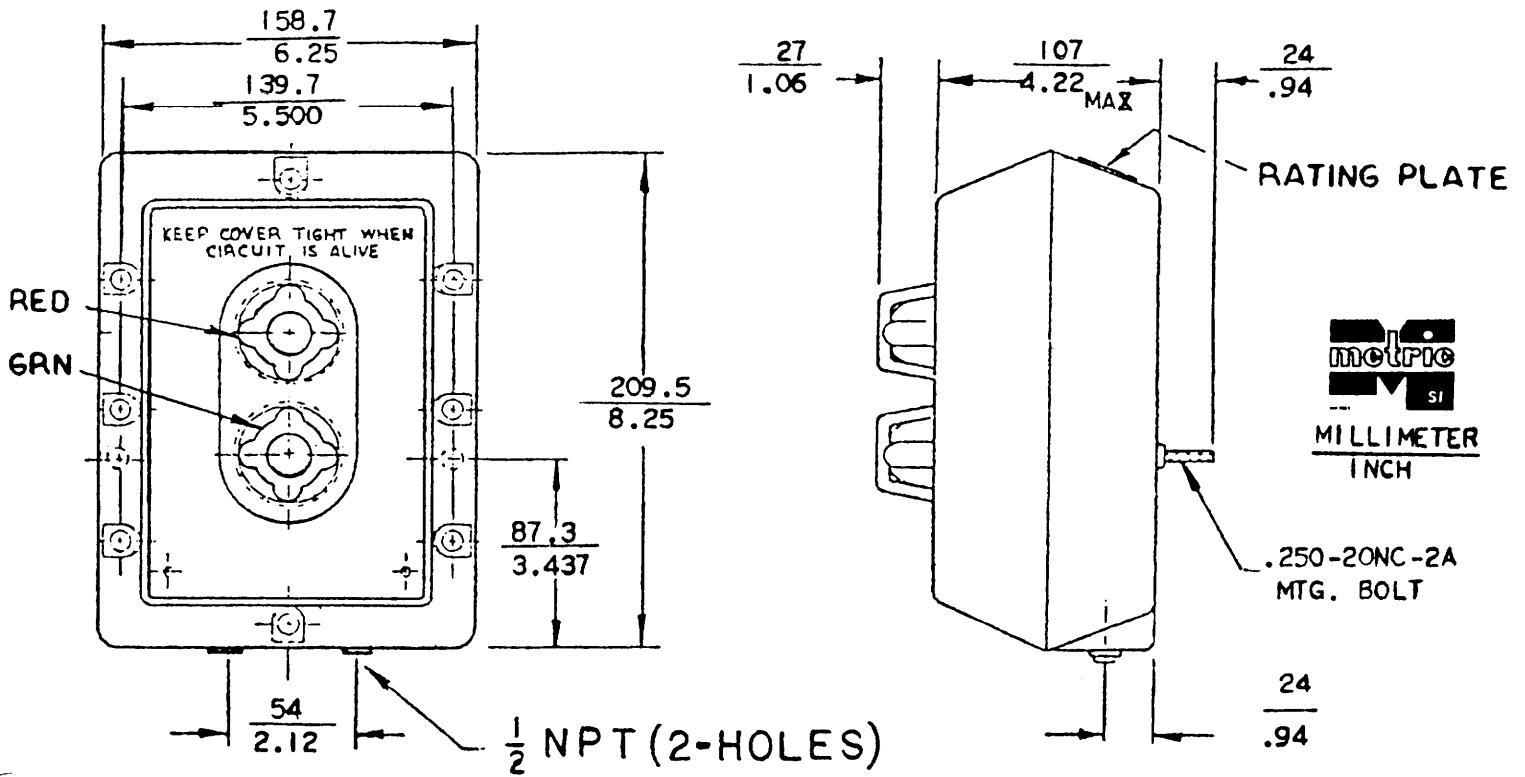
