Model 681❑5, 681❑ 6, 681❑ 7, 681❑ 8

RF Point Level Control with Sensor Monitor

General Instructions

General

The Series 681 Point Level Control utilizes DPDT relays to provide switching for peripheral devices (such as pumps) in level applications. A sensor attached to the control acts as an antenna to transmit the process material level to the electronics.

The failsafe switch allows the user to determine the relay state when the process contacts the probe.

The Series 681 Point Level Control can be mounted with the sensor in the process (integral units **K** housing), or up to 150' (45m) from the sensor in the remote configuration (**R** housing).

The Series 681 Point Level Control constantly monitors sensor integrity. In the unlikely event of a sensor failure, a secondary relay provides alarm switching.

An optional timer (DT accessory) is available to delay the switching from 0 seconds to 30 seconds (over and above the standard 0.5 second delay). The delay timer provides added process control, valuable for use in turbulent conditions to prevent false trips.

An optional adjustable differential circuit (AD accessory) allows the user to select on and off level points for the control.

DT and AD accessories may not be used simultaneously. All adjustments will be present, but only those corresponding to the accessory in the model number will function.

Specifications

Ambient temperature limits ..... -40 to 160°F/ -40 to 71°C

Enclosure

Weathertight ..... NEMA 4, 4X, IP65

Explosion proof.....Class I, Group C & D; Class II, Group E, F, & G; Class III; Divisons 1 & 2

Supply voltage ..... See page 8

DPDT relay contact rating ..... 10 Amps 250 VAC 10 Amp 30 VDC (resistive)

Remote distance from sensor .....150'/45m

Adjustment range

Range I .....0 - 300pf,.5pF sensitivity

Range II ..... 300 - 1000pf, 1pF sensitivity

Setpoint stability

Range I .....0.075 pF/°F (0.13 pF/°C)

Range II .....0.15 pF/°F (0.27 pF/°C)

Zero rangeablility 1000pF

Repeatability 0.5%

Adjustable differential range ..... 0 - 1000pF

Response time .....<100 msec

Power at sensor ..... <10 µ joules

Electrostatic discharge (ESD) protection

IEC 1000-4-2 compatible

Electrical conduit connection .....3/4" NPT(F)

Design and specifications are subject to change without notice.

Pre-Installation Test

1. Remove instrument from shipping box and visually inspect for obvious physical damage. Report any shipping damage to the carrier. Report any internal discrepancies to the factory representative in your area. Record the serial number from the nameplate should conversation with the factory be necessary.
2. Remove housing cover.
3. Place instrument on an insulated surface or support so sensor does not touch a conductive surface.
4. Ensure area is safe and observe normal precautions for exposed and powered electronic components.
5. Apply appropriate power to terminals of Line Power Terminal Block. (See page 4.) Move failsafe select switch to LO position and observe green LVL LED. (See Figure 10.)
6. Turn the Level adjustment clockwise (25 turns) to decrease the setpoint until the green LVL LED turns on.

   NOTE: Do not turn the Level adjustment past 25 turns! Damage to the unit could result.

7. Turn the LEVEL adjustment counterclockwise until the green LED turns off.
8. Slowly move a hand toward the probe to touch it. The green LED will be on when the probe is touched. If not, turn the LEVEL adjustment clockwise less than one turn. The green LED should be on when the probe is touched.
9. When practical, use a small container of actual process material to calibrate the control. If the actual process vessel is metal, use a metal container (coffee can, etc.) and ground it to the instrument housing. If the actual process vessel is an insulator, such as fiberglass, use a plastic container.
10. Immerse the sensor in the process material; the LED should light. If not, it may be necessary to turn the level adjustments.
11. To detect an interface, such as oil/water or foam/liquid, the lighter material must be on the sensor, then tuned out. Then move the LEVEL adjustment to detect the heavier process material. (See Figures 1 and 2.)

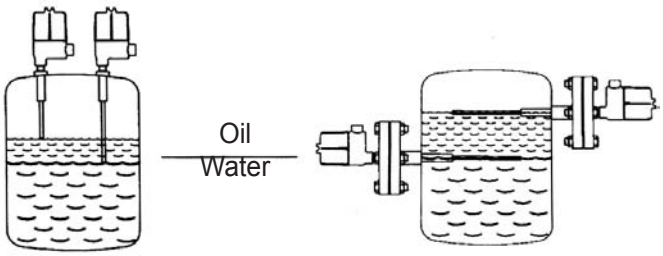


FIGURE 1 ***FIGURE 2***

SOR Form 924 (09.02) Printed in USA

Installation

WARNING: This product must be installed with an explosion proof breather vent per Agency requirements and the National Electrical Code-Article 501, Section F, paragraph 3.

