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General Information

Custom Design

Our catalog products offer a great deal of design flexibility, but they cannot satisfy every need. We've been designing custom products for many years, and can provide application and design assistance, as well as guidance based on our experience. Give us a call or send a sketch or description of your requirement. If we can offer a product to fit it, we'll quote quickly.

Calibration

We maintain the equipment to provide both routine and custom measurement of our products. Measurements are traceable to the NIST and we can perform measurements at -196°C, 0°C, 100°C, and at any temperature between 30 and 420°C. Data accuracy is $\pm 0.05^\circ\text{C}$ between 0 and 125°C, and $\pm 0.1^\circ\text{C}$ outside this range. All measurements are on the ITS-90.

Routine Measurements

We test 4100 model probes containing platinum sensors at 0°C and 100°C, and provide this resistance data to two decimal digits on tags which are attached to each probe. Although we test 4100 model probes which contain thermistors, we do not usually provide this data, nor do we provide test data, except for custom measurements, for 41000 series probes.

Custom Measurements

We can provide measurements for probes which contain either platinum or thermistor sensors. This data can be used to create resistance vs. temperature printouts. Printouts for platinum sensors can be in either ITS-90 or Callendar-Van Dusen format, and include the appropriate coefficients and average sensitivity at printout intervals to assist in interpolation. Minimum resolution is $.01^\circ$. Printouts for thermistor sensors use the Steinhart and Hart equation, are limited to 100°C maximum span, and minimum resolution is $.1^\circ\text{C}$. We can also measure and provide printouts for various thermocouple sensors over the same ranges.

Printouts for platinum sensors require two to four measurements, depending on the temperature span and format. Printouts for thermistor sensors require three measurements, and printouts for thermocouples require two or three measurements.



Ordering

You can order directly from Logan Enterprises, Inc., or, in some cases, from a representative who also acts as a distributor. Orders can be telephoned, faxed, mailed, or e-mailed to us. Because of the complexity of catalog part numbers, we may request a written purchase order.

We try to maintain a consistent approach to order entry to reduce errors and duplication of part numbers in our system. You must follow the indicated format for the required portions of each part number. If you use your own part numbers for catalog products, you must also indicate the correct Logan Enterprises part numbers.

You can establish an open account by forwarding the appropriate bank and trade references, or you can purchase COD if your business is in the US. We accept major credit cards. Prices shown in our price list, or quoted from the factory, are FOB West Liberty OH. Our payment terms are net 30 days. Our minimum billing is \$50.00 US.

Warranty

Most of our products are date-coded. We warrant all products to be free of manufacturing defects and to perform within published or stated specifications for a period of two years from date of manufacture. The warranty is limited to replacement or repair of a defective product, at our discretion.

Performance

This section describes general performance of the 4150, 4116/4126, 4119/4159, and 4120/4160 probes. Sensors are 100 ohm wirewound platinum. Except where otherwise noted, the information is in the form of estimated, rather than guaranteed, performance.

Service Temperatures

The temperature limits shown are generally determined by the internal construction and by lead materials. The transition area is the rearmost one inch of specified sheath length.

	Sensor/Sheath	Transition/Cable
4150 standard	to 650°C	to 250°C
K option	-200 to 400°C	-200 to 200°C
VI option	to 650°C	to 250°C
4116A, 4126A	to 650°C	to 250°C
4119, 4159	-40 to 500°C	-40 to 100°C
H option	to 650°C	to 360°C
HS option	to 650°C	to 250°C
4120, 4160	-40 to 100°C	-40 to 100°C

We do not show a lower temperature limit for most probe styles. However, we suggest that you consider the K option or one of the underwater probes if the probe is likely to be frequently operated at temperatures near, or below, the average dewpoint temperature at the rear of the probe. Refer to the technical notes for more information.

The platinum film sensors which we offer are rated for operation to 500°C. However, for best long-term stability we recommend that probes which contain these sensors be limited to 400°C.

Probes which contain thermocouple sensors can generally be operated to the limits defined by the particular thermocouple calibration, although lead wire temperature limits, calibration drift, and oxidation of the probe sheaths should be considered.

Probes which contain thermistor sensors are temperature-limited by the range of the particular thermistor used.

Stem Effect

This is the approximate measurement error caused by energy transfer along the probe's internal leads and its sheath. It is stated as the error in °C resulting from a 1°C difference in temperature between the measurement media- water flowing at 3 ft/second minimum- and still air at the surface of the media.

Immersion Depth	1 inch	2 inches	3 inches	4 inches
1/8" dia.	.005	.001	.0005	<.0001
3/16", 1/4" dia.	.01	.002	.0005	<.0001

Insulation Resistance

Measured from any active lead to the probe sheath at less than 95% relative humidity.

Any probe style	>1 gigohm at 100VDC at 25°C.
	>100 megohms at 100VDC at 500°C.
K option-tested	>1 gigohm at 500VDC at 25°C.

Thermal Response

This is the approximate time required for a sensor to "indicate" 99% of an instantaneous change in the temperature of the measurement media- water flowing at 3 ft/second minimum- with the probe immersed to at least 4 inches depth.

1/8" Diameter	60-80 seconds
3/16" Diameter	80-120 seconds
1/4" Diameter- single sensor	120-150 seconds
1/4" Diameter- dual sensor	140-180 seconds
1/4" Diameter- QR option	60-80 seconds
1/4" Diameter- VI option	140-180 seconds

External Pressure

These are calculated maximum pressures, based on approximately 25% of theoretical collapse pressures for 316 stainless steel sheaths of various wall thicknesses, without fittings, at 25°C. Reference ASME B31.3. Performance will be affected by sheath surface quality, operating temperatures, and probe mounting methods.

1/8" Diameter	300PSI
3/16" Diameter	4600PSI
1/4" Diameter- single sensor	6900PSI
1/4" Diameter- dual sensor	800PSI
1/4" Diameter- QR option	estimated 800PSI
1/4" Diameter- VI option	2300PSI

Technical Notes

These notes briefly define platinum and thermistor temperature sensors and signal-conditioning methods used with each. They also identify some common sources of measurement errors and performance problems. Where error magnitudes are noted, they are based on products manufactured by Logan Enterprises, Inc., and do not necessarily apply to those of other manufacturers.

Platinum Based Products

The most widely used platinum sensor has a resistance of 100 ohms at 0°C and an average sensitivity below 0.4 ohms per °C. It is necessary to reduce the effect of lead resistance to achieve accurate temperature measurement. For this reason most platinum RTD's are manufactured with three or four external leads, rather than the two needed for simple resistance measurements. The extra leads are used in various ways to perform the function.

Signal-Conditioning

Four Wire Measurement- figure 1

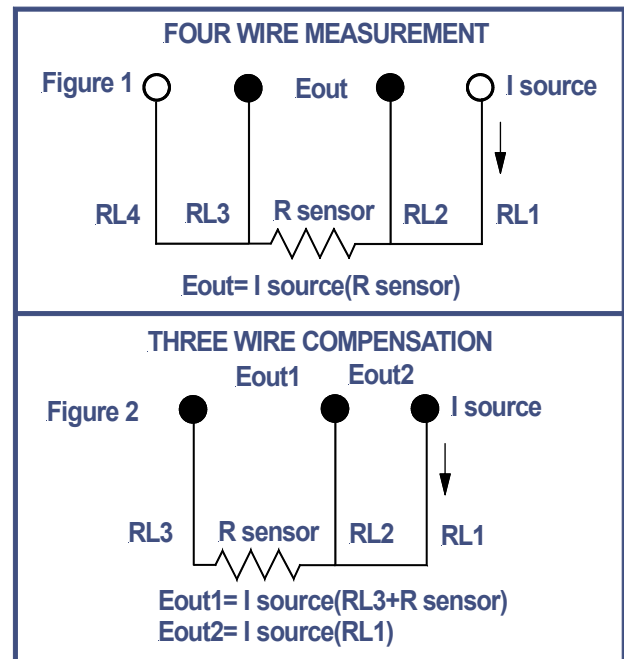
This is the most effective method to measure a low resistance device. Two leads are attached directly to each end of the sensor and excitation current is passed through the sensor and one pair of leads. The voltage developed across the sensor is detected by a high impedance circuit using the second pair of leads. The result is an accurate measurement of the sensor's resistance. Since it is not necessary to determine the resistance of any of the leads, the circuit needs no compensation. Lead resistance is limited only by the voltage available to provide excitation current, allowing long runs from sensor to signal-conditioner with light gauge leads. This approach is used in all precision bench-top meters and in some industrial instrumentation.

Three Wire Compensation- figure 2

This is the most common method used in industrial signal-conditioning devices. As in the four wire system, excitation current is passed through the sensor and a pair of leads. However, the voltage detection method differs somewhat. In this case, the voltage developed across the sensor and one excitation lead, Eout1, is detected. The voltage developed across the second excitation lead, Eout2, is also detected and is subtracted from Eout1. If the resistance of both excitation leads is equal, the circuit will provide an output proportional to the sensor's resistance. Any mis-match in resistance of the two excitation leads will result in a measurement error of about 0.1°C for each 0.04 ohm difference. For this reason, external leads should be of identical wire gauge.

Four Wire Compensating Loop

This method, used in early devices, functions in similar fashion to three wire compensation. A 'loop' of wire is installed in the RTD along with the sensor's leads. Four leads run to the instrumentation. The instrument measures the resistance of the sensor plus its leads and subtracts the resistance of the 'loop' for compensation. While some of this equipment may still be in use, it has generally been replaced with three or four wire designs.



CIRCUIT CONFIGURATIONS

Moisture Damage and Prevention

In many applications- storage tank, refrigeration, and soil temperature monitoring are examples- water intrusion into the probe can be a severe problem. Although the connection area in the rear of most of our probes is imbedded in epoxy, the primary function of the epoxy is to anchor the leads, and it does not provide a good seal against moisture. If the probe is immersed or if its temperature is lowered enough to allow moisture to condense within it, its performance will quickly degrade. The short-term effects may be subtle- erratic or drifting outputs, or alarms in systems which monitor circuit-to-ground impedances. In the long-term, oxidation and other chemical reactions will occur and the probe, regardless of sensor style, will fail unpredictably. The following probe styles and options can prevent these failures from occurring.

Waterproof Probes

The 4119 and 4120 are heavy-duty probes, designed originally for outdoor applications. They feature a neoprene jacketed cable and a vulcanized neoprene junction or tip. Both are rated for operation between -40 and 100°C, although the sensing end of a 4119 with a long sheath can withstand high temperatures. Either can be used for temperature monitoring in water tanks, lakes and streams, or soil. Because the sensor is imbedded in metal within the tip in both cases, they can be immersed to several hundred feet or can be buried without damage.

The 4159 and 4160 feature reduced junction and cable sizes. Although not as rugged as the 4119 and 4120 probes, the probes are easier to handle, and they provide installation options not available for the larger probes.

The K Option

If a probe doesn't need to be immersed or buried, this option offers greater temperature range and design flexibility than do the waterproof probes. It is designed to operate to cryogenic temperatures, and the probe is hermetically sealed. Although we don't rate the probe to high temperatures- the suggested operating range is -200 to 400°C, and the seal area is limited to 200°C maximum- our experience indicates that the design provides an extremely stable device over this temperature range. The option is available on most 4100 style probes and may be used with thermistors.

Vibration

Wirewound sensors will withstand reasonable levels- to 30 g's or more- of low frequency vibration. This is sufficient to allow the use of standard probe configurations in most applications. Where higher levels of shock or vibration occur, it may be necessary to provide additional protection or to use a more rugged sensor.

The VI Option

In this option, we combine a method of reducing movement of the probe's internal leads with, in the larger diameter probes, a fiberglass sleeve over the internal assembly. This increases resistance to shock and vibration while retaining the high temperature capability of the probe. The use of this option increases the thermal response time and reduces the pressure capability of the 3/16 inch and 1/4 inch diameter probes. It has no detectable effect on the performance of the 1/8 inch diameter probe.

Where very high levels of vibration or shock are expected, the best choice may be to use a platinum film sensor with the VI option. This sensor has a much lower mass than the wirewound sensor, and the sensing element is a glass-encapsulated film rather than a fine wire. It does have certain disadvantages- we don't recommend its use above 400°C, it's available only in the .00385 (DIN) alpha, and it is not as accurate as a wirewound sensor at elevated temperatures.

