1. ***INSIDE SALES CONTACTS for QUOTATIONS, and PRODUCT INFORMATION***

BRUCE CHIVINGTON
(bruce@pyromation.com)

CHAD McMILLAN
(chad@pyromation.com)

JEFF RYAN
(jeff@pyromation.com)

GREG RYAN
(greg@pyromation.com)

SCOTT MOTTRAM
(scottm@pyromation.com)

MATT LAMAR
(matt@pyromation.com)

JIM MARKLAND
(jim@pyromation.com)

TODD PEZLEY
(tpezley@pyromation.com)

2. ***DELIVERY INFORMATION*** . . . . . ***Customer Service***
cs@pyromation.com

3. ***ORDER PLACEMENT*** . . . . . ***Customer Service***
orders@pyromation.com

4. ***SALES, APPLICATION ASSISTANCE, and PRICING*** . . . . . ***Inside Sales***
sales@pyromation.com

5. ***SALES ADMINISTRATION, SALES POLICIES, and GENERAL RESALE INFORMATION*** . . . . . ***Scott Farnham***
scott@pyromation.com

6. ***MARKETING and SALES PROMOTION ACTIVITIES*** . . . . . ***Greg Craghead***
gcraghead@pyromation.com

7. ***ENGINEERING and TECHNICAL INFORMATION*** . . . . . ***Dave Myers***
dmyers@pyromation.com

8. ***QUALITY ASSURANCE and RELATED ISSUES*** . . . . . ***Bruce Merritt***
bmerritt@pyromation.com

9. ***CATALOG and LITERATURE REQUESTS*** . . . . . ***Michelle Honeycutt***
michelle@pyromation.com

10. ***MATERIAL RETURN AUTHORIZATIONS PRODUCT EVALUATIONS and SENSOR REPAIRS*** . . . . . ***Trent Rowdon***
trent@pyromation.com

11. ***CALIBRATION SERVICES*** . . . . . ***Steve Archacki***
steve@pyromation.com

Chris Moritz
chris@pyromation.com

12. ***BILLING, CREDIT INFORMATION, and ACCOUNTS RECEIVABLE*** . . . . . ***Beth Terry***
beth@pyromation.com

Calibration Ordering Information

Our NVLAP Lab Code 200502-0 (National Voluntary Laboratory Accreditation Program) Accredited Metrology Laboratory provides comparison temperature calibrations from -196 °C to 1450 °C [-321 °F to 2642 °F] on the International Temperature Scale of 1990 (ITS-90) for temperature sensors and instruments.

Pyromation's laboratory managerial staff and technical team have documented education, training, technical knowledge and experience to precisely perform their assigned functions. The laboratory's test enviornment is constantly monitored and controlled to maintain all required conditions, while access is strictly defined and controlled.

Our Laboratory equipment includes fluidized baths and tube furnaces, standard platinum resistance thermometers, and type "B" and "S" thermocouples. All standards and calibrations are traceable to the International System of Units (SI) through NIST or other National Metrology Institutes and are part of a comprehensive measurement assurance program for ensuring continued accuracy and measurement traceability within the level of uncertainty reported. Note: Our quality system meets or exceeds the requirements for NIST Handbook 150, ISO 9001, and ANSI/NCSL Z540-1.

ORDER CODES

Example Order Numbers:

1	2	3		4		5
CAL	**(100, 200, 300)**	**F**	**-**	**PTD**	**-**	**TBL**

1 Standard Calibrations

CODE	DESCRIPTION
CAL[2]	**Sensor Calibration** - All sensors of line item calibrated to specified temperatures.
LOT[2]	**Lot Calibration - Beginning and End** - (BE) - One sample from the beginning and the end of the lot will be tested at specified temperatures.
LOP[1][2]	**Loop Calibration -** One instrument and one sensor will be tested together at specified temperatures.
SMC[1][2]	**RTD Sensor Matching Calibration -** The RTD is calibrated and offsets are applied to the transmitter. The RTD and transmitter are then retested. Above zero ranges require three test points; below zero ranges require 4 test points.
[1] Additional length may be required for loop calibrations.	
[2] Uncertainties are not included in determination of acceptance criteria.	

2 Calibration Temperatures: Specified Required Calibration Points

3 Temperature Scale

CODE	DESCRIPTION
C	Degrees Celsius
F	Degrees Fahrenheit

4 Tagging Options

CODE	DESCRIPTION
PTD	Calibration Detail, Paper Tag
STD	Calibration Detail, Stainless Tag
ATD	Calibration Detail, Aluminum Tag
PTA	Tag all sensors with Beginning and End Calibration, Paper Tag

5 Custom Table Options[1]

CODE	DESCRIPTION
TBL	Table in 1 degree increments
TBL (0.1)	Table in 0.1 degree increments
TBL (CVD)	Callendar Van Dusen Coefficients
[1] Table options require a minimum of 3 temperature points	

1A Calibrations Per AMS 2750[2]

CODE	DESCRIPTION	ASTM E230 Tolerances
CAL-AMS-TUS	**Temperature Uniformity Survey Calibration** - All sensors of line item calibrated to specified temperatures.	± 2.2 °C [± 4 °F] or ± 0.75%
CAL-AMS-SAT	**System Accuracy Test Calibration** - All sensors of line item calibrated to specified temperatures.	(J, K, T, E, N) ± 1.1 °C [± 2 °F] or ± 0.4% (R,S) ± 0.6 °C [± 1 °F] or ± 0.1% (B) ± 0.6 °C [± 1 °F] or ± 0.25%
CAL-AMS-CRM	**Control, Recording & Monitoring Calibration -** All sensors of line item calibrated to specified temperatures.	Class 1 & 2: ± 1.1 °C [± 2 °F] or ± 0.4% Class 3 to 6: ± 2.2 °C [± 4 °F] or ± 0.75%
CAL-AMS-L	**Load Calibration** - All sensors of line item calibrated to specified temperatures.	± 2.2 °C [± 4 °F] or ± 0.75%

1B Lot Calibrations Per AMS 2750[1][2]

CODE	DESCRIPTION	Max. Lot Length		ASTM E230 Tolerances	Allowable Delta Limits
LOT-AMS-TUS	**Temperature Uniformity Survey Lot Calibration** - Beginning and End - One sample from the beginning and the end of the lot will be tested at specified temperatures.	Base	5000 ft	± 2.2 °C [± 4 °F] or ± 0.75%	± 1.1 °C [± 2 °F]
		Noble	2000 ft		
LOT-AMS-SAT	**System Accuracy Test Lot Calibration** - One sample from the beginning and the end of the lot will be tested at specified temperatures.	Base	5000 ft	(J, K, T, E, N) ± 1.1 °C [± 2 °F] or ± 0.4% (R,S) ± 0.6 °C [± 1 °F] or ± 0.1% (B) ± 0.6 °C [± 1 °F] or ± 0.25%	± 1.1 °C [± 2 °F]
		Noble	2000 ft		
LOT-AMS-CRM	**Control, Recording & Monitoring Lot Calibration -** One sample from the beginning and the end of the lot will be tested at specified temperatures.	Base	5000 ft	Class 1 & 2: ± 1.1 °C [± 2 °F] or ± 0.4% Class 3 to 6: ± 2.2 °C [± 4 °F] or ± 0.75%	± 1.1 °C [± 2 °F]
		Noble	2000 ft		
LOT-AMS-L	**Load Lot Calibration** - One sample from the beginning and the end of the lot will be tested at specified temperatures.	Base	5000 ft	± 2.2 °C [± 4 °F] or ± 0.75%	± 1.1 °C [± 2 °F]
		Noble	2000 ft		

[1] Lot AMS calibration reports contain beginning, end and average temperatures.

[2] Maximum interval between temperatures is 140 °C [250 °F]

Minimum Sensor Length Requirements for Temperature Calibrations

-196 °C	-75 °C	(-40 to 0) °C	(0 to 100) °C	(40 to 215) °C	(200 to 500) °C	(425 to 1204) °C	(800 to 1450) °C
[-321 °F]	[-103 °F]	[-40 to 32] °F	[32 to 212] °F	[104 to 420] °F	[392 to 932] °F	[800 to 2200] °F	[1472 to 2642] °F
12 Inch	12 Inch	6 Inch	6 Inch	6 Inch	18 Inch	18 Inch	30 Inch

Additional charges may apply if sensor modification is required to accommodate the minimum calibration length requirement

PAYMENT TERMS: Net 30 days

MINIMUM BILLING CHARGE: $25.00 Net Per Order

PRICES: Prices are subject to change without notice. Customer order acknowledgements will reflect current prices.

SHIPPING CHARGES: Shipped FOB Origin sellers plant. UPS shipments are prepay and add, as are air shipments unless otherwise requested. Truck shipments are freight collect. Packing and insurance charges are included in the shipping charge.

PARTIAL SHIPMENTS: Partial shipments will normally only be made at the customer's request, or when unreasonable delay for an entire order would occur due to holding items for complete order shipment. Requests for *'**partial shipments**',* or requests for *'**shipments in full only**'*, must be clearly marked or stated at the time of order entry.

DROP SHIPMENTS: Drop shipments will be made at a customer's request provided that a separate purchase order is issued for each drop shipment, and that the invoice is to be issued to the 'ordering customer' and not to the '**drop shipment customer**'. Drop shipment orders cannot be combined with other order quantity discounts.

SHIPMENT DAMAGES: Damage to shipments beyond the F.O.B. point is the responsibility of the carrier. Shipments should be opened promptly upon receipt and any claim for damage is to be initiated by the purchaser with the carrier. Replacement shipments will be made on a chargeable basis.

SHIPMENT SHORTAGES: Each shipment should be examined promptly by the purchaser upon receipt. All claims for loss or shortages must be made to Pyromation within 7 (seven) days of receipt of shipment.

SHIPPING LENGTHS: The maximum uncoiled straight length shipment of Pyromation temperature sensors is 264 cm [104 in], if shipped via UPS. Straight lengths over 264 cm [104 in] must be shipped by truck.

MATERIAL SUBSTITUTION: Pyromation reserves the right to substitute superior materials of construction without notification. These include, but are not limited to, superior metals and special limits of error thermocouple wire.

MATERIAL RETURNS: No returns for credit, warranty repairs, or evaluation will be allowed without prior factory authorization. Contact the factory for a 'Return Authorization' (RA) number, and clearly state what the item is and the reason the return is desired. Provide the factory with the original purchase order number, date ordered, and the invoice number for the item being returned.

RESTOCKING CHARGES: Unused and like-new condition materials returned to Pyromation for credit will be subject to a minimum 20% restocking charge. The actual restocking charge will be determined by the type of material, its resale value, and upon our receipt, inspection and evaluation of the material in question.

BLANKET ORDERS: Blanket orders will be accepted for a defined quantity of products with scheduled releases for a time period not exceeding one year. Blanket orders will be afforded price protection for 60 days after customer notification of a price change.

EXPRESS ORDERS: Orders for manufactured products that require delivery earlier than normal shipment schedules provide, can be placed as an express order with either a same-day, 24-hour or 72-hour shipping guarantee. Our acceptance of any express order will be dependent upon material availability, the manufacturing complexity of the product, and the quantity ordered. Actual acceptance of any express order will be determined at the time of order entry, and acceptance will be at the sole discretion of Pyromation, Inc.

1. Express orders may be placed with our Sales Department anytime during normal office hours, and can be placed for any reasonable quantity of temperature sensors, or other related products, on either a same-day, 24-, or a 72-hour customer-selected shipping schedule.

2. **Same-day express orders** will normally be **shipped** the **same workday** the order is placed.

3. **24-hour express orders** will normally be **shipped** the **next workday** following the date of order entry.

4. **72-hour express orders** will normally be **shipped** on the **third workday** following the date of order entry.

5. Express orders may also be placed for expedited delivery on manufactured products that require Pyromation to order non-stock materials from our vendors. The 24- or 72-hour express order period will begin on the day of our receipt of the ordered materials.

6. Express orders cannot be guaranteed, nor deliveries confirmed, unless the order is placed via telephone.

7. Express orders that miss scheduled delivery dates will nullify all customer express charges.

8. Not all cataloged items are available on an express service basis. Consult factory for availability when in doubt.

LIMITED DISCOUNTS: Limited discounts may apply for some sensor assemblies. See individual price pages for discount information.

WARRANTY: Thermocouples, assemblies, wire, and related parts are sold by Pyromation, Inc. under the following warranties, which extend only to the first buyer of said products as new merchandise received directly from Pyromation or from an authorized Pyromation distributor, representative, or reseller.

These products are warranted to be free from functional defects in materials and workmanship at the time of manufacture, and conform to specifications set forth in relevant Pyromation catalog pages for such products.

Pyromation's sole and exclusive obligation, and buyer's sole and exclusive remedy under the above warranty is limited to repair or replacement. This remedy applies, at Pyromation's option, free of charge, to the products which are reported in writing to Pyromation at its main office - Pyromation, Inc., 5211 Industrial Road, Fort Wayne, IN 46825 - and which, if so advised by Pyromation, are returned to the designated facility during normal business hours, transportation prepaid, and, which upon examination by Pyromation, are found not to comply with the above warranty.

Pyromation shall not be liable for any expressed or implied warranties beyond the above warranty, nor any incidental, consequential, special or other damage, costs or expenses, with the exclusive exception of the repair or replacement as described above. Pyromation makes no warranty of merchantability or fitness for a particular purpose with respect to these products.

THERMOCOUPLES - Thermocouples are the most common, convenient, and versatile devices used to measure temperature. They convert units of heat into useable engineering units that serve as input signals for process controllers and recorders.

A thermocouple consists of a welded 'hot' junction between two dissimilar metals - usually wires - and a reference junction at opposite ends of the parent materials. Heating the 'hot' junction in the working environment produces a temperature gradient which generates an Electromotive Force (EMF). The EMF appears across the free ends of the thermocouple wires where it is measured and converted into units of heat calibration. Through selection of appropriate thermocouple wires and sheath components, thermocouples are suitable to be used in temperature ranges from (-200 to 2316) °C [-328 to 4200] °F.

RESISTANCE TEMPERATURE DETECTORS - Resistance temperature detectors (RTD) accurately sense temperature with an excellent degree of repeatability and interchangeability of elements. The RTD is composed of certain metallic elements whose change in resistance is a function of temperature. In operation, a small excitation current is passed across the element, and the voltage, which is proportional to resistance, is then measured and converted to units of temperature calibration. The RTD element is manufactured by winding a wire (wire wound elements) or plating a film (thin film elements) on a ceramic or glass core and sealing the element within a ceramic or glass capsule.

Since most RTDs have a low initial resistance, often 100 ohms, and have a small change in resistance per unit of temperature range, the resistance of the lead wire is often compensated for with a three or four wire bridge configuration built into the measuring devices. By selecting the proper elements and protective sheathing, RTDs can operate in a temperature range of (-200 to 600) °C [-328 to 1112] °F.

THERMISTORS - A thermistor is an economical means of precisely sensing heat over a limited range of temperatures. A thermistor is a metal oxide whose change in resistance is typically an inverse function of the change in temperature. An excitation current is passed across the sensor and the voltage, which is proportional to the resistance, is measured and converted to units of heat calibration. Since thermistors usually have a large base resistance and a large change in resistance per unit of temperature change, compensation for lead wire length is not generally needed. Thermistors can operate across a temperature range of (-40 to 150) °C [-40 to 302] °F by selecting the proper sensor and protective materials.

ADDITIONAL REQUIREMENTS - Other components usually essential in integrating the principles of thermocouple, RTD, and thermistor sensors into a functioning system may include: (1) a protection tube or sheath of a material suitable to protect the sensing element from the environment surrounding the point of measurement; (2) a connecting head and terminal block, or possibly a temperature transmitter; (3) leadwire of the correct material and insulation to connect the temperature sensor and the process instrumentation; and (4) recording or controlling instrumentation and control devices to provide a continuous temperature history of the system and to provide constant or programmed temperature regulation.

Thermocouple Material Specifications

The thermocouple element materials listed below are those most commonly found in process applications. Selection of the proper thermocouple type for a particular application is determined by temperature expectations and by the environment in which the sensor will be placed. The following temperature and application tables are intended to aid in this selection. The thermocouples are listed by ASTM letter designations per thermocouple type.

Letter Designated Thermocouples

TYPE		TEMPERATURE RANGE	APPLICATION INFORMATION
J E230	Iron (+) Copper - 45% Nickel (Constantan) (-)	(0 to 760) °C [32 to 1400] °F	Suitable for vacuum, reducing, or inert atmospheres, oxidizing atmosphere with reduced life. Iron oxidizes rapidly above 538 °C [1000 °F] so only heavy gauge wire is recommended for high temperature. Bare elements should not be exposed to sulphurous atmospheres above 538 °C [1000 °F].
K E230	Nickel - 10% Chromium (+) Nickel - 2% Aluminum, 2% Manganese, 1% Silicon (-)	(0 to 1260) °C [32 to 2300] °F	Recommended for continuous oxidizing or neutral atmospheres. Mostly used above 538 °C [1000 °F]. Subject to failure if exposed to sulphur. Preferential oxidation of chromium in positive leg at certain low oxygen concentrations causes 'green rot' and large negative calibration drifts most serious in the (816 to 1038) °C [1500 to 1900] °F range. Ventilation or inert-sealing of the protection tube can prevent this.
N E230	Nickel - 14% Chromium, 1 1/2% Silicon (+) Nickel - 4 1/2% Silicon - 1/10% Magnesium (-)	(0 to 1260) °C [32 to 2300] °F	Can be used in applications where Type K elements have shorter life and stability problems due to oxidation and the development of 'green rot'.
T E230	Copper (+) Copper - 45% Nickel (Constantan) (-)	(-200 to 370) °C [-328 to 700] °F	Useable in oxidizing, reducing, or inert atmospheres as well as vacuum. Not subject to corrosion in moist atmospheres. Limits of error published for sub-zero temperature ranges.
E E230	Nickel - 10% Chromium (+) Copper - 45% Nickel (Constantan) (-)	(0 to 870) °C [32 to 1600] °F	Recommended for continuously oxidizing or inert atmospheres. Sub-zero limits of error not established. Highest thermoelectric output of common calibrations.
R E230	Platinum - 13% Rhodium (+) Platinum (-)	(538 to 1482) °C [1000 to 2700] °F	Recommended for high temperature. Must be protected with non-metallic protection tube and ceramic insulators. Continued high temperature usage causes grain growth which can lead to mechanical failure. Negative calibration drift caused by Rhodium diffusion to pure leg as well as from Rhodium volatilization. Type R is used in industry; Type S in the laboratory.
S E230	Platinum - 10% Rhodium (+) Platinum (-)		
B E230	Platinum - 30% Rhodium (+) Platinum - 6% Rhodium (-)	(871 to 1704) °C [1600 to 3100] °F	Same as R & S but output is lower. Also less susceptible to grain growth and drift.
C E230	95% Tungsten - 5% Rhenium (+) 74% Tungsten - 26% Rhenium (-)	(0 to 2315) °C [32 to 4200] °F	Very high temperature applications in inert or vacuum. Preferred over Tungsten/Tungsten-26% Rhenium because it is less brittle at low temperatures.

Non-Letter Designated Thermocouples

TYPE		TEMPERATURE RANGE	APPLICATION INFORMATION
M E1751	Nickel - 18% Molybdenum (+) Nickel - 0.8% Cobalt (-)	(-50 to 1410) °C [-58 to 2570] °F	High temperature applications in inert or vacuum atmosphere. Useful in many hydrogen applications. Continuous cycling causes excessive grain growth.
P E1751	Platinel II® Platinel 5355 (+) Platinel 7674 (-)	(0 to 1395) °C [32 to 2543] °F	Noble metal combination which approximates Type K curve but has much improved oxidation resistance. Should be treated as any noble metal calibration.

Platinel® is a registered trademark of BASF Catalysts.

Thermocouple Initial Material Tolerances

The tolerances shown in the table below apply to new, essentially homogeneous thermocouple wire in the size range of 30 AWG to 8 AWG. These tolerances only apply to thermocouples used at temperatures not exceeding the recommended limits. If thermocouples are used at temperatures above the recommended limits, or in detrimental enviornments, the below stated tolerances may not apply.

Tolerances on Initial Values of EMF vs Temperature for Thermocouples

Reference Junction 0 °C [32 °F]. Published in ASTM E230

TYPE	TEMPERATURE RANGE for STANDARD TOLERANCES	STANDARD TOLERANCES	TEMPERATURE RANGE for SPECIAL TOLERANCES	SPECIAL TOLERANCES
J	(0 to 293) °C [32 to 559] °F (293 to 760) °C [559 to 1400] °F	± 2.2 °C [± 4 °F] ± 0.75%	(0 to 275) °C [32 to 527] °F (275 to 760) °C [527 to 1400] °F	± 1.1 °C [± 2 °F] ± 0.4%
K	(-200 to -110) °C [-328 to -166] °F (-110 to 0) °C [-166 to 32] °F (0 to 293) °C [32 to 559] °F (293 to 1260) °C [559 to 2300] °F	± 2% [1] ± 2.2 °C [± 4 °F][1] ± 2.2 °C [± 4 °F] ± 0.75%	[2] [2] (0 to 275) °C [32 to 527] °F (275 to 1260) °C [527 to 2300] °F	 ± 1.1 °C [± 2 °F] ± 0.4%
N	(0 to 293) °C [32 to 559] °F (293 to 1260) °C [559 to 2300] °F	± 2.2 °C [± 4 °F][1] ± 0.75%	(0 to 275) °C [32 to 527] °F (275 to 1260) °C [527 to 2300] °F	± 1.1 °C [± 2 °F] ± 0.4%
T	(-200 to -67 °C [-328 to -89] °F (-67 to 0) °C [-89 to 32] °F (0 to 133) °C [32 to 271] °F (133 to 370) °C [271 to 700] °F	± 1.5%[1] ± 1 °C [± 1.8 °F][1] ± 1 °C [± 1.8 °F] ± 0.75%	[2] [2] (0 to 125) °C [32 to 257] °F (125 to 370) °C [257 to 700] °F	 ± 0.5 °C [± 0.9 °F] ± 0.4%
E	(0 to 870) °C [32 to 1600] °F	± 1.7 °C [± 3.06 °F][3] or ± 0.5%	(0 to 870) °C [32 to 1600] °F	± 1.0 °C [± 1.8 °F][3] or ± 0.4%
R	(0 to 600) °C [32 to 1112] °F (600 to 1480) °C [1112 to 2700] °F	± 1.5 °C [± 2.7 °F] ± 0.25%	(0 to 600) °C [32 to 1112] °F (600 to 1480) °C [1112 to 2700] °F	± 0.6 °C [± 1.1 °F] ± 0.1%
S	(0 to 600) °C [32 to 1112] °F (600 to 1480) °C [1112 to 2700] °F	± 1.5 °C [± 2.7 °F] ± 0.25%	(0 to 600) °C [32 to 1112] °F (600 to 1480) °C [1112 to 2700] °F	± 0.6 °C [± 1.1 °F] ± 0.1%
B	(870 to 1700) °C [1600 to 3100] °F	± 0.5%	(870 to 1700) °C [1600 to 3100] °F	± 0.25%
C	(0 to 400) °C [32 to 752] °F (400 to 2315) °C [752 to 4200] °F	± 4.4 °C [± 8 °F] ± 1.0%	Not Available	

[1] Thermocouples and thermocouple materials are supplied to meet the tolerance specified for temperatures above 0 °C. A thermocouple material may not conform to the published sub-zero limits of error for that material when purchased, unless conformance is agreed upon by customer and Pyromation when ordering.

[2] Special tolerances for sub-zero temperatures have not yet been established. The following limits for calibrations of types E and T are useful to start discussion between customer and Pyromation.

(-200 to 0) °C Type T ± 0.5 °C or ± 0.8%, whichever is greater

[3] The standard tolerances shown do not apply to Type E mineral-insulated, metal-sheathed (MIMS) thermocouples and thermocouple cables. The standard tolerances for MIMS Type E constructions are the greater of ± 2.2 °C or ± 0.75 % from 0 to 870 °C and the greater of ± 2.2 °C or ± 2 % from -200 to 0 °C.

Initial values of tolerance for Type J and special tolerance for Type K thermocouples below 0 °C are not given due to the characteristics of the materials.

Tolerances on Initial Values of EMF vs Temperature for Thermocouples

CODE	MATERIAL	TEMPERATURE RANGE	TOLERANCE
M	Ni18Mo/Ni	(-50 to 1410) °C [-58 to 2570] °F	± 0.75%
P	Platinel® II	(0 to 1395) °C [32 to 4200] °F	± 0.10 mV

Platinel® is a registered trademark of BASF Catalysts.

Recommended Temperature Limits and Color Codes

Thermocouples must be selected to meet application conditions and only general recommendations of size and type can be given. Selection considerations involve useful length of service life, temperature, atmosphere, and response time. Smaller gauges provide faster response times and less service life. Larger gauges provide longer service life and reduced response times. The recommended temperature limits below are to be used as a guideline in the selection process, and the table applies only to thermocouples protected by a suitable protecting tube, sheath, or well. The color coding chart below provides ANSI/ASTM standard color codes found on thermocouple wire, extension wire, and plug and jack connectors.

Suggested Upper Temperature Limits For Protected Industrial Thermocouples

TYPE	MAXIMUM TEMPERATURE						
	8 GAUGE	11 GAUGE	14 GAUGE	20 GAUGE	24 GAUGE	28 GAUGE	30 GAUGE
	°C [°F]	°C [°F]	°C [°F]	°C [°F]	°C [°F]	°C [°F]	°C [°F]
T			370 [700]	260 [500]	200 [400]	200 [400]	150 [300]
J	760 [1400]		590 [1100]	480 [900]	370 [700]	370 [700]	320 [600]
E	870 [1600]		650 [1200]	540 [1000]	430 [800]	430 [800]	370 [700]
K, N	1260 [2300]		1090 [2000]	980 [1800]	870 [1600]	870 [1600]	760 [1400]
M		1287 [2250]	1287 [2250]				
R, S					1480 [2700]		
B					1700 [3100]		
C					2330 [4200]		

THERMO-COUPLE TYPE	U.S. & CANADIAN (ANSI/ASTM E230, ANSI/MC96.1)			
	ALLOY COMBINATION	THERMOCOUPLE GRADE	EXTENSION GRADE	PLUG & JACK
T	Copper / Constantan (Copper-Nickel)	Brown, Blue (+), Red (-)	Blue (+), Blue, Red (-)	Blue
J	Iron *(magnetic)* / Constantan (Copper-Nickel)	Brown, White (+), Red (-)	White (+), Black, Red (-)	Black
E	Nickel - Chromium / Constantan (Copper- Nickel)	Brown, Purple (+), Red (-)	Purple (+), Purple, Red (-)	Purple
K	Nickel - Chromium / Nickel - Aluminium *(magnetic)*	Brown, Yellow (+), Red (-)	Yellow (+), Yellow, Red (-)	Yellow
N	Nicrosil (Nickel-Chromium- Silicon) / Nisil (Nickel-Silicon-Magnesium)	Brown, Orange (+), Red (-)	Orange (+), Orange, Red (-)	Orange
S	Platinum Rhodium -10% / Platinum	None Established	Black (+), Green, Red (-)	Green
R	Platinum Rhodium -13% / Platinum	None Established	Black (+), Green, Red (-)	Green
B	Platinum Rhodium - 30% / Platinum Rhodium - 6%	None Established	Gray (+), Gray, Red (-) (Compensated Cable)	White (Uncom-pensated)
C	Tungsten Rhenium - 5% / Tungsten Rhenium - 26%	None Established	Green (+), Red, Red (-)	Red

Tubing, Sheath, Protection Tube, and Well Materials

Pyromation provides a variety of common tubing, MgO sheath, protection tube, and drilled-well materials to protect temperature sensing elements from the environmental conditions typically found in industrial process applications. The following tables are intended as guidelines to aid in the selection of the proper materials for sensors used in different environments. Consult the factory for the availability of other protective materials for specialty applications. NOTE: All chemical compositions and temperature ratings are nominal and are stated as received from suppliers.

Material Code Index

METALS						CERAMICS and COMPOSITE MATERIALS	
CODE	MATERIAL	CODE	MATERIAL	CODE	MATERIAL	CODE	MATERIAL
2	Molybdenum	25	Tantalum	37	Alloy 800	12	Metal Ceramic LT-1
3	Alloy 600	26	Titanium	38	Alloy 20	13	Vesuvius
4	310 S.S.	27	Alloy 400	41	HR - 160®	14	Cerite® - II
5	446 S.S.	28	Alloy B	50	Zirconium	15	Cerite® - III
6	Carbon Steel	29	Alloy C -276	59	F22-1	16	Mullite
7	Alloy 601	31	Nickel 200	60	F11-2	17	Alumina
8	316 S.S.	32	304 LC S.S.	61	A105	18	Silicon Carbide
9[2]	304 S.S.	33	316 LC S.S.	91	F91	19	Hexoloy® SA
11	Cast Iron	35	321 S.S.			71	Recrystallized Silicon Carbide
22	Brass	36	347 S.S.				
23	Copper						
24	Platinum						

Metals

CATALOG MATERIAL CODE	MATERIAL/COMPOSITION	TYPICAL AREAS OF USE				APPLICATION GUIDELINE INFORMATION
		TUBING	MGO SHEATHS	PROT. TUBES	DRILLED WELLS	
2	**MOLYBDENUM** 99.9% min. Molybdenum, 0.03% Tungsten	X	X			Up to 1926 °C [3500 °F] in inert atmospheres, to 1871 °C [3400 °F] in vacuum at 10-4 torr. Has poor mechanical shock resistance after heated to 1038 °C [1900 °F]. Oxidizes in air above 427 °C [800 °F].
3	**ALLOY 600 (UNS N06600)** 72% Nickel, 15% Chromium, 8% Iron	X	X	X	X	Up to 1149 °C [2100 °F] under oxidizing conditions. Reducing conditions reduce maximum temperature to 1038 °C [1900 °F]. Must not be placed in sulfurous atmospheres above 538 °C [1000 °F]. Main areas of application for thermocouple protection are carburizing, annealing and hardening furnaces, Cyanide saltbaths, blast furnace downcomers, open hearth flue stacks, steel soaking pits, waste heat boilers, ore roasters, cement exit flues, incinerators, and glass tank flues. (INCONEL® 600)
4	**310 STAINLESS STEEL (UNS S31000)** 25% Chromium, 20% Nickel	X	X	X	X	Up to 1038 °C [1900 °F] continuous, 1149 °C [2100 °F] intermittent. Mechanical and corrosion resistance similar to and better than 304 stainless steel.
5	**446 STAINLESS STEEL (UNS S44600)** 27% Chromium		X	X	X	Up to 1093 °C [2000 °F] under oxidizing conditions. Excellent high temperature corrosion and oxidizing resistance. Main areas of application are hardening, nitriding, and annealing furnaces, salt baths, molten lead, tin and babbitt metal, sulfurous atmospheres. Not for carburizing atmospheres. Other areas of application are steel soaking pits, tinning pots, waste heat boilers, ore roasters, cement exit flues, boiler tubes to 982 °C [1800 °F], incinerators to 1093 °C [2000 °F], glass flue tanks.
6	**CARBON STEEL**[1]	X		X	X	Up to 538 °C [1000 °F] in non-oxidizing environments. Main areas of usage are galvanizing pots, tinning pots, molten babbitt metal, molten mangesium, molten zinc, Petroleum refinery applications such as dewaxing and thermal cracking.
7	**ALLOY 601 (UNS N06601)** 61% Nickel, 23% Chromium, 14% Iron, 1.35% Aluminum		X	X	X	Similar applications to Inconel® 600 but with superior resistance to sulfur, high temperature oxidation resistance to 1260 °C [2300 °F]. (INCONEL® 601)
8	**316 STAINLESS STEEL (UNS S31600)** 16% Chromium, 12% Nickel 2% Molybdenum	X	X	X	X	Up to 927 °C [1700 °F] under oxidizing conditions. Same areas of applications as 304 stainless steel. Has improved resistance to mild acid and pitting corrosion.
9[2]	**304 STAINLESS STEEL (UNS S30400)** 18% Chromium, 8% Nickel	X	X	X	X	Up to 899 °C [1650 °F] under oxidizing conditions. Has general good oxidation and corrosion resistance in a wide range of industrial environments. Subject to carbide precipitation, which can reduce corrosion resistance in the (427 to 538) °C [800 to 1000] °F range. Good mechanical properties from (-184 to 788) °C [-300 to 1450] °F. Main areas of usage for thermocouple protection is in chemicals, foods, plastics and petroleum. Generally regarded as standard protection tube material.

[1] Materials available in various alloys - consult factory
[2] Machined fittings may be supplied as 303 Series stainless steel
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INCONEL® is a registered trademark of Special Metals Corporation
HR-160® is a registered trademark of Haynes International, Inc.

CATALOG MATERIAL CODE	MATERIAL/COMPOSITION	TYPICAL AREAS OF USE				APPLICATION GUIDELINE INFORMATION
		TUBING	MGO SHEATHS	PROT. TUBES	DRILLED WELLS	
11	**CAST IRON**			X		Up to 704 °C [1300 °F] in oxidizing conditions. Main area of usage is in molten non-ferrous metals, daily whiting is recommended. Can be used to 871 °C [1600 °F] under reducing conditions.
22	**BRASS**[1]	X			X	Up to 538 °C [1000 °F] continuous. Good thermal conductivity and mechanical strength.
23	**COPPER**	X	X Limited Avail.			Up to 260 °C [500 °F] continuous. Excellent thermal conductivity. Poor mechanical strength.
24	**PLATINUM**[1]	X	X			Up to 1374 °C [2500 °F] continuous oxidizing atmospheres. Good thermal conductivity. Used in applications where high temperature, but no vacuum or inert atmosphere is available.
25	**TANTALUM**[2]	X	X		X[2]	Up to 2349 °C [4350 °F]. Good resistance to corrosion and quick heat conductivity. Good mechanical strength. Used in chemical processes and high temperatures in vacuum or inert atmosphere.
26	**TITANIUM**	X	X		X	Up to 1260 °C [2300 °F] in inert or vacuum atmosphere. Acid and chemical resistant. Oxidation resistance to 538 °C [1000 °F].
27	**ALLOY 400 (UNS N04400)** 67% Nickel 30% Copper	X	X	X	X	Up to 538 °C [1000 °F] in sulfur-free atmosphere. Excellent resistance to corrosion. Used in chemical processing and food processing equipment. (MONEL® 400)
28	**ALLOY B-3 (UNS N10675)** 65% Nickel 28.5% Molybdenum 1.5% Chromium 1.5% Iron	X	X Limited Avail.	X	X	Up to 600 °C [1200 °F] Exhibits extremely high resistance to pure hydrochloric, hydrobromic, and sulfuric acids. Greatly improved structural stability compared with previous B-type alloys, leading to fewer concerns during welding, fabrication, and service. Used in numerous chemical process industry applications, especially in the construction of reaction vessels for pure, reducing acid service. Poor corrosion resistance to oxidizing environments, not recommended for use in oxidizing media or in the presence of ferric or cupric salts. (HASTELLOY® B-3)
29	**ALLOY C-276 (UNS N10276)** 54% Nickel 16% Molybdenum, 15% Chromium	X	X Limited Avail.	X	X	Up to 1038 °C [1900 °F] in oxidizing atmospheres. Exceptional resistance to a wide variety of chemical environments. Withstands wet chlorine gas, hypochlorite and chlorine dioxide. (HASTELLOY® C-276)
31	**NICKEL 200 (UNS N02200)** 99% Nickel		X Limited Avail.		X	Up to 899 °C [1650 °F] in sulfur-free atmospheres. Good corrosion-resistance. Used in contact with reducing acids, foods, chemicals caustics, rayon, and plastics.
32	**304 STAINLESS STEEL LOW CARBON (UNS S30403)** 18% Chromium, 8% Nickel	X	X	X	X	Same characteristics as 304 except the low carbon allows for corrosion-resistant weld areas. Not recommended to be used above 427 °C [800 °F]. (0.03% max. carbon)
33	**316 STAINLESS STEEL LOW CARBON (UNS S31603)** 16% Chromium 12% Nickel 2% Molybdenum	X	X	X	X	Same characteristics as 316 except the low carbon allows for corrosion-resistant weld areas. Not recommended to be used above 427 °C [800 °F]. (0.03% max. carbon)
35	**321 STAINLESS STEEL (UNS S32100)** 18% Chromium 10% Nickel, Titanium	X	X	X	X	Good corrosion resistance between (482 to 871) °C [900 to 1600] °F. Used where conditions are too severe for low carbon stainless steels.
36	**347 STAINLESS STEEL (UNS S34700)** 18% Chromium, 10% Nickel, Columbium	X	X Limited Avail.		X	Good corrosion resistance between (482 to 871) °C [900 to 1600] °F. Used where conditions are too severe for low carbon stainless steels.
37	**ALLOY 800 (UNS N08800)** 33% Nickel 42% Iron 21% Chromium	X	X Limited Avail.	X	X	Strong resistance to oxidation and carburization at high temperatures. Resists sulfur attack, internal oxidation, and scaling in a wide variety of atmospheres. (INCOLOY® 800)
38	**ALLOY 20 (UNS N08020)** 35% Nickel 35% Iron 20% Chromium Columbium		X Limited Avail.	X	X	Superior resistance to stress-corrosion cracking in boiling 20-40% sulfuric acid. Also used in high octane gas, solvents, explosives, heavy chemicals and agri-chemicals. (CARPENTER 20Cb-3®)
41	**HR - 160® (UNS N12160)** 37% Nickel 30% Cobalt 28% Chromium		X	X		A premier alloy that provides excellent resistance to sulphur, vanadium, chlorines, chlorides, and other salt deposits up to 1204 °C [2200 °F]. A superior material for use in aggressive waste incineration processes.

[1] Materials available in various alloys - consult factory
[2] Generally applied as a well jacket
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Metals

CATALOG MATERIAL CODE	MATERIAL/COMPOSITION	TYPICAL AREAS OF USE				APPLICATION GUIDELINE INFORMATION
		TUBING	MGO SHEATHS	PROT. TUBES	DRILLED WELLS	
50	**ZIRCONIUM (UNS R60702)** 99.2% Zr	X		X	X	Up to 400 °C [752 °F]. Zirconium has a high affinity to oxygen that results in the formation of a regenerative protective oxide layer in most media. This oxide layer gives the material chemical resistance and erosive resistance in high velocity applications. Zirconium is resistant to corrosion from most organic and inorganic acids and salts and it is totally resistant to alkalis.
59	**F22 (UNS K21590)** Cr 2.25%, Mo 1%			X	X	Carbon steel alloy typically used in power plant, boiler and turbine applications.
60	**F11 (UNS K11572)** Cr 1.25%, Mo .5%, Si			X	X	Carbon steel alloy typically used in power plant, boiler and turbine applications.
61	**A105** C, Si				X	Carbon steel alloy typically used in power plant, boiler and turbine applications.
91	**F91 (UNS K91560)** Cr 9%, Mo 1%, V			X	X	Chrome Moly alloy typically used in power plant, boiler and turbine applications.

Ceramics and Composite Materials

CATALOG MATERIAL CODE	MATERIAL/ COMPOSITION	TYPICAL AREAS OF USE				APPLICATION GUIDELINE INFORMATION
		TUBING	MGO SHEATHS	PROT. TUBES	DRILLED WELLS	
12	**METAL CERAMIC LT-1** (slip cast composite of chromium and aluminum oxide,) 77% chromium, 23% aluminum oxide			X		Up to 1374 °C [2500 °F] in oxidizing conditions. Main areas of usage are molten copper base alloys to 1149 °C [2100 °F], blast furnace and stack gases to 1316 °C [2400 °F], Sulfur burners to 1093 °C [2000 °F], cement kilns to 1204 °C [2200 °F], chemical process reactors to 1371 °C [2500 °F]. A ceramic primary tube is required when a noble metal thermocouple is used.
13	**VESUVIUS**			X		Up to 927 °C [1700 °F]. For use in aluminum and other non-ferrous metals. Not wetted by molten aluminum and other non-ferrous metals. No contamination. Resists thermal and mechanical shock. Brittle after heating. Handle carefully.
14	**CERITE®-II** (Cast oxide composites)			X		Up to 1093 °C [2000 °F]. For submerged use in aluminum and other non-ferrous metals. Not wetted by molten aluminum and other non-ferrous metals. No contamination. Good thermal and mechanical shock resistance.
15	**CERITE®-III** (Cast oxide composites)			X		Up to 1093 °C [2000 °F]. For submerged use in aluminum and other non-ferrous metals. Not wetted by molten aluminum and other non-ferrous metals. No contamination. Good thermal and mechanical shock resistance.
16	**MULLITE** 63% alumina			X		Up to 1510 °C [2750 °F] when supported. Has poor mechanical shock resistance, but good thermal shock resistance. For barium chloride salt baths to 1288 °C [2350 °F]. Should be vertical mounted or supported if horizontal. For high temperature applications of ceramic industry, heat treating, glass manufacture. Impervious to gases at high temperatures.
17	**ALUMINA** (Recrystallized 99.7% AL_2O_3)			X		Up to 1889 °C [3400 °F] when supported. Has only fair resistance to thermal and mechanical shock. Essentially same applications as Mullite including induction melting, vacuum furnaces. Impervious to gases at high temperatures.
18	**SILICON CARBIDE** 90% silicon carbide, 9% silicon dioxide, balance aluminum oxide			X		Up to 1650 °C [3000 °F]. For an outer protection tube with Alumina® or mullite primary tube. For brick and ceramic kilns, steel soaking pits, molten non-ferrous metals. Can withstand direct flame impingement. Fair thermal shock resistance. Approximately 14% porosity.
19	**HEXOLOY® SA** sintered alpha, silicon carbide			X		Up to 1650 °C [3000 °F] in air. High thermal conductivity, excellent wear and abrasion resistance, high thermal shock resistance, and good mechanical strength. Superior chemical resistance in both reducing and oxidizing environments. Attacked by Halides, fused caustics, and ferrous metals.
71	**RECRYSTALLIZED SILICON CARBIDE** (Halsic R) 99% silicon			X		Up to 1600 °C [2912 °F] in oxidizing atmosphere, and 2000 °C [3632 °F] in a vacuum atmosphere. Used as an outer protection tube in hot stack emissions, combustion chambers, chemical reactors, and incineration of medical, municipal, and industrial waste. Can withstand direct flame impingement, has excellent thermal shock characteristics, and excellent corrosion resistance. A ceramic inner tube is required when used with noble metal thermocouples.

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General MgO Specifications

The information contained in the following pages is intended as a guideline only for general sensor usage. The specific application and the enviornmental conditions may require that other sensor sheath materials, diameters, or construction styles be used to provide optimum temperature measurement results. The dimensions, temperature ratings, and response times indicated are nominal, and they may vary in actual practice.

Thermocouple Types and Sizes

SHEATH DIAMETER (inches) - AWG WIRE SIZE									
TYPE	**MATERIAL**	0.020 O.D.	0.032 O.D.	0.040 O.D.	1/16 O.D.	1/8 O.D.	3/16 O.D.	1/4 O.D.	3/8 O.D.
E	Chromel-Constantan	38	35	32	30	24	21	19	15
J	Iron-Constantan	38	35	32	30	24	21	19	15
K	Chromel-Alumel	38	35	32	30	24	21	19	15
T	Copper-Constantan	38	35	32	30	24	21	19	15
N	Nicrosil-Nisil	38	35	34	-	29	21	19	15

Recommended Upper Temperature Limits For Protected Thermocouples
Upper Temperature Limits (F) For Various Sheath & Diameter Combinations

SHEATH TYPE	SHEATH MATERIAL	SHEATH DIAMETER (inches)					
		0.020, 0.032, 0.040	1/16	1/8	3/16	1/4	3/8
		TEMPERATURE RANGE					
J	*316 S.S.*	(0 to 260) °C [32 to 500] °F	(0 to 441) °C [32 to 825] °F	(0 to 521) °C [32 to 970] °F	(0 to 621) °C [32 to 1150] °F	(0 to 721) °C [32 to 1330] °F	(0 to 721) °C [32 to 1330] °F
K or N		(0 to 700) °C [0 to 1290] °F	(-200 to 921) °C [-328 to 1690] °F	(-200 to 927) °C [-328 to 1700] °F	(-200 to 927) °C [-328 to 1700] °F	(-200 to 927) °C [-328 to 1700] °F	(-200 to 927) °C [-328 to 1700] °F
E		(-200 to 260) °C [-328 to 570] °F	(-200 to 510) °C [-328 to 950] °F	(-200 to 649) °C [-328 to 1200] °F	(-200 to 732) °C [-328 to 1350] °F	(-200 to 821) °C [-328 to 1510] °F	(-200 to 821) °C [-328 to 1510] °F
T		(-200 to 260) °C [-324 to 500] °F	(-200 to 260) °C [-328 to 500] °F	(-200 to 371) °C [-328 to 700] °F	(-200 to 371) °C [-328 to 700] °F	(-200 to 371) °C [-328 to 700] °F	(-200 to 371) °C [-328 to 700] °F
K or N	*ALLOY 600*	(0 to 700) °C [0 to 1290] °F	(-200 to 921) °C [-328 to 1690] °F	(-200 to 1071) °C [-328 to 1960] °F	(-200 to 1149) °C [-328 to 2100] °F	(-200 to 1149) °C [-328 to 2100] °F	(-200 to 1149) °C [-328 to 2100] °F
E		(-200 to 300) °C [-328 to 570] °F	(-200 to 510) °C [-328 to 950] °F	(-200 to 649) °C [-328 to 1200] °F	(-200 to 732) °C [-328 to 1350] °F	(-200 to 821) °C [-328 to 1510] °F	(-200 to 821) °C [-328 to 1510] °F

This table gives the suggested upper temperature limits for various thermocouples in several common sheath sizes. It does not address compatibility considerations between the thermoelement materials and the sheath containing them. The temperature limits given here are intended only as a guide to the purchaser and should not be taken as absolute values, nor as guarantees of satisfactory life or performance. These types and sizes are sometimes used at temperatures above the given limits, but usually at the expense of stability, life or both. In other instances, it may be necessary to reduce the given limits in order to achieve adequate service.

HOT or MEASURING JUNCTIONS and RESPONSE TIMES

UNGROUNDED JUNCTION (U)
The welded thermocouple junction is fully isolated from the welded closure of the sheath. This junction provides electrical isolation to reduce problems associated with electrical interference. Ungrounded junctions are also recommended for use in extreme positive or negative temperatures, rapid thermal cycling and for ultimate corrosion resistance of the sheath alloy. Ungrounded junctions exceed 1000 MΩ resistance @ 500 V dc at ambient room temperatures for diameters 1/16 inch and larger.

SHIELDED JUNCTION (S)
The thermocouple wires are welded and recessed inside the sheath with the tip of the sheath open. Insulation is not sealed against process conditions.

GROUNDED JUNCTION (G)
The thermocouple junction is welded securely into the closure end of the sheath, becoming an integral part of the weld. This is a good general purpose, low cost junction providing faster response times than an un-grounded junction of similar sheath diameter. Grounded junctions should not be used with Type T thermocouples, due to the copper wire.

EXPOSED JUNCTION (E)
The thermocouple wires are welded and exposed. The insulation is not sealed against liquid or gas penetration. Recommended where fast response is desired, and corrosive conditions are nonexistent. The exposed hot junction length for 1/8-inch diameter sheaths and above is typically 3/16" past sheath. The exposed junctions for sheath diameters less than 1/8-inch diameter are supplied as shielded junctions.

Typical Junction Response Times (63.2% of a (25 to 100) ºC Step Change)

SHEATH O.D. (inches)	"E" JUNCTION (seconds)	"G" JUNCTION (seconds)	"U" JUNCTION (seconds)
0.020	0.02 s	0.03 s	0.24 s
0.032	0.03 s	0.05 s	0.26 s
0.040	0.03 s	0.06 s	0.28 s
1/16	0.01 s	0.3 s	0.4 s
1/8	0.1 s	0.6 s	1.6 s
3/16	0.2 s	0.9 s	2.4 s
1/4	0.3 s	1.3 s	2.9 s
3/8	0.4 s	3.5 s	7.2 s

Elements of several different materials, base resistances, temperature coefficients, accuracies, and construction styles are available for installation into final RTD temperature sensor assemblies to meet customer specifications. Pyromation's standard RTD constructions utilize both thin film and wire wound elements as specified by the part number. The temperature ranges are either dictated by the construction style or element type whichever is lower. These construction styles are listed below.

LOW RANGE - THIN-FILM CONSTRUCTION (L) (-50 to 200) °C [-58 to 392] °F
The element is welded to Fluoropolymer-insulated, silver-plated copper leads, and then placed inside a specially-cleaned stainless steel sheath. The space surrounding the element and leads is filled and loosely packed with alumina oxide powder to provide good heat transfer times, and to provide a damping cushion against vibration and mechanical shock. The filled sheath is then sealed with low temperature epoxies to prevent moisture penetration.

LOW RANGE - WIRE-WOUND CONSTRUCTION (L) (-200 to 200) °C [-328 to 392] °F
The element is welded to Fluoropolymer-insulated, silver-plated copper leads, and then placed inside a specially-cleaned stainless steel sheath. The space surrounding the element and leads is filled and loosely packed with alumina oxide powder to provide good heat transfer times, and to provide a damping cushion against vibration and mechanical shock. The filled sheath is then sealed with low temperature epoxies to prevent moisture penetration.

MEDIUM RANGE - THIN-FILM CONSTRUCTION (M) (-50 to 480) °C [-58 to 896] °F
The element is welded to fiberglass-insulated, nickel-plated copper leads, and then placed inside a specially-cleaned stainless steel sheath. The space surrounding the element and leads is filled and loosely packed with alumina oxide powder to provide good heat transfer times, and to provide a damping cushion against vibration and mechanical shock. The filled sheath is then sealed with low-temperature epoxies to prevent moisture penetration.

MEDIUM RANGE - THIN-FILM CONSTRUCTION (K) (-50 to 315) °C [-58 to 599] °F
The element is welded to Polyimide-insulated, nickel-plated copper leads, and then placed inside a specially-cleaned stainless steel sheath. The space surrounding the element and leads is filled and loosely packed with alumina oxide powder to provide good heat transfer times, and to provide a damping cushion against vibration and mechanical shock. The filled sheath is then sealed with low-temperature epoxies to prevent moisture penetration.

HIGH RANGE - WIRE-WOUND CONSTRUCTION (H) (-200 to 600) °C [-328 to 1112] °F
The element is welded to nickel leads that are insulated with compacted magnesium oxide (MgO) powder inside the stainless steel sheath. The void surrounding the element is packed with MgO powder and the sheath tip is welded closed with a stainless steel cap. The leads and sheath are sealed with low-temperature epoxies to prevent moisture penetration.

HIGH RANGE - THIN-FILM CONSTRUCTION (H) (-50 to 500) °C [-58 to 932] °F
The element is welded to nickel leads that are insulated with compacted magnesium oxide (MgO) powder inside the 316 stainless steel sheath. The void surrounding the element is packed with MgO powder and the sheath tip is welded closed with a 316 stainless steel cap. The leads and sheath are sealed with low-temperature epoxies to prevent moisture penetration.

RTD Element Terminology

TEMPERATURE COEFFICIENT OF RESISTANCE: The fractional change in element resistance per change of 1 °C , is expressed as Ω/Ω/ °C or $\Omega \cdot \Omega^{-1} \cdot °C^{-1}$ or $°C^{-1}$

TOLERANCE: Initial maximum allowable deviation expressed as $\Delta t(t)$ in °C from nominal temperature/resistance relationship R(*t*).

SELF-HEATING: Self-heating is the rise in the measured temperature caused by the power dissipated in the element. Self-heating error is affected by the thermal conductivity and velocity of the process being measured and is negligible for most applications.

THERMAL RESPONSE: The time a thermometer takes to respond at a specified percentage to a step change in temperature. To specify response time, it is necessary to declare the percentage of response, usually $\tau_{0.9}$, $\tau_{0.5}$, or $\tau_{0.1}$, which gives 90%, 50% or 10% of the response. The test medium and its flow conditions have to be specified (usually flowing water or flowing air).

MINIMUM IMMERSION DEPTH: Immersion depth at which the change from calibration at full immersion does not exceed 0.1 °C.

REPEATABILITY-STABILITY: The ability of an element to reproduce the same resistance or temperature reading each time it is at equilibrium at a given repeated temperature. Expressed as a ± resistance or temperature value over a given temperature range. This may also be expressed as the stability of its resistance. Typically platinum elements will not change more than 0.04% at 0 °C [32 °F] after receiving ten consecutive shocks from (-200 to 600) °C [-328 to 1112] °F.

VIBRATION: Pyromation's fully assembled sheathed RTD sensors are designed to withstand an average vibration level of 30 G's using random vibrating frequencies from (20 to 2,000) Hz at ambient temperature. Supporting test results indicate that initial RTD tolerances remain as specified when tested at these vibration levels.

HUMIDITY LIMITS: Sheaths, transition fittings, and lead seals capable of withstanding 100% humidity at normal atmospheric pressure, and at normal ambient temperatures.

INTERCHANGEABILITY: The amount of allowable difference in readings between two RTD's when placed side by side in a process at the same temperature. This is determined by the allowable RTD tolerance at that particular temperature.

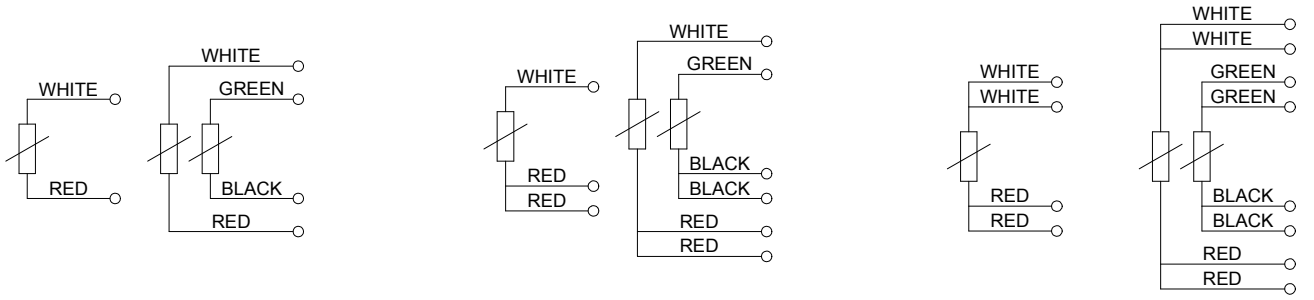
Element Connections

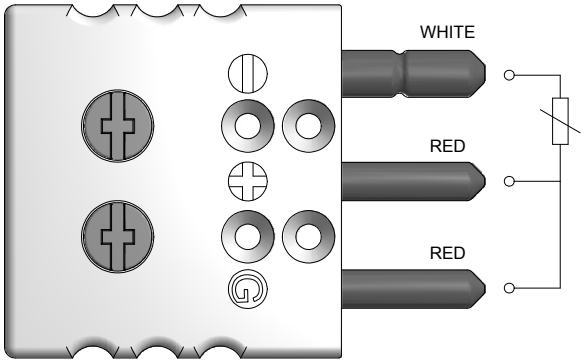
Two-Wire: Provides one connection to each end of the element. This construction is suitable where the resistance of the lead wire may be considered as an additive constant in the circuit, and particularly where the changes in lead resistance due to ambient temperature changes may be ignored.

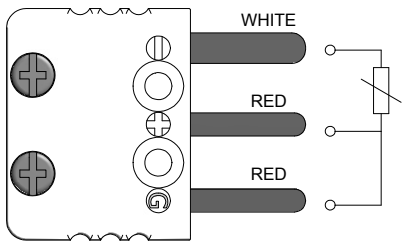
Three-Wire: Provides one connection to one end of the element and two to the other end of the element. Connected to an instrument designed to accept three wire input, sufficient compensation is usually achieved for leadwire resistance and temperature change in leadwire resistance. This is the most commonly used configuration.

Four-Wire: Provides two connections to each end of the element to completely compensate for leadwire resistance and temperature change in leadwire. This configuration is used where highly accurate temperature measurement is vital.

2-WIRE SINGLE **2-WIRE DUPLEX** **3-WIRE SINGLE** **3-WIRE DUPLEX** **4-WIRE SINGLE** **4-WIRE DUPLEX**







Lead resistance has a large effect on RTD temperature measurement accuracy. A 2-wire circuit provides no compensation and can provide large measurement errors. The following table shows the effects of leadwire resistance on temperature measurements using low-temperature RTD assemblies with copper leadwire.

Leadwire Resistance

LEADWIRE-WIRE GAUGE	RESISTANCE-OHMS PER FOOT	UNCOMPENSATED 2-WIRE CIRCUITS	
		MAX. LENGTH FOR 1 °F ERROR @ 20 °C [68 °F]	ERROR IN °F PER DOUBLE FT.
30	0.133	0.81 ft	1.24 °F
28	0.0851	1.26 ft	0.79 °F
24	0.0333	3.2 ft	0.31 °F
22	0.0213	5.1 ft	0.198 °F
20	0.0148	7.27 ft	0.14 °F
18	0.0083	13.0 ft	0.077 °F
16	0.0052	20.7 ft	0.048 °F

STANDARD PLATINUM RTD ASSEMBLIES - Pyromation standard RTD assemblies are constructed using either wire-wound platinum elements or thin-film elements with a reference resistance of 100 ohms at 0 °C, a temperature coefficient 0.003 85 $°C^{-1}$ and which are in accordance with the following standards:

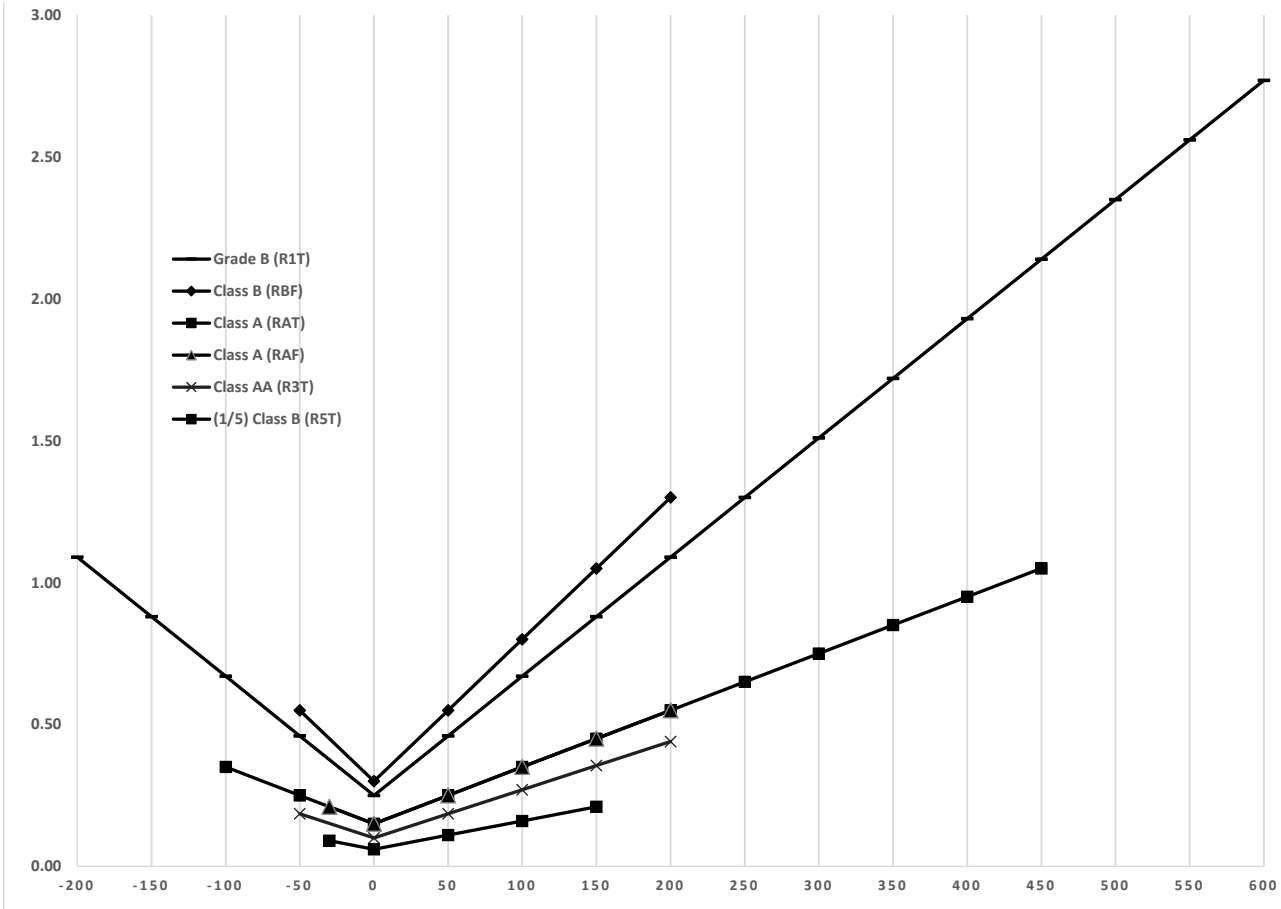
1. International Standard, IEC 60751 2. American Standard, ASTM E1137

TEMPERATURE		IEC CLASS B [1] (RBF) ± (0.12% × R_O) Ω		ASTM GRADE B [1] (RIT) ± (0.1% × R_O) Ω		IEC CLASS A [1] (RAT) ± (0.06% × R_O) Ω		IEC CLASS A [1] (RAF) ± (0.06% × R_O) Ω		IEC CLASS AA [1] (R3T) ± (0.04% × R_O) Ω		(1/5) IEC CLASS B [2] (R5T) ± (0.02% × R_O) Ω	
		± (0.3 + 0.005 |t|) °C		± (0.25 + 0.0042 |t|) °C		± (0.15 + 0.002 |t|) °C		± (0.15 + 0.002 |t|) °C		± (0.1 + 0.0017 |t|) °C		± (0.06 + 0.001 |t|) °C	
°C	[°F]	°C	[°F]	°C	[°F]	°C	[°F]	°C	[°F]	°C	[°F]	°C	[°F]
-200	[-328]			1.09	[1.96]								
-100	[-148]			0.67	[1.21]	0.35	[0.63]						
-50	[-58]	0.55	[0.99]	0.46	[0.83]	0.25	[0.45]			0.19	[0.34]		
-30	[-22]	0.45	[0.77]	0.38	[0.64]	0.21	[0.36]	0.21	[0.36]	0.15	[0.26]	0.09	[0.16]
0	[32]	0.30	[0.54]	0.25	[0.45]	0.15	[0.27]	0.15	[0.27]	0.10	[0.18]	0.06	[0.11]
100	[212]	0.80	[1.44]	0.67	[1.21]	0.35	[0.63]	0.35	[0.63]	0.27	[0.49]	0.16	[0.29]
150	[302]	1.05	[1.89]	0.88	[1.58]	0.45	[0.81]	0.45	[0.81]	0.36	[0.65]	0.21	[0.38]
200	[392]	1.30	[2.34]	1.09	[1.96]	0.55	[0.99]	0.55	[0.99]	0.44	[0.79]		
250	[482]	1.55	[2.79]	1.30	[2.34]	0.65	[1.17]	0.65	[1.17]	0.53	[0.95]		
300	[572]	1.80	[3.24]	1.51	[2.72]	0.75	[1.35]	0.75	[1.35]				
400	[752]	2.30	[4.14]	1.93	[3.47]	0.95	[1.71]						
450	[842]	2.55	[4.59]	2.14	[3.85]	1.05	[1.89]						
500	[932]	2.80	[5.04]	2.35	[4.23]								
600	[1112]			2.77	[4.99]								

Where: |t| = value of temperature without regard to sign, °C

[1] The equations represent values for 3- and 4-wire PRTs. Caution must be exercised with 2-wire PRTs due to lead resistance.

[2] This tolerance can only be met with a 4-wire PRT.



Leadwire Transition Fitting Dimensions

CODE	SHEATH DIAMETERS (inches)	FITTING O.D. (inches)	FITTING LENGTH	
			W/SPRING (inches)	W/O SPRING (inches)
15,16,19	0.020	3/8	2 (5/8)	1 (3/16)
15,16,19	0.032	3/8	2 (5/8)	1 (3/16)
15,16,19	0.040	3/8	2 (5/8)	1 (3/16)
15,16,19	1/16	1/4	2 (5/8)	1 (3/16)
15,16,19	1/16[1]	3/8	2 (5/8)	1 (3/16)
15,16,19	1/8	1/4	2 (5/8)	1 (3/16)
15,16,19	1/8[1]	3/8	2 (5/8)	1 (3/16)
15,16,19	3/16	3/8	2 (5/8)	1 (3/16)
15,16,19	1/4	3/8	2 (5/8)	1 (3/16)
15,16,19	3/8	7/16	2 (5/8)	1 (3/16)

[1] Used with flexible armor tubing, duplex T/C's, and wire codes P3, P1, and F3

Compression Fitting Pressure Rating Table

CODE	05A	05A, 05B, 05C	05A, 05B	05A, 05B, 05C	05B, 05C
Sheath O.D. & Wall Thickness	1/6" O.D. x 0.0077"	1/8" O.D. x 0.012"	3/16" O.D. x 0.020"	1/4" O.D. x 0.028"	3/8" O.D. x 0.049"
TEMPERATURE	MAXIMUM ALLOWANCE WORKING PRESSURE (PSIG)				
(-29 to 149) ºC [-20 to 300] ºF	3300	2850	3150	3350	3900
204 ºC [400 ºF]	3200	2750	3050	3250	3800
260 ºC [500 ºF]	3000	2550	2850	3000	3500
316 ºC [600 ºF]	2800	2400	2700	2850	3300
371 ºC [700 ºF]	2700	2350	2600	2750	3200
427 ºC [800 ºF]	2650	2300	2550	2650	3100
482 ºC [900 ºF]	2600	2200	2450	2600	3050
538 ºC [1000 ºF]	2400	2100	2300	2450	2850

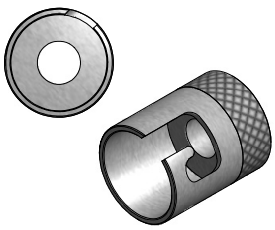
Calculations are based on the following criteria: 316 stainless steel sheath, ultimate tensil stress of 75,000 PSI for seamless tube, Conservative Barlow Formula and safety factor of 4.0.

Sheath Mounting Fitting Dimensions

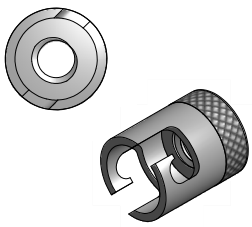
CODE	STYLE	SHEATH O.D. (inches)	NPT SIZE (inches)	LENGTH (inches)
01A	303 SS one-time adjustable	1/16, 1/8, 3/16, 1/4	1/8	1 5/16
05A	316 SS one-time adjustable	1/16, 1/8, 3/16, 1/4	1/8	1 1/4
05B	316 SS one-time adjustable	1/8, 3/16, 1/4, 3/8	1/4	1 7/8
05C	316 SS one-time adjustable	1/8, 1/4, 3/8	1/2	1 13/16
15A	Brass one-time adjustable	1/8, 3/16, 1/4	1/8	1 1/4
15B	Brass one-time adjustable	3/16, 1/4, 3/8	1/4	1 3/8
15C	Brass one-time adjustable	1/4, 3/8	1/2	1 1/2
10A	303 SS re-adjustable	1/16, 1/8, 3/16	1/8	1 1/4
10B	303 SS re-adjustable	1/4, 3/8	1/4	2 7/16
10C	303 SS re-adjustable	1/4, 3/8	1/2	2 7/16
12A	316 SS re-adjustable	1/16, 1/8, 3/16, 1/4	1/8	1 1/4
12B	316 SS re-adjustable	1/8, 3/16, 1/4, 3/8	1/4	1 1/2
12C	316 SS re-adjustable	1/8, 1/4, 3/8	1/2	1 3/4
11A	Brass re-adjustable	1/16, 1/8, 3/16, 1/4	1/8	1 19/64
11B	Brass re-adjustable	1/8, 3/16, 1/4, 3/8	1/4	1 9/16
11C	Brass re-adjustable	1/4, 3/8	1/2	1 13/16
19C	303 SS spring-loaded well ftg.	3/16, 1/4	1/2	2 1/4
8A	316 SS fixed bushing	All sizes	1/8	5/8
8B	316 SS fixed bushing	All sizes	1/4	11/16
8C	316 SS fixed bushing	All sizes	1/2	15/16
8D	316 SS fixed bushing	All sizes	3/4	1
6HN	Steel hex fitting	1/8, 3/16, 1/4, 3/8	1/2	2
8HN	316 SS hex fitting	1/8, 3/16, 1/4, 3/8	1/2	2
8RNDC	316 SS reducing hex fitting	1/8, 3/16, 1/4, 3/8	3/4 x 1/2	2
9HNB	303 SS hex fitting	1/8, 3/16, 1/4, 3/8	1/4	1 3/16
13A	Fixed bayonet fitting	1/8, 3/16	N/A	1 5/8
14	Adjustable flange	1/8, 3/16, 1/4, 3/8	N/A	1 1/2
16A	Adustable bayonet fitting	1/8	N/A	1 5/8

Bayonet Caps

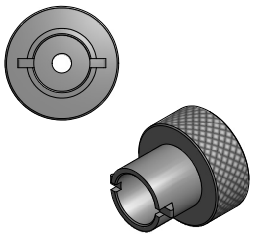
7/16" I.D. single slot
Order code: A



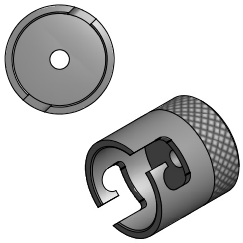
12 mm I.D. double slot
Order code: B



12 mm O.D. dual pin
Order code: C



15 mm I.D. double slot
Order code: E



Corrosive Service Guide to Materials for Sheaths and Thermowells
Refer to A.S.M.E. Boiler Code, Section VIII for allowable stress levels
(Fluoropolymer coated thermowells and/or Fluoropolymer sheaths may be substituted for all corrosive agents listed)

CORROSIVE AGENT	TEMP. ºC	TEMP. °F	CONC. %	RECOM. MATERIAL	CORROSIVE AGENT	TEMP. ºC	TEMP. °F	CONC. %	RECOM. MATERIAL
Acetic Acid (Glacial)	199	[390]	ALL	316 SS	Chlorine (Gas)	93	[200]	ALL	Monel®
Acetic Acid	143	[290]	80%	Hast. C		199	[390]	ALL	316 SS[1]
	199	[390]	50%	316 SS	Chlorine (Gas - Moist)	66	[150]	ALL	Hast C
	143	[290]	80%	Carp. 20[1]	Chloroacetic Acid	182	[360]	ALL	Hast. B
Acetic Anhydride	132	[270]	ALL	Hast. C	Chloroform	93	[200]	ALL	Nickel
	199	[390]	ALL	316 SS[1]		93	[200]	ALL	Carp. 20[1]
Acetone	199	[390]	ALL	316 SS	Chromic Acid	93	[200]	50%	Titanium
Acetylene	199	[390]	ALL	304 SS		93	[200]	50%	Hast. C[1]
Alcohol, Ethyl	93	[200]	ALL	Hast. C	Citric Acid	127	[260]	ALL	Hast. C
	199	[390]	ALL	316 SS[1]		93	[200]	ALL	Carp. 20[1]
Aluminum Chloride (Aqueous)	143	[290]	ALL	Hast. B	Copper Chloride	88	[190]	ALL	Titanium
	143	[290]	ALL	Nickel[1]		88	[190]	ALL	Hast. C[1]
Aluminum Nitrate (Saturated)	93	[200]	ALL	446 SS	Copper Nitrate	149	[300]	ALL	304 SS
	88	[190]	ALL	316 SS[1]	Copper Sulfate	93	[200]	ALL	Hast. C
Aluminum Sulfate (Saturated)	93	[200]	ALL	Titanium		199	[390]	ALL	316 SS[1]
	93	[200]	ALL	316 SS[1]	Corn Oil	238	[460]	ALL	TFE
Ammonia (Anhydrous)	293	[560]	ALL	316 SS		193	[380]	ALL	FEP
Ammonia (Gas)	93	[200]	ALL	304 SS		171	[340]	ALL	316 SS[1]
Ammonium Chloride	88	[190]	ALL	Titanium	Crude Oil	93	[200]	ALL	304 SS
	293	[560]	ALL	Nickel[1]	Cyanogen Gas	238	[460]	ALL	TFE
	71	[160]	50%	Nickel		193	[380]	ALL	FEP
Ammonium Hydroxide	27	[80]	ALL	Steel		171	[340]	ALL	316 SS[1]
	82	[180]	ALL	Steel[1]	Ether	88	[190]	ALL	304 SS
Ammonium Nitrate	93	[200]	ALL	Carp. 20	Ethyl Acetate	93	[200]	ALL	Titanium
Ammonium Sulfate	93	[200]	SAT.	Hast. B		199	[390]	ALL	316 SS[1]
	143	[290]	SAT.	304 SS[1]	Ethyl Chloride (Dry)	293	[560]	ALL	316 SS
	93	[200]	10 - 40%	Titanium	Ethylene Glycol	93	[200]	ALL	Carp. 20
	199	[390]	10 - 40%	316 SS[1]		93	[200]	ALL	304 SS[1]
Amyl Acetate	143	[290]	ALL	304 SS	Ethylene Oxide	21	[70]	ALL	Hast. C
Aniline	254	[490]	ALL	304 SS		199	[390]	ALL	316 SS[1]
Barium Chloride (Saturated)	93	[200]	ALL	Hast. C	Fatty Acids	199	[390]	ALL	316 SS
	293	[560]	ALL	Inconel®[1]	Ferric Chloride	143	[290]	ALL	Titanium
Barium Hydroxide (Saturated)	104	[220]	50%	Carp. 20		27	[80]	ALL	Hast. C[1]
	199	[390]	ALL	316 SS[1]	Ferric Sulfate	49	[120]	ALL	Carp. 20
Beer	88	[190]		304 SS		88	[190]	10%	316 SS
Benzene (Benzol)	104	[220]	ALL	Carp. 20	Ferrous Sulfate	27	[80]		Titanium
	104	[220]	ALL	304 SS[1]		93	[200]	ALL	304 SS[1]
Benzoic Acid	199	[390]	ALL	Titanium	Formaldehyde	49	[120]	ALL	304 SS
	199	[390]	ALL	304 SS[1]		49-293	[120-560]	50%	304 SS[1]
Black Liquor	238	[460]	ALL	TFE	Formic Acid (Anhydrous)	93	[200]	50%	Carp. 20
	193	[380]	ALL	FEP	Freon (F-11)	204	[400]	ALL	Monel®
	93	[200]	ALL	Carp. 20[1]		204	[400]	ALL	316 SS[1]
Bleach (Active Chlorine)	60	[140]	12.5%	Hast. C	Furfural	199	[390]	ALL	Nickel
Borax	199	[390]	ALL	316 SS		199	[390]	ALL	304 SS[1]
Boric Acid	293	[560]	ALL	Hast. C	Gallic Acid	238	[460]	ALL	TFE
	93	[200]	ALL	Nickel[1]		193	[380]	ALL	FEP
Brine Acid	60	[140]	ALL	Hast. C		199	[390]	ALL	316 SS[1]
	27	[80]	ALL	Brass[1]	Gasoline (Unleaded)	154	[310]	ALL	Hast. C
Bromine (Liquid)	293	[560]	ALL	Tantalum		16	[60]		446 SS
	93	[200]	ALL	Aluminum[1]		171	[340]		Steel[1]
Butane	171	[340]	ALL	Steel		238	[460]		TFE
Butyl Acetate	93	[200]	ALL	Titanium	Gasoline (Refined)	193	[380]		FEP
	188	[370]	ALL	316 SS[1]		88	[190]		Steel[1]
Butyl Alcohol	199	[390]	ALL	316 SS		27	[80]	ALL	Nickel
Butyric Acid	143	[290]	ALL	Carp. 20	Glucose	193	[380]	ALL	316 SS[1]
	199	[390]	ALL	316 SS[1]		27	[80]	ALL	Hast. B
Calcium Bisulfite	93	[200]	ALL	TFE	Glue	60	[140]	ALL	Steel[1]
	193	[380]	ALL	FEP		127	[260]	ALL	304 SS
	171	[340]	ALL	316 SS[1]	Glycerine	88	[190]	50%	Titanium
Calcium Chlorate	238	[460]	ALL	TFE	Hydrobromic Acid	121	[250]	50%	Hast. B[1]
	193	[380]	ALL	FEP		60	[140]	38%	Hast. B
	93	[200]	ALL	316 SS[1]	Hydrochloric Acid	238	[460]	ALL	TFE
Calcium Chloride (Saturated)	171	[340]	ALL	Hast. C	Hydrocyanic Acid	193	[380]	ALL	FEP
	93	[200]	ALL	Carp. 20[1]		171	[340]	ALL	316 SS[1]
Calcium Hydroxide	93	[200]	50%	Hast. C		238	[460]	ALL	TFE
	88	[190]	SAT.	304 SS[1]	Hydroflouric Acid	193	[380]	ALL	FEP
Carbonic Acid	293	[560]	ALL	Carp. 20		93	[200]	ALL	Hast. C[1]
	171	[340]	ALL	316 SS[1]		293	[560]	ALL	Carp. 20
Carbon Dioxide (Dry)	427	[800]	ALL	Brass	Hydrogen Chloride (Gas, Dry)	38	[100]	ALL	304 SS
Carbonated Beverages	100	[212]	ALL	304 SS	Hydrogen Flouride (Dry)	199	[390]	ALL	304 SS[1]
Carbon Disulfide	93	[200]	ALL	Titanium		88	[190]	90%	Hast. C
	199	[390]	ALL	316 SS[1]	Hydrogen Peroxide	71	[160]	ALL	316 SS
Carbon Tetrachloride	93	[200]	ALL	304 SS	Hydrogen Sulfide (Dry)	293	[560]	ALL	316 SS

All materials listed are rated < 2 Mils penetration/year except as noted: [1] = < 20 Mils penetration/year

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Corrosive Service Guide to Materials for Sheaths and Thermowells

Refer to A.S.M.E. Boiler Code, Section VIII for allowable stress levels

(Fluoropolymer coated thermowells and/or Fluoropolymer sheaths may be substituted for all corrosive agents listed)

CORROSIVE AGENT	TEMP. °C	TEMP. °F	CONC. %	RECOM. MATERIAL
Iodine	83	[190]	ALL	Hast. C
	21	[70]	ALL	Nickel
Kerosene	238	[460]	ALL	TFE
	193	[380]	ALL	FEP
	171	[340]		Steel[1]
Ketones	32	[90]	ALL	Hast. C
	127	[260]	ALL	316 SS[1]
Lactic Acid	154	[310]	ALL	Titanium
	116	[240]	ALL	Hast. B[1]
Lime (Sulfur)	238	[460]	ALL	TFE
	193	[380]	ALL	FEP
	154	[310]	ALL	316 SS[1]
Linseed Oil	60	[140]	ALL	Carp. 20
	27	[80]	ALL	Steel[1]
Magnesium Chloride	143	[290]	ALL	Nickel
	88	[190]	50%	Carp. 20[1]
Magnesium Hydroxide	93	[200]	ALL	304 SS
Magnesium Sulfate	93	[200]	60%	Nickel
	171	[340]	ALL	316 SS[1]
Mercuric Chloride	143	[290]	ALL	Tantalum
	77	[170]	10%	Hast. C[1]
Mercury	293	[560]	ALL	304 SS
Methyl Chloride (Dry)	171	[340]	ALL	316 SS
Methylene Chloride	93	[200]	ALL	Carp. 20
Milk	93	[200]		304 SS
Naphtha	16	[60]	ALL	446 SS
	116	[240]	ALL	304 SS[1]
Natural Gas	238	[460]		TFE
	193	[380]		FEP
	43	[110]		Steel[1]
Nickel Chloride	93	[200]	80%	Hast. C
Nickel Sulfate	82	[180]	10%	Tantalum
	93	[200]	ALL	304 SS[1]
Nitric Acid	21	[70]	ALL	304 SS
	93	[200]	40%	304 SS
Nitrobenzene	143	[290]	ALL	Carp. 20
	171	[340]	ALL	316 SS[1]
Oleic Acid	138	[280]	ALL	316 SS
Oleum	49	[120]	40%	Hast. C
	116	[240]	ALL	316 SS[1]
Oxalic Acid	93	[200]	ALL	Tantalum
	93	[200]	ALL	Carp. 20[1]
Oxygen	271	[520]	ALL	Tantalum
	16	[60]	ALL	446 SS
	171	[340]	ALL	316 SS[1]
Palmitic Acid	238	[460]	ALL	TFE
	193	[380]	ALL	FEP
	199	[390]	ALL	304 SS[1]
Phenol (Carbolic Acid)	293	[560]	ALL	316 SS
Phosphoric Acid	93	[200]	50-85%	Hast. C
Phosphoric	43	[110]	50-85%	Carp. 20
	171	[340]	ALL	316 SS
Phosphoric Solutions	27	[80]	ALL	Titanium
Picric Acid	21	[70]	ALL	Aluminum
	199	[390]	ALL	316 SS[1]
Potassium Bromide	93	[200]	30%	Titanium
	93	[200]	30%	446 SS
Potassium Carbonate	93	[200]	50%	304 SS
Potassium Chlorate	171	[340]	30%	316 SS
Potassium Hydroxide	93	[200]	50%	Nickel
Potassium Nitrate	171	[340]	80%	Aluminum
	277	[530]	80%	446 SS[1]
Potassium Permanganate	21	[70]	20%	Hast C.
	171	[340]	20%	316 SS[1]
Potassium Sulfate	171	[340]	10%	316 SS
Propane	60	[140]	ALL	446 SS
	27	[80]	ALL	Brass
Pyrogallic Acid	27	[80]	ALL	Copper
	171	[340]	ALL	316 SS[1]
Salicylic Acid	116	[240]	ALL	Hast. C
	171	[340]	ALL	316 SS[1]
Sea Water (Stagnant)				Monel®
Sea Water (Cavitation)				316 SS
Soap Solutions	16	[60]	ALL	446 SS
	54	[130]	ALL	Nickel[1]
Sodium Bicarbonate	171	[340]	20%	316 SS
Sodium Bisulfite	71	[160]	10%	316 SS
	93	[200]	10 - 40%	Carp. 20
Sodium Carbonate	93	[200]	30%	Carp. 20
	293	[560]	10-100%	Hast. B[1]
Sodium Chloride	27	[80]	30%	Nickel
Sodium Flouride	71	[160]	ALL	Monel®
	77	[170]	ALL	Carp. 20[1]
Sodium Hydroxide	104	[220]	ALL	Monel®
	71	[160]	ALL	316 SS[1]
Sodium Nitrate	171	[340]	60%	316 SS
Sodium Nitrite	93	[200]	Saturated	Titanium
	93	[200]	40%	304 SS[1]
Sodium Peroxide	16	[60]	10%	446 SS
	171	[340]	10%	316 SS[1]
Sodium Phosphate Acid	93	[200]	ALL	Titanium
	93	[200]	ALL	304 SS[1]
Sodium Silicate	27	[80]	ALL	446 SS[1]
	166	[330]	ALL	316 SS[1]
Sodium Sulfate	199	[390]	ALL	316 SS
Sodium Sulfide	238	[460]	50%	TFE
	193	[380]	50%	FEP
	93	[200]	50%	316 SS[1]
Sodium Sulfite	93	[200]	10%	304 SS
Sodium Thiosulfate	16	[60]	25%	446 SS
	116	[240]	ALL	316 SS[1]
Steam (Low Pressure)				Inconel
				304 SS[1]
(Medium Pressure)				Nickel
				304 SS[1]
(High Pressure)				316 SS[1]
Sulfur	293	[560]	ALL	304 SS
	871	[1600]	ALL	Alloy 556
Sulfur Chloride (Dry)	32	[90]	ALL	Tantalum
	293	[560]	ALL	Nickel[1]
Sulfur Dioxide (Dry)	49	[120]	ALL	Steel
	293	[560]	ALL	316 SS[1]
Sulfur Trioxide (Dry)	238	[460]	ALL	TFE
	193	[380]	ALL	FEP
	293	[560]	ALL	304 SS[1]
Sulfuric Acid	38	[100]	100%	Carp. 20
	121	[250]	60%	Hast. B
Sulfurous Acid	71	[160]	ALL	Titanium
	177	[350]	ALL	Carp. 20[1]
Tannic Acid	93	[200]	10 - 20%	Titanium
	93	[200]	ALL	304 SS[1]
Tartaric Acid	199	[390]	ALL	304 SS
Titanium Tetrachloride	27	[80]	ALL	Carp. 20
	138	[280]	ALL	Titanium
Toluene (Toluol)	171	[340]	ALL	Steel
	93	[200]	ALL	304 SS
Trichloroacetic Acid	238	[460]	ALL	TFE
	193	[380]	ALL	FEP
	93	[200]	ALL	Hast. C[1]
Trichloroethylene	71	[160]	ALL	Inconel®
Turpentine	88	[190]	ALL	304 SS
Whiskey and Wine			ALL	304 SS
Xylene (Xylol)	88	[190]	ALL	446 SS
Zinc Chloride	82	[180]	to 70%	Titanium
	293	[560]	ALL	Hast. B[1]
Zinc Sulfate	93	[200]	SAT.	316 SS

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All materials listed are rated < 2 Mils penetration/year except as noted: [1] = < 20 Mils penetration/year

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Fahrenheit and Celsius Conversion Chart

Read known temperature in bold face type. Corresponding temperature in degrees Fahrenheit will be found in column to the right. Corresponding temperature in degrees Celsius will be found in column to the left.