Standard Configuration is a 3/4" NPT(M) pipe nipple that threads into a 3/4" NPT(F) vessel nozzle or half coupling. Allow a 4-inch turn radius. (See Figures 3 and 4.) Open tanks, vats, sumps or basins may require a locally-made bracket mount similar to that shown in Figure 7.

Optional Configuration is a raised face or flat face ANSI flange. See Form 1100 for selection. (See Figures 5 and 6.)

Orientation The control can be mounted in any position. (See Figures below.) Placement and orientation of the sensor in a vessel is usually determined by available nozzles. The sensor should be away from fill points to avoid false trips. The insulator bushing on the sensor should protrude a minimum of 1" from the inner wall of the vessel. The sensor must not touch any metal, nor should conductive process build-up be allowed to bridge between the sensor and a grounded metal tank wall.

If the sensor is a solid rod it may be cut or bent for clearance or placement. Use a 3-inch radius should a bend be required. It is permissible to increase the sensor length by welding a length of identical rod to the supplied sensor. Re-calibration is required if the probe length is changed.

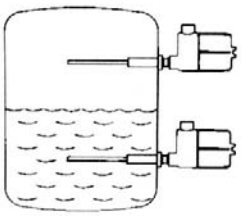


FIGURE 3

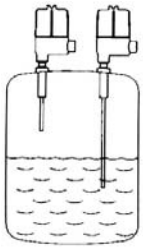


FIGURE 4

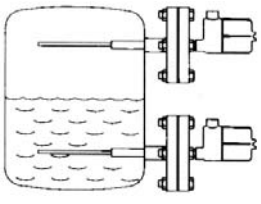


FIGURE 5

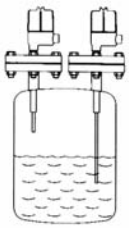


FIGURE 6

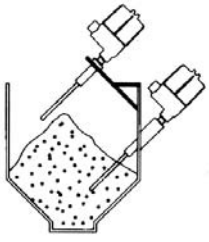


FIGURE 7

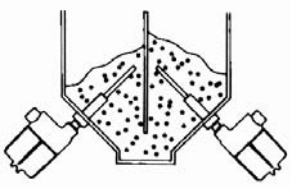


FIGURE 8

Remote Cable Connection

Conduit must be installed between the sensor base and the electronics housing to provide a raceway for sensor extension cables. (See Figure 9.)

CAUTION: Electrical power must be disconnected from explosion-proof models before the cover is removed. Failure to do so could result in severe personal injury or substantial property damage.

Ensure that wiring conforms to all applicable local and national electrical codes and install unit(s) according to relevant national and local safety codes.

Fishing the Sensor Extension Cables

One three-conductor extension cable is required. Pull cable from the sensor base so that the free ends follow the fish through the conduit. (See Figure 9.)

Connections Inside Sensor Base

Inside the sensor base, a remote circuit board rests in a plastic holder. Attach the cable wires to the terminal block on the circuit board as follows:

Terminal Block	Cable
+	red wire
-	black wire
PROBE	white wire

Connections Inside Electronics Housing

Inside the electronics housing, unscrew the bracket holding the circuit board in place. Pull the board out of the holder. At the bottom of the circuit board, there is a connector labeled "+ - probe". Attach the cable wires to the terminal block as follows:

Terminal Block	Cable
+	red wire
-	black wire
PROBE	white wire

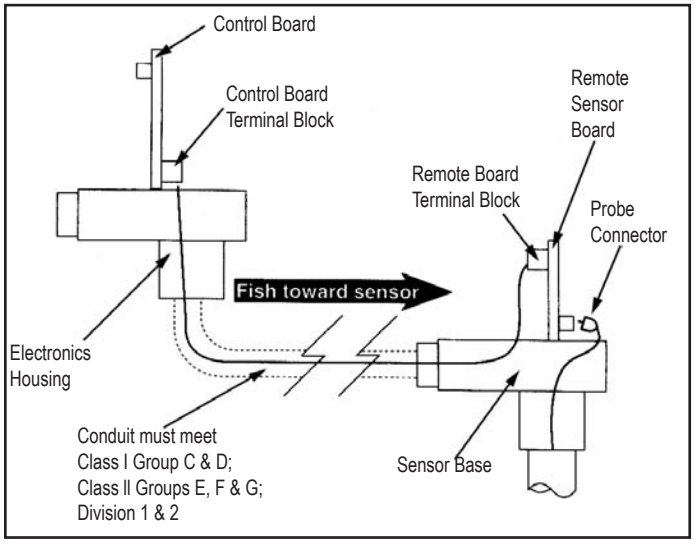


FIGURE 9

Electrical Connection

CAUTION: Electrical power must be disconnected from explosion-proof models before the cover is removed. Failure to do so could result in severe personal injury or substantial property damage.

