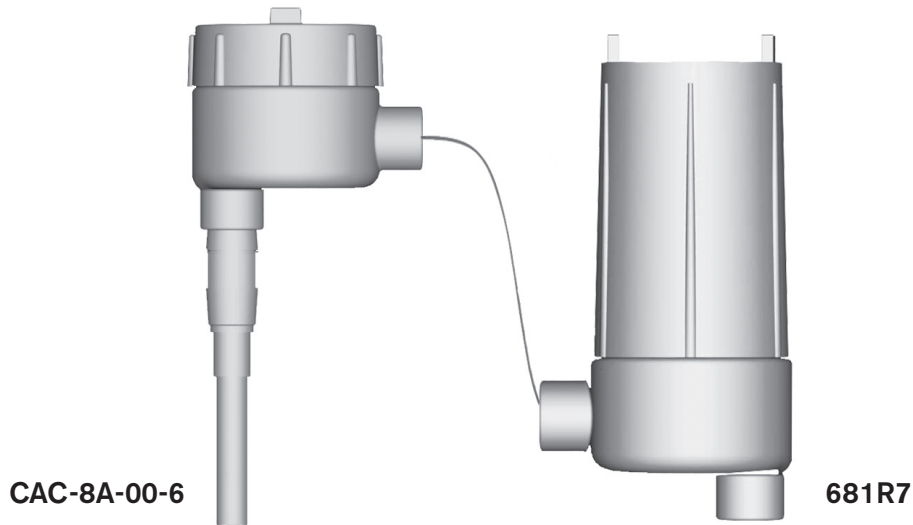


## RF Capacitance Level Controls



### Features and Benefits

- Reliability
- Low maintenance costs
- No moving parts
- Interface measurement with on/off and continuous output
- Unaffected by changes in pressure, temperature, specific gravity, vapor or density
- Versatile - can be used with both conductive and non-conductive substances. Manages a variety of liquids, granular solids, powders and slurries.
- Dielectric range is unlimited
- 316SS, Teflon® or Kynar probes
- Can be used in virtually every type of chamber
- Set point/span are completely adjustable
- Withstands temperatures up to 400°F (204°C)
- Withstands pressure up to 2000 psig (138 bar)

#### Agency Listings/Certification

- Select models with CSA, FM, IECEx, INMETRO, Rostechnadzor (RTN)
- Meets most code and customer requirements.

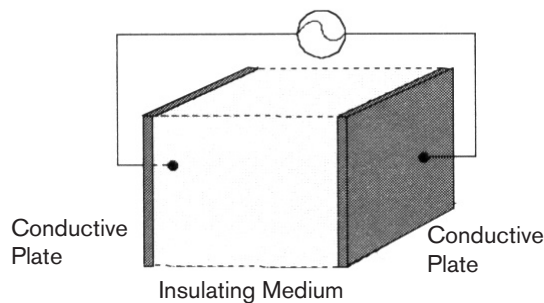
# RF Capacitance Level Controls

## Principle

### Operating Principle

RF Capacitance level controls are based on an electronic device called a capacitor. The capacitor is a device that stores energy. This energy is not stored in the probe; rather, the RF Capacitance level control is merely measuring how much energy can be stored. The amount of capacitance the RF Capacitance level control is measuring is extremely small and is measured in picofarads ( $1 \times 10^{-12}$  farads).

The capacitor is made up of two conductive plates parallel to each other. Separating the two plates is an insulator.



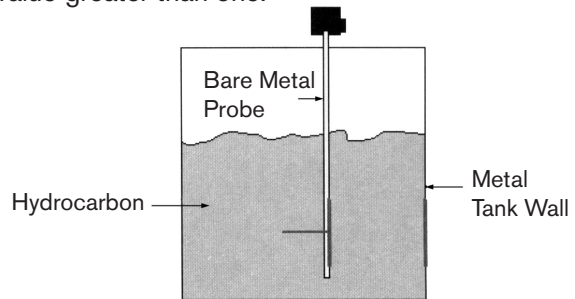
The amount of energy a capacitor can store is influenced by several things. First, a larger plate area results in more space to store energy. Second, more space between the plates reduces the amount of energy storage. Finally, a higher dielectric constant media can contain more energy than a lower dielectric media. The dielectric is where the actual capacitance is developed. The following chart shows the dielectric constant and conductivity for some sample materials.

| Dielectric Constant |         |         |          |            |
|---------------------|---------|---------|----------|------------|
| 2                   | 6.9     | 20      | 50       | 80 or more |
| Acetone             | Popcorn | Alcohol | Glycerin | Water      |
| Mineral Oil         |         |         |          |            |
| Conductivity        |         |         |          |            |
| 1.6                 | 5       | 14.6    | 31.5     | 60 or more |
| Acetone             | Popcorn | Alcohol | Glycerin | Water      |
| Mineral Oil         |         |         |          |            |

Substances are considered either conductive or non-conductive. Non-conductive materials have a dielectric less than 10 or a conductivity less than  $10 \mu\text{siemens/cm}$ . Conductive materials have a dielectric constant greater than 10 or a conductivity greater than  $10 \mu\text{siemens/cm}$ . Interestingly, there is a similar relationship between dielectric constant and conductivity. Non-conductive substances tend to have low dielectric constants and conductive substances tend to have high dielectric constants.

### Non-Conductive Substances

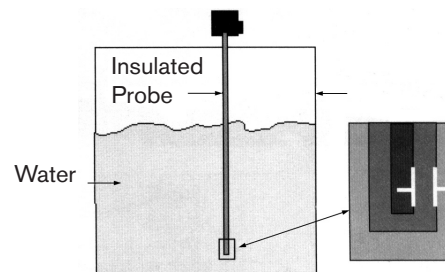
The structure of the capacitor actually changes in a level application. One plate is the probe and the other is the wall of the tank (see following figure). These do not change, nor does the distance between them. The only thing that changes is the dielectric constant. Air has a dielectric constant of one; anything else you measure will have dielectric value greater than one.



When the substance level increases, the dielectric of the substance is replacing the air and causes the capacitance to increase. The preset capacitance value is equal to the set point level wanted and trips a switch when the level is reached. The transmitter creates a linear output in relationship to the capacitance measured.

### Conductive Substances

The substance between the two plates has to be an insulator in order to have a capacitor. When a conductive material is between the plates, an electrical short is created. This, in turn, signals the level transmitter to indicate a high level. A Teflon insulator around the sensor will prevent this from happening, as the figure below demonstrates.



An electrical connection is created through the conductive substance from the tank wall and the Teflon probe. When the level in the tank rises, the capacitor is created by the metal probe rod, the substance being measured and the probe insulator (Teflon), where the sensor rod and substance are the plates and insulator is the dielectric. This means that rather than measuring the dielectric of the substance, the dielectric of the probe where it is covered by the substance is being measured.

# RF Capacitance Level Controls

## Principle

### Restrictions of RF

- Sensitive to changes in material dielectric (**Note:** dielectric compensation additives help, but the liquid can stratify.)
- Normally needs field calibration, which requires a change in level
- Dependent on contact with the substance being measured
- Conductive coatings can build up on the sensor and create false readings

### The Difference Between RF Capacitance and RF Admittance

Contrary to popular belief, there really isn't an application difference between RF Capacitance and RF Admittance. The only difference is in the electronics; the overall performance of the unit remains the same. That's where the "RF" part comes in, as the following will explain:

RF measurement is actually measuring capacitance, as well as capacitance reactance (impedance). The energy (Radio Frequency) is traveling from one conductive plate to the other. The following equation represents capacitance reactance:

$$X_c = \frac{1}{2\pi fC}$$

where

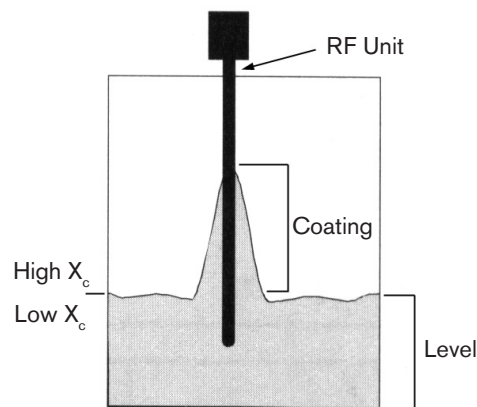
$X_c$  = Capacitance Reactance (Ohms)

$2\pi$  = Radians in a 360° cycle of AC (alternating current)

$f$  = Frequency of AC (hertz)

$C$  = Capacitance of system (in farads)

When there is a conductive coating on the probe, a non-RF unit will indicate the level at the top of the coating. By looking at the conductivity, an RF system can reduce the error caused by the coating (see following figure). Consider this: At the actual level, the amount of capacitive reactance (impedance) is low because the space between the tank wall and probe is filled with a conductive liquid. However, at the coating on the probe, there is also a large air space between the probe and tank wall. This air space results in a high amount of capacitive reactance.

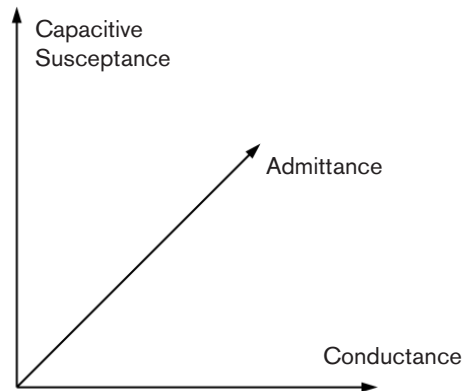
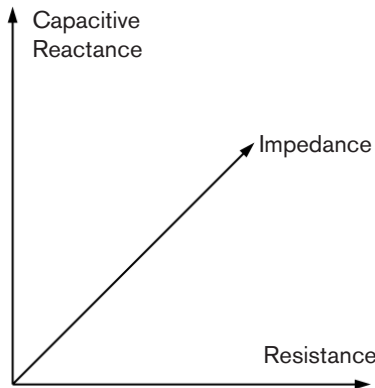


## The Difference Between RF Capacitance and RF Admittance

Look at the formula for capacitive reactance. Since we are striving to measure the capacitance,  $C$  cannot change, and  $2\pi$  is a constant and cannot change. The only thing left we can change is the frequency. If the frequency is increased (RF), the capacitive reactance decreases.