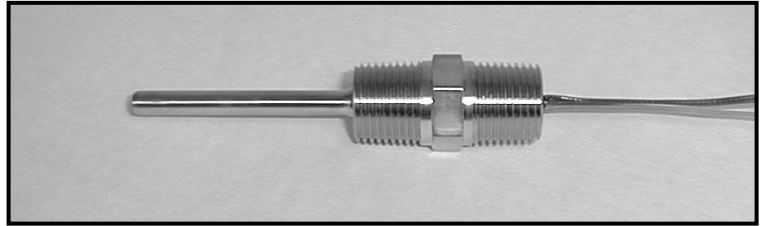
Thermistor Based Products

The thermistors most commonly used for temperature measurement are sintered mixtures of metallic oxides with large negative temperature coefficients of resistance- typically on the order of -4%/°C. Because of their relatively high resistances and high sensitivity, they do not require lead resistance compensation. Their small size- typical diameters of 0.12 inch down to 0.005 inch- make them suitable for miniaturization. They are used in applications ranging from cryogenic temperatures to 400°C. The most precise of these are more accurate than many platinum sensors in the temperature range 0 to 100°C, and they are generally less expensive than platinum sensors of equivalent accuracy. Individual device specifications are usually stated over fairly limited temperature spans, with typical accuracies for precision thermistors of $\pm 0.1^\circ\text{C}$ to $\pm 0.2^\circ\text{C}$ between 0 and 100°C. Accuracy degrades rapidly outside the specified range.

Many indicators, controllers, and hand-held thermometers are available for operation with thermistors. Because of non-linear characteristics and a lack of standardization, instrumentation is usually designed for fixed ranges and often for a specific manufacturer's thermistors.

4150 General Purpose Probe

We can also supply this general style in metric diameters with certain metric fittings.



4150 Part Number Format

4150-1/4-12-36-PT138P-()-()

Model Number _____ 4150
 Sheath Diameter (1/8", 3/16", 7/32", 1/4") _____ 1/4
 Sheath Length in Inches _____ 12
 Cable Length in Inches _____ 36
 Sensor Part Number (from Sensor Section) _____ PT138P
 Options (from Options List) _____ ()-()

Leads- these are standard for the indicated sensors-(PT), platinum- (TH), thermistor- (TC), thermocouple- and options.

Standard- (PT)	Cable, 4x #26AWG stranded, TFE insulation, PFA jacket, 250°C
Standard- (PT) 12" or less	Individual leads, #22AWG stranded, TFE insulation, 250°C
Standard- (TH)	Cable, #22AWG stranded, PVC insulation and jacket, 125°C
Standard- (TH) 12" or less	Individual leads, #28AWG stranded, PVC insulation, 125°C
Standard- (TC)	#20AWG or #24AWG (1/8" sheath) solid duplex, fiberglass insulation, 360°C
Dual Option- (PT)	Without connector- 1 cable, 8x #26AWG stranded, TFE insulation, PFA jacket, 250°C With connector- 2 cables, 4x #26AWG stranded, TFE insulation, PFA jacket, 250°C
Dual Option- (TH)	Cable, 4x #24AWG stranded, PVC insulation and jacket, 125°C
H Option- (PT)	Cable, 4x #26AWG stranded, fiberglass insulation and jacket, 360°C

Options- specified in alphabetic order. Refer to Option Drawings.

Leads- these are special leads available for the indicated sensors.

PFA (TC)	#20AWG solid duplex, PFA insulation, 250°C.
RTS (PT, TH)	Cable, 4x #26AWG stranded, TFE insulation, braid shield, TFE jacket, 250°C.

Connectors

Single connectors may be installed on the end of a cable or on the rear of the probe. For installation on the probe, specify NA for cable length. A PT Dual Option requires the use of two cables and two connectors. A TH Dual Option requires only one connector, on probe or on cable. If a connector and mating connector are specified, the one designated first in the probe part number will be installed and the second will be supplied loose. All mating connectors are in-line cable style and include hardware. Other connectors are available as specials.

AMP Microphone-PT, TH AMP1	4 contact male (Switchcraft A4M) Female mates with AMP.
MC Thermocouple-PT MC1	3 contact male, uncompensated. Female mates with MC.
MS Military-PT, TH MS1	4 contact male (3101A-14S-2P). Female (3106A-14S-2S) mates with MS.
MFP Thermocouple-TC MFP1	2 contact male miniature flat pin. Female mates with MFP.
PH Phone Plug-TH	1/4 inch diameter.
SP Spade Lugs-PT, TH	#6 spade lugs.
SPL Spade Lugs-TC	#8 compensated spade lugs.
SRP Thermocouple-TC SRP1	2 contact male standard round pin. Female mates with SRP



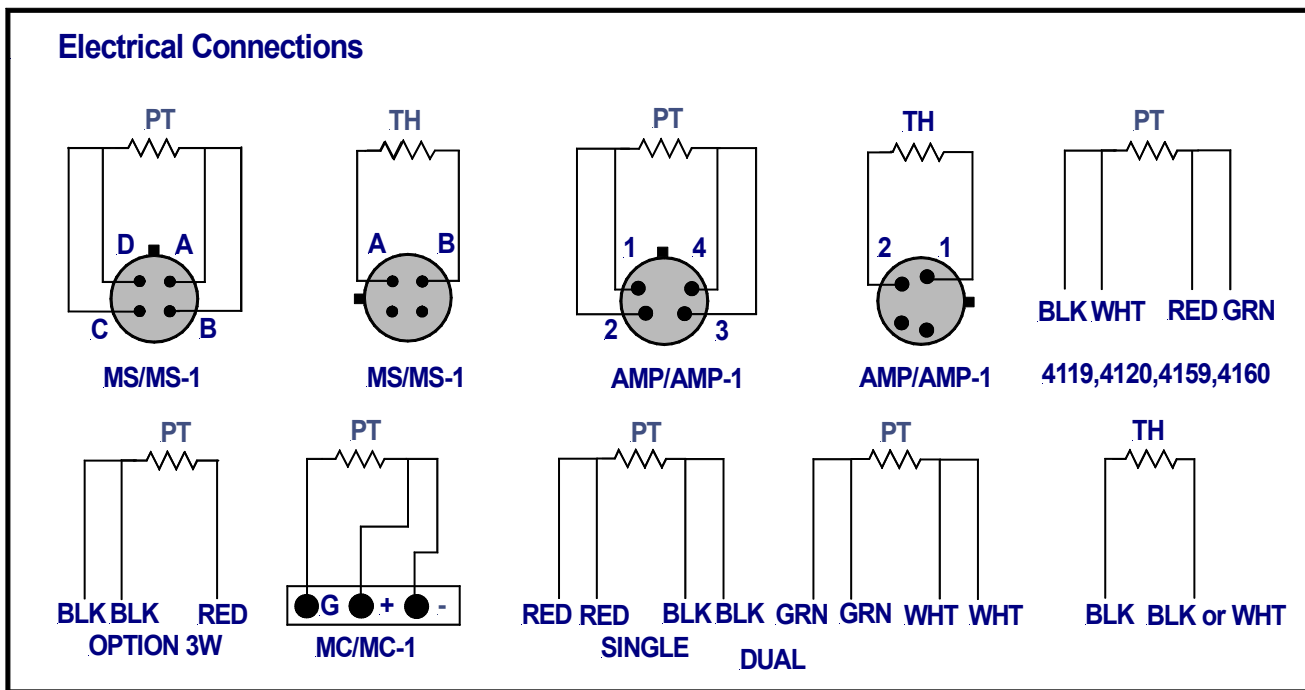
Fittings- fractional dimensions are male pipe thread sizes.

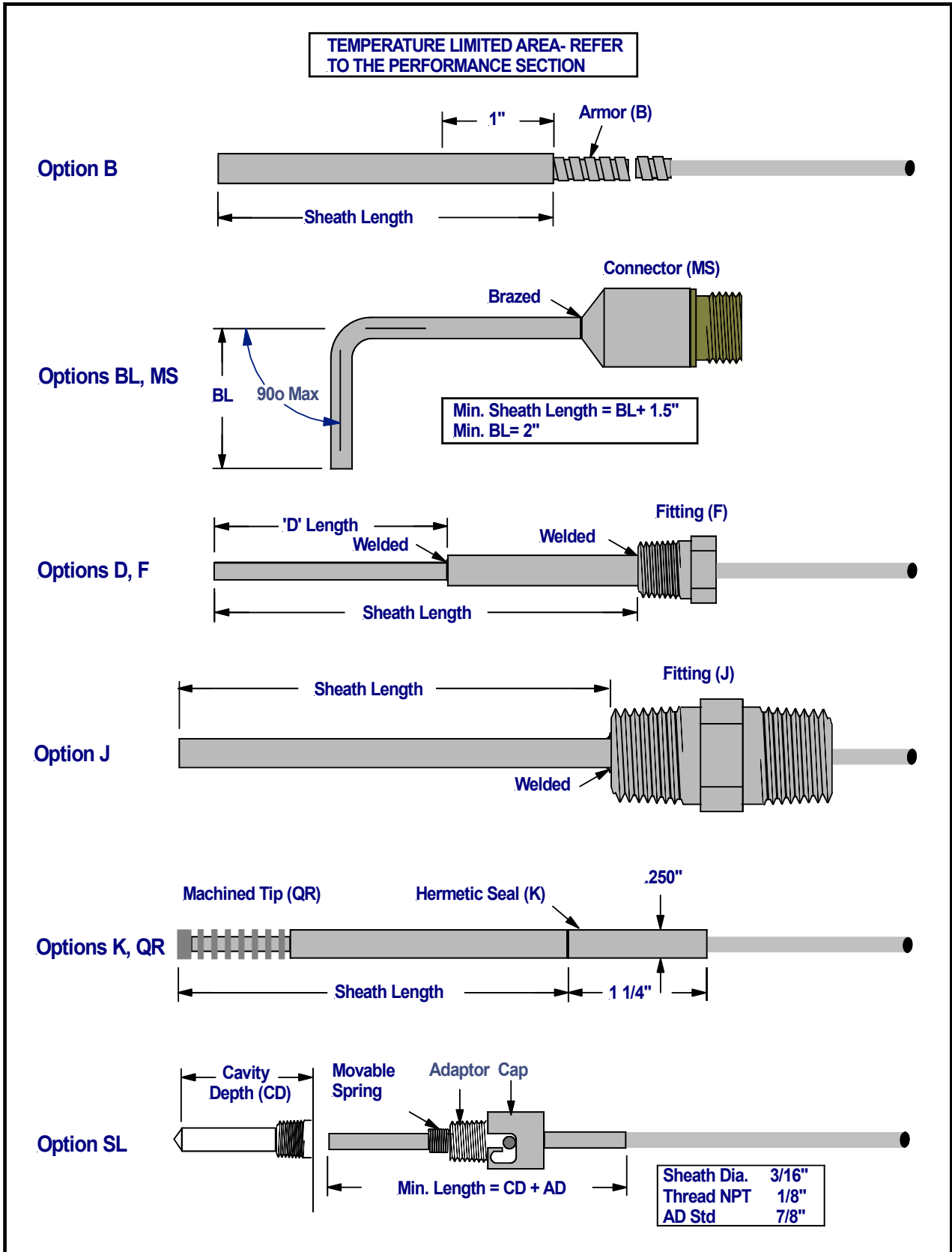
AF Armor	A threaded brass cap and a 1/8NPT by 7/8 inch long stainless steel bayonet adaptor are installed on the option B armor to compress the armor and spring-load the probe. Specify AF and B .
C Compression	316 stainless steel male NPT supplied loose. Specify C1/8 , C1/4 or C1/2 . C1/2 is available only for the 1/4 inch sheath. Fitting is not available for the 7/32 inch sheath.
CC Cord Connector	1/2NPT male polyimide, neoprene insert, for use with option SA and sealed junction box for damp applications. Specify CC and SA
F Fixed Forward	316 stainless steel welded male NPT. Specify F1/8 , F1/4 , or F1/2 .
G Fixed Reverse	316 stainless steel welded male NPT. Specify G1/8 , G1/4 , or G1/2 .
J Fixed Double	316 stainless steel welded male/male NPT, both threads same size. Specify J1/8 , J1/4 , or J1/2 .
OSD Oil Seal	316 stainless steel 1/2NPT male/male, fluid seal for 7/32 or 1/4 sheath. <u>See 42000 Series.</u>
OSS Oil Seal	Single-ended version of OSD. Specify OSS1/8 or OSS1/4 . <u>See 42000 Series.</u>
SL1/8 Spring-Load	A stainless steel cap, a 1/8NPT by 7/8 inch long stainless steel adaptor, and an adjustable stainless steel spring are installed on a 3/16" diameter probe. Specify SL1/8-CD (cavity depth) or SL1/8- M (probe tip to spring end dimension)- ADxx , if a special adaptor length is required.