INTERPOLATION FACTORS

°C		°F	°C		°F
0.56	1	1.8	3.33	6	10.8
1.11	2	3.6	3.89	7	12.6
1.67	3	5.4	4.44	8	14.4
2.22	4	7.2	5.00	9	16.2
2.78	5	9.0	5.56	10	18.0

TEMPERATURE CONVERSION FORMULA

°C = (°F - 32) ÷ 1.8

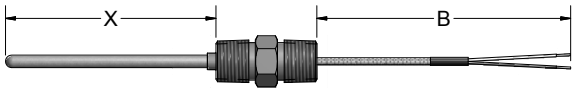
°F = (°C x 1.8) + 32

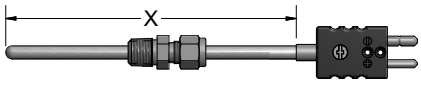
0 to 100						100 to 1000						1000 to 2000						2000 to 3000					
°C		°F	°C		°F	°C		°F	°C		°F	°C		°F	°C		°F	°C		°F	°C		°F
-17.8	**0**	32.	10.0	**50**	122.0	38	**100**	212	260	**500**	932	538	**1000**	1832	816	**1500**	2732	1093	**2000**	3632	1371	**2500**	4532
-17.8	**1**	33.8	10.6	**51**	123.8	43	**110**	230	266	**510**	950	543	**1010**	1850	821	**1510**	2750	1099	**2010**	3650	1377	**2510**	4550
-16.7	**2**	35.6	11.1	**52**	125.6	49	**120**	248	271	**520**	968	549	**1020**	1868	827	**1520**	2768	1104	**2020**	3668	1382	**2520**	4568
-16.1	**3**	37.4	11.7	**53**	127.4	54	**130**	266	277	**530**	986	554	**1030**	1886	832	**1530**	2786	1110	**2030**	3686	1388	**2530**	4586
-15.6	**4**	39.2	12.2	**54**	129.2	60	**140**	284	282	**540**	1004	560	**1040**	1904	838	**1540**	2804	1116	**2040**	3704	1393	**2540**	4604
-15.0	**5**	41.0	12.8	**55**	131.0	66	**150**	302	288	**550**	1022	566	**1050**	1922	843	**1550**	2822	1121	**2050**	3722	1399	**2550**	4622
-14.4	**6**	42.8	13.3	**56**	132.8	71	**160**	320	293	**560**	1040	571	**1060**	1940	849	**1560**	2840	1127	**2060**	3740	1404	**2560**	4640
-13.9	**7**	44.6	13.9	**57**	134.6	77	**170**	338	299	**570**	1058	577	**1070**	1958	854	**1570**	2858	1132	**2070**	3758	1410	**2570**	4658
-13.3	**8**	46.4	14.4	**58**	136.4	82	**180**	356	304	**580**	1076	582	**1080**	1976	860	**1580**	2876	1138	**2080**	3776	1416	**2580**	4676
-12.8	**9**	48.2	15.0	**59**	138.2	88	**190**	374	310	**590**	1094	588	**1090**	1994	866	**1590**	2894	1143	**2090**	3794	1421	**2590**	4694
-12.2	**10**	50.0	15.6	**60**	140.0	93	**200**	392	316	**600**	1112	593	**1100**	2012	871	**1600**	2912	1149	**2100**	3812	1427	**2600**	4712
-11.7	**11**	51.8	16.1	**61**	141.8	99	**210**	410	321	**610**	1130	599	**1110**	2030	877	**1610**	2930	1154	**2110**	3830	1432	**2610**	4730
-11.1	**12**	53.6	16.7	**62**	143.6	100	**212**	413	327	**620**	1148	604	**1120**	2048	882	**1620**	2948	1160	**2120**	3848	1438	**2620**	4748
-10.6	**13**	55.4	17.2	**63**	145.4	104	**220**	428	332	**630**	1166	610	**1130**	2066	888	**1630**	2966	1166	**2130**	3866	1443	**2630**	4766
-10.0	**14**	57.2	17.8	**64**	147.2	110	**230**	446	338	**640**	1184	616	**1140**	2084	893	**1640**	2984	1171	**2140**	3884	1449	**2640**	4784
-9.44	**15**	59.0	18.3	**65**	149.0	116	**240**	464	343	**650**	1202	621	**1150**	2102	899	**1650**	3002	1177	**2150**	3902	1454	**2650**	4802
-8.89	**16**	60.8	18.9	**66**	150.8	121	**250**	482	349	**660**	1220	627	**1160**	2120	904	**1660**	3020	1182	**2160**	3920	1460	**2660**	4820
-8.33	**17**	62.6	19.4	**67**	152.6	127	**260**	500	354	**670**	1238	632	**1170**	2138	910	**1670**	3038	1188	**2170**	3938	1466	**2670**	4838
-7.78	**18**	64.4	20.0	**68**	154.4	132	**270**	518	360	**680**	1256	638	**1180**	2156	916	**1680**	3056	1193	**2180**	3956	1471	**2680**	4856
-7.22	**19**	66.2	20.6	**69**	156.2	138	**280**	536	366	**690**	1274	643	**1190**	2174	921	**1690**	3074	1199	**2190**	3974	1477	**2690**	4874
-6.67	**20**	68.0	21.1	**70**	158.0	143	**290**	554	371	**700**	1292	649	**1200**	2192	927	**1700**	3092	1204	**2200**	3992	1482	**2700**	4892
-6.11	**21**	69.8	21.7	**71**	159.8	149	**300**	572	377	**710**	1310	654	**1210**	2210	932	**1710**	3110	1210	**2210**	4010	1488	**2710**	4910
-5.56	**22**	71.6	22.2	**72**	161.6	154	**310**	590	382	**720**	1328	660	**1220**	2228	938	**1720**	3128	1216	**2220**	4028	1493	**2720**	4928
-5.00	**23**	73.4	22.8	**73**	163.4	160	**320**	608	388	**730**	1346	666	**1230**	2246	943	**1730**	3146	1221	**2230**	4046	1499	**2730**	4946
-4.44	**24**	75.2	23.3	**74**	165.2	166	**330**	626	393	**740**	1364	671	**1240**	2264	949	**1740**	3164	1227	**2240**	4064	1504	**2740**	4964
-3.89	**25**	77.0	23.9	**75**	167.0	171	**340**	644	399	**750**	1382	677	**1250**	2282	954	**1750**	3182	1232	**2250**	4082	1510	**2750**	4982
-3.33	**26**	78.8	24.4	**76**	168.8	177	**350**	662	404	**760**	1400	682	**1260**	2300	960	**1760**	3200	1238	**2260**	4100	1516	**2760**	5000
-2.78	**27**	80.6	25.0	**77**	170.6	182	**360**	680	410	**770**	1418	688	**1270**	2318	966	**1770**	3218	1243	**2270**	4118	1521	**2770**	5018
-2.22	**28**	82.4	25.6	**78**	172.4	188	**370**	698	416	**780**	1436	693	**1280**	2336	971	**1780**	3236	1249	**2280**	4136	1527	**2780**	5036
-1.67	**29**	84.2	26.1	**79**	174.2	193	**380**	716	421	**790**	1454	699	**1290**	2354	977	**1790**	3254	1254	**2290**	4154	1532	**2790**	5054
-1.11	**30**	86.0	26.7	**80**	176.0	199	**390**	734	427	**800**	1472	704	**1300**	2372	982	**1800**	3272	1260	**2300**	4172	1538	**2800**	5072
-0.56	**31**	87.8	27.2	**81**	177.8	204	**400**	752	432	**810**	1490	710	**1310**	2390	988	**1810**	3290	1266	**2310**	4190	1543	**2810**	5090
0	**32**	89.6	27.8	**82**	179.6	210	**410**	770	438	**820**	1508	716	**1320**	2408	993	**1820**	3308	1271	**2320**	4208	1549	**2820**	5108
0.56	**33**	91.4	28.3	**83**	181.4	216	**420**	788	443	**830**	1526	721	**1330**	2426	999	**1830**	3326	1277	**2330**	4226	1554	**2830**	5126
1.11	**34**	93.2	28.9	**84**	183.2	221	**430**	806	449	**840**	1544	727	**1340**	2444	1004	**1840**	3344	1282	**2340**	4244	1560	**2840**	5144
1.67	**35**	95.0	29.4	**85**	185.0	227	**440**	824	454	**850**	1562	732	**1350**	2462	1010	**1850**	3362	1288	**2350**	4262	1566	**2850**	5162
2.22	**36**	96.8	30.0	**86**	186.8	232	**450**	842	460	**860**	1580	738	**1360**	2480	1016	**1860**	3380	1293	**2360**	4280	1571	**2860**	5180
2.78	**37**	98.6	30.6	**87**	188.6	238	**460**	860	466	**870**	1598	743	**1370**	2498	1021	**1870**	3398	1299	**2370**	4298	1577	**2870**	5198
3.33	**38**	100.4	31.1	**88**	190.4	243	**470**	878	471	**880**	1616	749	**1380**	2516	1027	**1880**	3416	1304	**2380**	4316	1582	**2880**	5216
3.89	**39**	102.2	31.7	**89**	192.2	249	**480**	896	477	**890**	1634	754	**1390**	2534	1032	**1890**	3434	1310	**2390**	4334	1588	**2890**	5234
4.44	**40**	104.0	32.2	**90**	194.0	254	**490**	914	482	**900**	1652	760	**1400**	2552	1038	**1900**	3452	1316	**2400**	4352	1593	**2900**	5252
5.00	**41**	105.8	32.8	**91**	195.8				488	**910**	1670	766	**1410**	2570	1043	**1910**	3470	1321	**2410**	4370	1599	**2910**	5270
5.56	**42**	107.6	33.3	**92**	197.6				493	**920**	1688	771	**1420**	2588	1049	**1920**	3488	1327	**2420**	4388	1604	**2920**	5288
6.11	**43**	109.4	33.9	**93**	199.4				499	**930**	1706	777	**1430**	2606	1054	**1930**	3506	1332	**2430**	4406	1610	**2930**	5306
6.67	**44**	111.2	34.4	**94**	201.2				504	**940**	1724	782	**1440**	2624	1060	**1940**	3524	1338	**2440**	4424	1616	**2940**	5324
7.22	**45**	113.0	35.0	**95**	203.0				510	**950**	1742	788	**1450**	2642	1066	**1950**	3542	1343	**2450**	4442	1621	**2950**	5342
7.78	**46**	114.8	35.6	**96**	204.8				516	**960**	1760	793	**1460**	2660	1071	**1960**	3560	1349	**2460**	4460	1627	**2960**	5360
8.33	**47**	116.6	36.1	**97**	206.6				521	**970**	1778	799	**1470**	2678	1077	**1970**	3578	1354	**2470**	4478	1632	**2970**	5378
8.89	**48**	118.4	36.7	**98**	208.4				527	**980**	1796	804	**1480**	2696	1082	**1980**	3596	1360	**2480**	4496	1638	**2980**	5396
9.44	**49**	120.2	37.2	**99**	210.2				532	**990**	1814	810	**1490**	2714	1088	**1990**	3614	1366	**2490**	4514	1643	**2990**	5414
			37.8	**100**	212.0				538	**1000**	1832				1093	**2000**	3632				1649	**3000**	5432

MgO

Configuration Code Mg01
MgO Insulated Thermocouples with Extension Leadwire
Configuration Code Mg02
MgO Insulated Thermocouples with Sheath Terminations

A Pyromation MgO thermocouple assembly consists of a thermocouple element swaged in hard-packed, standard-purity (96%) Magnesium Oxide mineral insulation and encased in a metal sheath. Thermocouple sheaths have been fully annealed; they can be formed into many configurations, and can be bent into a radius of twice the size of its outer sheath. The tables found on this page and the following pages allow customer selection of standard thermocouple types, sheath diameters, mounting fittings and terminations. Custom built products are available upon request.





ORDER CODES

Example Order Number:

1-1	1-2	1-3	1-4	1-4 A		1-5		
K	**4**	**8**	**G**	**M**	**-**	**012**	**-**	For Optional Sheath Mounting Fittings See Page MgO-2

1-1 Thermocouple Types

CODE		
SINGLE	***DUPLEX***	***TRIPLEX***
E	EE	-
J	JJ	JJJ
K	KK	KKK
T	TT	-
N	NN	-

1-2 Sheath Diameters

CODE	DIAMETER (inches)
1	1/16 [1]
2	1/8
3	3/16
4	1/4
6	3/8
[1] 1/16" will be coiled unless otherwise specified for 36" and longer lengths.	

1-3 Sheath Materials

CODE	MATERIAL	STANDARD AVAILABLE TYPES
3	Alloy 600	K, N
4	310 Stainless steel	K
5	446 Stainless steel	K[1]
8	316 Stainless steel	E, J, K, T
[1] All sensors with 446SS sheaths must have an ungrounded measuring junction.		

1-5 "X" Dimension

Insert three digit sheath length ("X" Dimension) in inches
Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

1-4 A Special Options

CODE	DESCRIPTION
M	Special limits of error
H	High-Purity MgO Insulation (99.4% Pure)
Use this table only if options are desired.	

1-4 Measuring Junctions

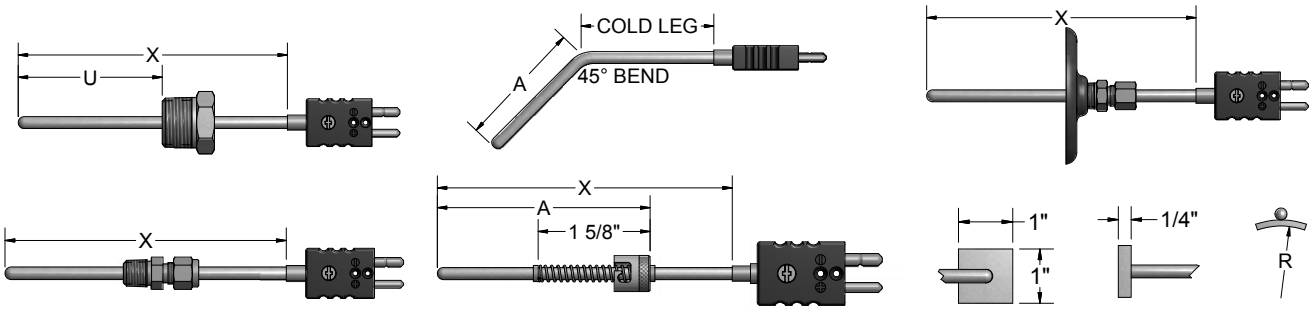
CODE	DESCRIPTION
G	Grounded junction
U	Ungrounded junction
E[1]	Exposed junction
S	Exposed shielded junction
[1] Not available with 1/16" O.D..	

1-2 A Reduced-Tip MgO Thermocouples

CODE	NORMAL SHEATH DIA. O.D. (inches)	TIP DIA. (inches)	TIP LENGTH (inches)	MATERIAL
88R48	1/2	1/4	1 (1/4)	316 SS
68R38	3/8	3/16	1 (1/4)	316 SS
48R28	1/4	1/8	1 (1/4)	316 SS

Table 1-2 A lists thermocouple elements with reduced-tip sheaths. To order, use order code numbers from Tbl. 1-2 A in place of straight sheath order code numbers from Tbl. 1-2 and 1-3. EXAMPLE: J88R48

Select Sheath Mounting or Bend Options as desired from tables below.



ORDER CODES

Example Order Number: **K48GM - 012 - 01A,306 - Page MgO-3 - Page MgO-4 - Page MgO-5**

2

2-1 No Fitting or Bend Options

CODE	00

2-2 One-Time Adjustable Compression Fittings

CODE	TYPE	NPT SIZE (inches)	PRESSURE RATED	AVAILABLE SHEATH DIAMETERS (inches)
01A	303 Stainless steel	1/8	NO	1/16, 1/8, 3/16, 1/4
05A	316 Stainless steel	1/8	YES	1/16, 1/8, 3/16, 1/4
05B	316 Stainless steel	1/4	YES	1/8, 3/16, 1/4, 3/8
05C	316 Stainless steel	1/2	YES	1/8, 3/16, 1/4, 3/8
15A	Brass	1/8	NO	1/8, 3/16, 1/4
15B	Brass	1/4	NO	3/16, 1/4, 3/8
15C	Brass	1/2	NO	1/4, 3/8

2-3 Re-Adjustable Compression Fittings

CODE	TYPE	NPT SIZE (inches)	AVAILABLE SHEATH DIAMETERS (inches)
10A	303 Stainless steel	1/8	1/16, 1/8, 3/16
10B	303 Stainless steel	1/4	1/4, 3/8
10C	303 Stainless steel	1/2	1/4, 3/8
12A	316 Stainless steel	1/8	1/16, 1/8, 3/16, 1/4
12B	316 Stainless steel	1/4	1/8, 3/16, 1/4, 3/8
12C	316 Stainless steel	1/2	1/8, 3/16, 1/4, 3/8
11A	Brass	1/8	1/16, 1/8, 3/16, 1/4
11B	Brass	1/4	1/8, 3/16, 1/4, 3/8
11C	Brass	1/2	1/4, 3/8
19C	Spring-loaded SS well fitting	1/2	3/16, 1/4

FEP gland standard 204 ºC [400 ºF] max. For lava gland 649 ºC [1200 ºF] max. opt. 10A, 10B, and 10C only use letter suffix "L" after compression fitting order code. EXAMPLE: 10AL for lava gland.

2-4 Fixed Bushings

CODE *316 SS*	MOUNTING THREAD NPT (inches)	AVAILABLE SHEATH DIAMETERS (inches)
8A _ _ [1]	1/8	1/16, 1/8, 3/16, 1/4
8B _ _ [1]	1/4	1/16, 1/8, 3/16, 1/4, 3/8
8C _ _ [1]	1/2	1/8, 3/16, 1/4, 3/8
8D _ _ [1]	3/4	1/8, 3/16, 1/4, 3/8

[1] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

2-5 Sheath Bends

CODE	DESCRIPTION
2 _ _	Sheath bent 45º
3 _ _	Sheath bent 90º

When ordering bend options, specify hot leg dim. "A". EX: order code 206 is a 45º bend with 6" hot leg. Total sheath length in Table 1, referred to as "X" length = hot leg plus cold leg.

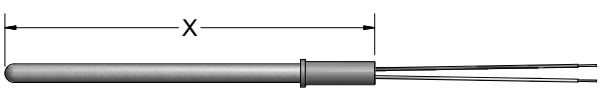
2-6 Weld Pads

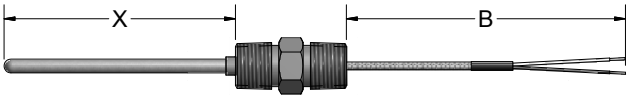
CODE	DESCRIPTION
17	316 SS weld pad 1" x 1" x 1/4" thick perpendicular mount
18	316 SS weld pad 1" x 1" x 1/4" thick horizontal mount
17R	316 SS weld pad 1" x 1" x 1/8" thick perpendicular mount with radius bend (specify radius)
18R	316 SS weld pad 1" x 1" x 1/8" thick horizontal mount with radius bend (specify radius)

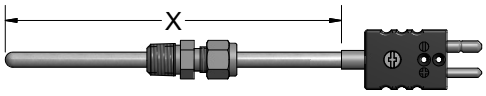
2-7 Miscellaneous Options

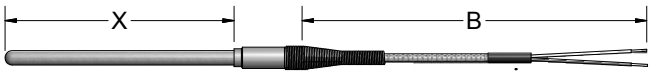
CODE	DESCRIPTION	AVAILABLE SHEATH DIAMETERS (inches)
13A _ _ [1]	Spring-loaded bayonet fitting	1/8, 3/16
14	Adjustable flange with brass compression fitting	1/8, 3/16, 1/4, 3/8
16A	Compression fitting with bayonet cap and spring	1/8 (2 5/8" min. "A" dim.)

[1] When ordering fixed bayonet fitting, specify hot leg dimension "A". EXAMPLE: order code 13A06 for a fixed bayonet adapter with 6" hot leg. Total sheath length is Table 1 "X" length = hot leg plus cold leg.









MgO2 ORDER CODES MgO1

Example Order Number: **K48GM - 012 - 15C - 4, MC or K48GM - 012 - 00 - 16 - Page MgO-4 - Page MgO-5**

(3-1 points to "4, MC"; 3-2 points to "16")

3-1 Plug and Jack Sheath Terminations

CODE	DESCRIPTION
4	Standard plug
5	Standard jack
6[1]	Miniature plug
7[1]	Miniature jack
	Options
MC	Mating connector
HT	High temp connector 385 ºC [725 ºF]
SP[2]	Solid pin plug
CL[3]	Compression L bracket to hold plug to sheath

[1] Not available with 1/4 or 3/8" O.D. sheath.
[2] Standard with 385 °C [725 °F]
[3] Not available with miniature connector

3-1 Sheath Terminations

CODE	DESCRIPTION
10	2" stripped leads (insert two digit strip length for other lengths - ex. 10(03")
14[1]	Ceramic wafer block

[1] Only available on 1/8, 3/16, 1/4" O.D. sheath.

3-2 Leadwire Transitions

(Requires Table 4 and 5 selections)

CODE	DESCRIPTION
15	Extension leadwire transition with relief spring 204 ºC [400 °F]
16	Extension leadwire transition with heat-shrink tubing 104 ºC [220 °F]
13[1]	Same size transition with heat-shrink tubing 104 ºC [220 °F]
18[1]	Same size transition without heat-shrink tubing 204 ºC [400 °F]
19	Extension leadwire transition w/o spring or heat-shrink tubing 204 ºC [400 °F]
	Options
HT[2]	High-temperature potting 538 ºC [1000 ºF]

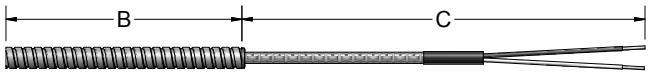
[1] Not available with Flex Armor
[2] Not available with option 13 or 16. When specifying high temp potting with Flex Armor, Option 19 must be selected.

3-2 Threaded Fittings with Extension Leadwire

(Requires Table 4 and 5 selections)

CODE	DESCRIPTION
6HN23	1/2" x 1/2" NPT steel hex nipple
8HN23	1/2" x 1/2" NPT stainless steel hex nipple
9HP23	1/2" NPT stainless steel bushing (no process threads)
8RNDC23	3/4" process x 1/2" NPT stainless steel hex nipple

Select desired leadwire type by order code number, followed by desired length in inches



ORDER CODES

Example Order Number: **K48GM - 012 - 01A,306 - 15 - F1048 - Page MgO-5**

4 5

4

	CODE	DESCRIPTION	AVAILABLE CALIBRATIONS					TEMP. RATING
Fiberglass	F1	Fiberglass insulation - solid conductor	J	K	T	E	N	482 ºC [900 ºF]
	F1A	Fiberglass insulation - solid conductor - flexible armor	J	K	T	E	N	482 ºC [900 ºF]
	F1B	Fiberglass insulation - solid conductor - stainless steel overbraid	J	K	T	E		482 ºC [900 ºF]
	F3	Fiberglass insulation - stranded conductor	J	K	T	E		482 ºC [900 ºF]
	F3A	Fiberglass insulation - stranded conductor - flexible armor	J	K	T	E		482 ºC [900 ºF]
	F3B	Fiberglass insulation - stranded conductor - stainless steel overbraid	J	K	T			482 ºC [900 ºF]
	H1	Hi-temp fiberglass insulation - solid conductor	J	K				704 ºC [1300 ºF]
	H1A	Hi-temp fiberglass insulation - solid conductor - flexible armor	J	K				704 ºC [1300 ºF]
	H1B	Hi-temp fiberglass insulation - solid conductor - stainless steel overbraid	J	K				704 ºC [1300 ºF]
Fluoropolymer	T3J	Individual stranded fluoropolymer leads - 12 inch limit	J	K				204 ºC [400 ºF]
	T1	Fluoropolymer insulation - solid conductor	J	K	T		N	204 ºC [400 ºF]
	T1A	Fluoropolymer insulation - solid conductor - flexible armor	J	K	T		N	204 ºC [400 ºF]
	T1B	Flouropolymer insulation - solid conductor - stainless steel overbraid	J	K				204 ºC [400 ºF]
	T1M	Fluoropolymer insulation - solid conductor - polyester shield	J	K				204 ºC [400 ºF]
	T3	Fluoropolymer insulation - stranded conductor	J	K	T	E		204 ºC [400 ºF]
	T3A	Fluoropolymer insulation - stranded conductor - flexible armor	J	K	T	E		204 ºC [400 ºF]
	T3B	Fluoropolymer insulation - stranded conductor - stainless steel overbraid	J	K				204 ºC [400 ºF]
PVC	P5	PVC insulation - solid conductor	J	K	T	E	N	105 ºC [221 ºF]
	P7	PVC insulation - stranded conductor	J	K				105 ºC [221 ºF]
	P5M	PVC insulation - solid conductor - polyester shield	J	K	T			105 ºC [221 ºF]
	P7M	PVC insulation - stranded conductor - polyester shield	J	K				105 ºC [221 ºF]
	C3060	PVC insulated coil cord - stranded; 60" extended	J	K	T	E		105 ºC [221 ºF]
	C3120	PVC insulated coil cord - stranded; 120" extended	J	K	T			105 ºC [221 ºF]
Polyimide	K1	Polyimide insulation - solid conductor	J	K				316 ºC [600 ºF]
	K1A	Polyimide insulation - solid conductor - flexible armor	J	K				316 ºC [600 ºF]
	K3	Polyimide insulation - stranded conductor	J	K				316 ºC [600 ºF]
	K3A	Polyimide insulation - stranded conductor - flexible armor	J	K				316 ºC [600 ºF]

Insert wire code number and 3 digit "B" length code. **Example: F1036 = 36" "B" length.**

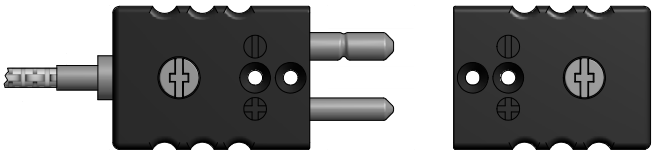
For assemblies requiring leadwire beyond the flexible armor, illustrated as "C" in drawing, insert 3 digit "C" length after armor length. **Example: T1A036-012 = 36" "B" length with additional 12" "C" length leads beyond armor.**

Insulated leadwires in flexible armor are available with either extruded PVC or FEP covering over the flexible armor. Substitute suffix codes T (FEP) or P (PVC) for the suffix "A" code above. **Example: T3T is FEP covered armor.**

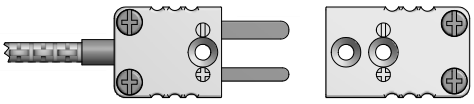
Duplex elements supplied with individual leads.

Select desired leadwire termination and options (if desired) by order code numbers below

OPTIONS 4 OR 4,MC

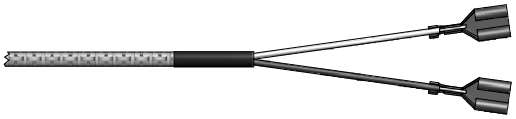


OPTIONS 6 OR 6,MC



OPTION 3

OPTION 8



ORDER CODES

Example Order Number: **K48GM - 012 - 01A,306 - 15 - F1048 - 4, CC**

5-1 5-2

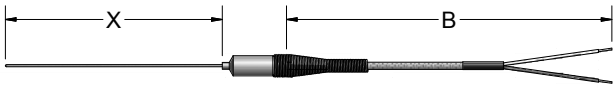
5-1 Terminations

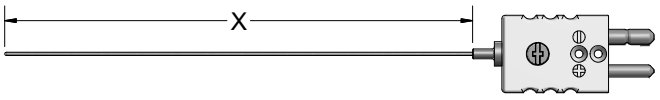
CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" quick disconnect female terminal lugs

5-2 Options

CODE	DESCRIPTION
BX	1/2" NPT BX connector with Opt. 0, 2, 3, or 8
CC	Plug or jack secured to leads with cable clamp
RB	Rubber boot
SP[1]	Solid pin plug
CG	Cord grip (1/2" NPT weatherproof PVC connector)
MC	Mating connector
HT	High temp. connector 385 °C [725 °F]
[1] Standard with 385 °C [725 °F]	

Miniature thermocouple assemblies have very small swaged sheath diameters containing standard-purity MgO (96%) insulated thermocouple elements. The small sheath size provides accurate and fast response time temperature measurement in a variety of laboratory, process, and special applications. These units are only offered with ungrounded junctions to prolong their useful life. Illustrated below are the most commonly used assemblies, however, other sensor configurations are available upon request.





ORDER CODES

Example Order Number:

1-1	1-2	1-3	1-4		2		3		4		5
J	040	8	U	-	012	-	00	-	16	-	PAGE MGO-7	-	PAGE MGO-7

1-1 Thermocouple Types

CODE
J
K

1-2 Sheath Diameter

CODE	DIAMETER (INCHES)
032	0.032
040	0.040

1-3 Sheath Material

CODE	MATERIAL
3	Alloy 600
8	316 Stainless steel

1-4 Measuring Junction

CODE	MATERIAL
U	Ungrounded junction
M	Special limits (consult factory)

2 "X" Dimension

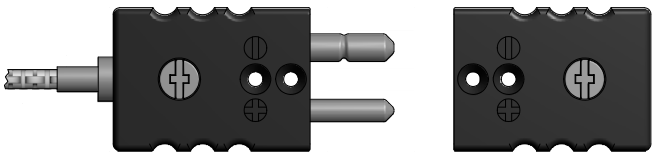
Insert three digit sheath length ("X" Dimension) in inches

3 Sheath Terminations

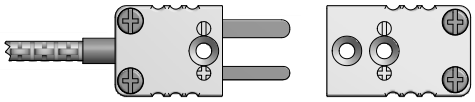
CODE	DESCRIPTION
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
Options	
MC	Mating connector
	Leadwire Transitions
15	Extension leadwire transition fitting with relief spring 204 ºC [400 °F]
16	Extension leadwire transition fitting with heat-shrink tubing 104 ºC [220 °F]
19	Extension leadwire transition ftg. w/o relief spring or heat-shrink tubing 204 ºC [400 °F]
Options	
HT[1]	High Temperature Potting 538 ºC [1000 °F]
[1] Not available with option 16. When specifying flex armor, Option 19 must be selected.	

Select desired extension leadwire type (in inches) and leadwire termination and options (if desired) by order code number from the tables below.

OPTIONS 4 OR 4,MC

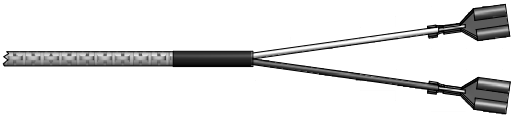


OPTIONS 6 OR 6,MC



OPTION 3

OPTION 8



ORDER CODES

Example Order Number: **J0408UM - 012 - 00 - 16 - F1048 - 6**

(4 = F1048, 5 = 6)

4 Extension Leadwire

	CODE	DESCRIPTION	AVAILABLE CALIBRATIONS		TEMP. RATING
Fiberglass	F1	Fiberglass insulation - solid conductor	J	K	482 ºC [900 ºF]
	F1A	Fiberglass insulation - solid conductor - flexible armor	J	K	482 ºC [900 ºF]
	F1B	Fiberglass insulation - solid conductor - stainless steel overbraid	J	K	482 ºC [900 ºF]
	F3	Fiberglass insulation - stranded conductor	J	K	482 ºC [900 ºF]
	F3B	Fiberglass insulation - stranded conductor - stainless steel overbraid	J	K	482 ºC [900 ºF]
Fluoropoly-mer	T1	Fluoropolymer insulation - solid conductor	J	K	204 ºC [400 ºF]
	T1A	Fluoropolymer insulation - solid conductor - flexible armor	J	K	204 ºC [400 ºF]
	T3	Fluoropolymer insulation - stranded conductor	J	K	204 ºC [400 ºF]
PVC	P5	PVC insulation - solid conductor	J	K	105 ºC [221 ºF]

Insert wire code number and 3 digit "B" length code. Example: F1036 = 36" "B" Length

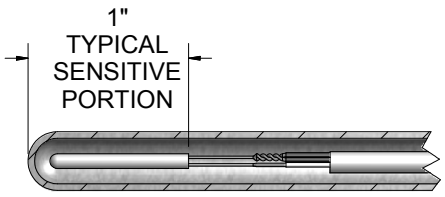
5 Terminations

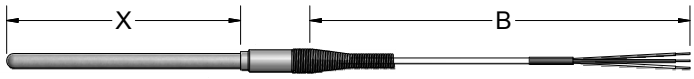
CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
Options	
MC	Mating connector
CC	Plug or jack secured to leads with cable clamp

RTD

Configuration Code RT01
RTD Assemblies with Extension Leadwire
Configuration Code RT02
RTD Assemblies with Sheath Terminations

The RTD elements illustrated and described on this page are designed to measure temperature in a variety of process and laboratory applications. These RTDs are specifically designed for use in two different process temperature ranges and will provide accurate and repeatable temperature measurement through a broad range. Low range RTDs are constructed using fluoropolymer-insulated, silver-plated copper internal leads with potting compounds to resist moisture penetration. High range RTDs are constructed with nickel internal leads inside swaged MgO insulated cable to allow higher temperature measurements at the RTD element and provide higher temperature lead protection along the sheath. The following tables allow customer selection of standard element materials, tolerances, sheath diameters, mounting fittings and terminations. Custom-built assemblies with non-standard specifications are available upon request.





ORDER CODES

Example Order Number:

1-1	1-2(A)	1-3		1-4		Page RTD-2		Page RTD-3		Page RTD-4		Page RTD-5
R5T185L	**48**	**3**	**-**	**006**	**-**		**-**		**-**		**-**	

1-1 Single Platinum RTD Elements

1-2 Available Sheath Diameters 316SS

CODE	TOLERANCE[1]	TEMP. RANGE	BASE RESISTANCE @ 0 ºC (R_0)	TEMPERATURE COEFFICIENT	CODE			
					1/8" O.D.	*3/16" O.D.*	*1/4" O.D.*	*3/8" O.D.*
R1T185L	Grade B	(-200 to 200) °C	100 Ω	α = 0.003 85 ºC^{-1}	28	38	48	68
R3T185L	Class AA	(-50 to 200) °C	100 Ω	α = 0.003 85 ºC^{-1}	28	38	48	68
R5T185L	(1/5) Class B	(-30 to 150) °C	100 Ω	α = 0.003 85 ºC^{-1}	28	38	48	68
R1T192L	Grade B	(-200 to 200) °C	100 Ω	α = 0.003 92 ºC^{-1}	28	38	48	68
R3T192L	Class AA	(-50 to 200) °C	100 Ω	α = 0.003 92 ºC^{-1}	28	38	48	68
RBF185L	Class B	(-50 to 200) °C	100 Ω	α = 0.003 85 ºC^{-1}	28	38	48	68
RAF185L	Class A	(-30 to 200) °C	100 Ω	α = 0.003 85 ºC^{-1}	28	38	48	68
RBF195L	Class B	(-50 to 200) °C	1000 Ω	α = 0.003 85 ºC^{-1}	28	38	48	68
R1T185H	Grade B	(-200 to 600) °C	100 Ω	α = 0.003 85 ºC^{-1}	28	38	48	68
RAT185H	Class A	(-100 to 450) °C	100 Ω	α = 0.003 85 ºC^{-1}	28	38	48	68
R1T192H	Grade B	(-200 to 600) °C	100 Ω	α = 0.003 92 ºC^{-1}	28	38	48	68

[1] Refer to RTD tolerance information in the general information section for calculations to determine specific tolerance at temperature.

1-4 Length

CODE
3 Digit 'X' Length

1-3 Element Connection

CODE	DESCRIPTION
2	2-wire
3	3-wire
4[1]	4-wire

[1] Not available in duplex

1-1 Duplex Platinum RTD Elements

1-2 Available Sheath Diameters 316SS

CODE	TOLERANCE[1]	TEMP. RANGE	BASE RESISTANCE @ 0 ºC (R_0)	TEMPERATURE COEFFICIENT	CODE		
					3/16" O.D.	*1/4" O.D.*	*3/8" O.D.*
R1T285L	Grade B	(-200 to 200) °C	100 Ω	α = 0.003 85 ºC^{-1}	38	48	68
R3T285L	Class AA	(-50 to 200) °C	100 Ω	α = 0.003 85 ºC^{-1}	38	48	68
R5T285L	(1/5) Class B	(-30 to 150) °C	100 Ω	α = 0.003 85 ºC^{-1}	38	48	68
R1T292L	Grade B	(-200 to 200) °C	100 Ω	α = 0.003 92 ºC^{-1}	38	48	68
R3T292L	Class AA	(-50 to 200) °C	100 Ω	α = 0.003 92 ºC^{-1}	38	48	68
RBF285L	Class B	(-50 to 200) °C	100 Ω	α = 0.003 85 ºC^{-1}	38	48	68
RAF285L	Class A	(-30 to 200) °C	100 Ω	α = 0.003 85 ºC^{-1}	38	48	68
RBF295L	Class B	(-50 to 200) °C	1000 Ω	α = 0.003 85 ºC^{-1}	38	48	68
R1T285H	Class B	(-200 to 600) °C	100 Ω	α = 0.003 85 ºC^{-1}	38	48	68
RAT285H	Class A	(-100 to 450) °C	100 Ω	α = 0.003 85 ºC^{-1}	38	48	68
R1T292H	Grade B	(-200 to 600) °C	100 Ω	α = 0.003 92 ºC^{-1}	38	48	68

[1] Refer to RTD tolerance information in the general information section for calculations to determine specific tolerance at temperature.

1-2A

CODE	NOMINAL SHEATH DIAMETER (inches)	TIP DIA. O.D. (inches)	TIP LENGTH (inches)
88R48	1/2	1/4	1 1/4
68R38	3/8	3/16	1 1/4
48R28	1/4	1/8	1 1/4

REDUCED-TIP RTD's

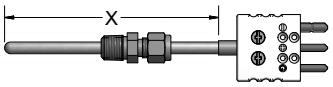
Table 1-2A lists RTD elements with reduced tip sheaths. To order, use order code numbers from Tbl. 1-2A in place of straight sheath order code numbers from Tbl. 1-2. Other reduced tips are available upon request. EXAMPLE: R1T185L**88R483**-006.

Configuration Code RT01
Configuration Code RT02

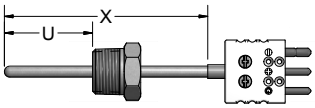
Optional Sheath Mounting Fittings and Bends

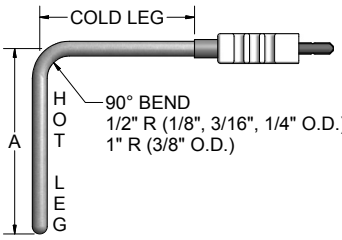
Select Sheath Mounting or Bend Options as desired from tables below.

COMPRESSION FITTING

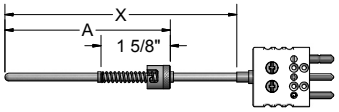


FIXED BUSHING

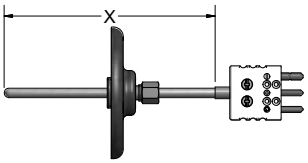




BAYONET CAP and SPRING (OPTION 13A)



ADJUSTABLE FLANGE (OPTION 14)



ORDER CODES

Example Order Number: **R5T185L483-006 - 01A,304 - PAGE RTD 3 - PAGE RTD 4 - PAGE RTD 5**

(2)

2-1 No Fitting or Bend Options

CODE	
	00

2-2 One-time Adjustable Compression Fittings

CODE	TYPE	NPT SIZE (inches)	PRESSURE RATED	AVAILABLE SHEATH DIAMETERS (inches)
01A	303 stainless steel	1/8	NO	1/8, 3/16, 1/4
05A	316 stainless steel	1/8	YES	1/8, 3/16, 1/4
05B	316 stainless steel	1/4	YES	1/8, 3/16, 1/4, 3/8
05C	316 stainless steel	1/2	YES	1/8, 3/16,1/4, 3/8
15A	Brass	1/8	NO	1/8, 3/16, 1/4
15B	Brass	1/4	NO	3/16, 1/4, 3/8
15C	Brass	1/2	NO	1/4, 3/8

2-3 Re-adjustable Compression Fittings

CODE	TYPE	NPT SIZE (inches)	AVAILABLE SHEATH DIAMETERS (inches)
10A	303 stainless steel	1/8	1/8, 3/16
10B	303 stainless steel	1/4	1/4, 3/8
10C	303 stainless steel	1/2	1/4, 3/8
12A	316 stainless steel	1/8	1/8, 3/16, 1/4
12B	316 stainless steel	1/4	1/8, 3/16, 1/4, 3/8
12C	316 stainless steel	1/2	1/8, 3/16, 1/4, 3/8
11A	Brass	1/8	1/8, 3/16, 1/4
11B	Brass	1/4	1/8, 3/16, 1/4, 3/8
11C	Brass	1/2	1/4, 3/8
19C	Spring-loaded SS well fitting	1/2	3/16, 1/4
FEP gland standard 204 ºC [400 °F] max. For lava gland 649 ºC [1200 °F] max. opt. 10A, 10B, and 10C only use letter suffix "L" after compression fitting order code. EXAMPLE: 10AL for lava gland.			

2-6 Miscellaneous Options

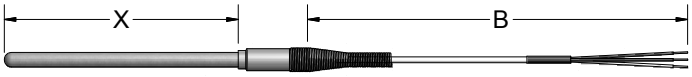
CODE	TYPE	AVAILABLE SHEATH DIAMETER (inches)
13A _ _ [1]	Spring-loaded bayonet fitting	1/8, 3/16
14	Adjustable flange with brass compression fitting	1/8, 3/16, 1/4, 3/8
16A	Spring-loaded adjustable bayonet compression fitting	1/8
[1] When ordering fixed bayonet fitting specify dimension "A". EXAMPLE: order code 13A06 is for a fixed bayonet adapter with 6" A Dimension.		

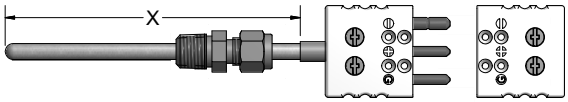
2-5 Fixed Bushings

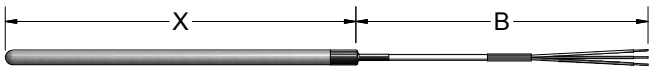
CODE 316 SS	MOUNTING THREAD NPT (inches)	AVAILABLE SHEATH DIAMETERS (inches)
8A _ _ [1]	1/8	1/8, 3/16, 1/4
8B _ _ [1]	1/4	1/8, 3/16, 1/4, 3/8
8C _ _ [1]	1/2	1/8, 3/16, 1/4, 3/8
8D _ _ [1]	3/4	1/8, 3/16, 1/4, 3/8
[1] When ordering fixed bushings, specify order code above, plus insertion length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.		

2-4 Sheath Bends

CODE	DESCRIPTION
2 _ _	Sheath bent 45º
3 _ _	Sheath bent 90º
2" minimum hot leg length	
When ordering bend options, specify hot leg dim. "A". EXAMPLE: order code 206 is a 45° bend with 6" hot leg. Total sheath length is Table 1 "X" length = hot leg plus cold leg.	







RT02 ORDER CODES RT01

Example Order Number:

R5T185L483-006-00 - 4, MC or R5T185L483-006-01A,304 - 16 - PAGE RTD-4 - PAGE RTD-5

(3-1: 4, MC — 3-2: 16)

3-1 Plug and Jack Sheath Terminations

CODE	DESCRIPTION
4	Standard plug
5	Standard jack
6[1]	Miniature plug
7[1]	Miniature jack
	Options
MC	Mating connector
CL[2]	Compression L bracket to hold plug to sheath
[1] Not available with 1/4" O.D. or 3/8" O.D. sheath [2] Not available with miniature connector	

3-2 Leadwire transitions

(Requires Table 4 and 5 selections)

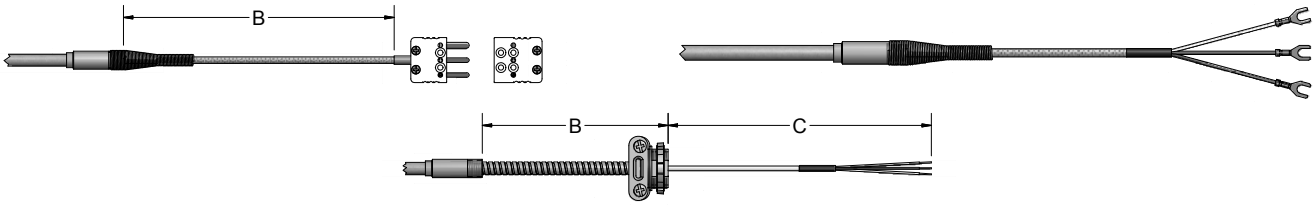
CODE	DESCRIPTION
13[1]	Same size transition with heat-shrink tubing 104 ºC [220 ºF]
15	Extension leadwire transition with relief spring 204 ºC [400 ºF]
16	Extension leadwire transition with heat-shrink tubing 104 ºC [220 ºF]
18[1]	Same size transition without heat-shrink tubing 204 ºC [400 ºF]
19	Extension leadwire transition without spring or heat-shrink tubing 204 ºC [400 ºF]
	Options
HT[2]	High temperature potting 538 ºC [1000 ºF] not available with option 13 or 16
[1] Not available with flex armor	
[2] Not available with option 13 or 16. When specifying high temp potting with Flex Armor option 19 must be selected.	

3-2 Threaded Fittings with Extension Leadwire

(Requires Table 4 and 5 selections)

CODE	DESCRIPTION
6HN23	1/2" x 1/2" NPT steel hex nipple
8HN23	1/2" x 1/2" NPT stainless steel hex nipple
9HP23	1/2" NPT stainless steel bushing (no process threads)
8RNDC23	3/4" process x 1/2" NPT stainless steel hex nipple

Select desired leadwire type by order code number, followed by desired length in inches.



ORDER CODES

Example Order Number: **R5T185L483-006-01A,304-16 - T3 036 -** PAGE RTD-5

4 5

4 Extension Leadwire Type and B + C Dimension

CODE	DESCRIPTION	TEMP. RATING
FIBERGLASS		
F3J_ _ _	Fiberglass insulation - individual leads - stranded conductor (12" limit)	482 ºC [900 ºF]
F3_ _ _	Fiberglass insulation - stranded conductor	
F3A_ _ _	Fiberglass insulation - stranded conductor - flexible armor	
F3B_ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid	
FLUOROPOLYMER		
T3J_ _ _	Fluoropolymer insulation - individual leads - stranded conductor (12" limit)	204 ºC [400 ºF]
T3_ _ _	Fluoropolymer insulation - stranded conductor	
T3A_ _ _	Fluoropolymer insulation - stranded conductor - flexible armor	
T3B_ _ _	Fluoropolymer insulation - stranded conductor - stainless steel overbraid	
M3_ _ _	Fluoropolymer insulation - stranded conductor - stainless steel overbraid - Fluoropolymer insulation	
T3M_ _ _	Fluoropolymer insulation - stranded conductor - polyester shield	
T3MA_ _ _	Fluoropolymer insulation - stranded conductor - polyester shield - flexible armor	
POLYIMIDE		
K3_ _ _	Polyimide insulation - stranded conductor	316 ºC [600 ºF]
K3A_ _ _	Polyimide insulation - stranded conductor - flexible armor	
K3B_ _ _	Polyimide insulation - stranded conductor - stainless steel overbraid	
SILICON RUBBER		
S3_ _ _	Fluoropolymer insulation - stranded conductor - silicon rubber	204 ºC [400 ºF]
COIL CORDS		
C3060	PVC insulation - stranded conductor - coil cord - 60" extended length	104 ºC [220 ºF]
C3120	PVC insulation - stranded conductor - coil cord - 120" extended length	

Insert wire code number and 3 digit 'B' length in inches EXAMPLE: T3036 = 36" B length

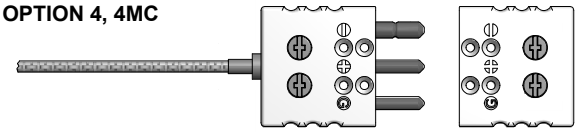
For assemblies requiring leadwire beyond the flexible armor (illustrated in 'C' in drawing), insert 3 digit 'C' length after armor length.
EXAMPLE: F3A036 -012 = 36" B length with additional 12" 'C' length leads beyond armor.

All insulated leadwires in flexible armor are available with either extruded PVC or FEP covering over the flexible armor.
Substitute suffix codes T (FEP) or P (PVC) for the suffix 'A' code above. EXAMPLE: T3T is FEP covered armor.

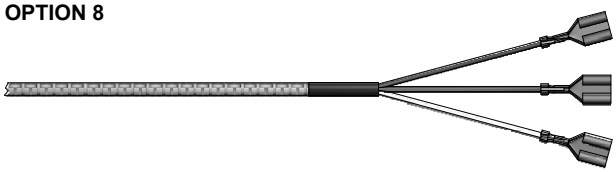
Select desired leadwire termination and options (if desired), by order code numbers below.

OPTION 3

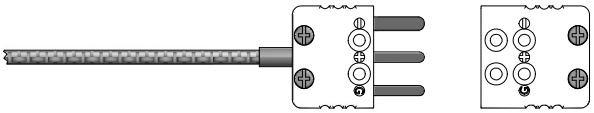
OPTION 4, 4MC



OPTION 8



OPTION 6, 6MC



ORDER CODES

Example Order Number: **R5T185L483-006-01A,304-16-T3036 -** **4,** **MC**

5-1 5-2

5-1 Terminations

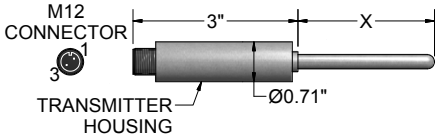
CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female quick disconnects

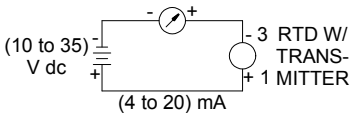
5-2 Options

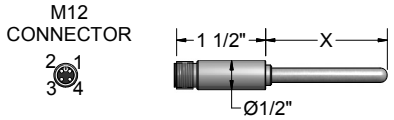
CODE	DESCRIPTION
BX	1/2" NPT BX connector with Options 0, 2, 3, or 8
CC	Plug or jack secured to leads with cable clamp
CG	Cord grip (1/2" NPT PVC)
MC	Mating connector
RB	Rubber boot

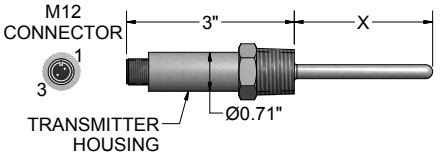
Configuration Code RT03
Water-Tight RTD Assembly
With Optional Series 450 Temperature Transmitter

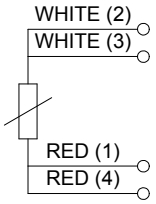
These RTD Assemblies house an optional Series 450 Temperature Transmitter (no connection head is required) that is ideal for monitoring temperature in small areas such as tanks and pipes. The water-tight construction meets the NEMA 6P, IP68 Protection Rating requirements. Standard units include a sensor, an M12 process connection housing, and optional transmitter. The transmitter is a 2-wire unit with an analog output. It has measurement input for Pt100 resistance thermometers (RTD) in 4-wire connections. Transmitters can be ranged from (-51 to 160) ºC [-60 to 320] ºF. With a 10 ºC [18 ºF] minimum span requirement. **The ambient temperature limits for the M12 connector is (-40 to 85) ºC.**

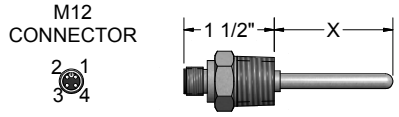












ORDER CODES

Example Order Number:

1	2		3		4		5		6		7		8	9
R1T185L	484	-	06	-	00	-	C45, T	-	450	-	U	-	S(0-200)	F

1 Pt100 (α=0.003 85 ºC^{-1}) RTD Assemblies

CODE	TOLERANCE[1]
R1T185L	Grade B
R3T185L	Class AA
R5T185L	(1/5) Class B
RAF185L	Class A
RBF185L	Class B

[1] Refer to RTD tolerance information in the General information section for calcalations to determine specific tolerance at temperature. See Instrument Section for total sensor and transmitter output accuracy.

2 316 S.S. Sheath

CODE	DIAMETER O.D. (inches)
284	1/8
384	3/16
484	1/4

3 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length desired. EXAMPLE: 04 = 4", 04(1/2) = 4.5"

4-1 Sheath Fittings

CODE	
00	No Fitting

4-2 Re-Adjustable Compression Fittings

CODE	DESCRIPTION	NPT (inches)	AVAILABLE SHEATH DIAMETERS (inches)
12A	Stainless Steel	1/8	1/8, 3/16
12B	Stainless Steel	1/4	3/16, 1/4, 1/8
12C	Stainless Steel	1/2	1/8, 3/16, 1/4
19C	Spring-loaded SS well fitting	1/2	3/16, 1/4

FEP gland standard 204 ºC [400 ºF] max.

4-3 One-Time Adjustable Compression Fittings

CODE	DESCRIPTION	NPT (inches)	AVAILABLE SHEATH DIAMETERS (inches)
05A	Stainless Steel	1/8	1/8, 3/16, 1/4
05B	Stainless Steel	1/4	1/8, 3/16, 1/4
05C	Stainless Steel	1/2	1/8, 3/16, 1/4

4-4 316SS Fixed Bushings[1]

CODE	MOUNTING THREAD NPT (inches)	AVAILABLE SHEATH DIAMETERS (inches)
8A_ _	1/8	1/8, 3/16, 1/4
8B_ _	1/4	1/8, 3/16, 1/4
8C_ _	1/2	1/8, 3/16, 1/4
8D_ _	3/4	1/8, 3/16, 1/4

[1] Requires Table 5 - Option 45 Selection

When ordering fixed bushings, specify order code above plus insertion length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

5 M12 Connector Termination

CODE	DESCRIPTION
45	No process connection
C45	1/2" NPT process connection
B45	1/4" NPT process connection
D45	3/4" NPT process connection
OPTIONAL TRANSMITTER	
T	4 to 20 mA Temperature Transmitter (Requires Table 6 selection)

6 Transmitter

CODE	DESCRIPTION
450-00	Programmable transmitter-unconfigured
450	Programmable transmitter-configured

7 Fault Signal

CODE	DESCRIPTION
U	Upscale burnout
D	Downscale burnout

8 Range

CODE	DESCRIPTION
S	(lower limit - upper limit)

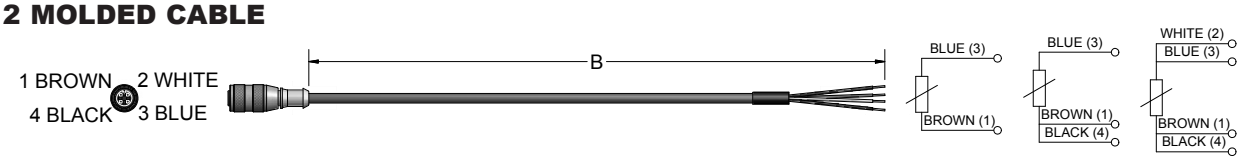
9 Units

CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

M12 Molded and Field-Wireable cables are available for connection to Pyromation Water-Tight Assemblies with Optional Series 450 Transmitters. The M12 quick disconnect plug eliminates all external screw connections, simplifying the electrical installation process and solving the problems caused by moisture, loose connections, and corrosion. They are easier to install and more secure than conventional field-wired connections. Both are available in 2-, 3-, and 4-wire connection options, and in straight or 90º angle styles. Molded cables are PVC insulated and meet NEMA 1, 3, 4, 6P and IEC IP68. Field-Wireable Cable insulations are listed below and meet IP67 requirements. Cable lengths are manufactured to customer specifications. All M12 Molded Cables are supplied as 4-wire and are terminated as specified in part number.

ORDER CODES

M12 MOLDED CABLE



Example Order Number: **RT3E46MS - P3072 - 2** (1 - 2 - 3)

1 M12 Connector Options

CODE	NUMBER OF WIRES	DESCRIPTION
RT2E46MS	2	Straight M12 Molded Connector
RT3E46MS	3	
RT4E46MS	4	
RT2E46MA	2	90º Angle M12 Molded Connector
RT3E46MA	3	
RT4E46MA	4	

2 Extension Cable

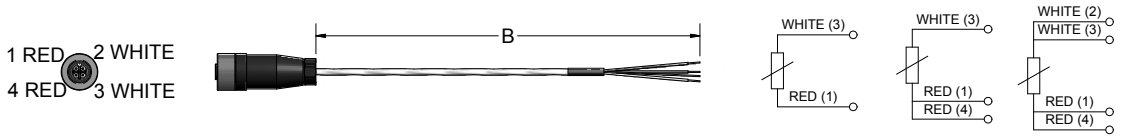
CODE	DESCRIPTION
P3_ _ _ [1]	22 AWG PVC insulation
[1] Insert length in inches	

3 Terminations and Options

CODE	DESCRIPTION
0	No termination
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard Jack
Options	
BX	Box connector
CC	Cable clamp
CG	1/2" NPT plastic cord grip
MC	Mating connector
RB	Rubber boot

ORDER CODES

M12 FIELD-WIREABLE CABLES



Example Order Number: **RT3E46S - T3072 - 2** (1 - 2 - 3)

1 M12 Connector Options

CODE	NUMBER OF WIRES	DESCRIPTION
RT2E46S	2	Straight M12 Connector
RT3E46S	3	
RT4E46S	4	
RT2E46A	2	90º Angle M12 Connector
RT3E46A	3	
RT4E46A	4	

2 Extension Leadwire and B + C Dimension

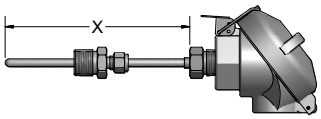
CODE[1]	WIRE DESCRIPTION
P3 _ _ _	Stranded; PVC insulation
T3 _ _ _	Stranded; fluoropolymer insulation
T3M_ _ _	Stranded; fluoropolymer with aluminum polyester shield and drain
[1] Insert 3 digit B length in inches. EXAMPLE: T3036=36" B length.	

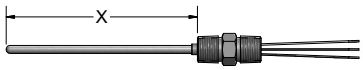
3 Terminations and Options

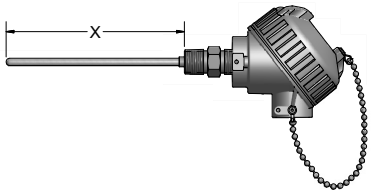
CODE	DESCRIPTION
0	No termination
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnects
Options	
BX	Box connector
CC	Cable clamp
CG	1/2" NPT plastic cord grip
MC	Mating connector
RB	Rubber boot

Configuration Code GP01
Fixed-Sheath RTD Assemblies with General-Purpose Connection Heads

Fixed-Sheath RTD Assemblies with General-Purpose Connection Heads are provided with head mounting fittings that are welded or brazed to the sheath for direct immersion into a process. To order an assembly with an optional 4 to 20 mA transmitter, select the assembly below and the transmitter from the back of this section. The RTD assemblies are supplied with a 316 stainless steel sheath in several diameters. They are available in various tolerances and temperature ranges as noted below.







ORDER CODES

	1-0	1-1	1-2		2-0		3		4-0	4-1	4-2		
Example Order Number:	**RBF185L**	**48**	**3**	**-**	**006(1/2)**	**-**	**00**	**-**	**8HN**	**31,**	**SB,**	**T-**	Select Type and Range from back of section

1-0 100 Ω Platinum RTD Elements α = 0.003 85 °C^{-1}

CODE		TOLERANCE[1]	TEMP. RANGE
SINGLE	*DUPLEX*		
R1T185L	R1T285L	Grade B	(-200 to 200) °C
R5T185L	R5T285L	(1/5) Class B	(-30 to 150) °C
RBF185L	RBF285L	Class B	(-50 to 200) °C
RAF185L	RAF285L	Class A	(-30 to 200) °C
R1T185H	R1T285H	Grade B	(-200 to 600) °C
RAT185H	RAT285H	Class A	(-100 to 450) °C

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

1-1 Sheath Diameters

CODE	DIAMETERS (inches) 316 SS
28[1]	1/8
38	3/16
48	1/4
68	3/8

[1] Not available in duplex

1-2 Element Connection

CODE	DESCRIPTION
2	2-wire element
3	3-wire element
4[1]	4-wire element

[1] Not available in duplex or with 440 Series Transmitter

2-0 "X" Dimensions

Insert three digit "X" length in inches.
Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

3-0 No Fitting

CODE	00

3-1 One-Time Adjustable Fittings

CODE	TYPE	NPT SIZE (inches)	AVAILABLE SHEATH DIAMETERS (inches)
01A	303 SS	1/8	1/8, 3/16, 1/4
05A	316 SS	1/8	1/8, 3/16, 1/4
05B	316 SS	1/4	1/8, 3/16, 1/4, 3/8
05C	316 SS	1/2	1/8, 3/16, 1/4, 3/8
15A	Brass	1/8	1/8, 3/16, 1/4
15B	Brass	1/4	3/16, 1/4, 3/8
15C	Brass	1/2	1/4, 3/8
14	Brass/ Steel	Flange	1/8, 3/16, 1/4, 3/8

3-2 Re-Adjustable Compression Fittings

CODE	TYPE	NPT SIZE (inches)	AVAILABLE SHEATH DIAMETERS (inches)
10A	303 SS	1/8	1/8, 3/16
10B	303 SS	1/4	1/4, 3/8
10C	303 SS	1/2	1/4, 3/8
12A	316 SS	1/8	1/8, 3/16, 1/4
12B	316 SS	1/4	1/8, 3/16, 1/4, 3/8
12C	316 SS	1/2	1/8, 3/16, 1/4, 3/8
11A	Brass	1/8	1/8, 3/16, 1/4
11B	Brass	1/4	1/8, 3/16, 1/4, 3/8
11C	Brass	1/2	1/4, 3/8
19C	Spring-loaded SS well fitting	1/2	3/16, 1/4

FEP gland standard 204 ºC [400 ºF] max.

3-3 Fixed Bushings[1]

CODE *316 SS*	MOUNTING THREAD NPT (inches)	AVAILABLE SHEATH DIAMETERS (inches)
8A _ _[2]	1/8	1/8, 3/16, 1/4
8B _ _[2]	1/4	1/8, 3/16, 1/4, 3/8
8C _ _[2]	1/2	1/8, 3/16, 1/4, 3/8
8D _ _[2]	3/4	1/8, 3/16, 1/4, 3/8

[1] Requires Table 4, Option 9HP Selection
[2] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

4-0 Head Mounting Fittings

CODE	DESCRIPTION
6HN	1/2" x 1/2" NPT steel hex nipple 1" "E" length
8HN	1/2" x 1/2" NPT stainless steel hex nipple 1" "E" length
9HP	1/2" NPT stainless steel bushing (no process threads)
8RNDC	3/4" x 1/2" NPT stainless steel hex nipple

4-1 Head and Sheath Terminations

CODE	DESCRIPTION
22	3" Individual fluoropolymer leads with terminal pins
31	Aluminum screw-cover head
34	Cast iron screw-cover head
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® dual cavity field temperature transmitter with general-purpose aluminum housing
49	Flip-top aluminum head
63	White polypropylene screw-cover head
91	316 L stainless steel screw-cover head

4-2 Options

W[1]	Epoxy Coating
GS	Ground screw
I	Stainless tag
NB	1/2" NPT nylon conduit reducer bushing
SB	1/2" NPT conduit reducer bushing
T-440	(4 to 20) mA head-mounted RTD transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter

See transmitter ordering information in back of section.

[1] Available with option 31 only.

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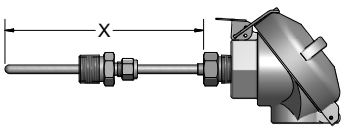
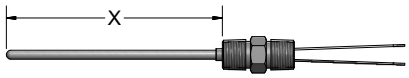
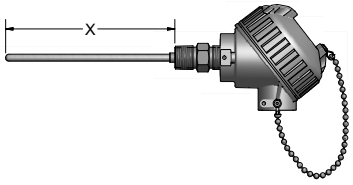
Sensors with Connection Heads

Configuration Code GP02
Fixed-Sheath Thermocouple Assemblies with General-Purpose Connection Heads

Fixed-Sheath Thermocouple Assemblies with General-Purpose Connection Heads have head mounting fittings that are welded or brazed to the sheath for direct immersion into a process. To order an assembly with an optional 4 to 20 mA transmitter, select the assembly below and the transmitter from the back of this section. The MgO-insulated thermocouple assemblies are offered in a variety of calibrations, sheath diameters, and sheath materials.







ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3		2-0		3		4-0	4-1	4-2	
J	3	8	U	-	012	-	01A	-	9HP	49,	T-	Select Type and Range from back of section

1-0 Thermocouple Types

CODE		
SINGLE	*DUPLEX*	*TRIPLEX*
E	EE	-
J	JJ	JJJ
K	KK	KKK
T	TT	-

1-1 Sheath Diameters

CODE	DIAMETER (inches)
2	1/8
3	3/16
4	1/4
6	3/8

1-2 Sheath Materials

CODE	MATERIAL	STANDARD AVAILABLE TYPES
3	Alloy 600	K
4	310 SS	K
5	446 SS	K[1]
8	316 SS	E, J, K, T

[1] All sensors with 446SS sheaths must have an ungrounded measuring junction.

1-3 Measuring Junctions

CODE	DESCRIPTION
G	Grounded junction
U	Ungrounded junction
E	Exposed junction

2-0 'X' Dimension

Insert three digit "X" length in inches

Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

3-0 No Fitting

CODE	00

3-1 One-Time Adjustable Fittings

CODE	TYPE	NPT SIZE (inches)	PRESSURE-RATED	AVAILABLE SHEATH DIAMETERS (inches)
01A	303 SS	1/8	NO	1/8, 3/16, 1/4
05A	316 SS	1/8	YES	1/8, 3/16, 1/4
05B	316 SS	1/4	YES	1/8, 3/16, 1/4, 3/8
05C	316 SS	1/2	YES	1/8, 3/16, 1/4, 3/8
15A	Brass	1/8	NO	1/8, 3/16, 1/4
15B	Brass	1/4	NO	3/16, 1/4, 3/8
15C	Brass	1/2	NO	1/4, 3/8
14	Brass/ Steel	Flange	NO	1/8, 3/16, 1/4, 3/8

3-2 Re-Adjustable Compression Fittings

CODE	TYPE	NPT SIZE (inches)	AVAILABLE SHEATH DIAMETERS (inches)
10A	303 SS	1/8	1/8, 3/16
10B	303 SS	1/4	1/4, 3/8
10C	303 SS	1/2	1/4, 3/8
12A	316 SS	1/8	1/8, 3/16, 1/4
12B	316 SS	1/4	1/8, 3/16, 1/4, 3/8
12C	316 SS	1/2	1/8, 3/16, 1/4, 3/8
11A	Brass	1/8	1/8, 3/16, 1/4
11B	Brass	1/4	1/8, 3/16, 1/4, 3/8
11C	Brass	1/2	1/4, 3/8
19C	Spring-loaded SS well fitting	1/2	3/16, 1/4

FEP gland standard 204 ºC [400 ºF] max.

3-3 Fixed Bushings[1]

CODE *316 SS*	MOUNTING THREAD NPT (inches)	AVAILABLE SHEATH DIAMETERS (inches)
8A _ _[2]	1/8	1/8, 3/16, 1/4
8B _ _[2]	1/4	1/8, 3/16, 1/4, 3/8
8C _ _[2]	1/2	1/8, 3/16, 1/4, 3/8
8D _ _[2]	3/4	1/8, 3/16, 1/4, 3/8

[1] Requires Table 4, Option 9HP Selection
[2] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

4-0 Head Mounting Fittings

CODE	DESCRIPTION
6HN	1/2" x 1/2" NPT steel hex nipple 1" "E" length
8HN	1/2" x 1/2" NPT stainless steel hex nipple 1" "E" length
9HP	1/2" NPT stainless steel bushing (no process threads)
8RNDC	3/4" x 1/2" NPT stainless steel hex nipple

4-1 Head and Sheath Terminations

CODE	DESCRIPTION
22	3" Individual fluoropolymer leads with terminal pins
31	Aluminum screw-cover head
34	Cast iron screw-cover head
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® dual cavity field temperature transmitter with general-purpose aluminum housing
49	Flip-top aluminum head
63	White polypropylene screw-cover head
91	316 L stainless steel screw-cover head
4-2 Options	
W[1]	Epoxy Coating
GS	Ground screw
I	Stainless tag
NB	1/2" NPT nylon conduit reducer bushing
SB	1/2" NPT conduit reducer bushing
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated Hart® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter

See transmitter ordering information in back of section.

[1] Available with option 31 only.

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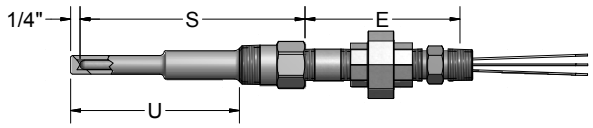
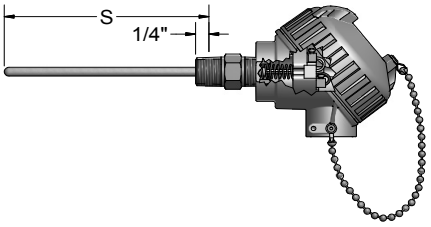
Sensors with Connection Heads

Configuration Code GP03
Spring-Loaded RTD/Thermowell Assemblies with General-Purpose Connection Heads

Spring-Loaded RTD/Thermowell Assemblies with General-Purpose Connection Heads are designed for use with various thermowell types. Complete assemblies can be ordered by selecting the RTD assembly below, the thermowell from the thermowell section of this catalog, and a temperature transmitter from the back of this section. Assemblies without a thermowell can be ordered by selecting the sensor assembly from this page and inserting the "S" length in table 2-0. These sensors are supplied with a 316 stainless steel sheath and are available in various tolerances and temperature ranges as noted in the tables below.





ORDER CODES

	1-0	1-1	1-2		2-0		3-0		4-0	4-1	4-2	
Example Order Number:	**R1T185L**	**48**	**3**	**-**	Select Thermowell Part # or Insert 3 Digit Length Code	**-**	**SL**	**-**	**8HN**	**31,**	**T-**	Select Type and Range from back of section

1-0 100 Ω Platinum RTD Elements α = 0.003 85 °C^{-1}

CODE		TOLERANCE[1]	TEMP. RANGE
SINGLE	*DUPLEX*		
R1T185L	R1T285L	Grade B	(-200 to 200) °C
R5T185L	R5T285L	(1/5) Class B	(-30 to 150) °C
RBF185L	RBF285L	Class B	(-50 to 200) °C
RAF185L	RAF285L	Class A	(-30 to 200) °C
R1T185H	R1T285H	Grade B	(-200 to 600) °C
RAT185H	RAT285H	Class A	(-100 to 450) °C
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.			

1-1 Sheath Diameters

CODE	DIAMETERS (inches) 316 SS
38	3/16
48	1/4

1-2 Element Connection

CODE	DESCRIPTION
2	2-wire element
3	3-wire element
4[1]	4-wire element
[1] Not available in duplex or with 440 Series Transmitter	

2-0

Select thermowell part number from Thermowell Section, or specify 3 digit "S" length in inches if no thermowell is required.

3-0 Element Options

CODE	DESCRIPTION
SL[1]	Spring-loaded element
SC	Self-contained spring-loaded element
SN	Self-contained spring-loaded element with Buna-N oil seal 121°C [250°F] 100 PSI Max.
[1] Not available with option 35T, 36T, or 37T	

4-0 Head Mounting Fittings

CODE	DESCRIPTION	CODE	DESCRIPTION
STEEL FITTINGS		*316SS FITTINGS*	
6HN	1/2" x 1/2" NPT hex nipple 1" length	8HN	1/2" x 1/2" NPT hex nipple 1" length
6PN_	1/2" NPT pipe nipple (specify "E" length in inches)	8PN_	1/2" NPT pipe nipple (specify "E" length in inches)
6PU_ [1]	1/2" NPT union/nipple (specify "E" length in inches)	8PU_ [1]	1/2" NPT union/nipple (specify "E" length in inches)
[1] 4" Minimum length required			

4-1 Head and Sheath Terminations

CODE	DESCRIPTION
22	3" Individual fluoropolymer leads with terminal pins
31	Aluminum screw-cover head
34	Cast iron screw-cover head
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® dual cavity field temperature transmitter with general-purpose aluminum housing
49	Flip-top aluminum head
63	White polypropylene screw-cover head
91	316 L stainless steel screw-cover head

4-2 Options

W[1]	Epoxy Coating
GS	Ground screw
I	Stainless tag
NB	1/2" NPT nylon conduit reducer bushing
SB	1/2" NPT conduit reducer bushing
T-440	(4 to 20) mA head-mounted RTD transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter
See transmitter ordering information in back of section.	
[1] Available with option 31 only.	

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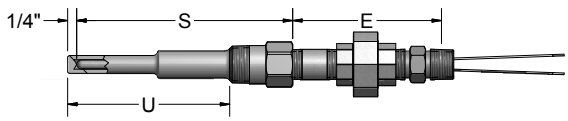
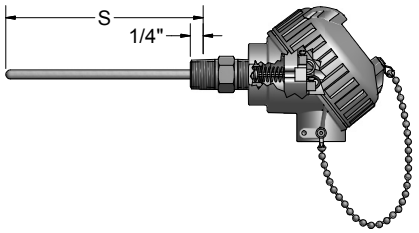
Sensors with Connection Heads

Configuration Code GP04
Spring-Loaded MgO Thermocouple/Thermowell Assemblies with General-Purpose Connection Heads

Spring-Loaded MgO Thermocouple/Thermowell Assemblies with General-Purpose Connection Heads are designed for use with various thermowell types. Complete assemblies can be ordered by selecting the MgO assembly below, the thermowell from the thermowell section of this catalog, and a temperature transmitter from the back of this section. Assemblies without a thermowell can be ordered by selecting the sensor assembly from this page and inserting the "S" length in table 2-0. These sensors are supplied with a 316 stainless steel sheath and as standard limits of error.





ORDER CODES

Example Order Number: **J 48 U - [Select Thermowell Part # or Insert 3 Digit Length Code] - SL - 8PU4 31, T- [Select Type and Range from back of section]**

(1-0 = J, 1-1 = 48, 1-2 = U, 2-0 = Select Thermowell Part # or Insert 3 Digit Length Code, 3-0 = SL, 4-0 = 8PU4, 4-1 = 31,, 4-2 = T-, Select Type and Range from back of section)

1-0 Thermocouple Types

CODE		
SINGLE	***DUPLEX***	***TRIPLEX***
E	EE	-
J	JJ	JJJ
K	KK	KKK
T	TT	-

1-1 Sheath Diameters

CODE	DIAMETERS (inches) 316 SS
38	3/16
48	1/4

1-2 Measuring Junction

CODE	DESCRIPTION
G	Grounded junction
U	Ungrounded junction

2-0

Select thermowell part number from Thermowell Section, or specify 3 digit "S" length in inches if no thermowell is required.

3-0 Element Options

CODE	DESCRIPTION
SL[1]	Spring-loaded element
SC	Self-contained spring-loaded element
SN	Self-contained spring-loaded element with Buna-N oil seal 121°C [250°F] 100 PSI Max.
[1] Not available with option 35T, 36T, or 37T	

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4-0 Head Mounting Fittings

CODE	DESCRIPTION
STEEL FITTINGS	
6HN	1/2" x 1/2" NPT hex nipple 1" "E" length
6PN_	1/2" NPT pipe nipple (specify "E" length in inches)
6PU_ [1]	1/2" NPT union/nipple (specify "E" length in inches)
316 SS FITTINGS	
8HN	1/2" x 1/2" NPT hex nipple 1" "E" length
8PN_	1/2" NPT pipe nipple (specify "E" length in inches)
8PU_ [1]	1/2" NPT union/nipple (specify "E" length in inches)
[1] 4" Minimum length required	

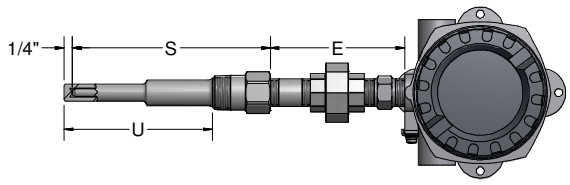
4-1 Head and Sheath Terminations

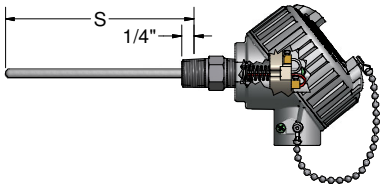
CODE	DESCRIPTION
22	3" Individual fluoropolymer leads with terminal pins
31	Aluminum screw-cover head
34	Cast iron screw-cover head
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® dual cavity field temperature transmitter with general-purpose aluminum housing
49	Flip-top aluminum head
63	White polypropylene screw-cover head
91	316 L stainless steel screw-cover head
4-2 Options	
W[1]	Epoxy Coating
GS	Ground screw
I	Stainless tag
NB	1/2" NPT nylon conduit reducer bushing
SB	1/2" NPT conduit reducer bushing
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter
See transmitter ordering information in back of section.	
[1] Available with option 31 only.	

Sensors with Connection Heads

Configuration Code GP03
Spring-Loaded RTD/Thermowell Assemblies with Explosion-Proof Connection Heads

Spring-Loaded RTD/Thermowell Assemblies with Explosion-Proof Connection Heads are designed for use with various thermowell types. Complete assemblies can be ordered by selecting the RTD assembly below, the thermowell from the thermowell section of this catalog, and a temperature transmitter from the back of this section. Assemblies without a thermowell can be ordered by selecting the sensor assembly from this page and inserting the "S" length in table 2-0. These sensors are supplied with a 316 stainless steel sheath and are available in various tolerances and temperature ranges as noted in the tables below.





ORDER CODES

	1-0	1-1	1-2		2-0		3-0		4-0	4-1	4-2	
Example Order Number:	**RBF185L**	**48**	**3**	**-**	Select Thermowell Part # or Insert 3 Digit Length Code	**-**	**SL**	**-**	**8HN**	**93,**	**T-**	Select Type and Range from back of section

1-0 100 Ω Platinum RTD Elements α = 0.003 85 °C^{-1}

CODE		TOLERANCE[1]	TEMP. RANGE
SINGLE	*DUPLEX*		
R1T185L	R1T285L	Grade B	(-200 to 200) °C
R5T185L	R5T285L	(1/5) Class B	(-30 to 150) °C
RBF185L	RBF285L	Class B	(-50 to 200) °C
RAF185L	RAF285L	Class A	(-30 to 200) °C
R1T185H	R1T285H	Grade B	(-200 to 600) °C
RAT185H	RAT285H	Class A	(-100 to 450) °C
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.			

1-1 Sheath Diameters

CODE	DIAMETERS (inches) 316 SS
38	3/16
48	1/4

1-2 Element Connection

CODE	DESCRIPTION
2	2-wire element
3	3-wire element
4[1]	4-wire element
[1] Not available in duplex or with 440 Series Transmitter	

2-0

Select thermowell part number from Thermowell Section, or specify 3 digit "S" length in inches if no thermowell is required.