Level and Alarm
See Figure 10

DPDT relays: 10 amp 250 VAC; 10 amp 30 VDC (resistive)
Connect external circuit wires as required to screw clamp terminals marked:
C1 (Common)
NO1 (Normally Open)
NC1 (Normally Closed)

C2 (Common)
NO2 (Normally Open)
NC2 (Normally Closed)

Line Power
See Figure 10

Voltage Limits		Max. Current Draw	Board Marking
12 ± 10%	VDC	100 mA	+ –
24 ± 10%	VDC	100 mA	+ –
120 (95-130)	VAC	25 mA	L1, N (shown)
240 (195-250)	VAC	13 mA	L1, L2

Ensure that wiring conforms to all applicable local and national electrical codes and install unit(s) according to relevant national and local safety codes.

120 VAC (681K7)
1. Remove housing cover.
2. Observe applicable electrical codes and recognized wiring practices.
3. Remove two mounting screws and slide out PC board to expose green ground screw (Internal Primary Equipment Ground/Earth) in base of housing.
4. Connect green line ground wire to green ground screw on base of housing. (Ground wire should be a minimum of 18-AWG.)
5. Reposition PC board, replace and tighten mounting screws. Ensure that banana plug on sensor lead wire is secure in sensor jack.
6. Connect hot line power wire (typically black) to **L1** position on the terminal block.
7. Connect neutral line power wire (typically white) to **N** position on the terminal block.
8. Replace cover.
9. Apply power as desired.

240 VAC (681K8)
1. Perform Steps 1 through 6 above.
2. Connect second hot line power wire (typically red) to **L2** position on the terminal block.
3. Replace cover.
4. Apply power as desired.

12 VDC (681K5)
24 VDC (681K6)
1. Perform Steps 1 through 5 at left if a case or equipment ground wire is provided for connection to earth ground.
2. Connect positive line power wire to the terminal marked (+).
3. Connect negative line power wire to the terminal marked (–).
4. Replace cover.
5. Apply power as desired.

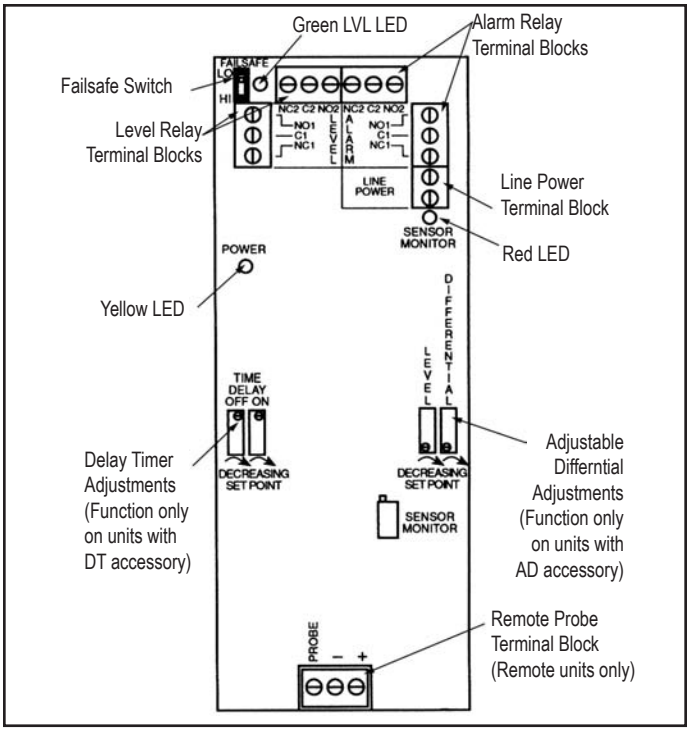


FIGURE 10

SOR Form 924 (09.02) Printed in USA

Set Point and Sensor Monitor Calibration

WARNING: Units in Hazardous Locations — Prior to calibration, make sure that the work area is declassified before removing the explosion proof cover to calibrate the unit. Failure to do so could result in severe personal injury or substantial property damage.

The failsafe mode on either rising or falling level can be easily changed in the field. See procedure and chart below.

NOTE: Upon loss of power, or some component failures, the output relay is de-energized and its contacts return to the "shelf position" NC (Normally Closed) to signal an alarm condition regardless of process level.

Sensor Monitor Calibration

1. Disconnect the probe wire from the circuit.
2. Turn the SENSOR MONITOR adjustment until the red Sensor Monitor LED just lights. The circuit will close the normally open contacts on the ALARM relay.
3. Reconnect the probe wire to the circuit board. The circuit will return the ALARM relay contacts to the normal state.