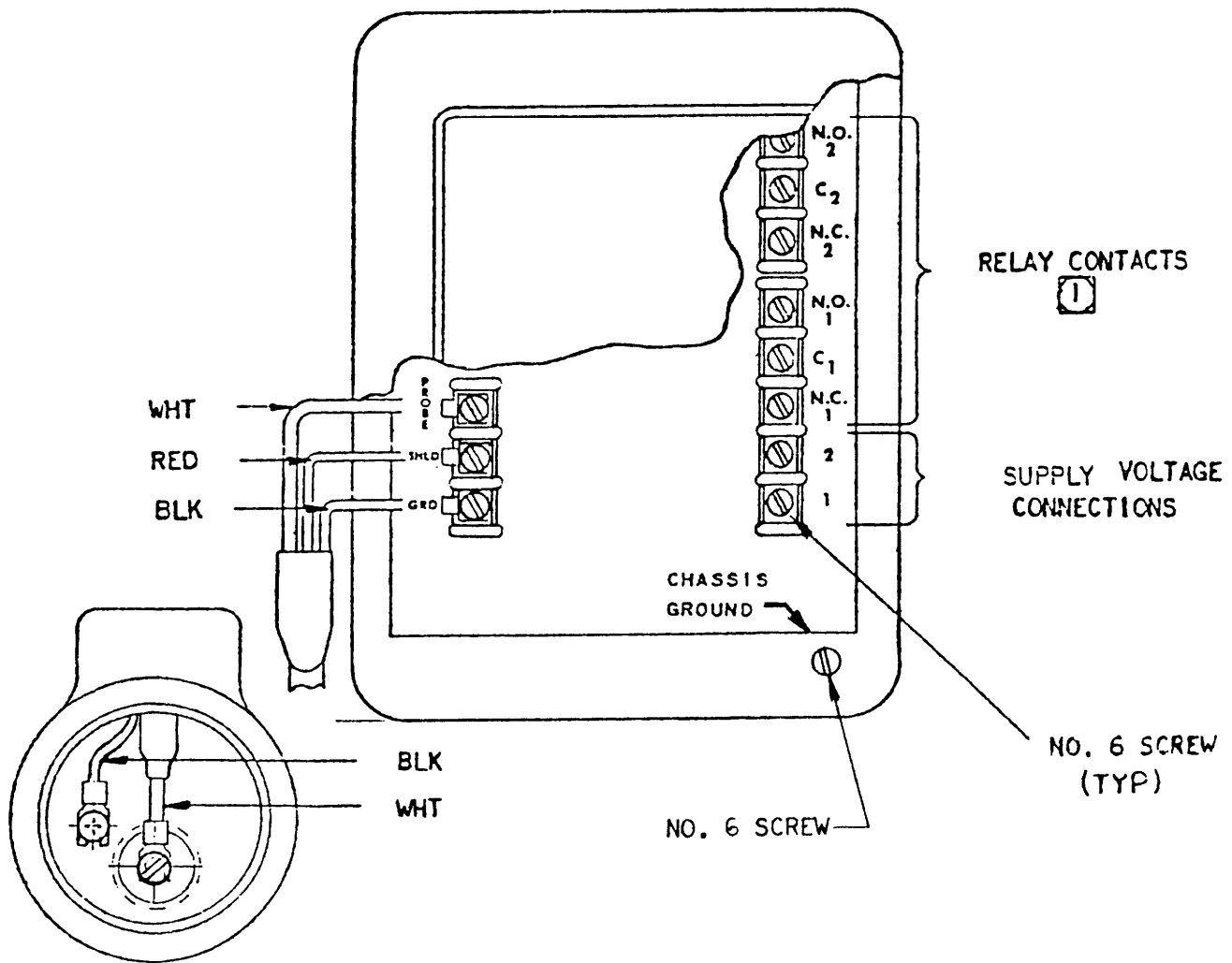