4-1 Head Terminations

CODE	DESCRIPTION
74	Dual conduit DIN form B aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved
75T-642C	(4 to 20) mA HART® field transmitter with aluminum explosion-proof housing, Group A
76T82-D10	(4 to 20) mA dual input HART® field transmitter with digital display and explosion-proof aluminum housing, Group A
77T-662C	(4 to 20) mA HART® field transmitter with dual cavity explosion-proof aluminum housing, Group A
93	Aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved
94	316L stainless steel explosion-proof/flame-proof head, NEC, IEC, Atex approved

4-2 Options

SB	1/2" NPT conduit reducer bushing
I	Stainless tag
T-440[1]	(4 to 20) mA head-mounted RTD transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input, isolated HART® head-mounted transmitter
See transmitter ordering information in back of section.	
[1] Not available with option 74.	

4-0 Head Mounting Fittings

CODE	DESCRIPTION	CODE	DESCRIPTION
STEEL FITTINGS		*316SS FITTINGS*	
6HN	1/2" x 1/2" NPT hex nipple 1" length	8HN	1/2" x 1/2" NPT hex nipple 1" length
6PN_	1/2" NPT pipe nipple (specify "E" length in inches)	8PN_	1/2" NPT pipe nipple (specify "E" length in inches)
6XU_ [1]	1/2" NPT union/nipple (specify "E" length in inches)	8XU_ [1]	1/2" NPT union/nipple (specify "E" length in inches)
[1] 3 1/2" Minimum length required			

3-0 Element Options

CODE	DESCRIPTION
SL[1]	Spring-loaded element
SC	Self-contained spring-loaded element
SN	Self-contained spring-loaded element with Buna-N oil seal 121°C [250°F] 100 PSI Max.
[1] Not available with option 75T, 76T, or 77T	

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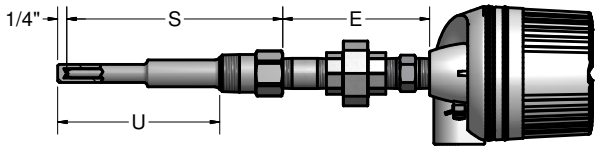
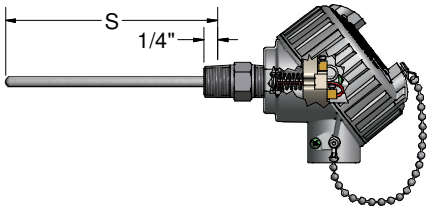
Configuration Code GP04
Spring-Loaded MgO Thermocouple/Thermowell Assemblies with Explosion-Proof Connection Heads

Spring-Loaded MgO Thermocouple/Thermowell Assemblies with Explosion-Proof Connection Heads are designed for use with various thermowell types. Complete assemblies can be ordered by selecting the MgO assembly below, the thermowell from the thermowell section of the catalog, and a temperature transmitter from the back of this section. Assemblies without a thermowell can be ordered by selecting the sensor assembly from this page and inserting the "S" length in table 2-0. These sensors are supplied with a 316 stainless steel sheath and as standard limits or error.





ORDER CODES

Example Order Number:

1-0	1-1	1-2		2-0		3-0		4-0	4-1	4-2	
J	48	U	-	Select Thermowell Part # or Insert 3 Digit Length Code	-	SL	-	8XU4	93,	T-	Select Type and Range from back of section

1-0 Thermocouple Types

CODE		
SINGLE	*DUPLEX*	*TRIPLEX*
E	EE	-
J	JJ	JJJ
K	KK	KKK
T	TT	-

1-1 Sheath Diameters

CODE	DIAMETERS (inches) 316 SS
38	3/16
48	1/4

1-2 Measuring Junction

CODE	DESCRIPTION
G	Grounded junction
U	Ungrounded junction

2-0

Select thermowell part number from Thermowell Section, or specify 3 digit "S" length in inches if no thermowell is required.

3-0 Element Options

CODE	DESCRIPTION
SL[1]	Spring-loaded element
SC	Self-contained spring-loaded element
SN	Self-contained spring-loaded element with Buna-N oil seal 121°C [250°F] 100 PSI Max.
[1] Not available with option 75T, 76T, or 77T	

4-0 Head Mounting Fittings

CODE	DESCRIPTION
STEEL FITTINGS	
6HN	1/2" x 1/2" NPT hex nipple 1" "E" length
6PN_	1/2" NPT pipe nipple (specify "E" length in inches)
6XU_ [1]	1/2" NPT union/nipple (specify "E" length in inches)
316 SS FITTINGS	
8HN	1/2" x 1/2" NPT hex nipple 1" "E" length
8PN_	1/2" NPT pipe nipple (specify "E" length in inches)
8XU_ [1]	1/2" NPT union/nipple (specify "E" length in inches)
[1] 3 1/2" Minimum length required	

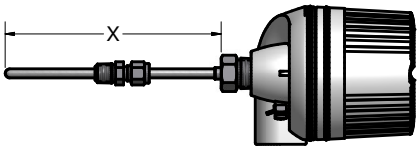
4-1 Head Terminations

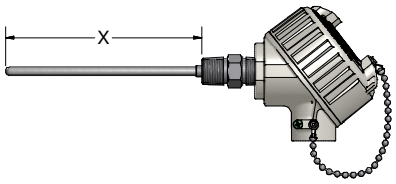
CODE	DESCRIPTION
74	Dual conduit DIN form B aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved
75T-642C	(4 to 20) mA HART® field transmitter with aluminum explosion-proof housing, Group A
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof aluminum housing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
93	Aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved
94	316L stainless steel explosion-proof/flame-proof head, NEC, IEC, Atex approved
4-2 Options	
SB	1/2" NPT conduit reducer bushing
I	Stainless tag
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA Dual input, isolated HART® head-mounted transmitter
See transmitter ordering information in back of section.	

Sensors with Connection Heads

Configuration Code GP01
Fixed-Sheath RTD Assemblies with Explosion-Proof Connection Heads

Fixed-Sheath RTD Assemblies with Explosion-Proof Connection Heads are provided with head mounting fittings that are welded or brazed to the sheath for direct immersion into a process. To order an assembly with an option 4 to 20 mA transmitter, select the assembly below and the transmitter from the back of this section. The RTD assemblies are supplied with a 316 stainless steel sheath in several diameters. They are available in various tolerances and temperature ranges as noted below.





ORDER CODES

	1-0	1-1	1-2		2-0		3		4-0	4-1	4-2		
Example Order Number:	**RAF185L**	**48**	**3**	**-**	**012(1/2)**	**-**	**00**	**-**	**8HN**	**94,**	**SB,**	**T-**	Select Type and Range from back of section

1-0 100 Ω Platinum RTD Elements α = 0.003 85 °C^{-1}

CODE		TOLERANCE[1]	TEMP. RANGE
SINGLE	*DUPLEX*		
R1T185L	R1T285L	Grade B	(-200 to 200) °C
R5T185L	R5T285L	(1/5) Class B	(-30 to 150) °C
RBF185L	RBF285L	Class B	(-50 to 200) °C
RAF185L	RAF285L	Class A	(-30 to 200) °C
R1T185H	R1T285H	Grade B	(-200 to 600) °C
RAT185H	RAT285H	Class A	(-100 to 450) °C

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

1-1 Sheath Diameters

CODE	DIAMETERS (inches) 316 SS
28[1]	1/8
38	3/16
48	1/4
68	3/8

[1] Not available in duplex

1-2 Element Connection

CODE	DESCRIPTION
2	2-wire element
3	3-wire element
4[1]	4-wire element

[1] Not available in duplex or with 440 Series Transmitter

2 -0 "X" Dimensions

Insert three digit "X" length in inches.

Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

3-0 No Fitting

CODE	00

3-1 One-Time Adjustable Fittings

CODE	TYPE	NPT SIZE (inches)	AVAILABLE SHEATH DIAMETERS (inches)
01A	303 SS	1/8	1/8, 3/16, 1/4
05A	316 SS	1/8	1/8, 3/16, 1/4
05B	316 SS	1/4	1/8, 3/16, 1/4, 3/8
05C	316 SS	1/2	1/8, 1/4, 3/8
15A	Brass	1/8	1/8, 3/16, 1/4
15B	Brass	1/4	3/16, 1/4, 3/8
15C	Brass	1/2	1/4, 3/8
14	Brass/ Steel	Flange	1/8, 3/16, 1/4, 3/8

3-2 Re-Adjustable Compression Fittings

CODE	TYPE	NPT SIZE (inches)	AVAILABLE SHEATH DIAMETERS (inches)
10A	303 SS	1/8	1/8, 3/16
10B	303 SS	1/4	1/4, 3/8
10C	303 SS	1/2	1/4, 3/8
12A	316 SS	1/8	1/8, 3/16, 1/4
12B	316 SS	1/4	1/8, 3/16, 1/4, 3/8
12C	316 SS	1/2	1/8, 1/4, 3/8
11A	Brass	1/8	1/8, 3/16, 1/4
11B	Brass	1/4	1/8, 3/16, 1/4, 3/8
11C	Brass	1/2	1/4, 3/8
19C	Spring-loaded SS well fitting	1/2	3/16, 1/4

FEP gland standard 204 ºC [400 ºF] max.

3-3 Fixed Bushings[1]

CODE *316 SS*	MOUNTING THREAD NPT (inches)	AVAILABLE SHEATH DIAMETERS (inches)
8A _ _[1]	1/8	1/8, 3/16, 1/4
8B _ _[1]	1/4	1/8, 3/16, 1/4, 3/8
8C _ _[1]	1/2	1/8, 3/16, 1/4, 3/8
8D _ _[1]	3/4	1/8, 3/16, 1/4, 3/8

[1] Requires Table 4, Option 9HP Selection
[2] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

4-0 Head Mounting Fittings

CODE	DESCRIPTION
6HN	1/2" x 1/2" NPT steel hex nipple 1" "E" length
8HN	1/2" x 1/2" NPT stainless steel hex nipple 1" "E" length
9HP	1/2" NPT stainless steel bushing (no process threads)
8RNDC	3/4" x 1/2" NPT stainless steel hex nipple

4-1 Head Terminations

CODE	DESCRIPTION
74	Dual conduit DIN form B aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved
75T-642C	(4 to 20) mA HART® field transmitter with aluminum explosion-proof housing, Group A
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof aluminum housing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
93	Aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved
94	316L stainless steel explosion-proof/flame-proof head, NEC, IEC, Atex approved

4-2 Options

SB	1/2" NPT conduit reducer bushing
I	Stainless tag
T-440[1]	(4 to 20) mA head-mounted RTD transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input, isolated HART® head-mounted transmitter

See transmitter ordering information in back of section.

[1] Not available with option 74.

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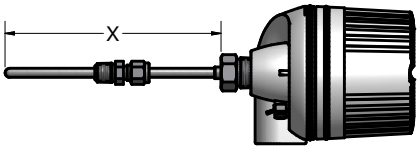
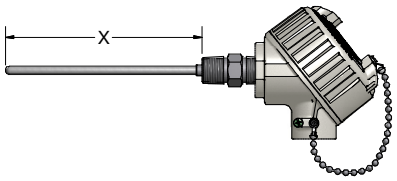
Sensors with Connection Heads

Configuration Code GP02
Fixed-Sheath Thermocouple Assemblies with Explosion-Proof Connection Heads

Fixed-Sheath Thermocouple Assemblies with Explosion-Proof Connection Heads are provided with head mounting fittings that are welded or brazed to the sheath for direct immersion into a process. To order an assembly with an optional 4 to 20 mA transmitter, select the assembly below and the transmitter from the back of this section. The MgO-insulated thermocouple assemblies are offered in a variety of calibrations, sheath diameters, and sheath materials.





ORDER CODES

	1-0	1-1	1-2	1-3		2-0		3		4-0	4-1	4-2	
Example Order Number:	**J**	**2**	**8**	**U**	**-**	**012**	**-**	**01A**	**-**	**9HP**	**74,**	**T-**	Select Type and Range from back of section

1-0 Thermocouple Type

CODE		
SINGLE	*DUPLEX*	*TRIPLEX*
E	EE	-
J	JJ	JJJ
K	KK	KKK
T	TT	-

1-1 Sheath Diameters

CODE	DIAMETER (inches)
2	1/8
3	3/16
4	1/4
6	3/8

1-2 Sheath Materials

CODE	MATERIAL	STANDARD AVAILABLE TYPES
3	Alloy 600	K
4	310 SS	K
5	446 SS	K[1]
8	316 SS	E, J, K, T

[1] All sensors with 446SS sheaths must have an ungrounded measuring junction.

1-3 Measuring Junctions

CODE	DESCRIPTION
G	Grounded junction
U	Ungrounded junction
E	Exposed junction

2-0 'X' Dimension

Insert three digit "X" length in inches

Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

3-0 No Fitting

CODE	00

3-1 One-Time Adjustable Fittings

CODE	TYPE	NPT SIZE (inches)	PRESSURE-RATED	AVAILABLE SHEATH DIAMETERS (inches)
01A	303 SS	1/8	NO	1/8, 3/16, 1/4
05A	316 SS	1/8	YES	1/8, 3/16, 1/4
05B	316 SS	1/4	YES	1/8, 3/16, 1/4, 3/8
05C	316 SS	1/2	YES	1/8, 1/4, 3/8
15A	Brass	1/8	NO	1/8, 3/16, 1/4
15B	Brass	1/4	NO	3/16, 1/4, 3/8
15C	Brass	1/2	NO	1/4, 3/8
14	Brass/ Steel	Flange	NO	1/8, 3/16, 1/4, 3/8

3-2 Re-Adjustable Compression Fittings

CODE	TYPE	NPT SIZE (inches)	AVAILABLE SHEATH DIAMETERS (inches)
10A	303 SS	1/8	1/8, 3/16
10B	303 SS	1/4	1/4, 3/8
10C	303 SS	1/2	1/4, 3/8
12A	316 SS	1/8	1/8, 3/16, 1/4
12B	316 SS	1/4	1/8, 3/16, 1/4, 3/8
12C	316 SS	1/2	1/8, 1/4, 3/8
11A	Brass	1/8	1/8, 3/16, 1/4
11B	Brass	1/4	1/8, 3/16, 1/4, 3/8
11C	Brass	1/2	1/4, 3/8
19C	Spring-loaded SS well fitting	1/2	3/16, 1/4

FEP gland standard 204 ºC [400 ºF] max.

3-3 Fixed Bushings[1]

CODE *316 SS*	MOUNTING THREAD NPT (inches)	AVAILABLE SHEATH DIAMETERS (inches)
8A _ _[1]	1/8	1/8, 3/16, 1/4
8B _ _[1]	1/4	1/8, 3/16, 1/4, 3/8
8C _ _[1]	1/2	1/8, 3/16, 1/4, 3/8
8D _ _[1]	3/4	1/8, 3/16, 1/4, 3/8

[1] Requires Table 4, Option 9HP Selection
[2] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

4-0 Head Mounting Fittings

CODE	DESCRIPTION
6HN	1/2" x 1/2" NPT steel hex nipple 1" "E" length
8HN	1/2" x 1/2" NPT stainless steel hex nipple 1" "E" length
9HP	1/2" NPT stainless steel bushing (no process threads)
8RNDC	3/4" x 1/2" NPT stainless steel hex nipple

4-1 Head Terminations

CODE	DESCRIPTION
74	Dual conduit DIN form B aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved
75T-642C	(4 to 20) mA HART® field transmitter with aluminum explosion-proof housing, Group A
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof aluminumhousing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
93	Aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved
94	316L stainless steel explosion-proof/ flame-proof head, NEC, IEC, Atex approved

4-2 Options

SB	1/2" NPT conduit reducer bushing
I	Stainless tag
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input, isolated HART® head-mounted transmitter

See transmitter ordering information in back of section.

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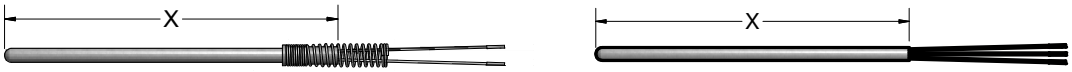
Thermocouple and RTD Spring-Loaded Replacement Elements

Thermocouple and RTD spring-Loaded Replacement elements are designed for spring-loaded thermowell assemblies. The replacement elements can be ordered by selecting the sensor type below and inserting the "X" length in table 2-0. The RTD assemblies are supplied with a 316 stainless steel sheath and are available in various tolerances and temperature ranges as noted in the tables below. The MgO-insulated thermocouple assemblies are supplied with a 316 stainless steel sheath, various calibrations, and as standard limits of error.



ORDER CODES — Configuration Code GP06

Thermocouple Example Order Number:

1-0	1-1		2-0		3-0		4-0
J48	U	-	012	-	SL	-	22(06)

1-0 Thermocouple Types

CODE			AVAILABLE SHEATH DIAMETERS (316 SS)	
SINGLE	*DUPLEX*	*TRIPLEX*	3/16" O.D.	1/4" O.D.
E	EE	-	38	48
J	JJ	JJJ	38	48
K	KK	KKK	38	48
T	TT	-	38	48

1-1 Measuring Junction

CODE	DESCRIPTION
G	Grounded junction
U	Ungrounded junction

4-0 Sheath Terminations

CODE	DESCRIPTION
22[1]	3" Individual fluoropolymer leads with terminal pins
[1] For longer leads, insert 2 digit length in inches. Example: 22(06)	

3-0 Element Style

CODE	DESCRIPTION
SL	Spring-loaded element
00	Supplied without spring

2-0 Length

CODE
Insert 3 Digit "X" length in inches

ORDER CODES — Configuration Code GP05

RTD Example Order Number:

1-0	1-1	1-2		2-0		3-0		4-0
R1T185L	48	3	-	012(1/2)	-	00	-	22

1-0 100 Ω Platinum RTD Elements α = 0.003 85 °C^{-1}

CODE		TOLERANCE[1]	TEMP. RANGE
SINGLE	*DUPLEX*		
R1T185L	R1T285L	Grade B	(-200 to 200) °C
R5T185L	R5T285L	(1/5) Class B	(-30 to 150) °C
RBF185L	RBF285L	Class B	(-50 to 200) °C
RAF185L	RAF285L	Class A	(-30 to 200) °C
R1T185H	R1T285H	Grade B	(-200 to 600) °C
RAT185H	RAT285H	Class A	(-100 to 450) °C
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.			

1-1 Sheath Diameters

CODE	DIAMETERS (inches) 316 SS
38	3/16
48	1/4

4-0 Sheath Terminations

CODE	DESCRIPTION
22[1]	3" Individual fluoropolymer leads with terminal pins
[1] For longer leads insert 2 digit length in inches. Example: 22(06)	

3-0 Element Style

CODE	DESCRIPTION
SL	Spring-loaded element
00	Supplied without spring

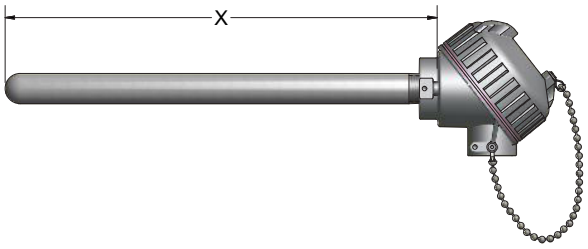
2-0 Length

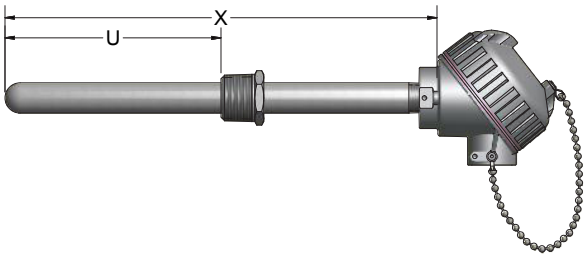
CODE
Insert 3 Digit "X" length in inches

1-2 Element Connection

CODE	DESCRIPTION
2	2-wire element
3	3-wire element
4	4-wire element

Configuration Code GP09
MgO Thermocouple Pipe Well with Spring-Loaded or Loose Elements





Example Order Number:

1-0	1-1	1-2	1-3	1-4		2-0		3-0		4-0		5-0		6-0	6-1
K	4	8	U	M8VS	-	8-75	-	36	-	SL	-	815R133	-	31,	I

1-0 Thermocouple Type

CODE		
SINGLE	*DUPLEX*	*TRIPLEX*
J	JJ	JJJ
K	KK	KKK
E	EE	-
T	TT	-
N	NN	-

1-1 Sheath Diameter

CODE	DESCRIPTION
4	1/4 inch
6	3/8 inch

1-2 Sheath Material

CODE	DESCRIPTION
8	316 Stainless steel
3	Alloy 600

1-3 Junction Style

CODE	DESCRIPTION
G	Grounded junction
U	Ungrounded junction

1-4 Element Options

CODE	DESCRIPTION
M	Special limits of error
8VS	316 Stainless steel vibration spacers (see table on GP12)

2-0 Pipe Material and Size

CODE	MATERIAL	MAX TEMP	CODE (INCHES)	
			1/2 INCH NPT	3/4 INCH NPT
6	Carbon steel	538 ºC [1000 ºF]	50	75
8	316 Stainless steel	927 ºC [1700 ºF]	50	75
5	446 Stainless steel	1093 ºC [2000 ºF]	50	75
3	Alloy 600	1149 ºC [2100 ºF]	50	75
7	Alloy 601	1260 ºC [2300 ºF]	50	75
41	HR 160	1204 ºC [2200 ºF]	50	75

6-0 Head Terminations and Options

CODE	DESCRIPTION
31	Aluminum screw-cover head
34	Cast iron screw-cover head
91	316 L Stainless steel screw-cover head
49	Aluminum flip-top head
93	Aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved
94	316L stainless steel explosion-proof/flame-proof head, NEC, IEC, Atex approved
6-1 OPTIONS	
SB	1/2 inch NPT conduit reducer bushing
I	Stainless steel tag
GS	Ground screw
H	Adjustable steel mounting flange

5-0 Optional Welded Fittings

CODE		DESCRIPTION
STEEL	316 SS	
6D(U)	8D(U)	3/4 inch NPT welded bushing (50 tubes only)
6E(U)	8E(U)	1 inch NPT welded bushing
6F(U)	8F(U)	1 (1/4) inch NPT welded bushing
6G(U)	8G(U)	1 (1/2) inch NPT welded bushing
6H(U)	8H(U)	2 inch NPT welded bushing
610R1(U)	810R1(U)	1 inch 150# class raised-face flange
615R1(U)	815R1(U)	1 (1/2) inch 150# class raised-face flange
620R1(U)	820R1(U)	2 inch 150# class raised-face flange
Other sizes and materials available - consult factory.		

4-0 Element Options

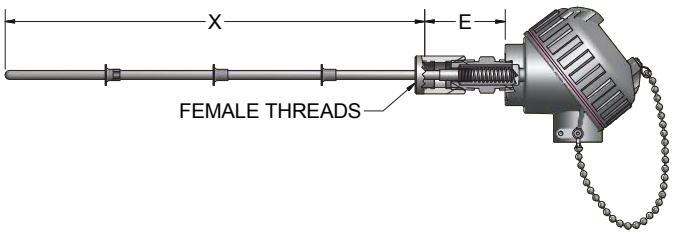
CODE	DESCRIPTION
SL	Spring-loaded element
LE	Loose element

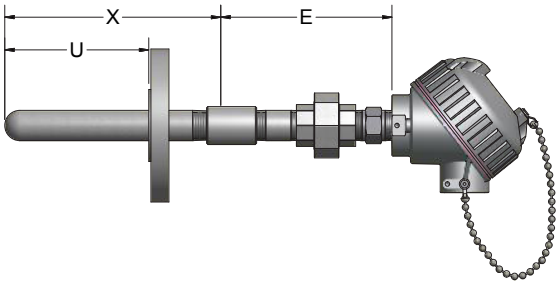
3-0 Protection Tube

"X" LENGTH
Specify length in one inch increments. 4 inch minimum to 240 inch maximum.

Configuration Code GP10

MgO Thermocouple Pipe Wells with Self-Contained, Spring-Loaded Elements and Optional Transmitters





Example Order Number:

1-0	1-1	1-2	1-3	1-4		2-0		3-0		4-0		5-0		6-0	7-0	7-1
K	4	8	U	M8VS	-	8-75	-	36	-	815R130	-	PC	-	8PU4	31,	I

1-0 Thermocouple Type

CODE		
SINGLE	*DUPLEX*	*TRIPLEX*
J	JJ	JJJ
K	KK	KKK
E	EE	-
T	TT	-
N	NN	-

1-1 Sheath Diameter

CODE	DESCRIPTION
4	1/4 inch

1-2 Sheath Material

CODE	DESCRIPTION
8	316 Stainless Steel
3	Alloy 600

1-3 Junction Style

CODE	DESCRIPTION
G	Grounded junction
U	Ungrounded junction

1-4 Element Options

CODE	DESCRIPTION
M	Special limits of error
8VS	316 Stainless steel vibration spacers (see table on GP11)

2-0 Pipe Material and Size

CODE	MATERIAL	MAX TEMP	CODE (INCHES)	
			1/2 INCH NPT	3/4 INCH NPT
6	Carbon steel	538 ºC [1000 ºF]	50	75
8	316 Stainless steel	927 ºC [1700 ºF]	50	75
5	446 Stainless steel	1093 ºC [2000 ºF]	50	75
3	Alloy 600	1149 ºC [2100 ºF]	50	75
7	Alloy 601	1260 ºC [2300 ºF]	50	75
41	HR 160	1204 ºC [2200 ºF]	50	75
00[1]	No protection tube	N/A	50	75
[1] Supplied with a female process connection.				

3-0 Protection Tube

"X" LENGTH
Specify length in one inch increments. 4 inch minimum to 240 inch maximum.

4-0 Optional Welded Fittings

CODE		DESCRIPTION
STEEL	316 SS	
6D(U)	8D(U)	3/4 inch NPT welded bushing (50 tubes only)
6E(U)	8E(U)	1 inch NPT welded bushing
6F(U)	8F(U)	1 (1/4) inch NPT welded bushing
6G(U)	8G(U)	1 (1/2) inch NPT welded bushing
6H(U)	8H(U)	2 inch NPT welded bushing
610R1(U)	810R1(U)	1 inch 150# class raised-face flange
615R1(U)	815R1(U)	1 (1/2) inch 150# class raised-face flange
620R1(U)	820R1(U)	2 inch 150# class raised-face flange
Other sizes and materials available - consult factory		

7-0 Head Terminations and Options

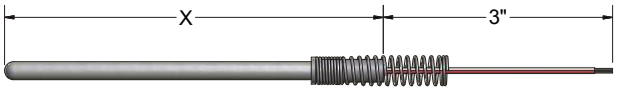
CODE	DESCRIPTION
22	3 inch individual leads with terminal pins
31	Aluminum screw-cover head
34	Cast iron screw-cover head
91	316 L Stainless steel screw-cover head
49	Aluminum flip-top head
93	Aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved
94	316L stainless steel explosion-proof/flame-proof head, NEC, IEC, Atex approved
35T-642A	(4 to 20) mA Isolated HART® field transmitter with general-purpose aluminum housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® dual cavity field temperature transmitter with general-purpose aluminum housing
75T-642C	(4 to 20) mA Isolated HART® field transmitter with explosion-proof aluminum housing, Group A
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof housing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
7-1 OPTIONS AND TRANSMITTERS	
SB	1/2 inch NPT conduit reducer bushing
I	Stainless steel tag
GS	Ground screw
H	Adjustable steel mounting flange
T-441[1]	(4 to 20) mA Isolated head-mounted transmitter
T-442[1]	(4 to 20) mA Isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter
[1] Not available with option 71 or 81	
See Transmitter section for transmitter ordering information	

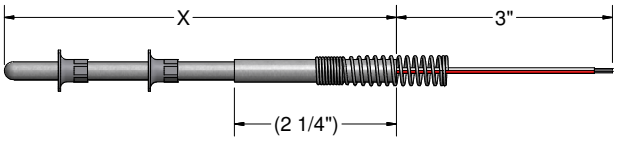
6-0 Head Mounting Fittings

CODE		DESCRIPTION
STEEL	316 SS	
6HN	8HN	1/2 inch X 1/2 inch NPT hex nipple 2 Inch "E" length
6PU_	8PU_	1/2 inch NPT union/hex nipple (specify "E" length)
6XU_	8XU_	1/2 inch NPT explosion-proof union/hex nipple (specify "E" length)

5-0 Element Options

CODE	DESCRIPTION
PC	Self-contained spring-loaded element





Example Order Number:

1-0	1-1	1-2	1-3	1-4		2-0		3-0		4-0
K	4	8	U	M8VS50	-	36	-	PC	-	22(06)

1-0 Thermocouple Type

CODE		
SINGLE	*DUPLEX*	*TRIPLEX*
J	JJ	JJJ
K	KK	KKK
E	EE	-
T	TT	-
N	NN	-

1-1 Sheath Diameter

CODE	DESCRIPTION
4	1/4 inch
6[1]	3/8 inch
[1] Not available with PC option	

1-2 Sheath Material

CODE	DESCRIPTION
8	316 Stainless steel
3	Alloy 600

1-3 Junction Style

CODE	DESCRIPTION
G	Grounded junction
U	Ungrounded junction

1-4 Element Options

CODE	DESCRIPTION
M	Special limits of error
8VS50	316 Stainless steel vibration spacers for 1/2 inch schedule 40 pipe
8VS75	316 Stainless steel vibration spacers for 3/4 inch schedule 40 pipe

4-0 Sheath Termination

CODE	DESCRIPTION
22[1]	3 inch individual leads with terminal pins
10[1]	2 inch stripped leads
[1] For longer leads, insert 2 digit length in inches. Example: 22(06) or 10(04)	

3-0 Element Options

CODE	DESCRIPTION
SL[1]	Spring-loaded element
PC[1]	Self contained spring-loaded element
LE[2]	Loose element
[1] Only available with option 22 sheath termination	
[2] Only available with option 10 sheath termination	

2-0 Element

"X" LENGTH
Specify length in one inch increments. 4 inch minimum to 240 inch maximum.

Replacement Element "X" Dimension Calculations

ASSEMBLY TYPE	REPLACEMENT ELEMENT "X" DIMENSION
SL	Assembly "X" length - 1/4 inch
PC	Assembly "X" length + "E" length + 1/2 inch
LE	Same as assembly "X" length

Standard Vibration Spacer Placement

ASSEMBLY LENGTH	SPACER SPECIFICATIONS
4 inches to 18 inches	2 spacers equally spaced
> 18 inches to 36 inches	3 spacers equally spaced
> 36 inches	1 additional spacer for each additional 18 inches. All spacers are equally spaced.

ORDER CODES

Example Order Number:

1-0		1-1		1-2	1-3	1-4		1-5		1-6
440	-		-	3	85	U	-	S(0-200)		C

1-0 Transmitter Type

CODE	DESCRIPTION
440[1]	(4 to 20) mA programmable head-mounted RTD Transmitter
441	(4 to 20) mA programmable head-mounted universal Transmitter
442	(4 to 20) mA HART® programmable head-mounted universal Transmitter
35T-642A	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing
75T-642C	(4 to 20) mA HART® Field Transmitter with explosion-proof aluminum housing FM/ CSA / XP Class I Div I Groups A,B,C,D; DIP Class II Div I Groups E,F,G; Class III; NI Class I Div II Groups A,B,C,D
[1] Only available with 2- or 3-wire input connection and Pt100 sensor type	

1-1 Options (For 642 Series only)

CODE	DESCRIPTION
T	Solid cover
D	Glass cover with digital display
Leave blank if using 440, 441, or 442	

1-2 Input Type

CODE	DESCRIPTION
00[1]	Unconfigured
1	Thermocouple (TC)
2	RTD (2-wire)
3	RTD (3-wire)
4	RTD (4-wire)
[1] Default setting supplied as 3-wire Pt100 (0-100) °C	

1-3 Sensor Type

CODE	DESCRIPTION
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
85	100 ohm platinum (α = 0.003 85 $ºC^{-1}$)

1-4 Failure Mode

CODE	DESCRIPTION
U	Upscale Burnout ≥ 20.5 mA
D	Downscale Burnout ≤ 3.8 mA

1-5 Range

CODE	DESCRIPTION
S	(lower limit – upper limit)

1-6 Unit of Measure

CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

For complete transmitter specifications see Transmitter Section.

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ORDER CODES

Example Order Number:

1-0		1-1	1-2	1-3	1-4	1-5	1-6		1-7	1-8
37T-662A	-	D	- 33	- 85	- 85	- A	- U	-	S(0-200)	C

1-0 Transmitter Type

CODE	DESCRIPTION
37T-662A	(4 to 20) mA HART® Field Transmitter, single or dual input, with general-purpose dual cavity aluminum housing
77T-662C	(4 to 20) mA HART® Field Transmitter with dual-cavity explosion-proof aluminum housing FM/CSA XP Class I Div I Groups B,C,D; DIP Class II Div I Groups E,F,G; Class III; NI Class I Div II Groups B,C,D
T82-00	(4 to 20) mA dual input, isolated HART® head-mounted Transmitter
36T82	(4 to 20) mA dual input HART® Transmitter and general-purpose aluminum housing
76T82	(4 to 20) mA dual input HART® programmable Transmitter with digital display and explosion-proof aluminum housing, FM/CSA,NI,IS,XP,DIP Class I Div I and Div II, Groups A,B,C,D

1-1 Housing Cover Options

CODE	DESCRIPTION
T	Solid cover for 662 series
D	Glass cover with digital display for 662 series
D10	Glass cover with digital display for 36T82 and 76T82 series

1-2 Configuration Input

CODE	DESCRIPTION
2I	Ch1: RTD 2-wire, Ch2: inactive
22	Ch1: RTD 2-wire, Ch2: RTD 2-wire
23	Ch1: RTD 2-wire, Ch2: RTD 3-wire
2T	Ch1: RTD 2-wire, Ch2: Thermocouple
3I	Ch1: RTD 3-wire, Ch2: inactive
32	Ch1: RTD 3-wire, Ch2: RTD 2-wire
33	Ch1: RTD 3-wire, Ch2: RTD 3-wire
3T	Ch1: RTD 3-wire, Ch2: Thermocouple
4I	Ch1: RTD 4-wire, Ch2: inactive
4T	Ch1: RTD 4-wire, Ch2: Thermocouple
TI	Ch1: Thermocouple, Ch2: inactive
TT	Ch1: Thermocouple, Ch2: Thermocouple

1-8 Unit of Measure

CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

1-7 Range

CODE	DESCRIPTION
S	(lower limit – upper limit)

1-6 Failure Mode

CODE	DESCRIPTION
U	Upscale Burnout ≥ 20.5 mA
D	Downscale Burnout ≤ 3.8 mA

1-5 Input Set-ups

CODE	DESCRIPTION
0	One Input (662 only)
A	Process Variable = Ch1; CH2 = inactive
B	Process variable = CH1; secondary variable = Ch2 (T82 Only)
C	Process variable = the difference between CH1 and Ch2
D	Process variable = the average between CH1 and Ch2
E	Sensor backup; Process variable= Ch1 and Ch2

1-4 Sensor Input Channel 2

CODE	DESCRIPTION
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
85	100 ohm platinum (α = 0.003 85 ºC^{-1})
00	No second channel

1-3 Sensor Input Channel 1

CODE	DESCRIPTION
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
85	100 ohm platinum (α = 0.003 85 ºC^{-1})

For complete transmitter specifications see Transmitter Section.

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Sensors with Connection Heads

Fixed-sheath RTD assemblies with miniature heads are offered with mounting fittings that are welded or brazed to the sheath for direct immersion into a process. The miniature heads offer a compact design and are ideal for laboratory applications or applications where space is limited. The RTD assemblies are supplied with a 316 stainless steel sheath in several diameters. They are offered in various tolerances and temperature ranges as noted below.

ORDER CODES

Example Order Number:

1-0	1-1	1-2		2-0		3		4-0	4-1
RBF185L	48	3	-	006(1/2)	-	00	-	8HPB	25

1-0 100 Ω Platinum RTD Elements α = 0.003 85 °C^{-1}

CODE		TOLERANCE[1]	TEMP. RANGE
SINGLE	*DUPLEX*		
R1T185L	R1T285L	Grade B	(-200 to 200) °C
R5T185L	R5T285L	(1/5) Class B	(-30 to 150) °C
RBF185L	RBF285L	Class B	(-50 to 200) °C
RAF185L	RAF285L	Class A	(-30 to 200) °C
R1T185H	R1T285H	Grade B	(-200 to 600) °C

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

1-1 Sheath Diameters

CODE	DIAMETERS (inches) 316 SS
28	1/8
38	3/16
48	1/4
68	3/8

1-2 Element Connection

CODE	DESCRIPTION
2	2 wire element
3	3 wire element
4	4 wire element

2 -0 "X" Dimensions

Insert three digit "X" length in inches.
Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

3-0 No Fitting

CODE	00

3-1 One-Time Adjustable Fittings

CODE	TYPE	NPT SIZE (inches)	AVAILABLE SHEATH DIAMETERS (inches)
01A	303 SS	1/8	1/8, 3/16, 1/4
05A	316 SS	1/8	1/8, 3/16, 1/4
05B	316 SS	1/4	1/8, 3/16, 1/4, 3/8
05C	316 SS	1/2	1/8, 3/16, 1/4, 3/8
15A	Brass	1/8	1/8, 3/16, 1/4
15B	Brass	1/4	3/16, 1/4, 3/8
15C	Brass	1/2	1/4, 3/8

3-2 Re-Adjustable Compression Fittings

CODE	TYPE	NPT SIZE (inches)	AVAILABLE SHEATH DIAMETERS (inches)
10A	303 SS	1/8	1/8, 3/16
10B	303 SS	1/4	1/4, 3/8
10C	303 SS	1/2	1/4, 3/8
12A	316 SS	1/8	1/8, 3/16, 1/4
12B	316 SS	1/4	1/8, 3/16, 1/4, 3/8
12C	316 SS	1/2	1/8, 3/16, 1/4, 3/8
11A	Brass	1/8	1/8, 3/16, 1/4
11B	Brass	1/4	1/8, 3/16, 1/4, 3/8
11C	Brass	1/2	1/4, 3/8
19C	Spring-loaded SS well fitting	1/2	3/16, 1/4
FEP gland standard 204 °C [400 °F] max.			

3-3 Fixed Bushings

CODE *316 SS*	MOUNTING THREAD NPT (inches)	AVAILABLE SHEATH DIAMETERS (inches)
8A _ _ [1]	1/8	1/8, 3/16, 1/4
8B _ _ [1]	1/4	1/8, 3/16, 1/4, 3/8
8C _ _ [1]	1/2	1/8, 3/16, 1/4, 3/8
8D _ _ [1]	3/4	1/8, 3/16, 1/4, 3/8

[1] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

4-0 Head Mounting Fittings

CODE	DESCRIPTION
9HNB	1/4" x 1/4" stainless steel hex nipple
8HPB	1/4" stainless steel hex bushing (no process threads)
8CFB	1/4" NPT 316 stainless steel compression fitting (no process threads)
22CFB	1/4" NPT brass compression fitting (no process threads)

4-1 Miniature Head Terminations

CODE	DESCRIPTION
17	Miniature plastic head (3/8" NPT conduit opening)
25	Miniature nickel-plated head

Configuration Code GP08
Fixed-Sheath Thermocouple Assemblies with Miniature Connection Heads

Fixed-Sheath Thermocouple Assemblies with miniature connection heads are offered with mounting fittings that are welded or brazed to the sheath for direct immersion into a process. The miniature heads offer a compact design and are ideal for laboratory applications or applications where space is limited. The MgO-insulated thermocouple assemblies are offered in a variety of calibrations, sheath diameters, and sheath materials.

ORDER CODES

1-0	1-1	1-2	1-3		2-0		3		4-0	4-1
Example Order Number: **J**	**3**	**8**	**U**	**-**	**012**	**-**	**01A**	**-**	**8HPB**	**25**

1-0 Thermocouple Types

CODE	
SINGLE	*DUPLEX*
E	EE
J	JJ
K	KK
T	TT

1-1 Sheath Diameters

CODE	DIAMETER (inches)
2	1/8
3	3/16
4	1/4
6	3/8

1-2 Sheath Materials

CODE	MATERIAL	STANDARD AVAILABLE TYPES
3	Alloy 600	K
4	310 SS	K
5	446 SS	K[1]
8	316 SS	E, J, K, T

[1] All sensors with 446SS sheaths must have an ungrounded measuring junction.

1-3 Measuring Junctions

CODE	DESCRIPTION
G	Grounded junction
U	Ungrounded junction
E	Exposed junction

2-0 'X' Dimension

Insert three digit "X" length in inches

Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

3-0 No Fitting

CODE	00

3-1 One-Time Adjustable Fittings

CODE	TYPE	NPT SIZE (inches)	PRESSURE RATED	AVAILABLE SHEATH DIAMETERS (inches)
01A	303 SS	1/8	NO	1/8, 3/16, 1/4
05A	316 SS	1/8	YES	1/8, 3/16, 1/4
05B	316 SS	1/4	YES	1/8, 3/16, 1/4, 3/8
05C	316 SS	1/2	YES	1/8, 3/16, 1/4, 3/8
15A	Brass	1/8	NO	1/8, 3/16, 1/4
15B	Brass	1/4	NO	3/16, 1/4, 3/8
15C	Brass	1/2	NO	1/4, 3/8

3-2 Re-Adjustable Compression Fittings

CODE	TYPE	NPT SIZE (inches)	AVAILABLE SHEATH DIAMETERS (inches)
10A	303 SS	1/8	1/8, 3/16
10B	303 SS	1/4	1/4, 3/8
10C	303 SS	1/2	1/4, 3/8
12A	316 SS	1/8	1/8, 3/16, 1/4
12B	316 SS	1/4	1/8, 3/16, 1/4, 3/8
12C	316 SS	1/2	1/8, 3/16, 1/4, 3/8
11A	Brass	1/8	1/8, 3/16, 1/4
11B	Brass	1/4	1/8, 3/16, 1/4, 3/8
11C	Brass	1/2	1/4, 3/8
19C	Spring-loaded SS well fitting	1/2	3/16, 1/4

FEP gland standard 204 ºC [400 ºF] max.

3-3 Fixed Bushings

CODE *316 SS*	MOUNTING THREAD NPT (inches)	AVAILABLE SHEATH DIAMETERS (inches)
8A _ _ [1]	1/8	1/8, 3/16, 1/4
8B _ _ [1]	1/4	1/8, 3/16, 1/4, 3/8
8C _ _ [1]	1/2	1/8, 3/16, 1/4, 3/8
8D _ _ [1]	3/4	1/8, 3/16, 1/4, 3/8

[1] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

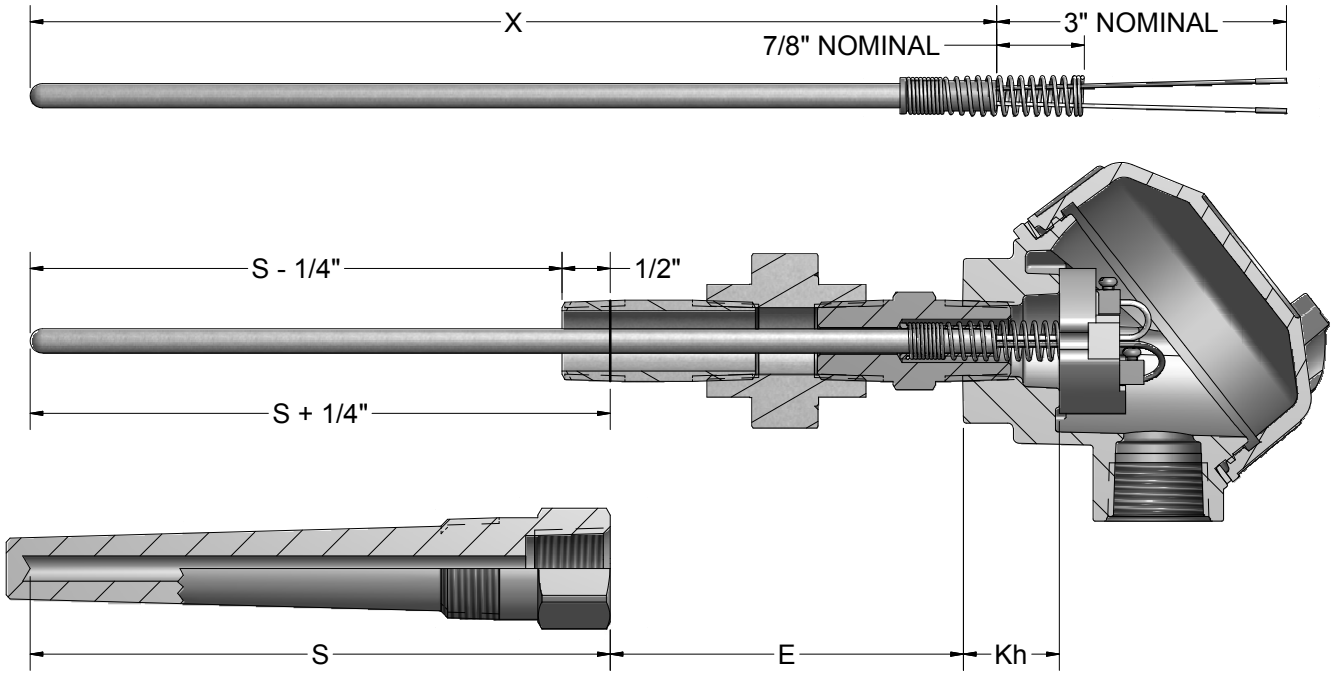
4-0 Head Mounting Fittings

CODE	DESCRIPTION
9HNB	1/4" x 1/4" stainless steel hex nipple
8HPB	1/4" stainless steel hex bushing (no process threads)
8CFB	1/4" NPT 316 stainless steel compression fitting (no process threads)
22CFB	1/4" NPT brass compression fitting (no process threads)

4-1 Miniature Head Terminations

CODE	DESCRIPTION
17	Miniature plastic head (3/8" NPT conduit opening)
25	Miniature nickel-plated head

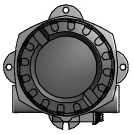
Replacement Element "X" Dimension Calculations



Pyromation Head Order Code	Kh Dimension in inches	Formula for SL option	Formula for SC option
31	1.00	X = S + E + 5/8"	X = S + E
34	1.00	X = S + E + 5/8"	X = S + E
49	1.00	X = S + E + 5/8"	X = S + E
63	1.00	X = S + E + 5/8"	X = S + E
74	1.625	X = S + E + 1 1/4"	X = S + E
91	1.00	X = S + E + 5/8"	X = S + E
93	1.00	X = S + E + 5/8"	X = S + E
94	1.00	X = S + E + 5/8"	X = S + E
71	1.00	X = S + E + 5/8"	X = S + E
72	1.125	X = S + E + 3/4"	X = S + E
81	1.00	X = S + E + 5/8"	X = S + E
82	1.00	X = S + E + 5/8"	X = S + E

Complete Transmitter Specifications are located in the Transmitter Section.

Complete Connection Head Specifications are located in the Accessories Section.

Temperature Transmitters				Connection Heads				
				31	34	49	63	91
								
				Aluminum Screw-Cover Head	Cast Iron Screw-Cover Head	Flip-Top Aluminum Head	White Polypropyl-ene Screw-Cover Head	316L Stainless Steel Screw-Cover Head
T-440		Input: Pt100 RTD Only	Programmable head-mounted transmitter, (4 to 20) mA analog output	X	X	X	X	X
T-441		Input: Thermocouple, RTD, Other	Programmable head-mounted transmitter, isolated, (4 to 20) mA analog output	X	X	X	X	X
T-442	 HART	Input: Thermocouple, RTD, Other	Programmable head-mounted transmitter, isolated, HART® protocol, (4 to 20) mA analog output	X	X	X	X	X
T-82	 HART	Input: Thermocouple, RTD, Other	(4 to 20) mA dual input, isolated HART® head-mounted transmitter	X	X	X	X	X
T-642, T-662	 HART	Input: Thermocouple, RTD, Other	Programmable field transmitter, isolated, HART® protocol, (4 to 20) mA analog output	Unit includes housing and transmitter.				
T-642, T-662 w/ display	 HART	Input: Thermocouple, RTD, Other	Programmable field transmitter, isolated, HART® protocol, (4 to 20) mA analog output with digital display	Unit includes housing and transmitter.				
36T82-D10	 HART	Input: Thermocouple, RTD, Other	(4 to 20) mA dual input, HART® transmitter with digital display and general purpose aluminum housing	Unit includes housing and transmitter.				

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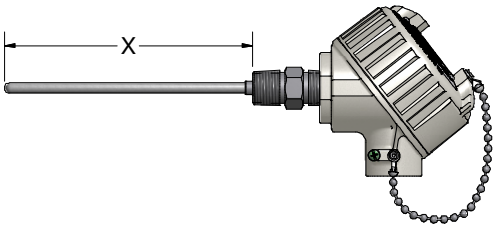
Explosion-Proof

Configuration Code XP01
Hazardous Location Explosion-Proof-Approved, Fixed-Element RTD Assemblies

Explosion-Proof, Fixed-Element RTDs are made for use in U.S. and Canadian hazardous areas. They are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, dependent on connection head type, meet XP Class I Division I & II; Groups A, B, C, D; DIP Class II Division I; Groups E, F, G; Class III; Type 4/4X. They may be installed directly in the process without being inserted into a thermowell. The assemblies feature 316 stainless steel sheaths in various diameter sizes. They are available with or without process mountings and with aluminum or stainless steel explosion-proof connection heads.

CSA file #217989

FM APPROVED



ORDER CODES

Example Order Number:

1-0	2-0	2-1	2-2		3-0		4-0		5-0	5-1	5-2	
XP	- R1T185L	48	3	-	012	-	00	-	8HN	94,	T-	Select Type and Range from back of Section

1-0 Agency Approval

CODE	DESCRIPTION
XP	FM/CSA explosion-proof-approved assembly

2-0 100 Ω Platinum RTD Elements α = 0.003 85 °C^{-1}

CODE		TOLERANCE[1]	TEMP. RANGE
SINGLE	*DUPLEX*		
R1T185L	R1T285L	Grade B	(-200 to 200) °C
R5T185L	R5T285L	(1/5) Class B	(-30 to 150) °C
RBF185L	RBF285L	Class B	(-50 to 200) °C
RAF185L	RAF285L	Class A	(-30 to 200) °C
R1T185H	R1T285H	Grade B	(-200 to 600) °C
RAT185H	RAT285H	Class A	(-100 to 450) °C

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2-1 Sheath Diameters 316 SS

CODE	DIAMETERS (inches)
28[1]	1/8
38	3/16
48	1/4
68	3/8

[1] Not available in duplex

2-2 Element Connection

CODE	DESCRIPTION
2	2-wire element
3	3-wire element
4[1]	4-wire element

[1] Not available in duplex or with 440 Series Transmitter

5-1 Head Terminations

CODE	DESCRIPTION
74	DIN form B aluminum explosion-proof head, Group A
75T-642B	(4 to 20) mA HART® Field Transmitter with aluminum explosion-proof housing, Group A
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof aluminum housing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
93	Aluminum explosion-proof head, Group A
94	316L stainless steel explosion-proof head, Group A

5-2 Options

SB	1/2" NPT conduit reducer bushing
I	Stainless steel tag
T-440[1]	(4 to 20) mA head-mounted transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA HART® isolated head-mounted transmitter
T82-00	(4 to 20) mA dual input, isolated HART® head-mounted transmitter

See transmitter ordering information in back of section.

[1] Not available with option 74

5-0 Head Mounting Fittings

CODE	DESCRIPTION
6HN	1/2" x 1/2" NPT steel hex nipple 1" "E" length
8HN	1/2" x 1/2" NPT stainless steel hex nipple 1" "E" length
9HP	1/2" NPT stainless steel bushing (no process threads)
8RNDC	3/4" x 1/2" NPT stainless steel hex nipple

4-0 Sheath Mounting Fittings

CODE	DESCRIPTION
00	No Fitting

3-0 "X" Dimensions

Insert three digit sheath length ("X" Dimension) in inches.

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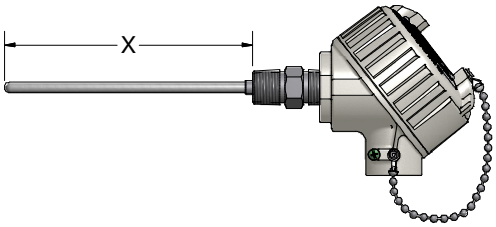
Explosion-Proof

Configuration Code XP02
Hazardous Location Explosion-Proof-Approved, Fixed-Element Thermocouple Assemblies

Explosion-Proof, Fixed-Element Thermocouples are made for use in U.S. and Canadian hazardous areas. They are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, dependent on connection head type, meet XP Class I Division I & II; Groups A, B, C, D; DIP Class II Division I; Groups E, F, G; Class III; Type 4/4X. They may be installed directly in the process without being inserted into a thermowell. The assemblies feature 316 stainless steel sheaths in various diameter sizes and ungrounded isolated junctions. They are available with or without process mountings and with aluminum or stainless steel explosion-proof connection heads.

CSA file #217989

FM APPROVED



ORDER CODES

Example Order Number:

1-0		2-0	2-1	2-2	2-3		3-0		4-0		5-0	5-1	5-2	
XP	-	K	4	8	U	-	012	-	00	-	8HN	93,	T-	Select Type and Range from back of Section

1-0 Agency Approval

CODE	DESCRIPTION
XP	FM/CSA explosion-proof-approved assembly

2-0 Thermocouple Types

CODE		
SINGLE	*DUPLEX*	*TRIPLEX*
E	EE	-
J	JJ	JJJ
K	KK	KKK
T	TT	-

2-1 Sheath Diameters

CODE	DIAMETER (inches)
2	1/8
3	3/16
4	1/4
6	3/8

2-2 Sheath Materials

CODE	MATERIAL	STANDARD AVAILABLE TYPES
3	Alloy 600	K
4	310 SS	K
5	446 SS	K
8	316 SS	E, J, K, T

2-3 Measuring Junction

CODE	DESCRIPTION
U	Ungrounded

3-0 "X" Dimensions

Insert three digit sheath length ("X" Dimension) in inches.

4-0 Sheath Mounting Fittings

CODE	DESCRIPTION
00	No Fitting

5-0 Head Mounting Fittings

CODE	DESCRIPTION
6HN	1/2" x 1/2" NPT steel hex nipple
8HN	1/2" x 1/2" NPT stainless steel hex nipple
9HP	1/2" NPT stainless steel bushing (no process threads)
8RNDC	3/4" x 1/2" NPT stainless steel hex nipple

5-1 Head Terminations

CODE	DESCRIPTION
74	DIN form B aluminum explosion-proof head, Group A
75T-642B	(4 to 20) mA HART® Field Transmitter with aluminum explosion-proof housing, Group A
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof aluminum housing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
93	Aluminum explosion-proof head, Group A
94	316L stainless steel explosion-proof head, Group A
5-2 Options	
SB	1/2" NPT conduit reducer bushing
I	Stainless steel tag
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA HART® isolated head-mounted transmitter
T82-00	(4 to 20) mA dual input, isolated HART® head-mounted transmitter
See transmitter ordering information in back of section.	

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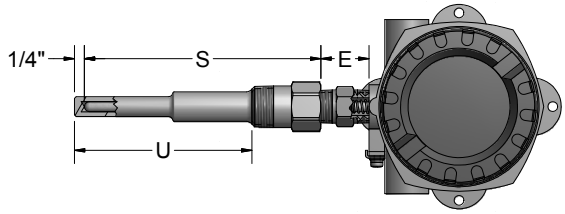
EXPLOSION-PROOF

Configuration Code XP03
Hazardous Location Explosion-Proof-Approved, RTD Assemblies with Thermowells

Explosion-Proof RTD Assemblies with Thermowells are made for use in U.S. and Canadian hazardous areas. They are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, dependent on connection head type, meet XP Class I Division I & II; Groups A, B, C, D; DIP Class II Division I; Groups E, F, G; Class III; Type 4/4X. The required thermowell is available in standard, heavy-duty, and flanged constructions. The assemblies feature 316 stainless steel sheaths. They are available with aluminum or stainless steel explosion-proof connection heads.

CSA file #217989

FM APPROVED



ORDER CODES

Example Order Number:

1-0		2-0	2-1	2-2		3-0		4-0		5-0	5-1	5-2
XP	-	R1T185L	48	3	-	Select Thermowell Part # from Thermowell Section	-	SC	-	8HN	75T-642B,	I

Select Type and Range from back of Section

1-0 Agency Approval

CODE	DESCRIPTION
XP	FM/CSA explosion-proof-approved assembly

2-0 100 Ω Platinum RTD Elements α = 0.003 85 °C^{-1}

CODE		TOLERANCE[1]	TEMP. RANGE
SINGLE	*DUPLEX*		
R1T185L	R1T285L	Grade B	(-200 to 200) °C
R5T185L	R5T285L	(1/5) Class B	(-30 to 150) °C
RBF185L	RBF285L	Class B	(-50 to 200) °C
RAF185L	RAF285L	Class A	(-30 to 200) °C
R1T185H	R1T285H	Grade B	(-200 to 600) °C
RAT185H	RAT285H	Class A	(-100 to 450) °C

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2-1 Sheath Diameters 316 SS

CODE	DIAMETERS (inches)
48	1/4

2-2 Element Connection

CODE	DESCRIPTION
2	2-wire
3	3-wire
4[1]	4-wire

[1] Not available in duplex or with 440 Series Transmitter

3-0 Thermowell

Select thermowell part number from Thermowell Section.

4-0 Element Options

CODE	DESCRIPTION
SL[1]	Spring-loaded element
SC	Self-contained, spring-loaded element

[1] Not available with option 75T, 76T, or 77T

5-0 Head Mounting Fittings

CODE	DESCRIPTION	CODE	DESCRIPTION
STEEL FITTINGS		*316SS FITTINGS*	
6HN	1/2" x 1/2" NPT hex nipple 1" length	8HN	1/2" x 1/2" NPT hex nipple 1" length
6PN_	1/2" NPT pipe nipple (specify "E" length in inches)	8PN	1/2" NPT pipe nipple (specify "E" length in inches)
6XU_[1]	1/2" NPT union/nipple (specify "E" length in inches)	8XU_[1]	1/2" NPT union/nipple (specify "E" length in inches)

[1] 3 1/2" Minimum length required. Maximum allowable "E" length is 9"

5-1 Head Terminations

CODE	DESCRIPTION
74	DIN form B aluminum explosion-proof head, Group A
75T-642B	(4 to 20) mA HART® Field Transmitter with aluminum explosion-proof housing, Group A
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof aluminum housing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
93	Aluminum explosion-proof head, Group A
94	316L stainless steel explosion-proof head, Group A

5-2 Options

SB	1/2" NPT conduit reducer bushing
I	Stainless steel tag
T-440[1]	(4 to 20) mA head-mounted transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA HART® isolated head-mounted transmitter
T82-00	(4 to 20) mA dual input, isolated HART® head-mounted transmitter
See transmitter ordering information in back of section.	
[1] Not available with option 74.	

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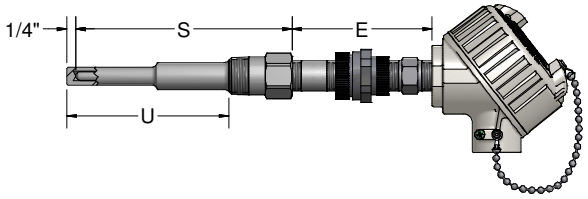
Explosion-Proof

Configuration Code XP04
Hazardous Location Explosion-Proof-Approved, Thermocouple Assemblies with Thermowells

Explosion-Proof Thermocouple Assemblies with Thermowells are made for use in U.S. and Canadian hazardous areas. They are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, dependent on connection head type, meet XP Class I Division I & II; Groups A, B, C, D; DIP Class II Division I; Groups E, F, G; Class III; Type 4/4X. The required thermowell is available in standard, heavy-duty, and flanged constructions. The assemblies feature 316 stainless steel sheaths and ungrounded isolated junctions. They are available with aluminum or stainless steel explosion-proof connection heads.

CSA file #217989

FM APPROVED



ORDER CODES

Example Order Number:

1-0		2-1	2-2	2-3		3-0		4-0		5-0	5-1	5-2	
XP	-	J	48	U	-	Select Thermowell Part # from Thermowell Section	-	SL	-	8XU4	94,	I	Select Type and Range from back of Section

1-0 Agency Approval

CODE	DESCRIPTION
XP	FM/CSA explosion-proof-approved assembly

2-1 Thermocouple Types

CODE		
SINGLE	*DUPLEX*	*TRIPLEX*
E	EE	-
J	JJ	JJJ
K	KK	KKK
T	TT	-

2-2 Sheath Diameters 316 SS

CODE	DIAMETER (inches)
48	1/4

2-3 Measuring Junction

CODE	DESCRIPTION
U	Ungrounded

3-0 Thermowell

Select thermowell from Thermowell Section.

4-0 Element Options

SL[1]	Spring-loaded element
SC	Self-contained spring-loaded element

[1] Not available with option 75T, 76T, or 77T

5-0 Head Mounting Fittings

CODE	DESCRIPTION	CODE	DESCRIPTION
STEEL FITTINGS		*316SS FITTINGS*	
6HN	1/2" x 1/2" NPT hex nipple 1" length	8HN	1/2" x 1/2" NPT hex nipple 1" length
6PN_	1/2" NPT pipe nipple (specify "E" length in inches)	8PN	1/2" NPT pipe nipple (specify "E" length in inches)
6XU_[1]	1/2" NPT union/nipple (specify "E" length in inches)	8XU_[1]	1/2" NPT union/nipple (specify "E" length in inches)

[1] 3 1/2" minimum length required
Maximum allowable "E" length is 9"

5-1 Head Terminations

CODE	DESCRIPTION
74	DIN form B aluminum explosion-proof head, Group A
75T-642B	(4 to 20) mA HART® Field Transmitter with aluminum explosion-proof housing, Group A
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof aluminum housing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
93	Aluminum explosion-proof head, Group A
94	316L stainless steel explosion-proof head, Group A
5-2 Options	
SB	1/2" NPT conduit reducer bushing
I	Stainless steel tag
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA HART® isolated head-mounted transmitter
T82-00	(4 to 20) mA dual input, isolated HART® head-mounted transmitter
See transmitter ordering information in back of section.	

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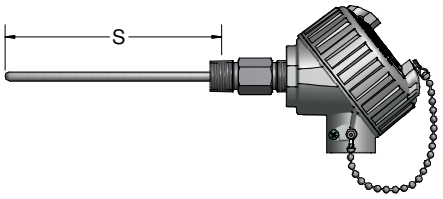
Explosion-Proof

Configuration Code XP05
Hazardous Location Explosion-Proof-Approved, Spring-Loaded RTD Assemblies

Explosion-Proof, Spring-Loaded RTDs are made for use in U.S. and Canadian hazardous areas. They are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, dependent on connection head type, meet XP Class I Division I & II; Groups B, C, D; DIP Class II Division I; Groups E, F, G; Class III; Type 4/4X. Pyromation provides sensors for installation into your existing thermowell or provides the required thermowell as part of the assembly. Refer to the Thermowell Section of this catalog for product selection. The assemblies feature 316 stainless steel sheaths. They are available with aluminum or stainless steel explosion-proof connection heads. **Note:** The "S" dimension will measure 1/4" longer than specified when the spring is in the relaxed position. The "S" dimension is calculated when the sensor is compressed or in the installed position. This design allows 1/4" spring compression to ensure positive contact with the bottom of the thermowell.

CSA file #217989

FM APPROVED



ORDER CODES

Example Order Number:

1-0		2-0	2-1	2-2		3-0		4-0		5-0	5-1	5-2	
XP	-	R1T185L	48	3	-	006	-	FP	-	8HN	93,	T-	Select Type and Range from back of Section

1-0 Agency Approval

CODE	DESCRIPTION
XP	FM/CSA explosion-proof-approved assembly

2-0 100 Ω Platinum RTD Elements α = 0.003 85 °C^{-1}

CODE		TOLERANCE[1]	TEMP. RANGE
SINGLE	*DUPLEX*		
R1T185L	R1T285L	Grade B	(-200 to 200) °C
R5T185L	R5T285L	(1/5) Class B	(-30 to 150) °C
RBF185L	RBF285L	Class B	(-50 to 200) °C
RAF185L	RAF285L	Class A	(-30 to 200) °C
R1T185H	R1T285H	Grade B	(-200 to 600) °C
RAT185H	RAT285H	Class A	(-100 to 450) °C

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2-1 Sheath Diameters 316 SS

CODE	DIAMETERS (inches)
48	1/4

2-2 Element Connection

CODE	DESCRIPTION
2	2-wire
3	3-wire
4[1]	4-wire

[1] Not available in duplex or with 440 Series Transmitter

5-1 Head Terminations

CODE	DESCRIPTION
74	DIN form B aluminum explosion-proof head, Group A
75T-642D	(4 to 20) mA HART® Field Transmitter with aluminum explosion-proof housing, Group B
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof aluminum housing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
93	Aluminum explosion-proof head, Group A
94	316L stainless steel explosion-proof head, Group A
5-2 Options	
SB	1/2" NPT conduit reducer bushing
I	Stainless steel tag
T-440	(4 to 20) mA head-mounted transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA HART® isolated head-mounted transmitter
T82-00	(4 to 20) mA dual input, isolated HART® head-mounted transmitter
See transmitter ordering information in back of section.	

5-0 Head Mounting Fittings

CODE	DESCRIPTION
316 STAINLESS STEEL FITTINGS	
8HN	1/2" NPT flame-path fitting (1-1/2" "E" length)
8PU4[1]	1/2" NPT union/nipple with flame-path fitting (specify "E" length in inches, maximum allowable 9")
[1] For longer lengths replace "4" with length in inches.	

4-0 Element Options

FP	Spring-loaded element with flame path

3-0 "S" Dimensions

Insert three digit sheath length ("S" Dimension) in inches

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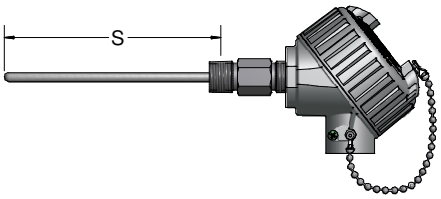
Explosion-Proof

Configuration Code XP06
Hazardous Location Explosion-Proof-Approved, Spring-Loaded Thermocouple Assemblies

Explosion-Proof, Spring-Loaded Thermocouples are made for use in U.S. and Canadian hazardous areas. They are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, dependent on connection head type, meet XP Class I Division I & II; Groups B, C, D; DIP Class II Division I; Groups E, F, G; Class III; Type 4/4X.Pyromation provides sensors for installation into your existing thermowell or provides the required thermowell as part of the assembly. Refer to the Thermowell Section of this catalog for product selection. The assemblies feature 316 stainless steel sheaths and ungrounded isolated junctions. They are available with aluminum or stainless steel explosion-proof connection heads. **Note:** The "S" dimension will measure 1/4" longer than specified when the spring is in the relaxed position. The "S" dimension is calculated when the sensor is compressed or in the installed position. This design allows 1/4" spring compression to ensure positive contact with the bottom of the thermowell.

CSA file #217989

FM APPROVED



ORDER CODES

Example Order Number:

1-0		2-1	2-2	2-3		3-0		4-0		5-0	5-1	5-2	
XP	-	J	48	U	-	012	-	FP	-	8HN	94,	T-	Select Type and Range from back of Section

1-0 Agency Approval

CODE	DESCRIPTION
XP	FM/CSA explosion-proof-approved assembly

2-1 Thermocouple Types

CODE		
SINGLE	*DUPLEX*	*TRIPLEX*
E	EE	-
J	JJ	JJJ
K	KK	KKK
T	TT	-

2-2 Sheath Diameters 316 SS

CODE	DIAMETER (inches)
48	1/4

2-3 Measuring Junction

CODE	DESCRIPTION
U	Ungrounded

3-0 "S" Dimensions

Insert three digit sheath length ("S" Dimension) in inches

4-0 Element Options

FP	Spring-loaded element with flame path

5-0 Head Mounting Fittings

CODE	DESCRIPTION
316 STAINLESS STEEL FITTINGS	
8HN	1/2" NPT flame-path fitting (1-1/2" "E" length)
8PU4[1]	1/2" NPT union/nipple with flame-path fitting (specify "E" length in inches, maximum allowable 9")
[1] For longer lengths replace "4" with length in inches.	

5-1 Head Terminations

CODE	DESCRIPTION
74	DIN form B aluminum explosion-proof head, Group A
75T-642D	(4 to 20) mA HART® Field Transmitter with aluminum explosion-proof housing, Group B
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof aluminum housing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
93	Aluminum explosion-proof head, Group A
94	316L stainless steel explosion-proof head, Group A
5-2 Options	
SB	1/2" NPT conduit reducer bushing
I	Stainless steel tag
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA HART® isolated head-mounted transmitter
T82-00	(4 to 20) mA dual input, isolated HART® head-mounted transmitter
See transmitter ordering information in back of section.	

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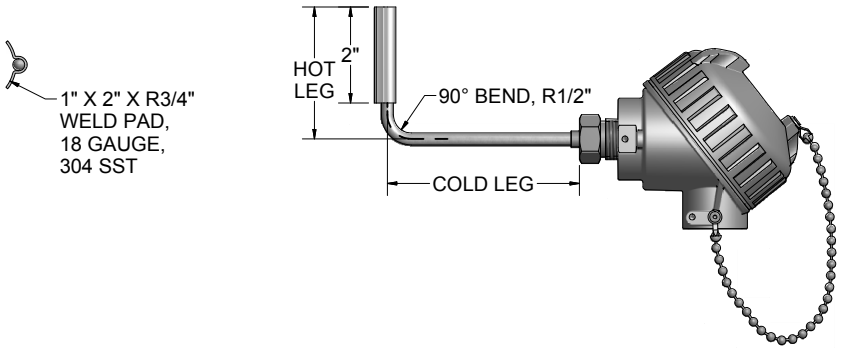
Explosion-Proof

Configuration Code XP07
Hazardous Location Explosion-Proof-Approved, Heat-Tracing RTD Assemblies

Explosion-Proof rated Heat-Tracing RTD assemblies are made for use in systems that measure the surface temperature of process pipe that is carrying products whose temperatures must be controlled to prevent freeze-up, or to maintain a viscosity level so that the inner medium will flow. They are intended for use in U.S. and Canadian hazardous areas and they are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, meet XP Class I Division I & II; Groups A, B, C, D; DIP Class II Division I; Groups E, F, G; Class III; Type 4/4X. These RTDs are offered in a variety of temperature ranges and are supplied with a 316SS sheath, and a 3/4" radius stainless steel mounting pad.



ORDER CODES

Example Order Number:

1-0		2-0	2-1	2-2		3-0		4-0		5-0	5-1
XP	-	RBF185L	48	3	-	HT	-	0304	-	18RD	-	93,	I

1-0 Agency Approval

CODE	DESCRIPTION
XP	FM/CSA explosion-proof-approved assembly

2-0 100 Ω Platinum RTD Elements α = 0.003 85 °C^{-1}

CODE		TOLERANCE[1]	TEMP. RANGE
SINGLE	*DUPLEX*		
R1T185L	R1T285L	Grade B	(-200 to 200) °C
R5T185L	R5T285L	(1/5) Class B	(-30 to 150) °C
RBF185L	RBF285L	Class B	(-50 to 200) °C
RAF185L	RAF285L	Class A	(-30 to 200) °C
RBF185M	RBF285M	Class B	(-50 to 482) °C
R1T185H	R1T285H	Grade B	(-200 to 600) °C
RAT185H	RAT285H	Class A	(-100 to 450) °C

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2-1 Sheath Diameters

CODE	DIAMETERS (inches) 316 SS
48	1/4
68	3/8

2-2 Element Connection

CODE	DESCRIPTION
2	2-wire element
3	3-wire element
4[1]	4-wire element

[1] Not available with 440 Series Transmitter

3-0 Sheath Lengths

CODE	HOT LEG (inches)	COLD LEG (inches)
0304	3	4
0306	3	6
0308	3	8

Consult factory for other hot leg lengths or cold leg lengths.

4-0 Radius Mounting Pads 1" W x 2" L x 18 Ga. 304 SS

CODE	RADIUS (inches)	NPT PIPE SIZE (inches)
18RD	3/4	1 1/2

Mounting pad is flexible enough to be formed around pipe sizes from 1" to 12" NPS pipe.

5-0 Standard Head Terminations

CODE	DESCRIPTION
74	DIN form B aluminum explosion-proof head, Group A
75T-642C	(4 to 20) mA HART® field transmitter with aluminum explosion-proof housing, Group A
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof aluminum housing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
93	Aluminum explosion-proof head, Group A
94	316L stainless steel explosion-proof head, Group A

5-1 Standard Head Options

CODE	DESCRIPTION
I	Stainless Steel Tag
SB	1/2" NPT conduit reducer bushing
T-440	4-20 mA head-mounted RTD transmitter (see instrument section)
T-441	4-20 mA isolated head-mounted transmitter (see instrument section)
T-442	4-20 mA HART® isolated head-mounted transmitter (see instrument section)
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter

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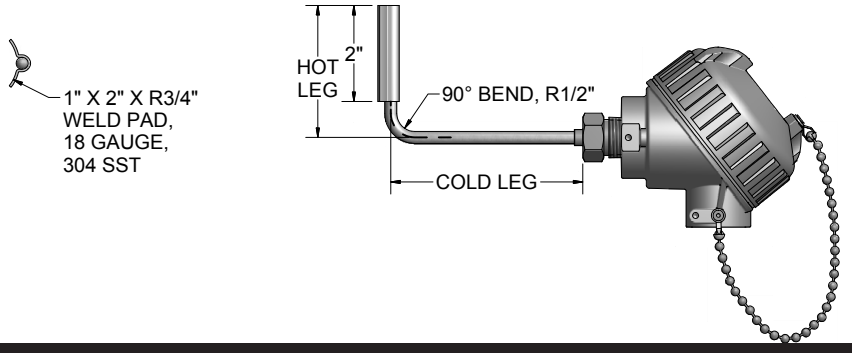
Explosion-Proof

Configuration Code XP07
Hazardous Location Explosion-Proof-Approved, Heat-Tracing Thermocouple Assemblies

Explosion-Proof rated Heat-Tracing Thermocouple assemblies are made for use in systems that measure the surface temperature of process pipe that is carrying products whose temperatures must be controlled to prevent freeze-up, or to maintain a viscosity level so that the inner medium will flow. They are intended for use in U.S. and Canadian hazardous areas and they are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, meet XP Class I Division I & II; Groups A, B, C, D; DIP Class II Division I; Groups E, F, G; Class III; Type 4/4X. These Thermocouples are offered in a variety of temperature ranges and are supplied with a 316SS sheath, and a 3/4" radius stainless steel mounting pad.



ORDER CODES

Example Order Number:

1-0		2-0	2-1	2-2		3-0		4-0		5-0	5-1
XP	-	J	48	U	-	HT	-	0304	-	18RD	-	94,	I

1-0 Agency Approval

CODE	DESCRIPTION
XP	FM/CSA explosion-proof-approved assembly

2-0 Thermocouple Types

CODE	
SINGLE	***DUPLEX***
E	EE
J	JJ
K	KK
T	TT

2-1 316 SS Sheath Diameters and Insulation Type

CODE	DIAMETER (inches)	Insulation Type
48	1/4	MgO
68	3/8	MgO
P48	1/4	Fiberglass
P68	3/8	Fiberglass

2-2 Measuring Junction

CODE	DESCRIPTION
U	Ungrounded
ELEMENT OPTIONS	
M	Special Limits of Error

3-0 Sheath Lengths

CODE	HOT LEG (inches)	COLD LEG (inches)
0304	3	4
0306	3	6
0308	3	8
Consult factory for other hot leg lengths or cold leg lengths.		

4-0 Radius Mounting Pads 1" W x 2" L x 18 Ga. 304 SS

CODE	RADIUS (inches)	NPT PIPE SIZE (inches)
18RD	3/4	1 1/2
Mounting pad is flexible enough to be formed around pipe sizes from 1" to 12" NPS pipe.		

5-0 Standard Head Terminations

CODE	DESCRIPTION
74	DIN form B aluminum explosion-proof head, Group A
75T-642C	(4 to 20) mA HART® field transmitter with aluminum explosion-proof housing, Group A
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof aluminum housing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
93	Aluminum explosion-proof head, Group A
94	316L stainless steel explosion-proof head, Group A

5-1 Standard Head Options

CODE	DESCRIPTION
I	Stainless Steel Tag
SB	1/2" NPT conduit reducer bushing
T-441	4-20 mA isolated head-mounted transmitter (see instrument section)
T-442	4-20 mA HART® isolated head-mounted transmitter (see instrument section)
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter

ORDER CODES

Example Order Number: **75T-642B - D - 3 85 U - S(0-200) C**

(1-0: 75T-642B | 1-1: D | 1-2: 3 | 1-3: 85 | 1-4: U | 1-5: S(0-200) | 1-6: C)

1-0 Transmitter Type

CODE	DESCRIPTION
440[1]	(4 to 20) mA programmable head-mounted RTD transmitter
441	(4 to 20) mA programmable head-mounted universal transmitter
442	(4 to 20) mA HART® programmable head-mounted universal transmitter
75T-642B	(4 to 20) mA HART® Field Transmitter with explosion-proof aluminum housing FM/ CSA / XP Class I Div I Groups A,B,C,D; DIP Class II Div 1 Groups E,F,G; Class III; NI Class I Div II Groups A,B,C,D
75T-642D	(4 to 20) mA HART® Field Transmitter with explosion-proof aluminum housing FM/ CSA / XP Class I Div I Groups B,C,D; DIP Class II Div I Groups E,F,G; Class III; NI Class I Div II Groups B,C,D
[1] Only available with 2- or 3-wire input connection and Pt100 sensor type	

1-1 Options (For 642 Series only)

CODE	DESCRIPTION
T	Solid cover
D	Glass cover with digital display
Leave blank if using 440, 441, or 442	

1-2 Input Type

CODE	DESCRIPTION
00[1]	Unconfigured
1	Thermocouple (TC)
2	RTD (2-wire)
3	RTD (3-wire)
4	RTD (4-wire)
[1] Default setting supplied as 3-wire Pt100 (0-100) °C	

1-3 Sensor Type

CODE	DESCRIPTION
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
85	100 ohm platinum (α = 0.003 85 ºC)

1-4 Failure Mode

CODE	DESCRIPTION
U	Upscale burnout ≥ 20.5 mA
D	Downscale burnout ≤ 3.8 mA

1-5 Range

CODE	DESCRIPTION
S	(lower limit – upper limit)

1-6 Unit of Measure

CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

For complete transmitter specifications see Transmitter Section.

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ORDER CODES

Example Order Number:

1-0		1-1		1-2		1-3		1-4		1-5		1-6		1-7		1-8
77T-662C	-	D	-	33	-	85	-	85	-	A	-	U	-	S(0-200)		C

1-0 Transmitter Type

CODE	DESCRIPTION
77T-662C	(4 to 20) mA HART® Field Transmitter with dual-cavity explosion-proof aluminum housing FM/CSA XP Class I Div I Groups B,C,D; DIP Class II Div I Groups E,F,G; Class III; NI Class I Div II Groups B,C,D
T82-00	(4 to 20) mA dual input, isolated HART® head-mounted Transmitter
76T82	(4 to 20) mA dual input HART® programmable Transmitter with digital display and explosion-proof aluminum housing, FM/CSA,NI,IS,XP,DIP Class I Div I and Div II, Groups A,B,C,D

1-1 Housing Cover Options

CODE	DESCRIPTION
T	Solid cover for 662 series
D	Glass cover with digital display for 662 series
D10	Glass cover with digital display for 36T82 and 76T82 series

1-2 Configuration Input

CODE	DESCRIPTION
2I	Ch1: RTD 2-wire, Ch2: inactive
22	Ch1: RTD 2-wire, Ch2: RTD 2-wire
23	Ch1: RTD 2-wire, Ch2: RTD 3-wire
2T	Ch1: RTD 2-wire, Ch2: Thermocouple
3I	Ch1: RTD 3-wire, Ch2: inactive
32	Ch1: RTD 3-wire, Ch2: RTD 2-wire
33	Ch1: RTD 3-wire, Ch2: RTD 3-wire
3T	Ch1: RTD 3-wire, Ch2: Thermocouple
4I	Ch1: RTD 4-wire, Ch2: inactive
4T	Ch1: RTD 4-wire, Ch2: Thermocouple
TI	Ch1: Thermocouple, Ch2: inactive
TT	Ch1: Thermocouple, Ch2: Thermocouple

1-8 Unit of Measure

CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

1-7 Range

CODE	DESCRIPTION
S	(lower limit – upper limit)

1-6 Failure Mode

CODE	DESCRIPTION
U	Upscale Burnout ≥ 20.5 mA
D	Downscale Burnout ≤ 3.8 mA

1-5 Input Set-ups

CODE	DESCRIPTION
0	One Input (662 only)
A	Process Variable = Ch1; CH2 = inactive
B	Process variable = CH1; secondary variable = Ch2 (T82 Only)
C	Process variable = the difference between CH1 and Ch2
D	Process variable = the average between CH1 and Ch2
E	Sensor backup; Process variable= Ch1 and Ch2

1-4 Sensor Input Channel 2

CODE	DESCRIPTION
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
85	100 ohm platinum (α = 0.003 85 ºC^{-1})
00	No second channel

1-3 Sensor Input Channel 1

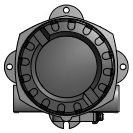
CODE	DESCRIPTION
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
85	100 ohm platinum (α = 0.003 85 ºC^{-1})

For complete transmitter specifications see Transmitter Section.

HART® is a registered trademark of HART Communication Foundation.

Complete Transmitter Specifications are located in Transmitter Section.

Complete Connection Head Specifications are located in the Accessories Section.

