MAGNETROL®

Kotron® RF Sensing Probes

DESCRIPTION

Kotron® RF Capacitance sensing probes are available in different configurations to handle a wide variety of application conditions.

The sensing probes in this brochure can be combined with KOTRON level switches and transmitters.

FEATURES

RIGID PROBES

- Available as bare probe or insulated probe
- Maximum process temperature: +400 °F (+200 °C)
- Lengths up to 234 inches (6 meters)
- Bare probes can be cut to length in the field
- Wetted materials include 316/316L SS

TECHNOLOGY

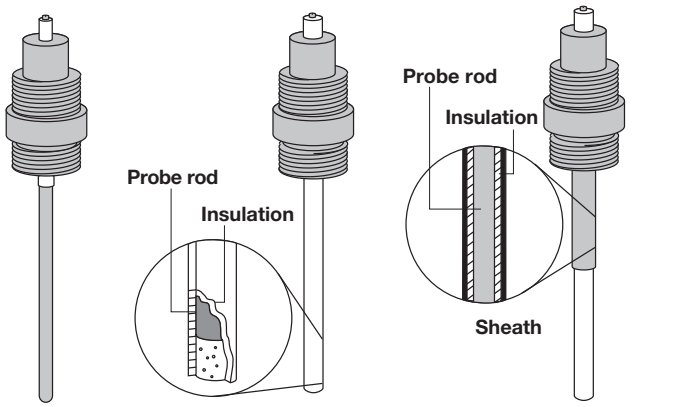
The amount of capacitance developed in any application is affected by three variables:

- Size (surface area) of the probe
- Distance from the probe to its ground
- Dielectric of the medium it is measuring

Considering that the probe's mounting position is fixed, and the dielectric constant of the process media is stable, then the amount of capacitance developed is directly proportional to the level of the process media on the probe. Increasing the surface area (diameter) of the probe and/or decreasing the distance between the probe and its ground reference will increase the capacitance gain.

APPLICATIONS

- Clean or dirty liquids
- Viscous liquids
- Light slurries
- Foods and beverages
- Hydrocarbons and solvents
- Corrosives, acids, and caustics



PROBE SELECTION

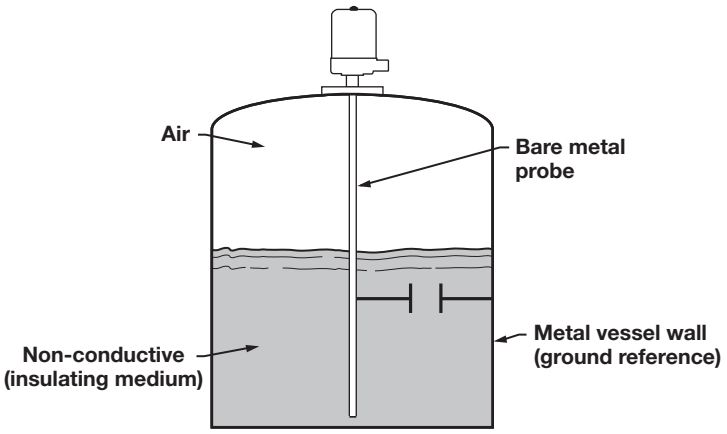
Probe selection is the most critical part of applying an RF Capacitance device for a given application. The goal is to select the probe that will give the optimum capacitance change per unit level change (pF/inch). The first step in selecting an RF probe is determining the correct configuration for your application. The following guidelines will assist you in this selection.

1. Use bare probes for non-conductive liquids.
2. Use insulated probes for conductive liquids. If you are uncertain about the conductivity value, use an insulated probe. Teflon® has the widest temperature range and material compatibility.
3. Use a probe with an integral ground reference (Reference Probe) when measuring non-conductive fluids in horizontal vessels, non-conductive liquids where the probe will be mounted more than 12" (30 cm) from the vessel wall, or when measuring any liquid in non-metallic vessels. The stillwell probe is the most common. If the application requires "no metal" in the process; or, if the liquid is too viscous for a stillwell, use the reference rod probe. The reference wire probe should be used only in clean, conductive, non-coating applications.
4. Use an inactive sheath probe when mounting horizontally through a nozzle.