Set Point Calibration

1. Disconnect line power supply.
2. Remove the housing cover.
3. Rotate TIME DELAY and DIFFERENTIAL adjustments 25 turns clockwise, or until you hear the potentiometer click.
4. Look at the chart below to determine the correct failsafe switch setting for your application.

FAILSAFE LO

5. Move the process to the level where switching is needed, and move the FAILSAFE switch to LO.
6. If the green LVL LED is off, turn the LEVEL adjustment clockwise until the LED just lights.
7. If the green LED is on, turn the LEVEL adjustment counterclockwise until the LED turns off. Then turn another 1/4 turn clockwise or until the LED just lights.

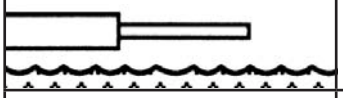
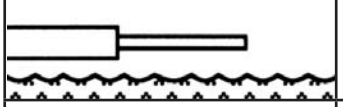
FAILSAFE HI

8. Move the process to the level where switching is needed and move the FAILSAFE switch to HI.
9. If the green LED is on, turn the LEVEL adjustment clockwise until the LED just turns off.
10. If the green LED is off, turn the LEVEL adjustment counterclockwise until the LED lights. Then turn another 1/4 turn clockwise or until the LED just turns off.

Adjustable Differential Calibration (AD accessory)

1. Perform set point calibration per instructions.
2. Locate the DIFFERENTIAL adjustment (see Figure 10), and rotate the screw head fully counterclockwise. Stop when you hear a small click.
3. Move the process level to the point where the adjustable differential will be set.
4. Turn the screw head of the DIFFERENTIAL adjustment clockwise until you see the LEVEL LED change from on to off, or off to on. You will also hear a click as the relay contacts change state.

Continuity Chart

Switch Position	Process Level	Terminal Continuity
 Failsafe HI		
		
 Failsafe LO		
		

Delay Timer Operation (DT accessory)

The delay timer is present in units which contain a **DT** near the end of the model number. Two potentiometers located on the control board adjust the delay timer. (See Figure 10.)

Off Delay = sensor wet ⟶ sensor dry
On Delay = sensor dry ⟶ sensor wet

Off Delay Timer Adjustment

Off delay is an integral timer that starts when the process material level falls. If the level rises to the sensor before the timer completes its cycle, the timer resets to zero and waits for the level to fall again. When the Off timer completes its cycle, the liquid level relay changes state to indicate the process level is below the probe.

Fully clockwise = 0-second delay
Fully counterclockwise = Approx. 30-second delay

On Delay Timer Adjustment

On delay is an integral timer that starts when the process material level rises to meet the probe. If the level falls away from the sensor before the timer completes its cycle, the timer resets to zero and waits for the level to meet the probe again. When the On timer completes its cycle, the liquid level relay changes state to indicate process presence at the probe.

Fully clockwise = 0-second delay
Fully counterclockwise = Approx. 30-second delay

Sensor Replacement

1. Disconnect power to the unit.
2. Remove the housing cover.
3. Remove two screws holding bracket to plastic holder.
4. Slide out PC board to expose the sensor connection.
5. Disconnect the sensor wire.
6. Unscrew the sensor from the housing.
7. Apply thread sealant to the male threads of the new sensor.
8. Thread the new sensor into the bottom of the housing.
9. Connect the sensor wire to the “probe” connection on the circuit board.
10. Slide the PC board into the grooves in the plastic ring inside the housing.
11. Replace the two screws in the circuit board bracket to the plastic holder.
12. Reconnect power and replace the housing cover.

Replacement Sensors
See Form 1100 RF Catalog for replacement sensor model numbers.

Troubleshooting

Sympton/Problem	Possible Cause	Corrective Action
No LEDS lit	1. Power supply turned off 2. Improperly wired line power 3. Broken power supply wire 4. Blown fuse 5. Blown varistor	1. Check power supply source 2. Check terminal block wiring 3. Check wiring integrity 4. Replace fuse F1 5. Replace varistor VR1, VR2 or VR3
LVL LED remains lit at all times	1. Probe wire touched housing or other ground 2. Setpoint is at the lowest level	1. Check probe that probe wire is properly attached to the probe 2. Turn the LEVEL adjustment counterclockwise and retry
LVL LED operates properly, but relay does not respond	1. Relay contact damage 2. Burned or broken circuits	1. Replace circuit board or relay 2. Replace circuit board
Process material is not detected	1. Sensitivity is improperly set 2. Highly conductive product 3. Heavy conductive build-up on the sensor 4. Circuit failure	1. Recalibrate per page 4 instructions 2. Use sheathed sensor 3. Use sheathed sensor and periodically remove the build-up 4. Replace circuit board

If corrective action is not effective, please consult the factory.