Miscellaneous Options

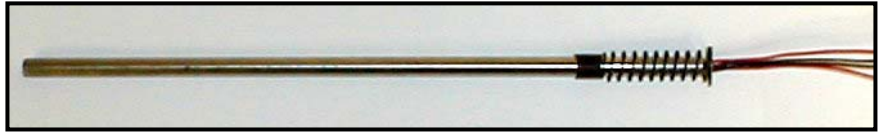
B Armored Cable	.20 inch nominal OD flexible 304 stainless steel armor installed over a specified length of probe cable. The specified cable length must be at least 3 inches longer than the armor length unless a connector is specified. Specify Bxx , with xx indicating the armor length in inches.
BL Bent Sheath	A single bend, to 90° maximum. Specify BLxx,Y , with xx indicating the distance from the probe tip to the bend centerline and Y indicating the bend angle relative to the probe's centerline.
D Reduced Tip Diameter	A specified portion of the overall probe length is reduced to 3/16 or 1/8 inch diameter. Specify D1/8 or D3/16-xx , with xx indicating the length of reduced diameter.
DU Dual Sensor	Two electrically isolated sensors in a 1/4 inch diameter probe.
DUCB Dual Cable	Use to specify two 4 conductor cables in place of a single 8 conductor cable with the DU platinum sensor option. Place this designation at the end of the part number unless connectors are specified.
EAL/EALDU Aluminum Head	Refer to the Connection Heads Section.
ECI Cast Iron Head	Refer to the Connection Heads Section.
EX/EXDU Malleable Explosion-proof Head	Refer to the Connection Heads Section.
EXAL/EXALDU Alum. Explosion-proof Head	Refer to the Connection Heads Section.
H High Temperature Probe	Nickel 600 sheath, fiberglass insulated cable, and high temperature construction. Fixed fittings will be 316 stainless steel and will be brazed to the sheath.
HS High Temperature	Nickel 600 sheath and PFA jacketed cable. Fixed fittings will be 316 stainless steel and will be brazed to the sheath.
K Hermetic Seal	Hermetically sealed for moisture protection of the sensor. Transition area is not waterproof. Not available for TC sensor.
PSN Serial Number	A serial number- the date code plus additional digits- is etched into the probe body.

- QR** Quick Response A series of grooves is machined into the tip end of a 1/4 inch diameter probe sheath to improve thermal response.
- R** Strain Relief Spring A stainless steel spring is installed at the rear of the probe to prevent sharp bends in the cable.
- SA** Sleeved Armor A specified length of armor is covered with PVC heat-shrunk tubing to provide protection in a damp area. The **CC** fitting can be used with this option to protect the armor's entry into a connection head or junction box. Specify **SAxx**, with **xx** indicating the length of the armor.
- SST** Stainless Steel Tag A tag, etched to customer specification, is supplied, along with a length of nickel wire for attachment. Specify **SST and data** to be etched.
- TS** Tip-sensitive The sensor is imbedded in a copper-alloy tip which is soldered into the end of a 3/16", 7/32" or 1/4" diameter tube. A platinum film or thermistor sensor is recommended. 200°C maximum temperature.
- VI** Vibration Resistant Special internal construction to improve resistance to vibration and shock.
- 3W** Three-Wire Removal of one lead for use with three wire input devices.





4116 and 4126 Spring-Loaded Probes



These probes are designed for use in thermowells or protection tubes. The 4116 includes a connection head and the necessary 304 stainless steel nipples and unions. The 4126 is a replacement probe with a spring-load only. Both styles use an adjustable stainless steel 'gripper' style spring which maintains its position on the probe by friction and can be moved on the probe to compensate for make-up tolerances. Both are 1/4 inch diameter.

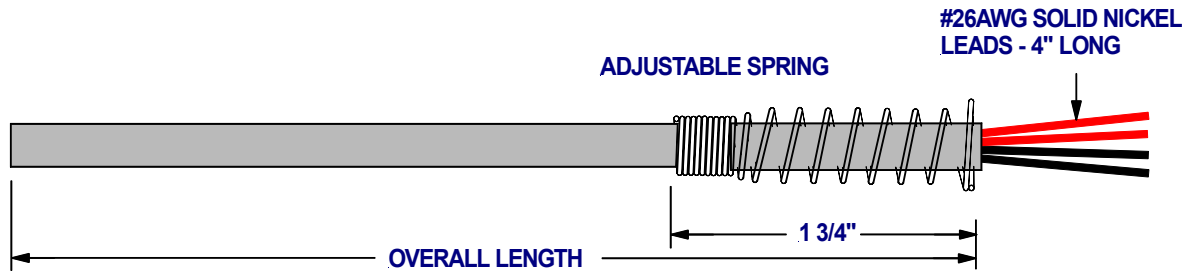
4116 Part Number Format **4116-12.00-PT138P-E3-EX-()-()**
 Model Number _____ 4116
 'A' Dimension- from drawing _____ 12.00
 Sensor Part Number- from Sensors Section _____ PT138P
 Extension and Length- from Options List and drawing _____ E3
 Connection Head- from Connection Heads Section _____ EX
 Options- from Options List _____ ()-()

4126 Part Number Format **4126-18.75-PT539W-()-()**
 Model Number _____ 4126
 Overall Length- from drawing _____ 18.75
 Sensor Part Number- from Sensors Section _____ PT539W
 Options- from Options List _____ ()-()

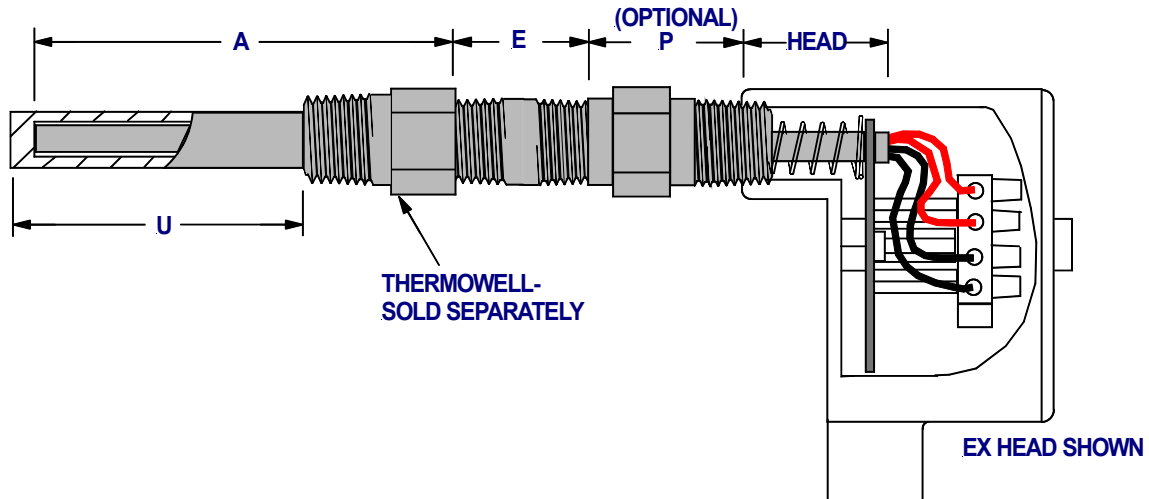
Options- specified in alphabetic order.

- DU** Dual Sensor Two electrically isolated sensors are installed.
- H** High Temperature Probe Nickel 600 sheath and fiberglass insulated leads, high temperature construction.
- K** Hermetic Seal Hermetically sealed for moisture protection.
- PSN** Probe Serial Number A serial number- the date code plus additional digits- is etched into the probe body.
- E1, E3, E6** Extension 1, 3, or 6 inch installed length 304 stainless steel pipe nipples. **Required for the 4116.**
- SP** Spade Lugs #6 spade lugs for PT or TH sensors.
- SPL** Spade Lugs TC #8 compensated spade lugs for TC sensor.
- P** Union 304 stainless steel 1/2NPT female union and close nipple. **4116 only- optional.**
- SST** Stainless Steel Tag A tag, etched to customer specification, is supplied, along with a length of nickel wire for attachment to the probe or to a connection head. Specify **SST and data** to be etched.
- VI** Vibration Resistant Special internal construction to improve resistance to vibration and shock.
- 3W** Three Wire Removal of one lead for use with three wire input devices.

4116/4126



Assembled Unit

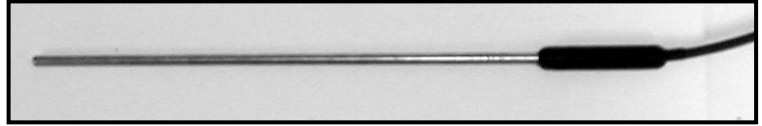


The P option includes a close nipple
 Specify A dimension when ordering the 4116
 Specify overall length when ordering the 4126

Thermowell Style	Overall Length= A+ E+ P+ HEAD				
	4116 A	4126 A	E	P if specified	HEAD
General S, H, W	U+ 1.50"	U+ 1.50"	1", 3", or 6"	2.25"	1.50"
Lagging L, HL	U+ T+ 1.50"	U+ T+ 1.50"			
Flanged F	U+ 2.00"	U+ 2.00"			

Special Category Probes

These are a few of many custom styles, catalogued because of uniqueness or popularity. Drawings on the following pages indicate their features and limitations and the available options.



4151 Miniature Probe **4151-6-48-PT139P-()-()**
Model Number _____ 4151
Sheath Length in Inches _____ 6
Cable Length in Inches _____ 48
Sensor Part Number (PT138, PT139 only) _____ PT139P
Options (refer to drawing and to 4150 Options) _____ ()-()

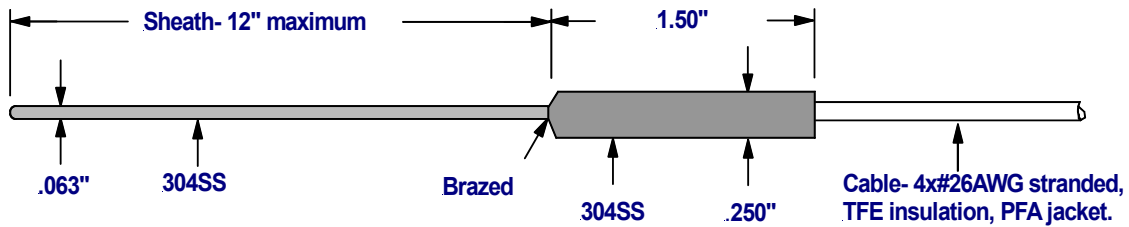
4153 Bendable Probe **4153ET-6.00-120-6-PT138W-()-()**
Model Number (4153ET or 4153FT) _____ 4153ET
Tip Length (4153ET 12" maximum- NA for 4153FT) _____ 6.00
Overall Length in Inches _____ 120
Cable Length in Inches _____ 6
Sensor Part Number (from Sensor Section) _____ PT138W
Options (refer to drawing) _____ ()-()

4159 Waterproof Probe **4159-3/16-12-250-PT139W-()-()**
Model Number _____ 4159
Sheath Diameter (1/8, 3/16, 1/4") _____ 3/16
Sheath Length in Inches _____ 12
Cable Length in Feet _____ 250
Sensor Part Number (from Sensor Section- TC not available) _____ PT139W
Options (refer to drawing and to 4150 Options) _____ ()-()

4160 Waterproof Probe **4160-100-TH44033-()-()**
Model Number _____ 4160
Cable Length in Feet _____ 100
Sensor Part Number (from Sensor Section- TC not available) _____ TH44033
Options (refer to drawing and to 4150 Options) _____ ()-()

4151 Miniature Probe

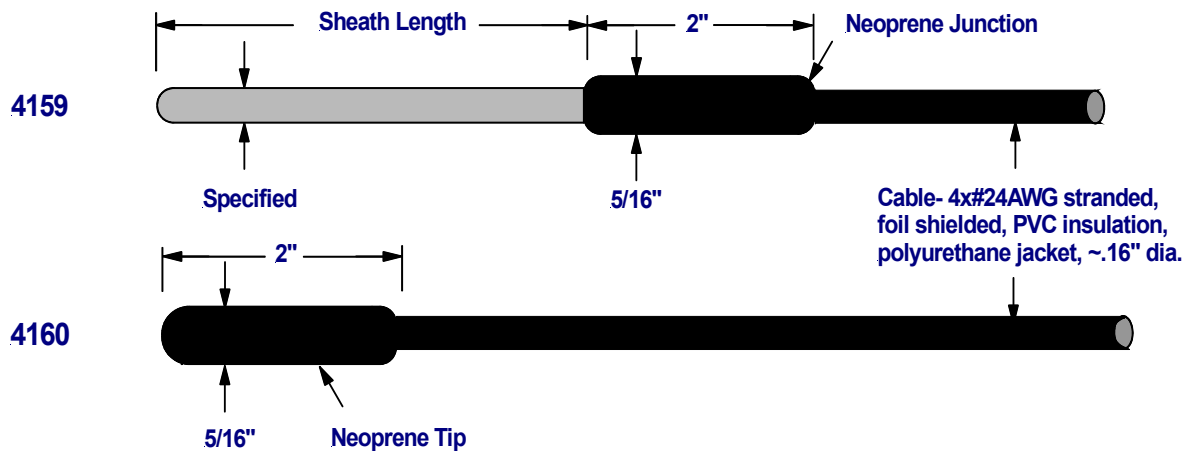
FEATURES
Fast response and low stem effect.
Temperatures to 200oC.



SENSORS- PT138 or PT139 only.
OPTIONS-
Connectors- AMP/AMP-1, MS/MS-1, SP only.
Miscellaneous- B, K, PSN, R, SST .

4159/4160 Waterproof Probes

FEATURES
Cable weight about 1/4 that of the 4119 and 4120.
The 4159 sheath diameter may be specified.
The 4160 sensor is encased in metal for protection.
Both can be buried or immersed to several hundred feet.
Cables are rated for operation between -40 and 100oC.
4159 probe tip can operate to 650oC.