PROCESS MEDIA GUIDELINES

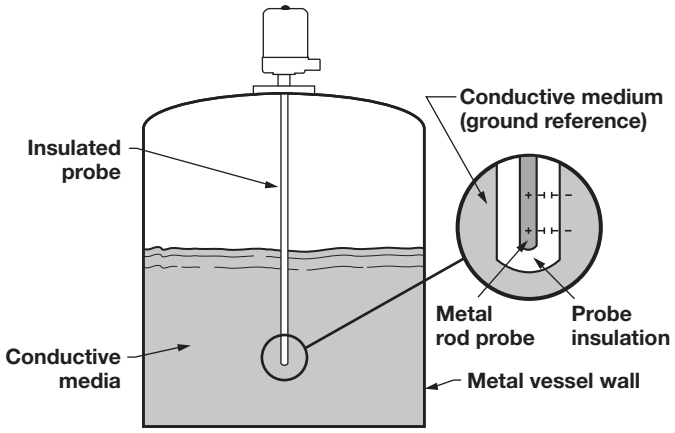
Non-conductive (dielectric less than 10 or conductivity less than 10 µsiemens/cm)

Hydrocarbons, solvents, and bulk solids typically fall into the category of non-conductive media. Initially, when the vessel is empty, the dielectric constant is 1 (air). As the media level rises, the dielectric of the media replaces the air, thus causing the capacitance to increase. This increase is linear with the level increase. A bare probe is usually the best choice for this application.



Conductive (dielectric greater than 10 or conductivity greater than 10 µsiemens/cm)

Conductive media in conjunction with a bare probe will result in an electrical "short" causing a transmitter to indicate a high level or a switch to change state. The solution is to use an insulated probe. The conductive media creates an electrical connection between a metal vessel wall and the probe insulation. Like the non-conductive application, the distance between the probe and ground, and the probe diameter, is fixed. Instead of measuring the dielectric of the media, we are measuring the dielectric of the probe insulation which is covered by the media.



RIGID PROBES

Rigid probes consist of a process connection, probe rod, and the seal. The rod may take many forms, depending on the application. The following is a description of some of the more common rigid probe styles:

Bare probes

Bare rod probes are typically used in non-conductive process media with a dielectric value less than 10 or a conductivity value less than 10 µsiemens/in. Capacitance is measured from the probe through the process media to the vessel wall.

Insulated probes

Insulated rod probes are used in conductive process media with a dielectric value greater than 10 or a conductivity value greater than 10 µsiemens/in. Capacitance is typically measured from the probe rod through the insulation to the process media, which is at the same potential as the vessel wall for conductive media. When you are uncertain about the dielectric constant of your process media, insulated probes are a wise choice.

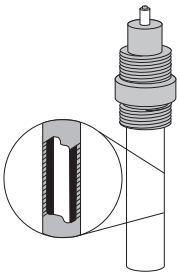
Inactive sheath probes

An inactive sheath is a metallic tube that is tightly coupled to the insulation on the probe rod and attached to the process connection. The sheath "deadens" the portion of the probe covered. It is used when a false capacitance could be developed by interference, such as:

- Collection of debris in a nozzle when the probe is horizontally mounted
- Falling process media entering the vessel
- Use with Retractable Probe Assembly (Hot Tap)

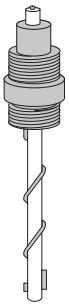
REFERENCE PROBES

This classification covers probes that supply the "second plate of the capacitor" in non-metallic vessels, or linearize an existing reference (i.e., horizontal cylindrical vessels). There are *three* types of referenced probes offered:



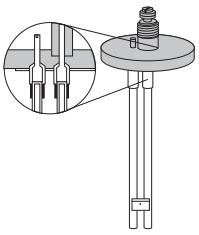
Stillwell probes

A stillwell is a metallic tube into which a probe is inserted. It can be used to minimize the effect of turbulence in a vessel and increases the capacitance gain by bringing the ground reference closer to the probe. Stillwell probes are recommended for vessels with agitators.



Reference wire

A reference wire is spirally wrapped around an insulated probe to provide a "ground" reference where none exists. It must be used selectively: clean, conductive, and low viscosity processes only.