The level is represented on the vertical axis in these two graphs. Changes in the resistance are represented on the horizontal axis. A vector representing a combination of the two (impedance) is shown to the left. The inverse of this graph is shown below.

As you can see, an “admittance” measurement is just the inverse of a capacitance measurement. The important part, as previously stated, is the “RF”



Use this chart to select the RF instrument that best meets your needs.

| Designator   | Line Power        | Loop Power       |
|--|-------------------|------------------|
| <b>Single-Point Sensing</b>                                |                   |                  |
| Integral Mount Electronics                                 | 651<br>Pages 5-6  | 651<br>Pages 5-6 |
| Integral Mount Electronics with Sensor Monitor (Self-Test) | 681<br>Pages 7-8  | 681<br>Pages 7-8 |
| Remote Mount Electronics with Sensor Monitor (Self-Test)   | 681<br>Pages 7-8  | 681<br>Pages 7-8 |
| <b>Multiple-Point Sensing</b>                              |                   |                  |
| Alarm or Pump Control                                      | 660<br>Pages 9-10 | N/A              |

### 651 Single-Point RF Switch

The 651 provides basic, single-point switching for use as an alarm or indicator. It's virtually immune to process coatings on the probe, making it a useful solution for many tough level applications. This immunity, combined with the absence of any moving parts, makes the 651 well suited for applications that are difficult for other technologies.

#### Features

- Economical point sensing
- Suitable for 12 VDC service
- FM Approved, CSA Certified hazardous locations, IEC Certified
- Field-selectable failsafe



| Product Specifications               |   |                                       |  |
|--------------------------------------|---|---------------------------------------|--|
| Input Power - Line                   | 120 VAC, 50/60 Hz<br>240 VAC, 50/60 Hz<br>24 VDC<br>12 VDC  | Response Time                         | 0.5 seconds                            |
| Input Power - Loop                   | 12-28 VDC   | Enclosure                             | NEMA 4X; IP65                          |
| Output Type - Line                   | 10A DPDT, 250 VAC<br>10A DPDT, 30 VDC<br>DC rating shown for<br>resistive loads 5A DPDT<br>for 12 VDC input power | Environmental Rating                  |  |
| Output Type - Loop                   | 8 mA (alarm), 16 mA<br>(normal)   | Electrostatic<br>Discharge Protection | 8000 volts (Line)<br>4000 volts (Loop) |
| Loop Resistive                       | 780 ohms maximum @ 24 VDC   | Line Surge Suppression                | 1000 volts line<br>voltage EMC         |
| Adjustment Range                     | 0 to 1000 pF  | Conduit Connection                    | 3/4" NPT                               |
| Sensitivity                          | 0.5 pF  | Ambient<br>Temperature Range          | -40 to 160°F (-40 to 71°C)             |
| Repeatability                        | 0.5%  | Process<br>Temperature Range          | Probe Dependent                        |
| Failsafe                             | Field-selectable  | Maximum<br>Process Pressure           | Probe Dependent                        |
| Maximum Current<br>Draw (line power) | 12 VDC - 100 mA<br>24 VDC - 50 mA<br>120 VAC - 20 mA<br>240 VAC - 10 mA   | Weight                                | 2.5 lbs. (1.2 kg)                      |

# RF Capacitance Level Controls

## How to Order

The 651 consists of two parts. The first is the electronics and housing. The second is the probe. For probe types and model numbers, see pages 21-25.

### Model Number System

## 651 K 7-TTYY

651 RF Admittance Switch with 120 VAC power supply, oversized nameplate and epoxy-coated housing.

| Power Supply          |   | 1      |
|-----------------------|---|--------|
| 12 VDC                | 5 |        |
| 24 VDC                | 6 |        |
| 120 VAC               | 7 |        |
| 240 VAC               | 8 |        |
| 12 - 28 VDC<br>(Loop) | 9 |        |
|                       |   | 651K 7 |

\* Electronics and probe must have the same agency to maintain the listing integrity (i.e. CS or AI electronics with CS probe, or FM or FI electronics with FM probe).

| 2 Accessories & Certificates   |   |
|--------------------------------|---|
| AI                             | CSA Intrinsically Safe*   |
| CS                             | CSA Explosion Proof Listing*  |
| FI                             | FM Intrinsically Safe*  |
| FM                             | FM Explosion Proof Listing*   |
| MB                             | IEC Certified Intrinsically Safe*   |
| NM                             | INMETRO approved*   |
| OD                             | 60-second time delay ON, 0.5-second delay OFF   |
| OF                             | 60-second time delay OFF, 0.5-second delay ON   |
| PP                             | Fiber tag with customer-specified tag information   |
| PY                             | Powder Coat epoxy coating. No coating on stainless steel parts or plated screws. (500 hours-salt spray) |
| RR                             | SS wired on nameplate with customer-specified information   |
| TT                             | SS nameplate permanently affixed to housing with customer-specified tag information                     |
| VV                             | Fungicidal varnish applied to housing exterior  |
| YY                             | Epoxy coating applied to housing exterior (200 hours-salt spray)  |
| <b>Individual Certificates</b> |   |
| C1                             | Certificate of Calibration  |
| C3                             | Inspection  |
| C4                             | Compliance/Conformance  |
| C6                             | Insulation Resistance   |
|                                | TT YY   |
|                                | Model Number  |

### Agency Approval

| Agency  | Safety Method      | Approval  | Model(s) |
|---------|--------------------|---|----------|
| FM      | Explosion Proof    | Class I, Groups C, D<br>Class II, Groups E, F, G<br>Class III, Division 1       | 651Kx-FM |
|         | Intrinsically Safe | Class I, Groups A, B, C, D<br>Class II, Groups E, F, G<br>Class III, Division 1 | 651Kx-FI |
| CSA     | Explosion Proof    | Class I, Groups C, D<br>Class II, Groups E, F, G<br>Class III, Division 1       | 651Kx-CS |
|         | Intrinsically Safe | Class I, Groups A, B, C, D<br>Class II, Groups E, F, G<br>Class III, Division 1 | 651K9-AI |
| IEC     | Intrinsically Safe | Ex ia IIB T4  | 651K9-MB |
| INMETRO | Intrinsically Safe | Ex ia IIB T4  | 651K9-NM |



### 681 Single-Point RF Switch with Self Test

Available as an integral or remote-mounted unit, the 681 provides single-point switching, and with its many safe and operation features, is well suited for demanding industrial applications.

Its "Self-Check" function constantly monitors circuit and probe integrity. A dedicated relay (line powered) or current shift (loop powered) indicates if the unit is not functioning properly. An optional, adjustable differential provides control of two set points with one relay, which gives the 681 pump and valve control for maintaining correct process levels.



### Features

- Continuous self testing (Self-Check) verifies operation of the unit
- Optional adjustable differential for pump/valve control
- Available as integral or remote-mounted
- Field-selectable failsafe
- Resists process media coating

### Product Specifications

|  |  |                                     |  |
|--|--|-------------------------------------|--|
| Input Power - Line                         | 120 VAC, 50/60 Hz<br>240 VAC, 50/60 Hz<br>24 VDC, 12 VDC                                     | Repeatability                       | 0.5%   |
| Input Power - Loop                         | 10-30 VDC  | Failsafe                            | Field-selectable   |
| Output Type - Line                         |  | Maximum Current Draw (line power)   | 12 VDC - 100 mA<br>24 VDC - 100 mA<br>120 VAC - 25 mA<br>240 VAC - 13 mA |
| Alarm                                      | 10A DPDT, 250 VAC<br>10A DPDT, 30 VDC  | Response Time                       | 0.1 second   |
| Sensor Monitor                             | 10A DPDT, 250 VAC<br>10A DPDT, 30 VDC<br>DC rating shown for resistive loads                 | Enclosure Environmental Protection  | NEMA 4X; IP65  |
| Output Type - Loop                         |  | Electrostatic Discharge Protection  | 8000 volts (line)<br>4000 volts (loop)                                   |
| Alarm                                      | 8 mA (Alarm), 16 mA (Normal)   | Line Surge Suppression              | 1000 volts line voltage EMC  |
| Sensor Monitor                             | 24-27 mA   | Conduit Connection                  | 3/4" NPT   |
| Loop Resistance                            | 456 ohms maximum @ 24 VDC  | Maximum Remote Distance from Sensor | 150 ft. (45.7 m)   |
| Adjustment Range                           | 0 to 1000 pF   | Ambient Temperature Range           | Probe Dependent  |
| Sensitivity                                | 0.5 pF   | Maximum Probe Pressure              | Probe Dependent  |
| Adjustment Range (Adjustment Differential) | Range I: 0 to 300 pF<br>0.5 pF sensitivity<br>Range II: 300 to 1000 pF<br>1.0 pF sensitivity | Weight                              | 3 lbs. (1.4 kg)<br>plus 2 lbs. (1 kg) for remote                         |



# RF Capacitance Level Controls

## How to Order

The 681 consists of two parts. The first is the electronics and housing. The second is the probe. For probe types and model numbers, see pages 21-25.