Temperature Transmitters				Connection Heads 74	93	94
						
				DIN form B Aluminum Explosion-Proof Head, Group A	Aluminum Explosion-Proof Head, Group A	316L Stainless Steel Explosion-Proof Head, Group A
T-440		Input: Pt100 RTD Only	Programmable head-mounted transmitter, (4 to 20) mA analog output		X	X
T-441		Input: Thermocouple, RTD, Other	Programmable head-mounted transmitter, isolated, (4 to 20) mA analog output	X	X	X
T-442	 HART	Input: Thermocouple, RTD, Other	Programmable head-mounted transmitter, isolated, HART® protocol, (4 to 20) mA analog output	X	X	X
T82-00	 HART	Input: Thermocouple, RTD, Other	(4 to 20) mA dual input, isolated HART® head-mounted transmitter	X	X	X
75T-642, 77T-662	 HART	Input: Thermocouple, RTD, Other	Programmable field transmitter, isolated, HART® protocol, (4 to 20) mA analog output	Unit includes housing and transmitter.		
75T-642, 77T-662 w/ display	 HART	Input: Thermocouple, RTD, Other	Programmable field transmitter, isolated, HART® protocol, (4 to 20) mA analog output with digital display	Unit includes housing and transmitter.		
76T82-D10	 HART	Input: Thermocouple, RTD, Other	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof housing, Group A	Unit includes housing and transmitter.		

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Classes	Groups	Divisions	
		1	2
Class I	**Examples**		
Location in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.	Group A: Acetylene Group B: Hydrogen Group C: Ethylene Group D: Propane, fuels, solvents	Locations where hazardous material exists under normal operating conditions or through breakdown or repair.	Locations where hazardous materials are expected to be confined within closed containers of closed systems but may become present through a leak or process failure.
Class II	**Examples**		
Locations that are hazardous because of the presence of combustible dust.	E: Metal dusts F: Carbon dust G: Combustible dust, flour, grain, wood, plastic, chemicals	Combustible dust is in the air under normal operating conditions in quantities sufficient to produce explosive or ignitable mixtures or through breakdown or repair.	Combustible dust may be in the air in sufficient quantities to produce an explosion due to abnormal operations or failure of electrical equipment.
Class III			
Locations that are hazardous because of the presence of easily ignitable fibers or flyings, but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures.	There are no defined groups. Examples are textiles, woodworking, paper fibers.	Easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used.	Easily ignitable fibers are stored or handled other than in the process of manufacture.

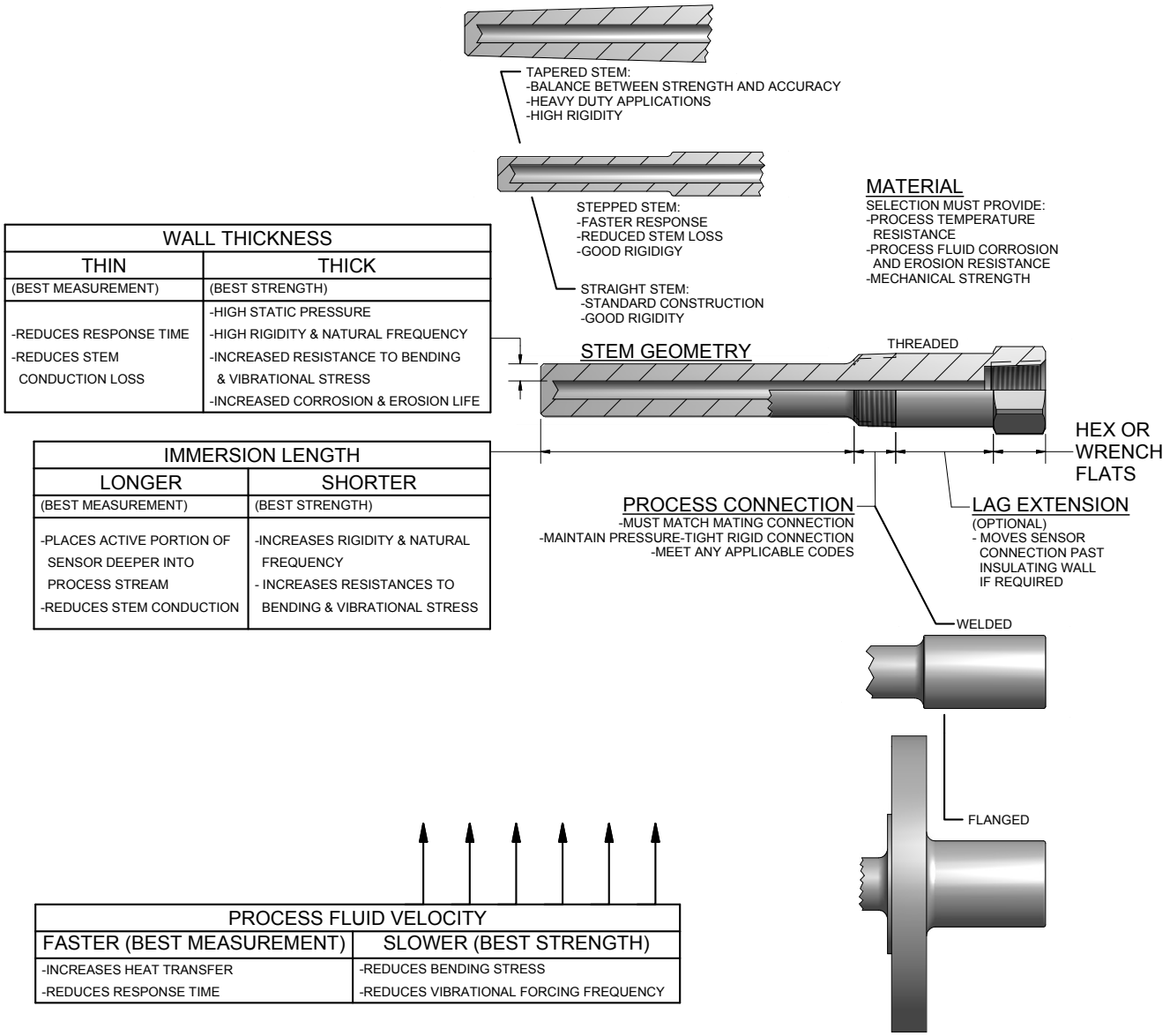
Methods of Protection			
Explosionproof (XP) **Class I, Division 1, 2**	**Dust-Ignitionproof (DIP)** **Class II, Division 1, 2**	**Intrinsically Safe (IS)** **Class I, Division 1, 2** **Class II, Division 1, 2** **Class III, Division 1, 2**	**Nonincendive (NI)** **Class I, Division 2** **Class II, Division 2** **Class III, Division 1, 2**
Apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and that operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby.	Equipment enclosed in a manner that excludes dust and does not permit arcs, sparks, or heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure.	Equipment not capable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific flammable or combustible atmospheric mixture in its most easily ignitable concentration.	Equipment having electrical circuitry that is incapable, under normal operating conditions, of causing ignition of a specified flammable gas-air, vapor-air, or dust-air mixture due to arcing or thermal means.

This material is for reference only. Refer to *The NEC® 2005 Handbook, NFPA 70: National Electrical Code® International Electrical Code® Series* (Quincy, MA, 2005) for authoritative and complete documentation.

Thermowell Design and Selection Criteria

A thermowell is a pressure-tight receptacle that protects and extends the life of a temperature sensor in processing applications where the sensor is not mechanically or chemically compatible with the process environment. Installed directly into the piping systems, thermowells facilitate sensor replacement in high-pressure pipelines and eliminate the need to interrupt the process flow or drain the process system for sensor maintenance functions. The use of standardized thermowells permits simple relocation of sensors throughout a plant.

Strength versus accurate and fast temperature measurement is a balancing act. The factors which tend to produce high strength also tend to reduce the temperature sensor's accuracy and speed of response. A properly selected thermowell will balance these opposing factors to produce a design capable of functioning satisfactorily in the intended application. The listed factors are a general guide and are not all inclusive. Refer to ASME PTC 19.3 TW for a more authoritative dissertation on proper thermowell selection.



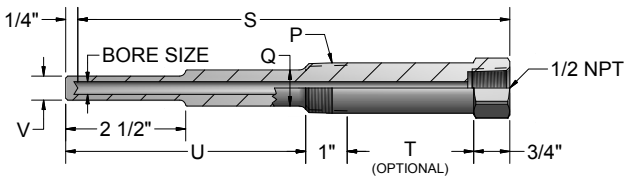
WALL THICKNESS	
THIN	THICK
(BEST MEASUREMENT)	(BEST STRENGTH)
-REDUCES RESPONSE TIME -REDUCES STEM CONDUCTION LOSS	-HIGH STATIC PRESSURE -HIGH RIGIDITY & NATURAL FREQUENCY -INCREASED RESISTANCE TO BENDING & VIBRATIONAL STRESS -INCREASED CORROSION & EROSION LIFE

IMMERSION LENGTH	
LONGER	SHORTER
(BEST MEASUREMENT)	(BEST STRENGTH)
-PLACES ACTIVE PORTION OF SENSOR DEEPER INTO PROCESS STREAM -REDUCES STEM CONDUCTION	-INCREASES RIGIDITY & NATURAL FREQUENCY - INCREASES RESISTANCES TO BENDING & VIBRATIONAL STRESS

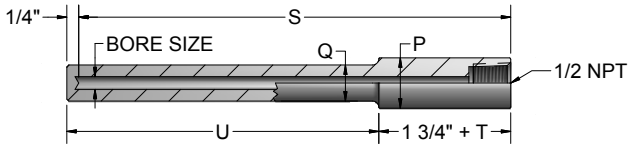
PROCESS FLUID VELOCITY	
FASTER (BEST MEASUREMENT)	SLOWER (BEST STRENGTH)
-INCREASES HEAT TRANSFER -REDUCES RESPONSE TIME	-REDUCES BENDING STRESS -REDUCES VIBRATIONAL FORCING FREQUENCY

The drilled thermowells listed below are those most commonly found in process applications. Other types and styles are listed later in this section. The thermowells listed below are available as separate component wells and can be ordered by the code numbers listed below. They can also be ordered as a part of a complete sensor assembly. Consult factory for wells with different mounting threads, lengths, and materials.

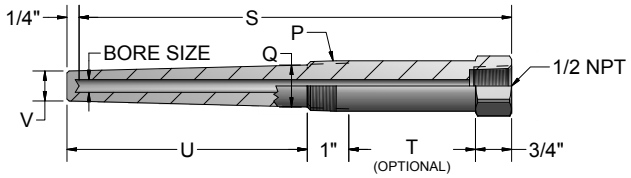
STANDARD-DUTY WELLS



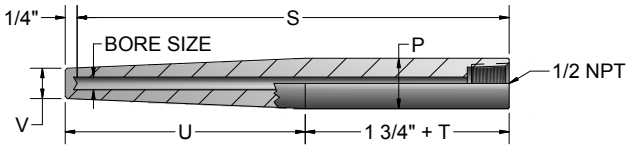
STRAIGHT-SHANK, SOCKET-WELD



HEAVY-DUTY WELLS



WELD-IN WELLS



ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6
S	4	D	06	08	T2	S

1-0 Well Type

CODE	DESCRIPTION
S	Standard-duty threaded (NPT)
H	Heavy-duty threaded (NPT)
SW	Straight-shank, socket-weld
WI	Weld-in

1-1 Bore Size

CODE	DESCRIPTION
4	0.260 Dia. Bore

1-2 Pipe Size "P"

CODE	DESCRIPTION
C	1/2" Pipe[1]
D	3/4" Pipe
E	1" Pipe
[1] Only available with well type S or H	

1-3 Length Dimensions (inches)

CODE	"S" DIMENSIONS	"U" DIMENSIONS	
		NO LAG	*WITH STANDARD LAG*
04	4	2(1/2)	N/A
06	6	4(1/2)	2(1/2)
09	9	7(1/2)	4(1/2)
12	12	10(1/2)	7(1/2)
15	15	13(1/2)	10(1/2)
18	18	16(1/2)	13(1/2)
24	24	22(1/2)	19(1/2)

1-4 Material

CODE	DESCRIPTION
08	316 stainless steel
09	304 stainless steel

1-5 Optional "T" Lag Dimension

CODE	DESCRIPTION
Leave blank if No Lag is required	
T2	2" Lag standard on 6" well
T3	3" Lag standard on 9, 12, 15, 18, 24" wells
T__	Special Lag specify "T" dimension in inches

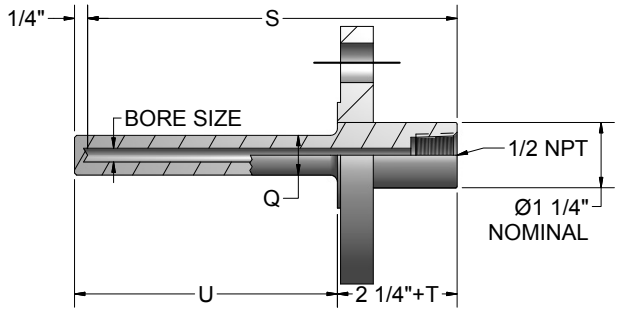
1-6 Well Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Customer specified part number marked on the thermowell - (10 digit maximum)

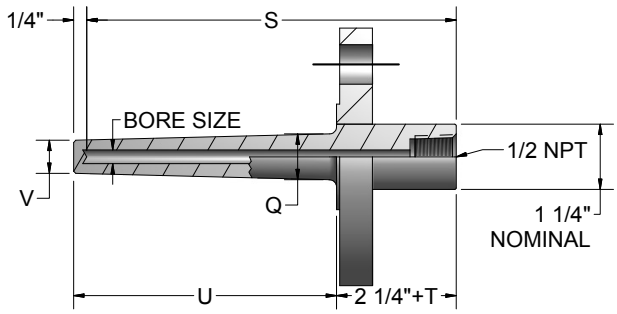
The flanged thermowells described on this page are those commonly found in most process applications. These wells are supplied as standard- or heavy-duty with raised-faced flanges. Other types and styles are listed later in this section. Consult factory for wells with different flange sides, lengths, and materials.

FLANGED THERMOWELLS

STANDARD-DUTY



HEAVY-DUTY



ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8
SF	4	15	R	3	12	08	T2	C8

1-0 Well Type

CODE	DESCRIPTION
SF	Standard-duty flanged
HF	Heavy-duty flanged

1-1 Bore Size

CODE	DESCRIPTION
4	0.260 Bore

1-2 Flange Size

CODE	DESCRIPTION
10	1"
15	1 1/2"
20	2"

1-3 Flange Type

CODE	DESCRIPTION
R	Raised face

1-4 Pressure Rating

CODE	DESCRIPTION
1	150 class
3	300 class

1-5 Well Length (inches)

CODE	DESCRIPTION	
	"S" DIMENSION	"U" DIMENSION
06	6	4
09	9	7
12	12	10
15	15	13
18	18	16
24	24	22

1-6 Well Material

CODE	DESCRIPTION
08	316 Stainless steel
09	304 Stainless steel

1-7 Optional "T" Lag Dimension

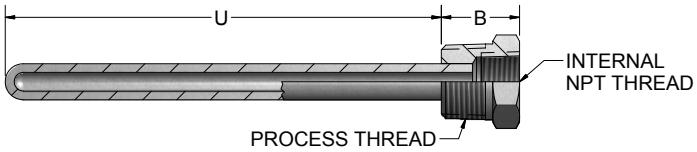
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

1-8 Well Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Customer specified part number marked on thermowell (10 digit maximum)

ORDER CODES

Built-Up Protection Wells are small diameter general-purpose wells for use in low temperature, low pressure, and low fluid velocity applications. Built-Up Protection Wells are constructed by welding or brazing bushings onto tubing. Built-Up Protection Wells of all stainless steel construction have welded-on bushings. Built-Up Protection Wells with brass bushings have brazed-on bushings.



Example Order Number: **26 - 48 - 06 - 803**

(1 = 48, 2 = 06, 3 = 803)

1 Well Size and Material

CODE	TUBE (inches) O.D. I.D.	MATERIAL
48	0.250 x 0.194	316 SS
58	0.313 x 0.257	316 SS
88	0.500 x 0.260	316 SS
Z	Special (Consult factory)	

2 Well 'U' Dimensions

Insert (2) digit 'U' length in inches.
EXAMPLES: 06 = 6" U Dim. 02 (1/2) = 2(1/2") U Dim.

3 Mounting Bushing Material - Dimensions

CODE		BUSHING THREADS (inches)		BUSHING 'B' DIM. (inches)
BRASS	*316 SS*	*EXT.*	*INT.*	
2201[1]	801[1]	1/4	1/8	3/4
2202	802	3/8	1/8	3/4
2203	803	3/8	1/4	3/4
2204	804	1/2	1/8	15/16
2205	805	1/2	1/4	15/16
2206	806	1/2	3/8	15/16
2207	807	1/2	1/2	1 1/2
2208	808	3/4	1/8	1
2209	809	3/4	1/4	1
2210	810	3/4	3/8	1
2211	811	3/4	1/2	1

[1] Not available with 1/2" O.D. wells

Code	Description	UNS Number	Trade Names
03	Alloy 600	N06600	Inconel®
04	310 SS	S31000	
05	446 SS	S44600	
07	Alloy 601	N06601	Inconel®
08	316 SS/316 L	S31603	
09	304 SS/304 L	S30403	
22	Brass[1]		
27	Alloy 400	N04400	Monel®
28	Alloy B-3	N10675	Hastelloy®
29	Alloy C-276	N10276	Hastelloy®
31	Nickel 200	N02200	
35	321 SS	S32100	
36	347 SS	S34700	
37	Alloy 800	N08800	Incoloy®
38	Alloy 20	N08020	Carpenter
41	HR-160	N12160	Haynes®
50	Zirconium	R60702	
51	Alloy X		Hastelloy®
56	Fluoropolymer		Fluoropolymer
59	F22	K21590	
60	F11	K11572	
61	A105	K03504	
91	F91	K90901	
[1] Materials available in various alloys - Consult factory.			

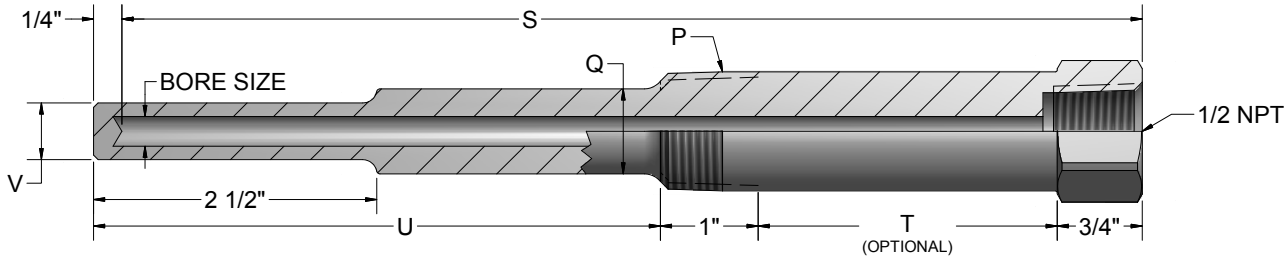
Thermowell Options and Specifications

The following options are available on Pyromation thermowells. Please contact our sales department for information and current pricing.

Documentation/Testing	
Certificate of Compliance	C of C
Hydrostatic Test (Internal or External)	ASTM E1003 Compliant
Liquid Dye Penetrant Test	ASTM E165 Compliant, ASTM E1220
Material Test Reports	MTR
NACE	NACE Certification available for applicable materials.
Positive Material Identification (PMI)	X-Ray Fluorescence Spectrometry, ASTM E572, ASTM E2465
Surface Roughness Test	ASME B46.1
Wake Frequency Calculation	ASME PTC 19.3 TW
Weld X-Ray Inspection	ASME B31.3
Services	
Expedited Delivery	Call for Availability
Oxygen cleaning	ASTM G93; CGA G-4.1
Stamping	10 Characters Maximum
Full-Penetration Weld	Performed by welders certified to ASME Section IX, Boiler and Pressure Vessel Code
Electropolish	15 µin R_a Standard
Components/Coatings	
Abrasive Coatings	Stellite #6, Colmonoy #72, Chrome Carbide, D-5 Tungston Carbide
Plug and Chain - Brass	See Catalog Option
Plug and Chain - Stainless Steel	See Catalog Option
Tantalum Jacket	0.015" Thickness Standard
FEP Coating	1-5 mils Thickness Average
Industry Specifications	
Canadian Registration Numbers (CRN)	ASME B31.3 Process Piping
Flanged Thermowells	ASME B16.5 prior to fabrication
Heat Treating	Stress relief, annealing, and custom heat treating available upon request.
Material	ASTM Compliance and other applicable National Standards
Pipe Threads	ASME B1.20.1
Sanitary Thermowells	3-A Sanitary Council Standard. Authorization Number: 487 32 µin R_a Food Grade Surface Finish
Manufacturing Tolerances and Maximums	
"S" Length Maximum	36" maximum for standard drilled thermowells. For over 36” or for multi-piece construction, consult factory.
Bore "Bottom" Shape	"W" (nominal)
Bore Concentricity	± 10% of minimum wall thickness
Bore Depth	±0.020" (through 36")
Bore Diameter	+0.005" / -0.003" (bore sizes 0.125" through 0.5156" I.D.)
Insertion Length	Lengths up to 22.50" ± 0.0625". Lengths from 22.50" through 48" ±0.125". Lengths over 48" ±0.25".
Stem Outside Diameter	±0.010”
Tapered Allowance	Maximum tapered length is 16.00”. “U” dimensions greater than 16.00” in length are manufactured with a straight O.D. beginning below the process connection radius and following throughout with only the last 16.00” of “U” dimension tapered to minor O.D.
Surface Finish	32 µin R_a standard
Internal Threads	1/2"-14 - NPT per ANSI B1.20.1 (1 to 3 turns deep per UL 866 and CSA C22.2 No. 30-M1986)
Marking	Standard marking includes material grade, material traceability codes, and CRN when applicable on drilled barstock and flanged thermowells
Passivation	ASTM A967

Standard-Duty, Threaded Thermowells

Standard-Duty, Threaded Thermowells are available in a variety of materials, process connection sizes, lengths, and optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. The stepped construction is used in standard-duty applications and increases the speed of response while maintaining mechanical strength. These thermowells are designed with standard 0.260" bore diameters to accommodate sensing elements with a 0.252" maximum diameter. These wells are available as separate components or as part of complete sensor assemblies.



Wells are made from round bar with milled wrench hex. 1 1/4" NPT and 1 1/2" NPT wells are supplied as round bar with milled wrench flats.

("U" length for non-lagging wells) = "S" -1 1/2"
("U" length for lagging wells) = "S" -1 1/2" -"T"
(To solve for "T"), "T" = "S" -"U" -1 1/2" (When "U" and "S" are specified)

Thermowell Dimensions

"P"	"Q"	"V"
1/2" NPT	5/8" Dia.	1/2" Dia.
3/4" NPT	3/4" Dia.	1/2" Dia.
1" NPT	7/8" Dia.	1/2" Dia.
1 1/4" NPT	1 1/4" Dia.	7/8" Dia.
1 1/2" NPT	1 1/2" Dia.	7/8" Dia.

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6
S	4	D	06	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
S	Standard-duty threaded

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore

1-2 Pipe Size "P"

CODE	DESCRIPTION
C	1/2" NPT
D	3/4" NPT
E	1" NPT
F	1 1/4" NPT
G	1 1/2" NPT

1-3 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-4 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

1-5 Optional "T" Lag Dimension

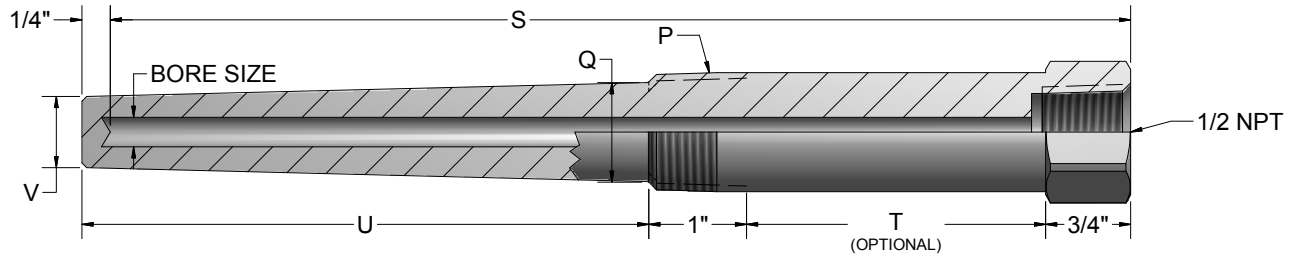
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

1-6 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Well stamped with customer-specified part number

Heavy-Duty, Threaded Thermowells

Heavy-Duty, Threaded Thermowells are available in a variety of materials, process connection sizes, lengths and optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. They are designed with a standard 0.260" or 0.385" bore diameter to accommodate sensing elements with either a 0.252" or 0.377" maximum diameter, respectively. The tapered design is suited for heavy-duty applications where greater rigidity is required for increased pressure and flow due to process conditions. These wells are available as separate components or as part of complete sensor assemblies.



Wells are made from round bar with milled wrench hex. 1 1/4" NPT and 1 1/2" NPT wells are supplied as round bar with milled wrench flats.

("U" length for non-lagging wells) = "S" -1 1/2"
("U" length for lagging wells) = "S" -1 1/2" -"T"
(To solve for "T"), "T" = "S" -"U" -1 1/2" (When "U" and "S" are specified)
Maximum tapered length is 16"

Thermowell Dimensions

"P"	"Q"	"V" (0.260")	"V" (0.385")
1/2" NPT	11/16" Dia.	5/8" Dia.	N/A
3/4" NPT	7/8" Dia.	5/8" Dia.	49/64" Dia.
1" NPT	1 1/16" Dia.	5/8" Dia.	49/64" Dia.
1 1/4" NPT	1 3/8" Dia.	7/8" Dia.	7/8" Dia.
1 1/2" NPT	1 5/8" Dia.	1" Dia.	1" Dia.

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6
H	4	D	06	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
H	Heavy-duty threaded

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore
6	0.385" Dia. bore

1-2 Pipe Size "P"

CODE	DESCRIPTION
C [1]	1/2" NPT
D	3/4" NPT
E	1" NPT
F	1 1/4" NPT
G	1 1/2" NPT

[1] Not available with 0.385" Dia. Bore

1-3 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-4 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

1-5 Optional "T" Lag Dimension

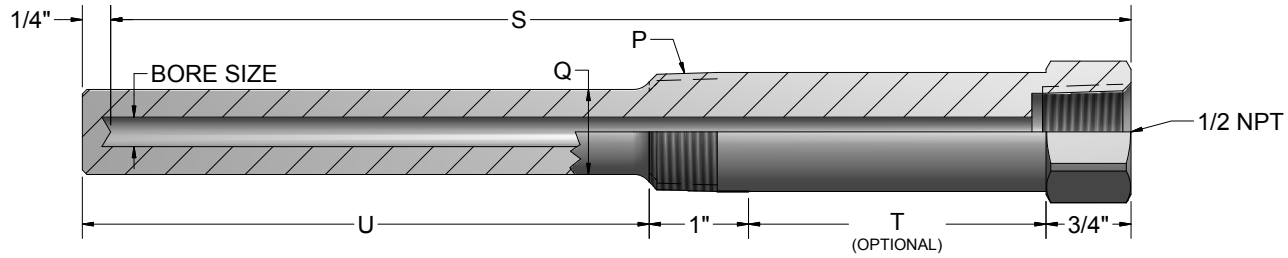
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

1-6 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Well stamped with customer-specified part number

Straight-Shank, Threaded Thermowells

Straight-Shank, Threaded Thermowells are available in a variety of materials, process connection sizes, lengths, and optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. They are designed with a standard 0.260" or 0.385" bore diameter to accommodate sensing elements with either a 0.252" or 0.377" maximum diameter, respectively. These wells are available as separate components or as part of complete sensor assemblies.



Wells are made from round bar with milled wrench hex. 1 1/4" NPT and 1 1/2" NPT wells are supplied as round bar with milled wrench flats.

("U" length for non-lagging wells) = "S" -1 1/2"
("U" length for lagging wells) = "S" -1 1/2" -"T"
(To solve for "T"), "T" = "S" -"U" -1 1/2" (When "U" and "S" are specified)

Thermowell Dimensions

"P"	"Q"
1/2" NPT	5/8" Dia.
3/4" NPT	3/4" Dia.
1" NPT	7/8" Dia.
1 1/4" NPT	1 1/4" Dia.
1 1/2" NPT	1 1/2" Dia.

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6
ST	4	D	09	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
ST	Straight-shank threaded

1-1 Bore Size

CODE	DESCRIPTION
4	0.260 Dia. bore
6	0.385" Dia. bore

1-2 Pipe Size "P"

CODE	DESCRIPTION
C	1/2" NPT
D	3/4" NPT
E	1" NPT
F	1 1/4" NPT
G	1 1/2" NPT

1-3 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-4 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

1-5 Optional "T" Lag Dimension

CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

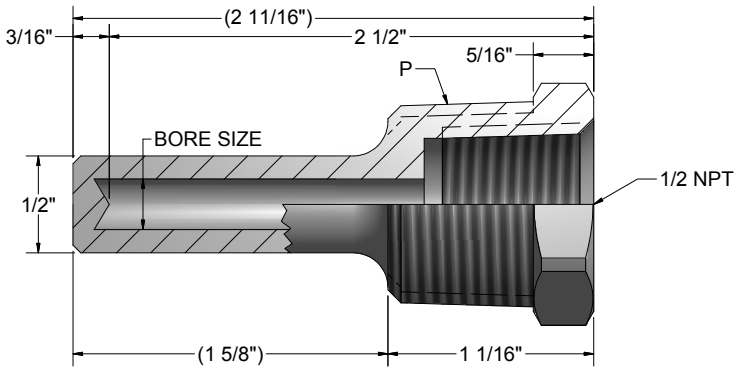
1-6 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Well stamped with customer-specified part number

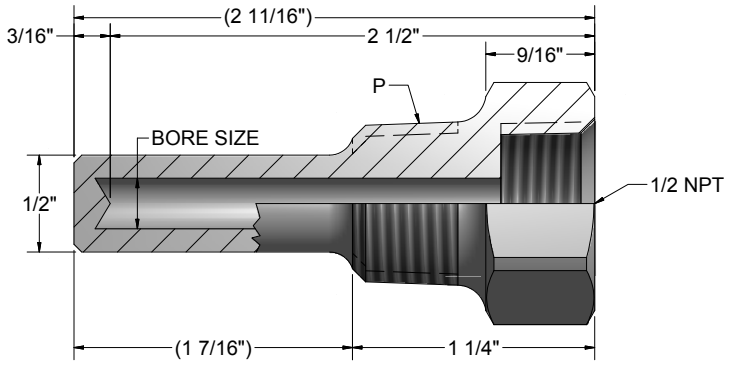
Limited-Space Thermowells

Limited-Space Thermowells are available in a variety of materials and process connection sizes. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. They are intended for use in piping systems where space is limited. They are designed with a standard 0.260" bore diameter to accommodate sensing elements with a 0.252" maximum diameter. These wells are available as separate components or as part of complete sensor assemblies.

3/4" and 1" NPT



1/2" NPT



ORDER CODES

Example Order Number:

1-0	1-1	1-2		1-3	1-4
LS	4	D	2.5	08	C8

1-0 Well Type

CODE	DESCRIPTION
LS	Limited-space threaded

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore

1-2 Pipe Size "P"

CODE	DESCRIPTION
C	1/2" NPT
D	3/4" NPT
E	1" NPT

1-4 Options

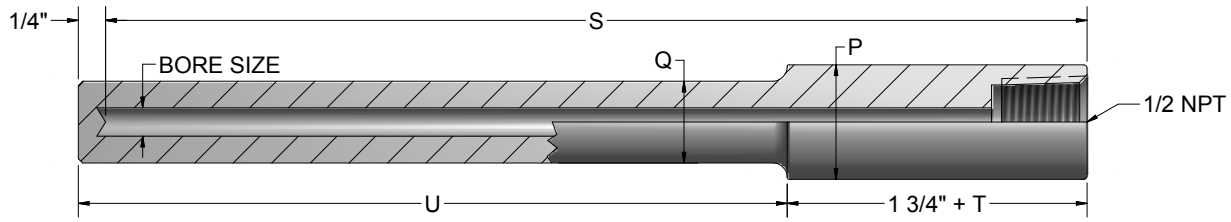
CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Well stamped with customer-specified part number

1-3 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

Straight-Shank, Socket-Weld Thermowells

Straight-Shank, Socket-Weld Thermowells are available in a variety of materials, process connection sizes, lengths, and optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. The Straight-Shank Socket-Weld is designed to be used with a 3000 class weld-o-let which allows the thermowell to be welded permanently into the process. They are designed with a standard 0.260" or 0.385" bore diameter to accommodate sensing elements with either a 0.252" or 0.377" maximum diameter, respectively. These wells are available as separate components or as part of complete sensor assemblies.



("U" length for non-lagging wells) = "S" -1 1/2"
("U" length for lagging wells) = "S" -1 1/2" -"T"
(To solve for "T"), "T" = "S" -"U" -1 1/2" (When "U" and "S" are specified)

Thermowell Dimensions

"P" PIPE SIZE		"Q"
NOM.	DIA.	
3/4"	1.050"	3/4" Dia.
1"	1.315"	7/8" Dia.
1 1/4"	1.660"	1 1/4" Dia.
1 1/2"	1.900"	1 1/2" Dia.

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6
SW	4	D	09	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
SW	Straight- shank socket-weld

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore
6	0.385" Dia. bore

1-2 Pipe Size "P"

CODE	DESCRIPTION
D	3/4" NPS
E	1" NPS
F	1 1/4" NPS
G	1 1/2" NPS

1-3 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-4 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

1-5 Optional "T" Lag Dimension

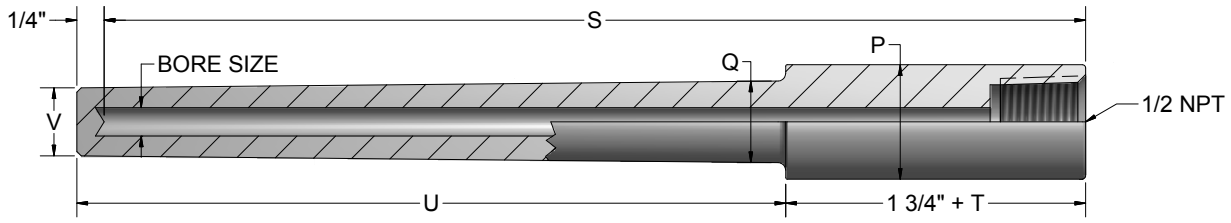
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

1-6 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Well stamped with customer-specified part number

Heavy-Duty, Socket-Weld Thermowells

Heavy-Duty, Socket-Weld Thermowells are available in a variety of materials, process connection sizes, lengths and optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. The Heavy-Duty Socket-Weld is designed to be used with a 3000 class weld-o-let which allows the thermowell to be welded permanently into the process. They are designed with a standard 0.260" or 0.385" bore diameter to accommodate sensing elements with a 0.252" or 0.377" maximum diameter, respectively. The tapered design is suited for heavy-duty applications where greater rigidity is required due to process conditions. These wells are available as separate components or as part of complete sensor assemblies.



Thermowell Dimensions

"P" PIPE SIZE		"Q"	"V" 0.260	"V" 0.385
NOM.	DIA.			
3/4"	1.050"	3/4" Dia.	5/8" Dia.	5/8" Dia.
1"	1.315"	7/8" Dia.	5/8" Dia.	49/64" Dia.
1 1/4"	1.660"	1 1/4" Dia.	7/8" Dia.	7/8" Dia.
1 1/2"	1.900"	1 1/2" Dia.	7/8" Dia.	7/8" Dia.

("U" length for non-lagging wells) = "S" -1 1/2"
("U" length for lagging wells) = "S" -1 1/2" -"T"
(To solve for "T"), "T" = "S" -"U" -1 1/2" (When "U" and "S" are specified)

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6
HW	4	D	09	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
HW	Heavy-duty socket-weld

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore
6	0.385" Dia. bore

1-2 Pipe Size "P"

CODE	DESCRIPTION
D	3/4" NPS
E	1" NPS
F	1 1/4" NPS
G	1 1/2" NPS

1-3 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-4 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

1-5 Optional "T" Lag Dimension

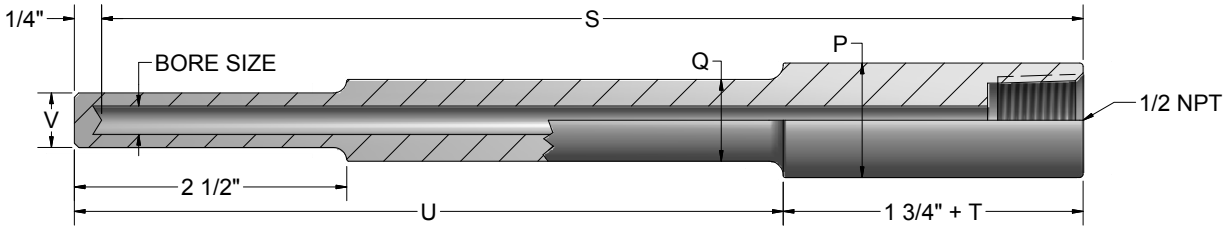
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

1-6 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Well stamped with customer-specified part number

Reduced-Tip, Socket-Weld Thermowells

Reduced-Tip, Socket-Weld Thermowells are available in a variety of materials, process connection sizes, lengths, and optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. The Reduced-Tip Socket-Weld is designed to be used with a class 3000 weld-o-let which allows the thermowell to be welded permanently into the process. The stepped construction is used in standard-duty applications and increases the speed of response while maintaining mechanical strength.They are designed with standard 0.260" bore diameters to accommodate sensing elements with a 0.252" maximum diameter. These wells are available as separate components or as part of complete sensor assemblies.



("U" length for non-lagging wells) = "S" -1 1/2"
("U" length for lagging wells) = "S" -1 1/2" -"T"
(To solve for "T"), "T" = "S" -"U" -1 1/2" (When "U" and "S" are specified)

Thermowell Dimensions

"P" PIPE SIZE		"Q"	"V"
NOM.	DIA.		
3/4"	1.050"	3/4" Dia.	1/2" Dia.
1"	1.315"	7/8" Dia.	1/2" Dia.
1 1/4"	1.660"	1 1/4" Dia.	7/8" Dia.
1 1/2"	1.900"	1 1/2" Dia.	7/8" Dia.

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6
RW	4	D	09	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
RW	Reduced-tip socket-weld

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore

1-2 Pipe Size "P"

CODE	DESCRIPTION
D	3/4" NPS
E	1" NPS
F	1 1/4" NPS
G	1 1/2" NPS

1-3 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-4 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

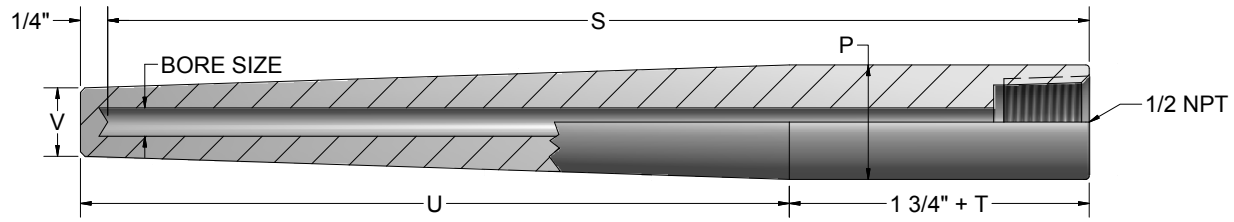
1-5 Optional "T" Lag Dimension

CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

1-6 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Well stamped with customer-specified part number

Weld-In Thermowells are available in a variety of materials, process connection sizes, lengths and optional lagging extensions. Thermowell specifications should be based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. Weld-In thermowells are welded directly into the process apparatus. They are designed with a standard 0.260" or 0.385" bore diameter to accommodate sensing elements with a 0.252" or 0.377" maximum diameter, respectively. The tapered design is suited for heavy-duty applications where greater rigidity is required due to process conditions. These wells are available as separate components or as part of complete sensor assemblies.



Thermowell Dimensions

"P" PIPE SIZE		"V" (0.260")	"V" (0.385")
NOM.	DIA.		
3/4"	1.050"	5/8" Dia.	49/64" Dia.
1"	1.315"	49/64" Dia.	49/64" Dia.
1 1/4"	1.660"	1" Dia.	1" Dia.
1 1/2"	1.900"	1 1/8" Dia.	1 1/8" Dia.

("U" length for non-lagging wells) = "S" -1 1/2"
("U" length for lagging wells) = "S" -1 1/2" -"T"
(To solve for "T"), "T" = "S" -"U" -1 1/2" (When "U" and "S" are specified)

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6
WI	4	D	09	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
WI	Weld-In

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore
6	0.385" Dia. bore

1-2 Pipe Size "P"

CODE	DESCRIPTION
D	3/4" NPS
E	1" NPS
F	1 1/4" NPS
G	1 1/2" NPS

1-3 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-4 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

1-5 "T" Lag Dimension

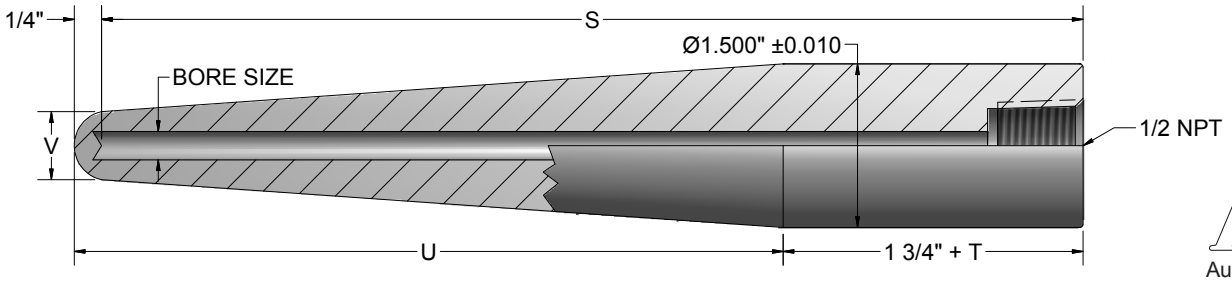
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

1-6 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Well stamped with customer-specified part number

Sanitary, Weld-In Thermowells

Sanitary, Weld-In Thermowells are offered in 304 and 316 stainless steel. They are available in a variety of lengths, process connection sizes, and optional lagging extensions. This type of thermowell is designed to be welded into a tank or vat with a full crevice-free fillet-weld to prevent corrosion, bacteria growth, and product contamination. Thermowells are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. These thermowells are designed with standard 0.260" or 0.385" bore diameter to accommodate sensing elements with a 0.252" or 0.377" maximum diameter, respectively. These wells are available as separate components or as part of complete sensor assemblies.



Authorized 74-

("U" length for non-lagging wells) = "S" -1 1/2"
("U" length for lagging wells) = "S" -1 1/2" -"T"
(To solve for "T"), "T" = "S" -"U" -1 1/2" (When "U" and "S" are specified)

Thermowell Dimensions

BORE SIZE	"V"
0.260" Dia.	5/8" Dia.
0.385" Dia.	49/64" Dia.

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6
WS	4	09	08	T2	C8S	

1-0 Well Type

CODE	DESCRIPTION
WS	Sanitary weld-in

1-1 Bore Size

CODE	DESCRIPTION
4	0.260 Dia. bore
6	0.385 Dia. bore

1-2 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-5 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Well stamped with customer-specified part number

1-4 Optional "T" Lag Dimension

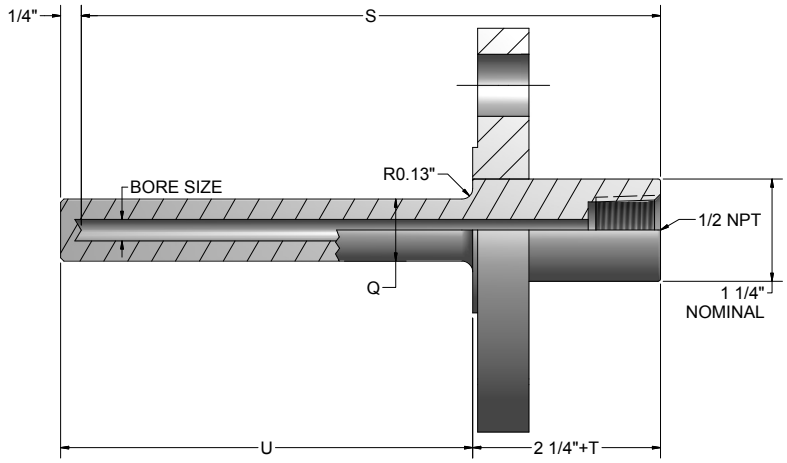
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

1-3 Material

CODE	DESCRIPTION
08	316 stainless steel
09	304 stainless steel

Standard Flanged Thermowells

Standard Flanged Thermowells are available in a variety of materials, flange types, flange sizes, and pressure ratings. They are also available in various lengths and with optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. Standard flanged thermowells are supplied with a straight shank and are designed with a 0.260" or 0.385" bore diameter to accommodate sensing elements with a 0.252" or 0.377 maximum diameter, respectively. These wells are available as separate components or as part of complete sensor assemblies.



("U" length for non-lagging wells) = "S" - 2"
("U" length for lagging wells) = "S" - 2" - "T"
(To solve for "T"), "T" = "S" - "U" - 2" (When "U" and "S" are specified)

Thermowell Dimensions

BORE	"Q" Dim.
0.260	3/4"
0.385	7/8"

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8
SF	4	15	R	1	09	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
SF	Standard flanged

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore
6	0.385" Dia. bore

1-2 Flange Size

CODE	DESCRIPTION
10	1" (DN 25)
13	1 1/4" (DN 32)
15	1 1/2" (DN 40)
20	2" (DN 50)
30	3" (DN 80)

1-3 Flange Type

CODE	DESCRIPTION
F	Flat face
J	Ring joint
R	Raised face

1-4 Pressure Rating

CODE	DESCRIPTION
1	150 Class
3	300 Class
6	600 Class
9	900 Class
15	1500 Class

1-5 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-6 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

1-7 Optional "T" Lag Dimension

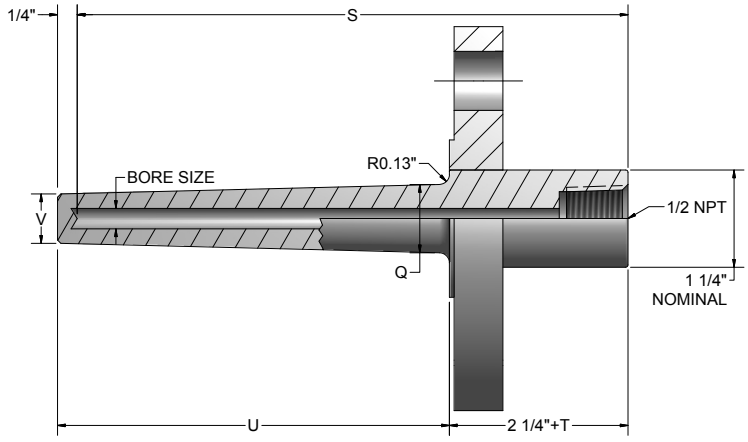
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches using two digits plus any fractional length

1-8 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
F	Full penetration weld
S	Well stamped with customer-specified part number

Heavy-Duty, Flanged Thermowells

Heavy-Duty, Flanged Thermowells are available in a variety of materials, flange types, flange sizes, and pressure ratings. They are also available in various lengths and with optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. Heavy-duty flanged thermowells are supplied with a 0.260" or 0.385" bore diameter to accommodate sensing elements with a 0.252" or 0.377" maximum diameter, respectively. The tapered design is suited for heavy-duty applications where greater rigidity is required for increased pressure and flow due to process conditions. These wells are available as separate components or as part of complete sensor assemblies.



Maximum tapered length is 16"
("U" length for non-lagging wells) = "S" - 2"
("U" length for lagging wells) = "S" - 2" - "T"
(To solve for "T"), "T" = "S" - "U" - 2" (When "U" and "S" are specified)

Thermowell Dimensions

FLANGE	"Q" (0.260")	"V"(0.260")	"V"(0.385")
1"	7/8" Dia.	5/8" Dia.	49/64" Dia.
1 1/4" thru 3"	1 1/16" Dia.	5/8" Dia.	49/64" Dia.

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8
HF	4	15	R	1	09	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
HF	Heavy-duty flanged

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore
6	0.385" Dia. bore

1-2 Flange Size

CODE	DESCRIPTION
10	1" (DN 25)
13	1 1/4" (DN 32)
15	1 1/2" (DN 40)
20	2" (DN 50)
30	3" (DN 80)

1-3 Flange Type

CODE	DESCRIPTION
F	Flat face
J	Ring joint
R	Raised face

1-4 Pressure Rating

CODE	DESCRIPTION
1	150 Class
3	300 Class
6	600 Class
9	900 Class
15	1500 Class

1-5 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-6 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

1-7 Optional "T" Lag Dimension

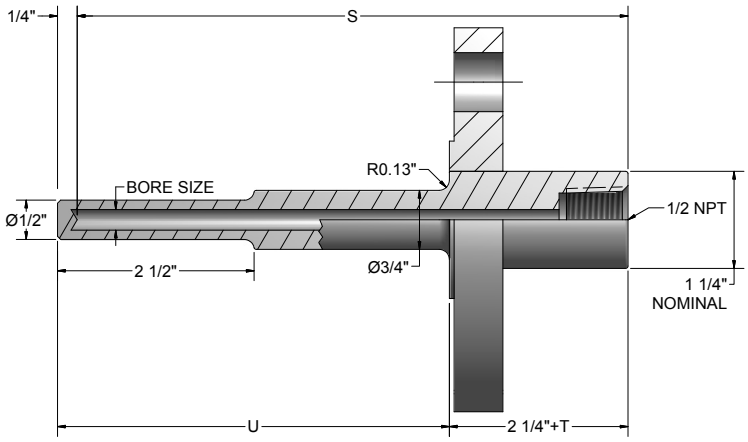
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

1-8 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
F	Full penetration weld
S	Well stamped with customer specified part number

Reduced-Tip Flanged Thermowells

Reduced-Tip, Flanged Thermowells are available in a variety of materials, flange types, flange sizes, and pressure ratings. They are also available in various lengths and with optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. The stepped construction is normally used in standard-duty applications, and increases the speed of response while maintaining mechanical strength. They are designed with standard 0.260" bore diameters to accommodate sensing elements with a 0.252" maximum diameter. These wells are available as separate components or as part of complete sensor assemblies.



("U" length for non-lagging wells) = "S" - 2"
("U" length for lagging wells) = "S" - 2" - "T"
(To solve for "T"), "T" = "S" - "U" - 2" (When "U" and "S" are specified)

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8
RF	4	15	R	1	09	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
RF	Reduced-tip flanged

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore

1-2 Flange Size

CODE	DESCRIPTION
10	1" (DN 25)
13	1 1/4" (DN 32)
15	1 1/2" (DN 40)
20	2" (DN 50)
30	3" (DN 80)

1-3 Flange Type

CODE	DESCRIPTION
F	Flat face
J	Ring joint
R	Raised face

1-4 Pressure Rating

CODE	DESCRIPTION
1	150 Class
3	300 Class
6	600 Class
9	900 Class
15	1500 Class

1-5 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-6 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

1-7 Optional "T" Lag Dimension

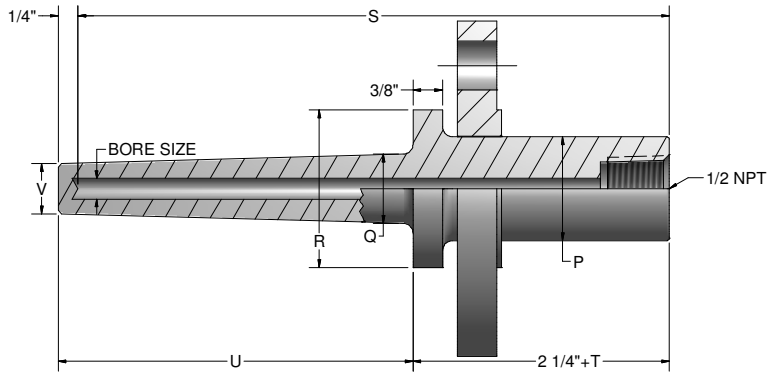
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

1-8 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
F	Full penetration weld
S	Well stamped with customer specified part number

Heavy-Duty Van Stone Thermowells

Heavy-Duty Van Stone Thermowells are available in a variety of materials, flange sizes, and pressure ratings. They are also available in various lengths and with optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. Heavy-duty Van Stone thermowells are supplied with a 0.260" or 0.385" bore diameter to accommodate sensing elements with 0.252" or 0.377" maximum diameter, respectively. Van Stone thermowells are connected using a separate and reusable backing flange, eliminating the need for expensive flange materials. The tapered design is suited for heavy-duty applications where greater rigidity is required for increased pressure and flow due to process conditions. These wells are available as separate components or as part of complete sensor assemblies.



Maximum tapered length is 16"
("U" length for non-lagging wells) = "S" - 2"
("U" length for lagging wells) = "S" - 2" -"T"
(To solve for "T"), "T" = "S" -"U" - 2" (When "U" and "S" are specified)

Thermowell Dimensions					
"P" PIPE SIZE		"R" DIA.	"Q" DIA.	"V" 0.260" DIA.	"V" 0.385" DIA.
NOM.	DIA.				
1"	1.315"	2"	7/8"	5/8"	49/64"
1 1/2"	1.900"	2 7/8"	1 1/16"	5/8"	49/64"

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8
HF	4	15	V	1	09	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
HF	Heavy-Duty Van Stone

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore
6	0.385" Dia. bore

1-2 Flange Size

CODE	DESCRIPTION
10	1" (DN 25)
15	1 1/2" (DN 40)

1-3 Flange Type

CODE	DESCRIPTION
V	Van Stone (lap joint)

1-4 Pressure Rating

CODE	DESCRIPTION
0	No backing flange
1	150 Class
3	300 Class
6	600 Class
9	900 Class
15	1500 Class
Carbon steel lap joint flange standard	

1-5 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-6 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

1-7 "T" Lag Dimension

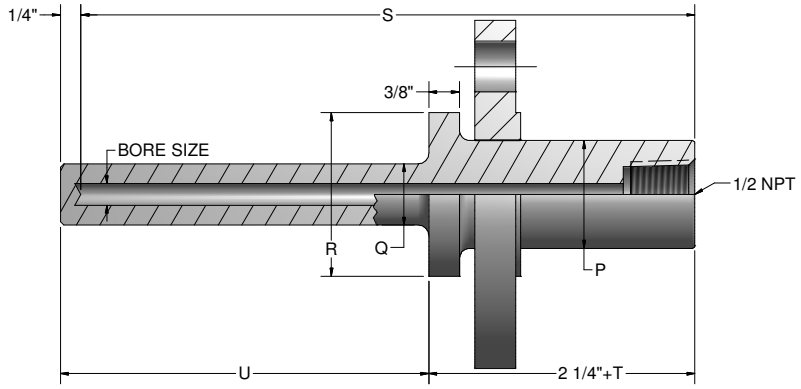
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches using two digits plus any fractional length

1-8 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Well stamped with customer-specified part number

Straight Van Stone Thermowells

Straight Van Stone Thermowells are available in a variety of materials, flange sizes, and pressure ratings. They are also available in various lengths and with optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. Straight Van Stone thermowells are supplied with a 0.260" or 0.385" bore diameter to accommodate sensing elements with a 0.252" or 0.377" maximum diameter, respectively. Van Stone thermowells are connected using a separate and reusable backing flange, eliminating the need for expensive flange materials. These wells are available as separate components or as part of complete sensor assemblies.



("U" length for non-lagging wells) = "S" - 2"
("U" length for lagging wells) = "S" - 2" - "T"
(To solve for "T"), "T" = "S" - "U" - 2"
(When "U" and "S" are specified)

Thermowell Dimensions

"P" PIPE SIZE		"R" DIA.	"Q" 0.260" DIA.	"Q" 0.385" DIA.
NOM.	DIA.			
1"	1.315"	2"	3/4"	7/8"
1 1/2"	1.900"	2 7/8"	3/4"	7/8"

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8
SF	4	15	V	1	09	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
SF	Straight Van Stone

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore
6	0.385" Dia. bore

1-2 Flange Size

CODE	DESCRIPTION
10	1" (DN25)
15	1 1/2" (DN40)

1-3 Flange Type

CODE	DESCRIPTION
V	Van Stone (lap joint)

1-4 Pressure Rating

CODE	DESCRIPTION
0	No backing flange
1	150 Class
3	300 Class
6	600 Class
9	900 Class
15	1500 Class
Carbon steel lap joint flange standard	

1-5 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-6 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

1-7 Optional "T" Lag Dimension

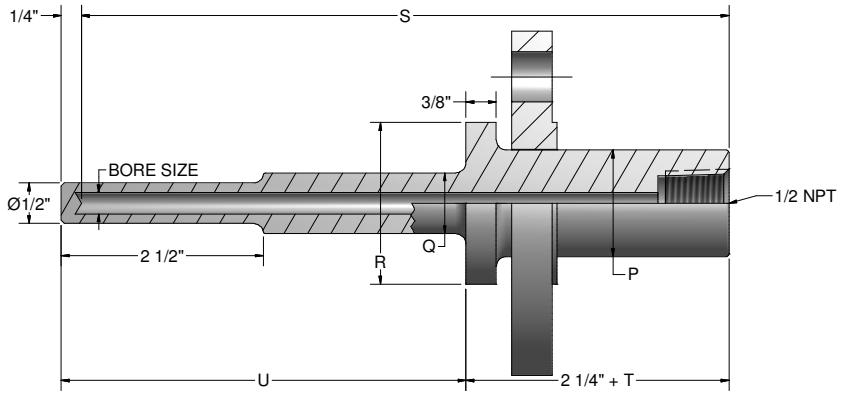
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

1-8 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Well stamped with customer specified part number

Reduced-Tip Van Stone Thermowells

Reduced-Tip Van Stone Thermowells are available in a variety of materials, flange sizes, and pressure ratings. They are also offered in various lengths and with optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. The Reduced Tip Van Stone thermowell is supplied with a 0.260" bore diameter to accommodate sensing elements with a 0.252" maximum diameter. The stepped construction is normally used in standard-duty applications and increases the speed of response while maintaining mechanical strength. Van Stone thermowells are connected using a separate and reusable backing flange, eliminating the need for expensive flange materials. These wells are available as separate components or as part of complete sensor assemblies.



("U" length for non-lagging wells) = "S" - 2"
("U" length for lagging wells) = "S" - 2" -"T"
(To solve for "T"), "T" = "S" -"U" - 2" (When "U" and "S" are specified)

Thermowell Dimensions

"P" PIPE SIZE NOM.	"P" DIA.	"R" DIA.	"Q" DIA.
1"	1.315"	2"	3/4"
1 1/2"	1.900"	2 7/8"	7/8"

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8
RF	4	15	V	1	09	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
RF	Reduced-Tip Van Stone

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore

1-2 Flange Size

CODE	DESCRIPTION
10	1" (DN25)
15	1 1/2" (DN40)

1-3 Flange Type

CODE	DESCRIPTION
V	Van Stone (lap joint)

1-4 Pressure Rating

CODE	DESCRIPTION
0	No backing flange
1	150 Class
3	300 Class
6	600 Class
9	900 Class
15	1500 Class
Carbon steel backing flange standard	

1-5 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-6 Material

CODE	DESCRIPTION
XX	Specify two digit material code as stated in the Thermowell Material Table located earlier in section

1-7 Optional "T" Lag Dimension

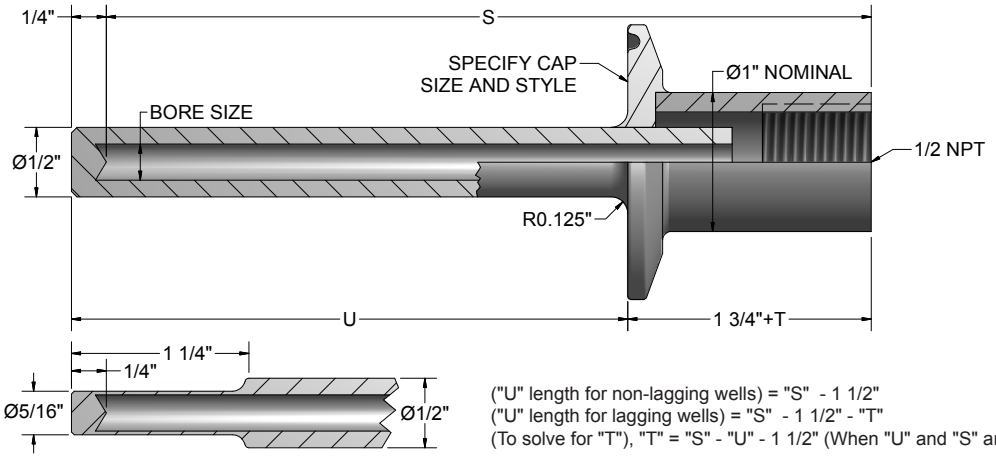
CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

1-8 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
C22	Brass well cap and chain
S	Well stamped with customer-specified part number

Sanitary-Connected Thermowells

Sanitary-Connected Thermowells are offered in 316 stainless steel. The DW and DR series are welded constructions, and they are available in a variety of lengths, cap styles, cap sizes, and optional lagging extensions. Thermowells are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. They are designed with standard 0.260" bore diameters to accommodate sensing elements with a 0.252" maximum diameter. These wells are available as separate components or as part of complete sensor assemblies.



("U" length for non-lagging wells) = "S" - 1 1/2"
("U" length for lagging wells) = "S" - 1 1/2" - "T"
(To solve for "T"), "T" = "S" - "U" - 1 1/2" (When "U" and "S" are specified)

3
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ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6
DW	4	25	09	08	T2	C8S

1-0 Well Type

CODE	DESCRIPTION
DW	Sanitary well
DR	Reduced-tip sanitary well

1-1 Bore Size

CODE	DESCRIPTION
4	0.260" Dia. bore

1-2 Cap Size & Style

CODE	DESCRIPTION
15	1", 1 1/2" Tri-clamp® 16 AMP
25	2" Tri-clamp® 16 AMP
35	2 1/2" Tri-clamp® 16 AMP
45	3" Tri-clamp® 16 AMP
Other styles - sizes available. Consult factory.	

1-3 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits plus fractional length

1-4 Material

CODE	DESCRIPTION
08	316 stainless steel

1-5 Optional "T" Lag Dimension

CODE	DESCRIPTION
Leave blank if no lag is required	
T__	Specify "T" dimension in inches

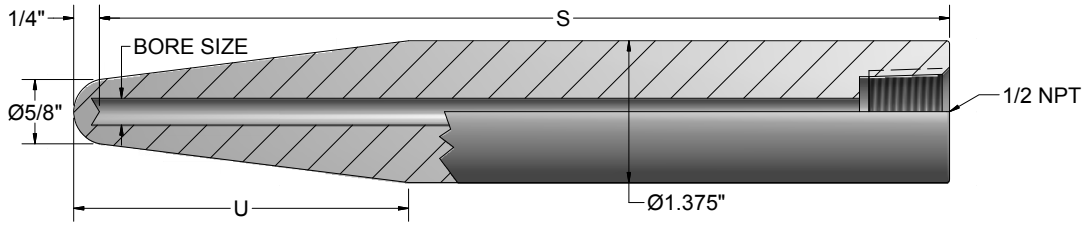
1-6 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
S	Well stamped with customer-specified part number

Tri-clamp® is a registered trademark of Alfa Laval, Inc.

W81 Series Sanitary Weld-In Thermowells

Sanitary Weld-In Thermowells are offered in 316 stainless steel. The thermowell is designed to be welded into a tank or vat with a full crevice-free fillet-weld to prevent corrosion, bacteria growth, and product contamination. Thermowells are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. They are designed with a standard 0.260" bore diameter to accommodate sensing elements with a 0.252" maximum diameter. These wells are available as separate components or as part of complete sensor assemblies.



74-

ORDER CODES

Example Order Number:

1-0		1-1	1-2	1-3
W81	-	1	8	S

1-0 Well Type

CODE	DESCRIPTION
W81	Sanitary weld-in

1-3 Options

CODE	DESCRIPTION
C8	316 stainless steel well cap and chain
S	Well stamped with customer-specified part number

1-1 Length

CODE	"S" LENGTH	"U" LENGTH
1	8 1/4"	3 1/4"
2	9 7/8"	3 1/4"
3	11 5/8"	5"
4	12 7/8"	3 3/4"

1-2 Material

CODE	DESCRIPTION
8	316 stainless steel

www.Pyromation.com/TechInfo/WakeFreq.aspx

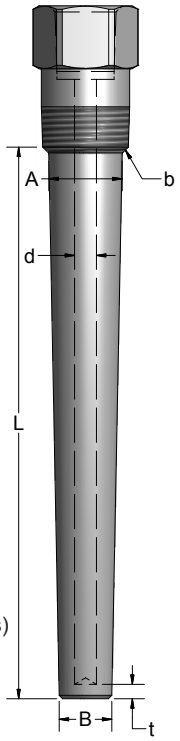
Based on calculations in accordance with ASME PTC 19.3 TW

ASME PTC 19.3 TW, the U.S. standard for evaluating the mechanical design of a thermowell used in a broad range of applications, was updated in 2010 to include a greater number of thermowell and process variables. Sometimes referred to as "Wake Frequency Calculation", the revision incorporates new elements for evaluating thermowell constructions that will reduce the chance of vibration and stress damage to the vessel, as well as avoid vibration damage to the temperature sensor it protects.

Please input data regarding your thermowell dimensions, thermowell properties and material/media/process properties in the designated spaces below. We will review the data, process the calculations and contact you with the results. Feel free to contact one of our Product Engineers to go through the process calculations.

Unit of Measure:	English Units	
Mounting Type:	Threaded	
Shank Profile:	Tapered	
Material:	316SS	
Process Connection:	1" NPT	
Unsupported Length (L):	6	in
Bore Diameter (d):	0.260	in
Root Diameter (A):	1.0625	in
Tip Diameter (B):	0.625	in
Minimum Tip Thickness (t):	0.188	in
Fillet Radius at Support Plane (b):	0.178	in
Fillet Radius at Base of Step (b_s):		in
Reduced-Diameter Shank Length (L_s):		in
Damping Factor (ζ):	0.0005	
Shielded Length of T-Well (L_o):	0	in
Max. Fluid Velocity (V):	15.5	ft/s
Fluid Density (ρ)	4.3	lb/ft^3
Max. Operating Temperature (T):	450	F
Max. Operating Pressure (P):	150	psig
Dynamic Viscosity (μ):		cP (1 centipoise = mPa*s)
Tag/Reference #:	TW-100	

1. Input your data online
2. We review and process the calculations
3. We will contact you with results
4. (*Optional*) Contact one of our Product Engineers to go through process calculation questions



Find this page at: www.Pyromation.com/TechInfo/WakeFreq.aspx

THIS IS A RESPONSE EXAMPLE ONLY - DO NOT USE DATA FOR ANY OTHER PURPOSE

pyromation inc.
beyond measure

5211 Industrial Road, Fort Wayne, IN 46825

Straight or Tapered Thermowell
Wake Frequency Evaluation Results

per PTC 19.3-TW 2010

Date: 8/3/2011

Customer Name: Dave Myers

Company/Org. Name: Pyromation, Inc

E-mail Address: dmyers@pyromation.com

Tag Number: TW-100

OUTPUTS

Frequency Condition	**PASS**
Frequency Ratio	**0.073**
Steady State Stress Limit	**PASS**
Dynamic Stress Limit	**PASS**
Pressure Limit	**PASS**

INPUTS

Mounting Type: Threaded
Material type: 316SS

Dimensions:

Length	L=	6.000	in	0.152 m
Root diameter	A=	1.063	in	0.027 m
Tip diameter	B=	0.625	in	0.016 m
Bore diameter	d=	0.260	in	0.007 m
Tip thickness	*t*=	0.188	in	0.005 m
Fillet radius at base	*b*=	0.178	in	0.005 m
Damping Factor	ζ=	0.0005		
Shielded length	L_0=	0.000	in	0.000 m
Sensor density	ρ_s=	2700	kg/m^3	

Fluid Properties:

Fluid velocity	*V*=	15.50	ft/s	4.72 m/s
Fluid density	ρ=	4.300	lb/ft^3	68.9 kg/m^3
Fluid temperature	*T*=	450.0	℉	232.2 ℃
Gauge pressure	*P*=	150.0	psig	1034214.0 Pa
Viscosity	μ=	0.019	cp	

T-Well Material Properties

Allowable stress	*S*=	18000	psi	1.24E+08 Pa
Fatigue limit	S_f=	5400	psi	3.72E+07 Pa
Modulus at temperature	*E*=	25900000	lbf/in^2	1.79E+11 Pa
Density of t-well material	ρ_m=	0.290	lbf/in^3	8026.9 kg/m^3

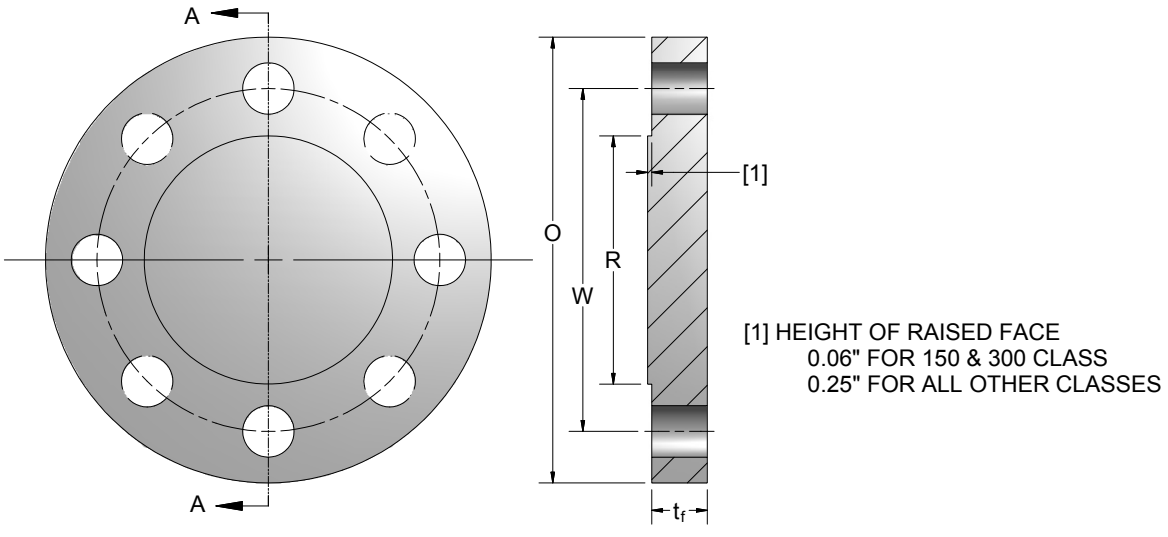
Summary/ Suggestions:

*Pyromation makes no claims regarding performance or safety based on the calculations provided. The results communicated are based on the ASME PTC 19.3 TW-2010 design standard for reliable service of tapered, straight and stepped-shank thermowells in a broad range of applications. The user assumes full responsibility for installation, application and operation of the product.

ANSI Flanged Thermowell Data Sheet

Flanges comply with ASME B16.5 and are welded in accordance with the Boiler Code ASME Section IX. Certified welders use ASME Section II Compliant materials. Gaskets are not supplied with flanged thermowells and assemblies.

Nominal Pipe Size (inches)	Nominal Diameter DN	Flange Class	"O" Outside Diameter of Flange	"R" Outside Diameter Raised Face Large Male and Large Tongue	"W" Diameter of Bolt Circle	Number of Bolts	"t_f" Thickness of Flange Min.
1/2	15	150	3.50	1.38	2.38	4	0.38
3/4	20	150	3.88	1.69	2.75	4	0.44
1	25	150	4.25	2.00	3.12	4	0.50
1 1/4	32	150	4.62	2.50	3.50	4	0.56
1 1/2	40	150	5.00	2.88	3.88	4	0.62
2	50	150	6.00	3.62	4.75	4	0.69
2 1/2	65	150	7.00	4.12	5.50	4	0.81
3	80	150	7.50	5.00	6.00	4	0.88
3 1/2	90	150	8.50	5.50	7.00	8	0.88
4	100	150	9.00	6.19	7.50	8	0.88
1/2	15	300	3.75	1.38	2.62	4	0.50
3/4	20	300	4.62	1.69	3.25	4	0.56
1	25	300	4.88	2.00	3.50	4	0.62
1 1/4	32	300	5.25	2.50	3.88	4	0.69
1 1/2	40	300	6.12	2.88	4.50	4	0.75
2	50	300	6.50	3.62	5.00	8	0.81
2 1/2	65	300	7.50	4.12	5.88	8	0.94
3	80	300	8.25	5.00	6.62	8	1.06
3 1/2	90	300	9.00	5.50	7.25	8	1.12
4	100	300	10.00	6.19	7.88	8	1.19
1/2	15	600	3.75	1.38	2.62	4	0.56
3/4	20	600	4.62	1.69	3.25	4	0.62
1	25	600	4.88	2.00	3.50	4	0.69
1 1/4	32	600	5.25	2.50	3.88	4	0.81
1 1/2	40	600	6.12	2.88	4.50	4	0.88
2	50	600	6.50	3.62	5.00	8	1.00
2 1/2	65	600	7.50	4.12	5.88	8	1.12
3	80	600	8.25	5.00	6.62	8	1.25
3.50	90	600	9.00	5.50	7.25	8	1.38
4.00	100	600	10.75	6.19	8.50	8	1.50



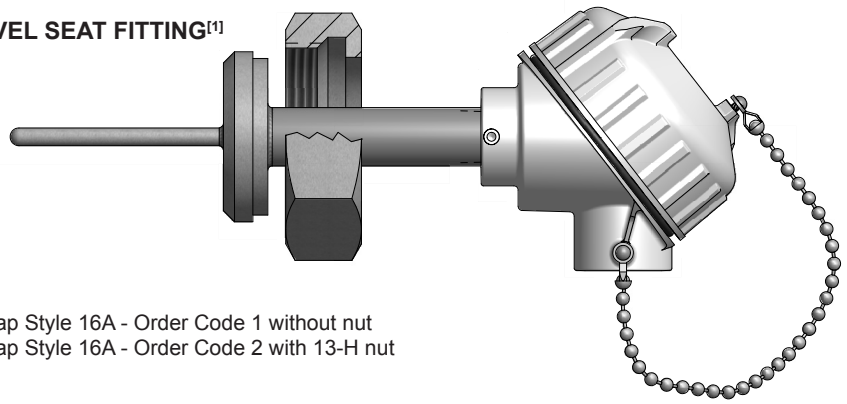
SECTION A-A

[1] HEIGHT OF RAISED FACE
0.06" FOR 150 & 300 CLASS
0.25" FOR ALL OTHER CLASSES

CIP Sanitary Fitting Reference Data Sheet

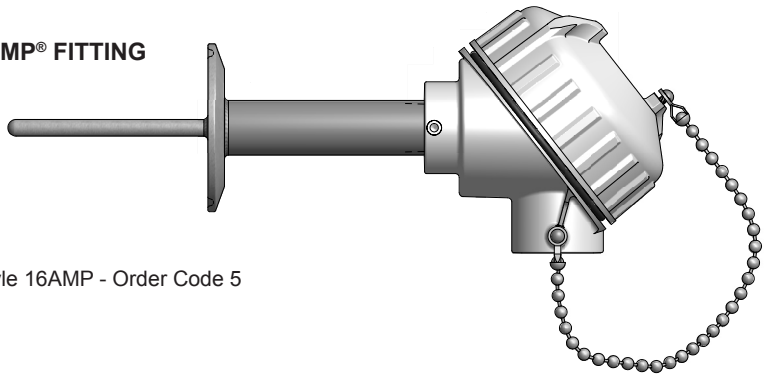
The CIP (clean in place) sanitary connections illustrated on this page are the most commonly used fittings in food, dairy, beverage, pharmaceutical, and chemical processes where contamination and cleanliness is of concern. Fittings other than those illustrated are available upon request. The illustrations are provided for reference purposes to aid in the selection of the correct fitting style for new or replacement sensor assemblies. Most CIP sensor assemblies manufactured by Pyromation are constructed in accordance with the **3-A Sanitary Council Standard 74-** for instrument fittings and connections.

BEVEL SEAT FITTING[1]



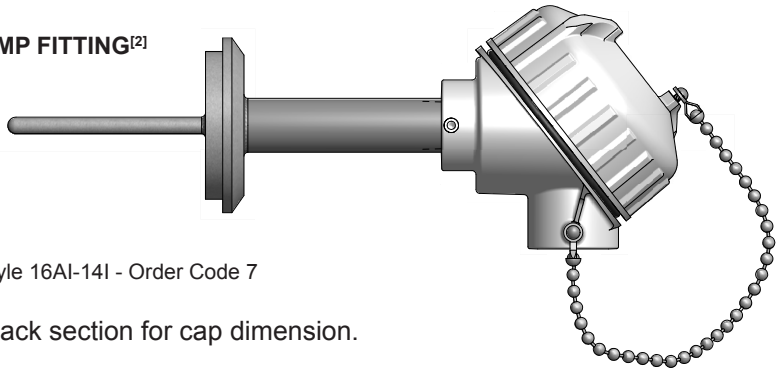
Cap Style 16A - Order Code 1 without nut
Cap Style 16A - Order Code 2 with 13-H nut

TRI-CLAMP® FITTING



Cap Style 16AMP - Order Code 5

"I" CLAMP FITTING[2]



Cap Style 16AI-14I - Order Code 7

See back section for cap dimension.

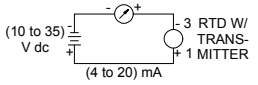
[1] Must be manually cleaned.
[2] Not 3-A authorized.

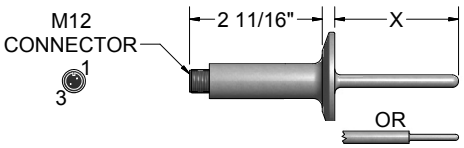
Tri-Clamp® is a registered trademark of Alfa Laval, Inc.

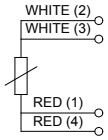
Configuration Code FD01

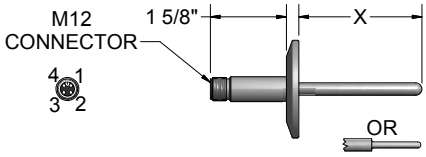
Water-Tight CIP RTD Assemblies With Optional Series 450 Integral Transmitters

The Water-Tight CIP RTD Assembly houses an optional integral Series 450 Temperature Transmitter (no connection head is required) that is ideal for monitoring temperature in small areas such as tanks and pipes. The water-tight construction meets NEMA 6P requirements. Assemblies are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. Standard units include a M12 process connection housing. The transmitter is a 2-wire unit with an analog output. It has measurement input for Pt100 resistance thermometers (RTD) in 4-wire connections. Transmitters can be ranged from (-51 to 160) ºC [-60 to 320] ºF with a 10 ºC [18 ºF] minimum span requirement. **Ambient temperature limits for the M12 connector are (-40 to 85) °C.**









ORDER CODES

Example Order Number:

1	2		3		4		5		6		7	8
R5T185L484	-	04	-	CIP	-	2-5	-	45, T	-	450	-	U	-	S (0-200)	F

1 Standard Tip
Pt100 (α = 0.003 85 °C^{-1}) RTD Assemblies

CODE	TOLERANCE[1]	NOMINAL SHEATH DIAMETER O.D. (inches)
RAF185L484	Class A	1/4
R1T185L484	Grade B	1/4
R5T185L484	(1/5) Class B	1/4

1-1 Reduced Tip
Pt100 (α = 0.003 85 °C^{-1}) RTD Reduced Tip Assemblies

CODE	TOLERANCE[1]	NOMINAL SHEATH DIAMETER O.D. (inches)	TIP OUTER DIA. (inches)
RAF185L88R484	Class A	1/2	1/4
RAF185L68R384	Class A	3/8	3/16
R1T185L88R484	Grade B	1/2	1/4
R1T185L68R384	Grade B	3/8	3/16
R5T185L88R484	(1/5) Class B	1/2	1/4
R5T185L68R384	(1/5) Class B	3/8	3/16

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length
Examples: 04 = 4", 04(1/2) = 4.5"

For field-wireable and molded extensions see RTD Section.

3 Sanitary Cap Size and Style 316 SS

CODE	DESCRIPTION
1-5	1" & 1 1/2" 16 AMP cap - Tri-Clamp®
2-5	2" 16 AMP cap - Tri-Clamp®
3-5	2 1/2" 16 AMP cap - Tri-Clamp®
4-5	3" 16 AMP cap - Tri-Clamp®
Other cap styles available - consult factory	

4 Termination

CODE	DESCRIPTION
45	M12 Water-tight connector
Optional Transmitter	
T[1]	(4 to 20)mA Temperature Transmitter (requires table 5 selection)

[1] See Transmitter Section for total sensor and transmitter output accuracy.

5 Transmitter

CODE	DESCRIPTION
450-00	Programmable transmitter-unconfigured
450	Programmable transmitter-configured

6 Fault Signal

CODE	DESCRIPTION
U	Upscale burnout
D	Downscale burnout

7 Range

S (lower limit - upper limit)

8 Units

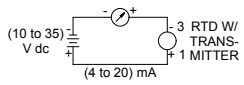
CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

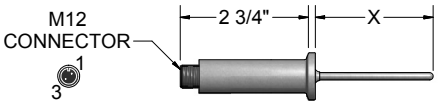
Tri-Clamp® is a registered trademark of Alfa Laval, Inc.