Reference rod probes

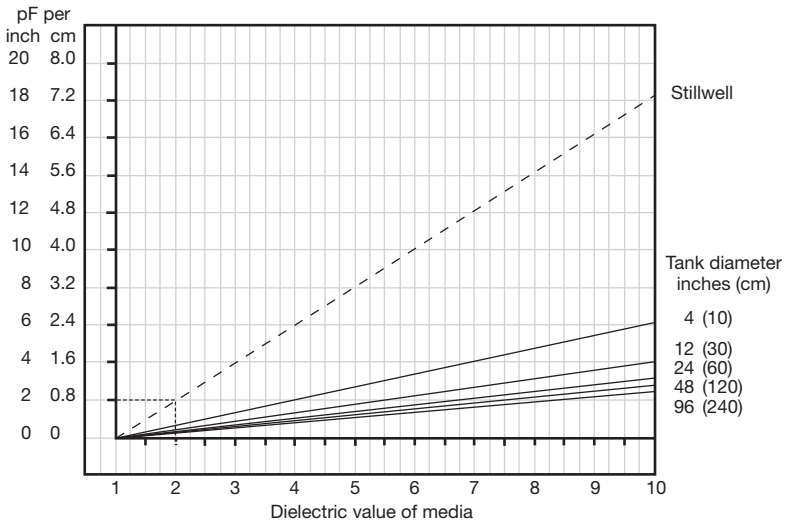
An insulated reference rod is mounted parallel with the sensing probe. It is typically used with corrosive process media in non-metallic vessels where no metal can be introduced to the process.

CAPACITANCE PICOFARAD (PF)

GAIN GRAPHS

The following graphs determine the proper probe/electronics choice for any given application. To use the graphs, follow these steps.

1. Determine the dielectric of the process medium being measured. If the dielectric is unknown, use a dielectric of 2 for non-conductive media such as hydrocarbons or dry media, and a dielectric value of 80 for water based, conductive liquids (dielectric values are along the X axis).
2. Choose a probe. Because more than one probe will usually work, consider the other application parameters such as temperature, pressure, material compatibility, etc.
3. Find the graph which covers the chosen probe. Choose the curve on the graph which most closely relates to your particular application.
4. Using the chosen curve, determine the amount of pF/inch or pF/centimeter your application will develop (values are on Y axis).
5. Multiply the pF/inch value by the transmitter span needed in the application.
6. Compare total capacitance generated by the probe against the needed zero and span of the KOTRON electronics to be used.



Example:

Parameters:
a. Dielectric = 2.0
b. Probe = Part No. 8AB-AA2B-072 (with stillwell)
c. pF/inch = 2.00
d. Electronics = KOTRON Two-Wire Transmitter
e. Required application span = 72 in.
f. Electronics span = 50 pF min. to 4000 pF maximum (See chart below)

2.00 pF/inch × 72 in = 144 pF
The total capacitance is enough to meet the 50 pF minimum span of the electronics.

GAIN GRAPHS

These charts are meant as an application aid; actual values may differ slightly. Always provide a 10% margin of error to ensure satisfactory performance.

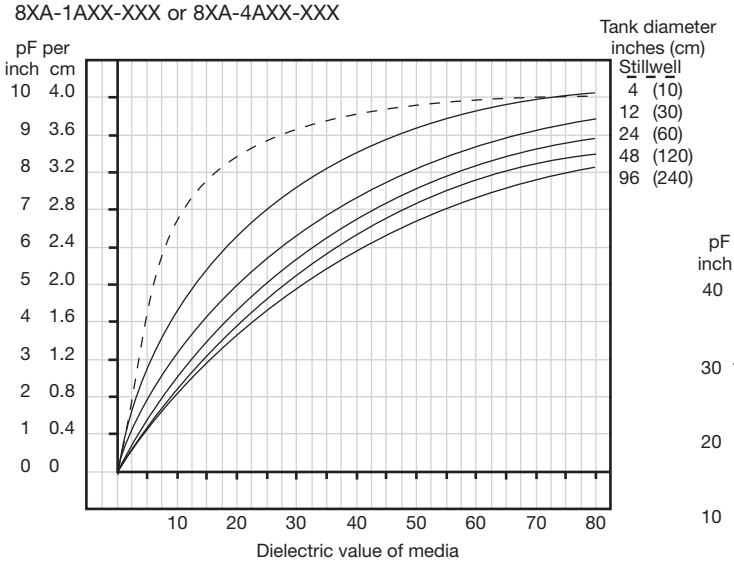
These curves represent the probe located in the center of the vessel. If the probe is near one wall of a large vessel, multiply the distance from the vessel wall by 2 (to develop a diameter), choose the closest curve in the chart to your application, and then multiply the resultant pF value × 78%. This will account for the probe not being totally surrounded by the ground reference.