SENSORS- All PT or TH sensors.
OPTIONS-
Connectors- all, on cable only.
Miscellaneous- DU for TH sensor only.

4153 Bendable Probe

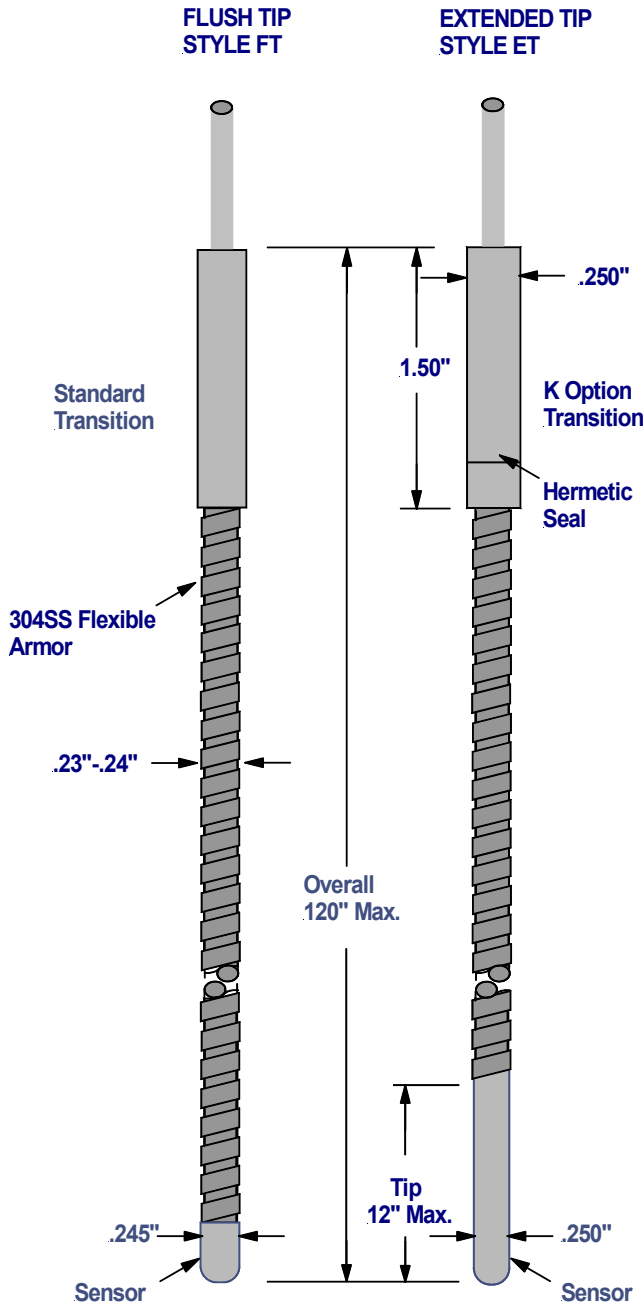
FEATURES

Simple installation and reduced transit costs- probes longer than 72 inches are coiled on 18-24 inch diameter and can be uncoiled on-site. Probes can be shipped by parcel delivery with no crate charges.

Sheath is one piece sealed 316 stainless steel from tip to transition, allowing for "spring-loading" in long thermowells and for direct exposure to moisture, corrosive gases, and high temperatures.

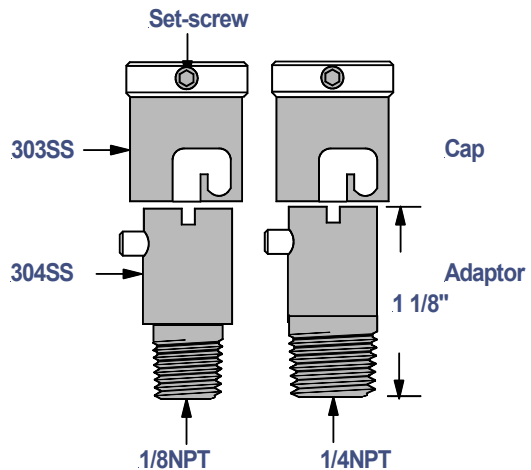
TEMPERATURE RATINGS

Standard- 650oC with PT sensor.
 K option- 400oC with PT sensor.
 Transition- 250oC for standard, 200oC for K option.



NOTE FOR COMPRESSION-LOADED APPLICATIONS

Order with the SLA option below- Set screw engages the armor and allows rapid positioning. Specify SLA1/8 or SLA1/4. Contact us for longer adaptors.



SENSORS- PT or TH
 Standard cables only.

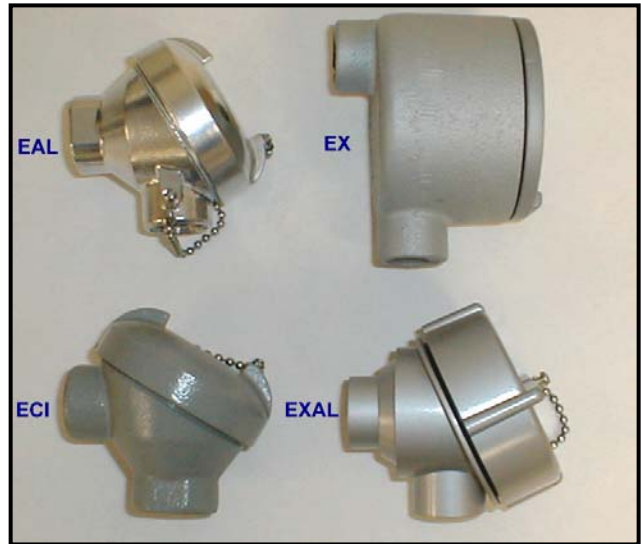
OPTIONS-
 All Connectors
 Miscellaneous- K, PSN, SST.

Connection Heads

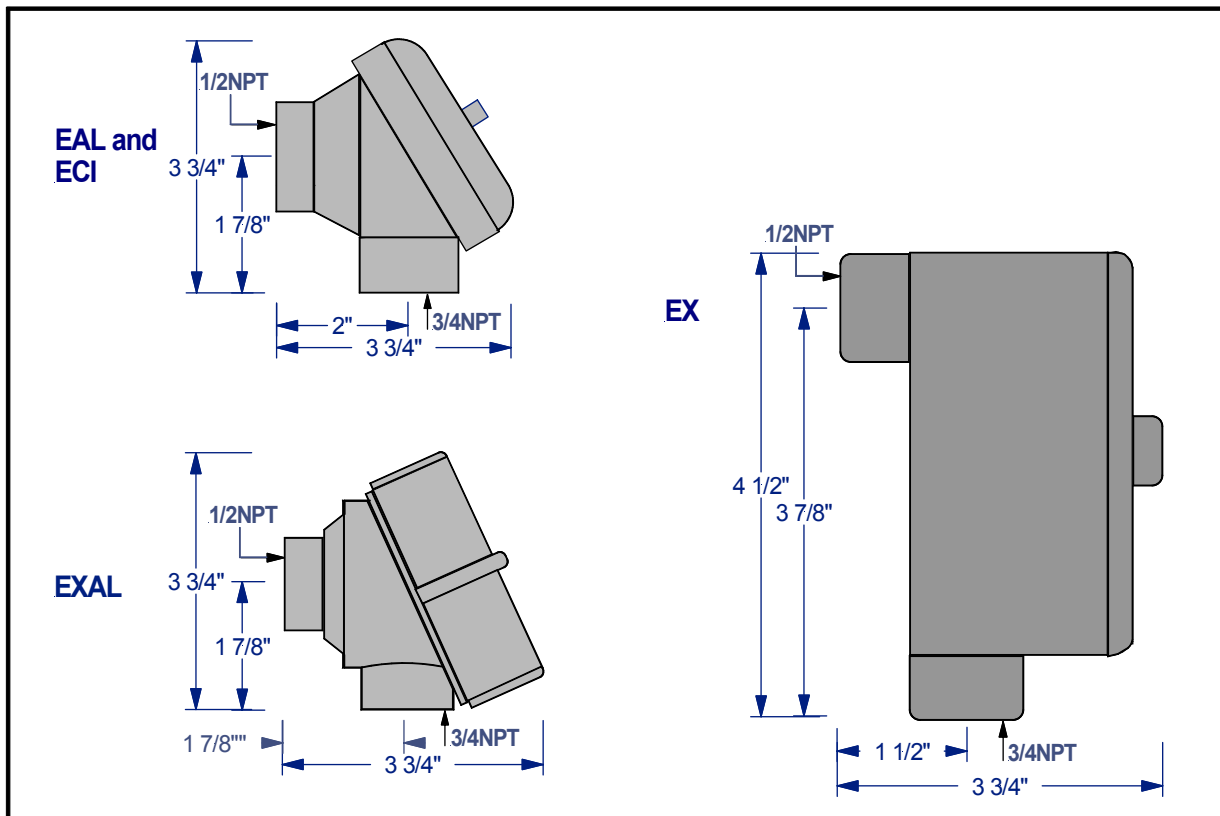
These are our standard connection heads. All models except the 42ECI are available with a removable transmitter-mounting plate for use with standard 1.3 inch (33MM) mounting center transmitters. Order as 42EALTM, 42EXALTM, or 42EXTM. The covers on all models except the 42EX are secured to the bodies with a removable 9 inch length of stainless steel bead chain. Heads are weathertight after installation- NEMA 4. The 42EXAL and 42EX heads are UL and CSA approved for Class I-B, C, D, Class II-E, F, G, and Class III environments when installed with approved conduit and fittings.

Option CH Cross Hole

A .060 inch diameter hole is drilled across one of the drive tangs on the cover of any of a head to provide a method for the user to install a wire and seal. Specify, for example, 42EXCH.

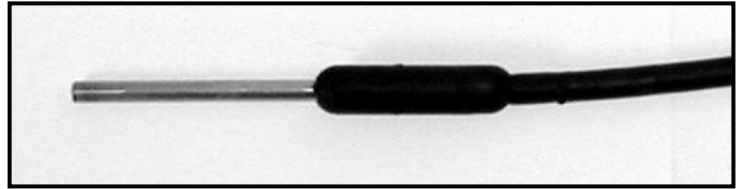


Part Number	Description	Terminals	Max. Temperature
42EAL, 42EALDU	Aluminum General Purpose	4 or 8- polyimide Barrier Strip	125°C
42EXAL, 42EXALDU	Aluminum Explosion-Proof	4 or 8- polyimide Barrier Strip	125°C
42ECI	Cast Iron General Purpose	6- Ceramic Terminal Block	250°C
42EX, 42EXDU	Cast Iron Explosion-Proof	4 or 8- polyimide Barrier Strip	125°C



4119 Waterproof Probe

This probe is designed to be immersed in water or to be used wherever heavy duty construction and a tubular probe design are needed. Probe sheath diameter is 1/4 inch.



4119 Part Number Format

4119-3-100-RN-PT138W-()-()

Model Number _____ 4119
 Sheath Length in Inches _____ 3
 Cable Length in Feet _____ 100
 Cable Style- from Options List _____ RN
 Sensor Part Number- from Sensor Section-TC not available _____ PT138W
 Options- from Options List _____ ()-()

Options- specified in alphabetic order.

Cables- Water-blocked cable is also available for deep water applications. Contact us.

- RN** 18-xSJO, rubber insulation, neoprene jacket. Number of conductors depends on sensor type.
- RNH** 18-4SO, rubber insulation, heavy duty neoprene jacket.
- RNS** 18-4SJO, rubber insulation, braid shield, neoprene jacket.

Connectors

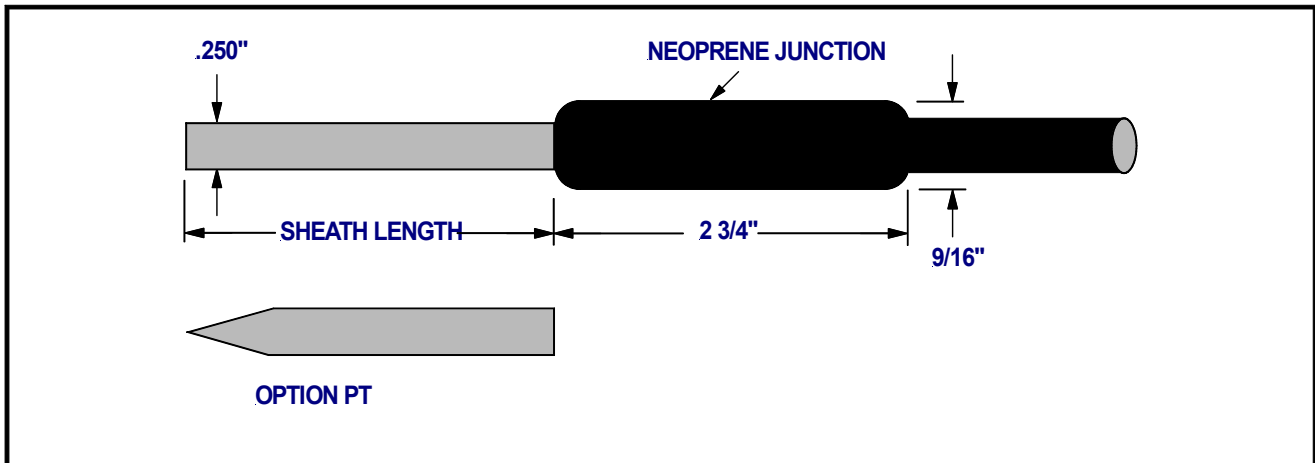
In addition to the connectors shown here, this probe can be ordered with molded underwater connectors attached. Because of the large variety of such connectors, we request that you contact us to discuss your needs. If a connector and mating connector are specified, the one designated first in the probe part number will be installed on the cable and the second will be supplied loose. All mating connectors are in-line style and include hardware.