SOR Form 924 (09.02) Printed in USA

Circuit Board Replacement

1. Contact the factory for the correct replacement circuit board (model number required).
2. Disconnect power to the unit.
3. Remove the housing cover.
4. Remove two screws holding bracket to plastic holder.
5. Slide out PC board.
6. Disconnect power wiring, sensor wire, and the ground connection to the housing.
7. Connect the sensor lead from the new board to the probe. Connect ground to the housing.
8. Slide the new board into the control housing.
9. Replace the two screws in the circuit board bracket to the plastic holder. These screw are self-tapping. Do not over–tighten.
10. Reconnect power and replace the housing cover.

Varistor Replacement

Use the replacement varistor per the following chart:

Control Model Number	Varistor Part Number	Quantity	Location
681❑5	2820-015	1	RV1
681❑6	2820-014	1	RV1
681❑7	2820-003	3	RV1, RV2, RV3
681❑8	2820-004	3	RV1, RV2, RV3

1. Disconnect power to the unit.
2. Remove the housing cover.
3. Unplug the varistor(s) (RV1, RV2, RV3) located on the opposite side of the circuit board from the wiring terminals. (See Figure 11.)
4. Plug in replacement varistor(s).
5. Replace the housing cover. Re-connect power to the unit.

Fuse Replacement (AC units only)

Use replacement fuse part number: 2806-001 1/2A

1. Disconnect power to the unit.
2. Remove the housing cover.
3. Unplug the fuse (F1) from the circuit board (See Figure 11.) The fuse is located on the opposite side of the circuit board from the wiring terminals.
4. Plug in replacement fuse.
5. Replace the housing cover.
6. Reconnect power to the unit.

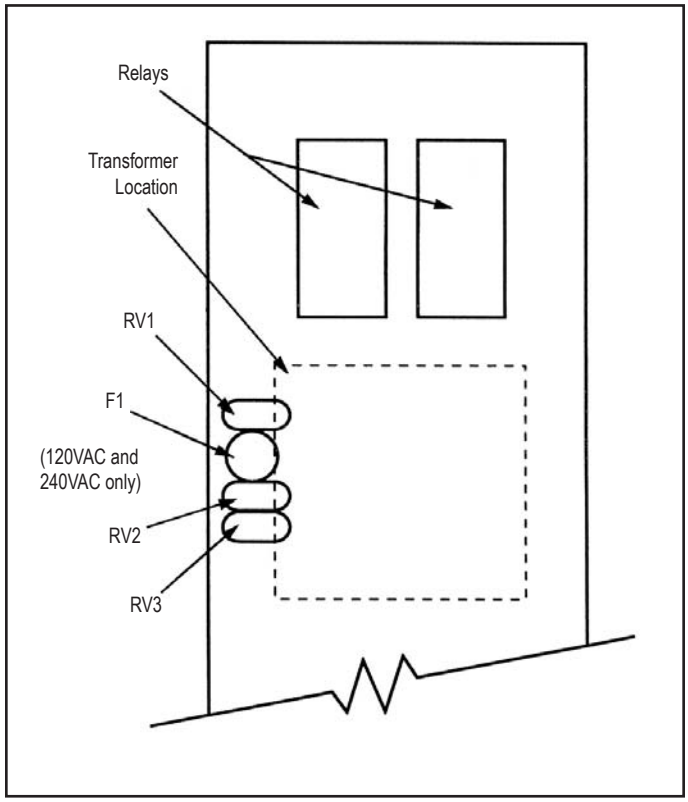


FIGURE 11
Reverse Side of Printed Circuit Board

Model Number

681 □ □ – □ □

	Accessories
A D	Adjustable Differential (do not use with DT accessory)
B K	Remote electronics flat surface mounting bracket (R housing only)
D T	Delay Timer on and off (do not use with AD accessory)
P K	Pipe mounting kit for use with BK accessory (R housing only)
P P	Fiber tag with customer specified tag information
R R	316 SS nameplate wired to the unit with customer specified tag information
T T	316 SS nameplate permanently affixed to the unit with customer specified tag information
V V	Fungicidal varnish applied to housing exterior
Y Y	Epoxy coating applied to housing exterior

Power Supply

	Nominal	Actual	Max Current Draw	Output
5	12 VDC	12 VDC ± 10%	100 mA	Relay 10A @ 250 VAC, 10A @ 30 VDC
6	24 VDC	24 VDC ± 10%		
7	120 VAC	95 to 130 VAC	25 mA	
8	240 VAC	195 to 250VAC	13 mA	
9	12-28 VDC*			4-20 mA