Figure 3. Mounting Dimension for Model 310 Level-Tek with Explosion Proof Display Unit.



(REF.) CONDUIT OUTLET BOX

ELECTRICAL CONNECTIONS		
SUPPLY VOLTAGE SEE RATING PLATE		RELAY CONTACTS
TERMINAL		TERMINAL
1	120 V 50/60 Hz	N.C. 1 NORMALLY CLOSED NO. 1
2		C 1 COMMON NO. 1
1	240 V 50/60 Hz	N.O. 1 NORMALLY OPEN NO. 1
2		N.C. 2 OPTIONAL NORMALLY CLOSED NO. 2
1 (-)	26.5 VDC	C 2 OPTIONAL COMMON NO. 2
2 (+)		N.O. 2 OPTIONAL NORMALLY OPEN NO. 2

CONTROL RELAY CONTACTS DESIGNATIONS ARE SHOWN WITH RELAY IN THE DE-ENERGIZED CONDITION. THE RELAY IS NORMALLY ENERGIZED AND BECOMES DE-ENGIZED WHEN LEVEL OR PROCESS REACHES THE CONTROL POINT.

Figure 4. Electrical Connections.

## 4.2 CHANGING THE OPERATIONAL MODE

The operational mode may be changed by relocating the shorting bar links on the chassis assembly. (See Figure 5.) The supply voltage to the instrument should be momentarily disconnected when making this change.

## 4.3 CALIBRATION ADJUSTMENTS

All the adjustments for calibrating the Model 310 Level-Tek are located on the top of the chassis assembly and consist of the following: (See Figure 5.)

### NOTE:

The Solid State Light shall be ON when the Control Relay is energized.

### 4.3.1 Zero Adjustment (Control Point)

The zero adjustment is a multi-turn potentiometer (approximately 20 turns) that varies the control point through a range of approximately 20 to 225 pf of terminal capacitance. Clockwise rotation of the zero adjustment provides for an increase in control point capacitance.

### 4.3.2 Differential Adjustment (Deadband)

A multi-turn potentiometer (approximately 20 turns) varies the ON-to-OFF differential (or deadband) over a range of approximately 0.2 pf to 200 pf. Clockwise rotation of the differential adjustment increases the differential or deadband of the instrument.

### 4.3.3 Response Time Adjustment (Time Delay)

The response time adjustment is a multi-turn potentiometer (approximately 20 turns) that varies the instrument response time to a change in capacitance or level. Clockwise adjustment of the potentiometer increases the response time through a range of approximately 0.5 to 20 seconds.

The adjustable response time provides a delay to alarm or de-energize the control relay and no delay to reset the relay. To de-energize the control relay, the level in the vessel must exceed the control point setting (either high or low) for a period of time as dictated by the response time adjustment setting. Each rotation of the response time adjustment, from the full counterclockwise position, increases the response time approximately 1.0 seconds.