AMP Microphone 4 contact male (Switchcraft A4M or equal).
AMP-1 Female mates with AMP.

SP Spade Lugs #8 spade lugs.

Miscellaneous Options

- BL** Bent Sheath A single bend, to 90° maximum. Specify **BLxx,Y** with **xx** indicating the distance from the probe tip to the centerline of the bend and **Y** indicating the bend angle relative to the probe's centerline.
- DU** Dual Sensor Two electrically isolated sensors, in two wire configuration, are installed in the probe sheath. Recommended for TH sensors only.
- PT** Pointed Tip Sheath tip is pointed to allow penetration into non-rigid materials.



4120 Waterproof Probe

This probe can be buried in concrete, soil, or can be used to monitor water temperature in tanks, streams, and lakes. It can be immersed to depths of several hundred feet and can be used in any environment that is not harmful to neoprene.



4120 Part Number Format 4120-100-RNH-PT138P-()-()
Model Number _____ 4120
Cable Length in Feet _____ 100
Cable Style- from Options List _____ RNH
Sensor Part Number- from Sensor Section- TC not available _____ PT138P
Options- from Options List _____ ()-()

Options- specified in alphabetic order.

Cables

- RN** 18-xSJO, rubber insulation, neoprene jacket. Number of conductors depends on sensor type.
- RNH** 18-4SO, rubber insulation, heavy duty neoprene jacket.
- RNS** 18-4SJO, rubber insulation, braid shield, neoprene jacket.

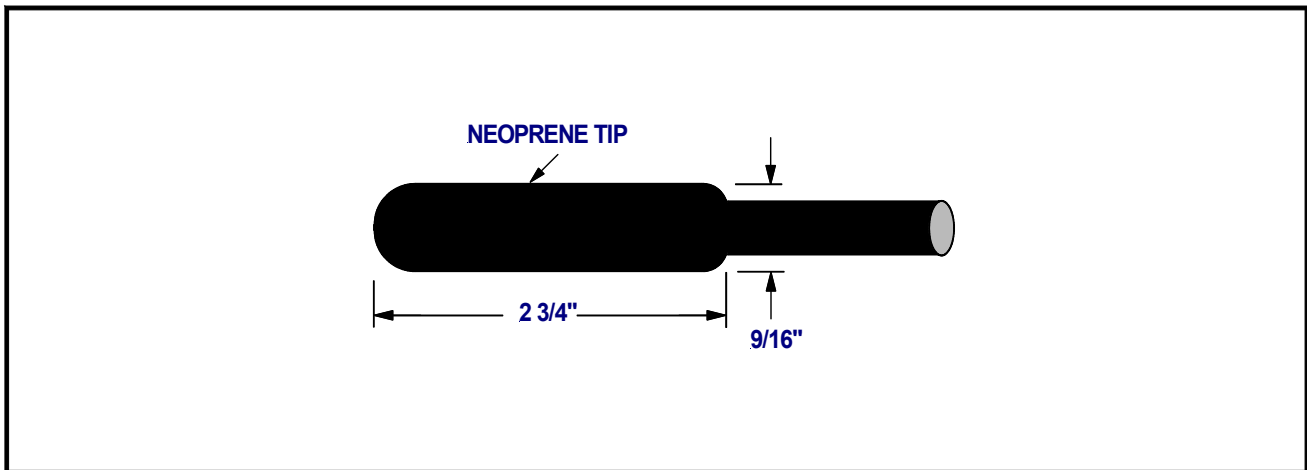
Connectors

If a connector and mating connector are specified, the one designated first in the probe part number will be installed on the cable and the second will be supplied loose. All mating connectors are in-line style and include hardware.

- AMP Microphone AMP-1** 4 contact male (Switchcraft A4M or equal). Female mates with AMP.
- SP Spade Lugs** #6 spade lugs.

Miscellaneous Options

- DU Dual Sensor** Two electrically isolated sensors, in two wire configuration, are installed in the probe tip. Recommended for TH sensors only.



41000 Series Probes

The drawings and table on the following pages provide descriptions and ordering information. All these styles have upper temperature limits which are defined by the lower of either the lead wire's or the sensor's temperature limit.



41000 Series Part Number Format **41031-PT138W-7.50-RT-36-SP-()-()**
 Model Number _____ 41031
 Sensor Part Number- from Sensor Section _____ PT138W
 Sheath Length in Inches- NA if length not applicable _____ 7.50
 Lead Style- from Lead Style List and Table _____ RT
 Lead Length in Inches _____ 36
 Lead Termination/Connector- from Connector List _____ SP
 Options- from Options List and Table _____ ()-()

Lead Styles- () indicates compatible sensors- (PT), platinum- (TC), thermocouple- (TH), thermistor

IP (PT, TH)	Individual, #26 to #30 stranded, PVC, 125°C.
IT (PT, TH)	Individual, #26 to #30 stranded, TFE, 250°C.
FEP (TC)	Thermocouple, 24AWG solid duplex , FEP, 200°C.
OF (TC)	Thermocouple, 24AWG solid duplex, fiberglass, 480°C.
PFA (TC)	Thermocouple, 24AWG solid duplex, PFA, 250°C.
PUT (PT, TH)	Cable, #24AWG stranded, polyurethane jacket, 125°C.
RF (PT)	Cable, #26AWG stranded, fiberglass jacket, 360°C.
RP (PT, TH)	Cable, #22AWG stranded, PVC jacket, 125°C.
RPS (PT, TH)	Cable, #24AWG stranded, foil shield, PVC jacket, 125°C.
RT (PT, TH)	Cable, #26AWG stranded, PFA jacket, 250°C.
RTS (PT, TH)	Cable, #26AWG stranded, braid shield, TFE jacket, 250°C.

Connectors

Only thermocouple style connectors may be specified for attachment directly to the probe sheaths, and only to the tubular styles. Specify NA in the lead style and lead length locations. Refer to Model 4150 Connectors for complete descriptions. If a connector and mating connector are specified, the one designated first in the probe part number will be installed on the probe or cable and the second will be supplied loose. All mating connectors are in-line style and include hardware.

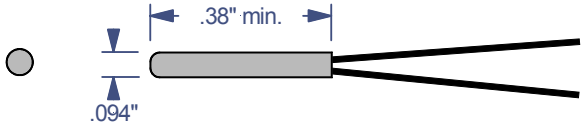
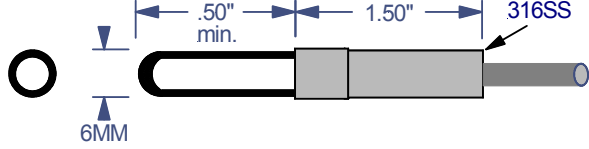

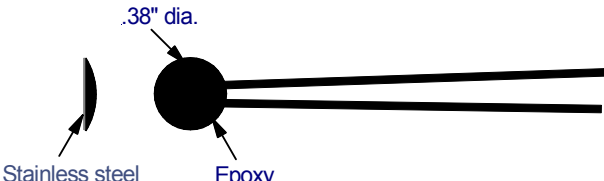
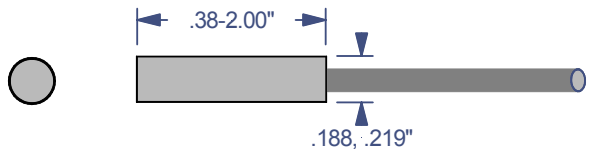
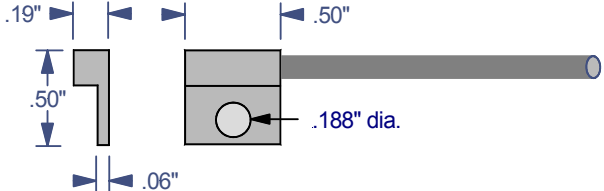
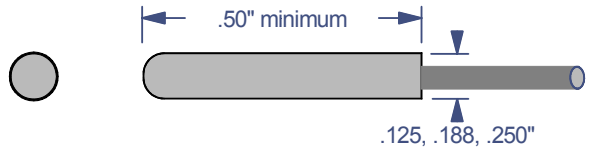
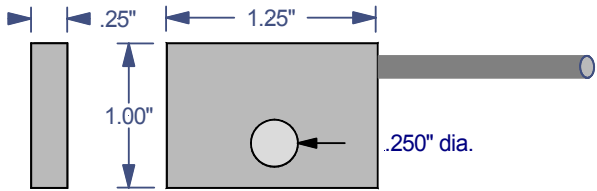
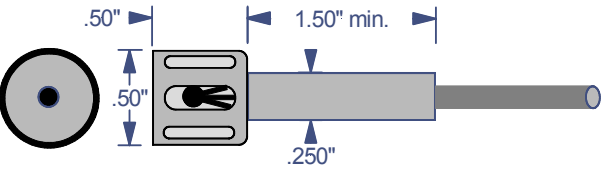
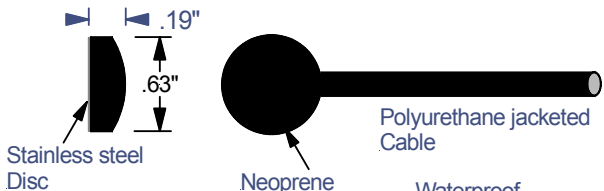
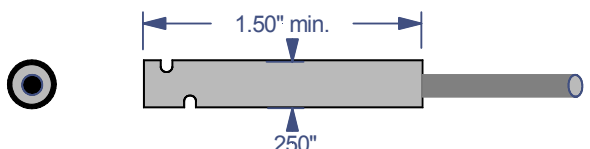
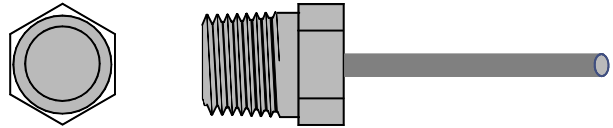
AMP or AMP-1	Microphone type, male or female 4 contact, for PT or TH sensor
MC or MC-1	Thermocouple type, uncompensated male or female 3 contact, for PT sensor.
MFP or MFP-1	Thermocouple, miniature male or female 2 contact, for TC sensor.
MS or MS-1	Military type, male or female 4 contact, for PT or TH sensor.
SP	#6 spade lugs for PT or TH sensor.
SPL	#8 compensated spade lugs for TC sensor.
SRP or SRP-1	Thermocouple, standard male or female 2 contact, for TC sensor.

Options- specified in alphabetic order.

Refer to 4150 Options and Drawings for complete descriptions.

AF Armor Fitting	Adjustable spring-loading assembly for use with option B.
B Armored Cable	Flexible armor. For use on 4103x, 4105x, 41066, 41083, or 4109x styles only.
C Compression Fitting	Process fitting. For use on 4103x, 4105x style probes only.
R Strain Relief Spring	Cable protection device. Not for use on 41010, 41011, 41081, or 41085.

41000 Series

 <p>41010 316SS Tube</p> <p>Polyurethane/Epoxy potted. Moisture resistant. -40 to 100oC</p>	 <p>41066 Glass Tube</p> <p>Thermal shock and chemical resistant. To 250oC maximum.</p>
 <p>41011 Neoprene Tip</p> <p>Polyurethane jacketed Cable</p> <p>Waterproof -40 to 100oC</p>	 <p>41081 Stainless Steel Disc</p> <p>Isolated sensor. 125oC maximum.</p>
 <p>41019A, 41022A Aluminum Cup 41019C, 41022C Copper Cup</p> <p>Bearing or block temperature sensing.</p>	 <p>41082 Aluminum Plate</p> <p>Small surface area.</p>
 <p>41030, 41031, 41032 316SS Tube</p> <p>Sealed tip.</p>	 <p>41083 Aluminum Plate</p> <p>Large surface area.</p>
 <p>41050 Slotted</p> <p>316SS, fast response. Exposed sensor. Not immersible.</p>	 <p>41085 Molded Surface</p> <p>Waterproof Isolated sensor -40 to 100oC</p>
 <p>41052 Slotted Tube</p> <p>316SS, fast response. Exposed sensor. Not immersible.</p>	 <p>41096B, 41097B, 41099B Brass Pipe Plug 41096S, 41097S, 41099S 316SS Pipe Plug</p> <p>1/8, 1/4, 1/2NPT</p>

41000 Series Table

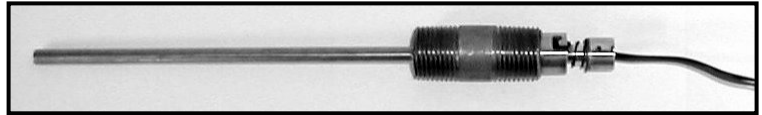
Use this table to determine compatibility of probe styles, sensors, and leads. Read horizontally from a model number to determine which sensor and lead style can be used. Lead styles can be used only with the sensors listed below them in the table. Compatible configurations are indicated by shaded blocks. Numbered notes further define choices and constraints. For example, the 41010 is available with platinum film and some thermistor sensors and only with IP or IT leads, while the 41031 is available with any sensor and any lead style.