* also available, but not included in this instruction

Housings

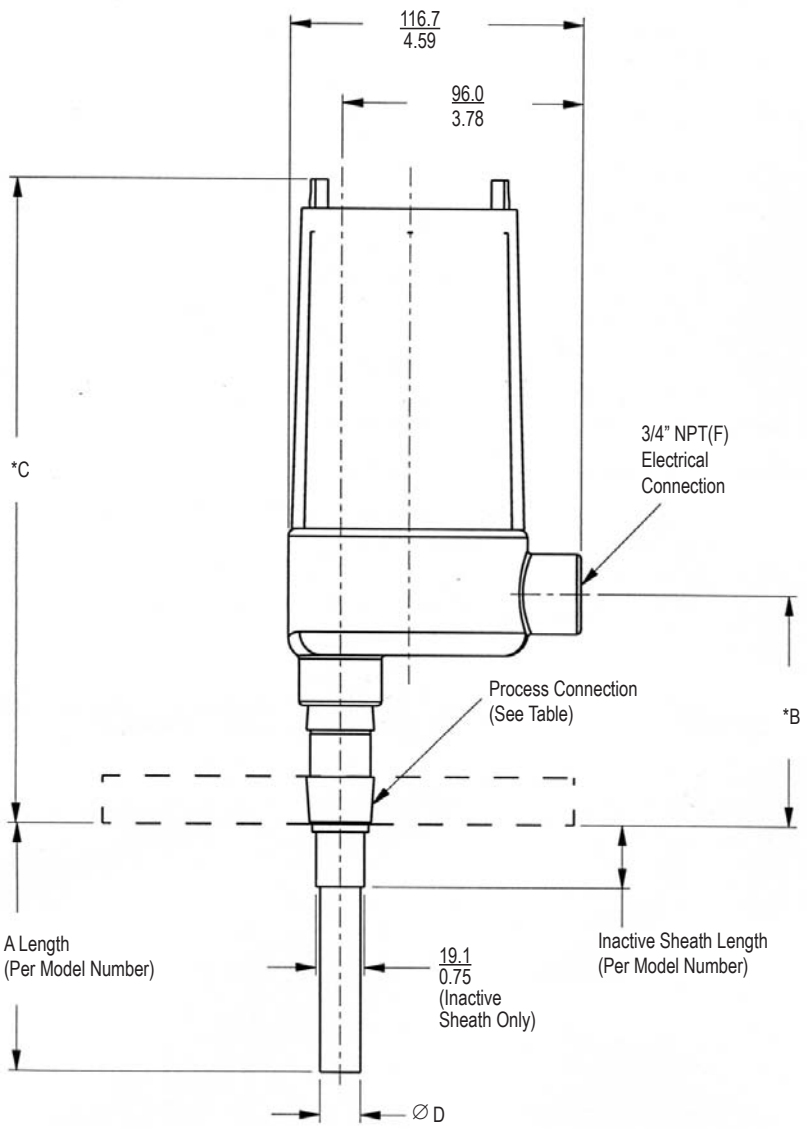
K	Integral
R	Remote 150 feet (45m) maximum Order remote cable part number 2924-113 and specify length.

SOR Form 924 (09.02) Printed in USA

Dimensions - K Housing Configuration (Explosion Proof Integral)

Linear = mm / in.

*Note: These dimensions are based upon a 5-thread engagement.