RANGE OF CAPACITANCE ADJUSTMENT

Level	KOTRON Electronics		Zero set point	Span/Differential
Point	Model 80-8032		0 to 350 pF	0.5 pF, fixed
	Model 811		0 to 1000 pF	0.5 pF to 700 pF
	Models 80/81	Narrow	0 to 3000 pF	0.5 pF, fixed
		Wide High Range	0 to 3000 pF	4 to 1500 pF
		Wide Low Range	0 to 3000 pF	2 to 1500 pF
Continuous	Model 82CE		0 to 1000 pF	50 to 4000 pF
	Model 805		0 to 10,000 pF	5 pF to 10,000 pF

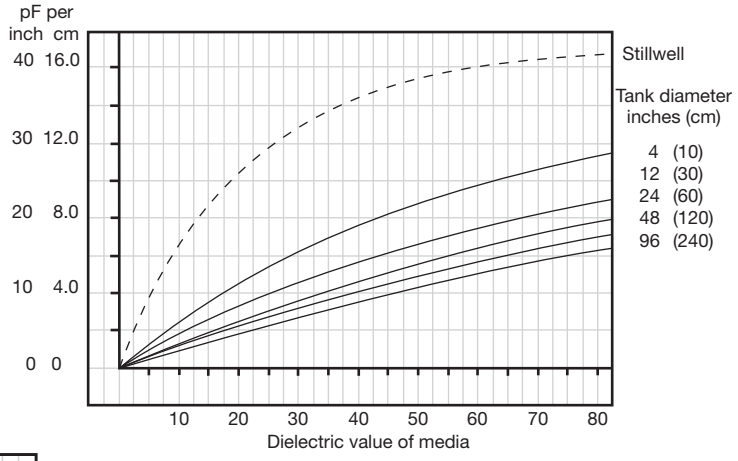
Capacitance gain for Teflon® coated probes

8XA-1AXX-XXX or 8XA-4AXX-XXX



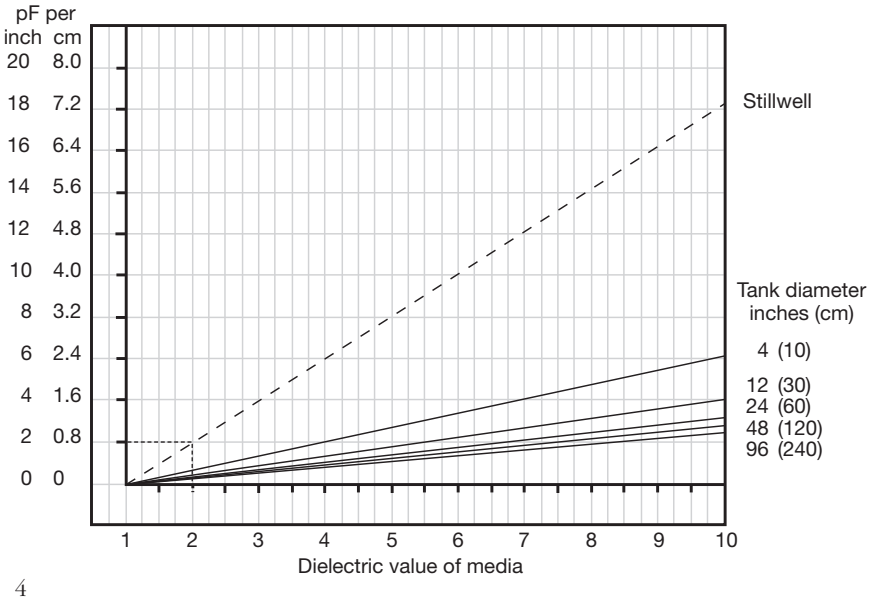
Capacitance gain for Kynar® coated probes