Model Numbers	Sensors			IP PT TH	IT PT TH	FEP TC	OF TC	PF TC	RF PT	RP PT TH	RT PT TH	RPS PT TH	RTS PT TH
	PT	TC	TH										
41010 .094" Tube	2		3	4	4								
41011 Neoprene Tip	2			5	5	5	5	5	5	5	5	5	5
41019A .19" Alum.Cup													
41022A .22" Alum.Cup													
41019C .19" Cu. Cup													
41022C .22" Cu. Cup													
41030 1/8" Tube													
41031 3/16" Tube													
41032 1/4" Tube													
41050 Slotted													
41052 1/4" Slotted													
41066 6MM Glass													
41081 3/8" SS Disc	2			4	4								
41082 Alum. Plate	2												
41083 Alum. Plate													
41085 Mold Surface	2			5	5	5	5	5	5	5	5	5	5
41096B 1/8NPT Brass	2												
41096S 1/8NPT SS	2												
41097B 1/4NPT Brass	2												
41097S 1/4NPT SS	2												
41099B 1/2NPT Brass	2												
41099S 1/2NPT SS	2												

- Note 1- PT138 or PT139 sensors only.
- Note 2- PT100 or PT1000 film sensor only.
- Note 3- Not all thermistors can be used. Contact us.
- Note 4- #28AWG or #30AWG stranded as needed.
- Note 5- PUT polyurethane cable only for this design.

42000 Series Products

This is a group of standard accessories. All the products should be ordered using the prefix 42. For example, 42CET24 tube.



Closed-End Tube

CET12
CET24
CET36
CET48

These are 1/4 inch diameter by .020 inch wall 316 stainless steel sealed-tip tubes which the user can cut to length on site. Dimensions shown are the standard lengths in inches.

Spring-Load Devices

SL3/16 Spring-Load

An adjustable stainless steel 'gripper' type spring used to spring-load any 3/16 inch diameter probe. Sold in packages of 10 pieces.

SL1/4 Spring-Load

An adjustable stainless steel 'gripper' type spring used to spring-load the CET tube or any 1/4 inch diameter probe. Sold in packages of 10 pieces.

SLA Spring-Load Assembly

This non-adjustable drop-on spring assembly is used to spring-load the CET tube or any 1/4 inch diameter probe. Sold in packages of 5 pieces.

ESL1, ESL3, or ESL6 Spring-Load Assembly

This assembly, available in 1, 3, or 6 inch mated lengths, is designed to be a transition fitting between a thermowell and nearly any connection head. Spring-loading of a CET tube or a 1/4 inch probe is independent of the internal construction of the head.

OSD7/32 and OSD1/4 Spring-Load Assemblies

These double-ended 1/2NPT male 316 stainless steel transition fittings provide spring-loading and, by the use of Viton® o-rings, a low pressure fluid seal. Nuts and spacers are brass. Use with 7/32 or 1/4 inch diameter probes to 200°C.

OSS7/32-1/8, or -1/4 OSS1/4-1/8, or -1/4 Spring-Load Assemblies

These single-ended male stainless steel fittings, available in 1/8 and 1/4NPT sizes, provide the same sealing and spring-loading function as the OSD series assemblies.

Compression Fittings

C1/8-1/8,-3/16, or -1/4 C1/4-1/8,-3/16, or -1/4 C1/2-1/4 only

316 stainless steel bored-through male compression fittings, 1/8, 1/4, or 1/2NPT male, for use on 1/8, 3/16, or 1/4 inch diameter probes and tubes. Fittings are supplied with one piece stainless steel ferrules.

TF1/8, TF3/16, TF1/4

TFE ferrules for use with the compression fittings listed above, or for the HC fitting below. Ferrules are ordered by probe or tube diameter and allow re-positioning and re-sealing of the fitting. Sold in packages of 5 pieces

NY1/8, NY3/16, NY1/4

Nylon ferrules for use with the compression fittings listed above, or for the HC fitting below. Ferrules are ordered by probe or tube diameter and allow re-positioning and re-sealing of the fittings. Sold in packages of 5 pieces

HC

A double-ended 316 stainless steel transition fitting contains a ferrule and nut to provide a compression seal on a 1/4 inch diameter probe or tube.

Nipples And Unions

E1, E3, E6

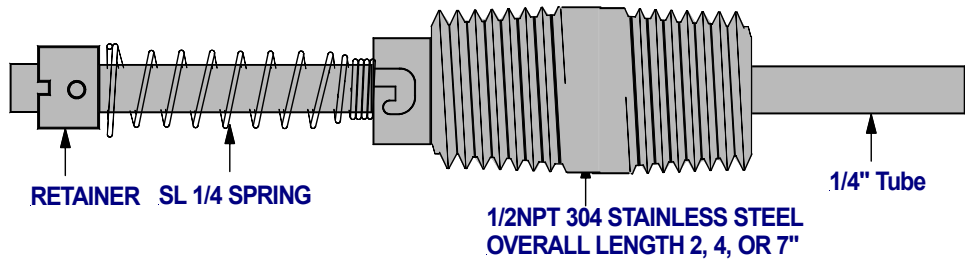
304 stainless steel nipples, 1/2NPT by 2, 4, or 7 inches length.

P Union

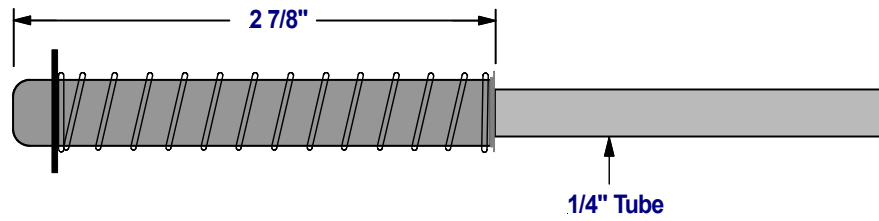
A 1/2NPT 304 stainless steel union supplied with a 304 stainless steel close nipple.

Spring-loading
Devices

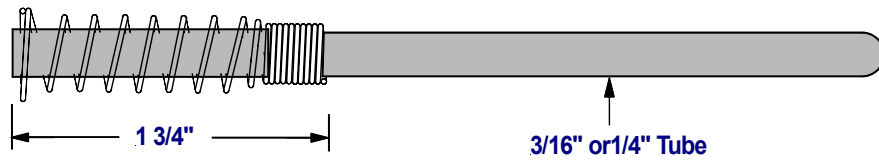
ESL1, ESL3,
ESL6



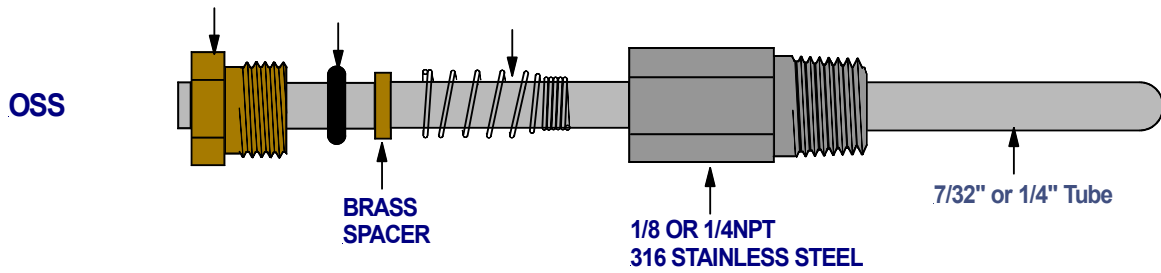
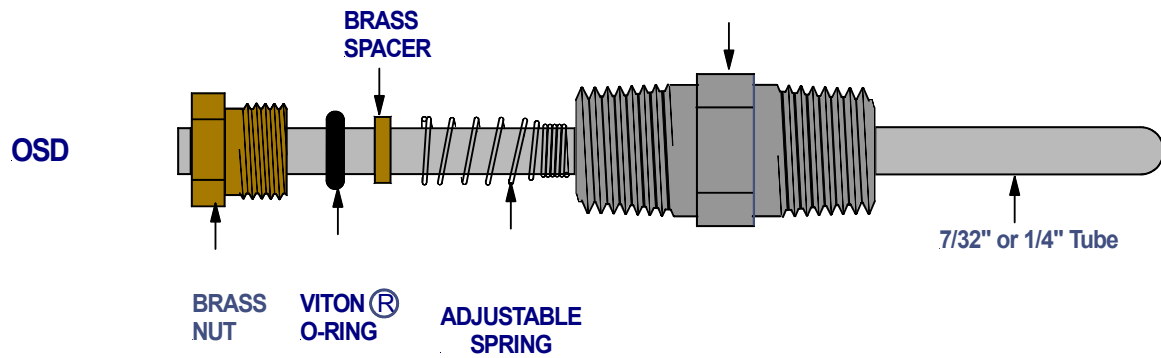
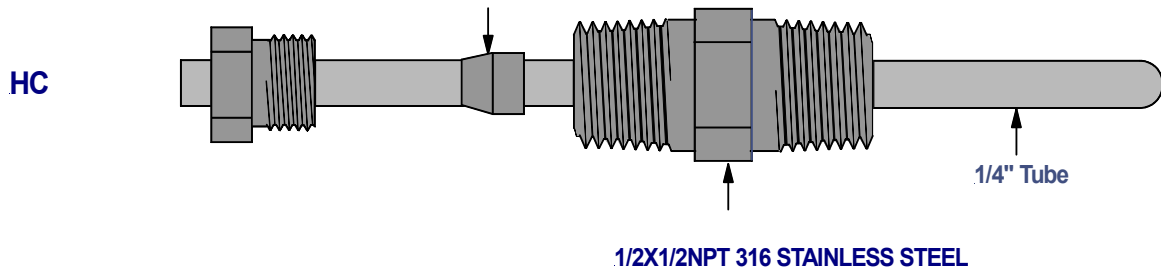
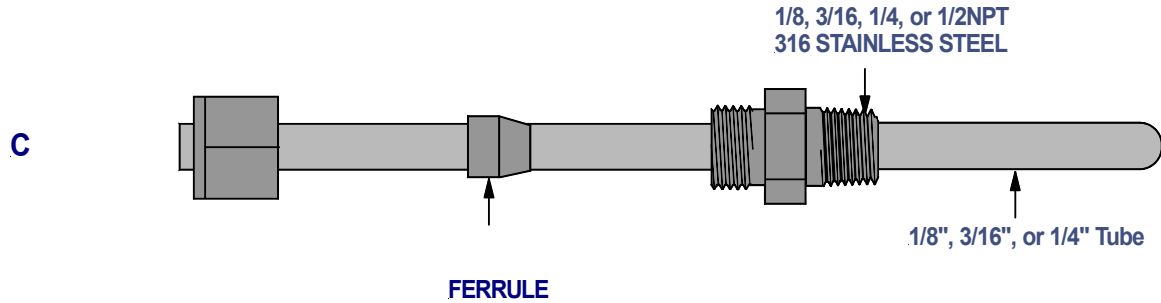
SLA



SL3/16
SL1/4

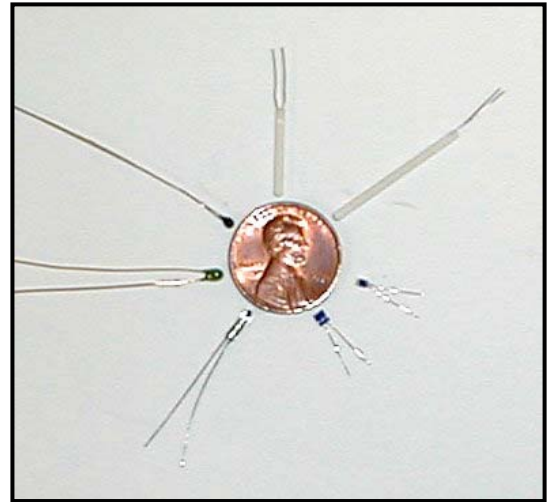


Sealing Fittings



Temperature Sensors

The principal characteristics of the most common sensors are indicated on the following pages. These sensors are in stock and can be delivered within our normal lead times. In addition to these, we can install many other types of temperature sensors in most of the standard probe configurations.