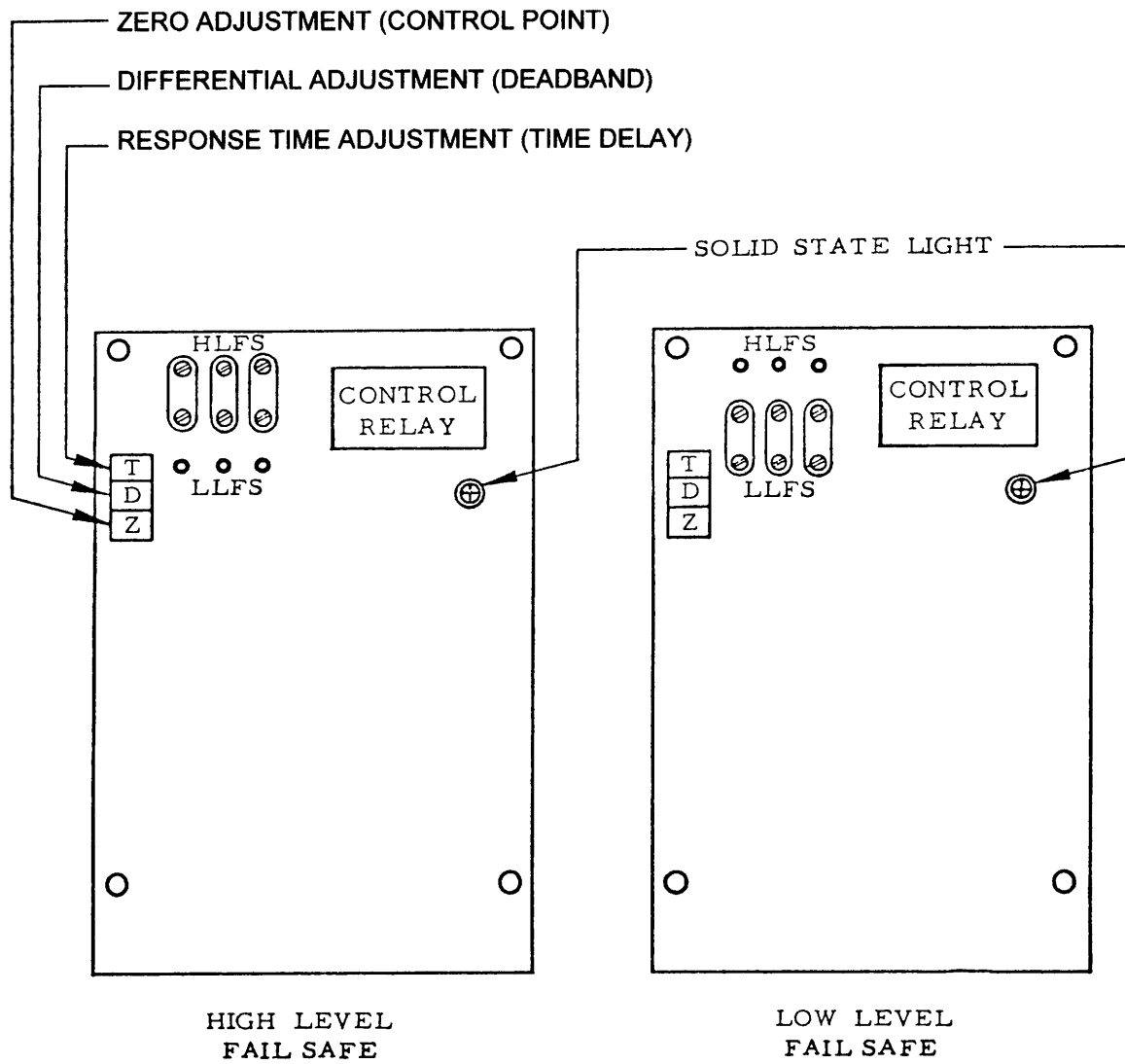


Figure 5. Calibration and Operational Mode Adjustments.

## SECTION V – CALIBRATION

### 5.1 CALIBRATION PROCEDURE

**NOTE:**

Connect a jumper wire as shown in Figure 6 to disable the response time to facilitate initial calibration.

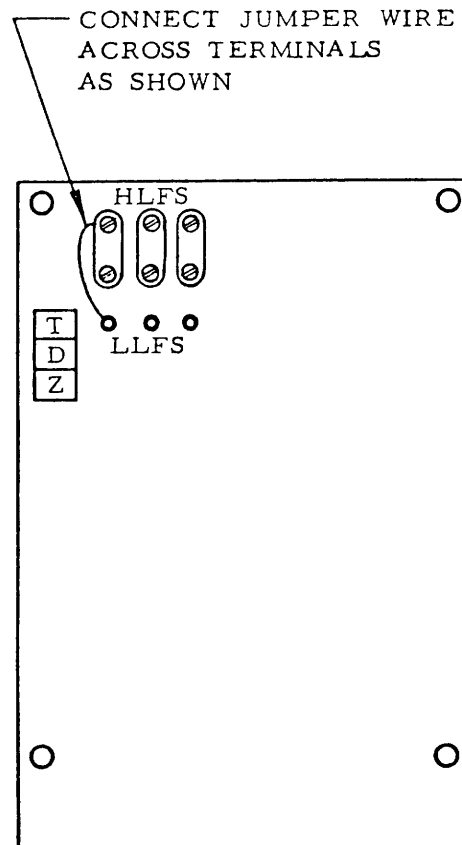


Figure 6. Method of Disabling Response Time.

#### 5.1.1 High Level Fail-Safe (if Differential is not being used)

1. Allow the material in the vessel to increase until the level reaches the centerline, or slightly above, the horizontal probe, or to a point on a vertically mounted probe where control action is desired.

2. Rotate the zero adjustment in the instrument full counterclockwise (approximately 20 turns).
3. Rotate the zero adjust clockwise until the control relay becomes energized (Solid State Light is ON).
4. Slowly rotate the zero adjustment counterclockwise until the control relay becomes de-energized (alarm point, Solid State Light if OFF).
5. Remove the jumper wire previously connected. The adjustable response time may be set by rotating the adjustment fully counterclockwise (approximately 20 turns) and then clockwise to the desired response time setting.