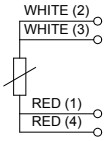
Configuration Code FD01

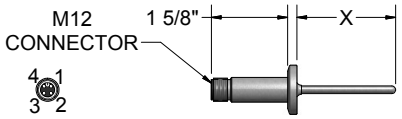
Water-Tight Miniature CIP RTD Assemblies With Optional Series 450 Integral Transmitters

The Water-Tight Miniature CIP RTD Assembly houses an optional Series 450 Temperature Transmitter (no connection head is required) that is ideal for monitoring temperature in small areas such as tanks and pipes. The water-tight construction meets NEMA 6P requirements. These assemblies include a 316SS clean-in-place connection. Assemblies are supplied with a surface finish that meets or exceeds 15µin R_a. Standard units include a M12 process connection housing. The transmitter is a 2-wire unit with an analog output. It has measurement input for Pt100 resistance thermometers (RTD) in 4 wire connections. Transmitters can be ranged from (-51 to 160) ºC [-60 to 320] ºF minimum span requirement. **Ambient temperature limits for the M12 connector is (-40 to 85) °C.**









ORDER CODES

Example Order Number:

1	2		3		4		5	6		7	8
R5T185L(156)84	- 04	- CIP	- 075-5	-	45, T	-	450	- U	-	S (0-200)	F

1 Pt100 (α = 0.003 85 °C^{-1}) RTD Assemblies

CODE	TOLERANCE[1]	NOMINAL SHEATH DIAMETER O.D. (inches)
RAF185L(156)84	Class A	5/32
R1T185L(156)84	Grade B	5/32
R3T185L(156)84	Class AA	5/32
R5T185L(156)84	(1/5) Class B	5/32

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length desired
Examples: 04 = 4", 04(1/2) = 4.5"

3 Sanitary Cap Size and Style 316SS

CODE	DESCRIPTION
075-5	1/2" & 3/4" 16 AMP cap - Tri-Clamp®

For field-wireable and molded extensions see RTD Section.

Tri-Clamp® is a registered trademark of Alfa Laval, Inc.

4 Termination

CODE	DESCRIPTION
45	M12 Water-tight connector
Optional Transmitter	
T[1]	(4 to 20)mA Temperature transmitter (requires table 5 selection)

[1] See Transmitter Section for total sensor and transmitter output accuracy.

5 Transmitter

CODE	DESCRIPTION
450-00	Programmable transmitter-unconfigured
450	Programmable transmitter-configured

6 Fault Signal

CODE	DESCRIPTION
U	Upscale burnout
D	Downscale burnout

7 Range

RANGE
S (lower limit - upper limit)

8 Units

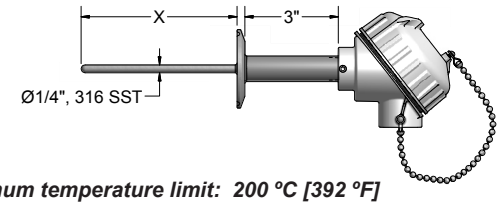
CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

Configuration Code FD02

CIP Sanitary-Connected RTDs

General-purpose CIP sanitary-connected RTD temperature sensors are used in food, dairy, beverage, pharmaceutical, and chemical processing applications where sensor corrosion and product contamination are critical factors. The sanitary caps listed are those most commonly used in such processes. Sanitary caps are welded to the sheath and to a heavier support tube, all made of stainless steel, and then ground and polished to a finish that exceeds the No. 4 minimum finish required by the **3-A Sanitary Standard 74 -** . Assemblies are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. The process contact surfaces are free of pits, crevices, and pockets thus preventing corrosion and bacteria growth. The 3-wire constructed sensor assembly consists of a high-accuracy platinum element sealed inside a 316 stainless steel sheath, and is provided with a FDA-compliant white thermoplastic gasketed connecting head. The complete assembly provides excellent washdown protection. It is recommended that once customer connections are made, the connecting terminals be further protected by applying a coating of moisture-proof sealant over the connections.

74-



Maximum temperature limit: 200 ºC [392 ºF]

ORDER CODES

Example Order Number: **R5T185L483 - 04 - CIP - 2 - 5 - 63, T**

(1-1 = R5T185L483; 1-2 = 04; CIP; 2; 3 = 5; 4 = 63, T)

1-1 Pt100 (α = 0.003 85 °C^{-1}) RTD Assemblies

CODE	TOLERANCE[1]
SINGLE	
RAF185L483	Class A
R1T185L483	Grade B
R3T185L483	Class AA
R5T185L483	(1/5) Class B
DUPLEX	
RAF285L483	Class A
R1T285L483	Grade B
R3T285L483	Class AA
R5T285L483	(1/5) Class B
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.	
Thermocouple Assemblies	
For CIP thermocouple assemblies use T/C types J, K, T, or E and options G for grounded junction or U for ungrounded junction as per example. EXAMPLE: TP48G-04 - CIP - 2 - 5 - 63	

1-2 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length desired
Examples: 04 = 4", 05(1/2) = 5.5"

2 Sanitary Cap Size

CODE	TUBE O.D. (inches)	CODE	TUBE O.D. (inches)
1	1(1/2)	4	3
2	2	5	Other (specify)
3	2 (1/2)		

3 Sanitary Cap Style

CODE	DESCRIPTION
2	16A cap - Bevel Seat with13-H Nut[1] 304SS
5	16 AMP cap - Tri-Clamp® 316SS
7	16AI-14I cap[2] 304SS
8	Other (describe)
[1] Must be manually cleaned	[2] Not 3-A authorized

4 Terminations

CODE	DESCRIPTION
91	316L stainless steel screw-cover head
63	White polypropylene screw-cover head
31,W	Aluminum screw-cover head with white epoxy coating
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® Field Transmitter with general-purpose dual cavity aluminum housing
22 (06)	6" individual fluoropolymer leads with terminal pins
02	1/2" O.D., 2 1/4" long extension leadwire transition (requires table 4 & 5 selections from RTD section)
Head Options	
T-440	(4 to 20) mA head-mounted RTD transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter
I	Stainless steel tags
HS	Wire seal security screws

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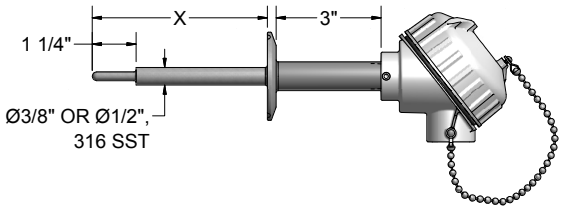
HART® is a registered trademark of HART Communication Foundation.

Configuration Code FD02

CIP Sanitary Reduced-Tip RTDs

General-purpose reduced-tip CIP sanitary-connected RTD temperature sensors are used in food, dairy, beverage, pharmaceutical, and chemical processing applications where sensor corrosion and product contamination are critical factors. The reduced tip construction provides strength along the major sheath length, and faster temperature response times at the reduced tip. The reduced tip sizes listed below are the most common constructions. For other configurations please consult the factory. The sanitary caps listed are those most commonly used in such processes. The sanitary caps are welded to the sheath and to a heavier support tube, all made of stainless steel, and then ground and polished to a finish that exceeds the No. 4 minimum finish required by the **3-A Sanitary Standard 74 -** . Assemblies are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. The process contact surfaces are free of pits, crevices, and pockets thus preventing corrosion and bacteria growth. The 3-wire constructed sensor assembly consists of a high-accuracy platinum element sealed inside a 316 stainless steel sheath, and is provided with a FDA compliant white thermoplastic gasketed connecting head. The complete assembly provides excellent washdown protection. It is recommended that once customer connections are made, the connecting terminals be further protected by applying a coating of moisture-proof sealant over the connections.

74-



Maximum temperature limit: 200 °C [392 °F]

ORDER CODES

Example Order Number: **R5T185L68R383 - 04 - CIP - 2 - 5 - 63, I**

(1-1 = R5T185L68R383; 1-2 = 04; 2 = CIP; 3 = 2; 4 = 5; 63, I)

1-1 Pt100 (α = 0.003 85 °C^{-1}) RTD Assemblies

CODE		TOLERANCE[1]	NORMAL SHEATH DIA. O.D. (inches)	TIP DIAMETER OD (inches)
SINGLE	*DUPLEX*			
RAF185L88R483	RAF285L88R483	Class A	1/2	1/4
RAF185L68R383	RAF285L68R383	Class A	3/8	3/16
R1T185L88R483	R1T285L88R483	Grade B	1/2	1/4
R1T185L68R383	R1T285L68R383	Grade B	3/8	3/16
R3T185L88R483	R3T285L88R483	Class AA	1/2	1/4
R3T185L68R383	R3T285L68R383	Class AA	3/8	3/16
R5T185L88R483	R5T285L88R483	(1/5) Class B	1/2	1/4
R5T185L68R383	R5T285L68R383	(1/5) Class B	3/8	3/16
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.				
Thermocouple Assemblies				
For CIP thermocouple assemblies use T/C types J, K, T, or E and options G for grounded junction or U for ungrounded junction as per example. EXAMPLE: TP68R38G-04 - CIP - 2 - 5 - 63				

1-2 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length desired. Examples: 04 = 4", 05(1/2) = 5.5"

2 Sanitary Cap Size

CODE	TUBE O.D. (inches)	CODE	TUBE O.D. (inches)
1	1(1/2)	4	3
2	2	5	Other (specify)
3	2 (1/2)		

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4 Terminations

CODE	DESCRIPTION
91	316L stainless steel screw-cover head
63	White polypropylene screw-cover head
31,W	Aluminum screw-cover head with white epoxy coating
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing
22 (06)	6" individual fluoropolymer leads with terminal pins
02	1/2" O.D., 2 1/4" long extension leadwire transition (requires table 5 & 6 selections from RTD section)
Head Options	
T-440	(4 to 20) mA head-mounted RTD transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter
I	Stainless steel tags
HS	Wire seal security screws

3 Sanitary Cap Style

CODE	DESCRIPTION
2	16A cap - bevel seat with13-H nut[1] 304SS
5	16 AMP cap - Tri-Clamp® 316SS
7	16AI-14I cap[2] 304SS
8	Other (describe)
[1] Must be manually cleaned [2] Not 3-A authorized	

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Food, Dairy & Pharmaceutical

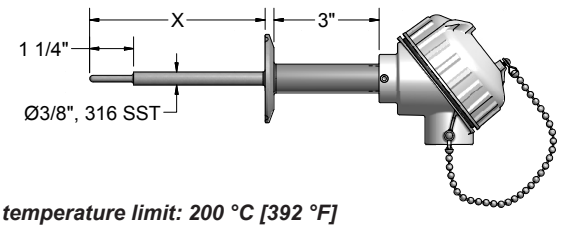
Configuration Code FD02

Fast Temperature Response RTDs with CIP Fittings

The sensors listed below are sanitary-connected RTD temperature sensor assemblies designed to meet the stringent requirements of HTST pasteurization systems. HTST requirements are described in the Grade "A" Milk Pasteurization Ordinance. The sensors listed on this page have response times below four seconds and come standard in accuracies at 100 ºC [212 ºF] ± 0.5 ºC. The below listed assemblies are available in a variety of sanitary connections. All wetted parts are ground and polished to a finish that exceeds the No. 4 minimum finish required by the 3-A Sanitary Standards for Sensors and Sensor Fittings and Connections used on Milk and Milk Product Equipment Standard **74-** . Assemblies are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. The three-wire constructed sensor assembly consists of a high accuracy platinum element sealed inside a 316 stainless steel sheath and a white FDA compliant polypropylene connecting head. The complete assembly provides excellent wash down protection. It is recommended that once customer connections are made, the connecting terminals be further protected by applying a coating of moisture-proof sealant over the connections.

3-A®

74-



Maximum temperature limit: 200 °C [392 °F]
Pasteurization Test Response Time: 2 to 3 seconds typical

ORDER CODES

Example Order Number:

1-1		1-2		2	3	4
R5T185L68R383	**-**	**04**	**-**	**HTST**	**-**	**2**	**-**	**5**	**-**	**63**

1-1 Pt100 (α = 0.003 85 °C^{-1}) RTD Assemblies

CODE		TOLERANCE[1]
SINGLE	*DUPLEX*	
R3T185L68R383	R3T285L68R383	Class AA
R5T185L68R383	R5T285L68R383	(1/5) Class B
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.		

1-2 Immersion Length "X"

Specify "X" length in inches using 2 digits,
plus any fractional length desired.
2" minimum length is required.
Examples: 04 = 4", 05(1/2) = 5.5"

2 Sanitary Cap Size

CODE	TUBE O.D. (inches)	CODE	TUBE O.D. (inches)
1	1(1/2)	4	3
2	2	5	Other (specify)
3	2 (1/2)		

3 Sanitary Cap Style

CODE	DESCRIPTION
2	16A cap - bevel seat with13-H nut[1] 304SS
5	16 AMP cap - Tri-Clamp® 316SS
7	16AI-14I cap[2] 304SS
8	Other (describe)
[1] Must be manually cleaned	[2] Not 3-A authorized

4 Terminations

CODE	DESCRIPTION
91	316L stainless steel screw-cover head
63	White polypropylene screw-cover head
31,W	Aluminum screw-cover head with white epoxy coating
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing
22 (06)	6" individual fluoropolymer leads with terminal pins
02	1/2" O.D., 2 1/4" long extension leadwire transition (requires table 5 & 6 selections from RTD section)
Head Options	
T-440	(4 to 20) mA head-mounted RTD transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter
I	Stainless steel tags
HS	Wire seal security screws

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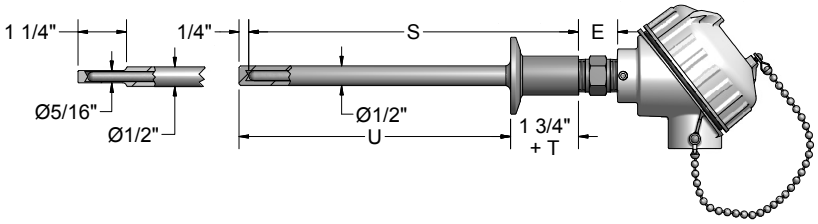
HART® is a registered trademark of HART Communication Foundation.

Configuration Code FD03

RTDs with CIP Sanitary-Connected Wells

The RTD sensors listed below are constructed with the CIP sanitary-connected cap thermowell, which is then mounted into the process with a clamp and mating sanitary cap. A 3-wire spring-loaded RTD element and sheath is then screwed into the back of the thermowell. This construction method allows for easy removal of both the well and/or the sensor assembly. The well and sanitary cap in contact with the process are all ground and polished to a finish that exceeds the **3-A Sanitary Standard 74-** . Thermowells are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request.

3-A® 74-



ORDER CODES

	1		2	2-1	2-2	2-3		3		4	5
Example Order Number:	**R5T185L483**	**-**	**DW4**	**25**	**06**	**08**	**-**	**SL**	**-**	**8HN**	**63**

1 Pt100 (α = 0.003 85 °C^{-1}) RTD Assemblies

CODE	TOLERANCE[1]
SINGLE	
R1T185L483	Grade B
R3T185L483	Class AA
R5T185L483	(1/5) Class B
RAF185L483	Class A
DUPLEX	
R1T285L483	Grade B
R3T285L483	Class AA
R5T285L483	(1/5) Class B
RAF285L483	Class A
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.	

2 Well Type

CODE	DESCRIPTION
DW4[1]	0.260" bore straight-stem sanitary well
DR4[2]	0.260" bore reduced-tip sanitary well
[1] Wells with "S" dimensions of 12" or less are supplied with drilled barstock stem. "S" dimensions above 12" will be supplied as tubing and welded tip. [2] Maximum "S" Dimension is 7 1/2"	

2.1 Cap Size and Style

CODE	DESCRIPTION
15	1", 1 1/2" Tri-clamp® 16 AMP
25	2" Tri-clamp® 16 AMP
35	2 1/2" Tri-clamp® 16 AMP
45	3" Tri-clamp® 16 AMP
Other styles - sizes available. Consult factory.	

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HART® is a registered trademark of HART Communication Foundation.

2.2 "S" Length

CODE	DESCRIPTION
XX	Specify length in inches using two digits.

2.3 Well Material

CODE	DESCRIPTION
08	316SS

3 Element Style

CODE	DESCRIPTION
SL[1]	Spring-loaded element
SC	Self-contained spring-loaded element
[1] Not available with 35, 36, or 37 series Transmitters	

4 Head Mounting Fittings

CODE	DESCRIPTION
8HN	316SS hex fitting
8PN(E)	316SS pipe nipple specify E length

5 Terminations

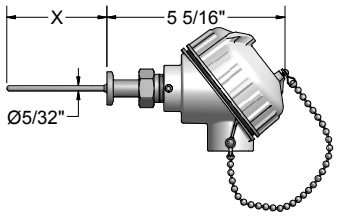
CODE	DESCRIPTION
91	316L stainless steel screw-cover head
63	White polypropylene screw-cover head
31,W	Aluminum screw-cover head with white epoxy coating
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing
Head Options	
T-440	(4 to 20) mA head-mounted RTD transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter
I	Stainless steel tags (specify tag #)

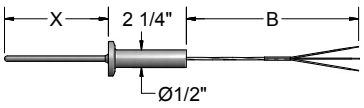
Configuration Code FD04

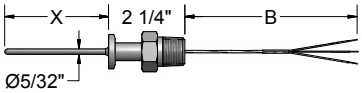
Miniature Sanitary CIP RTD Sensors

Miniature CIP sanitary RTD temperature sensors are provided with 16AMP sanitary caps to fit 1/2" and 3/4" tube size sanitary fittings. They are used in pharmaceutical, chemical, biotech, R & D laboratory, and food process applications. The sanitary caps are welded to the sheath, all made of 316 stainless steel, and then ground and polished to a finish that exceeds the No. 4 minimum finish required by the **3-A Sanitary Standard 74-** . Assemblies are supplied with a surface finish that meets or exceeds 15µin R_a. The process contact surfaces are free of pits, crevices, and pockets thus preventing corrosion and bacteria growth. All leads are fluoropolymer insulated to further provide moisture and chemical resistance. The listed sheath lengths provide assurance that the sensing element is properly placed in the flowing medium when used with typical sanitary tees and tube fittings, and the small sheath diameter provides fast temperature response times.

3-A® 74-







ORDER CODES

Example Order Number: **R1T185L(156)83 - 02 - CIP - 075-5 - 02 - T3T120 - 3**

1 Pt100 (α = 0.003 85 °C⁻¹) RTD Assemblies

CODE	TOLERANCE[1]
R1T185L(156)83	Grade B
R3T185L(156)83	Class AA
R5T185L(156)83	(1/5) Class B
RAF185L(156)83	Class A
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.	

2 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length desired
Examples: 02 = 2", 02(1/2) = 2.5"

3 16 AMP Sanitary Cap Size

CODE	DESCRIPTION
075-5	1/2", 3/4" 16AMP cap Tri-Clamp®

4 Terminations

CODE	DESCRIPTION
91	316L stainless steel screw-cover head
63	White polypropylene screw-cover head
31,W	Aluminum screw-cover head with white epoxy coating
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing
02	1/2" O.D., 2 1/4" long extension leadwire transition (requires table 5 and 6 selection)
8HP	1/2" NPT 316 SS hex fitting for conduit box or head mounting (use w/lead options from Tbl. 5 and 6)

6 Lead Terminations

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads w/spade lugs
4	Standard plug
6	Miniature plug
Options	
CG	1/2" NPT weatherproof nylon cord grip on FEP covered flex. armor
HS	Head supplied with wire seal security screws
I	Stainless steel tags
MC	Mating connector
T-440	(4 to 20) mA head-mounted RTD transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter

5 Extension Leadwire

CODE	DESCRIPTION	TEMP RATING
T3_ _ _[1]	Fluoropolymer Insulation - stranded conductor	204 °C [400 °F]
T3T_ _ _[1]	Fluoropolymer Insulation - stranded conductor - flexible armor - FEP coated	204 °C [400 °F]
M3_ _ _[1]	Fluoropolymer Insulation - stranded conductor - stainless steel overbraid - FEP Insulation	204 °C [400 °F]
[1] Insert 3 digit "B" dimension in inches.		

Tri-Clamp® is a registered trademark of Alfa Laval, Inc.

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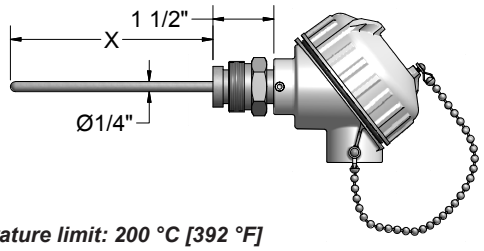
Configuration Code FD05

Thermometer Replacement RTDs

Thermometer replacement RTD temperature sensor assemblies are used when converting instrumentation from older direct reading thermometers to electronic instruments requiring RTD inputs. These RTD assemblies replace the filled system capillary actuating bulbs and will fit into the old existing bulb wells as listed below. These 3-wire constructed sensor assemblies consist of a high-accuracy platinum element sealed inside a spring-loaded 316 stainless steel sheath and are supplied with a FDA-compliant white thermoplastic gasketed head. Each sensor is supplied with a free-rotating stainless steel mounting fitting with the appropriate threading for the wells listed below.



Maximum temperature limit: 200 °C [392 °F]

ORDER CODES

Example Order Number: **R5T185L483 - 09(1/2) - TR - 63, I**

(1 = R5T185L483, 2 = 09(1/2), 3 = TR - 63, I)

1 Pt100 (α = 0.003 85 ºC^{-1}) RTD Assemblies

CODE		TOLERANCE[1]
SINGLE	***DUPLEX***	
R1T185L483	R1T285L483	Grade B
R3T185L483	R3T285L483	Class AA
R5T185L483	R5T285L483	(1/5) Class B
RAF185L483	RAF285L483	Class A
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.		
Thermocouple Assemblies		
For thermocouple assemblies use T/C types J, K, T, or E and options G for grounded junction or U for ungrounded junction as per example. EX.: TP48G - 09 (1/2) - TR - 63.		

2 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length desired. Examples: 04 = 4", 05(1/2) = 5.5

3 Terminations

CODE	DESCRIPTION
91	316L stainless steel screw-cover head
63	White polypropylene screw-cover head
31,W	Aluminum screw-cover head with white epoxy coating
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing
Head Options	
T-440	(4 to 20) mA head-mounted RTD transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter
I	Stainless steel tags
HS	Head supplied w/wire seal security screw

Immersion Length "X"

"X" IMMERSION LENGTH[1] (inches)	LENGTH AND MOUNTING FITTING TO FIT BELOW LISTED WELL PART NUMBER		MOUNTING FITTING THREAD
	TAYLOR	ANDERSON	
9 (1/2)	26P397	41247	1 (1/4)"-18 UNEF
12 (1/2)	26P398	41279	1 (1/4)"-18 UNEF
11 (1/2)	SK10274	41280	1 (1/4)"-18 UNEF
[1] "X" dimension indicates length with spring in its fully expanded position. Spring will retract 1/2" minimum to 3/4" maximum.			

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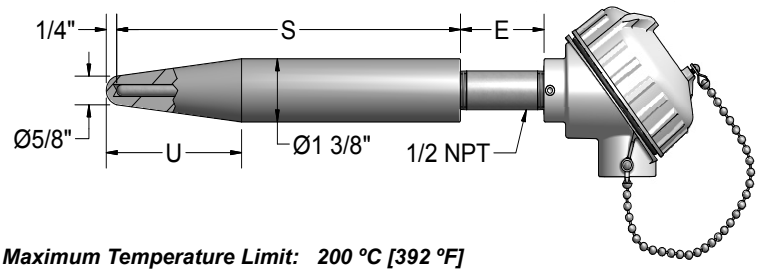
Configuration Code FD06

Weld-In RTD Assemblies

The Weld-In RTD temperature sensor assemblies listed below are commonly used in the food, dairy, beverage, pharmaceutical, and chemical processing industries. The complete assemblies are provided with a 3-wire platinum RTD element sealed inside a 1/4" O.D., spring-loaded, stainless steel sheath, and with a heavy wall sanitary protection well. Thermowells are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. The well is to be welded into a tank or vat with a full crevice-free fillet-weld to prevent corrosion, bacteria growth, and product contamination. Assemblies are provided with a FDA-compliant white thermoplastic-gasketed connection head. The complete assembly provides excellent washdown protection.

3-A® 74-



Maximum Temperature Limit: 200 ºC [392 ºF]

ORDER CODES

Example Order Number: **R1T185L483 - W81-18 - SL - 8PN4 - 63**

(1 = R1T185L483, 2 = W81-18, 3 = SL, 4 = 8PN4, 5 = 63)

1 Pt100 (α = 0.003 85 °C^{-1}) RTD Assemblies

CODE	TOLERANCE[1]	NORMAL SHEATH DIAMETER O.D. (inches)
SINGLE		
R1T185L483	Grade B	1/4
R3T185L483	Class AA	1/4
R5T185L483	(1/5) Class B	1/4
RAF185L483	Class A	1/4
DUPLEX		
R1T285L483	Grade B	1/4
R3T285L483	Class AA	1/4
R5T285L483	(1/5) Class B	1/4
RAF285L483	Class A	1/4
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.		

2 Weld - In Wells

CODE	WELL DIMENSIONS (inches)	
316SS	**S**	**U**
W81-18	8 (1/4)	3 (1/4)
W81-28	9 (7/8)	3 (1/4)
W81-38	11 (5/8)	5
W81-48	12 (7/8)	3 (3/4)

3 Element Style

CODE	DESCRIPTION
SL[1]	Spring-loaded element
SC	Self-contained spring-loaded element
[1] Not available with 35, 36, or 37 Series Transmitters	

4 Head Extensions

CODE	DESCRIPTION
8HN	316SS 1/2" NPT hex fitting
8PN(E)	316SS pipe nipple (specify length in inches)

5 Terminations

CODE	DESCRIPTION
91	316L stainless steel screw-cover head
63	White polypropylene screw-cover head
31,W	Aluminum screw-cover head with white epoxy coating
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing
Head Options	
T-440	(4 to 20) mA head-mounted RTD transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated HART® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter
I	Stainless steel tag

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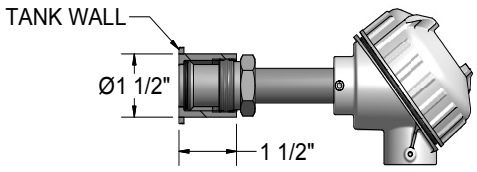
Example Order Number: **W81-18**

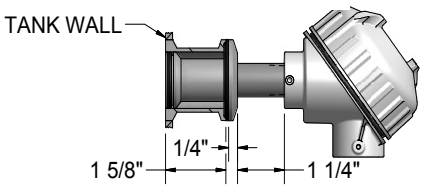
PART NUMBER	S LENGTH (inches)	U LENGTH (inches)
W81-18	8 (1/4)	3 (1/4)
W81-28	9 (7/8)	3 (1/4)
W81-38	11 (5/8)	5
W81-48	12 (7/8)	3 (3/4)

The non-intrusive tank sensors listed on this page are designed to mount flush with the interior tank wall for maximum product contact. This allows the wiping or mixing blades to properly mix the product within the tank without damaging the temperature sensor. The temperature sensors are manufactured of highly polished stainless steel and use various mounting methods for simple installation. These sensors are supplied standard with a 100 Ω, Platinum RTD sensing element. These RTD assemblies are constructed of 316 stainless steel and all wetted parts are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. These RTD assemblies have an operation temperature of (-50 to 200) ºC [-58 to 400] ºF. See back of section for complete dimensions and installation instructions.

STA SERIES



TTA SERIES



ORDER CODES

Example Order Number: **RAF185L 3 - DTA - 63**

(1-0: RAF185L; 1-1: 3; 1-2: DTA; 1-3: 63)

1-0 100 Ω Platinum RTD Elements

CODE		TOLERANCE[1]	TEMPERATURE COEFICIENT
Single	Duplex		
RBF185L	RBF285L	Class B	α = 0.003 85 ºC^{-1}
RAF185L	RAF285L	Class A	α = 0.003 85 ºC^{-1}
[1] Tolerance is based on initial element accuracy and can not be guaranteed in flush mount applications.			

1-1 Element Connection

CODE	DESCRIPTION
3	3-Wire Element
4 [1]	4-Wire Element
[1] Not Available in Duplex	

1-2 Assembly Types and Options

SINGLE-WALL RTD SENSOR	
CODE	**DESCRIPTION**
STA	Complete assembly, includes sensor, mounting adaptor, and O-ring
STS	Replacement sensor, includes sensor and O-ring
DUAL-WALL RTD SENSOR	
CODE	**DESCRIPTION**
DTA	Complete assembly, includes sensor, mounting adaptor, and O-ring
DTS	Replacement sensor, includes sensor and O-ring
TRI-CLAMP® RTD SENSOR	
CODE	**DESCRIPTION**
TTA	Complete assembly, includes sensor, mounting adaptor, clamp, gasket and O-ring
TTS	Replacement sensor, includes sensor and O-ring
CAN STYLE RTD SENSOR	
CODE	**DESCRIPTION**
FCA	Complete assembly, includes sensor, backing nut, mounting adaptor, and FEP gasket
FCS	Replacement sensor, includes sensor and FEP gasket

1-3 Head Terminations and Options

CODE	DESCRIPTION
63	White polypropylene screw-cover head
31,W	Aluminum screw-cover head with white epoxy coating
91	316 Stainless steel screw-cover head
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing
Optional Temperature Transmitters and Head Options	
CODE	**DESCRIPTION**
T-440	(4 to 20) mA head-mounted RTD transmitter
T-441	(4 to 20) mA isolated head-mounted transmitter
T-442	(4 to 20) mA isolated Hart® head-mounted transmitter
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter
I	Stainless steel identification tag
SB	1/2" NPT conduit reducer bushing
NB	1/2" NPT nylon conduit reducer bushing

Replacement Parts

CODE	DESCRIPTION
13445	Single-wall tank mounting adaptor (STA assembly)
13446	Dual-wall tank mounting adaptor (DTA assembly)
13538	Silicon/FEP O-ring for STA and DTA assemblies
13470	Tank mounting adaptor for Tri-Clamp® assembly
13542	Silicon/FEP O-ring for TTA Tri-Clamp® assembly
13439	1 1/2" clamp for TTA Tri-Clamp® assembly
13440	EDPM gasket for TTA Tri-Clamp® assembly
13447	Tank mounting adaptor for FCA Can style assembly
13449	Backing nut for FCA Can style assembly
13448	FEP gasket for FCA Can style assembly

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HART® is a registered trademark of HART Communication Foundation.

Pyromation insertion probes with formed pistol grip handles, are used to measure internal temperature of meat, fish, poultry, and other food products, both fresh and slightly frozen varieties. Other uses include penetration of soft process materials such as rubber and plastic compounds. The materials of construction are all FDA compliant for use in sanitary applications. The sheath tips are made of full hard-drawn 304SS hypodermic tubing with a sharp needle-point insertion tip. Handles are constructed of formed stainless steel tubing and are available in three size and strength configurations to match the process duty requirements. All leads are epoxy sealed.

FIGURE 1

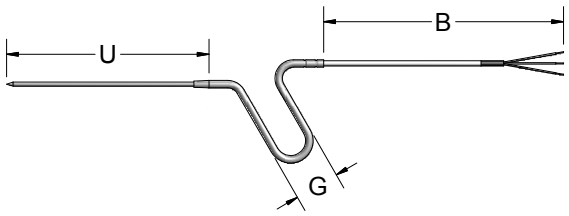
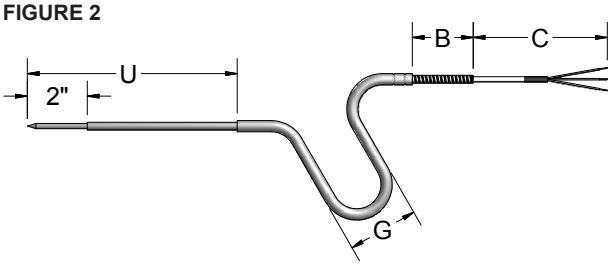


FIGURE 2



ORDER CODES

	1		2		3		4
Example Thermocouple Order Number:	**JPGM2G**	-	**06**	-	**M3036**	-	**4**
Example RTD Order Number:	**RBF185PGM3**	-	**06**	-	**M3120**	-	**2**

1 Penetration Thermocouple

CODE	TIP DIA. (inches)	GRIP "G" DIM. (inches)	GRIP DIA. (inches)
LIGHT-DUTY HANDLE - FIGURE 1			
JPGL2G	0.134	1 1/4	1/4
MEDIUM-DUTY HANDLE - FIGURE 2			
JPGM2G	0.134	2 3/8	5/16
JPGM3G	0.180	2 3/8	5/16
HEAVY-DUTY HANDLE - FIGURE 2			
JPGH3G	0.180	2 3/8	3/8
DUPLEX - FIGURE 2			
JJPGH3G	0.180	2 3/8	3/8
To specify other calibrations, change first digit to K or T. To specify ungrounded junction, change last digit from G to U.			

2 Immersion "U" Length

DESCRIPTION
Specify "U" dimension in inches using 2 digits, plus any fractional lengths. Examples: 02 = 2", 02(1/2) = 2.5". 12" maximum insertion length.

4 Terminations

CODE	DESCRIPTION
2	2" split leads 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
6	Miniature plug
Options	
RB	Rubber boot (2 pin plugs only)
MC	Mating connector
CG	Cord grip (1/2" NPT PVC)

1 Penetration Style 3-Wire RTDs Pt100 (α = 0.003 85 °C^{-1})

CODE	TOLERANCE[1]	TIP DIA. (inches)	GRIP 'G' DIM (inches)	GRIP DIA. (inches)
LIGHT-DUTY HANDLE - FIGURE 1				
RBF185PGL2	Class B	0.134	1 1/4	1/4
MEDIUM-DUTY HANDLE - FIGURE 2				
RBF185PGM2	Class B	0.134	2 3/8	5/16
RBF185PGM3	Class B	0.180	2 3/8	5/16
HEAVY-DUTY HANDLE - FIGURE 2				
RBF185PGH3	Class B	0.180	2 3/8	3/8
DUPLEX - FIGURE 2				
RBF285PGH3	Class B	0.180	2 3/8	3/8
Consult factory for other accuracies and types.				
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.				

3 Extension Leadwire

CODE	DESCRIPTION	TEMP RATING
T3_ _ _[1]	Fluoropolymer Insulation - Stranded Conductor	204 °C [400 °F]
T3A_ _ _[1]	Fluoropolymer Insulation - Stranded Conductor - Flexible Armor	204 °C [400 °F]
T3T_ _ _[1]	Fluoropolymer Insulation - Stranded Conductor - Flexible Armor - FEP coated	204 °C [400 °F]
T3P_ _ _[1]	Fluoropolymer Insulation - Stranded Conductor - Flexible Armor - PVC-Coated	105 °C [221 °F]
M3_ _ _[1][2]	Fluoropolymer Insulation - Stranded Conductor - Stainless Steel Overbraid - FEP Insulation	204 °C [400 °F]
S3_ _ _[1][3]	Fluoropolymer Insulation - Stranded Conductor - Silicon Rubber Jacket	204 °C [400 °F]
[1] Insert 3 digit "B" dimension in inches. [2] Not available with Type K. [3] Only available in single 3-wire RTD.		

Configuration Code FD08
Penetration Style RTD Sensors

Insertion RTD probes are used to monitor internal temperatures of meat, fish, poultry, dough, and other food products, both fresh and slightly frozen varieties. Other uses include penetration of soft process materials such as rubber and plastic compounds. The materials of construction are all FDA compliant for use in sanitary applications. The sheaths are made of full hard-drawn 304SS, hypodermic tubing with a sharp needle-point insertion tip. Several varieties of handles, leadwire, and termination configurations are available. All assemblies are 3-wire construction and use a 100 ohm platinum element with a Temperature Coefficient of 0.003 85 $ºC^{-1}$ (Class B) and are rated to 200 ºC [392 ºF] maximum temperature limit.

FIGURE 1

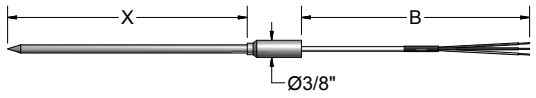


FIGURE 2

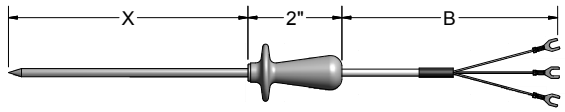


FIGURE 3

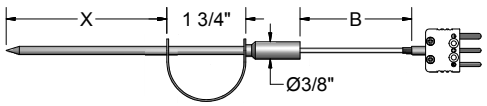
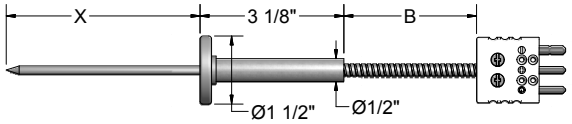


FIGURE 4



ORDER CODES

Example Order Number:

1		2		3		4
RBF185MH2	-	**06**	-	**T3120**	-	**4**

1 Pt100 (α = 0.003 85 $ºC^{-1}$) 3-Wire RTD Assemblies

CODE		NOM. SHEATH DIAMETER (inches)
SINGLE	***DUPLEX***	
FIGURE 1 LESS HANDLE		
RBF185LH2		0.134
RBF185LH3	RBF285LH3	0.180
FIGURE 2 MOLDED NYLON HANDLE 150 ºC [302 ºF]		
RBF185MH2		0.134
RBF185MH3	RBF285MH3	0.180
FIGURE 3 SABRE HANDLE		
RBF185SH2		0.134
RBF185SH3	RBF285SH3	0.180
FIGURE 4 HEAVY DUTY HANDLE		
RBF185HD2		0.134
RBF185HD3	RBF285HD3	0.180

2 Sheath 'X' Dimension

Specify "X" length in inches using 2 digits plus any fractional length. Examples: 02 = 2", 02(1/2)" = 2.5"
12" max. standard construction length.

4 Terminations

CODE	DESCRIPTION
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
6	Miniature plug
Options	
RB	Rubber boot (2 pin plugs only)
MC	Mating connector
CG	Cord grip (1/2" NPT PVC)

3 Extension Leadwire

CODE	DESCRIPTION	TEMP RATING
T3_ _ _ [1]	Fluoropolymer Insulation - stranded conductor	200 °C [392 °F]
T3A_ _ _ [1]	Fluoropolymer Insulation - stranded conductor - flexible armor	200 °C [392 °F]
T3T_ _ _ [1]	Fluoropolymer Insulation - stranded conductor - flexible armor - FEP coated	200 °C [392 °F]
T3P_ _ _ [1]	Fluoropolymer Insulation - stranded conductor - flexible armor - PVC-coated	105 °C [221 °F]
M3_ _ _ [1]	Fluoropolymer Insulation - stranded conductor - stainless steel overbraid - FEP Insulation	200 °C [392 °F]
S3_ _ _ [1]	Fluoropolymer Insulation - stranded conductor - silicon rubber jacket	200 °C [392 °F]
[1] Insert 3 digit "B" dimension in inches.		

Configuration Code FD08

Penetration Style Thermocouple Sensors

Insertion thermocouple probes are used to monitor internal temperatures of meat, fish, poultry, dough, and other food products, both fresh and slightly frozen varieties. Other uses include penetration of soft process materials such as rubber and plastic compounds. The materials of construction are all FDA compliant for use in sanitary applications. The sheaths are made of full hard-drawn 304SS hypodermic tubing with a sharp needle-point insertion tip. Several varieties of handles, leadwire, and termination configurations are available. Probes are supplied with grounded hot junctions unless otherwise specified and are rated to 200 ºC [392 ºF] maximum temperature limit.

FIGURE 1

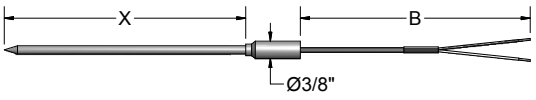


FIGURE 2

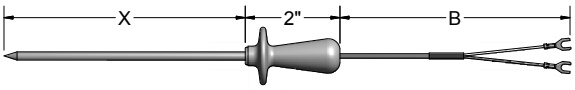


FIGURE 3

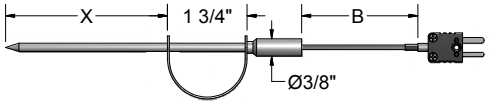
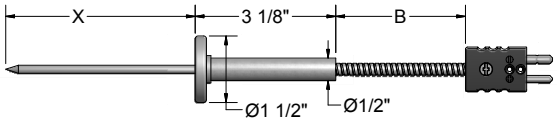


FIGURE 4



ORDER CODES

Example Order Number:

1		2		3		4
JMH2G	-	**06**	-	**T3120**	-	**4**

1 Thermocouple Type

CODE		NOM. SHEATH DIAMETER (inches)	
SINGLE	*DUPLEX*		
FIGURE 1 LESS HANDLE			
JLH2G		J	0.134
JLH3G	JJLH3G	J	0.180
FIGURE 2 MOLDED NYLON HANDLE 150 ºC [302 ºF]			
JMH2G		J	0.134
JMH3G	JJMH3G	J	0.180
FIGURE 3 SABRE HANDLE			
JSH2G		J	0.134
JSH3G	JJSH3G	J	0.180
FIGURE 4 HEAVY-DUTY HANDLE			
JHD2G		J	0.134
JHD3G	JJHD3G	J	0.180

To specify other calibrations, change first digit to K or T.
To specify ungrounded junctions, change last digit from G to U.

4 Terminations

CODE	DESCRIPTION
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
6	Miniature plug
Options	
RB	Rubber boot (2 pin plugs only)
MC	Mating connector
CG	Cord grip (1/2" NPT PVC)

3 Extension Leadwire

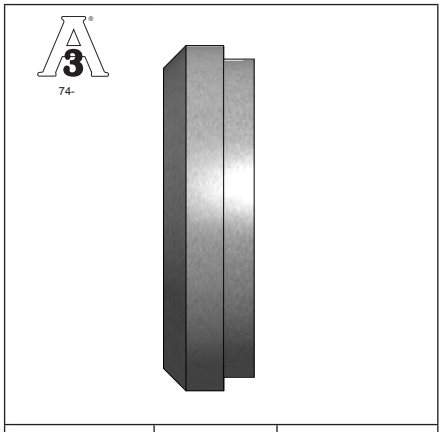
CODE	DESCRIPTION	TEMP RATING
T3_ _ _ [1]	Fluoropolymer Insulation - stranded conductor	200 °C [392 °F]
T3A_ _ _ [1]	Fluoropolymer Insulation - stranded conductor - flexible armor	200 °C [392 °F]
T3T_ _ _ [1]	Fluoropolymer Insulation - stranded conductor - flexible armor - FEP coated	200 °C [392 °F]
T3P_ _ _ [1]	Fluoropolymer Insulation - stranded conductor - flexible armor - PVC-coated	105 °C [221 °F]
M3_ _ _ [1][2]	Fluoropolymer Insulation - stranded conductor - stainless steel overbraid - FEP Insulation	200 °C [392 °F]

[1] Insert 3 digit "B" dimension in inches.
[2] Not available with Type K.

2 Sheath "X" Dimension

Specify "X" length in inches using 2 digits.
12" max. standard construction length.

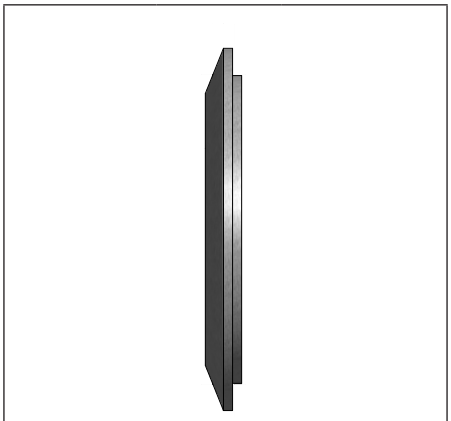
16A Bevel Seat[1]



TUBE SIZE (inches)	O.D. (inches)	THICKNESS (inches)
1	1.31	0.46
1 1/2	1.84	0.56
2	2.37	0.62
2 1/2	2.90	0.66
3	3.43	0.71
4	4.50	0.81

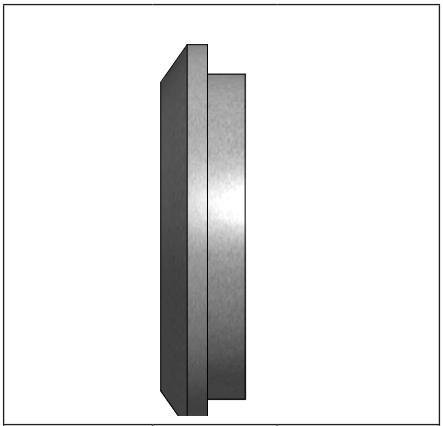
[1] Must be manually cleaned

16AH H-Line



TUBE SIZE (inches)	O.D. (inches)	THICKNESS (inches)
1 1/2	2.00	0.250
2	2.50	0.250
2 1/2	3.03	0.250
3	3.56	0.250
4	4.68	0.250

16AI - 14I

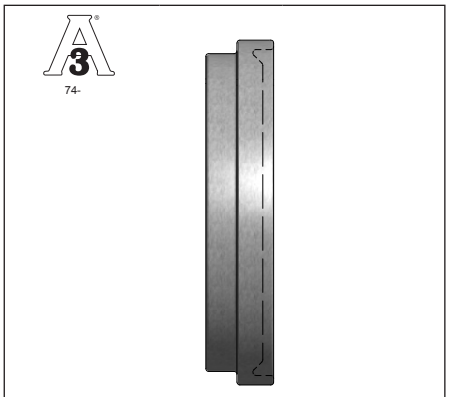


TUBE SIZE (inches)	O.D. (inches)	THICKNESS (inches)
1 or 1 1/2	2.00	0.50
2	2.65	0.56
2 1/2	3.12	0.56
3	3.87	0.75
4	4.87	0.75

16AMP

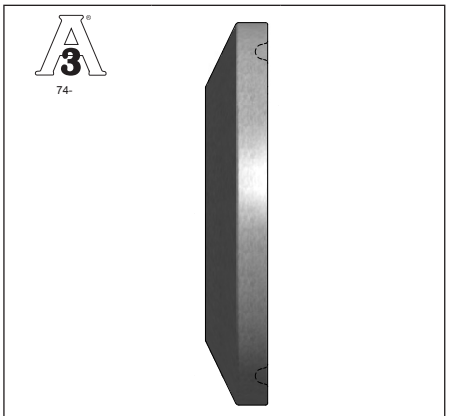
TUBE SIZE (inches)	O.D. (inches)	THICKNESS (inches)
1/2 or 3/4	1.00	0.25
1 or 1 1/2	1.98	0.25
2	2.51	0.25
2 1/2	3.03	0.25
3	3.57	0.25
4	4.68	0.31

16APV



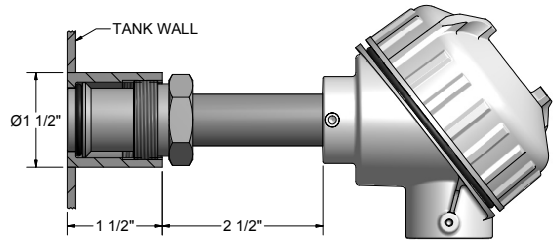
TUBE SIZE (inches)	O.D. (inches)	THICKNESS (inches)
1	1.38	0.29
1 1/2	1.88	0.42
2	2.38	0.46
2 1/2	2.88	0.47
3	3.38	0.50
4	4.38	0.53

16AQ - 14Q

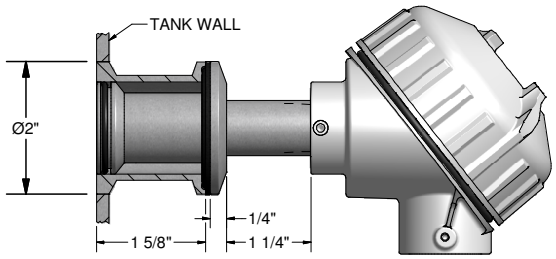


TUBE SIZE (inches)	O.D. (inches)	THICKNESS (inches)
1 or 1 1/2	1.98	0.31
2	2.64	0.43
2 1/2	3.30	9.50
3	3.87	0.50
4	4.87	0.62

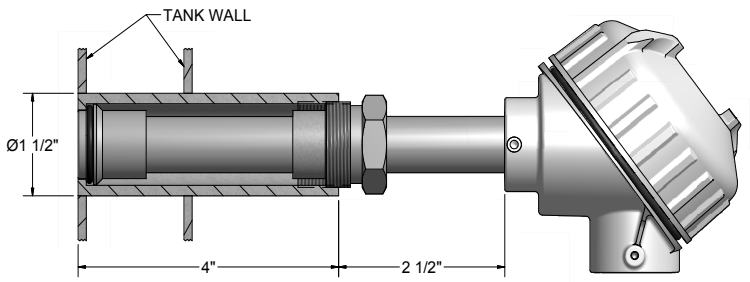
STA



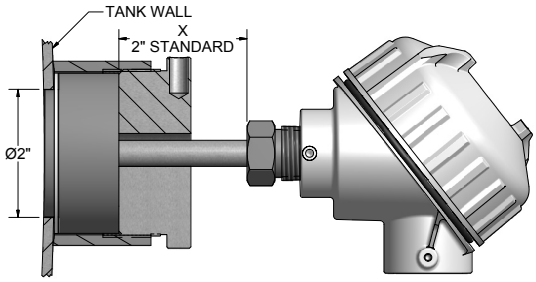
TTA



DTA



FCA



STA and DTA Series Tank Sensors

1. Drill a 1.50" Dia. (1 1/2") hole through the tank wall for tank adaptor.
2. Bevel tank wall(s) and/or tank adaptor as needed.
3. Tack weld (GTAW preferred) tank adaptor 3 to 4 places inside of tank wall to ensure flush/ square fit.
4. Seal weld (GTAW preferred) tank adaptor to inside tank wall, grind weld as needed, provide sanitary finish to 180 grit minimum.
5. Weld (GTAW preferred) tank adaptor to outside of tank wall, grind weld as needed.
6. Slide O-ring onto sensor housing assembly.
7. Insert assembly into tank adaptor and tighten backing nut.

TTA Series Tank Sensors

1. Drill a 2.00" hole through the tank wall for tank adaptor.
2. Bevel tank wall(s) and/or tank adapter as needed.
3. Tack weld (GTAW preferred) tank spud 3 to 4 places inside of tank wall to ensure flush/square fit.
4. Seal weld (GTAW preferred) tank spud to inside tank wall, grind weld as needed, provide sanitary finish to 180 grit minimum.
5. Weld (GTAW preferred) tank spud to outside of tank wall, grind weld as needed.
6. Slide O-ring onto sensor housing assembly.
7. Insert assembly into tank adaptor and tighten clamp.

FCA Tank Sensors

1. Drill a 2.00" hole through the tank wall(s) for the tank adaptor.
2. Deburr tank wall(s) as needed.
3. Use the sensor housing to align the tank adaptor to the tank wall.
4. Tack weld (GTAW preferred) the tank adaptor to the outside of the tank wall, grind weld as needed.
5. Slide the FEP Gasket onto the end of the sensor housing.
6. Insert assembly into the tank mounting adaptor and tighten backing nut.

Configuration Code ID01

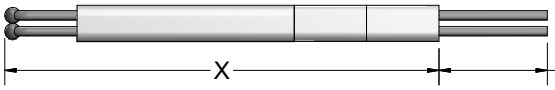
Straight Base-Metal Thermocouple Elements

The straight base metal thermocouple elements illustrated on this catalog page are replacement elements for use in Pyromation's complete industrial thermocouple assemblies as found elsewhere in this catalog section. These replacement elements are also compatible for use in other manufacturers' thermocouple assemblies. These thermocouples are available as bare wire or ceramic insulated elements, with options as listed below, and with special construction designs.

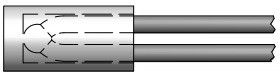
BARE ELEMENT

INSULATED ELEMENT

DUPLEX INSULATED



INSULATED JUNCTION



TWIST WELD

TIG WELD

ORDER CODES

Example Order Number:

1	2		3		4
K8	C	M	- 24	-	1,341

1 Single Straight Element Type

CODE (Type + Wire Gauge)				DESCRIPTION
J8		J14	J20	Iron - Constantan
K8	K11	K14	K20	Chromel - Alumel
N8		N14		Nicrosil - Nisil
DUPLEX STRAIGHT ELEMENTS				
Use thermocouple type code letter twice. Example: JJ14 or KK11. Dual elements with ceramic insulators are supplied as two single elements.				

2 Element Insulation

CODE	DESCRIPTION	WIRE GAUGE	INSULATOR DIMENSIONS (inches)	
			SINGLE	*DUPLEX*
O	Bare Element		None Used	
C	Oval Ceramic	8 Ga.	0.500 x 0.281	
		11 Ga.	0.375 x 0.218	
		14 Ga.	0.313 x 0.188	
R	Round Ceramic	8 Ga.	0.465 O.D.	0.500 O.D.
		11 Ga.	0.465 O.D.	0.500 O.D.
		14 Ga.	0.250 O.D.	0.320 O.D.
		20 Ga.	0.150 O.D.	0.188 O.D.
The above insulated elements are supplied with refractory insulators: 1277 °C [2330 °F] maximum temperature.				

Element Options

CODE	DESCRIPTION
M	Special limits wire - types J and K (consult factory for other types)

4 Element Options

CODE	DESCRIPTION
0	Standard weld as noted below
1	Twist and tig weld (not available with 8 gauge duplex)
2	Tig weld without twist
L	Insulated hot junction
341	Single terminal block on element
342	Duplex terminal block on element
Unless specified by option numbers above, all 8, 11, and 14 gauge elements will be provided with Opt. 2 (tig weld without twist). 20 gauge elements will be provided with Opt. 1 (twist and tig weld). All elements, regardless of gauge, over 96" will be supplied with Opt. 1 (twist and tig weld).	

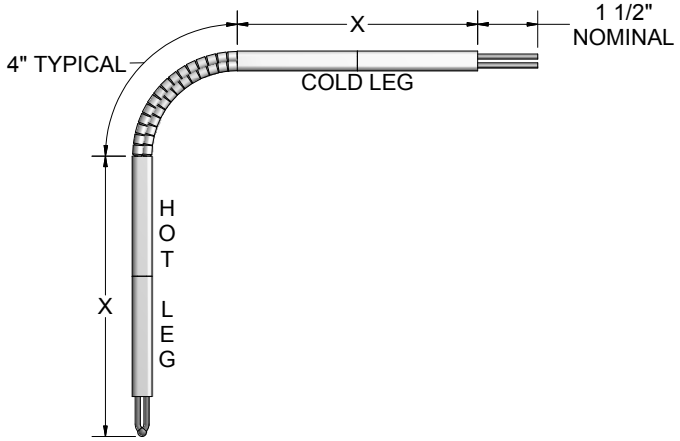
3 Element "X" Length

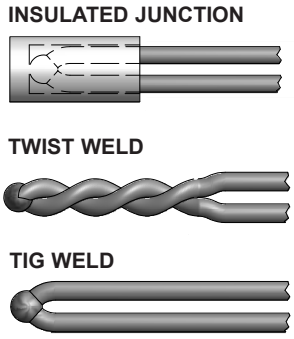
LENGTH (inches)	LENGTH (inches)
12	30
18	36
24	
Specify other lengths in 1" increments.	
Actual cut length will be 1(1/2)" longer than specified length to allow for terminal connections.	

Configuration Code ID01

Angle Base-Metal Thermocouple Elements

The angle base metal thermocouple elements illustrated on this catalog page are replacement elements for use in Pyromation's complete angle thermocouple assemblies as found elsewhere in this catalog section. These replacement elements are also compatible for use in other manufacturers' angle thermocouple assemblies. These thermocouples are available with the options listed below and with special construction designs. These replacement elements are shipped in a straight configuration and are to be bent at the time of installation.





ORDER CODES

Example Order Number: **K8 A - 12 - 18 - 1, L, 341**

1 Single Angle Element Type

CODE (Type + Wire Gauge)			DESCRIPTION
J8		J14	Iron - Constantan
K8	K11	K14	Chromel - Alumel
N8		N14	Nicrosil - Nisil
DUPLEX ANGLE ELEMENTS			
Requires the use of 2 single elements.			

2 Element Insulation

CODE	INSULATOR DESCRIPTION	WIRE GAUGE	INSULATOR DIMENSIONS (inches)
			SINGLE
A	Two hole oval ceramic insulators on hot and cold legs. Ball and socket insulators at bend	8 Ga.	0.500 x 0.281
		11 Ga.	0.500 x 0.286
		14 Ga.	0.375 x 0.218
The above insulated elements are supplied with refractory insulators: 1277 ºC [2330 ºF] maximum temperature.			

Element Options

CODE	DESCRIPTION
M	Special limits wire - types J and K (consult factory for other types)

3 Hot Leg "X" Length

LENGTH (inches)	LENGTH (inches)
12	30
18	36
24	Specify Other Lengths

4 Cold Leg "X" Length

LENGTH (inches)	LENGTH (inches)
12	30
18	36
24	
Specify other lengths in 1" increments.	
Actual cut length will be 1(1/2)" longer than specified length to allow for terminal connections.	

5 Element Options

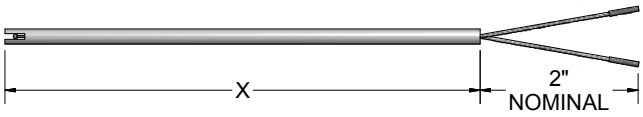
CODE	DESCRIPTION
0	Standard weld as noted below
1	Twist and tig weld
2	Tig weld without twist
L	Insulated hot junction
341	Single terminal block on element
342	Duplex terminal block on element
Unless specified by option numbers above, all 8, 11, and 14 gauge elements will be provided with Opt. 2 (tig weld without twist).	
All elements, regardless of gauge, over 96" will be supplied with Option 1 (twist and tig weld).	

Configuration Code ID02

Noble-Metal Platinum Thermocouple Elements

The noble-metal platinum thermocouple elements illustrated on this catalog page are replacement elements for use in Pyromation's complete high temperature industrial thermocouple assemblies as found elsewhere in this catalog section. These replacement elements are also compatible for use in other manufacturers' high temperature thermocouple assemblies. All insulated elements are supplied with high temperature alumina insulators and are available with the options as listed below. Element types R, S, and B are supplied with a fusion weld. Custom designed constructions are available.

INSULATED ELEMENT without COLLAR
(supplied with recessed junction as standard)



Note: Elements supplied without collars are intended to be used with ceramic tubes that are not supplied with hex fittings.

INSULATED ELEMENT with COLLAR

Note: Elements supplied with collars are intended to be used with ceramic tubes with hex fittings.

ORDER CODES

Example Order Number:

1	2		3		4
R24	**R**	**-**	**18**	**-**	**3**

1 Single Straight Element Type

CODE (Type + Wire Gauge)		DESCRIPTION
R24	R26	Platinum - Platinum 13% Rhodium
S24	S26	Platinum - Platinum 10% Rhodium
B24		Platinum - 30% Rhodium - Platinum 6% Rhodium
DUPLEX STRAIGHT ELEMENTS		
Use thermocouple type code letter twice. EXAMPLES: RR24 or SS26		

2 Element Insulation

CODE	INSULATOR DESCRIPTION	WIRE GAUGE	INSULATOR DIMENSIONS (inches)
			SINGLE and DUPLEX
O	Uninsulated bare element		None
R	Round, 99.7% Alumina Insulator (4-hole, single and duplex) 1871 ˚C [3400 ˚F] maximum temp.	24	0.188 O.D. w 0.535 O.D. Collar
		26	0.188 O.D. w 0.535 O.D. Collar
CODE	**DESCRIPTION**		
M	Reference grade (consult factory for other types)		

3 Element "X" Length

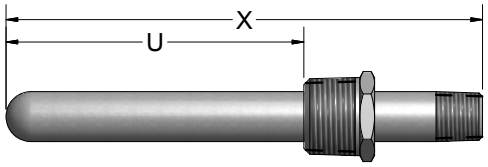
LENGTH (inches)	LENGTH (inches)
12	30
18	36
24	
Specify other lengths in 1" increments.	

4 Element Options

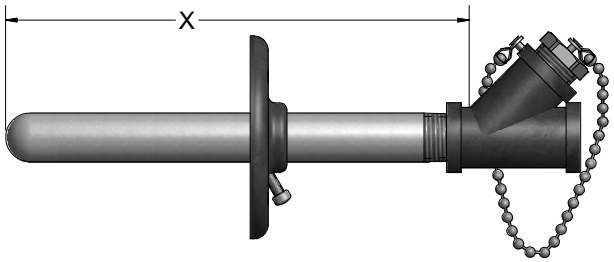
CODE	DESCRIPTION
3	Supplied without ceramic collar
L	Recessed insulated hot junction

The thermocouple protection tubes illustrated on this catalog page are replacement tubes for Pyromation's complete thermocouple assemblies as found elsewhere in this catalog section. They are compatible replacements for other manufacturers' protection tubes. The materials of construction are those most commonly used in general purpose industrial process heating applications. These protection tubes are available with the options as listed below, with other pipe schedule sizes, and they can be supplied with custom designed constructions. **Note: Welded bushings will be welded at maximum length possible when X and U dimensions are specified as the same length. Actual U dimension will be 1 to 2 inches shorter than specified depending on bushing size.**

TUBE with OPTIONAL WELDED BUSHING



TUBE with OPTION CODE H and 6Y



ORDER CODES

Example Order Number: 1 **8-50** - 2 **18** - 3 **8D16**

1 Protection Tube NPT Connections

CODE	NPT SIZE (inches)	PIPE SCHEDULE[1]
CARBON STEEL 538 ºC [1000 ºF] Max.		
6 - 25	1/4	40
6 - 50	1/2	40
6 - 75	3/4	40
6 - 100	1	40
316 SS 927 ºC [1700 ºF] Max.		
8 - 25	1/4	40
8 - 50	1/2	40
8 - 75	3/4	40
8 - 100	1	40
446 SS 1093 ºC [2000 ºF] Max.		
5 - 50	1/2	40
5 - 75	3/4	40
ALLOY 600 1149 ºC [2100 ºF] Max.		
3 - 50	1/2	40
3 - 75	3/4	40
ALLOY 601 1260 ºC [2300 ºF] Max.		
7 - 50	1/2	40
7 - 75	3/4	40
7 - 100	1	40
HR-160 1204 ºC [2200 ºF] Max.		
41 - 50	1/2	40
41 - 75	3/4	40
41 - 100	1	40

2 Tube "X" Length

LENGTH (inches)
12
18
24
30
36
Specify other lengths in 1" increments up to 240". Consult factory for lengths above 20'.

[1] Schedule 80 and 160 are available in some alloys as special order items. Consult factory for price and delivery.

3 Protection Tube Options

CODE	DESCRIPTION
A	Open end tube (closed end standard)
H	Adjustable steel mounting flange
NT	Supplied without threads
6Y	Steel temperature check fitting

Optional Welded Bushings

CODE		DESCRIPTION
STEEL	*316 SS*	**BUSHING SIZE (inches)**
6C(U)	8C(U)	1/2 NPT Bushing (25 tubes only)
6D(U)	8D(U)	3/4 NPT Bushing (25 and 50 tubes only)
6E(U)	8E(U)	1 NPT Bushing (25, 50, and 75 tubes only)
6F(U)	8F(U)	1(1/4) NPT Bushing
6G(U)	8G(U)	1(1/2) NPT Bushing

Substitute insertion length, in inches, measured from hot tip to bottom of bushing for (U) above. Insert NW in place of insertion length (U) for bushing supplied loose on tube.

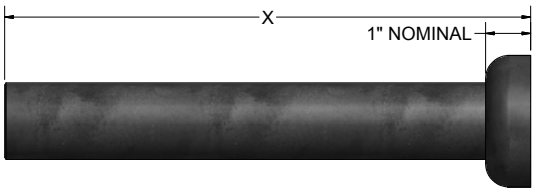
Metal Alloy Tube Dimensions

PIPE SIZE (inches)	O.D. (inches)	SCH. 40 I.D. (inches)	SCH. 80 I.D. (inches)	SCH. 160 I.D. (inches)
1/4	0.540	0.364	0.302	
1/2	0.840	0.622	0.546	0.466
3/4	1.050	0.824	0.742	0.612
1	1.315	1.049	0.957	0.815

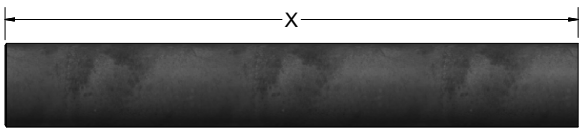
Configuration Code ID04
Special-Service Composite Protection Tubes

The protection tubes listed below are designed for use in high temperature corrosive service applications. These protection tubes can be used in waste incineration, cement kilns, lime kilns, and other harsh process environments where high levels of sulfur, chlorides, ash, and salt deposits are commonly found. The series 12 protection tube is also an excellent choice for immersion into molten copper and brass alloys. The series 71 and series 18 protection tubes are typically used as outer protection tubes in high temperature applications such as ceramic kilns, brick kilns, and steel melting furnaces. These tubes are excellent choices in applications where direct flame impingement occurs.

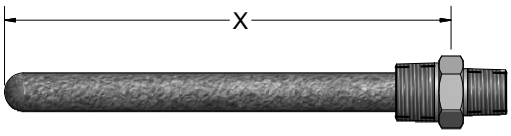
TUBE CODE 18JC



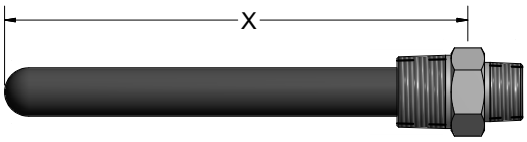
TUBE CODE 18J



TUBE CODE 71BH



TUBE CODE 12



ORDER CODES

Example Order Number: 1: **12W4** - 2: **24** - 3: **8,NT**

1

Metal Ceramic (LT-1) 1371 °C [2500 °F][1]					
CODE	**Nominal I.D. (inches)**	**Nominal O.D. (inches)**	**FITTING DESCRIPTION**	**PROCESS THREADS (inches)**	**TERM THREADS (inches)**
12WH	5/8	7/8	Steel hex fitting	1	3/4
12W(E)	5/8	7/8	Steel pipe nipple (specify "E" length)	1	1
Silicate-Bonded Silicon Carbide 1649 °C [3000 °F]					
18J	1	1(3/4)	Plain tube	None	None
18JC	1	1(3/4)	Tube with 3" O.D. collar	None	None
Recrystalized Silicon Carbide (RSiC) 1600 °C [2912 °F]					
71BH	3/8	11/16	Steel hex fitting	3/4	1/2
71B(E)	3/8	11/16	Steel pipe nipple (specify "E" length)	3/4	3/4
71WH	1/2	7/8	Steel hex fitting	1	3/4
71W(E)	1/2	7/8	Steel pipe nipple (specify "E" length)	1	1
[1] O.D. Tolerance ± 1/16", I.D. Tolerance + 1/16", - 3/32"					

2 Tube "X" Length

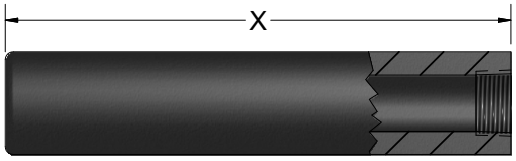
LENGTH (inches)
12
18
24
30
36
42
48

3 Options

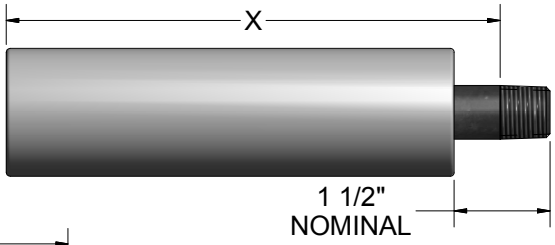
CODE	DESCRIPTION
8	316 SS nipple or hex tube fitting
NT	No process mounting threads on pipe nipples

The Series 11, 13, and 14 protection tubes are used to protect thermocouple elements in molten aluminum and zinc applications such as diecasting, melting, smelting, and high temperature holding furnace environments. Series 13 and 14 protection tubes should be preheated and slowly immersed into any molten materials.

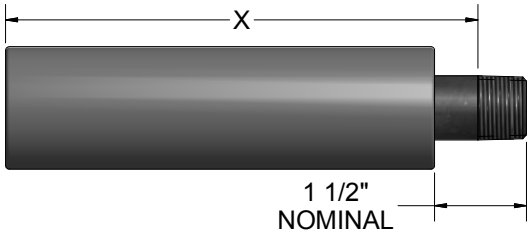
TUBE CODE 11



TUBE CODE 14[1]



TUBE CODE 13[1]



[1] Refractory length is 1" shorter than specified length

ORDER CODES

Example Order Number: 1 **11-75** - 2 **24**

1 Protection Tube NPT Connections

CODE	DESCRIPTION	NPT SIZE (inches)	TUBE		MAX. LENGTH (inches)
			Nominal O.D. (inches)	Nominal I.D. (inches)	
CAST-IRON 871 ºC [1600 ºF] Max.					
11 - 75	Internally threaded	3/4	1.625	0.075	72
VESUVIUS 927 ºC [1700 ºF] Max.					
13 - 75		3/4	2.00	0.824	48
CERITE® 815 ºC [1300 ºF] (36" maximum "X" length)					
14-50[1]	Cerite® II	1/2	2.00	0.622	36

[1] For Cerite® protection tubes supplied with 316SS pipe instead of a carbon steel pipe, change model number prefix code 14 to 148. EXAMPLE: 148-50-24

2 Tube "X" Length

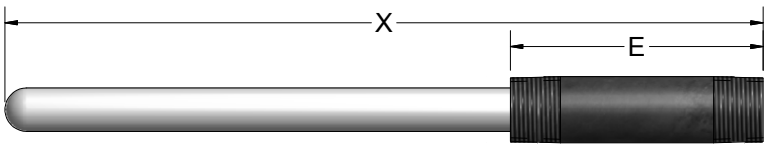
LENGTH (inches)
12
18
24
30
36
42
48

Recommended Applications

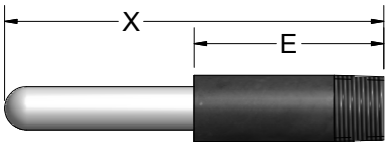
CAST-IRON	Aluminum
VESUVIUS	Aluminum
CERITE®	Aluminum, Zinc

The thermocouple protection tubes illustrated on this catalog page are replacement tubes for Pyromation's complete ceramic protection tube thermocouple assemblies as found elsewhere in this catalog section, and they are compatible replacements for other manufacturers' protection tubes. The Series 16 mullite tubes are composed of 63% alumina, and have slightly more porosity than the Series 17 alumina tube composed of 99.7% alumina, which is considered to be more gas tight.

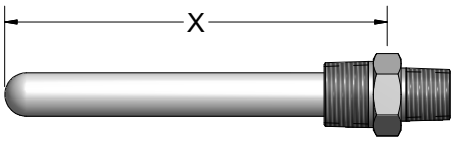
PIPE NIPPLE



BRASS FERRULE for OPEN STYLE HEAD or NT OPTION



HEX FITTING



ORDER CODES

Example Order Number: 1 **17A4** - 2 **18** - 3 **8**

1 Ceramic Protection Tube Materials - Sizes - Fittings

TUBE MATERIAL CODE		TUBE SIZE		FITTING DESCRIPTION	PROCESS THREAD (inches)	TERMINATION THREAD (inches)
MULLITE 1482 ºC [2700 ºF]	*ALUMINA 1871 ºC [3400 ºF]*	I.D. (inches)	O.D. (inches)			
16AH	17AH	1/4	3/8	Steel hex fitting	1/2 NPT	1/2 NPT
16A(E)	17A(E)	1/4	3/8	Steel pipe nipple (specify "E" length)	1/2 NPT	1/2 NPT
16AF	17AF	1/4	3/8	7/8" O.D. x 2" L brass ferrule for open head	None	7/8 x 27 UNS
16A	17A	1/4	3/8	Plain tube	None	None
16BH	17BH	7/16	11/16	Steel hex fitting	3/4 NPT	1/2 NPT
16B(E)	17B(E)	7/16	11/16	Steel pipe nipple (specify "E" length)	3/4 NPT	3/4 NPT
16BF	17BF	7/16	11/16	7/8" O.D. x 2" L brass ferrule for open head	None	7/8 x 27 UNS
16B	17B	7/16	11/16	Plain tube	None	None
16CH	17CH	1/2	3/4	Steel hex fitting	3/4 NPT	1/2 NPT
16C(E)	17C(E)	1/2	3/4	Steel pipe nipple (specify "E" length)	3/4 NPT	3/4 NPT
16C	17C	1/2	3/4	Plain tube	None	None
16WH	17WH	5/8	7/8	Steel hex fitting	1 NPT	3/4 NPT
16W(E)	17W(E)	5/8	7/8	Steel pipe nipple (specify "E" length)	1 NPT	1 NPT
16W	17W	5/8	7/8	Plain tube	None	None

3 Options

CODE	DESCRIPTION
8	316 SS nipple or hex tube fitting
NT	No process mounting threads on pipe nipples

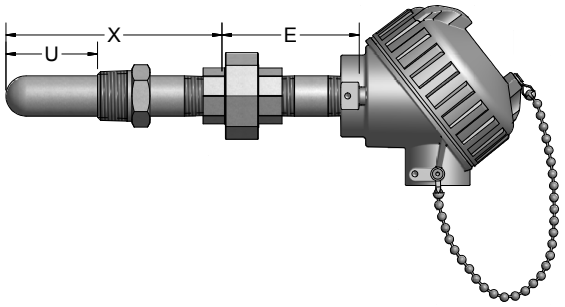
2 Tube "X" Length

LENGTH (inches)
12
18
24
30
36
Specify other lengths in 1" increments.

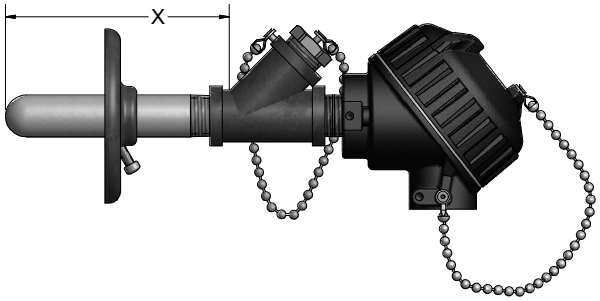
Configuration Code ID05
Thermocouples with Metal-Alloy Protection Tubes

The straight base metal thermocouple assemblies illustrated on this page are those most commonly used in industrial process heating applications. All listed assemblies are provided with schedule 40 protection tubes, and are available with listed options. Heavier pipe schedule protection tubes and special construction designs are also available. **Note: Welded bushings will be welded at maximum length possible when X and U dimensions are specified as the same length. Actual U dimension will be 1 to 2 inches shorter than specified depending on bushing size.**

ASSEMBLY with WELDED BUSHING



ASSEMBLY with OPTIONAL FLANGE



ORDER CODES

Example Order Number: **K8C - 7 - 50 - 24 - 6E20 - 34** (1 2 3 4 5 6)

1 Thermocouple Type and Wire Gauge Size

CODE		
J8C	K8C K11C	N8C
J14C	K14C	N14C
Thermocouples of 8 ga. wire require minimum of 1/2" NPT tube		
DUPLEX T/C ASSEMBLIES		
For duplex assemblies use the T/C type code letter twice. Example: K8C - 7 - 75 becomes KK8C - 7 - 75		

2 Protection Tube Material

3 NPT Thread Size

CODE	MATERIAL	CODE (inches) 1/4	1/2	3/4	1
6	*CARBON STEEL*	25	50	75	100
8	*316 SS*	25	50	75	100
5	*446 SS*		50	75	100
3	*ALLOY 600*		50	75	
7	*ALLOY 601*		50	75	100
41	*HR 160®*		50	75	100

4 Tube "X" Length

LENGTH (inches)	LENGTH (inches)
12	30
18	36
24	
Specify other lengths in 1" increments up to 240". Consult factory for lengths above 20'.	

Duplex 8, 11, and 14 ga. assemblies require a minimum 1/2" NPT protection tube size (size codes 50 and larger).

8 gauge duplex thermocouple elements supplied in 1/2" NPT protection tubes will be supplied with round insulators.

5 Optional Welded Bushings

CODE		DESCRIPTION
STEEL	*316SS*	**BUSHING SIZE (inches)**
6C(U)	8C(U)	1/2 NPT Bushing (25 tubes only)
6D(U)	8D(U)	3/4 NPT Bushing (25 and 50 tubes only)
6E(U)	8E(U)	1 NPT Bushing (25, 50 and 75 tubes only)
6F(U)	8F(U)	1(1/4) NPT Bushing
6G(U)	8G(U)	1(1/2) NPT Bushing
Substitute insertion length, in inches, measured from hot tip to bottom of bushing for (U) above. Insert NW in place of insertion length (U) for bushing supplied loose on tube.		
Optional Union and Nipple Head Connection		
STEEL	*316 SS*	Union-nipple supplied as material specified
6PU(E)[1]	8PU(E)[1]	
[1] Insert extension length, in inches, for (E) above.		

6 Head Terminations

CODE	DESCRIPTION
31	Aluminum screw-cover head
34	Cast-Iron screw-cover head
49	Flip-top aluminum head
91[1]	316L SS screw-cover head
93[1]	Aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved
94[1]	316L stainless steel explosion-proof/flame-proof head, NEC, IEC, Atex approved
[1] Not available with 1" NPT protection tubes.	

6-1 Assembly Options

CODE	DESCRIPTION
SB	1/2" NPT conduit reducer bushing
GS	Ground screw
H	Adjustable steel mounting flange
I	Stainless tag
6Y	Steel temperature check fitting
L	Insulated hot junction

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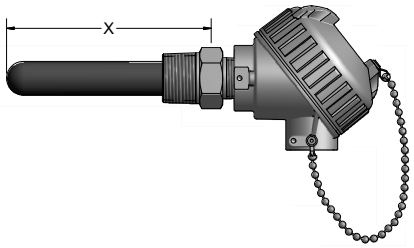
Configuration Code ID06

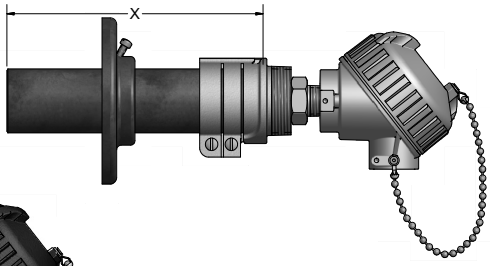
Thermocouples with Special-Service Composite Protection Tubes

The straight base-metal thermocouple assemblies illustrated on this page are typically used in high temperature and highly corrosive applications commonly found in waste incinerators, cement and lime kilns, utility and waste recovery boilers, and other severe process environments. Special construction designs are also available.

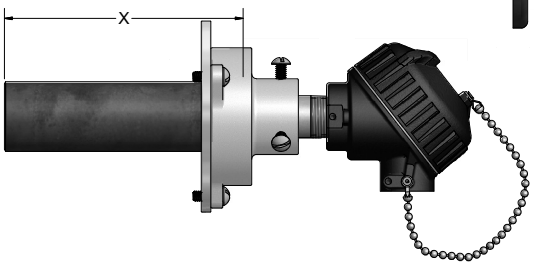
SERIES 12WH or 71WH ASSEMBLY with 1" STEEL HEX FITTING



SERIES 18J ASSEMBLY with OPTIONAL FLANGE



SERIES 18JC ASSEMBLY



ORDER CODES

Example Order Number: **K8C - 12WH - 36 - 34, I**

1 Thermocouple Type and Wire Gauge Size

CODE	DESCRIPTION
K8C	Type K 8 Gauge ceramic oval insulators
N8C	Type N 8 Gauge ceramic oval insulators
For duplex assemblies use the T/C type code letter twice. Round insulators will be supplied with 71 series tubes and duplex elements in 12 series tubes. Duplex elements are not available in series 71 tubes.	

3 Tube "X" Length

LENGTH (inches)	
12	36
18	42
24	48
30	

2 Protection Tube Material NPT Connection

CODE	I.D. (inches)	O.D. (inches)	FITTING DESCRIPTION	PROCESS THREADS (inches)	TERM THREADS (inches)
Metal Ceramic (LT-1) 1371 ºC [2500 ºF]					
12WH	5/8	7/8	Steel hex fitting	1	3/4
12W(E)	5/8	7/8	Steel pipe nipple (specify "E" length)	1	1
Silicate-Bonded Silicon Carbide 1649 ºC [3000 ºF]					
18J	1	1(3/4)	Plain tube	None	None
18JC	1	1(3/4)	Tube with 3" O.D. collar	None	None
Recrystalized Silicon Carbide (RSiC) 1600 ºC [2912 ºF]					
71WH	1/2	7/8	Steel hex fitting	1	3/4
71W(E)	1/2	7/8	Steel pipe nipple (specify "E" length)	1	1

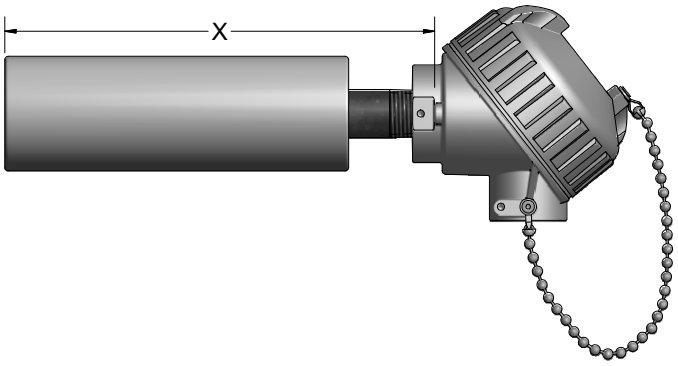
4 Head Terminations

CODE	DESCRIPTION
31	Aluminum screw-cover head
34	Cast-Iron screw-cover head
49	Flip-top aluminum head
91	316 stainless steel screw-cover head
Assembly	
SB	1/2" NPT conduit reducer bushing
GS	Internal ground screw
H	Adjustable mounting flange
HT	Threaded floor flange on nipple
SB	1/2" NPT conduit reducer bushing
I	Stainless tag
8	316 stainless steel nipple or hex fitting
NT	Supplied without threads

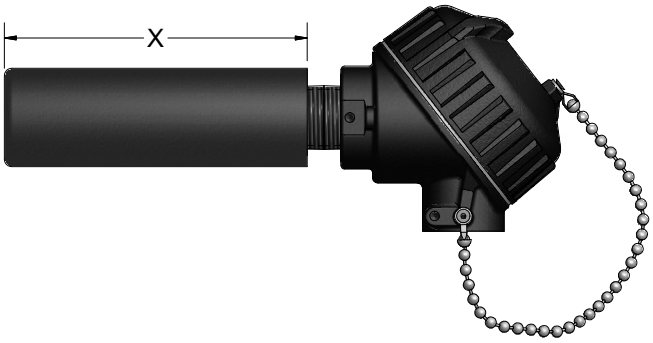
Configuration Code ID12
Thermocouple Assemblies with Protection Tubes for Molten Aluminum

The Series 11, 13 and 14 assemblies are used to protect thermocouple elements in molten aluminum and zinc applications such as diecasting, melting, smelting and high-temperature holding furnace environments. Series 13 and 14 assemblies should be preheated and slowly immersed into any molten materials.