### Model Number System

## 681 K 7-TTYY

The 681 RF Admittance Switch with 120 VAC power supply, oversized nameplate and epoxy-coated housing.

|   |   |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
|---|---|----------|------------------------------------|----------|--------|----------|---------|----------|---------|----------|---------------------|--|-----------|-------------------------|-----------|---|-----------|--|-----------|---|-----------|---|-----------|---|-----------|---|-----------|--|-----------|--|--------------------------------|--|-----------|----------------------------|-----------|------------|-----------|------------------------|-----------|-----------------------|
| <div style="background-color: #004a87; color: white; padding: 5px; text-align: center; font-weight: bold; font-size: 1.2em;">1</div> <div style="background-color: #004a87; color: white; padding: 5px; text-align: center; font-weight: bold;">Electrical Housing</div> <p style="text-align: center;">Integral Housing      <b>K</b></p> <p style="text-align: center;">Remote housing: 150 ft. (45m)<br/>maximum                      <b>R</b></p> <p>Order remote cable part #2924-113<br/>and specify length in feet</p> | <div style="background-color: #004a87; color: white; padding: 5px; text-align: center; font-weight: bold; font-size: 1.2em;">2</div> <div style="background-color: #004a87; color: white; padding: 5px; text-align: center; font-weight: bold;">Power Supply</div> <table border="0" style="width: 100%;"> <tr><td style="text-align: center; width: 20px;"><b>5</b></td><td>12 VDC</td></tr> <tr><td style="text-align: center;"><b>6</b></td><td>24 VDC</td></tr> <tr><td style="text-align: center;"><b>7</b></td><td>120 VAC</td></tr> <tr><td style="text-align: center;"><b>8</b></td><td>240 VAC</td></tr> <tr><td style="text-align: center;"><b>9</b></td><td>10 to 30 VDC (Loop)</td></tr> </table> | <b>5</b> | 12 VDC                             | <b>6</b> | 24 VDC | <b>7</b> | 120 VAC | <b>8</b> | 240 VAC | <b>9</b> | 10 to 30 VDC (Loop) | <div style="background-color: #004a87; color: white; padding: 5px; text-align: center; font-weight: bold; font-size: 1.2em;">3</div> <div style="background-color: #004a87; color: white; padding: 5px; text-align: center; font-weight: bold;">Accessories &amp; Certificates</div> <table border="0" style="width: 100%;"> <tr><td style="text-align: center; width: 20px;"><b>AD</b></td><td>Adjustable differential</td></tr> <tr><td style="text-align: center;"><b>BK</b></td><td>Remote electronics flat-surface mounting bracket (R housing only)</td></tr> <tr><td style="text-align: center;"><b>PK</b></td><td>Pipe mounting kit - BK accessory required (R housing only)</td></tr> <tr><td style="text-align: center;"><b>PP</b></td><td>Fiber tag with customer-specified information</td></tr> <tr><td style="text-align: center;"><b>PY</b></td><td>Powder Coat epoxy coating. No coating on stainless steel parts or plated screws. (500 hours-salt spray)</td></tr> <tr><td style="text-align: center;"><b>RR</b></td><td>SS wired-on nameplate with customer information</td></tr> <tr><td style="text-align: center;"><b>TT</b></td><td>SS nameplate permanently affixed to housing with customer-specified information</td></tr> <tr><td style="text-align: center;"><b>VV</b></td><td>Fungicidal varnish applied to housing exterior</td></tr> <tr><td style="text-align: center;"><b>YY</b></td><td>Epoxy coating applied to housing exterior (200 hours-salt spray)</td></tr> <tr><td colspan="2" style="padding-top: 10px;"><b>Individual Certificates</b></td></tr> <tr><td style="text-align: center;"><b>C1</b></td><td>Certificate of Calibration</td></tr> <tr><td style="text-align: center;"><b>C3</b></td><td>Inspection</td></tr> <tr><td style="text-align: center;"><b>C4</b></td><td>Compliance/Conformance</td></tr> <tr><td style="text-align: center;"><b>C6</b></td><td>Insulation Resistance</td></tr> </table> | <b>AD</b> | Adjustable differential | <b>BK</b> | Remote electronics flat-surface mounting bracket (R housing only) | <b>PK</b> | Pipe mounting kit - BK accessory required (R housing only) | <b>PP</b> | Fiber tag with customer-specified information | <b>PY</b> | Powder Coat epoxy coating. No coating on stainless steel parts or plated screws. (500 hours-salt spray) | <b>RR</b> | SS wired-on nameplate with customer information | <b>TT</b> | SS nameplate permanently affixed to housing with customer-specified information | <b>VV</b> | Fungicidal varnish applied to housing exterior | <b>YY</b> | Epoxy coating applied to housing exterior (200 hours-salt spray) | <b>Individual Certificates</b> |  | <b>C1</b> | Certificate of Calibration | <b>C3</b> | Inspection | <b>C4</b> | Compliance/Conformance | <b>C6</b> | Insulation Resistance |
| <b>5</b>  | 12 VDC  |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>6</b>  | 24 VDC  |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>7</b>  | 120 VAC   |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>8</b>  | 240 VAC   |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>9</b>  | 10 to 30 VDC (Loop)   |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>AD</b>   | Adjustable differential   |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>BK</b>   | Remote electronics flat-surface mounting bracket (R housing only)   |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>PK</b>   | Pipe mounting kit - BK accessory required (R housing only)  |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>PP</b>   | Fiber tag with customer-specified information   |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>PY</b>   | Powder Coat epoxy coating. No coating on stainless steel parts or plated screws. (500 hours-salt spray)   |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>RR</b>   | SS wired-on nameplate with customer information   |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>TT</b>   | SS nameplate permanently affixed to housing with customer-specified information   |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>VV</b>   | Fungicidal varnish applied to housing exterior  |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>YY</b>   | Epoxy coating applied to housing exterior (200 hours-salt spray)  |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>Individual Certificates</b>  |   |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>C1</b>   | Certificate of Calibration  |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>C3</b>   | Inspection  |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>C4</b>   | Compliance/Conformance  |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| <b>C6</b>   | Insulation Resistance   |          |                                    |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |
| 681   | <b>K</b>  | <b>7</b> | <b>TT YY</b> ← <b>Model Number</b> |          |        |          |         |          |         |          |                     |  |           |                         |           |   |           |  |           |   |           |   |           |   |           |   |           |  |           |  |                                |  |           |                            |           |            |           |                        |           |                       |

## Agency Approval

There are no third-party approvals at this time.

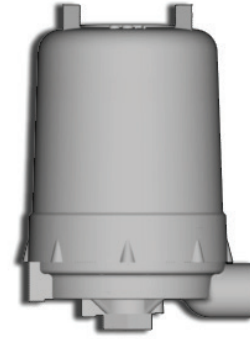


## 660 Series Multi-Point RF Switch

The 660 Series provides the options of multiple-point switching plus narrow and wide differential switching. By combining these features, the 660 Series units can be used for a wide variety of control needs. The available switching combinations are designed to provide multiple alarms, pump/valve control, or a combination of alarms and equipment control. The 660 Series makes it possible to combine up to four single-point devices into one package for lower costs and reduced maintenance.

### Features

- Up to 4-point indication
- Suitable for 12 VDC service
- FM Approved and CSA Certified for hazardous locations
- Field-selectable failsafe
- Resists process media coating



### Switching Combinations

The 660 Series has eight different combinations of fixed differential and/or adjustable differential switching points. Each unit is equipped with one of four discreet switching points. These points can be used to provide true point level sensing with no level differential, or latched together to provide wide, adjustable differential.

See page 11 for available combinations. Required combinations are selected using step 1 in the How to Order chart on page 10.

### Product Specifications

|                       |  |                                     |   |
|-----------------------|--|-------------------------------------|---|
| Input Power           | 120 VAC, 50/60 Hz<br>240 VAC, 50/60 Hz<br>24 VDC, 12 VDC                     | Enclosure                           | NEMA 4X; IP65   |
| Output Type           | 10A DPDT, 250 VAC<br>10A DPDT, 30 VDC<br>DC rating shown for resistive loads | Environmental Protection            |   |
| Adjustment Range      | 0 to 2000 pF   | Electrostatic Discharge Protection  | 8000 volts  |
| Sensitivity           | 0.5 pF   | Line Surge Suppression              | 1000 volts line voltage EMC   |
| Repeatability         | 0.5%   | Conduit Connection                  | 1" NPT(F)   |
| Failsafe              | Field-selectable   | Maximum Remote Distance from Sensor | 4000 feet (1219.2 m)  |
| Maximum Current Draw  | 12 VDC - 245 mA<br>24 VDC - 123 mA<br>120 VAC - 74 mA<br>240 VAC - 36 mA     | Ambient Temperature Range           | -40 to 160°F (-40 to 71°C)  |
| Response Time         | 0.5 second (standard)  | Process Temperature Range           | Probe Dependent   |
| Time Delay (optional) | 0 to 30 seconds  | Maximum Probe Pressure              | Probe Dependent   |
|                       |  | Weight                              | J Housing: 9 lbs. (4.1 kg)<br>R Housing: 11 lbs. (5 kg)<br>W Housing: 6 lbs. (2.7 kg) |

# RF Capacitance Level Controls

## How to Order

The Series 660 is comprised of two parts. The first is the electronics and housing. The second is the probe. Refer to pages 21-25 for probe model number.