**NOTE:**

Each rotation of the response time adjustment from the full counterclockwise position, increases the response time approximately one second.

**5.1.2 Low Level Fail-Safe (if Differential is not being used.)**

1. Allow the material in the vessel to decrease until the level reaches the centerline, or slightly below, the horizontally mounted probe, or to a point on a vertically mounted probe where control action is desired.
2. Rotate the zero adjustment in the instrument fully clockwise (approximately 20 turns).
3. Rotate the zero adjustment counterclockwise until the control relay becomes energized. (Solid State Light is ON).
4. Slowly rotate the zero adjustment clockwise until the control relay becomes de-energized (alarm point, Solid State Light is OFF).
5. Remove the jumper wire previously connected. The adjustable response time may be set by rotating the adjustment fully counterclockwise (approximately 20 turns) and then clockwise to the desired response time setting.

**NOTE:**

Each rotation of the response time adjustment from the full counterclockwise position, increases the response time approximately one second.



**5.1.3 High Level Fail-Safe (With Differential Adjustment)**

**NOTE:**

Connect a jumper wire as shown on Figure 6 to disable the response time to facilitate initial calibration.

1. Allow the material in the vessel to increase to the desired high level control point on the vertically mounted probe.
2. Rotate the differential adjustment and the zero adjustment to the full counterclockwise position (approximately 20 turns).
3. Rotate the zero adjustment clockwise until the control relay becomes energized (Solid State Light is ON).
4. Slowly rotate the zero adjustment counterclockwise until the control relay becomes de-energized (Solid State Light is OFF).
5. Rotate the differential adjustment fully clockwise (approximately 20 turns).
6. Allow the level of material in the vessel to decrease to the desired low level control point on the vertically mounted probe.
7. Rotate the differential adjustment slowly counterclockwise until the control relay becomes energized (Solid State Light in ON).
8. Remove the jumper wire previously connected. The adjustable response time may be set by rotating the adjustment fully counterclockwise (approximately 20 turns) and then clockwise to the desired response time setting.

**NOTE:**

Each rotation of the response time adjustment from the full counterclockwise position, increases the response time approximately one second.

#### 5.1.4 Low Level Fail-Safe (With Differential Adjustment)

**NOTE:**

Connect a jumper wire as shown in Figure 6 to disable the response time to facilitate initial calibration.

1. Allow the level of material in the vessel to increase to the desired high level control point on the vertically mounted probe.
2. Rotate the differential adjustment and the zero adjustment to the full counterclockwise position (approximately 20 turns).
3. Rotate the zero adjustment clockwise until the control relay becomes de-energized (Solid State Light is OFF).
4. Slowly rotate the zero adjustment counterclockwise until the control relay becomes energized (Solid State Light is ON).
5. Rotate the differential adjustment fully clockwise (approximately 20 turns).
6. Allow the level of material in the vessel to decrease to the desired low level control point on the vertically mounted probe.
7. Rotate the differential adjustment slowly counterclockwise until the control relay becomes de-energized (Solid State Light is OFF).
8. Remove the jumper wire previously connected. The adjustable response time may be set by rotating the adjustment fully counterclockwise (approximately 20 turns) and then clockwise to the desired response time setting.

**NOTE:**

Each rotation of the response time adjustment from the full counterclockwise position, increases the response time approximately one second.

## SECTION VI – MAINTENANCE

A detailed maintenance and servicing manual, Number 909GF117, can be purchased from Robertshaw Industrial Products Division.

### 6.1 SPARE PARTS

Part Number	Description	Used On
044KX169-01	Printed Circuit Assembly	26.5 VDC Supply Models
044KX169-02	Printed Circuit Assembly	120 VAC Supply Models
044KX169-03	Printed Circuit Assembly	240 VAC Supply Models
130KB033-03	Fuse, 1/4 AMP	120 & 240 VAC Supply Models
250KB051-04	Relay	All Models
909GM079	Probe Termination Pin	All Models

# Robertshaw

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