SERIES 14 PROTECTION TUBE ASSEMBLIES



SERIES 11 PROTECTION TUBE ASSEMBLIES



ORDER CODES

Example Order Number:

1		2		3		4	4-1
K8C	-	13-75	-	24	-	31,	H

1 Thermocouple Type and Wire Gauge Size

CODE
K8C
DUPLEX T/C ASSEMBLIES
For duplex assemblies use the T/C type code letter twice. Example: K8C - 13 - 75 becomes KK8C - 13 - 75.
For additional types and sizes consult factory.

2 Protection Tube Material

CODE	FIGURE NUMBER
CAST-IRON	
11-75	3
VESUVIUS	
13-75	1
CERITE® II	
14-50[1]	5
[1] For protection tubes supplied with a 316SS pipe instead of a carbon steel pipe, change order number 14 to 148. EXAMPLE: K8C-148-50-24-31	

Protection Tube Dimensions

CODE	I.D. x O.D. (inches)
11	0.875 x 1.625
13	0.824 x 2.00
14	0.622 x 2.00

3 Tube "X" Length

LENGTH (inches)	LENGTH (inches)
12	36
18	42[1]
24	48[1]
30	
Consult factory for other lengths.	
[1] 42 & 48 not available in 14 Series tubes.	

4 Head Terminations

CODE	DESCRIPTION
31	Aluminum screw-cover head
34	Cast-Iron screw-cover head
49	Flip-top aluminum head
91	316L SS screw-cover head

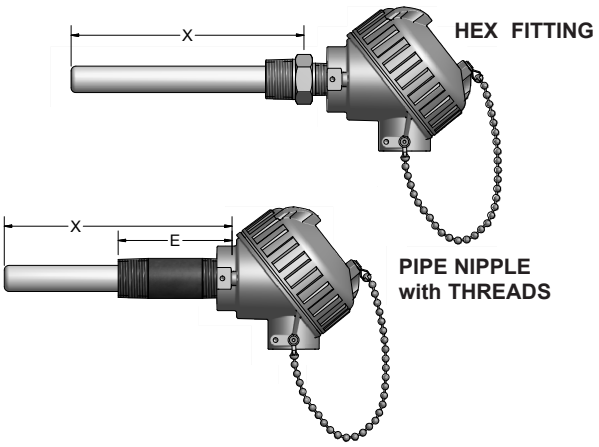
4-1 Assembly Options

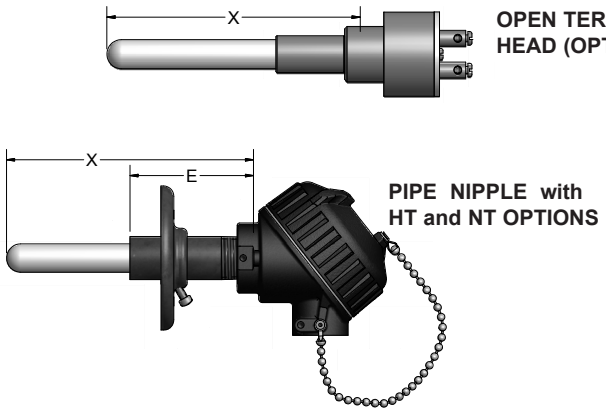
CODE	DESCRIPTION
SB	1/2" NPT conduit reducer bushign
GS	Ground screw
H	Adjustable steel mounting flange
I	Stainless tag
L	Insulated hot junction

Configuration Code ID13

Thermocouple Assemblies with Ceramic Protection Tubes

The straight noble- and base-metal thermocouple assemblies, with Series 16 mullite and Series 17 alumina protection tubes, illustrated on this catalog page are those most commonly used in high temperature process heating applications. These assemblies are available with a variety of process mounting fittings and assembly options as listed below. Special construction designs are also available.





ORDER CODES

Example Order Number: **R24R - 17BH - 18 - 31, 8**

1 Thermocouple Type and Wire Gauge Size

CODE		
B24R R24R R26R S24R S26R	K8R[1] N8R[1] ***[1] Use only with 16C or 16W series tubes***	K11C[2] N14C[2] ***[2] Use only with 16B or 16C series tubes***
8 ga. duplex elements only available in W series tubes. For duplex T/C's, use element type twice. Example: RR24R		

2 Protection Tube

TUBE MATERIAL AND SIZE				
CODE		TUBE O.D. (inches)	NPT SIZE (inches)	PROCESS MOUNTING FITTING
MULLITE 1482 ºC [2700 ºF]	*ALUMINA 1871 ºC [3400 ºF]*			
16AH[1]	17AH[1]	3/8	1/2	Steel hex fitting
16A(E)[1]	17A(E)[1]	3/8	1/2	Steel pipe nipple (Specify "E" length)
16AF	17AF	3/8	None	7/8" O.D. x 2" L open head fitting
16BH	17BH	11/16	3/4	Steel hex fitting
16B(E)	17B(E)	11/16	3/4	Steel pipe nipple (Specify "E" length)
16BF	17BF	11/16	None	7/8" O.D. x 2" L open head fitting
16CH		3/4	3/4	Steel hex fitting
16C(E)		3/4	3/4	Steel pipe nipple (Specify "E" length)
16WH		7/8	1	Steel hex fitting
[1] All assemblies with a 3/8" O.D. tube should be ordered with an aluminum termination head.				

4 Head Terminations

CODE	DESCRIPTION
31	Aluminum screw-cover head
34	Cast-Iron screw-cover head
49	Flip-top aluminum head
91	316L SS screw-cover head
N	Open terminal head - R, S, B only (require AF or BF protection tubes)

4-1 Assembly Options

CODE	DESCRIPTION
SB	1/2" NPT conduit reducer bushing
GS	Ground screw
NT	No process threads on pipe nipple
HT	Threaded floor flange on nipple
I	Stainless tag
8	316SS nipple or hex tube fitting
H	Adjustable steel mounting flange

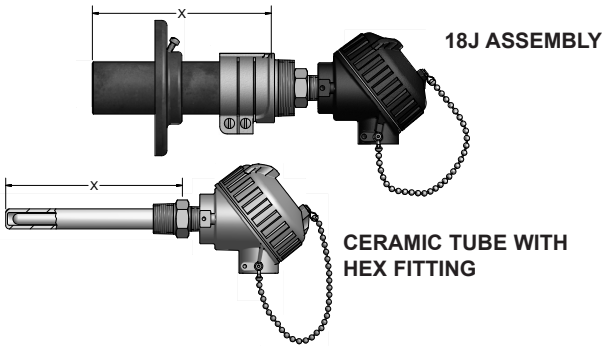
3 Tube "X" Length

LENGTH (inches)	LENGTH (inches)
12	30
18	36
24	
Specify other lengths in 1 inch increments.	

Configuration Code ID14

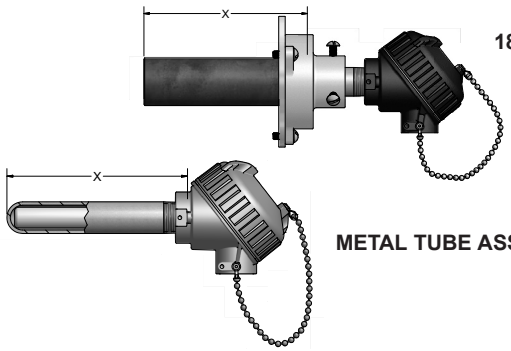
Thermocouple Assemblies with Double Protection Tubes

The noble-metal thermocouple assemblies illustrated on this page are provided with double protection tubes. Outer protection tube choices of ceramic, metal alloys, or composite materials offer protection from a variety of high temperature process environments. All assemblies are provided with a ceramic inner tube. The inner tubes are cemented to the outer tube and are not replaceable, except for 18J assemblies. These assemblies are available with a variety of process mounting fittings and assembly options as listed below. Special construction designs are also available. **Note: Welded bushings will be welded at maximum length possible when X and U dimensions are specified as the same length. Actual U dimension will be 1 to 2 inches shorter than specified depending on bushing size.**



18J ASSEMBLY

CERAMIC TUBE WITH HEX FITTING



18JC ASSEMBLY

METAL TUBE ASSEMBLY

ORDER CODES

Example Order Number: **S24R - 16BH-18J - 36 - 31, H**

1 Thermocouple Type and Wire Gauge Size

CODE				
B24R	R24R	S24R	R26R	S26R
For duplex T/C's, use element type twice. Example: RR24R				

2 Protection Tubes (Inner and Outer)

CODE	MATERIAL TYPE		SIZE	PROCESS MOUNTING FITTING	
	INNER	OUTER	O.D. (inches)	NPT. THREAD (inches)	FITTING TYPE
17A-17BH	Alumina	Alumina	11/16	3/4	Hex fitting
17A-17B(E)	Alumina	Alumina	11/16	3/4	Nipple (specify length)
17A-12WH	Alumina	LT-1	7/8	1	Hex fitting
17BH-18J	Alumina	Silicon Carbide	1(3/4)	None	None
17BH-18JC	Alumina	Silicon Carbide	1(3/4)	None	Support flange
16A-16BH	Mullite	Mullite	11/16	3/4	Hex fitting
16A-16B(E)	Mullite	Mullite	11/16	3/4	Nipple (specify length)
16A-12WH	Mullite	LT-1	7/8	1	Hex fitting
16BH-18J	Mullite	Silicon Carbide	1(3/4)	None	None
16BH-18JC	Mullite	Silicon Carbide	1(3/4)	None	Support flange
16B-41-75	Mullite	HR-160®	1.050	None	None
16B-7-75	Mullite	Alloy 601	1.050	None	None
17X-71BH	Alumina	RSiC	11/16	3/4	Hex fitting
17X-71B(E)	Alumina	RSiC	11/16	3/4	Nipple (specify length)
17A-71WH	Alumina	RSiC	7/8	1	Hex fitting
17A-71W(E)	Alumina	RSiC	7/8	1	Nipple (specify length)

4 Optional Welded Bushings (only on HR-160® and Alloy 601 Tubes)

CODE		DESCRIPTION
STEEL	*316 SS*	**BUSHING SIZE (inches)**
6E(U)	8E(U)	1 NPT Bushing
6F(U)	8F(U)	1 (1/4) NPT Bushing
6G(U)	8G(U)	1 (1/2) NPT Bushing
Substitute insertion length, in inches, measured from hot tip to bottom of bushing for (U) above. Insert NW in place of insertion length (U) for bushing supplied loose on tube.		

5 Head Terminations

CODE	DESCRIPTION
31	Aluminum screw-cover head
34	Cast-Iron screw-cover head
49	Flip-top aluminum head
91	316L SS screw-cover head

5-1 Assembly Options

CODE	DESCRIPTION
SB	1/2" NPT conduit reducer bushing
GS	Ground screw
NT	No mounting threads on pipe nipple
HT	Threaded floor flange on nipple
I	Stainless tag
8	316SS nipple or hex tube fitting
H	Adjustable steel mounting flange

3 Tube "X" Length

LENGTH (inches)	LENGTH (inches)
12	30
18	36
24	
Specify other lengths in 1" increments.	

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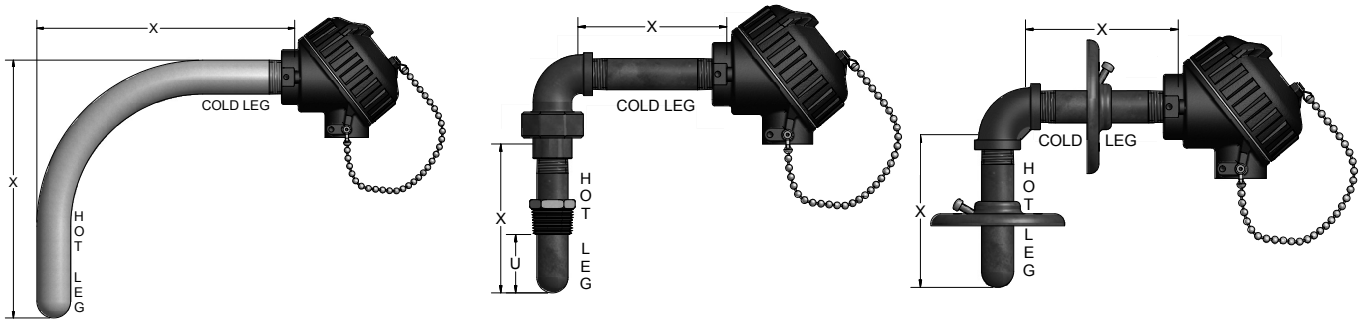
Configuration Code ID07

Angle Thermocouples with Metal-Alloy Protection Tubes

Angle thermocouple assemblies are most commonly used in general process applications requiring the use of "over-the-side" temperature sensors with metal-alloy protection tubes. Special construction designs are available. Assemblies may be shipped with the hot leg unattached for assembly at time of installation due to size limitations. Cold leg as standard is supplied as carbon steel.



ORDER CODES

Example Order Number: K8A - 8 -75 - 18 - 18 - 8E16 - 34, GS

(1) (2) (3) (4) (5) (6) (7) (7-1)

1 Thermocouple Type and Wire Gauge Size

CODE		
J8A	K8A K11A	N8A
J14A	K14A	N14A
For duplex assemblies use the T/C type code letter twice. Example: J8A - 7 - 75 becomes JJ8A - 7 - 75		

2 Hot Leg Protection Tube Material

3 Hot Leg NPT Thread Pipe Size

CODE	MATERIAL	CODE (inches)		
		1/2	3/4	1
6	*CARBON STEEL*	50	75	100
8	*316 SS*	50	75	100
5	*446 SS*	50	75	100
3	*ALLOY 600*	50	75	N/A
7	*ALLOY 601*	50	75	100

4 Hot Leg "X" Length

LENGTH (inches)	LENGTH (inches)
12	30
18	36
24	
Specify other lengths in 1" increments.	

5 Cold Leg "X" Length

LENGTH (inches)	LENGTH (inches)
12	30
18	36
24	
Specify other lengths in 1" increments.	

Continuous Bend Radius

1/2" NPT = 4(5/8)"
3/4" NPT = 4(5/8)"
1" NPT = 5(7/8)"

6 Optional Welded Bushings

CODE		DESCRIPTION
STEEL	*316SS*	**BUSHING SIZE (inches)**
6D(U)	8D(U)	3/4 NPT Bushing (50 tubes only)
6E(U)	8E(U)	1 NPT Bushing (50 and 75 tubes only)
6F(U)	8F(U)	1(1/4) NPT Bushing
6G(U)	8G(U)	1(1/2) NPT Bushing
Substitute insertion length, in inches, measured from hot tip to bottom of bushing for (U) above. Insert NW in place of insertion length (U) for bushing supplied loose on tube.		

7 Head Terminations

CODE	DESCRIPTION
31	Aluminum screw-cover head
34	Cast-Iron screw-cover head
49	Flip-top aluminum head

7-1 Assembly Options

CODE	DESCRIPTION
SB	1/2" NPT conduit reducer bushing
GS	Ground screw
H	Adjustable steel mounting flange
HC	Adjustable steel flange (cold leg)
L	Insulated hot junction
I	Stainless tag
UL	Steel union elbow
CB[1]	Continuous bend-angle assembly
[1] Requires 12" minimum on Hot Leg and Cold Leg	

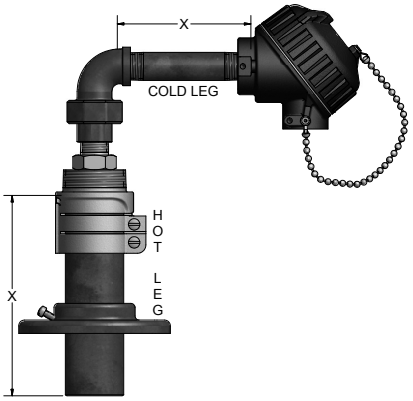
Standard Assembly Specifications

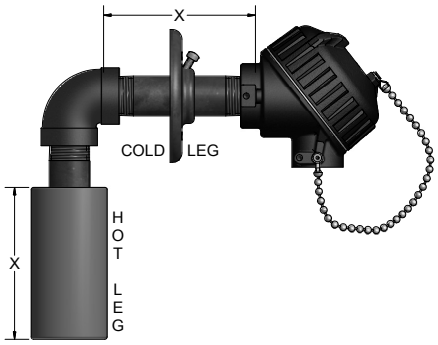
ELEMENT	HOT LEG TUBE CODE AVAIL.	COLD LEG SUPPLIED
SINGLE		3/4" NPT on HL tube codes 50, 75. 1" NPT on HL tube codes 100. 1" NPT on duplex 8 and 11 gauge assemblies.
8, 11, 14 GA.	50, 75, 100	
DUPLEX		
8, 11 GA.	75, 100	
14 GA.	50, 75, 100	

Configuration Code ID08

Angle Thermocouples with Special-Service Protection Tubes

Angle thermocouple assemblies are those commonly used in industrial process heating applications requiring the use of "over-the-side" temperature sensors with special metal alloy, composite material, or silicon carbide protection tubes. Special construction designs are available. Assemblies may be shipped with the hot leg unattached for assembly at time of installation due to size limitations. Cold leg as standard is supplied as carbon steel.





ORDER CODES

Example Order Number:

1		2		3		4		5	5-1
K8A	-	14-50	-	18	-	18	-	49,	L

1 Thermocouple Type and Wire Gauge Size

CODE	
K8A K11A K14A	N8A N14A
For duplex assemblies use the T/C type code letter twice. Example: K14A - 12 - 75 becomes KK14A - 12 - 75.	

2 Protection Tube Material NPT Connection

CODE	HOT LEG PROT. TUBE	TUBE O.D. or NPT SIZE (inches)
11 - 75	Cast-Iron	1.625
12WH	Metal Ceramic	0.875
13 - 75	Vesuvius	2.000
18J	Silicone Carbide	1.750
14 - 50[1]	Cerite® II	1/2 NPT
[1] For protection tubes with 316SS pipe instead of a carbon steel pipe, change order number to 148. Example: K8A-148-50-24-K.		

3 Hot Leg "X" Length

LENGTH (inches)	LENGTH (inches)
12	30
18	36
24	

4 Cold Leg "X" Length

LENGTH (inches)	LENGTH (inches)
12	30
18	36
24	
Specify other lengths in 1" increments.	
Code 14 Cerite® II actual length is one inch shorter than above.	

5 Head Terminations

CODE	DESCRIPTION
31	Aluminum screw-cover head
34	Cast-Iron screw-cover head
49	Flip-top aluminum head
91	316L SS screw-cover head

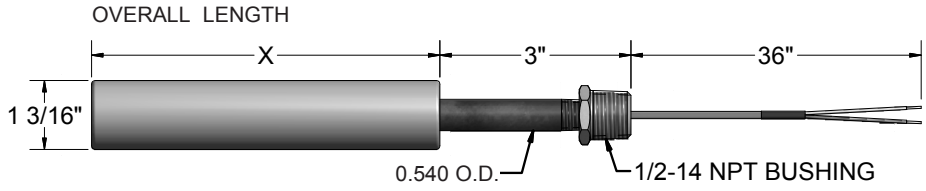
5-1 Assembly Options

CODE	DESCRIPTION
SB	1/2 NPT conduit reducer bushing
GS	Ground screw
H	Adjustable steel mounting flange
HC	Adjustable steel flange (cold leg)
L	Insulated hot junction
UL	Steel union elbow
I	Stainless tag

Configuration Code ID09

Cerite® - III Thermocouples for Molten Aluminum

Cerite® III thermocouples are provided with a protection tube, integral thermocouple element with 36" of high temperature 704 ºC [1300 °F] fiberglass leads, and a 1/2" NPT steel male face bushing for use in mounting. They are constructed by casting a phosphate bonded refractory material containing 85% alumina, 4% silica, and other trace elements around a 1/4" NPT steel pipe, containing an integral stainless steel sheathed magnesium oxide (MgO) insulated thermocouple element. The cast refractory material was developed for use in molten non-ferrous metals, specifically molten aluminum and zinc. It has excellent non-wetting properties, allowing easy slag removal, and the small diameter provides fast thermal response to process temperature changes. These assemblies provide good resistance to thermal shock and mechanical breakage. The refractory material is rated at 1538 ºC [2800 ºF] however, its use as a Cerite® III thermocouple assembly is generally limited to 815 °C [1500 °F] maximum. ***Protection tube pre-heating and slow immersion into the process is recommended.***



ORDER CODES

Example Order Number: **K39G - 15 - 25 - 24 - 36 - 4**

1 Cerite® Thermcouple Specifications

CODE *SINGLE*	T/C TYPE	"X" DIMENSION IMMERSION LENGTH (inches)	OVERALL LENGTH (inches)	LEAD LENGTH (inches)	APPROX. WGHT. (lbs.)
K39G-15-25-12-36	K	12	15	36	1.75
K39G-15-25-18-36	K	18	21	36	2.50
K39G-15-25-24-36	K	24	27	36	3.25
K39G-15-25-30-36	K	30	33	36	4.00
K39G-15-25-36-36	K	36	39	36	4.75

2 Terminations

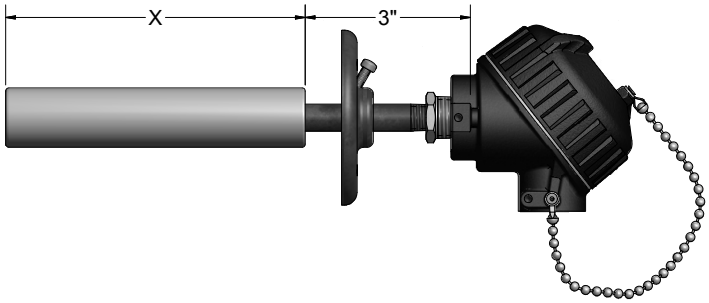
CODE	DESCRIPTION
0	No lead termination
2	2" split leads with 1/4" stripped leads
4	Standard plug
Options	
MC	Mating connector

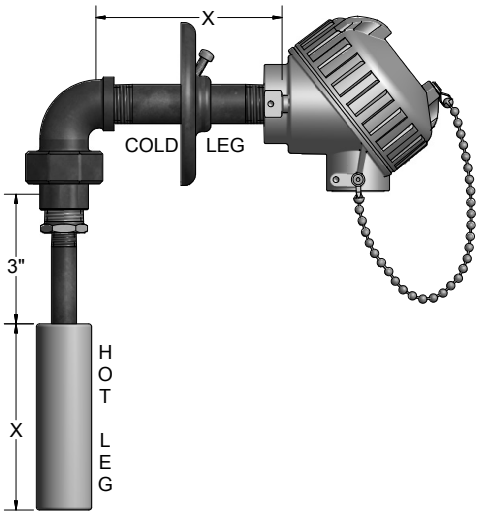
For duplex assemblies use thermocouple letter twice. **Example: KK39U - 15 - 25 - 24 - 36 - 0**
For assemblies with ungrounded junctions, substitute U for G in order code number. **Example: K39U - 15 - 25 - 24 - 36 - 0**
For additional lead length, change the last 2 digits of the order code number to desired length. **Example: K39G - 15 - 25 - 24 - 48 - 0**
For assemblies supplied with optional 316SS pipe insert, change order code number 15 to 158. **Example: K39G - 158 - 25 - 24 - 36 - 0**

Configuration Code ID09

Cerite® III Thermocouple Assemblies for Molten Aluminum

Cerite® III thermocouple assemblies are complete thermocouple and protection tube assemblies. These Cerite® III assemblies are constructed by casting a phosphate bonded refractory material containing 85% alumina, 4% silica, and other trace elements around a 1/4" NPT steel pipe containing an integral stainless steel sheathed magnesium oxide (MgO) insulated thermocouple element. The cast refractory material was developed for use in molten non-ferrous metals, specifically molten aluminum and zinc. It has excellent non-wetting properties allowing easy slag removal, and the small diameter provides fast thermal response to process temperature changes. These assemblies also provide good resistance to thermal shock and mechanical breakage. The refractory material is rated at 1538 ºC [2800 ºF] however its use as a Cerite®III thermocouple assembly is generally limited to 815 ºC [1500 ºF] maximum. Cold leg as standard is supplied as carbon steel. ***Protection tube pre-heating and slow immersion into the process is recommended.***





ORDER CODES

Example Order Number:

1	2	3	4	4.1	
K39GS-15-25	**24**	**—**	**34,**	**H**	***Straight Assembly, Single***
K39GA-15-25	**24**	**24**	**49,**	**HC**	***Angle Assembly, Single***

1 Thermocouple Type and Assembly Style

CODE	STYLE	CODE	STYLE
SINGLE ELEMENT		***DUPLEX ELEMENT***	
K39GS-15-25	Straight	KK39GS-15-25	Straight
K39GA-15-25	Angle	KK39GA-15-25	Angle
For ungrounded hot junctions change above letter code "G" to letter code "U". Example: K39US			
For assemblies supplied with optional 316SS pipe insert, change order code number 15 to 158. Example: K39G-158-25-24-36-34			

2 Straight or Angle Hot Leg Length

"X" LENGTH (inches)	"X" LENGTH (inches)
12	30
18	36
24	

4 Head Terminations

CODE	DESCRIPTION
31	Aluminum screw-cover head
34	Cast-Iron screw-cover head
49	Flip-top aluminum head

4-1 Assembly Options

CODE	DESCRIPTION
SB	1/2" NPT conduit reducer bushing
GS	Ground screw
H	Adjustable steel mounting flange
HC	Adjustable steel flange (cold leg)
I	Stainless tags

3 Angle Assembly Cold Leg Length

"X" LENGTH (inches)	"X" LENGTH (inches)
12	30
18	36
24	

The preceeding catalog pages have provided order code numbers for thermocouple elements, protection tubes, and the most commonly used industrial thermocouple assemblies. Non-standard assemblies can be designated by selecting the proper thermocouple element(s) and protection tube(s) from the appropriate pages in this catalog section. Component part order code numbers selected from those pages, and assembled as described below, with desired options from below, will provide the part number for a complete industrial thermocouple assembly. Special construction designs, using non-cataloged components, are also available. Consult factory for details.

ORDER CODES

Example Order Number:

1		2		3		4			
K8C	-	7-75	-	18	-	6E16	-	34	*Straight Assembly*
K8A	-	7-75	-	18-24	-	31, H			*Angle Assembly*
R24R	-	17A-17BH	-	24	-	49			*Double Tube Assembly*
K8E	-	18J	-	18-12	-	34			*Pipe Extended Assembly*

1 Thermocouple Element

Insert **order code** for thermocouple type, wire gauge size, and insulator type from the appropriate thermocouple element pages located in this catalog section.

2 Protection Tube

Insert **order code** for tube material and size from the appropriate protection tube pages located in this catalog section.

Double protection tube assemblies require selection of 2 tubes. **Example: 17A - 17BH**

3 Protection Tube Length

STRAIGHT ASSEMBLIES: Insert the desired protection tube "X" length in inches.

ANGLE ASSEMBLIES: Requires specifying **hot** and **cold** leg length in inches.

PIPE EXTENDED ASSEMBLIES: (Supplied with steel coupling and pipe extension beyond protection tube) Insert letter code "E" after wire gauge and specify extension length in inches.

4 Optional Welding Bushings (Applies to Metal-Alloy Tubes only)

CODE		DESCRIPTION
STEEL	*316SS*	**BUSHING SIZE (inches)**
6C(U)	8C(U)	1/2 NPT bushing (25 tubes)
6D(U)	8D(U)	3/4 NPT bushing (25 and 50 tubes)
6E(U)	8E(U)	1 NPT bushing (25, 50, 75 tubes)
6F(U)	8F(U)	1(1/4) NPT bushing (50, 75, 100 tubes)
6G(U)		1(1/2) NPT bushing (50, 75, 100 tubes)
Substitute insertion length, in inches, measured from hot tip to bottom of bushing for (U) above. Insert NW in place of insertion length (U) for bushing supplied loose on tube.		

Optional Union and Nipple Connections

CODE		DESCRIPTION
STEEL	*316SS*	Both union and nipple supplied as material specified
6PU(E)	8PU(E)	
Insert extension length, in inches, for (E)		

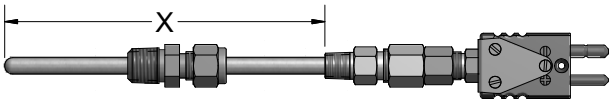
Head Terminations		Assembly Options	
CODE	**DESCRIPTION**	**CODE**	**DESCRIPTION**
31	Aluminum screw-cover head	A	Open-end protection tube
34	Cast-Iron screw-cover head	CB	Continuous-bend angle assembly
49	Flip-top aluminum head	GS	Ground screw
91[1]	316L SS screw-cover head	6Y	Steel temperature check fitting
93[1]	Aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved	H	Adjustable steel mounting flange
94[1]	316L stainless steel explosion-proof/flame-proof head, NEC, IEC, Atex approved	HC	Adjustable steel flange (cold leg)
N	Open type terminal head (B,R,S) with 16AF, 16BF, 17AF, 17BF tubes only	HT	Threaded floor flange on nipple
[1] Not Available with 1" NPT protection tubes		I	Stainless tags
		L	Insulated hot junction or recessed junction
		NT	Supplied without threads
		UL	Steel union elbows
		SB	1/2" NPT Conduit Reducer Bushing

Configuration Code ID10

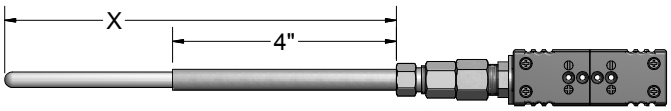
High-Temperature Thermocouple Assemblies

Pyromation's high-temperature thermocouples are designed to operate in a temperature range of (982 to 1871) ºC [1800 to 3400] ºF. They are designed for use in vacuum furnaces and other applications requiring high-temperature measurement in controlled atmospheric conditions. Metal sheaths of Alloy 600 and molybdenum are available as well as alumina ceramic sheaths. All assemblies are supplied with ungrounded, isolated hot junctions. The construction style consists of an alumina-insulated element inside the tube of choice as listed below. Special construction designs are also available.

METAL-SHEATHED ASSEMBLY



ALUMINA-SHEATHED ASSEMBLY



ORDER CODES

Example Order Number:

1		2		3		4		5		6		7
R24U	-	403	-	24	-	05A	-	TBL. 5	-	TBL. 6	-	TBL. 7

Select from following page

1 Single Elements

TYPE AND WIRE GAUGE CODE	
ALLOY 600	
B24U C24U R24U S24U	 R26U S26U
B24U C24U R24U S24U	 R26U S26U
MOLYBDENUM	
B24U C24U R24U S24U	 R26U S26U
B24U C24U R24U S24U	 R26U S26U
ALUMINA	
B24U C24U R24U S24U	 R26U S26U
For duplex elements use order code pre-fix letter twice. Example: RR24U	
CC24 assemblies not available in 0.188" O.D. sheath diameter.	

2 Sheath Size and Material

CODE	SHEATH DIA. (inches)	MAX. TEMP.	ATMOSPHERE
ALLOY 600			
303 303 303 303	0.188 0.188 0.188 0.188	1149 ºC [2100 ºF]	Oxidizing, Inert or Vacuum
403 403 403 403	0.250 0.250 0.250 0.250	1149 ºC [2100 ºF]	
MOLYBDENUM			
302 302 302 302	0.188 0.188 0.188 0.188	1704 ºC [3100 ºF] 1871 ºC [3400 ºF] 1482 ºC [2700 ºF] 1482 ºC [2700 ºF]	Inert or Vacuum
402 402 402 402	0.250 0.250 0.250 0.250	1704 ºC [3100 ºF] 1871 ºC [3400 ºF] 1482 ºC [2700 ºF] 1482 ºC [2700 ºF]	
ALUMINA			
617 617 617 617	0.275[1] 0.275[1] 0.275[1] 0.275[1]	1704 ºC [3100 ºF] 1871 ºC [3400 ºF] 1482 ºC [2700 ºF] 1482 ºC [2700 ºF]	Oxidizing, Inert or Vacuum
[1] Sheath supplied with 3/8" O.D. x 4" long stainless steel sleeve on tube cold end. Only available with size B and C compression fittings.			
Consult factory for availability of other diameters or insulations.			

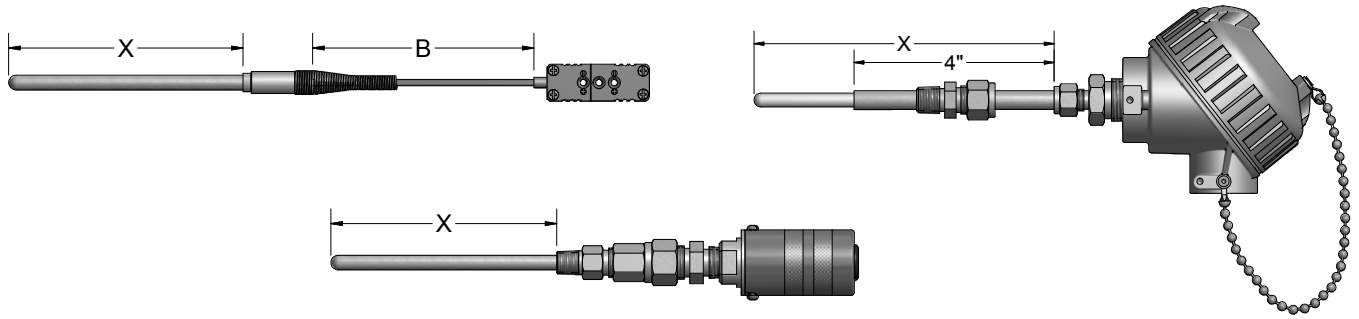
4 Sheath Mounting Fittings

CODE	TYPE	NPT SIZE (inches)	AVAILABLE SHEATH DIA. (inches)
00	No sheath mounting fitting		
One-Time Adjustable Compression Fittings			
05A	Stainless steel	1/8	3/16, 1/4
05B	Stainless steel	1/4	3/16, 1/4, 3/8
05C	Stainless steel	1/2	1/4, 3/8
Re-Adjustable Compression Fittings			
12A	Stainless steel	1/8	3/16, 1/4
12B	Stainless steel	1/4	1/4, 3/8
12C	Stainless steel	1/2	1/4, 3/8
FEP gland standard (400 °F max.)			

3 Sheath "X" Length

LENGTH (inches)	LENGTH (inches)
12	30
18	36
24	
Specify other lengths in 1" increments.	

All assemblies are provided with wire seal fitting except platinum element assemblies in Alloy protection tubes.
All C24 assemblies in alumina protection tubes can only be used in inert or vacuum atmospheres.



ORDER CODES

Example Order Number: **R24U - 403 - 24 - 05A - 15 - F1A036 - 4**

(1) (2) (3) (4) (5) (6) (7)

Select from preceeding pages

5 Plug and Jack Terminations

CODE	DESCRIPTION	SHEATH O.D. (inches)
4	Standard plug	3/16 thru 3/8
4,HT	Standard hi-temp plug 385 ºC [725 °F]	3/16 thru 3/8
MC	Mating connector	

Head Terminations

CODE	DESCRIPTION
9CF31	Aluminum screw-cover head secured to sheath with SS compression fitting
8HN31[1]	Aluminum screw-cover head with 1/2" NPT stainless steel hex fitting
9CF25	Mini nickel-plated steel head

Leadwire Transitions (requires leadwire selections)

CODE	DESCRIPTION
15[1]	Extension leadwire transition fitting with relief spring 204 ºC [400 °F]
15HT[1]	Extension leadwire transition fitting with relief spring and High temperature potting 538 ºC [1000 °F]

7 Terminations

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4", stripped
3	2" split leads with spade lugs
4[1]	Standard plug
6[1]	Miniature plug

Options

CODE	DESCRIPTION
MC[1]	Mating connector

6 Extension Leadwire

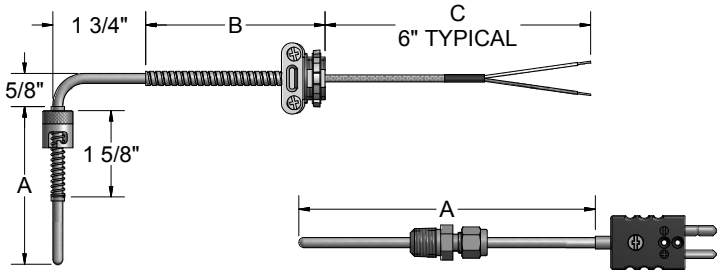
CODE	WIRE GAUGE INSULATION DESCRIPTION	T/C AVAILABLE
F1	Solid; fiberglass insulation	R,S,B
F1A	Solid; fiberglass insulation with flexible S.S. armor	R,S,B
T1	Solid; fluoropolymer insulation	R,S
T1A	Solid; fluoropolymer insulation with flexible S.S. armor	R,S
To complete order code, insert wire code and 3 digit "B" length code. Example: F1A036=36" "B" length		

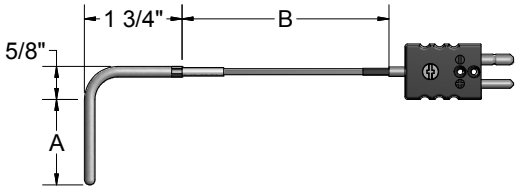
[1] Only with platinum elements in 303-403 sheaths.

Configuration Code PL01

General-Purpose Tube and Wire Thermocouples

The thermocouples described below are commonly used in the plastic process industry. These assemblies can be used in many general applications where a 1/8" NPT fitting is preferred by utilizing either a compression fitting or a bayonet adapter. These sensors are constructed using a 316 stainless steel sheath and insulated thermocouple wire.





ORDER CODES

Example Order Number:

1-1	1-2	1-3		2		3		4		5	
JP3	3	U	-	04	-	13A	-	F1A012	-	2,	BX

1-1 Thermocouple Type

CODE		SHEATH O.D. (inches)
SINGLE	*DUPLEX*	
JP2		1/8
JP3	JJP3	3/16
JP4	JJP4	1/4
Other Element Types		
For type E, K or T thermocouples, replace J in order code with required letter designation.		

1-2 Bend Angle

CODE	DESCRIPTION
1	Straight
2	45 degree bend
3	90 degree bend

1-3 Junction

Grounded junctions supplied as standard. Insert "U" only when requiring an ungrounded junction.

2 "A" Dimension

Insert 2 digit "A" length in inches (1" min).
EX: 04 = 4 inch "A" dimension.

3 Sheath Fittings

CODE	DESCRIPTION	NOMINAL LENGTH (inches)
00	No fitting	
13A[1]	7/16" I.D. single slot spring-loaded bayonet fitting	1 5/8
15A	1/8" NPT brass one time adjustable comp. fitting	1 1/8
01A	1/8" NPT SS one time adjustable comp. fitting	1 1/4
16A	Comp. fitting with bayonet cap and spring - 1/8" O.D. sheaths only (2 5/8" min. 'A' dimension)	2 3/8
[1] 13A are not available with 1/4" O.D. sheaths		

4 Extension Leadwire Type and "B"+"C" Dimension

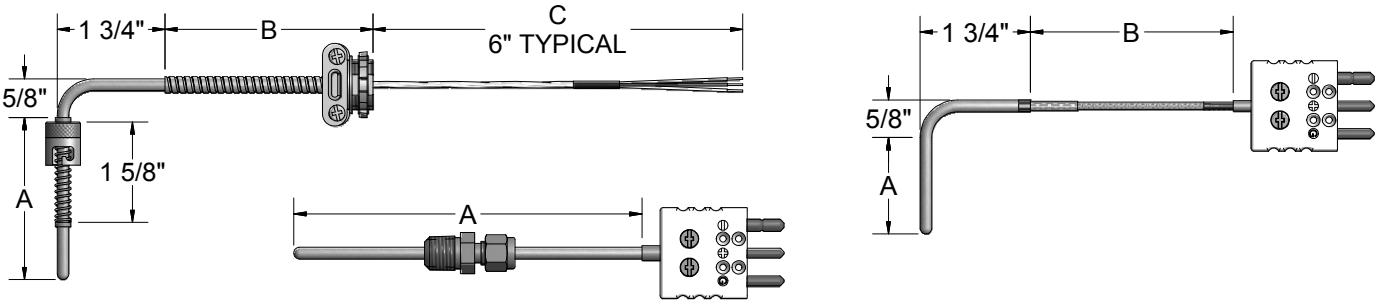
CODE[1]	DESCRIPTION
000	No leadwire, connector attached to sheath
F1 _ _ _	Fiberglass insulation - solid conductor
F1A _ _ _	Fiberglass insulation - solid conductor - flexible armor
F1B _ _ _	Fiberglass insulation - solid conductor - stainless steel overbraid
F3 _ _ _	Fiberglass insulation - stranded conductor
F3A _ _ _	Fiberglass insulation - stranded conductor - flexible armor
F3B _ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid
T1 _ _ _	Fluoropolymer insulation - solid conductor
T1A _ _ _	Fluoropolymer insulation - solid conductor - flexible armor
T3 _ _ _	Fluoropolymer insulation - stranded conductor
T3A _ _ _	Fluoropolymer insulation - stranded conductor - flexible armor
[1] Insert 3 digit "B" length in inches. EX: F1036=36" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B " length with additional 12" leads beyond armor.	

5 Terminations and Options

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnect lugs
	Options
MC	Mating connector
CC	Cable clamp
BX	Box connector

Configuration Code PL02
General-Purpose Plastic Industry RTDs

The RTDs described below are those most commonly used in the plastic process industry. These assemblies can be used in many general applications where a 1/8" NPT fitting is preferred by utilizing either a compression fitting or a bayonet adapter. These assemblies are supplied standard using 316 stainless steel sheath material and a 100 Ω platinum element with a temperature coefficient of 0.003 85 $ºC^{-1}$ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number:

1-1	1-2	1-3		2		3		4		5	
RBF1853P	3	3	-	06	-	13A	-	F3B012	-	2,	BX

1-1 RTD Element

CODE		ELEMENT CONNECTION
SINGLE	*DUPLEX [1]*	
RBF1853P	RBF2853P	3-wire
RBF1852P	RBF2852P	2-wire
[1] Duplex: no 1/8" O.D.; 3/16" O.D. limited to polyimide or fluoropolymer leadwire.		

1-2 Sheath Diameter

CODE	DESCRIPTION (inches)
2[1]	1/8
3	3/16
4	1/4
[1] Only available with polyimide or fluoropolymer leads.	

1-3 Bend Angle

CODE	DESCRIPTION
1	Straight
2	45 degree bend
3	90 degree bend

2 "A" Dimension

Insert 2 digit "A" length in inches (1" min). EX: 06 = 6 inch "A" dimension.

3 Sheath Fittings

CODE	DESCRIPTION	NOMINAL LENGTH (inches)
00	No fitting	
13A[1]	7/16" I.D. single slot spring loaded bayonet ftg	1 5/8
15A	1/8" NPT brass one time adjustable comp. ftg	1 1/8
01A	1/8" NPT SS one time adjustable comp. fitting	1 1/4
16A	Comp. fitting with bayonet cap and spring - 1/8" O.D. sheaths only (2 5/8" min. 'A' dimension)	2 3/8
[1] 13A are not available with 1/4" O.D. sheaths		

4 Extension Leadwire Type and "B"+"C" Dimension

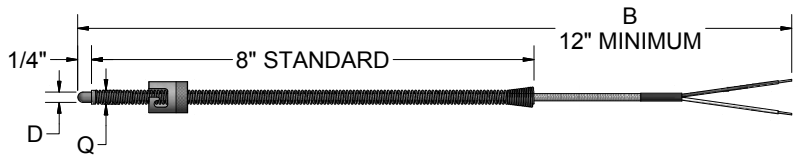
CODE[1]	DESCRIPTION
000	No leadwire, connector attached to sheath
F3 _ _ _	Fiberglass insulation - stranded conductor
F3A _ _ _	Fiberglass insulation - stranded conductor - flexible armor
F3B _ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid
F3J _ _ _	Fiberglass insulation - individual leads - stranded conductor (12" limit)
T3 _ _ _	Fluoropolymer insulation - stranded conductor
T3A _ _ _	Fluoropolymer insulation - stranded conductor - flexible armor
K3 _ _ _	Polyimide insulation - stranded conductor
K3A _ _ _	Polyimide insulation - stranded conductor - flexible armor
K3B _ _ _	Polyimide insulation - stranded conductor - stainless steel overbraid
[1] Insert 3 digit "B" length in inches. EX: F1036=36" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" leads beyond armor.	

5 Terminations and Options

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnect lugs
Options	
MC	Mating connector
CC	Cable clamp
BX	Box connector

Configuration Code PL03
Spring-Adjustable Immersion Thermocouples

The JB series spring-adjustable immersion thermocouple has a bayonet cap on an 8" spring (standard) to allow for immersion depths of 1/2" to 7". This assembly is used in a variety of applications (with a bayonet adapter) where ease of installation and quick disconnect is preferred. Standard and metric size bayonet caps and adapters are available.



ORDER CODES

Example Order Number:

1-1	1-2	1-3	1-4		2		3
JB	A	3	U	-	F3B024	-	2, LS

1-1 Thermocouple Type

CODE		TYPE
SINGLE	*DUPLEX[1]*	
JB	JJB	J
Other Element Types		
For type K or T thermocouples, replace J in order code with required letter designation. [1] Duplex not available with 1/8" O.D. tip.		

1-2 Bayonet Cap Style

CODE	DESCRIPTION
A	7/16" I.D. single slot (standard) (not available with Opt. 4 tip)
B	12 mm I.D. dual slot
C	12 mm O.D. dual pin
E	15 mm I.D. dual slot

1-3 Tip and Spring Diameters

CODE	TIP O.D. 'D' DIM. (inches)	SPRING O.D. 'Q' DIM. (inches)
2	0.125	0.203
3	0.188	0.263
4	0.250	0.324

1-4 Junction

Grounded junctions supplied as standard. Insert "U" only when requiring an ungrounded junction.

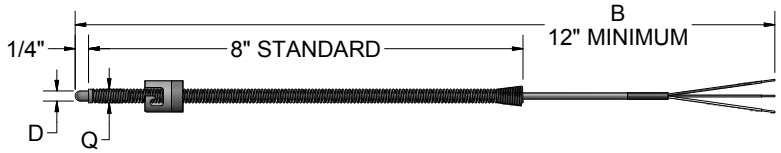
3 Terminations and Options

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnects
Options	
MC	Mating connector
CC	Cable clamp
BX	Box connector
LS	12" long spring (3/16" O.D. only)

2 Extension Leadwire "B"

CODE[1]	DESCRIPTION
F3B_ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid
[1] Insert 3 digit "B" length in inches. EX: F3B024=24" "B" length.	

This RTD spring-adjustable immersion sensor has a bayonet cap on an 8" spring (standard) to allow for immersion depths of 1/2" to 7". This assembly is used in a variety of applications (with a bayonet adapter) where ease of installation and quick disconnect is preferred. Standard and metric size bayonet caps and adapters are available. These assemblies are supplied standard using 316 stainless steel sheath material and a 100 Ω platinum element with a temperature coefficient of 0.003 85 $ºC^{-1}$ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number:

1-1	1-2	1-3		2		3
RBF1853B	A	3	-	F3B024	-	2

1-1 RTD Element Type

CODE		ELEMENT CONNECTION
SINGLE	***DUPLEX[1]***	
RBF1853B	RBF2853B	3-wire
RBF1852B	RBF2852B	2-wire
[1] Duplex assemblies available, with polyimide wire only.		

1-2 Bayonet Cap Style

CODE	DESCRIPTION
A	7/16" I.D. single slot (standard) (not available with Opt. 4 tip)
B	12 mm I.D. dual slot
C	12 mm O.D. dual pin
E	15 mm ID dual slot

1-3 Tip and Spring Diameters

CODE	TIP O.D. "D" DIM. (inches)	SPRING O.D. "Q" DIM. (inches)
3	0.188	0.263
4	0.250	0.324

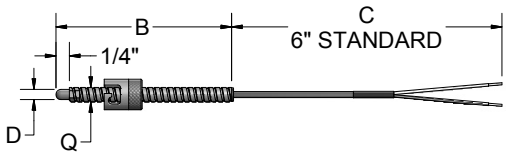
2 Extension Length "B"

CODE[1]	DESCRIPTION
F3B_ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid
K3B _ _ _	Polyimide insulation - stranded conductor - stainless steel overbraid
[1] Insert 3 digit "B" length in inches. EX: F3B024=24" "B" length.	

3 Terminations and Options

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnects
Options	
MC	Mating connector
CC	Cable clamp
BX	Box connector
LS	12" long spring (3/16" O.D. only)

The JA series armor-adjustable immersion thermocouple has a bayonet cap on the flexible armor and allows for immersion for the entire specified 'B' dimension. This assembly is used in a variety of applications (with a bayonet adapter) where ease of installation and quick disconnect is preferred. Standard and metric size bayonet caps and adapters are available.



ORDER CODES

Example Order Number:

1-1	1-2	1-3	1-4		2		3	
JA	A	3	U	-	F3A024	-	2,	BX

1-1 Thermocouple Type

CODE		TYPE
SINGLE	*DUPLEX*	
JA	JJA	J
KA	KKA	K
Other Element Types		
For type E and T thermocouples, replace J in order code with required letter designation.		

1-2 Bayonet Cap Style

CODE	DESCRIPTION
A	7/16" I.D. single slot (standard)
B	12 mm I.D. dual slot
C	12 mm O.D. dual pin
D	Positive seat indicating
E	15 mm I.D. dual slot

1-3 Tip and Flex Armor Diameters

CODE	TIP O.D. "D"DIM. (inches)	FLEX O.D. "Q" DIM. (inches)
2	0.125	0.210
3	0.188	0.275

1-4 Junction

Grounded junctions supplied as standard. Insert "U" only when requiring an ungrounded junction.

3 Terminations and Options

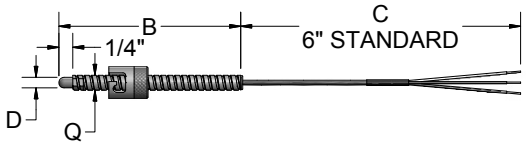
CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnects
Options	
MC	Mating connector
CC	Cable clamp
BX	Box connector

2 Extension Leadwire "B" + "C"

CODE[1]	DESCRIPTION
F1A_ _ _	Fiberglass insulation - solid conductor - flexible armor
F3A_ _ _	Fiberglass insulation - stranded conductor - flexible armor

[1] Insert 3 digit "B" length in inches. EX: F1036=36" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" leads beyond armor.

The RTD version of an armor-adjustable immersion sensor has a bayonet cap on the flexible armor and allows for immersion of the entire specified "B" dimension. This assembly is used in a variety of applications (with a bayonet adapter) where ease of installation and quick disconnect is preferred. Standard and metric size bayonet caps and adapters are available. These assemblies are supplied standard using 316 stainless steel sheath material and a 100 Ω platinum element with a temperature coefficient of 0.003 85 $ºC^{-1}$ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number:

1-1	1-2	1-3		2		3
RBF1853A	A	3	-	F3A012	-	3

1-1 RTD Element Type

CODE		ELEMENT CONNECTION
SINGLE	***DUPLEX[1]***	
RBF1852A	RBF2852A	2 wire
RBF1853A	RBF2853A	3 wire
[1] Duplex not available with 1/8" O.D.; 3/16" O.D. limited to polyimide leadwire.		

1-2 Bayonet Cap Style

CODE	DESCRIPTION
A	7/16" I.D. single slot (standard)
B	12 mm I.D. dual slot
C	12 mm O.D. dual pin
D	Positive seat indicating
E	15 mm I.D. dual slot

1-3 Tip and Flex Armor Diameters

CODE	TIP O.D. "D" DIM. (inches)	FLEX O.D. "Q" DIM. (inches)
2	0.125	0.210
3	0.188	0.275

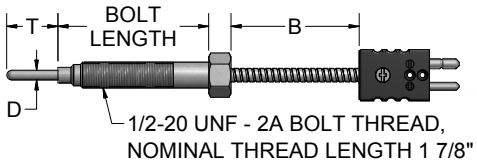
2 Extension Leadwire "B" + "C"

CODE[1]	DESCRIPTION
F3A_ _ _	Fiberglass insulation - stranded conductor - flexible armor
K3A_ _ _	Polyimide insulation - stranded conductor - flexible armor
[1] Insert 3 digit "B" length in inches. EX: F3B036=36" "B" length; for assemblies other than standard that require leadwire beyond the flexible armor, insert 3 digit "C" length after armor length. EX: F3A036-012=36" "B" length with additional 12" leads beyond armor.	

3 Terminations and Options

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnects
Options	
MC	Mating connector
CC	Cable clamp
BX	Box connector

The melt-bolt thermocouple illustrated below is made of 300 series stainless steel and is constructed using a fiberglass insulated element. This style of thermocouple is used on extruders and injection molding machines to directly measure the melt temperature of plastic as it moves down the extruder barrel.



ORDER CODES

Example Order Number:

1-1	1-2	1-3		2		3		4
JFMB2	3	U	-	02	-	F1A006	-	4

1-1 Thermocouple Type

CODE		TIP O.D. "D" DIM. (inches)
SINGLE	*DUPLEX*	
JFMB2		1/8
JFMB3	JJFMB3	3/16
Other Element Types		
For type E, K, or T thermocouples, replace J in order code with required letter designation.		

1-2 Bolt Length

CODE	LENGTH (inches)
3	3
4	4
6	6
Consult factory for other lengths.	

1-3 Junction

Grounded junctions supplied as standard. Insert 'U' only when requiring an ungrounded junction.

2 Tip Length

CODE	"T" TIP LENGTH (inches)	CODE	"T" TIP LENGTH (inches)
00	Flush	08	1/2
02	1/8	12	3/4
04	1/4	16	1
Consult factory for other lengths.			

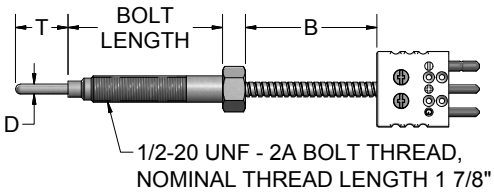
3 Extension Leadwire "B"

CODE[1]	DESCRIPTION
000	No leadwire, connector attached to sheath
F1A_ _ _	Fiberglass insulation - solid conductor - flexible armor
F3A_ _ _	Fiberglass insulation - stranded conductor - flexible armor
[1] Insert 3 digit "B" length in inches. EX: F1A012=12" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" "C" length.	

4 Terminations and Options

CODE	DESCRIPTION
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
Options	
MC	Mating connector

The melt-bolt RTD sensor illustrated below is used on extruders and injection molding machines to directly measure the melt temperature of plastic as it moves down the extruder barrel. This sensor is made of 300 series stainless steel and is constructed using a 100 Ω platinum element with a temperature coefficient of 0.003 85 $ºC^{-1}$ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number:

1-1	1-2	1-3		2		3		4
RBF1852MB	2	3	-	02	-	F3A012	-	4

1-1 RTD Element Type

CODE		ELEMENT CONNECTION
SINGLE	*DUPLEX[1]*	
RBF1853MB	RBF2853MB	3 wire
RBF1852MB	RBF2852MB	2 wire
Other Element Types		
[1] Duplex not available with 1/8" O.D.; 3/16" O.D. limited to polyimide leadwire.		

1-2 Tip Diameter

CODE	TIP O.D. "D" DIM. (inches)
2	1/8
3	3/16

1-3 Bolt Length

CODE	LENGTH (inches)
3	3
4	4
6	6
Consult factory for other lengths.	

2 Tip Length

CODE	"T" TIP LENGTH (inches)	CODE	"T" TIP LENGTH (inches)
00	Flush	08	1/2
02	1/8	12	3/4
04	1/4	16	1
Consult factory for other lengths.			

3 Extension Leadwire

CODE[1]	DESCRIPTION
000	No leadwire, connector attached to sheath
F3A_ _ _	Fiberglass insulation - stranded conductor - flexible armor
K3A_ _ _	Polyimide insulation - stranded conductor - flexible armor
[1] Insert 3 digit "B" length in inches. EX: F1A012=12" "B" length; for assemblies requiring other than the standard 6" "C" dimension. EX: F1A036-012=36" "B" length with additional 12" "C" length.	

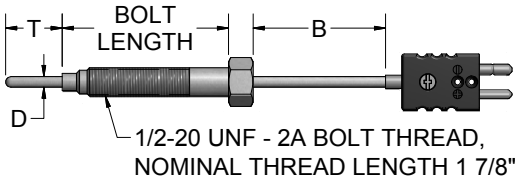
4 Terminations and Options

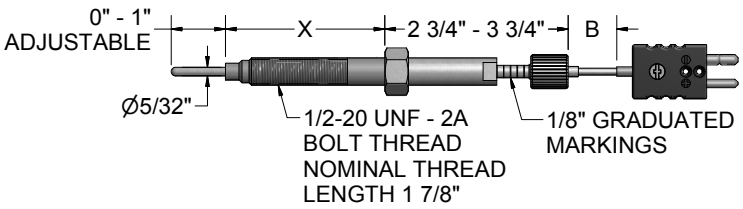
CODE	DESCRIPTION
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnects
Options	
MC	Mating connector
CC	Cable clamp
BX	Box connector

Configuration Code PL05

MgO and Adjustable Tip Melt-Bolt Thermocouples

The melt-bolt thermocouples illustrated below are used on extruders and injection molding machines to directly measure the melt temperature of plastic as it moves down the extruder barrel. These melt-bolts are made with 300 series stainless steel and are constructed using a metal-sheathed MgO element. The fixed tip style consists of an MgO element brazed to the bolt at a specified tip length and is supplied with a grounded junction as standard. Pyromation's Precision Tip Re-adjustable Melt-Bolt Thermocouples come standard with a fast response exposed junction. The precision tip is manufactured from hardened stainless steel and creates a positive shut off to prevent the back flow of plastic into the bolt. The 5/32" O.D. tip has an adjustment range of 0"-1".





ORDER CODES

ExampleOrder Number:

1-1	1-2		2 or 2A		3		4
JMMB23	U	-	02	-	004	-	4

1-1 Thermocouple Type

CODE		DESCRIPTION		
SINGLE	*DUPLEX*	*TIP O.D. "D" DIM.*	*BOLT LENGTH*	*TIP STYLE*
JMMB23	JJMMB23	1/8"	3"	Fixed
JMMB24	JJMMB24	1/8"	4"	Fixed
JMMB26	JJMMB26	1/8"	6"	Fixed
JMMB33	JJMMB33	3/16"	3"	Fixed
JMMB34	JJMMB34	3/16"	4"	Fixed
JMMB36	JJMMB36	3/16"	6"	Fixed
JAMB3E	JJAMB3E	5/32"	3"	Adjustable
JAMB6E	JJAMB6E	5/32"	6"	Adjustable
Other Element Types				
For type E, K or T thermocouples, replace J in order code with required letter designation.				

1-2 Junction

Grounded junctions supplied as standard on fixed tip melt-bolts and exposed tip junctions are standard on adjustable tip melt-bolts. For junction styles other than the standard, specify "U" for ungrounded or "G" for grounded junction.

2 Tip Length for Fixed Tip Melt-Bolt

CODE	"T" TIP LENGTH	CODE	"T" TIP LENGTH
00	Flush	08	1/2"
02	1/8"	12	3/4"
04	1/4"	16	1"

2A Tip Length for Adjustable Tip Melt-Bolt

CODE	"T" TIP LENGTH
01	Adjustable range 0" to 1"

3 MgO Extension "B"

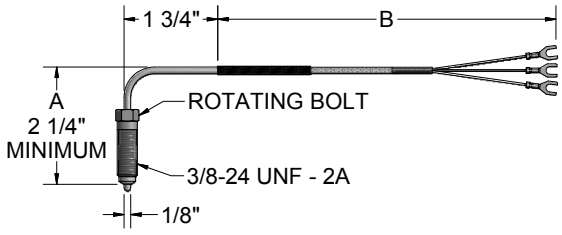
CODE	DESCRIPTION
000	Connector 1/2" from bolt
_ _ _	Insert "B" length in inches using 3 digits

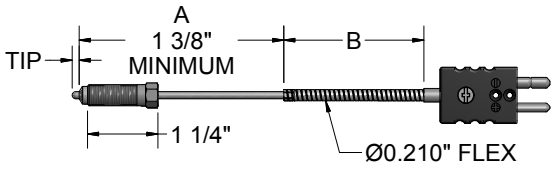
4 Terminations and Options

CODE	DESCRIPTION
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
Options	
MC	Mating connector
CL	Compression L bracket

Configuration Code PL07
Nozzle-Melt Thermocouples and RTDs

The nozzle-melt temperature sensors listed below are typically placed into the nozzle of a plastic injection molding machine and sense the temperature of the molten plastic prior to being injected into the mold. They are offered in a variety of thermocouple types as listed below. The RTDs are constructed using a 100 Ω platinum element with a temperature coefficient of 0.003 85 $ºC^{-1}$ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.





ORDER CODES

Example Order Number:

1 or 1A		2		3		4	
JNM32	-	04	-	F3B036	-	3,	BX

1 Thermocouple Type, Tip Length, and Sheath Style

CODE	DESCRIPTION	
	TIP LENGTH	BEND
JNM12	1/8"	Straight
JNM14	1/4"	Straight
JNM22	1/8"	45º
JNM24	1/4"	45º
JNM32	1/8"	90º
JNM34	1/4"	90º
Other Element Types		
For type E, K, or T thermocouples, replace J in order code with required letter designation.		

1A RTD Type, Tip Length, and Sheath Style

CODE	DESCRIPTION	
	TIP LENGTH	BEND
RBF1853NM12	1/8"	Straight
RBF1853NM14	1/4"	Straight
RBF1853NM22	1/8"	45º
RBF1853NM24	1/4"	45º
RBF1853NM32	1/8"	90º
RBF1853NM34	1/4"	90º
Other Element Types		
All RTDs are supplied as 3 wire constuction. Replace the 3 in the part number with a 2 for 2 wire construction.		

2 Sheath extension "A"

Insert 'A' dimension in inches using 2 digits.

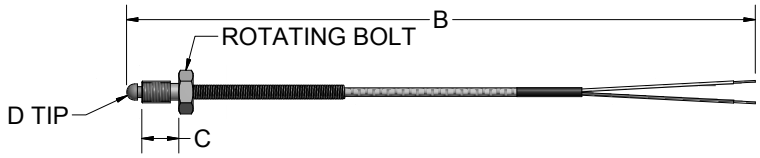
3 Extension Length "B"

CODE[1]	DESCRIPTION
000	No leadwire, connector attached to sheath
F1_ _ _	Fiberglass insulation - solid conductor
F1A _ _ _	Fiberglass insulation - solid conductor - flexible armor
F3_ _ _	Fiberglass insulation - stranded conductor
F3A _ _ _	Fiberglass insulation - stranded conductor - flexible armor
F3B _ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid
[1] Insert 3 digit "B" length in inches. EX: F1A012=12" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" "C" length.	

4 Terminations and Options

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnects
Options	
MC	Mating connector
CC	Cable clamp
BX	Box connector

The threaded nozzle thermocouple illustrated below is generally used to measure the temperature of the nozzle of an injection molding machine. This style is not in direct contact with the molten plastic. Due to the relatively small size of this sensor, other general areas of use include mounting in bearing housings, sealing bars, heat plates, and other limited space applications.



ORDER CODES

Example Order Number:

1-1	1-2		2		3		4
JTN	U	-	F6	-	F1B024	-	2

1-1 Thermocouple Type

CODE	DESCRIPTION
JTN	Iron - Constantan
Other Element Types	
For type E, K or T thermocouples, replace J in order code with required letter designation.	

1-2 Junction

Grounded junctions supplied as standard. Insert "U" only when requiring an ungrounded junction.

2 Bolt Designation

CODE	NOZZLE SIZE		
	THREADS	"D" TIP (inches)	"C" LENGTH
F6	1/4" - 28	3/16	3/8"
G8	3/8" - 24	1/4	1/2"
I6	6 mm x 1 mm	3/16	10 mm
K6	8 mm x 1.25 mm	1/4	10 mm
M10	10 mm x 1.50 mm	1/4	16 mm
Other bolt sizes available; consult factory.			

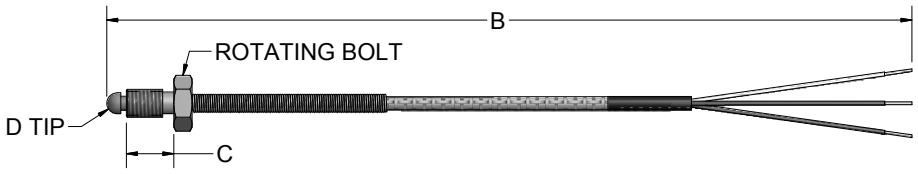
3 Extension Length "B"

CODE[1]	WIRE DESCRIPTION
F1 _ _ _	Fiberglass insulation - solid conductor
F1B_ _ _	Fiberglass insulation - solid conductor - stainless steel overbraid
F3_ _ _	Fiberglass insulation - stranded conductor
F3B_ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid
[1] Insert 3 digit "B" length in inches. EX: F3B024=24" "B" length.	

4 Terminations and Options

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnects
Options	
MC	Mating connector
CC	Cable clamp
BX	Box connector

The threaded nozzle RTD illustrated below is generally used to measure the temperature of the nozzle of an injection molding machine. This style is not in direct contact with the molten plastic. Due to the relatively small size of this sensor, other general areas of use include mounting in bearing housings, sealing bars, heat plates, and other limited space applications. These assemblies are supplied standard using a 100 ohm platinum element with a temperature coefficient of 0.003 85 $ºC^{-1}$ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number:

1		2		3		4
RBF1852TN	-	**F6**	-	**F3B012**	-	**2**

1 RTD Element Type

CODE	ELEMENT CONNECTION
RBF1853TN	3 wire
RBF1852TN	2 wire

2 Bolt Designation

CODE	NOZZLE SIZE		
	THREADS	"D" TIP (inches)	""C"" LENGTH
F6	1/4" - 28	3/16	3/8"
G8	3/8" - 24	1/4	1/2"
I6	6 mm x 1 mm	3/16	10 mm
K6	8 mm x 1.25 mm	1/4	10 mm
M10	10 mm x 1.50 mm	1/4	16 mm
Other bolt sizes available; consult factory.			

3 Extension Length "B"

CODE[1]	WIRE DESCRIPTION
F3_ _ _	Fiberglass insulation - stranded conductor
F3B_ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid
K3_ _ _	Polyimide insulation - stranded conductor
K3B _ _ _	Polyimide insulation - stranded conductor - stainless steel overbraid
[1] Insert 3 digit "B" length in inches. EX: F3B024=24" "B" length	

4 Terminations and Options

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnects
Options	
MC	Mating connector
CC	Cable clamp
BX	Box connector

The ring type assemblies pictured below have the thermocouples embedded either into a stainless steel stamping for grounded junctions (figure 1) or a brass ring for ungrounded junctions (figure 2). Various ring sizes are available to measure the surface temperature of nozzles, extruder barrels, die heads, molds, and many other applicable surfaces.

FIGURE 1

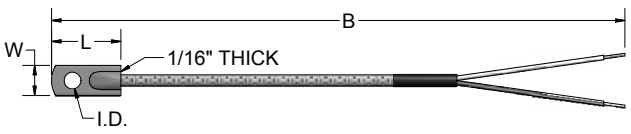
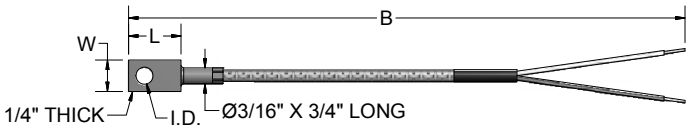


FIGURE 2



ORDER CODES

Example Order Number: 1 **JRS1** - 2 **F3012** - 3 **8**

FIGURE 1
1 Grounded Thermocouples - Ring Size

CODE	RING SIZE			SCREW or BOLT SIZE
	I.D. (inches)	W (inches)	L (inches)	
JRS1	0.20	3/8	7/8	#6 - #10 4mm-5mm
JRS2	0.33	7/16	1	#12, 1/4" - 5/16" 5mm - 8mm
JRS3	0.44	9/16	1 1/8	5/16" - 3/8" 8mm - 10mm

FIGURE 2
1 Ungrounded Thermocouples - Ring Size

CODE	RING SIZE			SCREW SIZE
	I.D. (inches)	W (inches)	L (inches)	
JRB1U	0.20	3/8	5/8	#6 - #10 4mm-5mm
JRB2U	0.33	5/8	7/8	#12, 1/4" - 5/16" 5mm - 8mm
JRB3U	0.44	5/8	7/8	5/16" - 3/8" 8mm - 10mm
Other Element Types				
For type E, K, or T thermocouples, replace J in order code with required letter designation.				

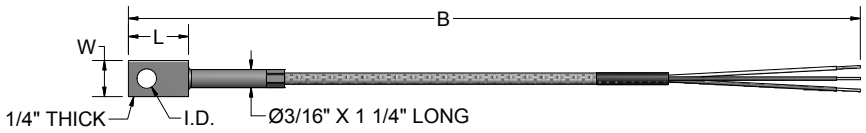
2 Extension Leadwire "B"

CODE[1]	DESCRIPTION
F1_ _ _	Fiberglass insulation - solid conductor
F1B _ _ _	Fiberglass insulation - solid conductor - stainless steel overbraid
F3_ _ _	Fiberglass insulation - stranded conductor
F3B _ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid
T1 _ _ _	Fluoropolymer insulation - solid conductor
T3 _ _ _	Fluoropolymer insulation - stranded conductor
K1 _ _ _	Polyimide insulation - solid conductor
[1] Insert 3 digit "B" length in inches. EX: F3B024=24" "B" length.	

3 Terminations and Options

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnect lugs
Options	
MC	Mating connector
CC	Cable clamp
BX	Box connector

The ring type assembly pictured below has the RTD element embedded into a brass ring. Various ring sizes are available to measure the surface temperature of nozzles, extruder barrels, die heads, molds, and many other applicable surfaces. This assembly is supplied standard using a 100 Ω platinum element with a temperature coefficient of 0.003 85 $°C^{-1}$ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number:

1	1-2		2		3
RBF1853RB	**2**	**-**	**F3B012**	**-**	**2**

1-1 RTD Element Type

CODE		ELEMENT CONNECTION
SINGLE	***DUPLEX[1]***	
RBF1853RB	RBF2853RB	3-wire
RBF1852RB	RBF2852RB	2-wire
[1] Duplex assemblies available with polyimide or fluoropolymer wire only.		

1-2 Ring Size

CODE	I.D. (inches)	W (inches)	L (inches)	SCREW SIZE
1	0.20	3/8	5/8	#6 - #10 4mm - 5mm
2	0.33	5/8	7/8	#12, 1/4" - 5/16" 5mm - 8mm
3	0.44	5/8	7/8	5/16" - 3/8" 8mm - 10mm

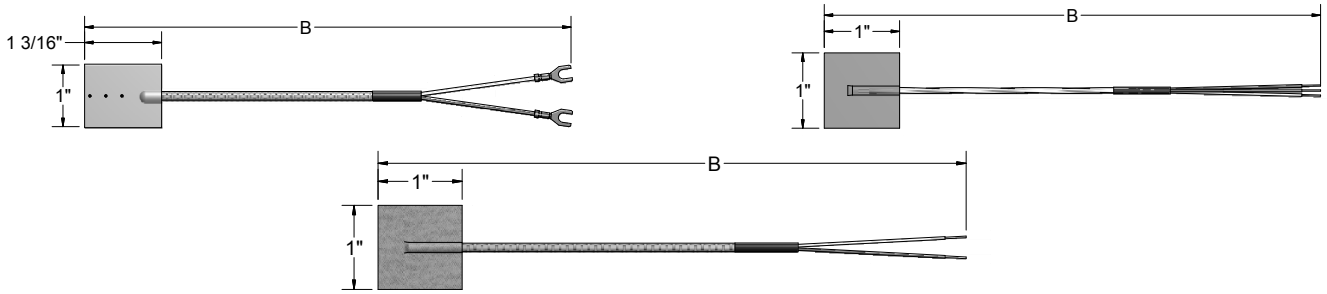
2 Extension Leadwire Type and "B" + "C" Dimension

CODE[1]	WIRE DESCRIPTION
F3_ _ _	Fiberglass insulation - stranded conductor
F3A_ _ _	Fiberglass insulation - stranded conductor - flexible armor
F3B_ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid
T3_ _ _	Fluoropolymer insulation - stranded conductor
T3A_ _ _	Fluoropolymer insulation - stranded conductor - flexible armor
K3_ _ _	Polyimide insulation - stranded conductor
K3A_ _ _	Polyimide insulation - stranded conductor - flexible armor
K3B _ _ _	Polyimide insulation - stranded conductor - stainless steel overbraid
[1] Insert 3 digit "B" length in inches. EX: F1A012=12" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" "C" length.	

3 Terminations and Options

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnects
Options	
MC	Mating connector
CC	Cable clamp
BX	Box connector

The temperature sensors illustrated below are generally used for surface temperature measurement. The series SS and ST spade thermocouples are sandwiched between two thin shims of either stainless steel or two pieces of fiberglass tape. They can be attached using a worm drive hose clamp or by placing under heater bands. These spades can be formed and secured to the outside of various size tubes, pipes, or nozzles. The SK series sensors are sealed in epoxy between two layers of polyimide tape and are provded with an adhesive backing for easy attachment to many surfaces. The SK series sensors are available in various thermocouple types or RTDs. The RTDs are constructed using a 100 Ω platinum element with a temperature coefficient of 0.003 85 °C^{-1} (IEC Class B).



ORDER CODES

Example Order Number: 1 **JSS** - 2 **F1B036** - 3 **3**

1 Thermocouple Type

CODE	DESCRIPTION
JSS	Stainless steel spade
JST	Flexible fiberglass spade 204 °C [400 °F] max
JSK[1]	Flexible Polyimide spade with adhesive tape backing 204 °C [400 °F]
Nominal spade thickness is 0.020" min to 0.090" max	
Other Element Types	
For type E, K, or T thermocouples, replace J in order code with required letter designation.	
[1] Not available with Fiberglass leadwire.	

1a RTD Type 100 Ω Platinum A = 0.003 85 °C^{-1}

CODE	ELEMENT CONNECTION	DESCRIPTION
RBF1853SK	3 wire	Flexible polyimide spade with adhesive tape backing 204 °C [400 °F]
RBF1852SK	2 wire	Flexible polyimide spade with adhesive tape backing 204 °C [400 °F]
Nominal spade thickness is 0.060" min to 0.100" max		

2 Extension Leadwire "B"

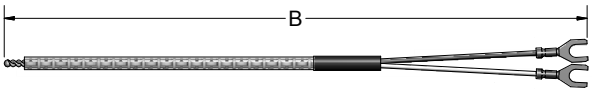
CODE[1]	DESCRIPTION
F1_ _ _	Fiberglass insulation - solid conductor
F1B _ _ _	Fiberglass insulation - solid conductor - stainless steel overbraid
F3_ _ _	Fiberglass insulation - stranded conductor
F3B _ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid
T1 _ _ _	Fluoropolymer insulation - solid conductor
T3 _ _ _	Fluoropolymer insulation - stranded conductor
K1 _ _ _	Polyimide insulation - solid conductor
[1] Insert 3 digit "B" length in inches. EX: F3B024=24" "B" length.	

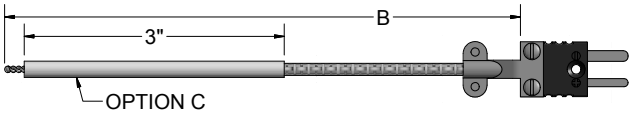
3 Terminations and Options

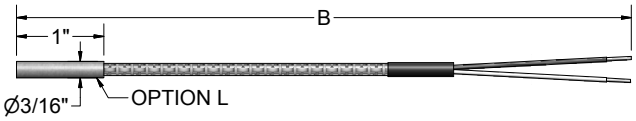
CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnects
Options	
MC	Mating connector
CC	Cable clamp
BX	Box connector

Configuration Code PL13
Insulated Wire Type Thermocouples

The multiple-purpose thermocouples listed below are constructed with insulated thermocouple wire and provided with twisted and TIG-welded hot junctions. Insulations and overbraids are offered to satisfy many industrial processes, furnace certification, load checking, and laboratory test temperature measurement applications.







ORDER CODES

Example Order Number: **K20-1-S-304 - 072 - 4**

1 Thermocouple and Insulation Type

CODE (Insert T/C Type Prefix Letter)	WIRE GA.	COND. TYPE	INSULATION[1]	INSULATION TEMPERATURE RATING	LIMITS OF ERROR[2]
(J,K,E) 20-1-304	20	Solid	Fiberglass	482 ºC [900 ºF]	Standard
(J,K) 20-1-S-304	20	Solid	Fiberglass/SS ovb.	482 ºC [900 ºF]	Standard
(K) 20-3-302	20	Strnd	Fiberglass	482 ºC [900 ºF]	Standard
(J,K) 20-3-S-317	20	Strnd	Fiberglass/SS ovb.	482 ºC [900 ºF]	Standard
(J,K) 20-2-321	20	Solid	Hi-temp fiberglass	704 ºC [1300 ºF]	Special
(J,K) 20-1-508	20	Solid	TFE	260 ºC [500 ºF]	Standard
(J,K) 20-2-513	20	Solid	Polyimide	316 ºC [600 ºF]	Special
(K) 20-2-301	20	Solid	Vitreous sil. fiber	871 ºC [1600 ºF]	Special
(K) 20-2-350	20	Solid	Ceramic fiber	1204 ºC [2200 ºF]	Special
(K) 20-2-N-350	20	Solid	Cer.fiber/Inc. ovb.	1204 ºC [2200 ºF]	Special
(J,K) 24-1-304	24	Solid	Fiberglass	482 ºC [900 ºF]	Standard
(J,K) 24-1-508	24	Solid	TFE	260 ºC [500 ºF]	Standard
(J,K) 30-1-305	30	Solid	Fiberglass	482 ºC [900 ºF]	Standard
(J,K,T) 30-2-506	30	Solid	FEP	204 ºC [400 ºF]	Special

[1] See Wire Section, for additional insulation specifications.
[2] Consult factory for availability of non-listed Special Limits of Error wire.

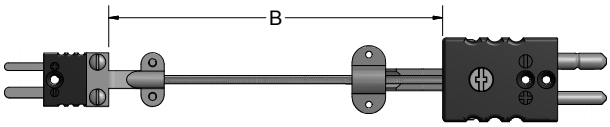
3 Terminations and Options

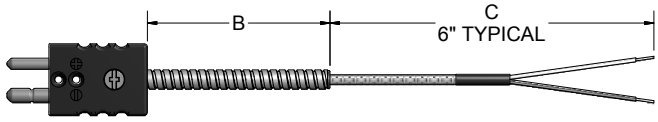
CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	Leads split 2" with spade lugs
4	Standard plug
6	Miniature plug
Options	
MC	Mating connector
CC	Cable clamp
L	Ungrounded hot junction
C	3" ceramic insulator at hot junction

2 Length

Insert 3 Digit Length Order Code in Inches.

The flexible thermocouple extensions illustrated below are constructed using thermocouple wire or thermocouple extension wire. They are used as extension cords to provide suitable connections between sensors, jack panels, or instrumentation.





ORDER CODES

Example Order Number: **JE6, CC - F1B036 - 4, CC**

1 2 3

1 Terminations and Options

CODE	DESCRIPTION
JE1	2" split leads with compensated spade lugs
JE2	2" split leads, 1/4" stripped
JE3	2" split leads with spade lugs
JE4	Standard plug
JE5	Standard jack
JE6	Miniature plug
JE7	Miniature jack
JE8	2" split leads with 1/4" female disconnects
For type E, K, or T thermocouples, replace J in order code with required letter designation.	
Options	
BX	Box connector
CC	Cable clamp
CG	1/2" NPT plastic cord grip
MC	Mating connector
RB	Rubber boot
SP	Solid pin plug

2 Extension Leadwire "B" + "C" Dimension

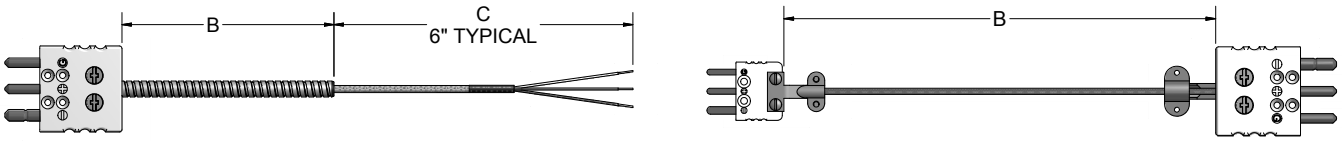
CODE[1]	DESCRIPTION
F1_ _ _	Fiberglass insulation - solid conductor
F1A _ _ _	Fiberglass insulation - solid conductor - flexible armor
F1B _ _ _	Fiberglass insulation - solid conductor - stainless steel overbraid
F3_ _ _	Fiberglass insulation - stranded conductor
F3A _ _ _	Fiberglass insulation - stranded conductor - flexible armor
F3B _ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid
T1 _ _ _	Fluoropolymer insulation - solid conductor
T1A _ _ _	Fluoropolymer insulation - solid conductor - flexible armor
T3 _ _ _	Fluoropolymer insulation - stranded conductor
T3A _ _ _	Fluoropolymer insulation - stranded conductor - flexible armor
C3 _ _ _	PVC insulated - stranded conductor - coil cord (only available in 60" and 120" extended lengths)

[1] Insert 3 digit "B" length in inches.
EX: F1036=36" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" "C" length.
For PVC-coated or FEP coated flex, substitute suffix code A with P for PVC and T for FEP coating. Example: F3P is stranded fiberglass leads with PVC flex.

3 Terminations and Options

CODE	DESCRIPTION
0	No termination
1	2" split leads with compensated spade lugs
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnect lugs
Options	
BX	Box connector
CC	Cable clamp
CG	1/2" NPT plastic cord grip
MC	Mating connector
RB	Rubber boot
SP	Solid pin plug

The flexible RTD extensions illustrated below are constructed using stranded copper wire with various insulations. They are used as extension cords to provide suitable connections between sensors, jack panels, or instrumentation.