8XA-3XXX-XXX



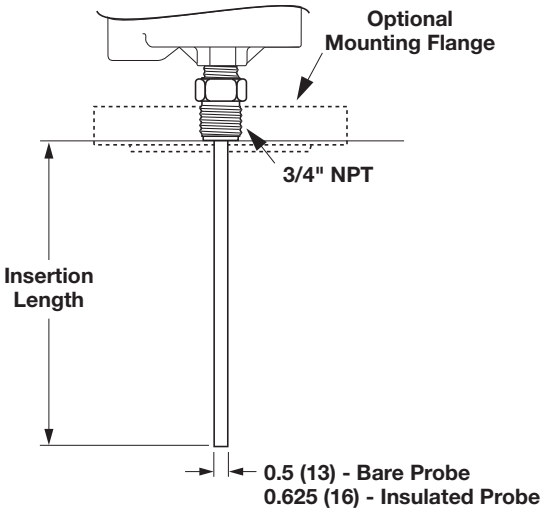
Capacitance gain chart for bare probes

8XB-XXXX-XXX or 8XC-XXXX-XXX

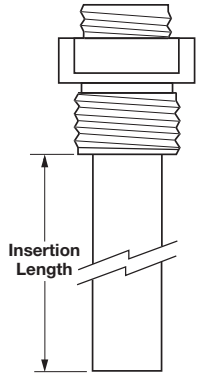


DIMENSIONS

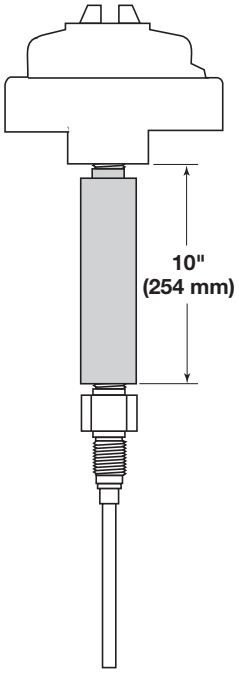
INCHES (MM)



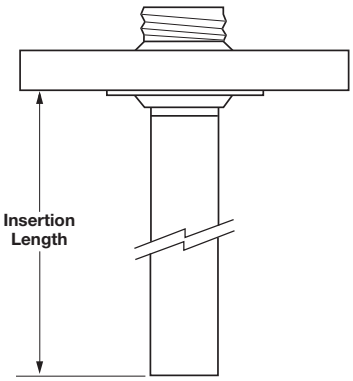
Rigid Probe



Threaded ¾"-1" NPT Connection



Heat Extension

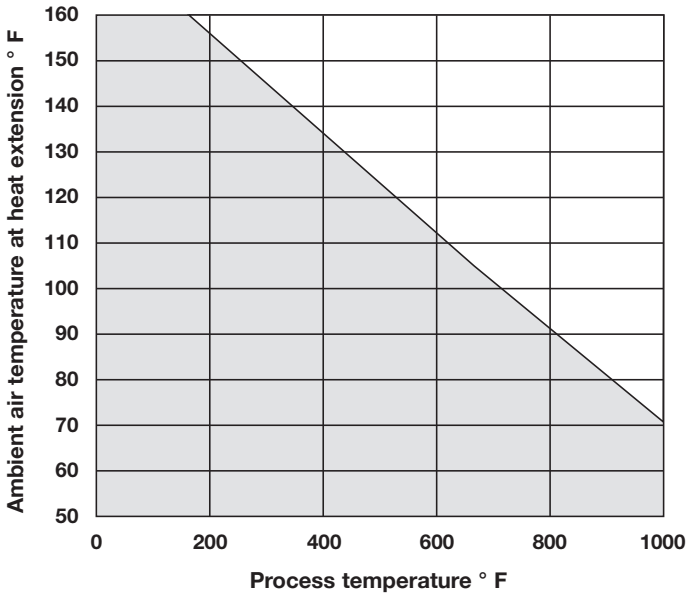


Welded flange ASME Connection

HEAT EXTENSION

HEAT DISSIPATION GRAPH

For use with Heat extension (89-6593-001)



The heat dissipation graph, at left, depicts the maximum temperatures at which the extension can be used effectively.

