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

An optional adjustable differential circuit (AD accessory) allows the user to select on and off level points for the control. (All adjustments will be present, but only those corresponding to the accessory in the model number will function.)

**NOTE:** If you suspect that a product is defective, contact the factory or the SOR® Representative in your area for a return authorization number (RMA). This product should only be installed by trained and competent personnel.

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## Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature limits</td>
<td>-40 to 160°F / -40 to 71°C</td>
</tr>
<tr>
<td>Enclosure</td>
<td>NEMA 4, 4X, IP65</td>
</tr>
<tr>
<td>Explosion proof</td>
<td>Class I, Group C &amp; D; Class II, Group E, F, &amp; G; Class III; Divisions 1 &amp; 2</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>See page 8</td>
</tr>
<tr>
<td>DPDT relay contact rating</td>
<td>10 Amps 250 VAC, 10 Amp 30 VDC (resistive)</td>
</tr>
<tr>
<td>Remote distance from sensor</td>
<td>150'/45m</td>
</tr>
<tr>
<td>Adjustment range</td>
<td>Range I: 0 - 300pf, .5pf sensitivity</td>
</tr>
<tr>
<td></td>
<td>Range II: 300 - 1000pf, 1pf sensitivity</td>
</tr>
<tr>
<td>Set point stability</td>
<td>Range I: 0.075 pF/°F (0.13 pF/°C)</td>
</tr>
<tr>
<td></td>
<td>Range II: 0.15 pF/°F (0.27 pF/°C)</td>
</tr>
<tr>
<td>Zero rangeability</td>
<td>1000pf</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.5%</td>
</tr>
<tr>
<td>Adjustable differential range</td>
<td>0 - 1000pF</td>
</tr>
<tr>
<td>Response time</td>
<td>&lt;100 msec</td>
</tr>
<tr>
<td>Power at sensor</td>
<td>&lt;10 μ joules</td>
</tr>
<tr>
<td>Electrostatic discharge (ESD)</td>
<td>IEC 1000-4-2 compatible</td>
</tr>
<tr>
<td>Electrical conduit connection</td>
<td>3/4&quot; NPT(F)</td>
</tr>
</tbody>
</table>
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 6.) Move failsafe select switch to LO position and observe green LVL LED. (See).

6. Turn the Level adjustment clockwise (25 turns) to decrease the set point 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 A and B).
Conduit must be installed between the sensor base and the electronics housing to provide a raceway for sensor extension cables. (See J).
Remote Cable Connection

Conduit must be installed between the sensor base and the electronics housing to provide a raceway for sensor extension cables. (See 1).

**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 1).

**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:

<table>
<thead>
<tr>
<th>Terminal Block</th>
<th>Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>red wire</td>
</tr>
<tr>
<td>-</td>
<td>black wire</td>
</tr>
<tr>
<td>PROBE</td>
<td>white wire</td>
</tr>
</tbody>
</table>

**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 shown above.

Conduit must meet Class I Group C & D; Class II Groups E, F & G; Division 1 & 2
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 Fig.). DPDT relays: 10 amp 250 VAC; 10 amp 30 VDC (resistive)

Connect external circuit wires as required to screw clamp terminals marked:

- C1 (Common)
- C2 (Common)
- NO1 (Normally Open)
- NO2 (Normally Open)
- NC1 (Normally Closed)
- NC2 (Normally Closed)

**Line Power**

<table>
<thead>
<tr>
<th>Voltage Limits</th>
<th>Max. Current Draw</th>
<th>Board Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 ± 10% VDC</td>
<td>100 mA</td>
<td>+ –</td>
</tr>
<tr>
<td>24 ± 10% VDC</td>
<td>100 mA</td>
<td>+ –</td>
</tr>
<tr>
<td>120 (95-130) VAC</td>
<td>25 mA</td>
<td>L1, N (shown)</td>
</tr>
<tr>
<td>240 (195-250) VAC</td>
<td>13 mA</td>
<td>L1, L2</td>
</tr>
</tbody>
</table>

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)**

1. Perform Steps 1 through 5 above if a case or equipment ground wire is provided for connection to earth ground.
2. Connect positive line power wire to the terminal marked (+).

**24 VDC (681K6)**

3. Connect negative line power wire to the terminal marked (−).
4. Replace cover.
5. Apply power as desired.
**IMPORTANT!**

Do not provide separate earth grounding for the process connection. This can create a parallel grounding circuit that will impair operation and calibration.
Set Point and Sensor Monitor Calibration

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 DIFFERENTIAL adjustment 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.

Continuity Chart

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>Process Level</th>
<th>Terminal Continuity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fail Safe HI</td>
<td></td>
<td>NC1 C1 NO1 NO2 C2 NC2</td>
</tr>
<tr>
<td>Fail Safe LO</td>
<td></td>
<td>NC1 C1 NO1 NO2 C2 NC2</td>
</tr>
</tbody>
</table>

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.
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  ), 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.
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
12. Reconnect power and replace the housing cover.

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

Troubleshooting

<table>
<thead>
<tr>
<th>Symptom/Problem</th>
<th>Possible Cause</th>
<th>Corrective Action</th>
</tr>
</thead>
</table>
| 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 6 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.

NOTE: Agency certified units, (FM, CSA, IEC) must be returned to SOR for repairs.
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:

<table>
<thead>
<tr>
<th>Control Model Number</th>
<th>Varistor Part Number</th>
<th>Quantity</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>681 5</td>
<td>2820-015</td>
<td>1</td>
<td>RV1</td>
</tr>
<tr>
<td>681 6</td>
<td>2820-015</td>
<td>1</td>
<td>RV1</td>
</tr>
<tr>
<td>681 7</td>
<td>2820-003</td>
<td>3</td>
<td>RV1, RV2, RV3</td>
</tr>
<tr>
<td>681 8</td>
<td>2820-004</td>
<td>3</td>
<td>RV1, RV2, RV3</td>
</tr>
</tbody>
</table>

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).
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 K). 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.
Dimensions are for reference only.
Contact the factory for certified drawings for a particular model number.

Linear = mm/inches

Drawing 0390654
Dimensions

Dimensions are for reference only. Contact the factory for certified drawings for a particular model number.

<table>
<thead>
<tr>
<th>SENSOR STYLE</th>
<th>DIM D</th>
</tr>
</thead>
<tbody>
<tr>
<td>BARE</td>
<td>12.7</td>
</tr>
<tr>
<td>SHEATH</td>
<td>15.9</td>
</tr>
<tr>
<td>BARE WITH STILLING WELL</td>
<td>26.7</td>
</tr>
<tr>
<td>SHEATH WITH STILLING WELL</td>
<td>26.7</td>
</tr>
<tr>
<td>CABLE</td>
<td>7.9</td>
</tr>
<tr>
<td>INACTIVE SHEATH</td>
<td>15.9</td>
</tr>
</tbody>
</table>

Linear = mm/inches

Drawing 0390653
Dimensions are for reference only. Contact the factory for certified drawings for a particular model number.

Linear = mm/inches

Drawing 0390653