### Model Number System



## 66 3 J5-TD VV

663 RF Admittance 3-point switch with 12 VDC power supply, time delay and fungicidal varnished housing.

| Electrical Housing  |   | 2  |   | 3 |                            | Power Supply                   |   |
|---|---|----|---|---|----------------------------|--------------------------------|---|
| Integral housing  | J | 5  | 12 VDC  | 3 | Power Supply               | 6                              | 24 VDC  |
| Explosion-proof remote housing (4000 feet [1219.m] maximum)                         | R | 7  | 120 VAC   |   |                            |                                |   |
|   |   | 8  | 240 VAC   |   |                            |                                |   |
|   |   |    |   |   |                            |                                |   |
| Switching Combination   |   | 1  |   | 4 |                            | Accessories & Certificates     |   |
| See page 11 for switching combinations.   |   | 1  |   | 4 | Accessories & Certificates | BK                             | Remote electronics flat surface mounting bracket (R housing only)                                       |
| Single fixed differential switching point   | 1 |    |   |   |                            | CS                             | CSA explosion-proof listing*  |
| Two fixed differential switching points   | 2 |    |   |   |                            | FM                             | FM explosion-proof listing*   |
| Three fixed differential switching points   | 3 |    |   |   |                            | PK                             | Pipe mounting kit- BK accessory required (R housing only)   |
| Four fixed differential switching points  | 4 |    |   |   |                            | PP                             | Fiber tag with customer-specified information   |
| Single adjustable differential switching  | 5 |    |   |   |                            | PY                             | Powder Coat epoxy coating. No coating on stainless steel parts or plated screws. (500 hours-salt spray) |
| High-level fixed differential point and adjustable differential switching           | 6 |    |   |   |                            | RR                             | SS wired-on nameplate with customer-specified information   |
| Single adjustable differential and low-level fixed differential point switching     | 7 |    |   |   |                            | TD                             | Time delay for each fixed differential set point  |
| High- and low-level fixed differential points and adjustable differential switching | 8 | TT | SS nameplate permanently affixed to housing with customer-specified information |   |                            |                                |   |
|   |   |    |   |   |                            | VV                             | Fungicidal varnish applied to housing exterior  |
|   |   |    |   |   |                            | YY                             | Epoxy coating applied to housing exterior (200 hours-salt spray)  |
|   |   |    |   |   |                            | <b>Individual Certificates</b> |   |
|   |   |    |   |   |                            | C1                             | Certificate of Calibration  |
|   |   |    |   |   |                            | C3                             | Inspection  |
|   |   |    |   |   |                            | C4                             | Compliance/Conformance  |
|   |   |    |   |   |                            | C6                             | Insulation Resistance   |
|   |   | 66 | 3   | J | 5                          | TD VV                          | ← Model Number  |

\* Electronics and probe must have the same agency to maintain the listing integrity (i.e. CS or AI electronics with CS probe, or FM or FI electronics with FM probe).

## Agency Approval

| Agency | Safety Method   | Approval   | Model(s)               |   |
|--------|-----------------|--|------------------------|---|
| FM     | Explosion Proof | Class I, Groups B, C, D<br>Class II, Groups E, F, G<br>Class III, Division 1 | 66x-Jx-FM<br>66x-Rx-FM |  |
| CSA    | Explosion Proof | Class I, Groups C, D<br>Class II, Groups E, F, G<br>Class III, Division 1    | 66x-Jx-CS<br>66x-Rx-CS |  |

## Connection Cable

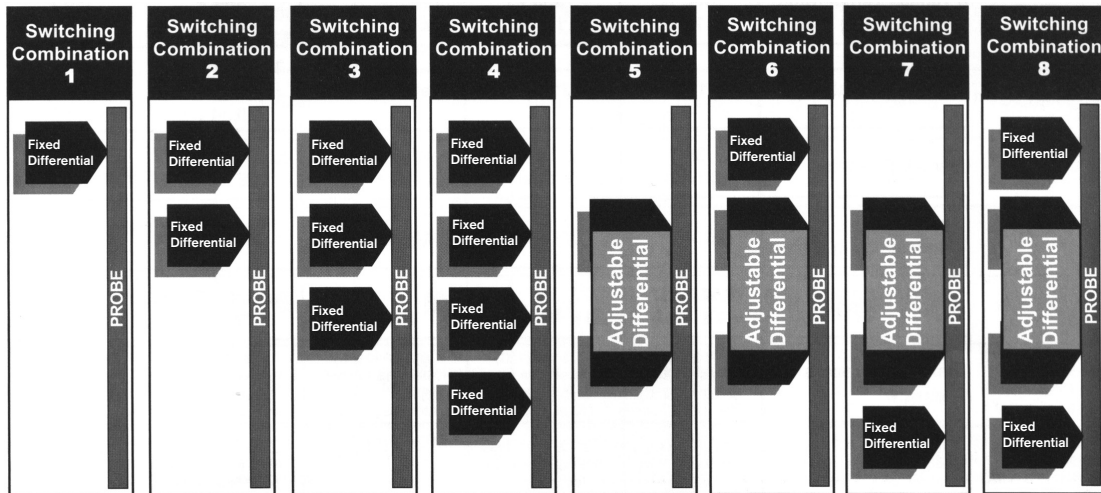
Remote units require #22AWG shielded twisted pair cable to connect the control to the probe. The maximum length of this cable is 4000 feet (1219.2m).

A 25 ft. (7.6m) cable is supplied with each unit. Other lengths can be ordered per the information below. The cable glands supplied with the unit must be replaced with suitable fittings when installing conduit.

- Specific length cable                      Part Number 2924-103 Specify length and units
- 1000 ft. (305m) reel                      Part Number 2924-102 (reel is non-returnable)

Order cable by the part numbers listed below.

## Series 660 Switching Combinations



# RF Capacitance Level Controls

## RF Transmitter

### 670 RF Transmitter

The 670 provides continuous level measurement and a 4-20 mA linear output. It is a high-performance, general-purpose level transmitter that is well suited for many demanding applications that other technologies cannot handle.

### Features

- FM Approved, CSA Certified hazardous locations
- Easy calibration
- Electrostatic discharge protection up to 4000 volts
- Resists process media coating



### Product Specifications

|                 |   |                                     |   |
|-----------------|---|-------------------------------------|---|
| Input Power     | 12-55 VDC 12-30VDC for Intrinsically Safe | Enclosure                           | NEMA 4X; IP65                                   |
| Output Type     | 4-20 mA                                   | Environmental Rating                |   |
| Loop Resistance | 600 ohms maximum @ 24 VDC                 | Electrostatic Discharge Protection  | 4000 volts                                      |
| Zero Range      | 0 to 500 pF                               | Conduit Connection                  | 3/4" NPT  |
| Span Range      | 50 to 2000 pF                             | Maximum Remote Distance from Sensor | 10 ft. (3m)                                     |
| Accuracy        | ±1.0% of span                             | Ambient Temperature Range           | -40 to 160°F (-40 to 71°C)                      |
| Linearity       | ±0.5% of full scale                       | Process Temperature Range           | Probe Dependent                                 |
| Sensitivity     | 0.5 pF                                    | Maximum Process Pressure            | Probe Dependent                                 |
| Repeatability   | ±0.5% of full scale                       | Weight                              | 2.5 lbs. (1.2 kg) plus 2 lbs. (1 kg) for remote |
| Response Time   | 0.1 second                                |                                     |   |

The 670 consists of two parts. The first is the electronics and housing. The second is the probe. For probe types and model numbers, see pages 21-25.

### Model Number System

## 670 R 9-BKPK

670 RF Transmitter with loop-powered remote housing, flat-surface mounting bracket and pipe mounting kit.

1

### Electrical Housing

Integral Housing **K**  
Remote housing - 10 feet (3m) maximum **R**

Order remote cable as 670-XX-S  
XX= cable length in feet

670
R
9
BK PK

\* Electronics and probe must have the same agency to maintain the listing integrity (i.e. CS or AI electronics with CS probe, or FM or FI electronics with FM probe).

2

### Accessories & Certificates

- AI** CSA Intrinsically Safe\*
- BK** Remote electronics flat surface mounting bracket (R housing only)
- CS** CSA Explosion Proof\*
- FI** FM Intrinsically Safe\*
- FM** FM Explosion Proof\*
- PK** Pipe mounting kit - BK accessory required (R housing only)
- PP** Fiber tag with customer-specified information
- PY** Powder Coat epoxy coating. No coating on stainless steel parts or plated screws. (500 hours-salt spray)
- RR** SS nameplate permanently affixed to housing with customer-specified information
- TT** SS nameplate permanently affixed to housing
- VV** Fungicidal varnish applied to housing exterior
- YY** Epoxy coating applied to housing exterior (200 hours-salt spray)

**Individual Certificates**

- C1** Certificate of Calibration
- C3** Inspection
- C4** Compliance/Conformance
- C6** Insulation Resistance

670
R
9
BK PK
← Model Number

### Agency Approval

| Agency | Safety Method      | Approval  | Model(s) |
|--------|--------------------|---|----------|
| FM     | Explosion Proof    | Class I, Groups C, D<br>Class II, Groups E, F, G<br>Class III, Division 1       | 670x9-FM |
|        | Intrinsically Safe | Class I, Groups A, B, C, D<br>Class II, Groups E, F, G<br>Class III, Division 1 | 670x9-FI |
| CSA    | Explosion Proof    | Class I, Groups C, D<br>Class II, Groups E, F, G<br>Class III, Division 1       | 670x9-CS |
|        | Intrinsically Safe | Class I, Groups A, B, C, D<br>Class II, Groups E, F, G<br>Class III, Division 1 | 670x9-AI |