1. Determine the maximum process temperature in the application and locate on X axis.
2. Determine the maximum ambient temperature surrounding the heat extension and locate on the Y axis.
3. If the intersecting point on the graph is within the shaded area the heat extension will dissipate enough heat to keep the electronics temperature below +160 °F (+70 °C).

NOTE: The heat extension may be used with all probe configurations.

PROBE QUICK SELECTION GUIDE

The KOTRON probes, handling the majority of applications, are outlined below. Probe lengths are available in inches (second digit A) or centimeters (second digit C).

Insulated rigid	¾" NPT, carbon steel rod, Teflon® insulation and seal	8AA-1A1A-XXX 8CA-1A1A-XXX
Bare rigid	¾" NPT, 316 stainless steel rod, Teflon® seal	8AB-AA1A-XXX 8CB-AA1A-XXX

INSULATED RIGID PROBES

MODEL NUMBER

Models available for quick shipment, usually within one week after factory receipt of a complete purchase order, through the Expedite Ship Plan (ESP).

INSULATED RIGID PROBES
(for conductive or non conductive media)

A complete measuring system consists of a:

1. KOTRON electronics (switch or transmitter)
2. KOTRON probe
3. Optional heat extension for process temperatures >200° F (95° C): P/N 089-6593-001 (see page 5)

BASIC MODEL NUMBER - INSULATED RIGID PROBE

8 A A	FM/CSA/ATEX, probe length in inches
8 C A	FM/CSA/ATEX, probe length in centimeters

ROD, SEAL, AND INSULATION MATERIAL ① ②

1 A	Carbon steel rod with Teflon® (TFE) insulation max +400 °F @ 200 psig/max 3000 psig @ +100 °F (max +200 °C @ 13.8 bar/max. 205 bar @ +40 °C)
3 A	Carbon steel rod with Kynar® (PVDF) insulation max +200 °F @ 200 psig/max 3000 psig @ +150 °F (max +95 °C @ 13.8 bar/max. 205 bar @ +65 °C)
4 A	316/316L SS rod with Teflon® (TFE) insulation max +400 °F @ 200 psig/max 3000 psig @ +100 °F (max +200 °C @ 13.8 bar/max. 205 bar @ +40 °C)

① Temperature at electronics should not exceed +160 °F (+70 °C).
② Minimum temperature -40 °F (-40 °C)

PROCESS CONNECTION - 316L SS (flange socket welded to probe)

1	¾" NPT (not available with Configuration Style code B)
2	1" NPT
4	1" 150 lbs ASME RF flange (not available with Configuration Style code B)
5	1½" 150 lbs ASME RF flange
6	2" 150 lbs ASME RF flange
7	3" 150 lbs ASME RF flange
8	4" 150 lbs ASME RF flange
A	1½" 300 lbs ASME RF flange
B	2" 300 lbs ASME RF flange
D	4" 300 lbs ASME RF flange

CONFIGURATION STYLE

A	Insulated rigid probe
B	Insulated rigid probe with 1" (25 mm) 316 SS diameter stillwell
C	Insulated rigid probe with 6" (15 cm) 316/316L SS inactive sheath
E	Insulated rigid probe with 316/316L SS reference wire

INSERTION LENGTH specify length in 1 inch (1 cm) increments (specify in digit 2)

6 to 234 inches (15 to 595 centimeters)
Example: 6 inches = 006 / 60 centimeters = 060
ESP available 6 to 234 inches in 1 inch increments (15 to 595 centimeters in 1 cm increment)

BARE RIGID PROBES

MODEL NUMBER

A complete measuring system consists of a:

1. KOTRON electronics (switch or transmitter)
2. KOTRON probe
3. Optional heat extension for process temperatures >200 °F (95 °C): P/N 089-6593-001 (see page 5)

BASIC MODEL NUMBER - BARE PROBES

8 A B	FM/CSA/ATEX, probe length in inches ①
8 C B	FM/CSA/ATEX, probe length in centimeters ①

① Bare probes cannot be installed in a hazardous area unless used with an intrinsically safe electronic circuit.