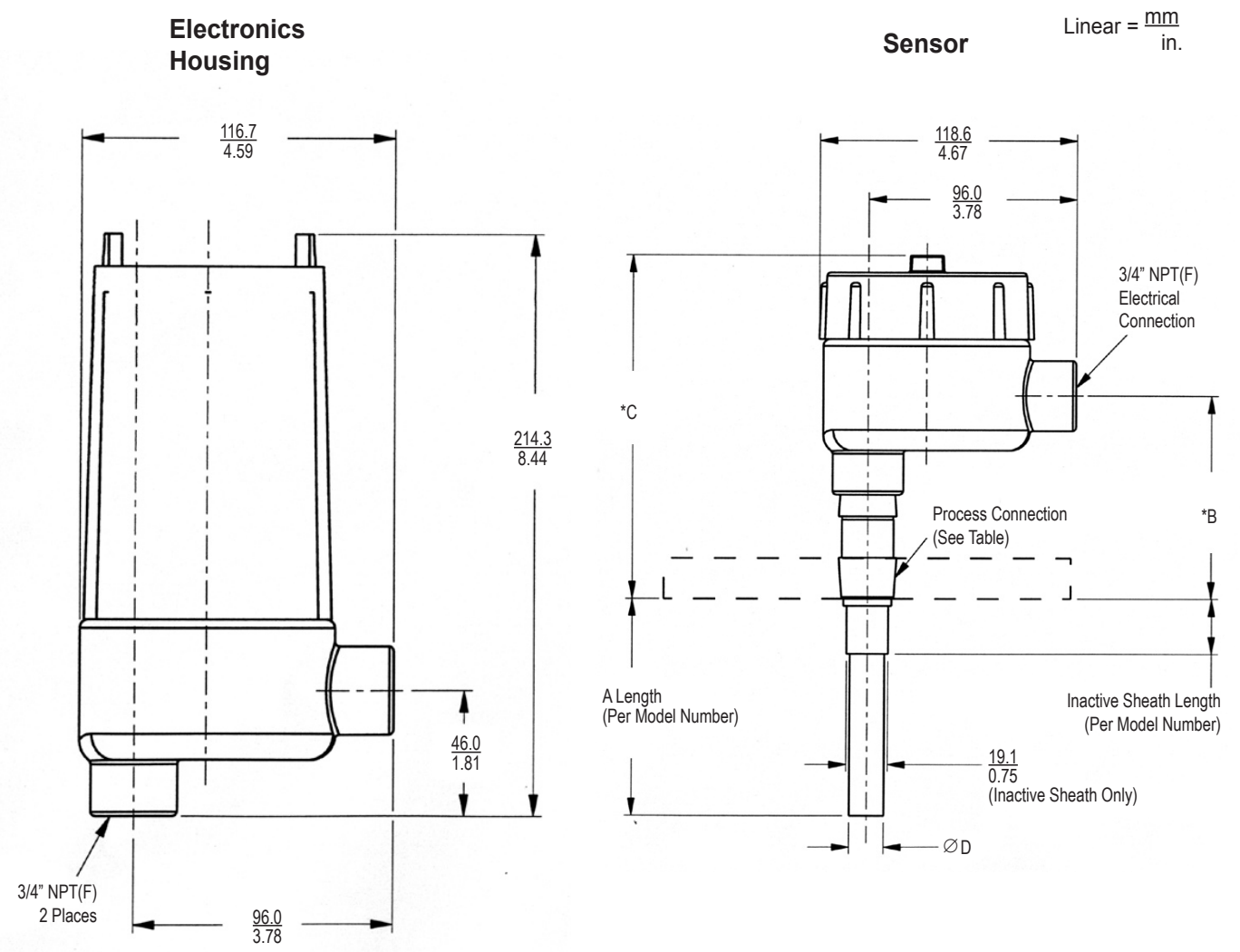


Sensor Style	∅ D
Bare	12.7 / 0.50
Sheath	15.9 / 0.63
Bare with Stilling Well	26.7 / 1.05
Sheath with Stilling Well	26.7 / 1.05
Cable	7.90 / 0.31
Inactive Sheath	15.9 / 0.63
Sanitary	15.9 / 0.63

Process Connection	Dim B		Dim C	
	Cable Probe	All Other Probes	Cable Probe	All Other Probes
3/4" NPT(M)	87.8 / 3.46	94.1 / 3.71	256.0 / 10.08	262.4 / 10.33
1, 1-1/2, & 2" NPT(M)	99.7 / 3.92	97.3 / 3.83	268.0 / 10.55	265.6 / 10.46
Flanged	158.5 / 6.24	158.5 / 6.24	326.8 / 12.87	326.8 / 12.87
Stilling Well	N/A	120.0 / 4.72	N/A	288.3 / 11.35
Sanitary	N/A	94.1 / 3.71	N/A	262.4 / 10.33

DWG. # 0390654

Dimensions - R Housing Configuration (Explosion Proof Remote)



*Note: These dimensions are based upon a 5-thread engagement.

Sensor Style	∅ D
Bare	12.7 / 0.50
Sheath	15.9 / 0.63
Bare with Stilling Well	26.7 / 1.05
Sheath with Stilling Well	26.7 / 1.05
Cable	7.90 / 0.31
Inactive Sheath	15.9 / 0.63
Sanitary	15.9 / 0.63