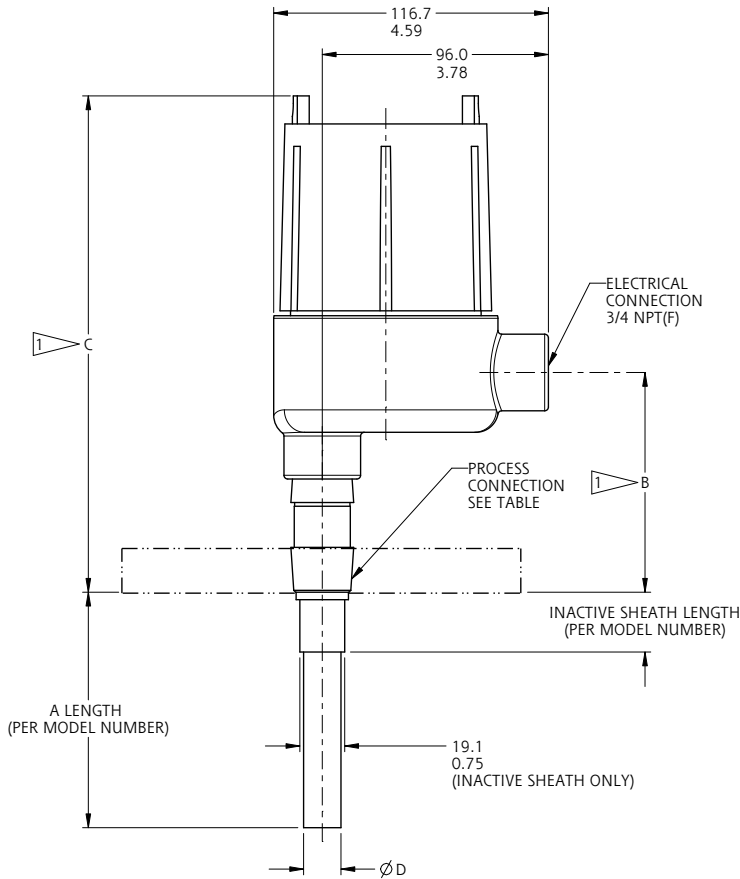


# RF Capacitance Level Controls

## Dimensions

### Housing: K for Model 651

Dimensions in this catalog are for reference only. They may be changed without notice. Contact the factory for certified drawings for a particular model number. Dimensions in this catalog are expressed as millimeters over inches. (Linear = mm/in.)



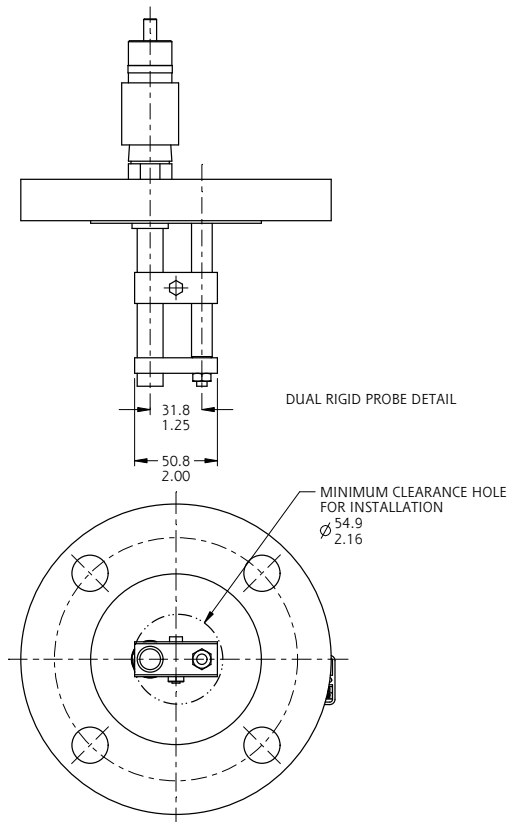
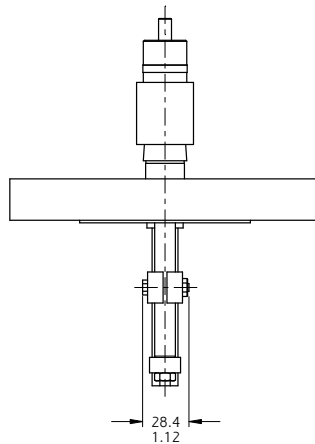
1 DIMENSION APPROXIMATE AND BASED ON A FIVE THREAD ENGAGEMENT.

| PROCESS CONNECTION | DIM B         | DIM C          |
|--------------------|---------------|----------------|
| 3/4 NPTM           | 94.1<br>3.71  | 211.6<br>8.33  |
| 1, 1-1/2, & 2 NPTM | 97.3<br>3.83  | 214.8<br>8.46  |
| FLANGED            | 158.5<br>6.24 | 276.0<br>10.87 |
| STILLING WELL      | 120.0<br>4.72 | 237.5<br>9.35  |

| SENSOR STYLE              | Ø D          |
|---------------------------|--------------|
| BARE                      | 12.7<br>0.50 |
| SHEATH                    | 15.9<br>0.63 |
| BARE WITH STILLING WELL   | 26.7<br>1.05 |
| SHEATH WITH STILLING WELL | 26.7<br>1.05 |
| INACTIVE SHEATH           | 15.9<br>0.63 |

Drawing 0390652

Linear =  $\frac{\text{mm}}{\text{in.}}$



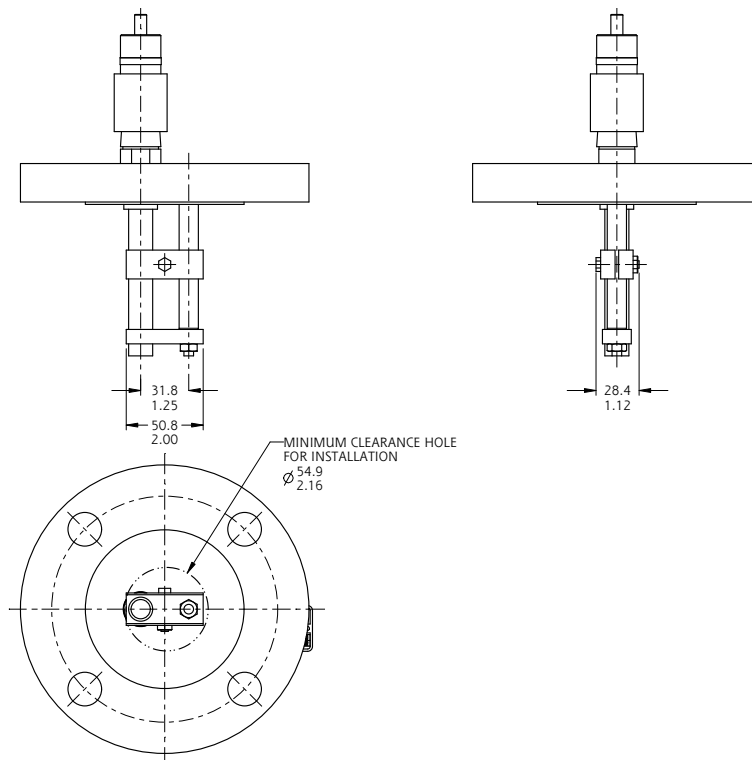
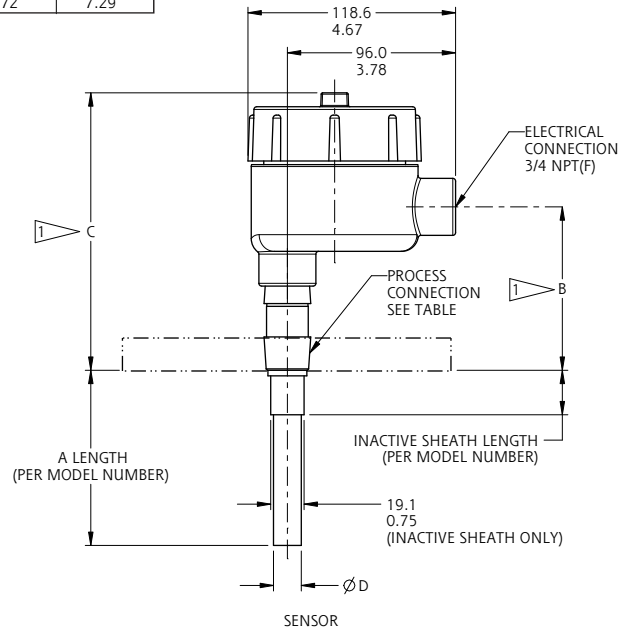
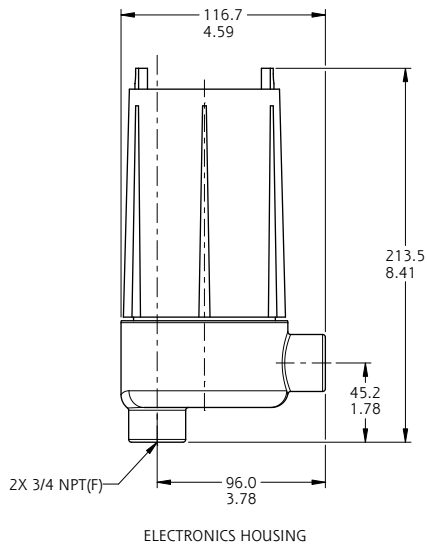
# RF Capacitance Level Controls

## Dimensions

### Housing: R for Model 670 & 681

| SENSOR STYLE              | DIM D        |
|---------------------------|--------------|
| BARE                      | 12.7<br>0.50 |
| SHEATH                    | 15.9<br>0.63 |
| BARE WITH STILLING WELL   | 26.7<br>1.05 |
| SHEATH WITH STILLING WELL | 26.7<br>1.05 |
| INACTIVE SHEATH           | 15.9<br>0.63 |

| DIMENSION APPROXIMATE AND BASED ON A FIVE THREAD ENGAGEMENT. |               |               |
|--|---------------|---------------|
| PROCESS CONNECTION   | DIM B         | DIM C         |
| 3/4 NPTM   | 94.1<br>3.71  | 159.2<br>6.27 |
| 1, 1-1/2, & 2 NPTM   | 97.3<br>3.83  | 162.4<br>6.39 |
| FLANGED  | 158.5<br>6.24 | 223.7<br>8.81 |
| STILLING WELL  | 120.0<br>4.72 | 185.1<br>7.29 |