Platinum Sensors

Those sensors listed below as PT100 or PT1000 are platinum film while the others are wirewound platinum. Differences in performance are indicated in the Technical Notes Section. We offer sensors with two alpha characteristics- .00385, which complies with DIN 43760 and IEC 751- and .00392. This second characteristic is based on high purity platinum wire, in as nearly strain-free condition as is practical in a commercial quality sensor. The table lists part numbers and accuracies of standard sensors.

Part Number	R0°C	Alpha	Tolerance 0°C	Slope	Recommended Maximum Temperature	
PT100B	100	.00385	±0.3°C	±.005°C/°C	400°C	
PT100P	100		±0.1°C	±.004°C/°C	400°C	
PT1000B	1000		±0.3°C	±.005°C/°C	400°C	
PT138W	100	.00385	±0.25°C	±.003°C/°C	650°C	
PT138P	100		±0.1°C	±.002°C/°C	650°C	
PT138PP	100		±0.05°C	±.0015°C/°C	650°C	
PT538W	500		±0.25°C	±.003°C/°C	650°C	
PT538P	500		±0.1°C	±.002°C/°C	650°C	
PT139W	100		.00392	±0.25°C	±.003°C/°C	650°C
PT139P	100			±0.1°C	±.002°C/°C	650°C
PT139PP	100	±0.05°C		±.0015°C/°C	650°C	
PT539W	500	±0.25°C		±.003°C/°C	650°C	
PT539P	500	±0.1°C		±.002°C/°C	650°C	

Option

MP Matched Pair

Matching of a pair of P tolerance sensors within .05°C at any specified temperature between 0 and 125°C, or within .1°C at any specified temperature above this range to a maximum temperature of 420°C. Requires PSN probe option and bath setup charges for temperatures other than 0 or 100°C. Specify in probe part number. Example, -MP,75°C.

S Selection

Selection of a P tolerance sensor, or group of sensors, to nominal value ±0.05°C at any specified temperature between 0 and 100°C. Requirements similar to MP. Example, -S, 75°C.

Thermocouple Sensors

Wire conforms to standard limits of accuracy and is of duplex construction, #20 or #24AWG solid, insulated and temperature rated as indicated in the appropriate probe categories. The G and U in the part numbers indicate grounded or ungrounded construction. We can offer wire with special limits of accuracy.

Part Number	Materials	Positive Lead	Negative Lead
TCEG/TCEU	Chromel/Constantan	Violet	Red
TCJG/TCJU	Iron/Constantan	White	Red
TCKG/TCKU	Chromel/Alumel	Yellow	Red
TCTG/TCTU	Copper/Constantan	Blue	Red

Thermistor Sensors

We maintain a small stock of thermistors manufactured by YSI, Incorporated, BetaTherm, and others. Because of the great variety, we purchase most items as we need them and cannot show a list of available sensors. Contact us.

Platinum Sensor Data

These tables provide resistance vs. temperature data on the ITS90 for all our standard platinum sensors.

The set of ITS-90 coefficients below will recreate the tables within about $\pm 0.01^\circ\text{C}$. A form of the Callendar-Van Dusen equation with coefficients which will recreate the tables within about $\pm 0.1^\circ\text{C}$ is also shown.

Temp °C	PT100/ PT138	PT538	PT 1000	PT139	PT539	Temp °C	PT100/ PT138	PT538	PT 1000	PT139	PT539
-200	18.52	92.60	185.20	17.05	85.25	0	100.00	500.00	1000.0	100.00	500.00
-195	20.65	103.24	206.47	19.22	96.08	5	101.95	509.76	1019.5	101.99	509.94
-190	22.78	113.91	227.83	21.39	106.95	10	103.90	519.51	1039.0	103.97	519.87
-185	24.90	124.60	249.20	23.56	117.82	15	105.85	529.24	1058.4	105.96	529.78
-180	27.06	135.28	270.55	25.74	128.69	20	107.79	538.96	1077.9	107.93	539.67
-175	29.19	145.93	291.85	27.91	139.53	25	109.73	548.67	1097.3	109.91	549.56
-170	31.31	156.54	313.09	30.07	150.34	30	111.67	558.36	1116.7	111.88	559.42
-165	33.42	167.12	334.24	32.22	161.11	35	113.61	568.03	1136.0	113.85	569.27
-160	35.53	177.66	355.32	34.37	171.83	40	115.54	577.70	1155.3	115.82	579.11
-155	37.63	188.16	376.31	36.50	182.52	45	117.47	587.34	1174.6	117.79	588.93
-150	39.72	198.61	397.23	38.63	193.16	50	119.39	596.97	1193.9	119.75	598.74
-145	41.81	209.03	418.06	40.75	203.77	55	121.32	606.59	1213.1	121.71	608.53
-140	43.88	219.41	438.82	42.87	214.33	60	123.24	616.19	1232.3	123.66	618.31
-135	45.95	229.75	459.51	44.97	224.86	65	125.16	625.78	1251.5	125.61	628.07
-130	48.01	240.06	480.13	47.07	235.36	70	127.07	635.36	1270.7	127.56	637.83
-125	50.07	250.34	500.68	49.16	245.82	75	128.98	644.92	1289.8	129.51	647.55
-120	52.12	260.59	521.17	51.25	256.25	80	130.89	654.46	1308.9	131.45	657.27
-115	54.16	270.81	541.61	53.33	266.65	85	132.80	663.99	1327.9	133.40	666.98
-110	56.20	281.00	561.99	55.41	277.03	90	134.70	673.51	1347.0	135.33	676.67
-105	58.23	291.16	582.32	57.48	287.38	95	136.60	683.01	1366.0	137.27	686.34
-100	60.26	301.30	602.60	59.54	297.70	100	138.50	692.50	1385.0	139.20	696.00
-95	62.28	311.42	622.83	61.60	308.00	105	140.39	701.97	1403.9	141.13	705.64
-90	64.30	321.51	643.02	63.65	318.27	110	142.29	711.43	1422.8	143.06	715.28
-85	66.32	331.58	663.16	65.71	328.53	115	144.18	720.88	1441.7	144.98	724.89
-80	68.33	341.63	683.26	67.75	338.76	120	146.06	730.30	1460.6	146.90	734.49
-75	70.33	351.66	703.33	69.79	348.97	125	147.94	739.72	1479.4	148.82	744.08
-70	72.33	361.67	723.35	71.83	359.17	130	149.82	749.12	1498.2	150.73	753.65
-65	74.33	371.67	743.33	73.87	369.34	135	151.70	758.51	1517.0	152.64	763.21
-60	76.33	381.64	763.28	75.90	379.49	140	153.58	767.88	1535.7	154.55	772.75
-55	78.32	391.59	783.19	77.93	389.63	145	155.45	777.24	1554.4	156.45	782.27
-50	80.31	401.53	803.06	79.95	399.74	150	157.32	786.59	1573.1	158.36	791.79
-45	82.29	411.45	822.90	81.97	409.84	155	159.18	795.91	1591.8	160.26	801.29
-40	84.27	421.35	842.71	83.99	419.93	160	161.05	805.23	1610.4	162.15	810.77
-35	86.25	431.24	862.48	86.00	429.99	165	162.91	814.53	1629.0	164.05	820.24
-30	88.22	441.11	882.22	88.01	440.04	170	164.76	823.82	1647.6	165.94	829.69
-25	90.19	450.96	901.93	90.01	450.07	175	166.62	833.09	1666.1	167.83	839.13
-20	92.16	460.80	921.60	92.02	460.09	180	168.47	842.35	1684.6	169.71	848.56
-15	94.12	470.62	941.25	94.02	470.09	185	170.32	851.59	1703.1	171.59	857.97
-10	96.09	480.43	960.86	96.02	480.08	190	172.16	860.82	1721.6	173.47	867.36
-5	98.04	490.22	980.45	98.01	490.05	195	174.01	870.03	1740.0	175.35	876.74

Temp °C	PT100/PT138	PT538	PT 1000	PT139	PT539	Temp °C	PT100/PT138	PT538	PT 1000	PT139	PT539
200	175.85	879.23	1758.4	177.22	886.11	430	257.41	1287.0	2574.0	260.26	1301.3
205	177.68	888.42	1776.8	179.09	895.46	435	259.11	1295.5	2591.1	262.00	1310.0
210	179.52	897.59	1795.1	180.96	904.80	440	260.82	1304.0	2608.1	263.74	1318.6
215	181.35	906.75	1813.5	182.82	914.12	445	262.52	1312.5	2625.1	265.47	1327.3
220	183.15	915.89	1831.7	184.69	923.43	450	264.21	1321.0	2642.1	267.19	1335.9
225	185.00	925.02	1850.0	186.55	932.73	455	265.91	1329.5	2659.0	268.92	1344.6
230	186.83	934.14	1868.2	188.40	942.01	460	267.60	1338.0	2675.9	270.64	1353.2
235	188.65	943.24	1886.4	190.25	951.27	465	269.29	1346.4	2692.8	272.36	1361.8
240	190.46	952.32	1904.6	192.10	960.52	470	270.97	1354.8	2709.7	274.08	1370.3
245	192.28	961.40	1922.7	193.95	969.76	475	272.65	1363.2	2726.5	275.79	1378.9
250	194.09	970.45	1940.9	195.80	978.98	480	274.33	1371.6	2743.3	277.50	1387.5
255	195.90	979.50	1959.0	197.64	988.19	485	276.01	1380.0	2760.1	279.21	1396.0
260	197.71	988.53	1977.0	199.48	997.38	490	277.68	1388.4	2776.8	280.91	1404.5
265	199.51	997.54	1995.0	201.31	1006.5	495	279.35	1396.7	2793.5	282.61	1413.0
270	201.31	1006.5	2013.0	203.14	1015.7	500	281.02	1405.1	2810.2	284.31	1421.5
275	203.11	1015.5	2031.0	204.97	1024.8	505	282.69	1413.4	2826.8	286.01	1430.
280	204.90	1024.5	2049.0	206.80	1034.0	510	284.35	1421.7	2843.4	287.70	1438.5
285	206.69	1033.4	2066.9	208.63	1043.1	515	286.01	1430.0	2860.0	289.39	1446.9
290	208.48	1042.4	2084.8	210.45	1052.2	520	287.66	1438.3	2876.6	291.08	1455.3
295	210.27	1051.3	2102.6	212.26	1061.3	525	289.32	1446.5	2893.1	292.76	1463.8
300	212.05	1060.2	2120.5	214.08	1070.4	530	290.97	1454.8	2909.6	294.44	1472.2
305	213.83	1069.1	2138.3	215.89	1079.4	535	292.61	1463.0	2926.1	296.12	1480.5
310	215.61	1078.0	2156.0	217.70	1088.5	540	294.26	1471.2	2942.5	297.79	1488.9
315	217.38	1086.9	2173.8	219.51	1097.5	545	295.90	1479.0	2958.9	299.46	1497.3
320	219.15	1095.7	2191.5	221.31	1106.5	550	297.53	1487.6	2975.3	301.13	1505.6
325	220.92	1104.6	2209.2	223.11	1115.5	555	299.17	1495.8	2991.6	302.80	1513.9
330	222.69	1113.4	2226.8	224.91	1124.5	560	300.80	1504.0	3008.0	304.46	1522.2
335	224.45	1122.2	2244.5	226.71	1133.5	565	302.43	1512.1	3024.2	306.12	1530.5
340	226.21	1131.0	2262.1	228.50	1142.5	570	304.05	1520.2	3040.5	307.77	1538.8
345	227.97	1139.8	2279.7	230.29	1151.4	575	305.68	1528.3	3056.7	309.43	1547.1
350	229.72	1148.6	2297.2	232.08	1160.3	580	307.30	1536.4	3072.9	311.08	1555.3
355	231.48	1157.3	2314.7	233.86	1169.2	585	308.91	1544.5	3089.1	312.72	1563.6
360	233.23	1166.1	2332.2	235.64	1178.2	590	310.53	1552.6	3105.2	314.37	1571.8
365	234.97	1174.8	2349.7	237.42	1187.0	595	312.14	1560.6	3121.3	316.01	1580.0
370	236.71	1183.5	2367.1	239.19	1195.9	600	313.74	1568.7	3137.4	317.64	1588.2
375	238.45	1192.2	2384.5	240.96	1204.8	605	315.35	1576.7	3153.4	319.28	1596.3
380	240.19	1200.9	2401.9	242.73	1212.6	610	316.95	1584.7	3169.4	320.91	1604.5
385	241.93	1209.6	2419.2	244.50	1222.5	615	318.55	1592.7	3185.4	322.54	1612.6
390	243.66	1218.2	2436.5	246.26	1231.3	620	320.14	1600.7	3201.4	324.16	1620.8
395	245.39	1226.9	2453.8	248.02	1240.1	625	321.73	1608.6	3217.3	325.78	1628.9
400	247.11	1235.5	2471.1	249.78	1248.9	630	323.32	1616.6	3233.2	327.40	1637.0
405	248.84	1244.1	2488.3	251.54	1257.6	635	324.91	1624.5	3249.0	329.02	1645.0
410	250.56	1252.7	2505.5	253.29	1266.4	640	326.49	1632.4	3264.9	330.63	1653.1
415	252.27	1261.3	2522.7	255.04	1275.1	645	328.07	1640.3	3280.7	332.24	1661.2
420	253.99	1269.9	2539.8	256.78	1283.9	650	329.65	1648.2	3296.4	333.85	1669.2
425	255.70	1278.5	2557.0	258.52	1292.6	655	331.22	1656.1	3312.2	335.45	1677.2
						660	332.79	1663.9	3327.9	337.05	1685.2

Callendar Van-Dusen Coefficients

A, B, and C are coefficients in the equation of the form $R=R_0 [1 + At + Bt^2 + [C (t-100) t^3]]$. t is temperature in degrees Celsius. For temperature ranges which do not extend below 0°C, the equation becomes $R=R_0 (1 + At + Bt^2)$.