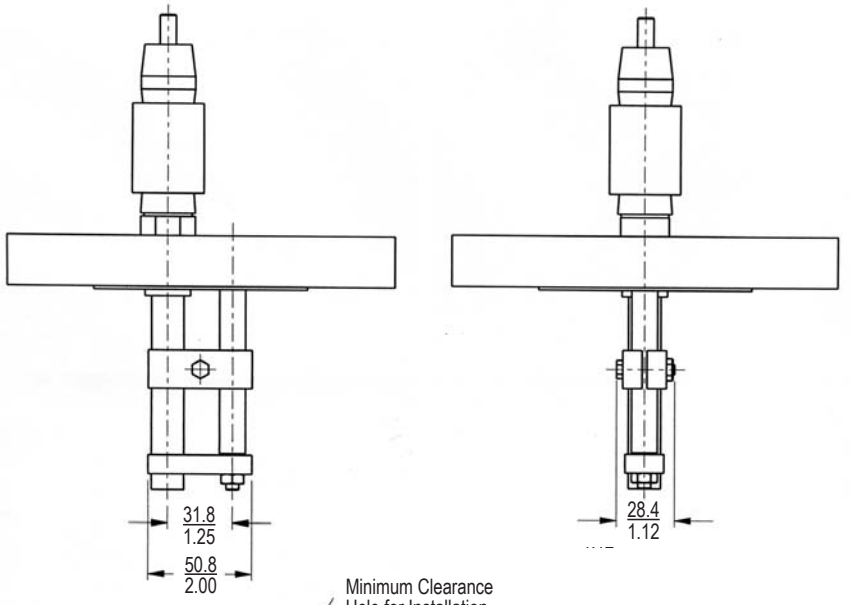
Process Connection	Dim B		Dim C	
	Cable	All Others	Cable	All Others
3/4" NPT(M)	87.8 / 3.46	94.1 / 3.71	152.9 / 6.02	159.2 / 6.27
1, 1-1/2, & 2" NPT(M)	99.7 / 3.92	97.3 / 3.83	164.8 / 6.49	162.46 / 6.396
Flanged	158.5 / 6.24	158.5 / 6.24	223.7 / 8.81	223.7 / 8.81
Stilling Well	N/A	120.0 / 4.72	N/A	185.1 / 7.29
Sanitary	N/A	94.1 / 3.71	N/A	159.2 / 6.27

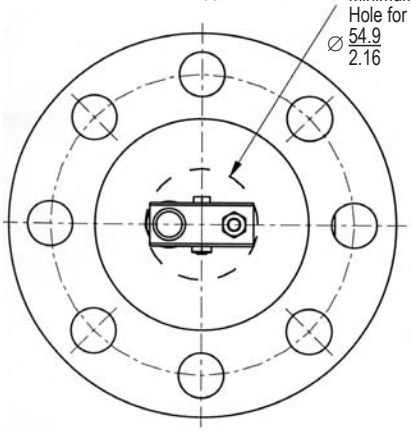
DWG. # 0390653

Dimensions - Other Sensors

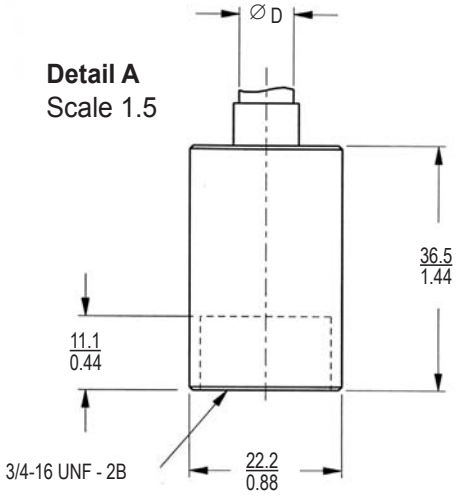
Dual Rigid Probe Detail

Linear = mm / in.

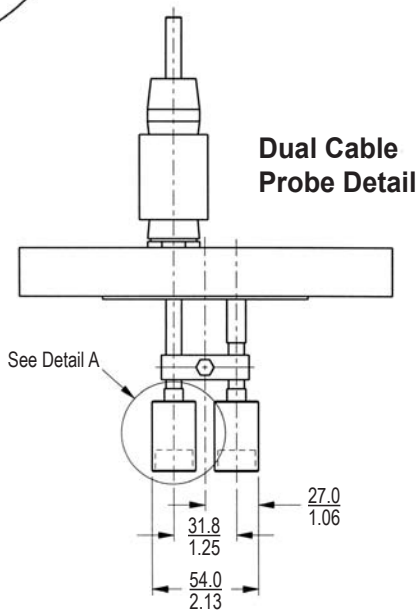




Detail A
Scale 1.5



Dual Cable Probe Detail



Sensor Style	∅ D
Bare	12.7 / 0.50
Sheath	15.9 / 0.63
Bare with Stilling Well	26.7 / 1.05
Sheath with Stilling Well	26.7 / 1.05
Cable	7.90 / 0.31
Inactive Sheath	15.9 / 0.63
Sanitary	15.9 / 0.63

DWG. # 0390653

14685 West 105th Street, Lenexa, Kansas 66215 913-888-2630 Fax 913-888-0767 www.sorinc.com