Linear =  $\frac{\text{mm}}{\text{in.}}$

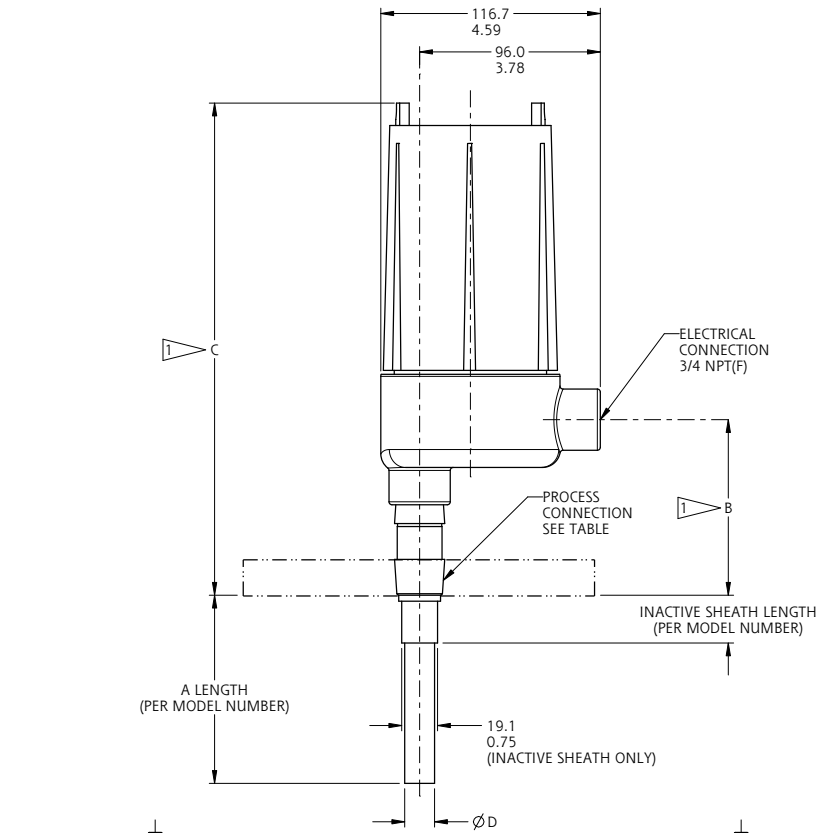
Drawing 0390653



# RF Capacitance Level Controls

## Dimensions

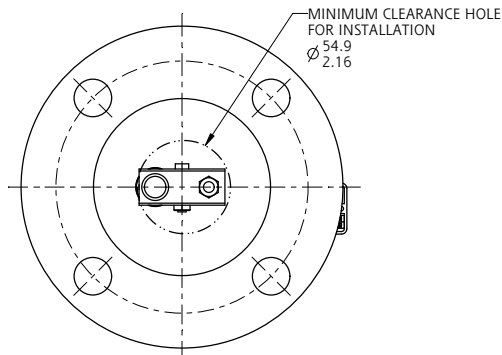
**Housing: K for Model 670 & 681  
(RF Probe Model 651-K9)**



**1** DIMENSION APPROXIMATE AND BASED ON A FIVE THREAD ENGAGEMENT.

| PROCESS CONNECTION | DIM B         | DIM C          |
|--------------------|---------------|----------------|
| 3/4 NPTM           | 94.1<br>3.71  | 262.4<br>10.33 |
| 1, 1-1/2, & 2 NPTM | 97.3<br>3.83  | 265.6<br>10.46 |
| FLANGED            | 158.5<br>6.24 | 326.8<br>12.87 |
| STILLING WELL      | 120.0<br>4.72 | 288.3<br>11.35 |

| SENSOR STYLE              | Ø D          |
|---------------------------|--------------|
| BARE                      | 12.7<br>0.50 |
| SHEATH                    | 15.9<br>0.63 |
| BARE WITH STILLING WELL   | 26.7<br>1.05 |
| SHEATH WITH STILLING WELL | 26.7<br>1.05 |
| INACTIVE SHEATH           | 15.9<br>0.63 |



Linear =  $\frac{\text{mm}}{\text{in.}}$

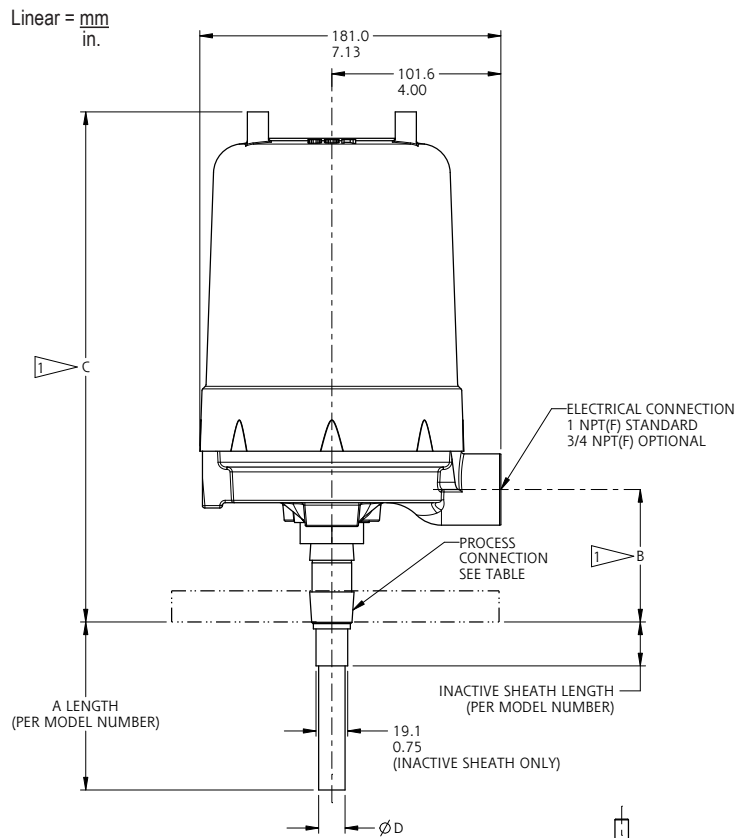
**Drawing 0390654**

# RF Capacitance Level Controls

## Dimensions

### Housing: J for Model 66X

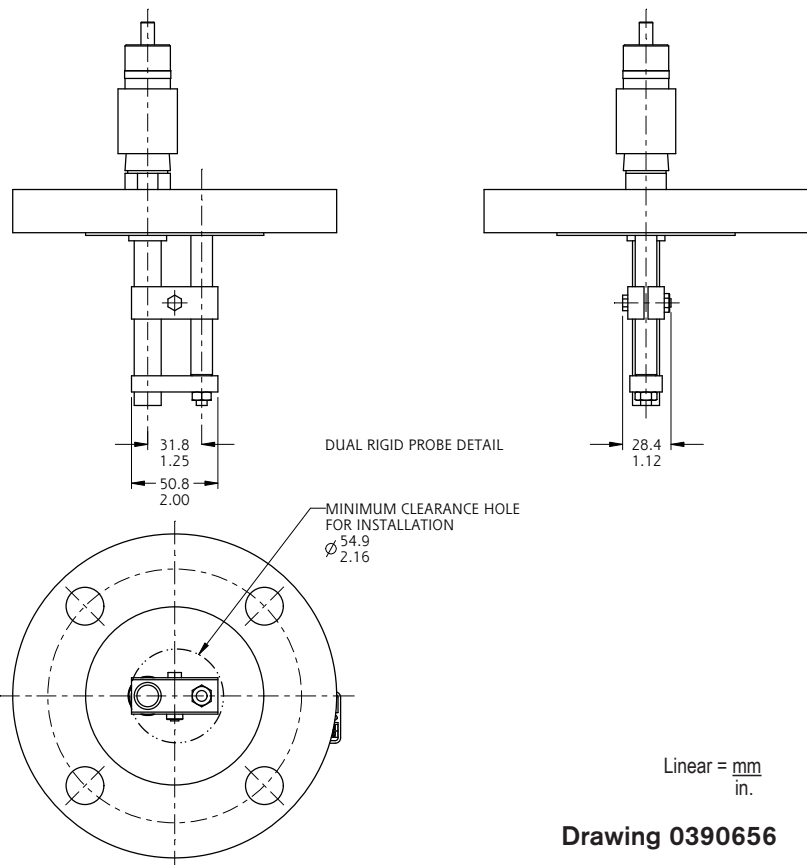
Drawing 0390656



| PROCESS CONNECTION | DIM B         | DIM C          |
|--------------------|---------------|----------------|
| 3/4 NPTM           | 78.6<br>3.10  | 305.6<br>12.03 |
| 1, 1-1/2, & 2 NPTM | 81.8<br>3.22  | 308.8<br>12.16 |
| FLANGED            | 183.9<br>7.24 | 370.1<br>14.57 |
| STILLING WELL      | 104.5<br>4.11 | 331.5<br>13.05 |

1 DIMENSION APPROXIMATE AND BASED ON A FIVE THREAD ENGAGEMENT

| SENSOR STYLE              | ØD           |
|---------------------------|--------------|
| BARE                      | 12.7<br>0.50 |
| SHEATH                    | 15.9<br>0.63 |
| BARE WITH STILLING WELL   | 26.7<br>1.05 |
| SHEATH WITH STILLING WELL | 26.7<br>1.05 |
| INACTIVE SHEATH           | 15.9<br>0.63 |