Alpha	.003850	.003920
Delta	1.49758	1.49569
Beta	.11045	.10971
A	3.90766x10-3	3.97863x10-3
B	-5.76568x10-7	-5.86310x10-7
C	-4.25233x10-12	-4.30063x10-12

A, B, and C are derived using the following equations.

$A = \text{Alpha} \times 1 + (\text{Delta} \times 10^{-2})$

$B = -\text{Alpha} \times \text{Delta} \times 10^{-4}$

$C = -\text{Alpha} \times \text{Beta} \times 10^{-8}$

ITS-90 Coefficients

These are coefficients for low sub-range 4 (83.8058K to 273.16K) and high sub-range 7 (273.15K to 933.473K).

Alpha	.003850	.003920
a4	-2.07624x10-2	-2.55033x10-3
b4	-1.07467x10-3	-9.36463x10-4
a7	-2.06489x10-2	-2.33345x10-3
b7	9.43956x10-4	6.35110x10-4
c7	-3.37352x10-4	-2.01787x10-4

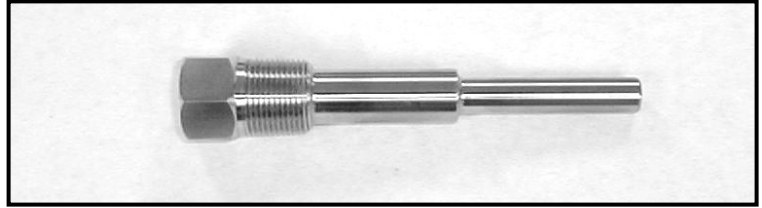
Thermocouple Sensor Data

The following tables list millivolts output, referenced to 0°C, for the four standard calibrations which we offer. Data is on the ITS-90. Tables cover only a portion of the ranges of Types J and K.

Temp °C	Type J	Type K	Type T	Type E	Temp °F	Type J	Type K	Type T	Type E
-200	-7.890	-5.891	-5.603	-8.825	-320	-7.791	-5.882	-5.532	-8.710
-180	-7.403	-5.550	-5.261	-8.273	-280	-7.219	-5.421	-5.135	-8.069
-160	-6.821	-5.141	-4.865	-7.632	-240	-6.536	-4.939	-4.673	-7.319
-140	-6.159	-4.669	-4.419	-6.907	-200	-5.760	-4.381	-4.149	-6.472
-120	-5.426	-4.138	-3.923	-6.107	-160	-4.903	-3.754	-3.565	-5.535
-100	-4.633	-3.554	-3.379	-5.237	-120	-3.978	-3.065	-2.923	-4.515
-80	-3.786	-2.920	-2.788	-4.302	-80	-2.994	-2.320	-2.225	-3.420
-60	-2.893	-2.243	-2.153	-3.306	-40	-1.961	-1.527	-1.475	-2.255
-40	-1.961	-1.527	-1.475	-2.255	0	-0.886	-0.692	-0.675	-1.026
-20	-0.995	-0.778	-0.757	-1.152					
0	0.000	0.000	0.000	0.000	32	0.000	0.000	0.000	0.000
20	1.019	0.798	0.790	1.192	40	0.225	0.176	0.173	0.262
40	2.059	1.612	1.612	2.420	80	1.364	1.068	1.060	1.597
60	3.116	2.436	2.468	3.685	120	2.527	1.977	1.988	2.977
80	4.187	3.267	3.358	4.985	160	3.709	2.897	2.958	4.403
100	5.269	4.096	4.279	6.319	200	4.907	3.820	3.968	5.871
120	6.360	4.920	5.228	7.685	240	6.117	4.738	5.015	7.379
140	7.459	5.735	6.206	9.081	280	7.336	5.644	6.096	8.924
160	8.562	6.540	7.209	10.503	320	8.562	6.540	7.209	10.503
180	9.669	7.340	8.237	11.951	360	9.793	7.429	8.352	12.113
200	10.779	8.138	9.288	13.421	400	11.025	8.316	9.525	13.751
220	11.889	8.940	10.362	14.912	440	12.260	9.208	10.725	15.413
240	13.000	9.747	11.458	16.420	480	13.494	10.108	11.951	17.096
260	14.110	10.561	12.574	17.945	520	14.727	11.017	13.202	18.798
280	15.219	11.382	13.709	19.484	560	15.958	11.933	14.476	20.517
300	16.327	12.209	14.862	21.036	600	17.188	12.855	15.771	22.252
320	17.434	13.040	16.032	22.600	640	18.416	13.782	17.086	23.999
340	18.538	13.874	17.219	24.174	680	19.642	14.713	18.422	25.757
360	19.642	14.713	18.422	25.757	720	20.868	15.647	19.777	27.525
380	20.745	15.554	19.641	27.348	760	22.093	16.585		29.302
400	21.848	16.397	20.872	28.946	800	23.320	17.526		31.086
420	22.952	17.243		30.550	840	24.549	18.469		32.875
440	24.057	18.091		32.159	880	25.781	19.414		34.669
460	25.164	18.941		33.772	920	27.020	20.360		36.466
480	26.276	19.792		35.387	960	28.266	21.308		38.265
500	27.393	20.644		37.005	1000	29.521	22.255		40.064
520	28.516	21.497		38.624	1040	30.788	23.203		41.862
540	29.647	22.350		40.243	1080	32.068	24.149		43.658
560	30.788	23.203		41.862	1120	33.363	25.094		45.452
580	31.939	24.055		43.479	1160	34.674	26.037		47.241
600	33.102	24.905		45.093	1200	36.004	26.978		49.027
620	34.279	25.755		46.705	1240	37.352	27.915		50.807
640	35.470	26.602			1280	38.718	28.849		52.581
660	36.675	27.447			1320	40.103	29.780		54.350
680	37.896	28.289			1360	41.504	30.706		56.113
700	39.132	29.129							
720	40.382	29.965							
740	41.645	30.798							
760	42.919	31.628							

Thermowells

We stock type S, 304 and 316 stainless steel thermowells with 1/2 and 3/4NPT process threads in 1 1/2", 2 1/2" and 4 1/2" U dimensions. Sizes and materials shown are representative only. In addition to the standard thermowells, we can provide wells with thin walls- .031" minimum- in U dimensions up to 4 1/2 inches and protection tubes in various diameters and wall thicknesses.

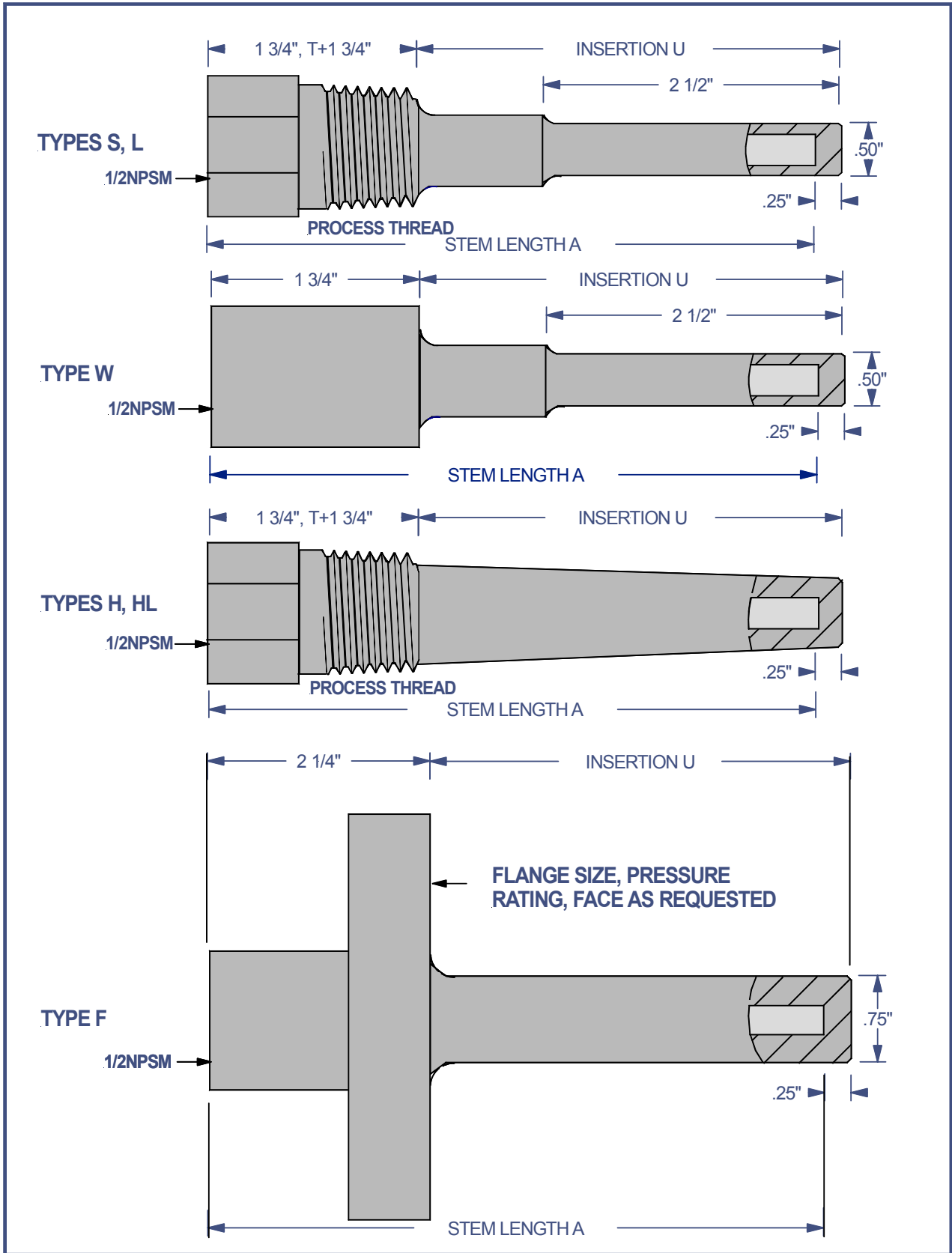


Threaded and Socket-Weld Part Number Format **3/4-260S-U4 1/2-316SS-BC**
 Process Connection Size -NPT thread (S) Pipe size (W) _____ 3/4
 Bore Diameter - .260" standard _____ 260
 Type -Screwed (S) Welded (W) Heavy Duty (H) Lagging (L or HL) _____ S
 Insertion Length- U Dimension in inches _____ U4 1/2
 Material- 304SS or 316SS standard _____ 316SS
 (Optional) Cap and Chain- BC is brass, SC is stainless steel _____ BC

Threaded thermowells are available with 1/2, 3/4 or 1NPT process threads.
 Socket-weld thermowell body diameters are equivalent to 1/2, 3/4, or 1 inch pipe.
 U dimensions longer than 4 1/2 inches are normally stated in 3 inch increments.
 Lagging dimension T is 2 inches for U= 2 1/2 inches and 3 inches for longer U dimensions.

Flanged Part Number Format **260F-U10-1 1/2-150#-RFSR-304SS-SC**
 Bore Diameter - .260" standard) _____ 260
 Type _____ F
 Insertion Length- U Dimension _____ U10
 Flange Size- 1", 1 1/2", 2", 3" pipe _____ 1 1/2
 Flange Pressure Rating- 150#, 300# _____ 150#
 Face Style- FF = flat face- RFSM= raised face smooth-RFSR= raised face serrated _____ RFSR
 Material- 304SS or 316SS standard _____ 304SS
 (Optional) Cap and Chain- BC is brass, SC is stainless steel _____ SC

Thermowells



Platinum/Thermocouple Transmitters

To support our lines, we maintain a small stock of Status Instruments Ltd. head-mountable 4-20MA transmitters in both non-isolated and input/output isolated, digitally calibrated versions. We calibrate these to required ranges and verify calibrations in a working circuit. In addition to these devices, we can provide DIN rail mounted transmitters with special accuracies or HART® communications, to name a few choices. These can be calibrated with individual platinum RTDs or thermocouples. Because of the great variety of transmitters which are currently available for platinum, thermocouple, and thermistor signal conditioning, we suggest you contact us with your requirements.



Stock Transmitter Mounting Configurations