ROD AND SEAL MATERIAL ② ③

A A	316 SS rod with Teflon® seal max +400 °F @ 200 psig/max 3000 psig @ +100 °F (max +200 °C @ 13.8 bar/max. 205 bar @ +40 °C)

② Temperature at electronics should not exceed +160° F (+70° C).

③ Minimum temperature -40° F (-40° C)

PROCESS CONNECTION - 316L SS (flange socket welded to probe)

1	¾" NPT (not available with Configuration Style code B)
2	1" NPT
6	2" 150 lbs ASME RF flange
7	3" 150 lbs ASME RF flange
8	4" 150 lbs ASME RF flange
B	2" 300 lbs ASME RF flange
D	4" 300 lbs ASME RF flange

CONFIGURATION STYLE

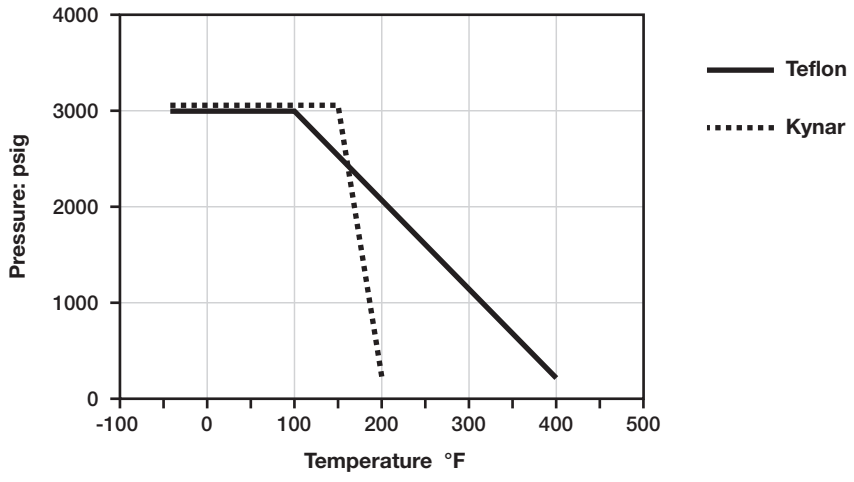
A	Bare rigid probe
B	Bare rigid probe with 1" (25 mm) 316 SS diameter stillwell (1" process connection minimum)

INSERTION LENGTH specify length in 1 inch (1 cm) increments (specify in digit 2)

6 to 234 inches (15 to 595 centimeters) Example: 6 inches = 006 / 60 centimeters = 060

A		B	A	A					

PRESSURE TEMPERATURE CURVE



QUALITY

MAGNETROL REGISTERED TO ISO 9001 Your Assurance of Quality and Service

The quality assurance system in place at MAGNETROL guarantees the highest level of quality throughout the company. MAGNETROL is committed to providing full customer satisfaction both in quality products and quality service.

The MAGNETROL quality assurance system is registered to ISO 9001 affirming its commitment to known international quality standards providing the strongest assurance of product/service quality available.

ESP

Expedite
Ship
Plan

Several KOTRON Sensing Probes are available for quick shipment, usually within one week after factory receipt of a complete purchase order, through the Expedite Ship Plan (ESP).

Models covered by ESP service are color coded in the selection data charts.

To take advantage of ESP, simply match the color coded model number codes (standard dimensions apply).

ESP service may not apply to orders of ten units or more. Contact your local representative for lead times on larger volume orders, as well as other products and options.

WARRANTY

All MAGNETROL electronic level and flow controls are warranted free of defects in materials or workmanship for eighteen months from the date of original factory shipment.

If returned within the warranty period; and, upon factory inspection of the control, the cause of the claim is determined to be covered under the warranty; then, MAGNETROL will repair or replace the control at no cost to the purchaser (or owner) other than transportation.

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

MAGNETROL®

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BULLETIN: 50-125.15
EFFECTIVE: April 2019
SUPERSEDES: January 2012