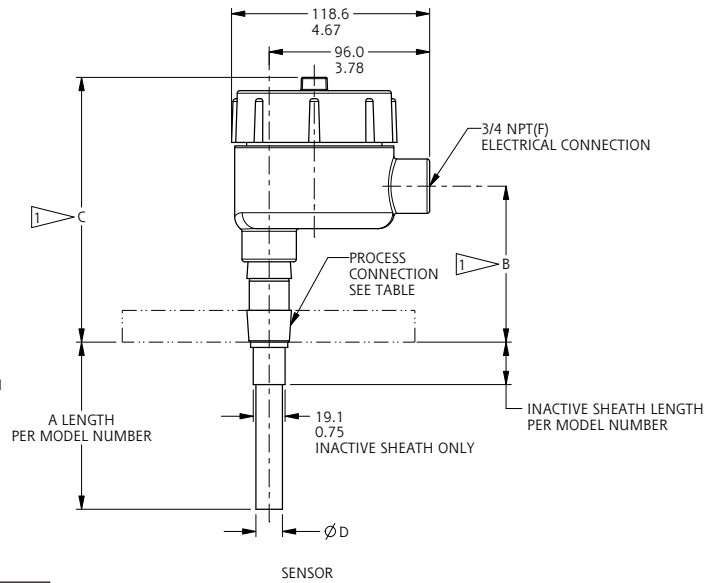
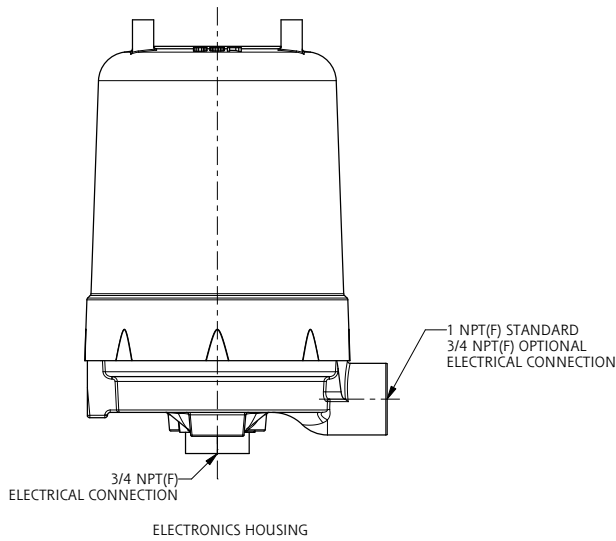


Drawing 0390656

# RF Capacitance Level Controls

## Dimensions

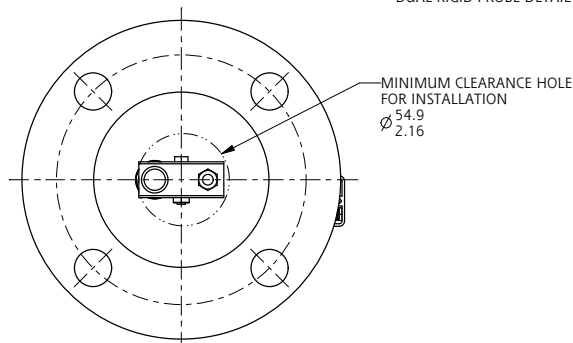
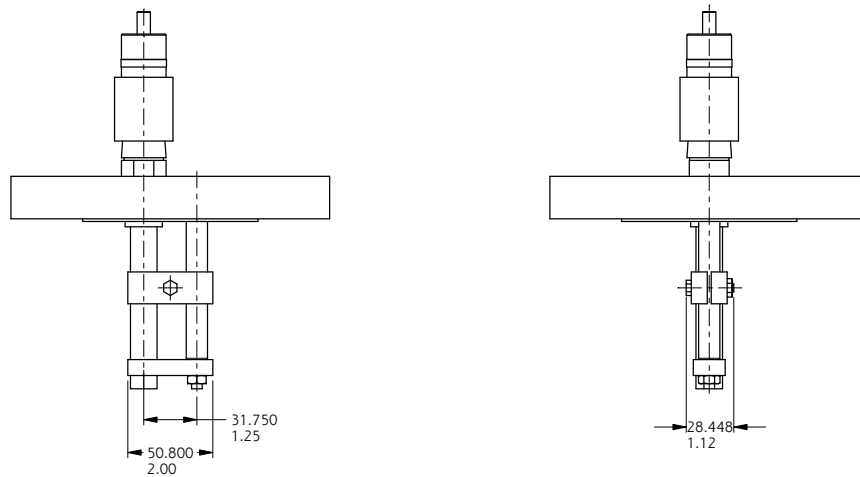
### Housing: R for Model 66X



| PROCESS CONNECTION    | DIM B         | DIM C         |
|-----------------------|---------------|---------------|
| 3/4 NPT (M)           | 94.1<br>3.71  | 159.2<br>6.27 |
| 1, 1-1/2, & 2 NPT (M) | 97.3<br>3.83  | 162.4<br>6.39 |
| FLANGED               | 158.5<br>6.24 | 223.7<br>8.81 |
| STILLING WELL         | 120.0<br>4.72 | 185.1<br>7.29 |

| SENSOR STYLE                 | Ø D          |
|------------------------------|--------------|
| BARE                         | 12.7<br>0.50 |
| SHEATH                       | 15.9<br>0.63 |
| BARE WITH<br>STILLING WELL   | 26.7<br>1.05 |
| SHEATH WITH<br>STILLING WELL | 26.7<br>1.05 |
| INACTIVE SHEATH              | 15.9<br>0.63 |

DIMENSION APPROXIMATE AND BASED  
ON A FIVE THREAD ENGAGEMENT



Linear = mm  
in.

Drawing 0390657

### Selection Guidelines

Selecting the right probe for your application is very important. The objective is to maximize the amount of capacitance change for every inch (cm) of level change. Following are general guidelines for selecting a probe for a particular application. Please consult with SOR® or your local SOR sales representative for additional and/or specific information.

1. If process media is non-conductive - less than 10 $\mu$  Siemens/low dielectric (less than 10), select a bare probe. If there is any water in the process, go to number 2.
2. If process media is conductive - greater than 10 $\mu$  Siemens/high dielectric (greater than 10), select an insulated probe.
3. If process is non-conductive and in a horizontal (bullet) tank, or if the probe must be mounted more than 12 inches from the vessel wall, select a stilling well, dual-rod or dual-cable probe.
4. If vessel is non-metallic, select a stilling well, dual-rod or dual-cable probe.
5. Use rigid probes for measurement lengths of 10 feet or less. Use cable probes for longer ranges.
6. For agency-listed controls, a matching agency listing must be specific on the probe. Available probe agency listings are provided in the following charts and specification pages.

### Rigid Probes - Sheathed



Single Rigid Sheath Probe

| Model Number | Probe Material | Sensor Diameter | Spanned Capacitance in Water | Process Temperature Limits   | Weight  |
|--------------|----------------|-----------------|------------------------------|------------------------------|---|
| CB           | Teflon® sheath | 5/8" (15.9 mm)  | 10 pF/in.                    | -100 to 400°F (-73 to 204°C) | 1 lbs. (0.5 kg)<br>+0.7 lb. (0.3 kg)<br>per foot of probe |



Rigid Sheath Probe with Stilling Well

| Model Number | Probe Material                            | Sensor Diameter | Spanned Capacitance in Water | Process Temperature Limits   | Weight  |
|--------------|---|-----------------|------------------------------|------------------------------|---|
| CC           | Teflon® sheath inside 316SS stilling well | 1.05" (26.7 mm) | 12 pF/in.                    | -100 to 400°F (-73 to 204°C) | 2 lbs. (0.9 kg)<br>+1.5 lb. (0.7 kg)<br>per foot of probe |



Rigid Sheath Dual Probe

| Model Number | Probe Material                        | Sensor Diameter             | Spanned Capacitance in Water | Process Temperature Limits   | Process Pressure   | Weight   |
|--------------|---------------------------------------|-----------------------------|------------------------------|------------------------------|--|--|
| CD           | Teflon® sheath and 316SS ground probe | 1/2 & 5/8" (12.7 & 15.9 mm) | 10 pF/in.                    | -100 to 400°F (-73 to 204°C) | Pressure per CB probe or flange rating, whichever is lower | 12 lbs. (5.5 kg)<br>+1.5 lb. (0.7 kg)<br>per foot of probe |

### Rigid Probes - Sheathed



Single Inactive  
Sheath Probe

| Model Number | Probe Material                 | Sensor Diameter                | Spanned Capacitance in Water | Process Temperature Limits      | Weight   |
|--------------|--------------------------------|--------------------------------|------------------------------|---------------------------------|--|
| CJ           | Teflon® sheath<br>316SS sheath | 5/8 & 3/4"<br>(15.9 & 19.1 mm) | 10 pF/in.                    | -100 to 400°F<br>(-73 to 204°C) | 1 lb. (0.5 kg)<br>+0.7 lb. (0.3 kg)<br>per foot of probe |

### Rigid Probes - Bare



Single Rigid  
Bare Probe

| Model Number | Probe Material | Sensor Diameter   | Spanned Capacitance in Water | Process Temperature Limits      | Weight   |
|--------------|----------------|-------------------|------------------------------|---------------------------------|--|
| CA           | 316SS          | 1/2"<br>(12.7 mm) | N/A                          | -100 to 400°F<br>(-73 to 204°C) | 1 lb. (0.5 kg)<br>+0.7 lb. (0.3 kg)<br>per foot of probe |