ORDER CODES

Example Order Number: **RT3E4, CC - F3B036 - 2**

1 Terminations and Options

CODE		DESCRIPTION
2 WIRE	*3 WIRE*	
RT2E2	RT3E2	2" split leads, 1/4" stripped
RT2E3	RT3E3	2" split leads with spade lugs
RT2E4	RT3E4	Standard plug
RT2E5	RT3E5	Standard jack
RT2E6	RT3E6	Miniature plug
RT2E7	RT3E7	Miniature jack
RT2E8	RT3E8	2" split leads with 1/4" female disconnects
Options		
BX	Box connector	
CC	Cable clamp	
CG	1/2" NPT plastic cord grip	
MC	Mating connector	
RB	Rubber boot	

2 Extension Leadwire and "B" + "C" Dimension

CODE[1]	DESCRIPTION
F3_ _ _	Fiberglass insulation - stranded conductor
F3A _ _ _	Fiberglass insulation - stranded conductor - flexible armor
F3B _ _ _	Fiberglass insulation - stranded conductor - stainless steel overbraid
T3 _ _ _	Fluoropolymer insulation - stranded conductor
T3A _ _ _	Fluoropolymer insulation - stranded conductor - flexible armor
K3_ _ _	Polyimide insulation - stranded conductor
K3A_ _ _	Polyimide insulation - stranded conductor - flexible armor
K3B _ _ _	Polyimide insulation - stranded conductor - stainless steel overbraid
C3 _ _ _	PVC insulated - stranded conductor - coil cord (only available in 60" and 120" extended lengths)

[1] Insert 3 digit "B" length in inches.
EX: F1036=36" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" leads beyond armor.

For PVC-coated or FEP coated flex,substitute suffix code A with P for PVC and T for FEP coating. Example: T3P is stranded Fluoropolymer leads with PVC flex.

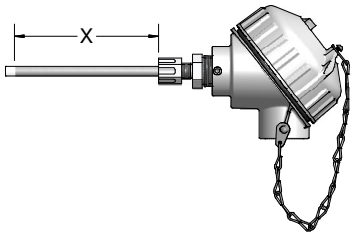
3 Terminations and Options

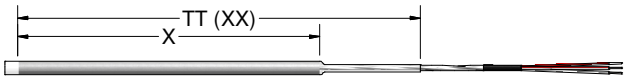
CODE	DESCRIPTION
0	No termination
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" female disconnects
Options	
BX	Box connector
CC	Cable clamp
CG	1/2" NPT plastic cord grip
MC	Mating connector
RB	Rubber boot

Special-Purpose

Configuration Code SP01
FEP-Coated Thermocouple Assemblies
Configuration Code SP02
FEP-Coated RTD Assemblies

The assemblies listed below are designed for a broad range of applications that require resistance to corrosion and chemical attack. They provide very good temperature measurement and service life in plating, pickeling, and acid bath applications. The stainless steel sheath is coated with FEP and includes a fused FEP tip for excellent corrosion resistance.





Maximum Temperature Rating 200 °C

ORDER CODES

Example Order Number:

1		2		3		4		5		6
JP38UT	-	**012**	-	**00**	-	**TT(36)**	-	**T3072**	-	**4**

1 Thermocouple Types

CODE	T/C TYPE	SHEATH O.D. (inches)
JP38UT	J	3/16
JP48UT	J	1/4
KP38UT	K	3/16
KP48UT	K	1/4
TP38UT	T	3/16
TP48UT	T	1/4
For grounded hot junctions substitute the letter 'G' in place of the 'U' above.		

1-2 100 Ω Platinum RTD α = 0.003 85 °C^{-1} Tolerance[1] Class B

CODE	LEADS	SHEATH O.D. (inches)
RBF185L383T	3	3/16
RBF185L483T	3	1/4
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.		

2 'X' Dimension

Insert 3 Digit Sheath Length (X dimension) in Inches.

3 Sheath Mountings

CODE	DESCRIPTION
00	No fitting

Re-Adjustable Compression Fittings

CODE	DESCRIPTION	NPT SIZE (inches)	AVAILABLE SHEATH DIAMETERS (inches)
10A	303 stainless steel	1/8	3/16
10B	303 stainless steel	1/4	1/4
10C	303 stainless steel	1/2	1/4
56B	FEP	1/4	1/4
56C	FEP	1/2	1/4

6 Leadwire Terminations

CODE	DESCRIPTION
0	No termination
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
6	Miniature plug
Options	
MC	Mating connector
RB	Rubber boot

5 Extension Leadwire

CODE	DESCRIPTION
T1	Fluoropolymer insulation - solid conductor (available in thermocouples only)
T3	Fluoropolymer insulation - stranded conductor

4 Head Terminations

CODE	DESCRIPTION
8HN63	White polypropylene screw-cover head with 1/2" NPT stainless steel hex mounting fitting
9HP63	White polypropylene screw-cover head with 1/2" NPT bushing holding head to sheath
56CF63[1]	White polypropylene screw-cover head with FEP compression fitting holding head to sheath
[1] Not available with 3/16" O.D. sheath	

4-1 Sheath Terminations

CODE	DESCRIPTION
4	Standard plug
5	Standard jack
Options	
MC	Mating connector
RB	Rubber boot

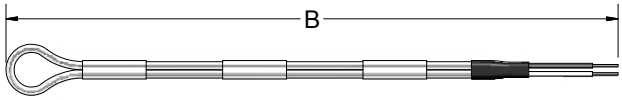
4-2 Leadwire Transitions

CODE	DESCRIPTION
TT	FEP coating: both sheath and leads (specify total length of FPE coating) Example: TT(36)
15	Extension leadwire transition with relief spring
16	Extension leadwire transition with heat-shrink tubing

The thermocouples listed below are designed for a broad range of uses in applications that require resistance to corrosion and chemical attack. They provide very good temperature measurement and service life in plating, pickling, and acid bath applications. The fluoropolymer assemblies provide excellent resistance to strong acids, alkalines, and saline solutions.

TEF ASSEMBLY

FEP ASSEMBLY



ORDER CODES

Example Order Number:

1-1	1-2		2		3
J4	TEF	-	072	-	4, RB

1-1 Thermocouple Type

CODE	DESCRIPTION
J4	Type J
K4	Type K
T4	Type T

1-2 Outer Tubing

CODE	DESCRIPTION	TEMPERATURE RATING
TEF	FEP Tubing	200 ºC [392 ºF]
FEP	TFE Sleeving	200 ºC [392 ºF]

2 Length

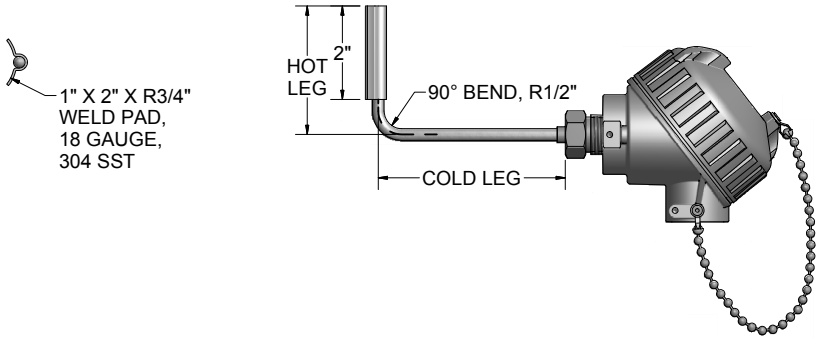
3 Digit "B" Length in Inches.

3 Terminations

CODE	DESCRIPTION
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
Options	
MC	Mating connector
CG	Cord grip (1/2" NPT PVC)
RB	Rubber boot
SP	Solid pin plug

Configuration Code SP03
Heat-Tracing Temperature Sensors

Heat-tracing temperature sensors are made for use in systems that measure the surface temperature of process pipe that is carrying products whose temperatures must be controlled to prevent freeze-up, or to maintain a viscosity level so that the inner medium will flow. These sensors are offered with either Thermocouple or RTD sensing elements inside 316SS sheaths, and with a 3/4" Radius stainless steel mounting pad. Cold legs are available in customer-specified lengths to accommodate pipe insulation thickness.



ORDER CODES

Example Order Number:

1-1	1-2		3		4		5	5-1
RBF185L483	- HT	-	0304	-	18RD	-	31,	I

1-1 Thermocouple Styles

CODE	T/C TYPE	HOT JUNCTION STYLE	SHEATH INSULATION
JP48G	J	Grounded	Fiberglass
KP48G	K	Grounded	Fiberglass
TP48G	T	Grounded	Fiberglass
EP48G	E	Grounded	Fiberglass
For ungrounded hot junctions substitute the letter "U" in place of the "G" above.			

1-2 100 Ω Platinum 3 Wire RTD Styles α = 0.003 85 °C^{-1}

CODE	TOLERANCE[1]	MAX. TEMP. RATING	INSULATION TYPE
RBF185L483	Class B	200 ºC [392 °F]	PTFE
RBF185M483	Class B	482 ºC [900 °F]	Fiberglass
R1T185H483	Grade B	593 ºC [1100 °F]	MgO
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at tempeature.			

3 Sheath Lengths

CODE	HOT LEG (inches)	COLD LEG (inches)
0304	3	4
0306	3	6
0308	3	8
Consult factory for other hot leg lengths or cold leg lengths.		

4 Radius Mounting Pads 1" W x 2" L x 18 Ga. 304 SS

CODE	RADIUS (inches)	NPT PIPE SIZE (inches)
18RD	3/4	1 1/2
Mounting pad is flexible enough to be formed around pipe sizes from 1" to 12" NPS pipe.		

5 Standard Head Terminations

CODE	DESCRIPTION
31	Aluminum screw-cover head
34	Cast iron screw-cover head
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing
36T82-D10	(4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid
37T-662A	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing
49	Flip-top aluminum head
63	White polypropylene screw-cover head
75T-642C	(4 to 20) mA HART® field transmitter with aluminum explosion-proof housing, Group A
76T82-D10	(4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof aluminum housing, Group A
77T-662C	(4 to 20) mA HART® Field Transmitter with dual cavity explosion-proof aluminum housing, Group A
91	316 L Stainless steel screw-cover head
93	Aluminum explosion-proof/flame-proof head, NEC, IEC, Atex approved
94	316L stainless steel explosion-proof/flame-proof head, NEC, IEC, Atex approved

5-1 Standard Head Options

CODE	DESCRIPTION
CG	Nylon cord grip
GS	Ground screw
I	Stainless steel tag
NB	1/2" NPT nylon conduit reducer bushing
SB	1/2" NPT conduit reducer bushing
T-440	4-20 mA head-mounted RTD transmitter (see instrument section)
T-441	4-20 mA isolated head-mounted transmitter (see instrument section)
T-442	4-20 mA HART® isolated head-mounted transmitter (see instrument section)
T82-00	(4 to 20) mA dual input HART® head-mounted transmitter

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Configuration Code SP04
Abrasion-Resistant Thermocouples

The hardened tip aggregate temperature sensor assemblies illustrated in Figures 1, 2, and 3 below are typically used to measure the temperature of severely abrasive materials found in asphalt aggregate mixers and other granular material mixing and drying processes. Three styles of hardened tip constructions are offered to resist destructive abrasion and wear. Figure 4 illustrates an open-end tube style thermocouple assembly used to measure the temperature of hot sand and other similar free flowing materials on conveyors, or at drop chutes, where abrasion is not as severe, but where product temperature response time is important.

FIG. 1 FLAME-SPRAYED, TUNGSTEN CARBIDE TIP

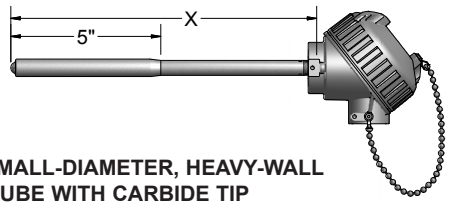


FIG. 2 RUGGEDIZED BULLET-NOSED, HARDENED-TOOL STEEL WITH CARBIDE TIP

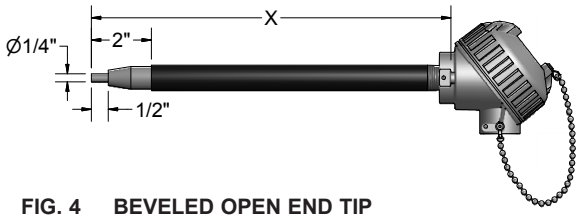


FIG. 3 SMALL-DIAMETER, HEAVY-WALL TUBE WITH CARBIDE TIP

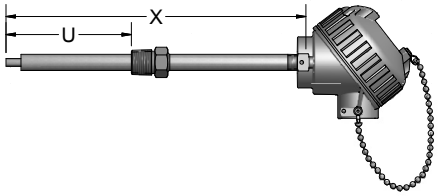
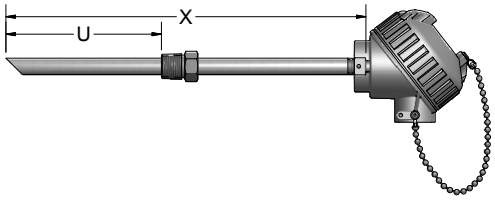


FIG. 4 BEVELED OPEN END TIP



ORDER CODES

Example Order Number: **J29GA1 - 18 - 6D12 - 31, H**

(1) (2) (3) (4)

1 Thermocouple Styles

CODE	T/C TYPE	NOM. PIPE DIA. (inches)	MEASURING TIP CONSTRUCTION	FIG. NO.
J29GA1	J	0.540	Flame-sprayed tungsten carbide	1
J29GA2	J	0.840	Tool steel with carbide tip	2
J29GA3	J	0.540	Carbide tip	3
J14CS	J	0.540	Open end tube	4
For ungrounded junctions, change 'G' in above order code to 'U'. Consult factory for availability of other thermocouple types and duplex elements.				

2 Length 'X'

CODE	LENGTH (inches)	CODE	LENGTH (inches)
12	12	20	20
14	14	24	24
18	18	Specify other lengths	

4 Head Terminations

CODE	DESCRIPTION
22[1]	3" individual leads with terminal pins
31	Aluminum screw-cover head
34	Cast iron screw-cover head
49	Flip-top aluminum head
91	316L stainless steel screw-cover head
[1] Not available with J14CS Series	
Options	
H	Adjustable steel mounting flange
SB	1/2" NPT conduit reducer bushing

3 Welded Bushings

CODE	DESCRIPTION
6C(U)	1/2" NPT steel bushing (for use with figures 1, 3, and 4 only)
6D(U)	3/4" NPT welded steel bushing
6E(U)	1" NPT welded steel bushing
Substitute length in inches from hot tip to bottom of bushing for 'U' above	

Configuration Code SP05

Rubber Compound Mixer Temperature Sensors

The below illustrated thermocouples are most commonly used in the mixing of rubber compounds and other abrasive substances. All standard thermocouples are individually tested to meet or surpass the Industry Time Response Test Standard. Thermocouple sensors are supplied with grounded hot junctions as standard. Thermocouples may be ordered with a choice of either a hard-chrome plated tip, or with a XH-5 coated tip that provides greater abrasion and wear resistance.

FIGURE 1

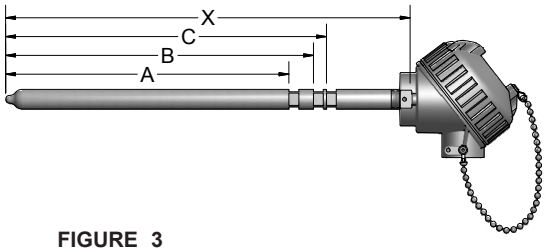


FIGURE 2

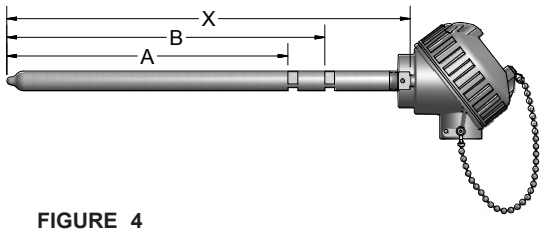


FIGURE 3

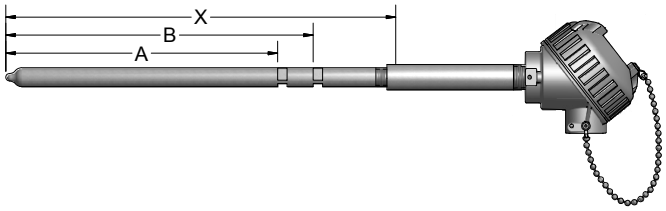
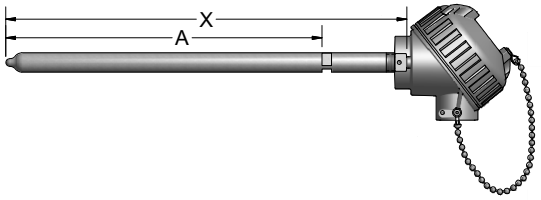


FIGURE 4



All mill slots are 5/16" wide. Abrasion-resistant tips are 0.625" O.D. x 1/2" long.

ORDER CODES

Example Order Number: **J050G - CM - 10 - 31** (1 - 2 - 3)

1 Measuring Element

CODE		ELEMENT TYPE
SINGLE	*DUPLEX*	
J050G	JJ050G	Type J thermocouple
To order type K thermocouple replace 'J' in the above order code with desired (K).		

3 Termination Options

CODE	ELEMENT TYPE
31	Aluminum screw-cover head
49	Aluminum flip-top head
[1]K1_ _ _	Polyimide - solid conductor
[1] Specify lead length in inches using 3 digits.	

2 Mounting Configuration

CODE		MOUNTING NOTCH CONFIGURATION	TYPICAL APPLICATION BY MIXER MODELS	FIG. NO.
HARD CHROME-PLATED TIP	XH-5 COATED TIP			
10	12	3 notch (square)	11D, F80, 9D, 3D	1
20	22	2 notch (triangular)	F270, F620	2
20E	22E	2 notch (triangular) w/ nipple extension	F370, F620	3
40	42	1 notch (triangular)	F270	4
Applications are typical, but may vary by machine.				

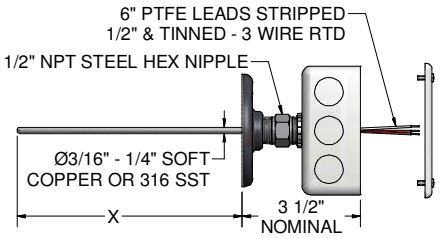
Critical Sensor Dimensions

MOUNTING CONFIG. CODE	FIG. NO.	DIMENSIONS (inches)				
		A	B	C	X	E
10 or 12	1	9 1/16	9 13/16	10 5/16	13	
20 or 22	2	13 31/32	15 31/32		18	
20E or 22E	3	13 31/32	15 31/32		17 5/8	5
40 or 42	4	10 7/32			12	
All notches are 5/16" wide (nominal)						

Special-Purpose

Configuration Code SP06
RTD Averaging Sensor

The averaging RTD sensor listed below measures the temperature over the entire sheath length to provide an average temperature measurement of the cross sectional area of air ducts, room gradient temperatures, and other low temperature averaging applications. The sensing element has a resistance output that conforms to a 100 Ω platinum element with a 0.003 85 $^{o}C^{-1}$ temperature coefficient within a measurement range of (0 to 100) ºC [32 to 212] ºF. The RTD sensors are available in copper or 316 stainless steel sheath materials and can be supplied in various lengths up to 800 inches. All RTD sensors 48 inches and longer will be shipped in a coiled configuration. The sensors on this page can be provided with a (4 to 20) mA Transmitter integrally mounted inside the available enclosures.



ORDER CODES

Example Order Number:

1	2		3		4	5	
2290L	4(23)3	-	120	-	8HN	47,	HT

1 RTD Averaging Sensor

CODE	DESCRIPTION
2290L	3-wire continuous averaging RTD sensor

2 Sheath Material and Diameter

CODE	DESCRIPTION	
	DIAMETER (inches)	MATERIAL
3(23)3	3/16	Copper
4(23)3	1/4	Copper
383	3/16	316 SS
483	1/4	316 SS

3 Length

AVAIL. LENGTHS (inches)	DIAMETER O.D. (inches)	BENDABILITY
12	3/16, 1/4	Rigid
24	3/16, 1/4	Rigid
36	3/16, 1/4	Rigid
37 to 324	3/16, 1/4	Bendable
325 to 828	1/4	Bendable
Specify length in inches using 3 digits.		

4 Head Mounting Fittings

CODE	DESCRIPTION
8HN	1/2" x 1/2" NPT stainless steel hex nipple
6HN	1/2" x 1/2" NPT steel hex nipple

5 Terminations

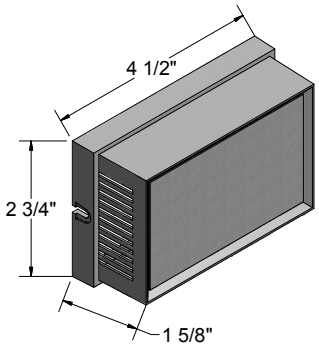
CODE	DESCRIPTION
22(06)	6" individual fluoropolymer leads with terminal pins
31	Aluminum screw-cover head
49	Flip-top aluminum head
47	2" x 4" electrical handibox
Options	
HT	Floor flange threaded on hex
T-440	4-20 mA head-mounted transmitter (see instrument section)

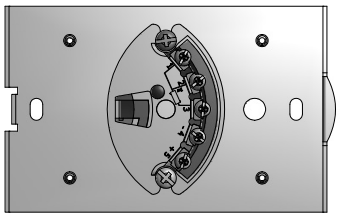
Initial averaging RTD accuracy calculation: ± [1.3 + 0.005 |t|] ºC
|t| = Value of temperature without regard to sign, ºC

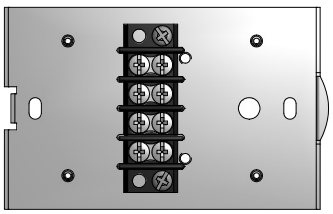
TEMPERATURE	ºC	ºF	TEMPERATURE	ºC	ºF
0 ºC [32 ºF]	1.3	2.3	60 ºC [140 ºF]	1.6	2.9
20 ºC [68 ºF]	1.4	2.5	80 ºC [176 ºF]	1.7	3.1
40 ºC [104 ºF]	1.5	2.7	100 ºC [212 ºF]	1.8	3.2

Configuration Code SP07
Thermostat Temperature Sensors

The Pyromation thermostat temperature sensors are provided with the sensor, or the sensor and a (4 to 20) mA temperature transmitter, mounted on a subplate within a standard size thermostat housing. The thermostat housing measures 2 3/4"h x 4 1/2"w x 1 5/8"d and can be mounted either horizontally or vertically on a 2" x 4" electrical handibox. The cover is vented on two sides to provide for airflow over the sensing element, regardless of mounting position. The standard temperature sensing elements are available as a fluoropolymer insulated thermocouple or a three-wire RTD. Matching transmitters are available for all configurations and output ranges.







Temperature Range (-40 to 85) ºC

ORDER CODES

Example Order Number: **2215-RBF185L3 - T**

Thermostat Housings

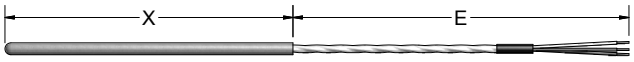
CODE	DESCRIPTION
2215 - RBF185L3	Thermostat housing with integral 100 Ω platinum RTD 0.003 85 0 $°C^{-1}$ temperature coefficient Class B
2215 - (J, K, T, E)	Thermostat housing with integral thermocouple element
2415	Thermostat housing with base plate and 4-position terminal strip - no sensing element

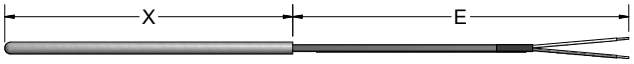
Option

CODE	DESCRIPTION
T-440	4-20 mA RTD transmitter mounted in housing with sensor (see instrument section)
T-441	4-20 mA isolated transmitter mounted in housing with sensor (see instrument section)
T-442	(4 to 20) mA isolated HART® head-mounted transmitter

Configuration Code SP08
Variable-Length RTD Elements

The sensing elements listed on this page can be cut to any desired length over 3" long by using an ordinary tubing cutter. All sheaths are provided in 316 stainless steel.





ORDER CODES

Example Order Number: **R1T185L48 | 3 - 012 - VCL - T3012 - 2**

(1 = R1T185L48 | 1-2 = 3 | 2 = 012 | 3 = VCL - T3012 - 2)

1 3-Wire RTD Assemblies Pt100 α = 0.003 85 °C^{-1}

CODE		TOLERANCE[1]	SHEATH DIAMETER O.D. (inches)
SINGLE	*DUPLEX*		
RBF185L483	RBF285L483	Class B	1/4
R1T185L483	R1T285L483	Grade B	1/4
RBF185L683	RBF285L683	Class B	3/8
R1T185L683	R1T285L683	Grade B	3/8
Consult factory for other RTD elements.			
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.			

3 RTD Extension Leadwire

CODE[1]	DESCRIPTION	TEMP. RATING
T3J _ _ _	Fluoropolymer insulation - individual leads stranded conductor (12" limit)	204 ºC [400 °F]
T3 _ _ _	Fluoropolymer insulation - stranded conductor	204 ºC [400 °F]
Leads supplied stripped and tinned 1/2" [1] Insert wire code number and 3 digit "E" length code in inches		

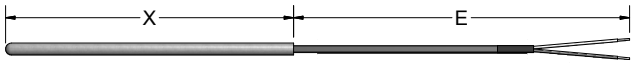
2 Sheath "X" Length

Specify "X" Length in Inches Using (3) Digits

Configuration Code SP10
Variable-Length Thermocouple Elements

ORDER CODES

Maximum T/C Temperature Limits:
Fiberglass insulated lead style: 482 °C [900 °F]
Fluoropolymer insulated lead style: 204 °C [400 °F]



Example Order Number: **JP48 | G - 006 - VCL - T1012 - 2**

(1-1 = JP48 | 1-2 = G | 2 = 006 | 3 = VCL - T1012 - 2)

1-1 Thermocouple Assemblies

CODE		T/C TYPE	SHEATH DIAMETER O.D. (inches)
SINGLE	*DUPLEX*		
JP48	JJP48	J	1/4
KP48	KKP48	K	1/4
TP48	TTP48	T	1/4
EP48	EEP48	E	1/4
JP68	JJP68	J	3/8
KP68	KKP68	K	3/8
TP68	TTP68	T	3/8
EP68	EEP68	E	3/8

1-2 Hot Junction

CODE	DESCRIPTION
G	Grounded
U	Ungrounded

3 Thermocouple Extension Leadwire

CODE[1]	DESCRIPTION	INSUL. TEMP. LIMIT
F1 _ _ _	Fiberglass insulation - solid conductor	482 ºC [900 °F]
T1 _ _ _	Fluoropolymer insulation - solid conductor	204 ºC [400 °F]
Leads supplied split 2", 1/4" stripped [1] Insert wire code number and 3 digit "E" length code in inches		

2 Sheath "X" Length

Specify "X" Length in Inches Using (3) Digits

The magnet sensors are designed to measure the surface temperature of ferrous metals with a convenient and non-destructive magnetic attachment. These sensors are designed to be mounted either vertically or horizontally and may be attached to molding press platens, bearing/motor housings and various other metal surfaces. These sensors provide stabilized temperature readings in less than 5 seconds. The magnet sensors have a continous operating temperature of 400 ºF. The T and H series can take intermittent temperatures up to 600 ºF, but the pull of the magnet will be degraded at temperatures above 450 ºF. The M series has a 2 lb. pull force magnet and the T and H series have a 16 lb. pull force magnet.

FIGURE 1

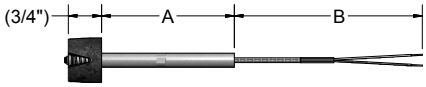


FIGURE 2

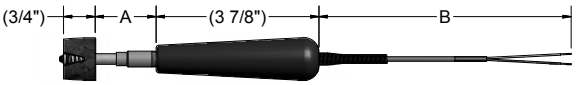
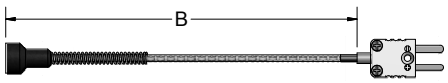


FIGURE 3



ORDER CODES

Example Order Number:

1		2		3		4		5		6
JMAG	-	T	-	006	-	304	-	T1B072	-	2

1 Thermocouple Types

CODE	DESCRIPTION
JMAG	Type J magnet sensor
KMAG	Type K magnet sensor

2 Magnet Assembly Styles

SHEATH STYLE (FIGURE 1)	
CODE	**DESCRIPTION**
T[1]	16 lb. Pull magnet with 5/16" O.D. sheath
PHENOLIC HANDLE STYLE (FIGURE 2)	
CODE	**DESCRIPTION**
H[2]	16 lb. Pull magnet with handle
MINIATURE STYLE (FIGURE 3)	
CODE	**DESCRIPTION**
M[3]	2 lb. Pull magnet
[1] 3 inch minimum "A" dimension	
[2] 1 inch minimum "A" dimension	
[3] No "A" Dimension required-specify as 000	

3 "A" Dimension

Specify 3 digit "A" Dimension length in inches.

4 Bend Options[1]

CODE	DESCRIPTION
00	No Bend
2__	Sheath bent 45º
3__	Sheath bent 90º
[1] Only available with "T" style magnet sensor. Requires a minimum "A" dimension of 4 3/4 inches.	

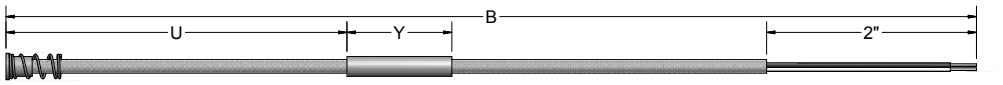
5 Extension Leadwire Type

CODE	DESCRIPTION
F1	Fiberglass insulation-solid conductor
F1B	Fiberglass insulation-solid conductor-stainless steel overbraid
F1A [1]	Fiberglass insulation-solid conductor-flexible armor
F3	Fiberglass insulation-stranded conductor
F3B	Fiberglass insulation-stranded conductor-stainless steel overbraid
F3A [1]	Fiberglass insulation-stranded conductor-flexible armor
T1	Fluoropolymer insulation-solid conductor
T1B	Fluoropolymer insulation-solid conductor-stainless steel overbraid
T1A[1]	Fluoropolymer insulation-solid conductor-flexible armor
T3	Fluoropolymer insulation-stranded conductor
T3B	Fluoropolymer insulation-stranded conductor-stainless steel overbraid
T3A [1]	Fluoropolymer insulation-stranded conductor-flexible armor
[1] Not available with M1 series assembly	

6 Terminations and Options

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs
4	Standard plug
5	Standard jack
6	Miniature plug
7	Miniature jack
8	2" split leads with 1/4" quick-disconnect female terminal lugs
Options	
CODE	**DESCRIPTION**
MC	Mating Connector
CC	Connector secured to leads with cable clamp
BX	1/2" NPT junction box connector

The miniature sensors are designed to measure the critical temperature of equipment such as sleeve bearings, thrust bearings, bearing shoes, and various other bearings where temperature is critical to performance. These types of bearings are generally used in the operation of high-speed rotating equipment such as compressors, generators, and turbines. The sensors are typically imbedded or installed beneath the Babbitt layer of the bearing to monitor the temperature, allowing early warning of the breakdown of the lubricants. This early warning allows preventative maintenance to take place before major problems occur.



ORDER CODES

Example Order Number:

0		1	1-1		2		3		4		5
HL30	-	RBF185LBS	3	-	BST	-	3P02(1/2),24	-	T3120	-	2

0 ATEX Certification[1]

CODE	DESCRIPTION
HL30	ATEX Certified CE Ex II3G Ex ic IIC T4
[1] Selection optional, not required for general-purpose sensors	

1-1 Element Connection

CODE	DESCRIPTION
2	2-Wire
3	3-Wire

2 Case Options

CASE STYLE	
CODE	**DESCRIPTION**
A	0.275" O.D. x 0.250" Long
B	0.188" O.D. x 0.250" Long
BS	0.188" O.D. x 0.250" Long (Includes spring and washer)
C[1]	0.125" O.D. x 0.300" Long
D[1]	0.080" O.D. x 0.300" Long
CASE MATERIAL	
CODE	**DESCRIPTION**
T	Tin-plated copper
N	Nickel-plated copper
[1] Not available in duplex	

3 Sealing Options

CODE	DESCRIPTION
00	No sealing option
E "U"	Elastomer fill (must specify length of elastomer fill "u" dimension) 72" maximum fill length. T3BT wire type must be specified.
3P"Y", "U"	3/16" O.D. pass through (must specify "Y" length and "U" length)
4P"Y", "U"	1/4" O.D. pass through (must specify "Y" length and "U" length)

4 Extension Leadwire Type ("B" Dimension)

CODE	DESCRIPTION
T3J	Fluoropolymer insulation-individual leads-stranded conductor
T3	Fluoropolymer insulation-stranded conductor
T3B	Fluoropolymer insulation-stranded conductor-stainless steel overbraid
T3BT	Fluoropolymer insulation-stranded conductor-stainless steel overbraid

5 Termination

CODE	DESCRIPTION
0	No Termination
2	2" split leads 1/4" strip
3	2" split leads with spade lugs

1 100 Ω Platinum RTD Elements (-40 to 204 °C)

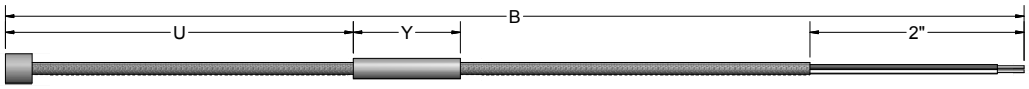
SENSOR TYPE		DESCRIPTION	
CODE		TOLERANCE[1]	TEMPERATURE COEFFICIENT
SINGLE	DUPLEX		
RBF185LBS	RBF285LBS	Class B	α = 0.003 85 °C $^{-1}$
RBF192LBS	RBF292LBS	Class B	α = 0.003 92 °C $^{-1}$
[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.			

WIRE TYPE		CASE STYLE A [1]		CASE STYLE B [1]		CASE STYLE C [1]		CASE STYLE D [1]	
CODE	DESCRIPTION	Single	Duplex	Single	Duplex	Single	Duplex	Single	Duplex
T3J	Fluoropolymer insulation-individual leads-stranded conductor	2- or 3-wire 24 AWG	2- or 3-wire 28 AWG	2- or 3-wire 24 AWG	2- or 3-wire 28 AWG	2- or 3-wire 28 AWG	2- or 3-wire 30 AWG	2- or 3-wire 30 AWG	N/A
T3	Fluoropolymer insulation-stranded conductor	2- or 3-wire 24 AWG	2- or 3-wire 28 AWG	2- or 3-wire 24 AWG	2- or 3-wire 30 AWG	2- or 3-wire 28 AWG	2- or 3-wire 28 AWG	N/A	N/A
T3B	Fluoropolymer insulation-stranded conductor-stainless steel overbraid	2- or 3-wire 24 AWG	2- or 3-wire 28 AWG	2- or 3-wire 24 AWG	2- or 3-wire 28 AWG	2- or 3-wire 28 AWG	N/A	N/A	N/A
T3BT	Fluoropolymer insulation-stranded conductor-stainless steel overbraid-Fluoropolymer outer jacket	2- or 3-wire 24 AWG	2- or 3-wire 30 AWG	2- or 3-wire 24 AWG	2- or 3-wire 30 AWG	N/A	N/A	N/A	N/A

[1] Refer to page SP-12 for case style dimensions.

Configuration Code BS01
Miniature Thermocouple Sensors

The miniature sensors are designed to measure the critical temperature of equipment such as sleeve bearings, thrust bearings, bearing shoes, and various other bearings where temperature is critical to performance. These types of bearings are generally used in the operation of high-speed rotating equipment such as compressors, generators, and turbines. The sensors are typically imbedded or installed beneath the Babbitt layer of the bearing to monitor the temperature, allowing early warning of the breakdown of the lubricants. This early warning allows preventative maintenance to take place before major problems occur.



ORDER CODES

Example Order Number:

0		1		2	3		4		5
HL30	-	JBS	U	- AT	- 00	-	T3120	-	2

0 ATEX Certification[1]

CODE	DESCRIPTION
HL30	ATEX Certified CE Ex II3G Ex ic IIC T4
[1] Selection optional, not required for general-purpose sensors	

1 Thermocouple Type

CODE	
SINGLE	DUPLEX
JBSU	JJBSU
KBSU	KKBSU
TBSU	TTBSU
EBSU	EEBSU

3 Sealing Options

CODE	DESCRIPTION
00	No sealing option
3P"Y", "U"	3/16" O.D. pass through (must specify "Y" length and "U" length)
4P"Y", "U"	1/4" O.D. pass through (must specify "Y" length and "U" length)

2 Case Options

CASE STYLE	
CODE	DESCRIPTION
A	0.275" O.D. x 0.250" Long
B	0.188" O.D. x 0.250" Long
BS	0.188" O.D. x 0.250" Long (Includes spring and washer)
C[1]	0.125" O.D. x 0.300" Long
D[1]	0.080" O.D. x 0.300" Long
CASE MATERIAL	
CODE	DESCRIPTION
T	Tin-plated copper
N	Nickel-plated copper
[1] Not available in duplex	

4 Extension Leadwire Type ("B" Dimension)

CODE	DESCRIPTION	AVAILABLE CALIBRATIONS			
		J	K	T	E
T1	Fluoropolymer insulation-solid conductor	X	X	X	
T3J	Fluoropolymer insulation-individual leads-stranded conductor	X	X	X	X
T3	Fluoropolymer insulation-stranded conductor	X	X	X	X
T3B	Fluoropolymer insulation-stranded conductor-stainless steel overbraid	X	X		

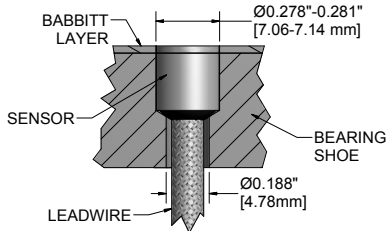
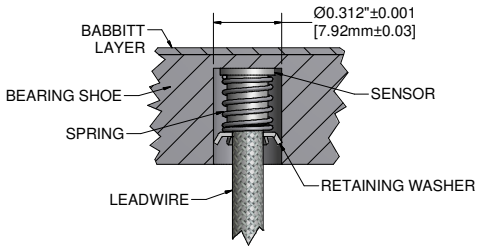
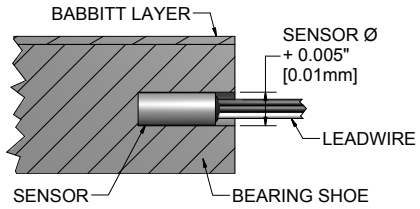
5 Termination

CODE	DESCRIPTION
0	No Termination
2	2" split leads 1/4" strip
3	2" split leads with spade lugs

WIRE TYPE		CASE STYLE A[1]		CASE STYLE B [1]		CASE STYLE C [1]		CASE STYLE D [1]	
CODE	DESCRIPTION	Single	Duplex	Single	Duplex	Single	Duplex	Single	Duplex
T1	Fluoropolymer insulation-solid conductor	24 AWG	24 AWG	24 AWG	24 AWG	24 AWG	N/A	30 AWG	N/A
T3J	Fluoropolymer insulation-individual leads-stranded conductor	24 AWG	24 AWG	24 AWG	24 AWG	24 AWG	N/A	N/A	N/A
T3	Fluoropolymer insulation-stranded conductor	24 AWG	24 AWG	24 AWG	24 AWG	24 AWG	N/A	N/A	N/A
T3B	Fluoropolymer insulation-stranded conductor-stainless steel overbraid	24 AWG	24 AWG	24 AWG	N/A	24 AWG	N/A	N/A	N/A

[1] Refer to page SP-12 for case style dimensions.

Installation Instructions

CASE STYLE	INSTALLATION	ILLUSTRATION
A	Install sensor just below the babbitt layer – near bearing shoe surface, then puddle the babbitt metal over the sensor tip and smooth.	
B	This sensor is designed with a spring and retaining washer that allows for spring loading. Slide the spring and washer over the leads. Insert the sensor tip into a hole bored into the bearing shoe and push down on the retaining ring to compress the spring and secure the sensor.	
C & D	Bore the sensor hole in the bearing shoe near, but not touching, the babbitt surface. Insert sensor and secure by potting/bonding with epoxy.	

Case Style Dimensions

CASE STYLE A

Ø 0.275" O.D. x 0.250" L

CASE STYLE B

Ø 0.188" O.D. x 0.250" L
Flange 0.250" O.D. x 0.030" L

CASE STYLE C

Ø 0.125" O.D. x 0.300" L

CASE STYLE D

Ø 0.080" O.D. x 0.300" L

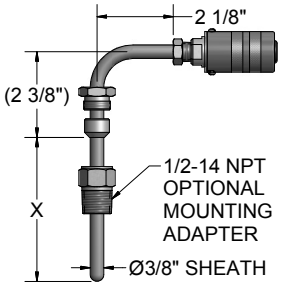
Accessories

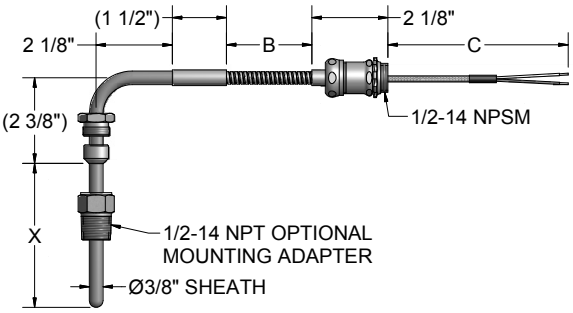
PART NUMBER	DESCRIPTION	ILLUSTRATION
12920	Spring	
12919	Retaining Washer	
10494	Retaining Ring	

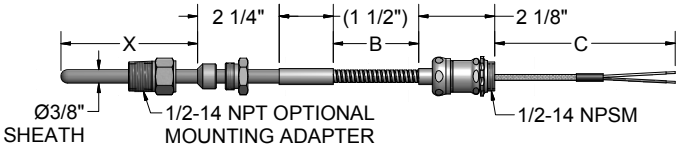
Configuration Code DE01

Diesel Engine Thermocouple Assemblies

These sensors are the most common of the diesel engine sensor family. Construction features include heavily- protected leads, a 3/8" O.D. 316 stainless steel sheath, bend options, protective conduit extensions and a variety of termination options.







Example Order Number:

1-0	1-1	1-2		2-0		3-0		4		5-0
J68	DA	U	-	06	-	20C	-	F1BA048	-012	- 2

1-0 Thermocouple Types

CODE	THERMOCOUPLE TYPE	SHEATH DIAMETER	SHEATH MATERIAL
J68	Single Type J	3/8 Inch	316 SS
K68	Single Type K	3/8 Inch	316 SS
JJ68	Duplex Type J	3/8 Inch	316 SS
KK68	Duplex Type K	3/8 Inch	316 SS

1-1 Assembly Styles

CODE	DESCRIPTION
DA	Diesel Engine 90º Bend
DS	Diesel Engine Straight

1-2 Junction Styles

CODE	DESCRIPTION
G	Grounded junction
U	Ungrounded junction

2-0 "X" Dimensions

Specify 2 digit "X" dimension length in inches

3-0 Sheath Mounting Fitting

CODE	DESCRIPTION
00	No fitting
20C	1/2" NPT 316 stainless steel mounting adaptor

5-0 Terminations and Options

CODE	DESCRIPTION
0	Leads not stripped
2	2" split leads, 1/4" stripped
3	2" split leads with spade lugs

4-0 Extension Leadwire "B" and "C" Dimensions[1]

CODE	DESCRIPTION
F1BA	Fiberglass insulation - Solid conductor - Stainless steel overbraid - Flexible armor
T1BA	Fluoropolymer insulation - Solid conductor - Stainless steel overbraid - Flexible armor
[1] Insert wire code number and 3 digit "B" length code. For assemblies requiring leadwire beyond the flexible armor, insert 3 digit "C" length after the armor "B" length code.	

4-1 Connection Head

CODE	DESCRIPTION
8HPB25	Miniature nickel-plated head secured to sheath with a 1/4 inch NPT 316 stainless steel bushing

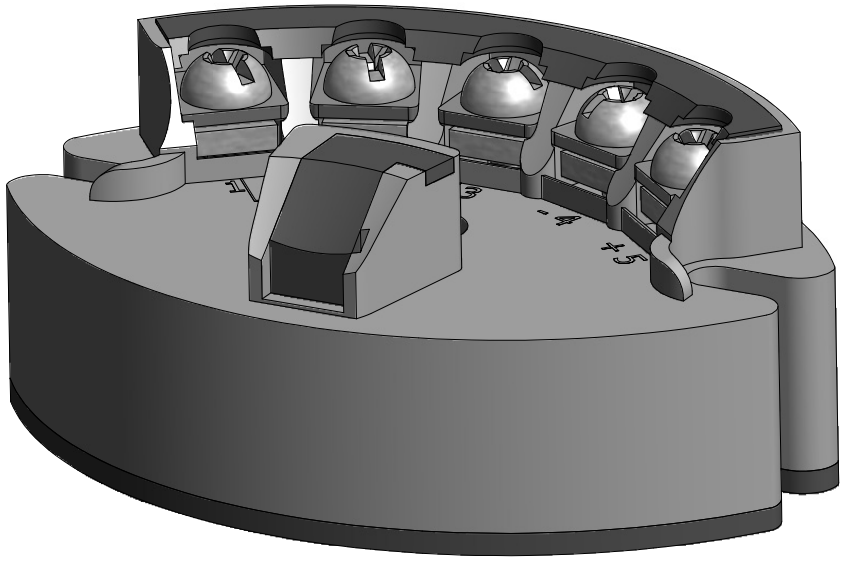
Transmitter

Configuration Code TM01
Series 440 Programmable
RTD Temperature Transmitter

The Series 440 programmable RTD temperature transmitter is a 2-wire transmitter with an analog output. It has measurement input for Pt100 resistance thermometers (RTD) in 2- or 3-wire connections. Setting up of the transmitter is done using the communication cable. These small units can be mounted in Pyromation connection heads or they can be used for surface mounting by using a 35 mm DIN-rail mounting clip.

TEMPERATURE HEAD TRANSMITTER

Universal head transmitter for Pt100 resistance thermometers (RTD), programmable using a PC, for installation in a sensor head.



Patent #D350, 596

Application Areas

- PC programmable temperature head transmitter for converting Pt100 input signal into an scalable (4 to 20) mA analog output signal
- Platinum resistance thermometer (RTD)
- Online configuration using PC with SETUP connector.

Features and Benefits

- Universally PC programmable for Pt100 signals
- 2-wire technology, (4 to 20) mA analog output
- High accuracy in total ambient temperature range
- Fault signal on sensor break or short circuit
- RFI/EMI Protected, CE marked
- c UL us UL Recognized Component
- FM CSA General Purpose and non-incendive for use in hazardous locations
- Online configuration during measurement using SETUP connector
- Output simulation

ORDER CODES

Unconfigured Order Number: **440-00[1]**

Example Configured Order Number:

1	2	3		4	5
4 4 0	-	3	85 U	-	S (50-300)	F

1

CODE	DESCRIPTION
2	RTD (2-wire)
3	RTD (3-wire)

2

CODE	DESCRIPTION
85	100 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)

[1] Default setting for unconfigured transmitter is 3-wire Pt100 (0 -100)°C.

3

CODE	DESCRIPTION
U	Upscale Burnout ≥ 21.0 mA
D	Downscale Burnout ≤ 3.6 mA

4

RANGE
S (lower limit – upper limit)

5

CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

Accessories

CODE	DESCRIPTION
10303	Communication Cable and Software (USB)
10307	35 mm DIN-rail mounting clip

Resistance Thermometer Input (RTD)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Pt100 (α = 0.003 85 °C^{-1})	(-200 to 650) °C [-328 to 1202] °F	10 ˚C [18 ˚F]
Connection Type	2- or 3-wire connection cable resistance compensation possible in the 2-wire system (0 to 20) Ω	
Sensor cable resistance	maximum 11 Ω per cable	
Sensor current	≤ 0.6 mA	

Output (Analog)

Output signal	(4 to 20) mA or (20 to 4) mA
Transmission as	Temperature linear
Maximum load	($V_{power\ supply}$ - 10 V) / 0.023 A (current output)
Digital filter 1st degree	(0 to 8) s
Induced current required	≤ 3.5 mA
Current limit	≤ 23 mA
Switch on delay	4 s (during power 1_a = 3.8 mA)
Electronic response time	1 s

Failure Mode

Undershooting measurement range	Decrease to 3.8 mA
Exceeding measurement range	Increase to 20.5 mA
Sensor breakage/short circuit	≤ 3.6 mA or ≥ 21.0 mA

Electronic Connection

Power supply	U_b = (10 to 30) V dc, polarity protected
Allowable ripple	U_{ss} ≤ 5 V at U_b ≥ 13 V, f_{max} = 1 kHz

Resistance Thermometer Accuracy (RTD)

TYPE	MEASUREMENT ACCURACY
Pt100	± 0.2 °C or 0.08% [1]
Reference conditions	Calibration temperature (23 ± 5) °C [73 ± 9] °F

General Accuracy

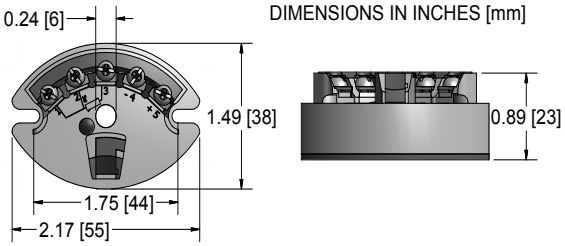
Influence of power supply	± 0.01%/V deviation from 24 V [2]
Load influence	± 0.02%/100 Ω [2]
Temperature drift	T_d = ± (15 ppm/°C × (range end value + 200) + 50 ppm/°C × measurement range) × $\Delta\vartheta$ $\Delta\vartheta$ = deviation of the ambient temperature according to the reference condition
Long term stability	≤ 0.1 °C/year [3] or ≤ 0.05%/year [1][3]

[1] % is related to the adjusted measurement range (the value to be applied is the greater)
[2] All data is related to a measurement end value of 20 mA
[3] Under reference conditions

Ambient Conditions

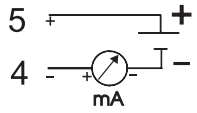
Ambient temperature	(-40 to 85) °C [-40 to 185] °F
Storage temperature	(-40 to 100) °C [-40 to 212] °F
Climatic class	EN 60 654-1, Class C
Condensation	Permitted
Shock resistance	4 g / (2 to 150) Hz according to IEC 60 068-2-6
EMC immunity	Interference immunity and interference emission according to EN 61 326-1 (1EC 1326)

Mechanical Construction

Dimensions	
Weight	Approximately 44 g
Materials	Housing: Polycarbonate • Potting: Polyurethane
Terminals	15 AWG (maximum)

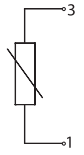
Terminal Connections

Power supply and current output

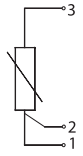


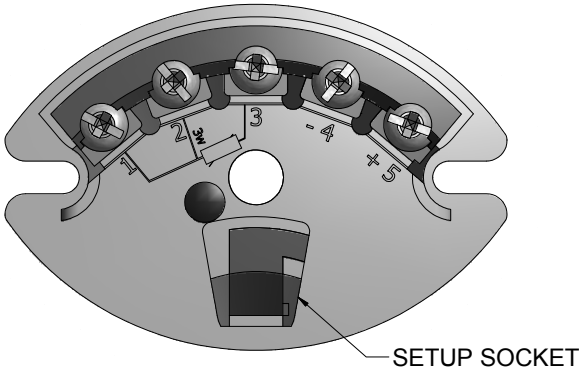
(10 to 30) V dc
(4 to 20) mA

2-Wire



3-Wire





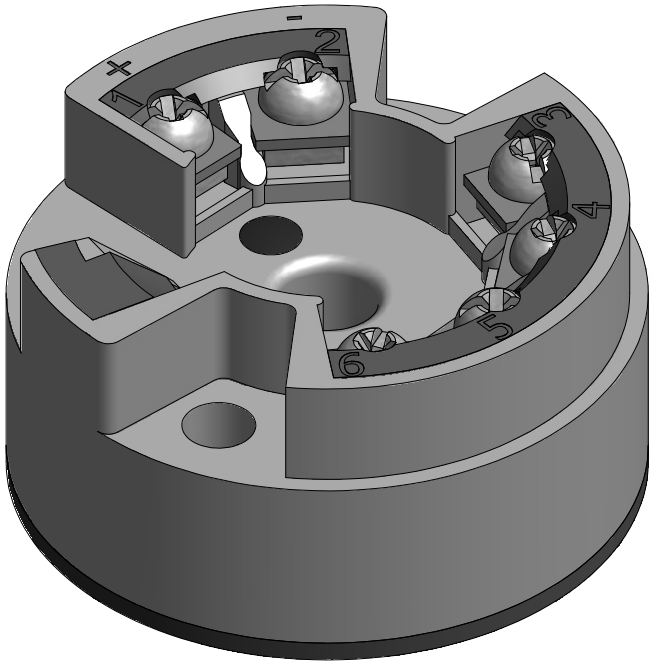
Approvals

CE marked	Unit complies with the legal requirements set forth by the EU regulations.
c UL us	UL Recognized Component
FM APPROVED CSA	General Purpose and non-incendive for use in hazardous locations Class I, Division 2 Groups A, B, C and D

The Series 441 programmable temperature transmitter is a 2-wire transmitter with an analog output. It has measurement input for resistance thermometers (RTD) in 2-, 3- or 4-wire connections, thermocouples, resistance and voltage inputs. Setting up of the transmitter is done using the communication cable. These small units can be mounted in Pyromation DIN (Form B) connection heads or they can be used for surface mounting by using a 35 mm DIN-rail mounting clip.

TEMPERATURE HEAD TRANSMITTER

Universal head transmitter for resistance thermometers (RTD), thermocouples, resistance and voltage inputs, programmable using a PC, for installation in a sensor head (Form B)



Application Areas

- PC programmable temperature head transmitter for converting various input signals into an scalable (4 to 20) mA analog output signal
- Input:
  Resistance thermometer (RTD)
  Thermocouple (TC)
  Resistance (Ω)
  Voltage (mV)
- Online configuration using PC with SETUP connector

Features and Benefits

- Universally PC programmable for various signals
- Galvanic isolation
- 2-wire technology, (4 to 20) mA analog output
- High accuracy in total ambient temperature range
- Fault signal on sensor break or short circuit
- RFI/EMI Protected, CE marked
- c UL us UL Recognized Component
- CSA Intrinsically safe and non-incendive for hazardous locations
- FM Intrinsically safe and non-incendive for hazardous locations
- Online configuration during measurement using SETUP connector
- Output simulation

ORDER CODES

Unconfigured Order Number: **441-00[1]**

Example Configured Order Number:

1	2	3		4	5
4 4 1	-	1	J	U	-	S (50-300)	F

1

CODE	DESCRIPTION
1	Thermocouple (TC)
2	RTD (2-wire)
3	RTD (3-wire)
4	RTD (4-wire)

2

CODE	DESCRIPTION
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
R	Type R thermocouple
S	Type S thermocouple
B	Type B thermocouple
85	100 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)
55	500 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)
95	1000 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)
MV	Millivolts
W	Resistance

[1] Default setting for unconfigured transmitter is 3-wire Pt100 (0 - 100) °C.

3

CODE	DESCRIPTION
U	Upscale Burnout ≥ 21.0 mA
D	Downscale Burnout ≤ 3.5 mA

4

RANGE
S (lower limit – upper limit)

5

CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

Accessories

CODE	DESCRIPTION
10303	Communication cable and software (USB)
10307	35 mm DIN-rail mounting clip

INPUT

Resistance Thermometer (RTD)

TYPE	MEASUREMENT RANGE		MINIMUM RANGE
Pt100 (α = 0.003 85 $^{o}C^{-1}$)	(-200 to 850) °C	[-328 to 1562] °F	10° C [18 °F]
Pt500	(-200 to 250) °C	[-328 to 482] °F	10° C [18 °F]
Pt1000	(-200 to 250) °C	[-328 to 482] °F	10° C [18 °F]
Ni100 (α = 0.006 18 $^{o}C^{-1}$)	(-60 to 180) °C	[-76 to 356] °F	10° C [18 °F]
Ni500	(-60 to 150) °C	[-76 to 302] °F	10° C [18 °F]
Ni1000	(-60 to 150) °C	[-76 to 302] °F	10° C [18 °F]
Connection type	2-, 3- or 4-wire connection cable. Resistance compensation possible in the 2-wire system (0 to 20) Ω		
Sensor cable resistance	maximum 11 Ω per cable		
Sensor current	≤ 0.6 mA		

Resistance (Ω)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Resistance (Ω)	(10 to 400) Ω (10 to 2000) Ω	10 Ω 100 Ω

Thermocouples (TC)

TYPE	MEASUREMENT RANGE		MINIMUM RANGE
B (PtRh30-PtRh6)	(0 to 1820) °C	[32 to 3308] °F	500 °C [900 °F]
C (W5Re-W26Re)	(0 to 2320) °C	[32 to 4208] °F	500 °C [900 °F]
D (W3Re-W25Re) [3]	(0 to 2495) °C	[32 to 4523] °F	500 °C [900 °F]
E (NiCr-CuNi)	(-200 to 915) °C	[-328 to 1679] °F	50 °C [90 °F]
J (Fe-CuNi)	(-200 to 1200) °C	[-328 to 2192] °F	50 °C [90 °F]
K (NiCr-Ni)	(-200 to 1372) °C	[-328 to 2501] °F	50 °C [90 °F]
L (Fe-CuNi) [2]	(-200 to 900) °C	[-328 to 1652] °F	50 °C [90 °F]
N (NiCrSi-NiSi)	(-270 to 1300) °C	[-454 to 2372] °F	50 °C [90 °F]
R (PtRh13-Pt)	(0 to 1768) °C	[32 to 3214] °F	500 °C [900 °F]
S (PtRh10-Pt)	(0 to 1768) °C	[32 to 3214] °F	500 °C [900 °F]
T (Cu-CuNi)	(-200 to 400) °C	[-328 to 752] °F	50 °C [90 °F]
U (Cu-CuNi) [2]	(-200 to 600) °C	[-328 to 1112] °F	50 °C [90 °F]
MoRe5-MoRe41 [1]	(0 to 2000) °C	[32 to 3632] °F	500 °C [900 °F]
Cold junction	internal (Pt100) or external (0 to 80) °C [32 to 176] °F		
Cold junction accuracy	± 1 °C		

[1] no reference
[2] according to DIN 43710
[3] according to ASTM E1751

Voltage (mV)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Millivolt (mV)	(-10 to 100) mV	5 mV

OUTPUT

Output (Analog)

Output signal	(4 to 20) mA or (20 to 4) mA
Transmission as	Temperature linear, resistance linear, voltage linear
Maximum load	($V_{power\ supply}$ - 8 V) / 0.025 A (current output)
Digital filter 1st degree	(0 to 8) s
Induced current required	≤ 3.5 mA
Current limit	≤ 25 mA
Switch on delay	4 s (during power up I_a = 3.8 mA)
Electronic response time	1 s

Failure Mode

Undershooting measurement range	Decrease to 3.8 mA
Exceeding measurement range	Increase to 20.5 mA
Sensor breakage/short circuit [1]	≤ 3.5 mA or ≥ 21.0 mA

Electrical Connection

Power supply	U_b = (8 to 30) V dc, polarity protected
Galvanic isolation (In/out)	Û = 3.75 kV ac
Allowable ripple	U_{ss} ≤ 5 V at U_b ≥ 13 V, f_{max} = 1 kHz

ACCURACY

Reference conditions	Calibration temperature (23 ± 5) °C [73 ± 9] °F

Resistance Thermometer (RTD)

TYPE	MEASUREMENT ACCURACY
Pt100, Ni100 Pt500, Ni500 Pt1000, Ni1000	± 0.2 °C or 0.08% [2] ± 0.5 °C or 0.20% [2] ± 0.3 °C or 0.12% [2]

Resistance (Ω)

TYPE	MEASUREMENT ACCURACY	MEASUREMENT RANGE
Resistance	± 0.1 Ω or 0.08% [2]	(10 to 400) Ω
	± 1.5 Ω or 0.12% [2]	(10 to 2000) Ω

[1] Not for thermocouple
[2] % is related to the adjusted measurement range (the value to be applied is the greater)

ACCURACY (continued)

Thermocouple (TC)

TYPE	MEASUREMENT ACCURACY
K, J, T, E, L, U N, C, D S, B, R MoRe5-MoRe41	± 0.5 °C or 0.08% [1] ± 1.0 °C or 0.08% [1] ± 2.0 °C or 0.08% [1]
Influence of the internal reference junction	Pt100 ± (0.30 + 0.005 |t|) °C |t| = value of temperature without regard to sign °C

Voltage (mV)

TYPE	MEASUREMENT ACCURACY	MEASUREMENT RANGE
Millivolt (mV)	± 20 µV or 0.08% [1]	(-10 to 100) mV

General Accuracy

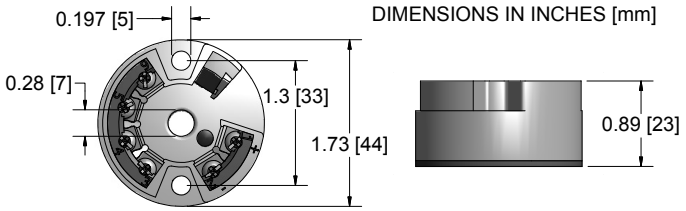
Influence of power supply	± 0.01%/V deviation from 24 V [2]
Load influence	± 0.02%/100 Ω [2]
Temperature drift	Resistive thermometer (RTD): T_d = ± (15 ppm/°C × range end value + 50 ppm/°C × measurement range) × $\Delta\vartheta$ Resistive thermometer Pt100: T_d = ± (15 ppm/°C × (range end value + 200) + 50 ppm/°C × measurement range) × $\Delta\vartheta$ Thermocouple (TC): T_d = ± (50 ppm/°C × range end value + 50 ppm/°C × measurement range) × $\Delta\vartheta$ $\Delta\vartheta$ = Deviation of the ambient temperature according to the reference condition
Long term stability	≤ 0.1 °C/year [3] or ≤ 0.05%/year [1][3]
[1] % is related to the adjusted measurement range (the value to be applied is the greater) [2] All data is related to a measurement end value of 20 mA [3] Under reference conditions	

INSTALLATION CONDITIONS

Ambient Conditons

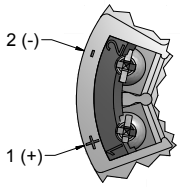
Ambient temperature	(-40 to 85) °C [-40 to 185] °F
Storage temperature	(-40 to 100) °C [-40 to 212] °F
Climatic class	To EN 60 654-1, Class C
Moisture condensation	Allowable
Vibration protection	4 g / (2 to 150) Hz according to IEC 60 068-2-6
EMC immunity	Interference immunity and interference emission as per EN 61 326-1 (IEC 1326)

MECHANICAL CONSTRUCTION

Dimensions	
Weight	approximately 40 g
Materials	Housing: Polycarbonate • Potting: Polyurethane
Terminals	15 AWG (maximum)

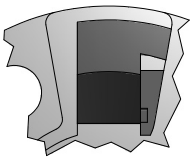
Terminal Connections

Power supply and current output

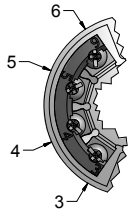


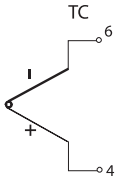
(8 to 30) V dc
(4 to 20) mA

SETUP socket

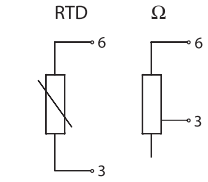


Sensor Connection

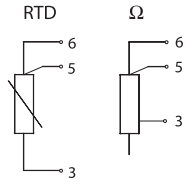




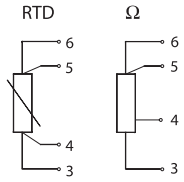
2-Wire



3-Wire



4-Wire



Remote Operation

Configurable parameters	Sensor type and connection type, engineering units (°C/°F), measurement range, internal/external cold junction compensation, cable resistance compensation on 2 wire connection, fault conditioning, output signal (4 to 20) mA or (20 to 4) mA, digital filter (damping), offset, measurement point identification (8 characters), output simulation

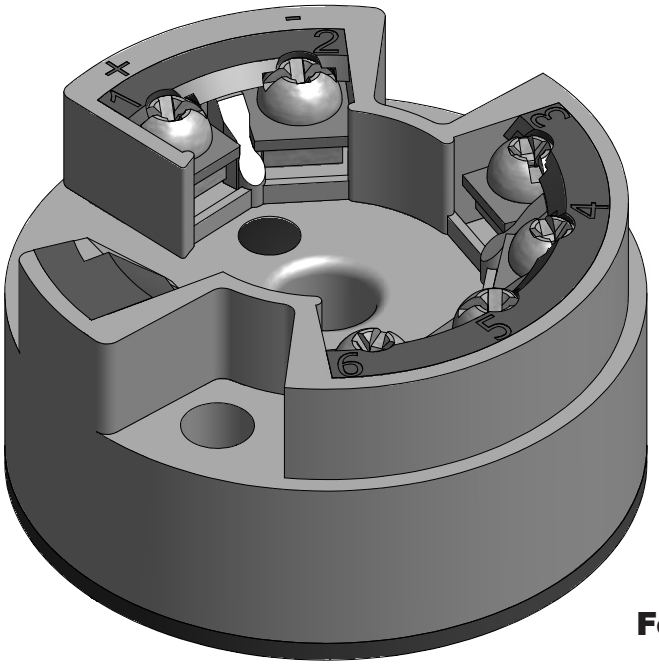
Approvals

CE marked	Unit complies with the legal requirements set forth by the EU regulations.
c UL us	UL Recognized Component
FM APPROVED CSA	General Purpose and non-incendive for use in hazardous locations Class I, Division 2 Groups A, B, C and D

The Series 442 programmable HART® temperature transmitter is a 2-wire transmitter with an analog output. It has measurement input for resistance thermometers (RTD) in 2-, 3- or 4-wire connections, thermocouples, resistance and voltage inputs. The transmitter can be programmed with a PC or HART® protocol hand-held terminal. These small units can be mounted in Pyromation DIN (Form B) connection heads, or they can be used for surface mounting by using a 35 mm DIN-rail mounting clip.

TEMPERATURE HEAD TRANSMITTER

Intrinsically safe universal head transmitter for resistance thermometers (RTD), thermocouples, resistance and voltage inputs, programmable using HART® protocol, for installation in a sensor head (Form B).



HART COMMUNICATION PROTOCOL

Features and Benefits

- Universal settings with HART® protocol for various signals.
- Galvanic isolation
- 2-wire technology, (4 to 20) mA analog output
- High accuracy in total ambient temperature range
- Fault signal on sensor break or short circuit
- RFI/EMI Protected, CE marked
- c UL us UL Recognized Component
- CSA Intrinsically safe and non-incendive for hazardous locations
- FM Intrinsically safe and non-incendive for hazardous locations
- Output simulation

ORDER CODES

Unconfigured Order Number: **442-00[1]**

Example Configured Order Number:

1	2	3		4	5
4 4 2	-	1	J	U	-	S (50-300)	F

1

CODE	DESCRIPTION
1	Thermocouple (TC)
2	RTD (2-wire)
3	RTD (3-wire)
4	RTD (4-wire)

2

CODE	DESCRIPTION
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
R	Type R thermocouple
S	Type S thermocouple
B	Type B thermocouple
85	100 ohm platinum (α = 0.003 85 $ºC^{-1}$)
55	500 ohm platinum (α = 0.003 85 $ºC^{-1}$)
95	1000 ohm platinum (α = 0.003 85 $ºC^{-1}$)
MV	Millivolts
W	Resistance

3

CODE	DESCRIPTION
U	Upscale Burnout ≥ 21.0 mA
D	Downscale Burnout ≤ 3.6 mA

4

RANGE
S (lower limit – upper limit)

5

CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

Accessories

CODE	DESCRIPTION
10307	35 mm DIN rail mounting clip

[1] Default setting for unconfigured transmitters is 3-wire Pt100 (0 - 100) °C.

INPUT

Resistance Thermometer (RTD)

TYPE	MEASUREMENT RANGE		MINIMUM RANGE
Pt100 (α = 0.003 85 $^{o}C^{-1}$)	(-200 to 850) °C	[-328 to 1562] °F	10° C [18 °F]
Pt500	(-200 to 250) °C	[-328 to 482] °F	10° C [18 °F]
Pt1000	(-200 to 250) °C	[-328 to 482] °F	10° C [18 °F]
Ni100 (α = 0.006 18 $^{o}C^{-1}$)	(-60 to 250) °C	[-76 to 356] °F	10° C [18 °F]
Ni500	(-60 to 150) °C	[-76 to 302] °F	10° C [18 °F]
Ni1000	(-60 to 150) °C	[-76 to 302] °F	10° C [18 °F]
Connection Type	2-, 3- or 4-wire connection cable. Resistance compensation possible in the 2 wire system (0 to 30) Ω		
Sensor cable resistance	maximum 11 Ω per cable		
Sensor current	≤ 0.2 mA		

Resistance (Ω)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Resistance (Ω)	(10 to 400) Ω (10 to 2000) Ω	10 Ω 100 Ω

Thermocouples (TC)

TYPE	MEASUREMENT RANGE		MINIMUM RANGE
B (PtRh30-PtRh6)	(0 to 1820) °C	[32 to 3308] °F	500 °C [900 °F]
C (W5Re-W26Re)	(0 to 2320) °C	[32 to 4208] °F	500 °C [900 °F]
D (W3Re-W25Re) [3]	(0 to 2495) °C	[32 to 4523] °F	500 °C [900 °F]
E (NiCr-CuNi)	(-270 to 1000) °C	[-454 to 1832] °F	50 °C [90 °F]
J (Fe-CuNi)	(-210 to 1200) °C	[-346 to 2192] °F	50 °C [90 °F]
K (NiCr-Ni)	(-270 to 1372) °C	[-454 to 2501] °F	50 °C [90 °F]
L (Fe-CuNi) [2]	(-200 to 900) °C	[-328 to 1652] °F	50 °C [90 °F]
N (NiCrSi-NiSi)	(-270 to 1300) °C	[-454 to 2372] °F	50 °C [90 °F]
R (PtRh13-Pt)	(-50 to 1768) °C	[-58 to 3214] °F	500 °C [900 °F]
S (PtRh10-Pt)	(-50 to 1768) °C	[-58 to 3214] °F	500 °C [900 °F]
T (Cu-CuNi)	(-270 to 400) °C	[-454 to 752] °F	50 °C [90 °F]
U (Cu-CuNi) [2]	(-200 to 600) °C	[-328 to 1112] °F	50 °C [90 °F]
MoRe5-MoRe41 [1]	(0 to 2000) °C	[32 to 3632] °F	500 °C [900 °F]
Cold junction	internal (Pt100) or external (0 to 80) °C [32 to 176] °F		
Cold junction accuracy	± 1 °C		

[1] no reference
[2] according to DIN 43710
[3] according to ASTM E1751

Voltage (mV)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Millivolt (mV)	(-10 to 75) mV	5 mV

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OUTPUT

Output (Analog)

Output signal	(4 to 20) mA or (20 to 4) mA
Transmission as	Temperature linear, resistance linear, voltage linear
Maximum load	($V_{power\ supply}$ - 11.5V) / 0.022 A current output)
Digital filter 1st degree	(0 to 60) s
Induced current required	≤ 3.5 mA
Current limit	≤ 25 mA
Switch on delay	4 s (during power up I_a = 3.8 mA)
Electronic response time	1 s

Failure Mode

Undershooting measurement range	Decrease to 3.8 mA
Exceeding measurement range	Increase to 20.5 mA
Sensor breakage/short circuit [1]	≤ 3.6 mA or ≥ 21.0 mA
[1] Not for thermocouple	

Electrical Connection

Power supply	U_b = (11.5 to 30) V dc, polarity protected
Galvanic isolation (In/out)	Û = 2 kV ac
Allowable ripple	U_{ss} ≤ 3 V at U_b ≥ 13 V, f_{max} = 1 kHz

ACCURACY

Reference conditions	Calibration temperature (23 ± 5) °C [73 ± 9] °F

Resistance Thermometer (RTD)

TYPE	MEASUREMENT ACCURACY
Pt100, Ni100 Pt500, Ni500 Pt1000, Ni1000	± 0.2 °C or 0.08% [2] ± 0.5 °C or 0.20% [2] ± 0.3 °C or 0.12% [2]

Resistance (Ω)

TYPE	MEASUREMENT ACCURACY	MEASUREMENT RANGE
Resistance	± 0.1 Ω or 0.08% [2]	(10 to 400) Ω
	± 1.5 Ω or 0.12% [2]	(10 to 2000) Ω
[2] % is related to the adjusted measurement range (the value to be applied is the greater)		

ACCURACY (continued)

Thermocouple (TC)

TYPE	MEASUREMENT ACCURACY [1]
K, J, T, E, L, U N, C, D S, B, R MoRe5-MoRe41	± 0.5 °C or 0.08% ± 1.0 °C or 0.08% ± 2.0 °C or 0.08%
Influence of the internal reference junction	Pt100 ± (0.30 + 0.005 |t|) °C |t| = value of temperature without regard to sign °C

Voltage (mV)

TYPE	MEASUREMENT ACCURACY	MEASUREMENT RANGE
Millivolt (mV)	± 20 µV or 0.08% [1]	(-10 to 100) mV

General Accuracy

Influence of power supply	± 0.01%/V deviation from 24 V [2]
Load influence	± 0.02%/100 Ω [2]
Temperature drift	Resistive thermometer (RTD): T_d = ± (15 ppm/°C × range end value + 50 ppm/°C measurement range) × $\Delta\vartheta$ Resistive thermometer Pt100: T_d = ± (15 ppm/°C × (range end value + 200) + 50 ppm/°C × measurement range) × $\Delta\vartheta$ Thermocouple (TC): T_d = ± (50 ppm/°C × range end value + 50 ppm/°C measurement range) × $\Delta\vartheta$ $\Delta\vartheta$ = Deviation of the ambient temperature according to the reference condition
Long term stability	≤ 0.1 °C/year [3] or ≤ 0.05%/year [1][3]

[1] % is related to the adjusted measurement range (the value to be applied is the greater)
[2] All data is related to a measurement end value of 20 mA
[3] Under reference conditions

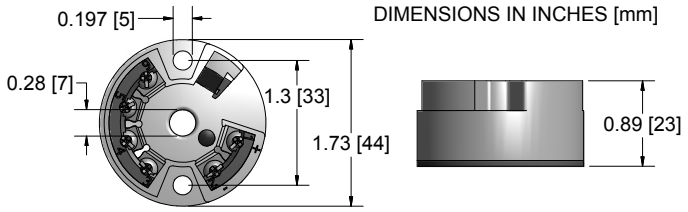
INSTALLATION CONDITIONS

Ambient Conditions

Ambient temperature	(-40 to 85) °C [-40 to 185] °F
Storage temperature	(-40 to 100) °C [-40 to 212] °F
Climatic class	To EN 60 654-1, Class C
Moisture condensation	Allowable
Vibration protection	4 g / (2 to 150) Hz according to IEC 60 068-2-6
EMC immunity	Interference immunity and interference emission as per EN 61 326-1 (IEC 1326)

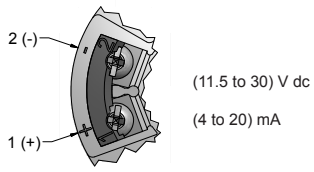
HART® is a registered trademark of HART Communication Foundation

MECHANICAL CONSTRUCTION

Dimensions	
Weight	approximately 40 g
Materials	Housing: Polycarbonate • Potting: Polyurethane
Terminals	15 AWG (maximum)

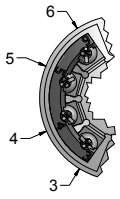
Terminal Connections

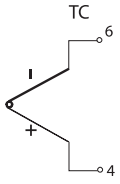
Power supply and current output

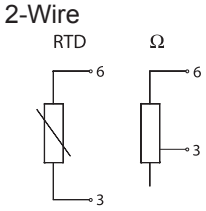


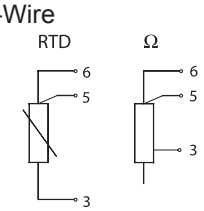
HART® Communication on (4 to 20) mA

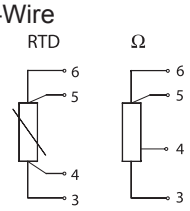
Sensor Connection











Remote Operation

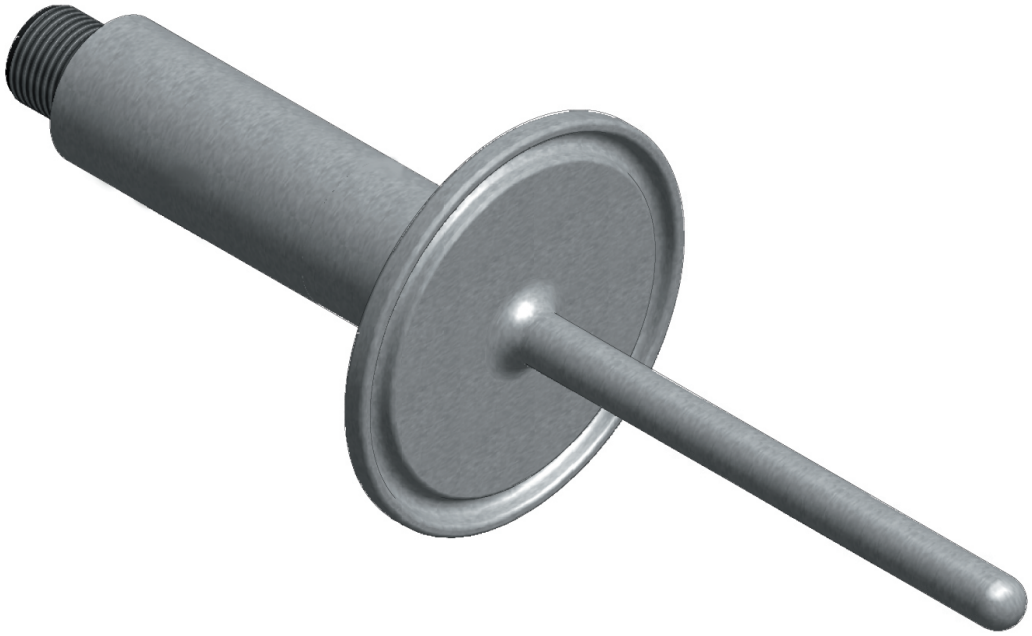
Configurable parameters	Sensor type and connection type, engineering units (°C/°F), measurement range, internal/external cold junction compensation, cable resistance compensation on 2-wire connection, fault conditioning, output signal (4 to 20) mA or (20 to 4) mA, digital filter (damping), offset, measurement point identification (8 characters), output simulation

Approvals

CE marked	Unit complies with the legal requirements set forth by the EU regulations.
c UL us	UL Recognized Component
FM APPROVED CSA	General Purpose and non-incendive for use in hazardous locations Class I, Division 2 Groups A, B, C and D

The Series 450 Programmable Integral Temperature Transmitter is ideal for monitoring temperature in highly moist or corrosive environments and in small areas such as pipes and tanks. The unit consists of a 4-wire Pt100 RTD sensor, built-in (4 to 20) mA transmitter, and process connection. The integral design eliminates all external screw connections, simplifying the electrical installation process and solving the problems caused by moisture, loose connections, and corrosion. A "quick disconnect" M12 plug adapter connects the transmitter to a PC for ease of calibration, re-programming, and wiring accuracy.