Single Rigid  
Bare Probe  
with Stilling Well

| Model Number | Probe Material                                 | Sensor Diameter    | Spanned Capacitance in Water | Process Temperature Limits      | Weight  |
|--------------|--|--------------------|------------------------------|---------------------------------|---|
| CE           | Bare 316SS probe inside<br>316SS stilling well | 1.05"<br>(26.7 mm) | N/A                          | -100 to 400°F<br>(-73 to 204°C) | 2 lbs. (0.9 kg)<br>+1.5 lb. (0.7 kg)<br>per foot of probe |



# RF Capacitance Level Controls

Agency Approval

| Agency  | Safety Method      | Approval   | Model(s)             |   |
|---------|--------------------|--|----------------------|---|
| FM      | Explosion Proof    | Class I, Groups B, C, D<br>Class II, Groups E, F, G<br>Class III, Division 1 | CB, CC, CD<br>and CJ |  |
| CSA     | Explosion Proof    | Class I, Groups C, D<br>Class II, Groups E, F, G<br>Class III, Division 1    | CB, CC,<br>CD and CJ |  |
| IEC     | Intrinsically Safe | Ex ia IIB T4   | CB, CC and CD        |   |
| INMETRO | Intrinsically Safe | Ex ia IIB T4   | CB, CC and CD        |  |

## Probe Insertion Lengths

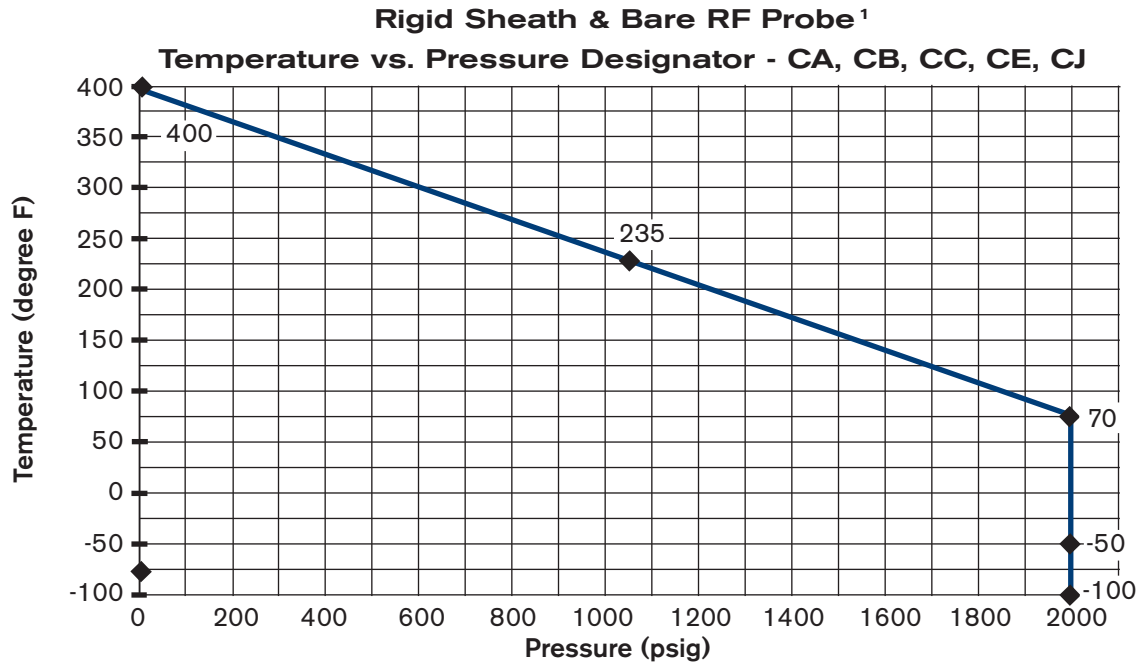
| Probe Type | Length (inch) |         | Length (cm) |         |
|------------|---------------|---------|-------------|---------|
|            | Minimum       | Maximum | Minimum     | Maximum |
| CA         | 3.5"          | 234"    | 8.89        | 594.4   |
| CB         | 1.5"          | 234"    | 3.81        | 594.4   |
| CC         | 2"            | 234"    | 5.08        | 594.4   |
| CD         | 2"            | 120"    | 5.08        | 304.8   |
| CE         | 4.5"          | 234"    | 5.08        | 594.4   |
| CJ         | 7"            | 120"    | 17.78       | 304.8   |
| Sheath*    | 1"            | 114"    | 2.54        | 289.6   |

\*Sheath length must be selected with CJ only.

## Flange Weight and Pressure Rating

| Process Connection | Add to Shipping Weight | Maximum Pressure Rating |
|--------------------|------------------------|-------------------------|
| 1C                 | 2 lbs. (1.0 kg)        | 275 psig (19 bar)       |
| 9C                 | 4 lbs. (1.8 kg)        | 275 psig (19 bar)       |
| 2C                 | 5 lbs. (2.3 kg)        | 275 psig (19 bar)       |
| 3C                 | 9 lbs. (4 kg)          | 275 psig (19 bar)       |
| 4C                 | 17 lbs. (8 kg)         | 275 psig (19 bar)       |
| 1D                 | 3 lbs. (1.5 kg)        | 720 psig (50 bar)       |
| 9D                 | 6 lbs. (2.7 kg)        | 720 psig (50 bar)       |
| 2D                 | 8 lbs. (3.6 kg)        | 720 psig (50 bar)       |
| 3D                 | 16 lbs. (7.5 kg)       | 720 psig (50 bar)       |
| 4D                 | 27 lbs. (12.5 kg)      | 720 psig (50 bar)       |





### Notes

1. Standard pressure rating: 2000 psi @ 70°F.

# RF Capacitance Level Controls

Please use the data sheet below to provide SOR with specific details of your application. This will allow us to help you select the proper model to ensure optimum performance.

|                                       |  |   |   |
|---------------------------------------|--|---|---|
| <b>General</b>                        | Tag Number   |   | Company   |
|                                       | Application  | <input type="radio"/> Level/ <input type="radio"/> Interface  | Address   |
|                                       | Function   |   |   |
|                                       | Area Classification                                | <input type="radio"/> Hazardous/ <input type="radio"/> Non-Hazardous                                      |   |
|                                       | Agency Approval                                    |   |   |
|                                       |  |   |   |
| <b>Sensor</b>                         | Probe Model  |   | Contact Name  |
|                                       | Orientation  | <input type="radio"/> Vertical/ <input type="radio"/> Horizontal  | Phone   |
|                                       | Style  |   | Fax   |
|                                       | Process Wetted Materials                           |   | E-mail  |
|                                       | Insertion (in/cm)                                  | _____ <input type="radio"/> in/ <input type="radio"/> cm  | Rep Company   |
|                                       | Process Connection Size                            |   | Rep Contact   |
| <b>Control</b>                        | Location   | <input type="radio"/> Integral/ <input type="radio"/> Remote  | <b>SKETCH APPLICATION HERE</b><br>Please indicate mounting location as well as other connections and internal obstructions. |
|                                       | Enclosure Class                                    |   |   |
|                                       | Conduit Connection                                 |   |   |
| <b>Switch</b>                         | Electronics Model                                  |   |   |
|                                       | Power Supply                                       |   |   |
|                                       | No. of Setpoints                                   |   |   |
|                                       | Type   | <input type="radio"/> Relay/ <input type="radio"/> 8 or 16 mA   |   |
|                                       | Quantity/Form                                      | _____ x <input type="radio"/> SPDT/ <input type="radio"/> DPDT  |   |
|                                       | Rating Type  | <input type="radio"/> AC/ <input type="radio"/> DC  |   |
|                                       | Rating: Amps                                       | _____ Amps  |   |
|                                       | Load Type  | <input type="radio"/> Inductive/ <input type="radio"/> Non-Inductive                                      |   |
| Setpoint Location                     | Measured from Process Connection (show on drawing) |   |   |
| <b>Transmitter</b>                    | Output   |   |   |
| <b>General Application Conditions</b> | Measurement Range                                  |   |   |
|                                       | Process Media Name                                 |   |   |
|                                       | Vessel Shape                                       | <input type="radio"/> Vert. Cylinder/ <input type="radio"/> Horiz. Cylinder/ <input type="radio"/> Sphere |   |
|                                       | Vessel Material                                    |   |   |
|                                       | Vessel Lining                                      | <input type="radio"/> Yes/ <input type="radio"/> No Mat'l. _____  |   |
|                                       | Press Max. Normal                                  |   |   |
|                                       | Temp. Max. Normal                                  |   |   |
|                                       | Ambient Temp. Range                                |   |   |
|                                       | Solids (%)   |   |   |
|                                       | Specific Gravity                                   |   |   |
|                                       | Viscosity (cp)                                     | _____ (cp)  |   |
|                                       | Turbulence   | <input type="radio"/> Yes/ <input type="radio"/> No   |   |
|                                       | Process Coating                                    | <input type="radio"/> Yes/ <input type="radio"/> No   |   |
| <b>Float/Displacer</b>                | Vibration Mixing                                   | <input type="radio"/> Yes/ <input type="radio"/> No   |   |
| <b>RF Instruments</b>                 | Upper Fluid Name                                   |   |   |
|                                       | Dielectric Constant                                |   |   |
|                                       | Lower Fluid Name                                   |   |   |
|                                       | Dielectric Constant                                |   |   |
| <b>Ultrasonic Switches</b>            | Aeration   |   |   |
|                                       | Suspended Solids (%)                               |   |   |
|                                       | Hydrocarbon Vapors                                 | <input type="radio"/> Yes/ <input type="radio"/> No   |   |
| <b>Submersible Pressure</b>           | Cable Length                                       |   |   |
|                                       | Nose cone  | <input type="radio"/> Yes/ <input type="radio"/> No   |   |
|                                       |  |   | Notes (list any special options)  |



MEASUREMENT AND CONTROL

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