SERIES 450 PROGRAMMABLE INTEGRAL TEMPERATURE TRANSMITTER



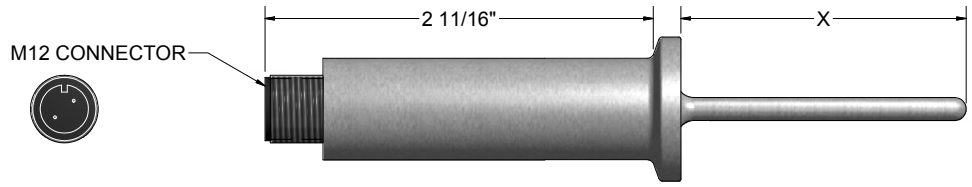
Application Areas

- PC programmable temperature transmitter for converting Pt100 input signal into a scalable (4 to 20) mA analog output signal
- Platinum Resistance Thermometer (RTD)
- Ideal for use in applications where sanitary wash-down procedures are required
- Compact design is well suited for use in small areas such as tanks and pipes
- Used for measuring temperatures from (-51 to 160) °C [-60 to 320] °F

Features and Benefits

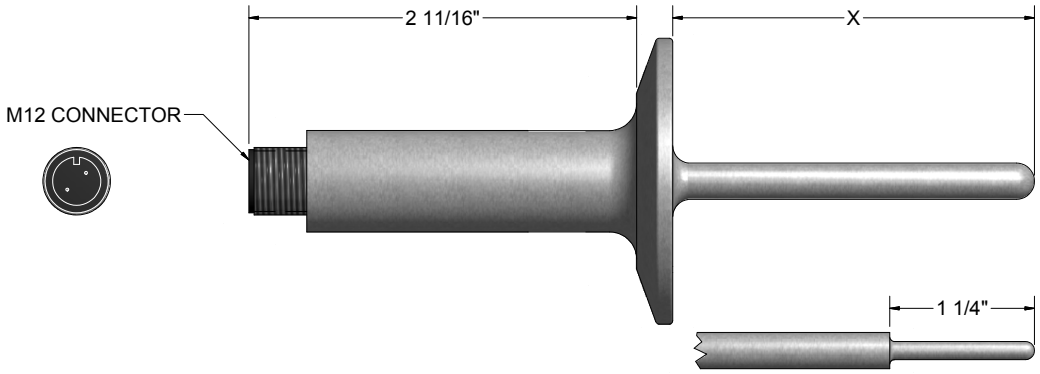
- PC programmable transmitter with (4 to 20) mA output
- Reliable measurements despite fluctuations in ambient temperature
- Available in threaded and Clean-In-Place (CIP) connections
- RFI/EMI Protected
- c UL us UL Recognized Component

MINIATURE CIP RTD ASSEMBLY



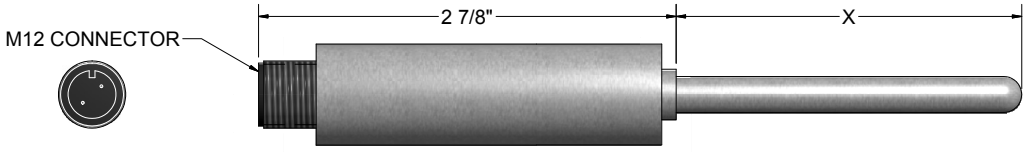
See Food & Dairy Section For Ordering Information

CIP RTD ASSEMBLY



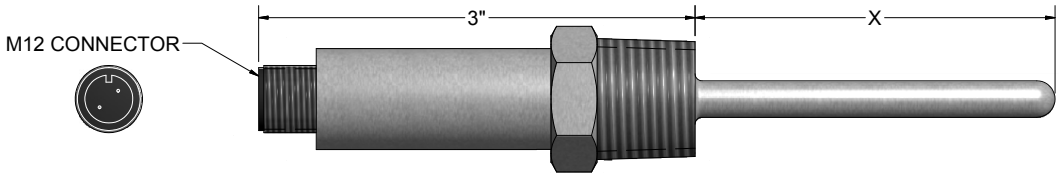
See Food & Dairy Section For Ordering Information

RTD ASSEMBLY WITH NO PROCESS FITTING



See RTD Section For Ordering Information

RTD ASSEMBLY WITH THREADED CONNECTION



See RTD Section For Ordering Information

INPUT

Resistance Thermometer Input (RTD)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Pt100 (α = 0.003 85)	(-51 to 160) °C [-60 to 320] °F	10 ˚C [18 ˚F]
Connection Type	4 wire connection (standard)	
Sensor current	≤ 0.6 mA	

OUTPUT

Output (Analog)

Output signal	(4 to 20) mA or (20 to 4) mA
Transmission as	Temperature linear
Maximum load	($V_{power\ supply}$ - 10 V) / 0.023 A (current output)
Induced current required	≤ 3.5 mA
Current limit	≤ 23 mA
Switch on delay	2 s
Electronic response time	1 s

Failure Mode

Undershooting measurement range	Decreases to 3.8 mA
Exceeding measurement range	Increases to 20.5 mA
Sensor breakage/short circuit	≤ 3.6 mA or ≥ 21.0 mA

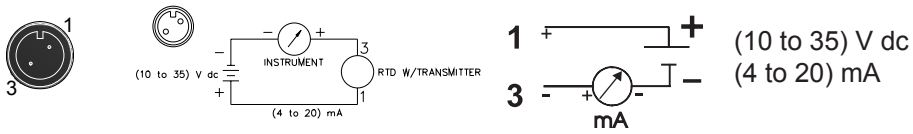
ACCURACY

Accuracy

Electronics measurement error	0.1 °C or 0.08% [1]
Reference conditions	Calibration temperature (23 ± 5) °C [73 ± 9] °F
Sensor measurement error	Class A ± (0.15 + 0.002 |t|) °C Class B ± (0.3 + 0.005 |t|) °C Grade B ± (0.25 + 0.0042 |t|) °C Class AA ± (0.01 + 0.0017 |t|) °C 1/5 Class B ± (0.06 + 0.0017 |t|) °C |t| = value of temperature without regard to sign, °C
Influence of power supply	± 0.01%/V deviation from 24 V [2]
Load influence	± 0.02%/100 Ω [2]
Temperature drift	T_d = ± (15 ppm/°C × (full scale value + 200) + 50 ppm/°C of set measuring range) × Δ^o Δ^o = deviation of ambient temperature from the reference operation condition
Electronics long term stability	≤ 0.1 °C/year [3] or ≤ 0.05%/year [1][3]

[1] % is related to the adjusted measurement range (the value to be applied is the greater)
[2] All data is related to a measurement and value of 20 mA
[3] Under reference conditions

Electrical Connection

Electrical connection	 Electrical connection of the compact thermometer (view from above) - M12 plug, 4-pin Pin 1: Power supply (10 to 35) V dc; Current output (4 to 20) mA Pin 2: PC configuration cable connection Pin 3: Power supply 0 V dc; current output (4 to 20) mA Pin 4: PC configuration cable connection
Power supply	U_b = (10 to 35) V dc, polarity protected
Allowable ripple	$U_{ss} \leq 3V$ at $U_b \geq 13V$, f_{max} = 1 kHz

Environmental Conditions

Ambient Temperature	(-40 to 85) ˚C [-40 to 185] ˚F
Storage Temperature	(-40 to 100) ˚C [-40 to 212] ˚F
Climatic Class	EN 60 654-1, class C
Condensation	Permitted
Ingress protection	IP 67
Shock resistance	4g / (2 to 150) Hz as per IEC 60 068-2-6
EMC immunity	Interference immunity and interference emission as per EN 61 326-1 (IEC 1326)

Process

	MAXIMUM AMBIENT	MAXIMUM PROCESS
Process temperature limit	to 25 °C [77 °F] to 40 °C [104 °F] to 60 °C [140 °F] to 85 °C [185 °F]	160 °C [320 °F] 135 °C [275 °F] 120 °C [248 °F] 100 °C [212 °F]

Approvals

c UL us	UL Recognized Component
3A AUTHORIZED 74-	3-A Sanitary Council Standard 74- (CIP sensors only)

The Series 642 programmable HART® field temperature transmitter is a 2-wire unit with analog output. It includes input for RTDs; resistance inputs in 2-wire, 3-wire, and 4-wire connections; thermocouples and voltage signals. The transmitter can be supplied with or without a digital display, in either a general-purpose aluminum housing, or explosion-proof aluminum housing. The Series 642 can be programmed with a PC or a HART® protocol handheld terminal. When supplied with a digital display, the LC screen shows the current measured value and a bar graph with limit value violation indicator.

PROGRAMMABLE FIELD TEMPERATURE TRANSMITTER

Programmable temperature transmitter for resistance thermometers (RTDs), thermocouples, resistance inputs and voltage inputs: adjustable via HART® protocol.

HART COMMUNICATION PROTOCOL

Application Areas

- Temperature field transmitter with HART® protocol for converting various input signals to an analog, scaleable (4 to 20) mA output signal
- Input:
  Resistance thermometer (RTD)
  Thermocouples (TC)
  Resistance input (Ohm)
  Voltage input (mV)
- HART® protocol for operating the device on site using a handheld communicator or remotely via the PC

Features and Benefits

- Universally programmable with HART® protocol for various input signals
- Illuminated display, rotatable
- Operation, visualization and maintenance with PC; e.g. using TransComm Light operating software
- 2-wire technology, analog output (4 to 20) mA
- Undervoltage detection
- Highly accurate in entire operating temperature range
- Approvals:
  FM and CSA (IS, NI, XP and DIP)
- Galvanic isolation
- Output simulation
- Min./max. process values recorded
- Customized measuring range setup or expanded SETUP; see questionnaire

FM APPROVED CE marked

ORDER CODES

Example Order Number:

1-0		1-1		1-2	1-3	1-4		1-5	1-6
642A	-	D	-	3	85	U	-	S(0-200)	C

1-0 Transmitter Type

CODE	DESCRIPTION
642A	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing
642C	(4 to 20) mA HART® Field Transmitter with explosion-proof aluminum housing FM/CSA / XP Class I / Div 1/ Groups A,B,C,D / DIP Class II / Div 1 / Groups E,F,G / Class III / NI Class I / Div 2 / Groups A,B,C,D
642F	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing FM/CSA IS Class I / Div 1 / Groups A,B,C,D / NI Class I / Div 2 / Groups A,B,C,D

1-1 Options

CODE	DESCRIPTION
T	Solid cover
D	Glass cover with digital display

1-2 Input Type

CODE	DESCRIPTION
00	Unconfigured[1]
1	Thermocouple (TC) or millivolt
2	RTD (2-wire) or resistance
3	RTD (3-wire) or resistance
4	RTD (4-wire) or resistance

[1] Default setting for unconfigured transmitter is 3-wire Pt100 (0 - 100) °C

Accessories

CODE	DESCRIPTION
10321	Pipe mounting bracket for use on pipes with a diameter between 1.5" to 3.3"

1-3 Sensor Type

CODE	DESCRIPTION
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
R	Type R thermocouple
S	Type S thermocouple
B	Type B thermocouple
85	100 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)
55	500 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)
95	1000 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)
MV	Millivolts
W	Resistance
Other types available. Consult factory.	

1-4 Failure Mode

CODE	DESCRIPTION
U	Upscale Burnout ≥ 23 mA
D	Downscale Burnout ≤ 3 mA

1-5 Range

CODE	DESCRIPTION
S	(lower limit – upper limit)

1-6 Unit of Measure

CODE	DESCRIPTION
C	Celsius
F	Fahrenheit
K	Kelvin

INPUT

Resistance Thermometer (RTD)

TYPE	STANDARDS	MEASUREMENT RANGE		MINIMUM RANGE
Pt100 (α = 0.003 85 °C^{-1}) Pt200 Pt500 Pt1000	ASTM E1137 IEC 60 751	(-200 to 850) °C (-200 to 850) °C (-200 to 250) °C (-200 to 250) °C	[-328 to 1562] °F [-328 to 1562] °F [-328 to 482] °F [-328 to 482] °F	10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F]
Pt100 (α = 0.003 916)	JIS C1604	(-200 to 649) °C	[-328 to 1200] °F	10 °C [18 °F]
Pt100 (α = 0.003 923)	SAMA	(-100 to 700) °C	[-148 to 1292] °F	10 °C [18 °F]
Ni100 (α = 0.006 180) Ni1000 (α = 0.006 180)	DIN 43 760	(-60 to 250) °C (-60 to 150) °C	[-76 to 482] °F [-76 to 302] °F	10 °C [18 °F] 10 °C [18 °F]
Ni120 (α = 0.006 720) Cu10 (α = 0.004 274)	Edison Curve	(-70 to 270) °C (-100 to 260) °C	[-94 to 518] °F [-148 to 500] °F	10 °C [18 °F] 10 °C [18 °F]
Pt50 (α = 0.003 911) Pt100 (α = 0.003 911) Cu50 (α = 0.004 278) Cu100 (α = 0.004 278)	GOST	(-200 to 1100) °C (-200 to 850) °C (-200 to 200) °C (-200 to 200) °C	[-328 to 2012] °F [-328 to 1562] °F [-328 to 392] °F [-328 to 392] °F	10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F]
Polynomial RTD Pt100 (Callendar - van Dusen)		(-200 to 850) °C (-200 to 850) °C	[-328 to 1562] °F [-328 to 1562] °F	10 °C [18 °F] 10 °C [18 °F]
Connection type		2-, 3- or 4-wire connection cable resistance compensation possible in the 2 wire system (0 to 30) Ω		
Sensor cable resistance		3-wire and 4-wire connection, sensor wire resistance to maximum 50 Ω per wire		
Sensor current		≤ 0.3 mA		

Resistance (Ω)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Resistance (Ω)	(10 to 400) Ω (10 to 2000) Ω	10 Ω 100 Ω

Thermocouples (TC) (ASTM E230)

TYPE	MEASUREMENT RANGE		MINIMUM RANGE
B (PtRh30-PtRh6)	(0 to 1820) °C	[32 to 3308] °F	500 °C [900 °F]
C (W5Re-W26Re)	(0 to 2320) °C	[32 to 4208] °F	500 °C [900 °F]
D (W3Re-W25Re) [1]	(0 to 2495) °C	[32 to 4523] °F	500 °C [900 °F]
E (NiCr-CuNi)	(-270 to 1000) °C	[-454 to 1832] °F	50 °C [90 °F]
J (Fe-CuNi)	(-210 to 1200) °C	[-346 to 2192] °F	50 °C [90 °F]
K (NiCr-Ni)	(-270 to 1372) °C	[-454 to 2501] °F	50 °C [90 °F]
L (Fe-CuNi) [2]	(-200 to 900) °C	[-328 to 1652] °F	50 °C [90 °F]
N (NiCrSi-NiSi)	(-270 to 1300) °C	[-454 to 2372] °F	50 °C [90 °F]
R (PtRh13-Pt)	(-50 to 1768) °C	[-58 to 3214] °F	500 °C [900 °F]
S (PtRh10-Pt)	(-50 to 1768) °C	[-58 to 3214] °F	500 °C [900 °F]
T (Cu-CuNi)	(-270 to 400) °C	[-454 to 752] °F	50 °C [90 °F]
U (Cu-CuNi) [2]	(-200 to 600) °C	[-328 to 1112] °F	50 °C [90 °F]
Cold junction	internal (Pt100) or external (0 to 80) °C [32 to 176] °F		
Cold junction accuracy	± 1 °C		
Max. sensor resistance	10 kΩ		
[1] According to ASTM E1751 [2] according to DIN 43 710			

Voltage (mV)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Millivolt (mV)	(-20 to 100) mV	5 mV

OUTPUT

Output (Analog)

Output signal	Analog (4 to 20) mA or (20 to 4) mA
Transmission as	Temperature linear, resistance linear, voltage linear
Maximum load	($V_{power\ supply}$ - 11V) / 0.022 A (current output)
Digital filter 1st degree	(0 to 60) s
Induced current required	≤ 3.5 mA
Current limit	≤ 23 mA
Switch on delay	4 s (during switch-on operation I_a = 4 mA)
Response time	1 s

Failure Mode

Undershooting measurement range	Decrease to 3.8 mA
Exceeding measurement range	Increase to 20.5 mA
Sensor breakage/short circuit	≤ 3.6 mA or ≥ 21.0 mA (configurable 21.6 mA to 23 mA)

Electrical Connection

Power supply	U_b = 11 to 40 Vdc (8 to 40 without display), reverse polarity protected
Cable entry	Three 1/2" NPT openings
Allowable ripple	U_{ss} ≤ 3 V at U_b ≥ 13.5 V, f_{max} = 1 kHz

ACCURACY

Reference conditions	Calibration temperature (23 ± 5) °C [73.4 ± 9] °F

Resistance Thermometer (RTD)

TYPE	MEASUREMENT ACCURACY - DIGITAL	MEASUREMENT ACCURACY - D/A[1]
Cu100, Pt100, Ni100, Ni120	± 0.2 °C [0.36 °F]	± 0.02%
Pt500	± 0.6 °C [1.08 °F]	± 0.02%
Cu50, Pt50, Pt1000, Ni1000	± 0.4 °C [0.72 °F]	± 0.02%
Cu10, Pt200	± 2 °C [3.6 °F]	± 0.02%

Thermocouple (TC)

TYPE	MEASUREMENT ACCURACY - DIGITAL	MEASUREMENT ACCURACY - D/A[1]
K, J, T, E, L, U	Typical ± 0.5 °C [0.9 °F]	± 0.02%
N, C, D	Typical ± 1 °C [0.18 °F]	± 0.02%
S, B, R	Typical ± 2 °C [3.6 °F]	± 0.02%

Resistance (Ω)

TYPE	MEASUREMENT ACCURACY - DIGITAL	MEASUREMENT ACCURACY - D/A[1]	MEASUREMENT RANGE
Resistance	± 0.08 Ω	± 0.02%	(10 to 400) Ω
	± 1.6 Ω	± 0.02%	(10 to 2000) Ω

Voltage (mV)

TYPE	MEASUREMENT ACCURACY - DIGITAL	MEASUREMENT ACCURACY - D/A[1]	MEASUREMENT RANGE
Voltage	± 20 µV	± 0.02%	(20 to 100) mV

[1] % relates to the set span. Accuracy = digital + D/A accuracy

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ACCURACY (continued)

Physical input range of the sensors

TYPE	MEASUREMENT ACCURACY[1]
(10 to 400) Ω	Cu10, Cu50, Cu100, polynomial RTD, Pt50, Pt100, Ni100, Ni120
(10 to 2000) Ω	Pt200, Pt500, Pt1000, Ni1000
(-20 to 100) mV	Thermocouple type: C, D, E, J, K, L, N
(-5 to 30) mV	Thermocouple type: B, R, S, T, U

[1] % is related to the adjusted measurement range (the value to be applied is the greater)

General

Repeatability	0.03% of the physical input range (15 Bit) Resolution A/D conversion: 18 Bit
Load influence	≤ ± 0.005%/V deviation from 24 V, related to the full-scale value
Long term stability	≤ 0.1 °C [0.18 °F] / year or ≤ 0.05%/year Date under reference conditions. % relates to the set span. The larger value applies.

Temperature Drift

Total temperature drift = input temperature drift + output temperature drift	Effect on the accuracy when ambient temperature changes by 1 °C [1.8 °F]	
	Input (10 to 400) Ω	0.002% of measured value
	Input (10 to 2000) Ω	0.002% of measured value
	Input (-20 to 100) mV	typ. 0.002% of measured value (maximum value = 1.5 x typical)
	Input (5 to 30) mV	typ. 0.002% of measured value (maximum value = 1.5 x typical)
	Output (4 to 20) mA	typ. 0.002% of measured value (maximum value = 1.5 x typical)

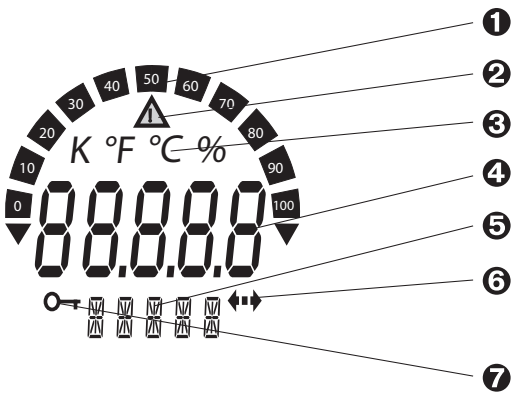
INSTALLATION CONDITIONS

Ambient Conditions

Ambient temperature	Without display: (-40 to 85) °C [-40 to 185] °F With display: (-40 to 70) °C [-40 to 158] °F NOTE: The display can react slowly for temperature < -20 °C [< -4 °F]
Storage temperature	Without display: (-40 to 100) °C [-40 to 212] °F With display: (-40 to 85) °C [-40 to 185] °F
Allowable Altitude	6500 ft. above sea level
Climatic class	As per EN 60 654-1, Class C
Moisture condensation	Allowable
Shock and vibration protection	3 g / (2 to 150) Hz according to IEC 60 068-2-6
EMC immunity	Interference immunity and interference emission as per EN 61 326-1 (IEC 1326) (0.08 to 2) GHz 10 V/m; (1.4 to 2) GHz 30 V/m to EN 61 000-4-3
Protection	IP67, NEMA 4X, Class 1, Division 1, Group A, B, C; Class II Division I, Groups E, F, G and Class III, Division I (when specified)

INTERFACE

Display Elements



LC display of the field transmitter (illuminated, can be rotated in 90° increments)

Item 1: Bar graph display in 10% increments with indicators for overranging / underranging
Item 2: 'Caution' display
Item 3: Unit display K, °F, or °C or %
Item 4: Measured value display (digit height 20.5 mm / 0.81 ")
Item 5: Status and information display
Item 6: 'Communication' display
Item 7: 'Programming disabled' display

Operating Elements

No operating elements are present directly on the display. The device parameters of the field transmitter are configured using the handheld communicator or a PC with HART® Modem and operating software TransComm Light.

Remote Operation

Interface	HART® communication via transmitter power supply
Configurable device parameters	Sensor type and connection type, engineering units (°C/°F), measurement ranges, internal/external cold junction, compensation of wire resistance with 2-wire connection, failure mode, output signal (4 to 20) mA (20 to 4) mA, digital filter (damping), offset, TAG+descriptor (8+16 characters), output simulation, customized linearization, recording of min./max process value, analog output: Option: customized linearization

STANDARDS

Approvals

CE marked	Unit complies with the legal requirements set forth by the EU regulations.
FM APPROVED CSA	Intrinsically safe and non-incendive or explosion proof for hazardous locations Class I, Division 1 and 2, Groups A, B, C and D
Other standards and guidelines	IEC 60 529: Degrees of protection through housing (IP code) IEC 61 010: Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures IEC1326: Electromagnetic compatibility (EMC requirements)

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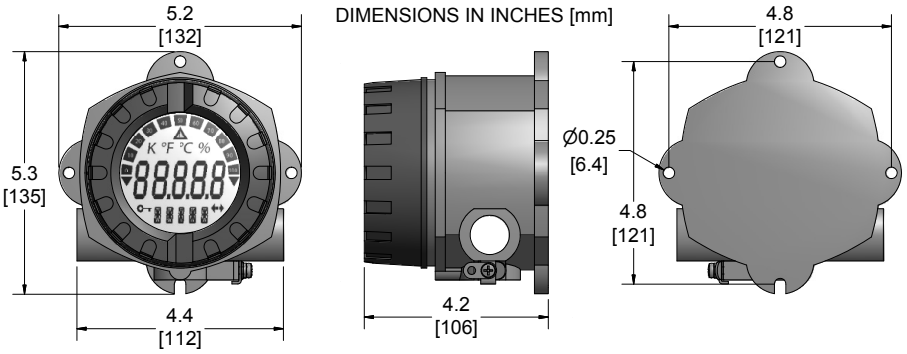
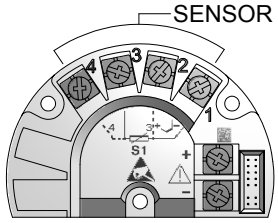
MECHANICAL CONSTRUCTION

Dimensions	 Display rotatable in 90° increments
Weight	approximately 1.6 kg [3.53 lb]
Materials	Housing: die-cast aluminum with powder coating
Terminals	Cables / wires up to max. 2.5 mm² (AWG 13)

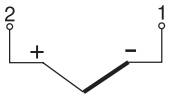
Terminal Connections



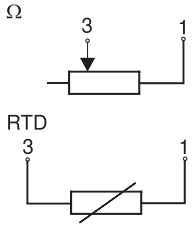
HART® Communication on (4 to 20) mA

Sensor

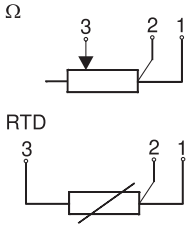
TC



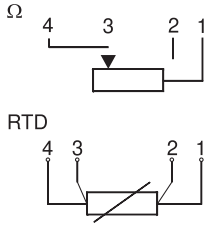
2-wire



3-wire



4-wire



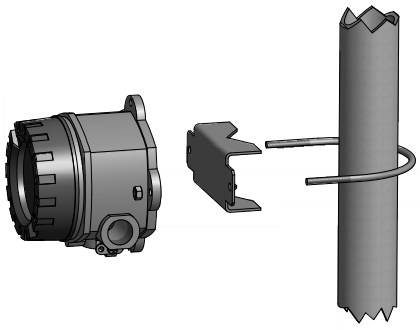
Optional Mounting Bracket

Part Number: 10321

Designed for use on pipes with a diameter between 1.5" to 3.3".

The additonal mounting plate must be used for pipes with a diameter of 1.5" to 2.2". No plate is required for pipes with a diameter of 2.2" to 3.3".

Assembly includes bracket, screws, and mounting plate.



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Configuration sheet for Series 642 temperature transmitter
For customer specific setup

Sensor

TC ( ) B ( ) C ( ) D ( ) E ( ) J
( ) K ( ) L ( ) N ( ) R ( ) S
( ) T ( ) U

RTD ( ) Pt100 ( ) Pt500 ( ) Pt1000
( ) Ni100 ( ) Ni500 ( ) Ni1000

( ) mV ( ) (10 to 400) Ohm ( ) (10 to 2000) Ohm

( ) 2-wire ( ) 3-wire ( ) 4-wire

Unit ( ) °C ( ) °F ( ) K ( ) mV ( ) Ohm

Range Lower limit [ ][ ][ ][ ][ ].[ ]

Upper limit [ ][ ][ ][ ][ ].[ ]

Note:
Must meet minimum space requirements

Expanded setup

Reference junction/TC only ( ) internal ( ) external [ ][ ][ ] (0 to 80) ºC (32 to 17) ºF

Compensation wire resistance S1 [ ][ ] (0 to 30) Ohm

Failure mode ( ) ≤ 3.6 mA ( ) ≥ 21.0 mA

Output ( ) (4 to 20) mA ( ) (20 to 4) mA

Filter [ ][ ] (0 to 60) s

Offset S1 [ ][ ].[ ] (-10 to 10) ºC [-18 to 18] ºF

Line voltage filter ( ) 50 Hz ( ) 60 Hz

TAG [ ][ ][ ][ ][ ][ ][ ][ ]

DESCRIPTION
16 characters max. [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

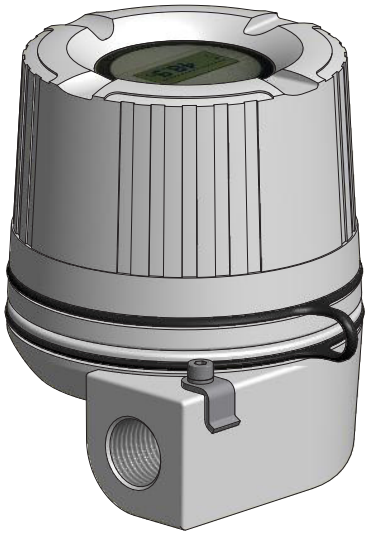
Transmitter

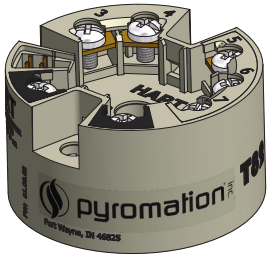
Configuration Code TM01
T82 Programmable HART®
Temperature Transmitter

The T82 programmable HART® field temperature transmitter is a 2-wire unit with analog output. It includes input for RTDs: resistance inputs in 2-wire, 3-wire, and 4-wire connections; thermocouples and voltage signals. The transmitter can be supplied with or without a digital display, in a general-purpose aluminum screw-cover housing. The T82 can be programmed using a HART® protocol handheld terminal. When supplied with a digital display, the LCD display shows the current measured value. When specified, the T82 transmitter is available with an optional Safety Integrity Level Rating (SIL) for critical applications.

PROGRAMMABLE DUAL INPUT TEMPERATURE TRANSMITTER

Programmable temperature transmitter for resistance thermometers (RTDs), thermocouples, resistance inputs and voltage inputs: adjustable via HART® protocol.





HART COMMUNICATION PROTOCOL

General Application Areas

- Temperature transmitter with 2 input channels and HART® protocol for converting various input signals to an analog, scalable (4 to 20) mA output signal
- Input:
  Resistance thermometer (RTD)
  Thermocouples (TC)
  Resistance input (Ohm)
  Voltage input (mV)
- HART® protocol for operating the device on site using a handheld communicator

SIL Application Areas

The device meets the following requirements

- Functional safety in accordance with IEC 61508, ed. 2.0
- Explosion protection
- Electromagnetic compatibility in accordance with the EN 61326 Series and NAMUR Recommendation NE21
- Electrical safety in accordance with EIC/EN 61010-1

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Features and Benefits

- Universally programmable with HART® protocol for various input signals
- 2-wire, single, analog output (4 to 20) mA
- Undervoltage detection
- Highly accurate in entire operating temperature range
- Approvals: FM and CSA (IS, NI)
- Galvanic isolation
- Output simulation
- Customized measuring range setup or expanded SETUP; see manual

SIL Features and Benefits

- Can be used for measuring points with one sensor or two sensors up to SIL2
- Creation of two measuring points up to SIL 3
- Functional Safety Assessment by TUV Sud in accordance with EIC 61508, ed.2.0
- Permanent self-monitoring
- Permanent monitoring of internal connections
- Safe parameterization

FM APPROVED CE marked

ORDER CODES

Example Order Number:

1-0		1-1	1-2		1-3		1-4		1-5		1-6	1-7		1-8
36T82-D10	-	33	85	-	85	-	E	-	U	-	S(0-200)	C	-	SIL

1-0 Transmitter Type

CODE	DESCRIPTION
T82-00	No display (transmitter only)
T82-D10	Transmitter with digital display
36T82-D10	Transmitter with digital display and general purpose screw-cover housing

1-1 Configuration Input

CODE	DESCRIPTION
00	Unconfigured
2I	Ch1: RTD 2-wire, Ch2: inactive
22	Ch1: RTD 2-wire, Ch2: RTD 2-wire
23	Ch1: RTD 2-wire, Ch2: RTD 3-wire
2T	Ch1: RTD 2-wire, Ch2: Thermocouple
3I	Ch1: RTD 3-wire, Ch2: inactive
32	Ch1: RTD 3-wire, Ch2: RTD 2-wire
33	Ch1: RTD 3-wire, Ch2: RTD 3-wire
3T	Ch1: RTD 3-wire, Ch2: Thermocouple
4I	Ch1: RTD 4-wire, Ch2: inactive
4T	Ch1: RTD 4-wire, Ch2: Thermocouple
TI	Ch1: Thermocouple, Ch2: inactive
TT	Ch1: Thermocouple, Ch2: Thermocouple

1-2 Sensor Input Channel 1

CODE	DESCRIPTION
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
R	Type R thermocouple
S	Type S thermocouple
B	Type B thermocouple
85	100 ohm platinum (α = 0.003 85 ºC^{-1})
55	500 ohm platinum (α = 0.003 85 ºC^{-1})
95	1000 ohm platinum (α = 0.003 85 ºC^{-1})

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1-3 Sensor Input Channel 2

CODE	DESCRIPTION
00	No second channel
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
R	Type R thermocouple
S	Type S thermocouple
B	Type B thermocouple
85	100 ohm platinum (α = 0.003 85 ºC^{-1})
55	500 ohm platinum (α = 0.003 85 ºC^{-1})
95	1000 ohm platinum (α = 0.003 85 ºC^{-1})

1-4 Input Set-ups

CODE	DESCRIPTION
A	Process variable = Ch1; Ch2 = inactive
B	Process variable = Ch1; Secondary value = Ch2
C	Process variable = the difference between Ch1 and Ch2
D	Process variable = average of Ch1 and Ch2
E	Sensor backup; Process variable = Ch1 and Ch2

1-5 Failure Mode

CODE	DESCRIPTION
U	Upscale Burnout ≥ 23 mA
D	Downscale Burnout ≤ 3 mA

1-6 Range

CODE	DESCRIPTION
S	(lower limit – upper limit)

1-7 Unit of Measure

CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

1-8 SIL Option

CODE	DESCRIPTION
SIL	Safety Integrity Level SIL2 and Supports SIL3

INPUT

Resistance Thermometer (RTD)

TYPE	STANDARD	MEASUREMENT RANGE		MINIMUM RANGE
Pt100 (α = 0.003 85 °C^{-1})	ASTM E1137	(-200 to 850) °C	[-328 to 1562] °F	10 °C [18 °F]
Pt200	IEC 60 751	(-200 to 850) °C	[-328 to 1562] °F	10 °C [18 °F]
Pt500		(-200 to 500) °C	[-328 to 932] °F	10 °C [18 °F]
Pt1000		(-200 to 250) °C	[-328 to 482] °F	10 °C [18 °F]
Pt100 (α = 0.003 916)	JIS C1604:1984	(-200 to 510) °C	[-328 to 950] °F	10 °C [18 °F]
Ni100 (α = 0.006 18)	DIN 43 760	(-60 to 250) °C	[-76 to 482] °F	10 °C [18 °F]
Ni120 (α = 0.006 18)	IPTS-68	(-60 to 250) °C	[-76 to 482] °F	10 °C [18 °F]
Pt50 (α = 0.003 91)	GOST 6651-94	(-185 to 1100) °C	[-301 to 2012] °F	10 °C [18 °F]
Pt100 (α = 0.003 91)		(-200 to 850) °C	[-328 to 1562] °F	10 °C [18 °F]
Cu50 (α = 0.004 28)		(-175 to 200) °C	[-283 to 392] °F	10 °C [18 °F]
Pt100 (Callendar van Dusen) Nickel polynomial Copper polynomial		The measuring range limits are specified by entering the limit values that depend on the coefficients A to C and R_O.		10 °C [18 °F]
Type of connection: 2-wire, 3-wire or 4-wire connection, sensor current: ≤ 0.3 mA With 2-wire circuit, compensation of wire resistance possible (0 to 30 Ω) With 3-wire and 4-wire connection, sensor wire resistance up to max. 50 Ω per wire				

Resistance (Ω)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Resistance (Ω)	(10 to 400) Ω (10 to 2000) Ω	10 Ω 100 Ω

Thermocouples (TC)

TYPE	STANDARD	MEASUREMENT RANGE		RECOMMENDED TEMPERATURE RANGE		MINIMUM RANGE
B (PtRh30-PtRh6)	IEC 584 part 1	(40 to 1820) °C	[104 to 3308] °F	(100 to 1500) °C	[212 to 2732] °F	50 °C [90 °F]
E (NiCr-CuNi)	ASTM E230	(-270 to 1000) °C	[-454 to 1832] °F	(0 to 750) °C	[32 to 1382] °F	50 °C [90 °F]
J (Fe-CuNi)		(-210 to 1200) °C	[-346 to 2192] °F	(20 to 700) °C	[68 to 1292] °F	50 °C [90 °F]
K (NiCr-Ni)		(-270 to 1372) °C	[-454 to 2501] °F	(0 to 1100) °C	[32 to 2012] °F	50 °C [90 °F]
N (NiCrSi-NiSi)		(-270 to 1300) °C	[-454 to 2372] °F	(0 to 1100) °C	[32 to 2012] °F	50 °C [90 °F]
R (PtRh13-Pt)		(-50 to 1768) °C	[-58 to 3214] °F	(0 to 1400) °C	[32 to 2552] °F	50 °C [90 °F]
S (PtRh10-Pt)		(-50 to 1768) °C	[-58 to 3214] °F	(0 to 1400) °C	[32 to 2552] °F	50 °C [90 °F]
T (Cu-CuNi)		(-260 to 400) °C	[-436 to 752] °F	(-185 to 350) °C	[-301 to 662] °F	50 °C [90 °F]
C (W5Re-W26Re)	ASTM E230	(0 to 2315) °C	[32 to 4199] °F	(0 to 2000) °C	[32 to 3632] °F	50 °C [90 °F]
D (W3Re-W25Re)	ASTM E1751	(0 to 2315) °C	[32 to 4199] °F	(0 to 2000) °C	[32 to 3632] °F	50 °C [90 °F]
L (Fe-CuNi)	DIN 43 710	(-200 to 900) °C	[-328 to 1652] °F	(0 to 750) °C	[32 to 1382] °F	50 °C [90 °F]
U (Cu-CuNi)		(-200 to 600) °C	[-328 to 1112] °F	(-185 to 400) °C	[-301 to 752] °F	50 °C [90 °F]
Cold junction		internal (Pt100) or external (-40 to 85) °C [-40 to 185] °F				
Max. sensor resistance		10 kΩ				

Voltage (mV)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Millivolt (mV)	(-20 to 100) mV	5 mV

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T82 Programmable HART® Temperature Transmitter Specifications

OUTPUT

Output (Analog)

Output signal	Analog (4 to 20) mA or (20 to 4) mA	
Transmission as	Temperature linear, resistance linear, voltage linear	
Maximum load	($U_{b\ max}$ - 11V) / 0.023 A (current output)	
Digital filter 1st degree	(0 to 120) s	
Minimum current required	3.5 mA, multidrop mode 4 mA	
Current limit	≤ 23 mA	
Switch on delay	10 s (during switch-on operation I_a ≤ 3.8 mA)	
Response time	Resistance thermometer (RTD)	0.9 to 1.2 s (depends on the connection method 2/3/4-wire)
	Thermocouples (TC)	0.7 s
	Reference temperature	0.5 s

Failure Mode

Underranging	Linear drop from 4.0 mA to 3.8 mA
Overranging	Linear increase from 20.0 mA to 20.5 mA
Failure, e.g. sensor breakage; sensor short circuit	≤ 3.6 mA or ≥ 21 mA (configurable 21.5 mA to 23 mA)

Electrical Connection

Supply Voltage	11V ≤ Vcc ≤ 42 V non-hazardous area, reverse polarity protected, see XP documentation for hazardous locations
Entry	3/4 inch NPT conduit connection x 1/2 inch NPT process connection
Residual	U_{ss} ≤ 3 V at U_b ≥ 13.5 V, f_{max} = 1 kHz

ACCURACY

Reference conditions	Calibration temperature (25 ± 5) °C [77 ± 9] °F Supply voltage: 24 V dc 4-wire circuit for resistance adjustment

Resistance Thermometer (RTD)

TYPE	MEASUREMENT ACCURACY - DIGITAL[1]	MEASUREMENT ACCURACY - D/A[2]
Pt100, Ni100, Ni120	0.1 °C [0.18 °F]	0.03%
Pt500	0.3 °C [0.54 °F]	0.03%
Cu50, Pt50, Pt1000	0.2 °C [0.36 °F]	0.03%
Pt200	1.0 °C [1.8 °F]	0.03%

Thermocouple (TC)

TYPE	MEASUREMENT ACCURACY - DIGITAL[1]	MEASUREMENT ACCURACY - D/A[2]
K, J, T, E, L, U	0.25 °C [0.45 °F]	0.03%
N, C, D	0.5 °C [0.9 °F]	0.03%
S, B, R	1.0 °C [1.8 °F]	0.03%

Resistance (Ω)

TYPE	MEASUREMENT ACCURACY - DIGITAL[1]	MEASUREMENT ACCURACY - D/A[2]	MEASUREMENT RANGE
Resistance	± 0.04 Ω	0.03%	(10 to 400) Ω
	± 0.8 Ω	0.03%	(10 to 2000) Ω

Voltage (mV)

TYPE	MEASUREMENT ACCURACY - DIGITAL[1]	MEASUREMENT ACCURACY - D/A[2]	MEASUREMENT RANGE
Voltage	± 10 µV	0.03%	(-20 to 100) mV

[1] Using HART® transmitted measured value
[2] % refers to the set span. Accuracy of current output = digital + D/A accuracy

ACCURACY (continued)

Physical input range of the sensors

(10 to 400) Ω	Cu50, Cu100, polynomial RTD, Pt50, Pt100, Ni100, Ni120
(10 to 2000) Ω	Pt200, Pt500, Pt1000
(-20 to 100) mV	Thermocouple type: B, C, D, E, J, K, L, N, R, S, T, U

General

Load influence	≤ ± 0.0025%/V with reference to the span
Long term stability	≤ 0.1 °C [0.18 °F] / year or ≤ 0.05%/year Date under reference conditions. % relates to the set span. The larger value is valid.

Influence of ambient temperaure (temperature drift)

Total temperature drift = input temperature drift + output temperature drift	Impact on the accuracy when ambient temperature changes by 1 °C [1.8 °F]	
	Input (10 to 400) Ω	typ. 0.001% of measured value, min. 1 mΩ
	Input (10 to 2000) Ω	typ. 0.001% of measured value, min. 10 mΩ
	Input (-20 to 100) mV	typ. 0.001% of measured value, min. 0.2 µV
	Output (4 to 20) mA	typ. 0.0015% of the span

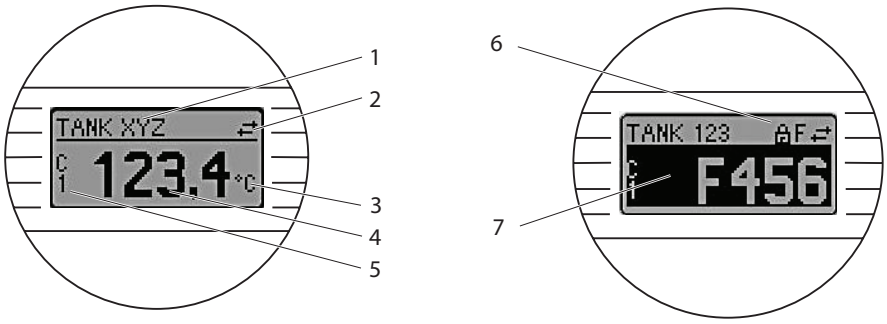
INSTALLATION CONDITIONS

Ambient Conditions

Ambient temperature	Without display: (-40 to 85) °C [-40 to 185] °F non-hazardous location (for hazardous locations, see XP documentation)			
Storage temperature	Without display: (-50 to 100) °C [-58 to 212] °F			
Altitude	Up to 4000 m (4374.5 yeards) above mean sea level per IEC 61010-1, CAN/CSA C22.2 No. 61010-1			
Climatic class	As per EN 60 654-1, Class C			
Humidity	Condensation permitted per IEC 60 068-2-33/Max. rel. humidity: 95% per IEC 60068-2-30			
Shock and vibration protection	(25 to 100) Hz for 4g			
Electromagnetic compatibility (EMC)	Electromagnetic compatibility in accordance with all the relevant requirements of the EN 61326 series and NAMUR Recommendation EMC (NE21),			
	ESD (electrostatic discharge)	EN/IEC 61000-4-2		6 kV cont., 8 kV air
	Electromagnetic fields	EN/IEC 61000-4-3	0.08 to 2.7 GHz	10 V/m
	Burst (fast transients)	EN/IEC 61000-4-4		2 kV
	Surge (surge voltage)	EN/IEC 61000-4-5		0.5 kV sym./1 kV assym.
	Conducted RF	EN/IEC 61000-4-6	0.01 to 80 MHz	10 V
Protection	IP 20 with screw terminals in the installed state. NEMA 4X, IP 66/67 when installed in field housing option 36.			

INTERFACE

Display Elements



Item 1: Displays the TAG
Item 2: 'Communication' symbol
Item 3: Unit display
Item 4: Measured value display
Item 5: Value/channel display S1, S2, DT, PV, I, %
Item 6: 'Configuration locked' symbol
Item 7: Status signals

Remote Operation

Interface	HART® (Version 6) communication via transmitter power supply
Configurable device parameters	Sensor type and connection type, engineering units (°C/°F), measurement ranges, internal/external cold junction, compensation of wire resistance with 2-wire connection, failure mode, output signal (4 to 20) mA (20 to 4) mA, digital filter (damping), offset, TAG+descriptor (8+16 characters), output simulation, analog output: option: customized linearization

APPROVALS

Approvals

CE marked	Unit complies with the legal requirements set forth by the EU regulations.
FM APPROVED CSA	Intrinsically safe and non-incendive Class I, Division 1 and 2, Groups A, B, C and D

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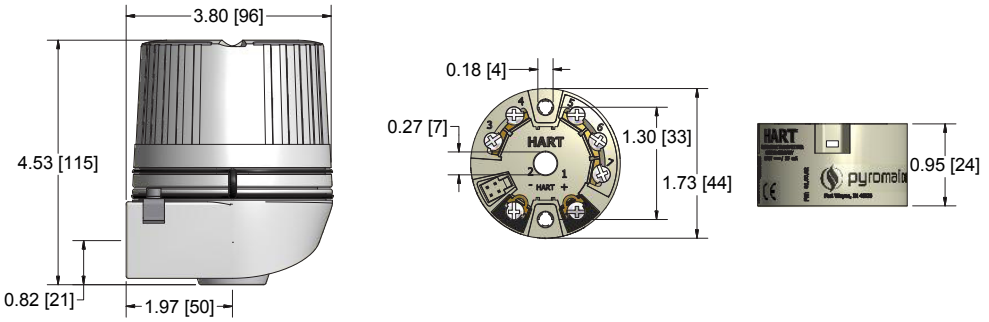
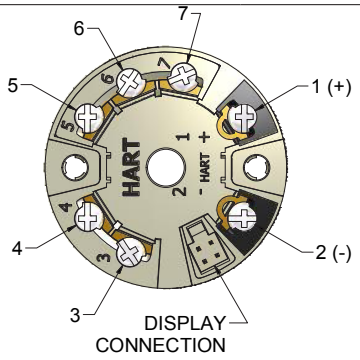
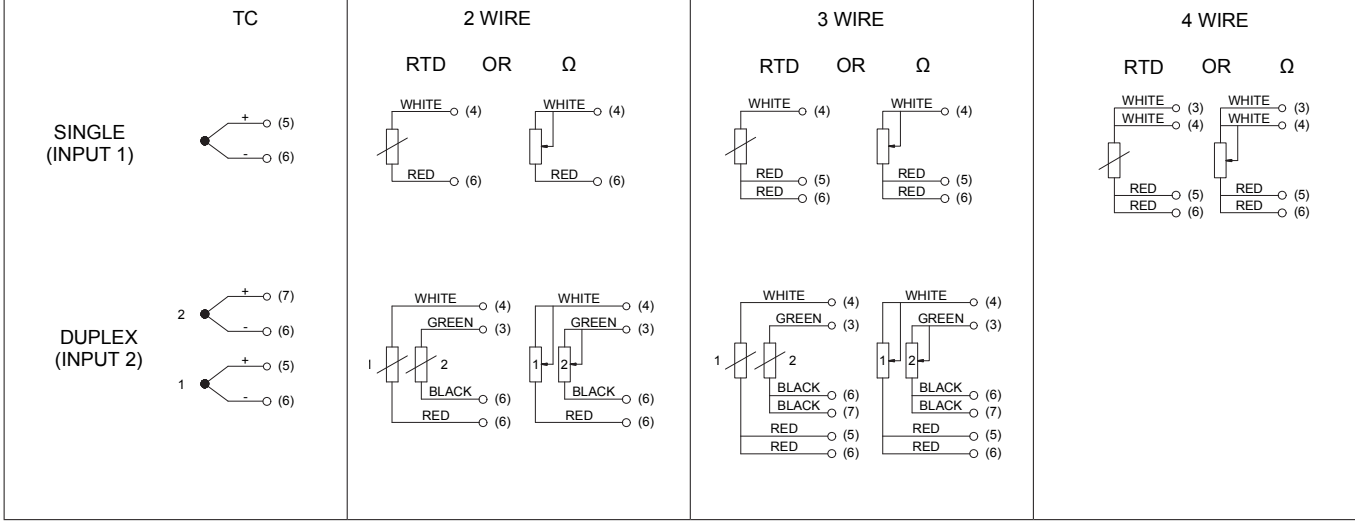
MECHANICAL CONSTRUCTION

Dimensions	
Weight	Housing, transmitter, and display: approximately 970 g (2 1/4 lbs)
	Transmitter only: approximately 50 g (1/4 lb)
Materials	Housing: die-cast aluminum with powder coating
Terminals	15 AWG Maximum

Terminal Connections





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Transmitter

Configuration Code TM01
Series 662 Programmable HART®
Dual Input Field Temperature Transmitter

The Series 662 programmable dual input HART® field temperature transmitter is a 2-wire unit with analog output. It includes input for RTDs; resistance inputs in 2-wire, 3-wire, and 4-wire connections; thermocouples and voltage signals. The transmitter can be supplied with or without a digital display, in either a general-purpose aluminum housing, or explosion-proof aluminum housing. The Series 662 can be programmed with a PC or a HART® protocol handheld terminal. When supplied with a digital display, the LC screen shows the current measured value and a bar graph with limit value violation indicator.

PROGRAMMABLE DUAL INPUT FIELD TEMPERATURE TRANSMITTER

Programmable temperature transmitter for resistance thermometers (RTDs), thermocouples, resistance inputs and voltage inputs: adjustable via HART® protocol.

HART® COMMUNICATION PROTOCOL

Application Areas

- Dual Input Temperature field transmitter with HART® protocol for converting various input signals to an analog, scaleable (4 to 20) mA output signal
- Input:
  Resistance thermometer (RTD)
  Thermocouples (TC)
  Resistance input (Ohm)
  Voltage input (mV)
- HART® protocol for operating the device on site using a handheld communicator or remotely via the PC

Features and Benefits

- Universally programmable with HART® protocol for various input signals
- Illuminated display, rotatable
- Operation, visualization and maintenance with PC; e.g. using TransComm Light operating software
- 2-wire technology, analog output (4 to 20) mA
- Highly accurate in entire operating temperature range
- Approvals:
  FM and CSA (IS, NI, XP and DIP)
- Galvanic isolation, 2kV (Sensor input to the output)
- Output simulation
- Min./max. process values recorded
- Customized measuring range setup or expanded SETUP; see questionnaire

FM APPROVED CE marked

ORDER CODES

Example Order Number:

1-0	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8
662A	- D	- 33	- 85	- 85	- E	- U	- S(0-200)	C

1-0 Transmitter Type

CODE	DESCRIPTION
662A	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing
662C	(4 to 20) mA HART® Field Transmitter with explosion-proof aluminum housing FM/CSA/ XP Class I / Div 1/ Groups A,B,C,D / DIP Class II / Div 1 / Groups E,F,G / Class III / NI Class I / Div 2 / Groups A,B,C,D
662F	(4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing FM/CSA IS Class I / Div 1 / Groups A,B,C,D / NI Class I / Div 2 / Groups A,B,C,D

1-1 Options

CODE	DESCRIPTION
T	Solid cover
D	Glass cover with digital display

1-2 Configuration Input

CODE	DESCRIPTION
2I	Ch1: RTD 2-wire, Ch2: inactive
22	Ch1: RTD 2-wire, Ch2: RTD 2-wire
23	Ch1: RTD 2-wire, Ch2: RTD 3-wire
2T	Ch1: RTD 2-wire, Ch2: Thermocouple
3I	Ch1: RTD 3-wire, Ch2: inactive
32	Ch1: RTD 3-wire, Ch2: RTD 2-wire
33	Ch1: RTD 3-wire, Ch2: RTD 3-wire
3T	Ch1: RTD 3-wire, Ch2: Thermocouple
4I	Ch1: RTD 4-wire, Ch2: inactive
4T	Ch1: RTD 4-wire, Ch2: Thermocouple
TI	Ch1: Thermocouple, Ch2: inactive
TT	Ch1: Thermocouple, Ch2: Thermocouple

1-3 Sensor Input Channel 1

CODE	DESCRIPTION
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
R	Type R thermocouple
S	Type S thermocouple
B	Type B thermocouple
85	100 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)
55	500 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)
95	1000 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)

1-4 Sensor Input Channel 2

CODE	DESCRIPTION
00	No second channel
J	Type J thermocouple
K	Type K thermocouple
T	Type T thermocouple
N	Type N thermocouple
E	Type E thermocouple
R	Type R thermocouple
S	Type S thermocouple
B	Type B thermocouple
85	100 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)
55	500 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)
95	1000 ohm platinum (α = 0.003 85 $^{\circ}C^{-1}$)

1-5 Input Set-ups

CODE	DESCRIPTION
0	One Input
A	Process variable = Ch1; Ch2 = inactive
C	Process variable = the difference between Ch1 and Ch2
D	Process variable = average of Ch1 and Ch2
E	Sensor backup; Process variable = Ch1 and Ch2

1-6 Failure Mode

CODE	DESCRIPTION
U	Upscale Burnout ≥ 23 mA
D	Downscale Burnout ≤ 3 mA

1-7 Range

CODE	DESCRIPTION
S	(lower limit – upper limit)

1-8 Unit of Measure

CODE	DESCRIPTION
C	Celsius
F	Fahrenheit

INPUT

Resistance Thermometer (RTD)

TYPE	STANDARDS	MEASUREMENT RANGE		MINIMUM RANGE
Pt100 (α = 0.003 85 °C^{-1})	ASTM E1137 IEC 60 751	(-200 to 850) °C	[-328 to 1562] °F	10 °C [18 °F]
Pt200		(-200 to 850) °C	[-328 to 1562] °F	10 °C [18 °F]
Pt500		(-200 to 250) °C	[-328 to 482] °F	10 °C [18 °F]
Pt1000		(-200 to 250) °C	[-328 to 482] °F	10 °C [18 °F]
Pt100 (α = 0.003 916)	JIS C1604	(-200 to 649) °C	[-328 to 1200] °F	10 °C [18 °F]
Pt100 (α = 0.003 923)	SAMA	(-100 to 700) °C	[-148 to 1292] °F	10 °C [18 °F]
Ni100 (α = 0.006 180)	DIN 43 760	(-60 to 250) °C	[-76 to 482] °F	10 °C [18 °F]
Ni1000 (α = 0.006 180)		(-60 to 150) °C	[-76 to 302] °F	10 °C [18 °F]
Ni120 (α = 0.006 720)	Edison Curve	(-70 to 270) °C	[-94 to 518] °F	10 °C [18 °F]
Cu10 (α = 0.004 274)		(-100 to 260) °C	[-148 to 500] °F	10 °C [18 °F]
Pt50 (α = 0.003 911)	GOST	(-200 to 1100) °C	[-328 to 2012] °F	10 °C [18 °F]
Pt100 (α = 0.003 911)		(-200 to 850) °C	[-328 to 1562] °F	10 °C [18 °F]
Cu50 (α = 0.004 278)		(-200 to 200) °C	[-328 to 392] °F	10 °C [18 °F]
Cu100 (α = 0.004 278)		(-200 to 200) °C	[-328 to 392] °F	10 °C [18 °F]
Polynomial RTD		(-200 to 850) °C	[-328 to 1562] °F	10 °C [18 °F]
Pt100 (Callendar - van Dusen)		(-200 to 850) °C	[-328 to 1562] °F	10 °C [18 °F]
Connection type		2-, 3- or 4-wire connection cable resistance compensation possible in the 2 wire system (0 to 30) Ω		
Sensor cable resistance		3-wire and 4-wire connection, sensor wire resistance to maximum 50 Ω per wire		
Sensor current		≤ 0.3 mA		

Resistance (Ω)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Resistance (Ω)	(10 to 400) Ω	10 Ω
	(10 to 2000) Ω	100 Ω

Thermocouples (TC) (ASTM E230)

TYPE	MEASUREMENT RANGE		MINIMUM RANGE
B (PtRh30-PtRh6)	(0 to 1820) °C	[32 to 3308] °F	500 °C [900 °F]
C (W5Re-W26Re)	(0 to 2320) °C	[32 to 4208] °F	500 °C [900 °F]
D (W3Re-W25Re) [1]	(0 to 2495) °C	[32 to 4523] °F	500 °C [900 °F]
E (NiCr-CuNi)	(-270 to 1000) °C	[-454 to 1832] °F	50 °C [90 °F]
J (Fe-CuNi)	(-210 to 1200) °C	[-346 to 2192] °F	50 °C [90 °F]
K (NiCr-Ni)	(-270 to 1372) °C	[-454 to 2501] °F	50 °C [90 °F]
L (Fe-CuNi) [2]	(-200 to 900) °C	[-328 to 1652] °F	50 °C [90 °F]
N (NiCrSi-NiSi)	(-270 to 1300) °C	[-454 to 2372] °F	50 °C [90 °F]
R (PtRh13-Pt)	(-50 to 1768) °C	[-58 to 3214] °F	500 °C [900 °F]
S (PtRh10-Pt)	(-50 to 1768) °C	[-58 to 3214] °F	500 °C [900 °F]
T (Cu-CuNi)	(-270 to 400) °C	[-454 to 752] °F	50 °C [90 °F]
U (Cu-CuNi) [2]	(-200 to 600) °C	[-328 to 1112] °F	50 °C [90 °F]
Cold junction	internal (Pt100) or external (0 to 80) °C [32 to 176] °F		
Cold junction accuracy	± 1 °C		
Max. sensor resistance	10 kΩ		
[1] ASTM E1751 [2] according to DIN 43 710			

Voltage (mV)

TYPE	MEASUREMENT RANGE	MINIMUM RANGE
Millivolt (mV)	(-20 to 100) mV	5 mV

1) Significant measuring inaccuracy for temperatures lower than 300 °C [572 °F]

2) When operating conditions are based on a large temperature range, the Series 662 offers the ability to split the range. For example, a Type S or R thermocouple can be used for the low range and a Type B can be used for the upper range. The Series 662 is then programmed to switch at a predetermined temperature. This allows for utilization of the best performance from each individual thermocouple and provides 1 output that represents the process temperature. Note: the dual sensor option must be included in the order code for the HART® protocol.

3) Basic requirements NE89: detection of increased sensor resistance (e.g. corrosion of contacts or wires) of TC or RTD/4-wire.

OUTPUT

Output (Analog)

Output signal	Analog (4 to 20) mA or (20 to 4) mA
Transmission as	Temperature linear, resistance linear, voltage linear
Maximum load	($V_{power\ supply}$ - 11V) / 0.023 A (current output)
Digital filter 1st degree	(0 to 60) s
Induced current required	≤ 3.5 mA
Current limit	≤ 23 mA
Switch on delay	4 s (during switch-on operation I_a = 4 mA)
Response time	1 s

Failure Mode

Undershooting measurement range	Decrease to 3.8 mA
Exceeding measurement range	Increase to 20.5 mA
Sensor breakage/short circuit	≤ 3.6 mA or ≥ 21.0 mA (configurable 21.6 mA to 23 mA)

Electrical Connection

Power supply	U_b = 11 to 40 V (8 to 40 without display), reverse polarity protected
Cable entry	Three 1/2" NPT openings
Allowable ripple	U_{ss} ≤ 3 V at U_b ≥ 13.5 V, f_{max} = 1 kHz

ACCURACY

Reference conditions	Calibration temperature (23 ± 5) °C [73.4 ± 9] °F

Resistance Thermometer (RTD)

TYPE	MEASUREMENT ACCURACY - DIGITAL	MEASUREMENT ACCURACY - D/A[1]
Cu100, Pt100, Ni100, Ni120	± 0.1 °C [0.18 °F]	± 0.02%
Pt500	± 0.3 °C [0.54 °F]	± 0.02%
Cu50, Pt50, Pt1000, Ni1000	± 0.2 °C [0.36 °F]	± 0.02%
Cu10, Pt200	± 1 °C [1.8 °F]	± 0.02%

Thermocouple (TC)

TYPE	MEASUREMENT ACCURACY - DIGITAL	MEASUREMENT ACCURACY - D/A[1]
K, J, T, E, L, U	Typical ± 0.25 °C [0.45 °F]	± 0.02%
N, C, D	Typical ± 0.5 °C [0.9 °F]	± 0.02%
S, B, R	Typical ± 1 °C [1.8 °F]	± 0.02%

Resistance (Ω)

TYPE	MEASUREMENT ACCURACY - DIGITAL	MEASUREMENT ACCURACY - D/A[1]	MEASUREMENT RANGE
Resistance	± 0.04 Ω	± 0.02%	(10 to 400) Ω
	± 0.08 Ω	± 0.02%	(10 to 2000) Ω

Voltage (mV)

TYPE	MEASUREMENT ACCURACY - DIGITAL	MEASUREMENT ACCURACY - D/A[1]	MEASUREMENT RANGE
Voltage	± 10 µV	± 0.02%	(20 to 100) mV

[1] % relates to the set span. Accuracy = digital + D/A accuracy

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ACCURACY (continued)

Physical input range of the sensors

TYPE	MEASUREMENT ACCURACY[1]
(10 to 400) Ω	Cu10, Cu50, Cu100, polynomial RTD, Pt50, Pt100, Ni100, Ni120
(10 to 2000) Ω	Pt200, Pt500, Pt1000, Ni1000
(-20 to 100) mV	Thermocouple type: C, D, E, J, K, L, N
(-5 to 30) mV	Thermocouple type: B, R, S, T, U

[1] % is related to the adjusted measurement range (the value to be applied is the greater)

General

Repeatability	0.0015% of the physical input range (15 Bit) Resolution A/D conversion: 18 Bit
Load influence	≤ ± 0.005%/V deviation from 24 V, related to the full-scale value
Long term stability	≤ 0.1 °C [0.18 °F] / year or ≤ 0.05%/year Date under reference conditions. % relates to the set span. The larger value applies.

Temperature Drift

Total temperature drift = input temperature drift + output temperature drift	Effect on the accuracy when ambient temperature changes by 1 °C [1.8 °F]	
	Input (10 to 400) Ω	0.001% of measured value, minimum 1 m Ω
	Input (10 to 2000) Ω	0.001% of measured value, minimum 10 m Ω
	Input (-20 to 100) mV	typ. 0.002% of measured value, minimum 0.2 µV
	Input (5 to 30) mV	typ. 0.001% of measured value, minimum 0.2 µV
	Output (4 to 20) mA	typ. 0.001% of span

INSTALLATION CONDITIONS

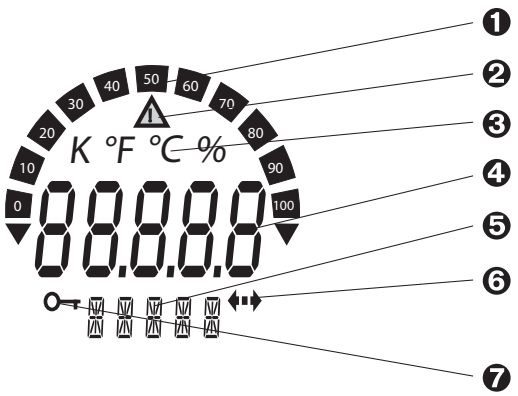
Ambient Conditions

Ambient temperature	Without display: (-40 to 85) °C [-40 to 185] °F With display: (-40 to 80) °C [-40 to 176] °F NOTE: The display can react slowly for temperature < -20 °C [< -4 °F]
Storage temperature	Without display: (-40 to 100) °C [-40 to 212] °F With display: (-40 to 80) °C [-40 to 176] °F
Allowable Altitude	6560 ft. above sea level
Climatic class	As per EN 60 654-1, Class C
Moisture condensation	Allowable
Shock and vibration protection	3 g / (2 to 150) Hz according to IEC 60 068-2-6
EMC immunity	Interference immunity and interference emission as per EN 61 326-1 (IEC 1326) (0.08 to 2) GHz 10 V/m; (1.4 to 2) GHz 30 V/m to EN 61 000-4-3
Protection	IP67, NEMA 4X, Class 1, Division 1, Group A, B, C; Class II Division I, Groups E, F, G and Class III, Division I (when specified)

Series 662 Programmable HART® Dual Input Field Temperature Transmitter Specifications

INTERFACE

Display Elements



LC display of the field transmitter (illuminated, can be rotated in 90° increments)

Item 1: Bar graph display in 10% increments with indicators for overranging / underranging
Item 2: 'Caution' display
Item 3: Unit display K, °F, or °C or %
Item 4: Measured value display (digit height 20.5 mm / 0.81 ")
Item 5: Status and information display
Item 6: 'Communication' display
Item 7: 'Programming disabled' display

Operating Elements

No operating elements are present directly on the display. The device parameters of the field transmitter are configured using the handheld communicator or a PC with HART® Modem and operating software TransComm Light.

Remote Operation

Interface	HART® communication via transmitter power supply
Configurable device parameters	Sensor type and connection type, engineering units (°C/°F), measurement ranges, internal/external cold junction compensation of wire resistance with 2-wire connection, failure mode, output signal (4 to 20) mA (20 to 4) mA, digital filter (damping), offset, TAG+descriptor (8+16 characters), output simulation, customized linearization, recording of min./max process value, analog output: Option: customized linearization

STANDARDS

Approvals

CE marked	Unit complies with the legal requirements set forth by the EU regulations.
FM APPROVED CSA	Intrinsically safe and non-incendive or explosion proof for hazardous locations Class I, Division 1 and 2, Groups A, B, C and D
Other standards and guidelines	IEC 60 529: Degrees of protection through housing (IP code) IEC 61 010: Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures IEC 1326: Electromagnetic compatibility (EMC requirements)

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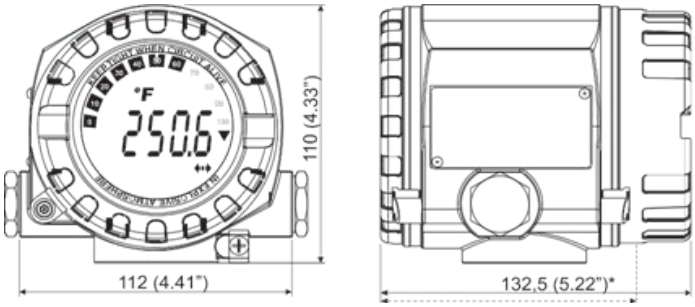
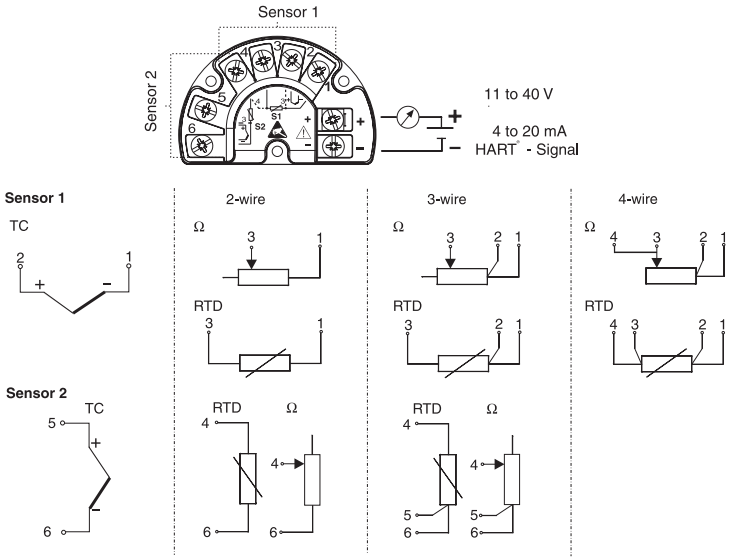
MECHANICAL CONSTRUCTION

Dimensions	 Display rotatable in 90° increments
Weight	approximately 1.6 kg [3.53 lb]
Materials	Housing: die-cast aluminum with powder coating
Terminals	Cables / wires up to max. 2.5 mm² (AWG 12)

Terminal Connections

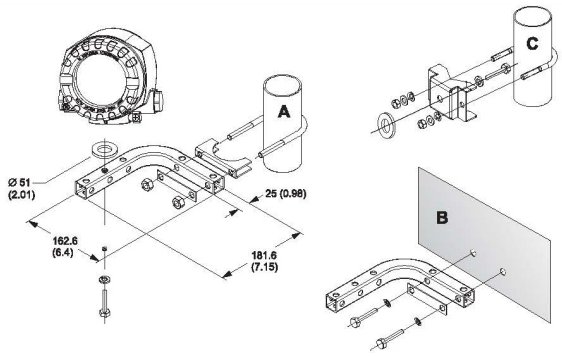


Optional Mounting Bracket

Part Number: 17614
Stainless Steel Wall/Tube Kit - Figure A or B.

Part Number: 17615
Stainless Steel Pipe Mounting Kit - Figure C.

Designed for use on pipes with a diameter of 2".



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ANSI Limits of Error

Unless otherwise specified, all thermocouple wire and extension wire is supplied to meet either Standard or Special Limits of Error per ASTM/ ANSI E - 230.

The Standard and Special Limits of Error for thermocouple and extension wires are given in the accompanying tables.

Where Limits of Error are given in percent, the percentage applies to the temperature being measured.

Limits of Error for Thermocouples and Thermocouple Wire

Reference Junction 0 °C [32 °F]

T/C TYPE	TEMPERATURE RANGE	LIMITS OF ERROR	
		STANDARD	SPECIAL
T	(0 to 133) °C [32 to 270] °F (133 to 350) °C [270 to 662] °F	± 1 °C [2 °F] ± 0.75%	± 0.5 °C [1 °F] ± 0.4%
J	(0 to 293) °C [32 to 559] °F (293 to 750) °C [559 to 1382] °F	± 2.2 °C [4 °F] ± 0.75%	± 1.1 °C [2 °F] ± 0.4%
E	(0 to 340) °C [32 to 644] °F (340 to 900) °C [644 to 1652] °F	± 1.7 °C [3 °F] ± 0.5%	± 1 °C [2 °F] ± 0.4%
K	(0 to 293) °C [32 to 559] °F (293 to 1250) °C [559 to 2282] °F	± 2.2 °C [4 °F] ± 0.75%	± 1.1 °C [2 °F] ± 0.4%
N	(0 to 293) °C [32 to 559] °F (0 to 1250) °C [559 to 2282] °F	± 2.2 °C [4 °F] ± 0.75%	± 1.1 °C [2 °F] ± 0.4%
R, S	(0 to 600) °C [32 to 1112] °F (600 to 1450) °C [1112 to 2642] °F	± 1.5 °C [3 °F] ± 0.25%	± 0.6 °C [1 °F] ± 0.1%
B	(870 to 1700) °C [1598 to 3092] °F	± 0.5%	
T[1]	(-200 to -66) °C [-328 to -87] °F (-66 to 0) °C [-87 to + 32] °F	± 1 °C [2 °F] ± 1.5%	
E[1]	(-200 to -100) °C [-328 to -148] °F (-100 to 0) °C [- 148 to 32] °F	± 1.1 °C [3 °F] ± 1%	
K[1]	(-200 to -110) °C [-328 to -166] °F (-110 to 0) °C [-166 to 32] °F	± 2.2 °C [4 °F] ± 2%	

[1] Thermocouples and thermocouple materials are normally supplied to meet the limits of error specified in the table for temperatures above 0 °C [32 °F]. The same materials, however, may not fall within the sub-zero limits of error given in the second section of the table. If materials are required to meet the sub-zero limits, the purchase order must so state. Selection of materials usually will be required. Little information is available to justify establishing special limits of error for sub-zero temperatures. Limited experience suggest the following limits for types E and T thermocouples:

Type E	(-200 to 0) °C [-328 to 32] °F
Type T	(-200 to 0) °C [-328 to 32] °F

These limits are given only as a guide for information purposes. Due to the characteristics of the materials, sub-zero limits of error for type J thermocouples and special sub-zero limits for type K thermocouples are not listed.

Limits of Error for Thermocouple

Extension Wire Reference Junction 0 °C [32 °F]

EXT. WIRE TYPE	TEMPERATURE RANGE	LIMITS OF ERROR	
		STANDARD	SPECIAL
KX	(0 to 200) °C [32 to 392] °F	± 2.2 °C [4 °F]	
JX	(0 to 200) °C [32 to 392] °F	± 2.2 °C [4 °F]	± 1.1 °C [2 °F]
EX	(0 to 200) °C [32 to 392] °F	± 1.7 °C [3 °F]	
TX	(0 to 100) °C [32 to 212] °F	± 1.0 °C [2 °F]	± 0.5 °C [1 °F]
NX	(0 to 200) °C [32 to 392] °F	± 2.2 °C [4 °F]	

Limits of Error for Thermocouple Compensating

Extension Wire Reference Junction 0 °C [32 °F]

T/C TYPE	COMPENSATION WIRE TYPE	TEMPERATURE RANGE	LIMITS OF ERROR[1]
R, S	SX§	(0 to 200) °C [32 to 392] °F	± 5 °C [9 °F]
B	BX#	(0 to 100) °C [32 to 212] °F	0 °C [0 °F] -3.7 °C [- 6 °F]

[1] Due to the non-linearity of the types R, S, and B temperature-EMF curves, the error introduced into a thermocouple system by the compensating wire will be variable when expressed in degrees. The degree C tolerances given in parentheses are based on the following measuring junction temperatures:

WIRE TYPE	MEASURING JUNCTION TEMPERATURE
SX	Greater than 870 °C [1598] °F
BX	Greater than 1000 °C [1832] °F

§ Copper (+) versus copper nickel alloy (-)

Copper versus copper compensating extension wire, usable to 100 °C [212 °F] with maximum errors as indicated, but with no significant error over (0 to 50) °C [32 to 122] °F range. Matched proprietary alloy compensating wire is available for use over the range (0 to 200) °C [32 to 392] °F with claimed tolerances of (+ 0.033 mV + 3.7) °C[1].

Calibrating, Checking, and Tagging

Pyromation thermocouple wire and extension wire is available calibrated, "checked and tagged" when so specified, at an extra charge. Wires of this classification are within the Standard Limits of Error but, most important, their specific departure at temperatures specified is known and can be taken into account. Each thermocouple, coil, reel, or spool of wire is checked and tagged to show the departure from the curve. Single conductors will be calibrated to show their EMF values versus pure platinum, with a 0 °C [32 °F] reference junction unless otherwise specified. Thermocouples and wire sample sent to the factory for evaluation must be at least 36" long.

The temperature range for all checking and selecting is from 0 °C [32 °F] to 1371 °C [2500 °F], depending on type and gauge of wire. Sub-zero checking to -79 °C [-110 °F] and high temperature rising from 1371 °F [2500 °F] to 1649 °C [3000 °F] is available. Calibration can also be accomplished at standard check points such as boiling points of helium, oxygen, and nitrogen.

Shipping
Each coil or spool is marked with its exact length, however, Pyromation reserves the right to ship plus or minus 10% of the total amount of either standard or special wire ordered.

ASTM/ANSI Letter Designations
Thermocouple and extension wires are now generally ordered and specified by ASTM/ANSI designations for calibration. Popular generic and trade name examples are Chromel/Alumel-ASTM/ANSI Type K; Iron/Constantan-ASTM/ANSI Type J; Copper/Constantan-ASTM/ANSI Type T; Chromel/Constantan-ASTM/ANSI Type E; Nicrosil/Nisil-ASTM/ANSI Type N; Platinum/Platinum 10% Rhodium-ASTM/ANSI Type S; Platinum/Platinum 13% Rhodium-ASTM/ANSI Type R; and Platinum 6% Rhodium/Platinum 30% Rhodium-ASTM/ANSI Type B. Positive and negative legs are identified by the appropriate letter suffixes P and N, respectively. Those not familiar with this system will find this table helpful.

ANSI Letter Designations	Generic or Trade Names
JP	Iron
JN, EN, or TN	Constantan, Cupron®, Advance
TP	Copper
KP or EP	Chromel®, Tophel®, T1
NP	Nicrosil
KN	Alumel®, Nial®, T2
NN	Nisil
RP	Platinum 13% Rhodium
SP	Platinum 10% Rhodium
RN or SN	Pure Platinum
BN	Platinum 6% Rhodium
BP	Platinum 30% Rhodium

Color Coding
Standard ASTM/ANSI color coding is used on all insulated thermocouple wire and extension wire when type of insulation permits. In color coding, the right is reserved to include a tracer to distinguish the calibration.

ASTM/ANSI TYPE		MAGNETIC		ASTM/ANSI COLOR CODE		
T/C	Sgl.	Yes	No	Sgl.	Overall Extension Wire	Overall T/C Wire
T	TP TN		X X	Blue Red	Blue	Brown
J	JP JN	X	 X	White Red	Black	Brown
E	EP EN		X X	Purple Red	Purple	Brown
K	KP KN	X	X	Yellow Red	Yellow	Brown
N	NP NN		X X	Orange Red	Orange	Brown
R, S	RP, SP RN, SN		X X	Black Red	Green	
B	BP BN		X X	Grey Red	Grey	

Solid and Stranded Conductors
Thermocouple wire and extension wire are usually solid conductors. When greater flexibility is required, either are available in stranded construction. The accompanying table gives the stranding combinations used in Pyromation wire. However, other stranding combinations may be ordered to suit requirements.

Stranding Combinations

CONDUCTOR		STRANDING	
GAUGE	I.S.I. TYPE	NO. of STRANDS	GAUGE
14	ALL	7	22
16	ALL	7	24
18	ALL	7	26
20	ALL	7	28
22	ALL	7	30
24	ALL	7	32

Stock Insulated Wire
'Stocked' insulated thermocouple and extension wire, as indicated in the catalog pages, is available in the following "standard packaging": 50 ft. coils - 100 ft. coils - 250 ft. spools - 500 ft. spools - 1,000 ft. spools. Coils or spools of less than 1,000 ft. packaged in non-standard lengths, are available at an additional charge and may result in a delay in shipment. Spools or reels of over 1,000 ft. can be supplied at no extra charge, but may also result in a delay in shipment.

Non-Stock Insulated Wire
'Non-stocked' insulated thermocouple and extension wire in 1,000 ft. spools and over is available at no additional charge. Coils or spools of less than 1,000 ft. are available at an additional charge. Minimum order is 100 ft.

How to Read Pyromation Catalog Numbers

EXAMPLE ORDER NUMBER:

K 20 - 1 - S - 305

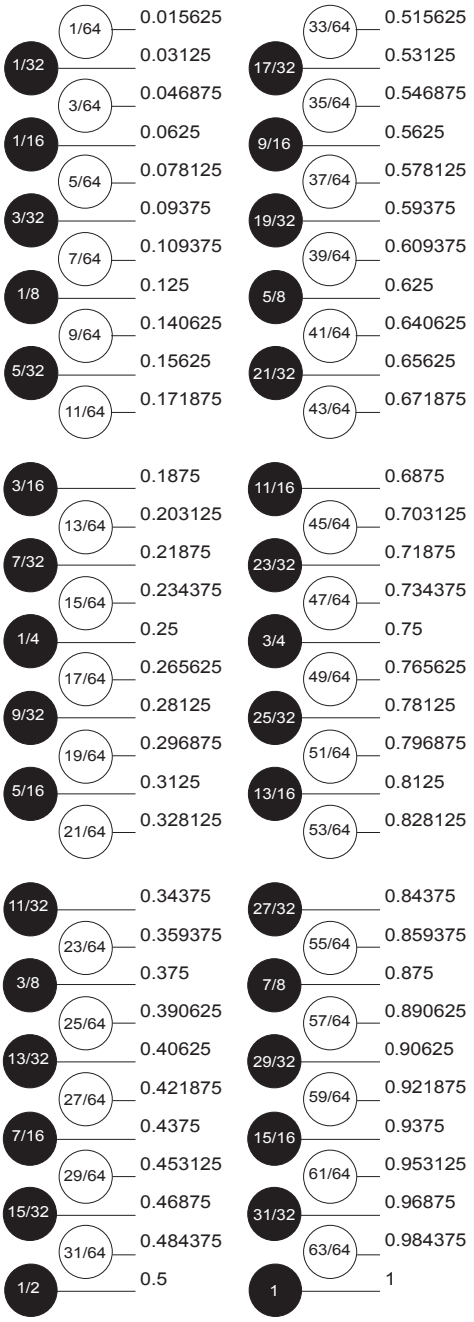
- **K** — ASTM/ANSI Thermocouple type
- **20** — Wire gauge
- **1** — Conductor Type
- **S** — Opt. Overbraid Selections
- **305** — Wire/Insulation (Pages W4, W5, W9)

Conductor Type

CODE	DESCRIPTION			
T/C Grades	Solid	Stranded	Std. Limits	Special
1	X		X	
2	X			X
3		X	X	
4		X		X
Ext. Grades	Solid	Stranded	Std. Limits	Special
5	X		X	
6	X			X
7		X	X	
8		X		X

Opt. Overbraid Selections

CODE	DESCRIPTION
S	SS wire braid
C	Tinned copper wire braid
F	Flat SS ribbon wrap
W	Flat SS spiral wrap
G	Half oval galvanized steel spiral wrap
N	Alloy 600 wire braid



INCHES in DECIMALS of a FOOT

1/16 - 0.0052	1 - 0.0833
3/32 - 0.0078	2 - 0.1667
1/8 - 0.0104	3 - 0.2500
3/16 - 0.0156	4 - 0.3333
1/4 - 0.0208	5 - 0.4167
5/16 - 0.0260	6 - 0.5000
3/8 - 0.0313	7 - 0.5833
1/2 - 0.0417	8 - 0.6667
5/8 - 0.0521	9 - 0.7500
3/4 - 0.0625	10 - 0.8333
7/8 - 0.0729	11 - 0.9167

Standard Wire Gauges in Approximate Decimals of an Inch and mm.

WIRE GAUGE	AMERICAN or BROWN AND SHARP DIAMETER (inches)	DIAMETER MILLIMETERS	BIRMINGHAM or STUBS	US STANDARD
1	0.2893	7.348	0.300	0.281
2	0.2576	6.544	0.284	0.266
3	0.2294	5.827	0.259	0.250
4	0.2043	5.189	0.238	0.234
5	0.1819	4.621	0.220	0.219
6	0.1620	4.115	0.203	0.203
7	0.1443	3.665	0.180	0.188
8	0.1285	3.264	0.165	0.172
9	0.1144	2.906	0.148	0.156
10	0.1019	2.588	0.134	0.141
11	0.0907	2.304	0.120	0.125
12	0.0808	2.053	0.109	0.109
13	0.0720	1.829	0.095	0.0938
14	0.0641	1.628	0.083	0.0781
15	0.0571	1.450	0.072	0.0703
16	0.0508	1.291	0.065	0.0625
17	0.0453	1.150	0.058	0.0563
18	0.0403	1.024	0.049	0.0500
19	0.0359	0.9116	0.042	0.0438
20	0.0320	0.8118	0.035	0.0375
21	0.0285	0.7230	0.032	0.0344
22	0.0253	0.6438	0.028	0.0313
23	0.0226	0.5733	0.025	0.0281
24	0.0201	0.5106	0.022	0.0250
25	0.0179	0.4547	0.020	0.0219
26	0.0159	0.4049	0.018	0.0188
27	0.0142	0.3606	0.016	0.0172
28	0.0126	0.3211	0.014	0.0156
29	0.0113	0.2859	0.013	0.0141
30	0.0100	0.2546	0.012	0.0125
31	0.0089	0.2268	0.010	0.0109
32	0.0080	0.2019	0.009	0.0102
33	0.00708	0.178	0.008	0.0094
34	0.00630	0.152	0.007	0.0086
35	0.00561	0.138	0.005	0.0078
36	0.00500	0.127	0.004	0.0070
37	0.00445	0.1131		0.0066
38	0.00397	0.1007		0.0063
39	0.00353	0.08969		
40	0.00314	0.07987		

CONDUIT SIZE (I.P.S.)	Approximate No. of Insulated Double Conductor Lengths of Extension					
	Wire - Size Conductor					
	NO. 14	NO. 14[1]	NO. 16	NO. 16[2]	NO. 20	NO. 24
1/2"	1	2	2	1	7	9
3/4"	3	7	4	2	16	21
1"	5	10	6	4	24	29
1 1/4"	7	14	10	5	35	44
1 1/2"	13	23	13	7	48	69
2"	18	48	20	11	73	95

[1] Single Conductor Insulated
[2] Three Conductor Insulated

STANDARD INSULATED BASE METAL THERMOCOUPLE WIRE

The following four pages give the details of the standard insulated thermocouple wires generally available for stock delivery. All of these wires are selected and matched to meet the Standards Limits of Error of ASTM/ANSI E230 given on page one of this catalog section. If the closer accuracy of the Special Limits of Error wire is desired, then special limit wires can be selected and matched. To order, change the fourth figure of the catalog number to the next higher “even” digit (example: K20-1-305 becomes K20-2-305). With the aid of the wire temperature limit tables from page one and the tabulated wire insulation data below, thermocouple wire can be selected to meet most industrial process requirements. When conditions call for other than the listed standard wires, special wires and insulations can be made to fulfill application requirements with minimum purchases. Complete process requirements and specifications should accompany quotation requests.

Thermocouple Wire Types, Construction and Characteristics

Standard Fiberglass Insulations

SINGLE CONDUCTOR			DUPLEX CONDUCTOR		TEMP. RATING		PHYSICAL PROPERTIES			
Type	Insulation (Inches)	Impregnation	Insulation (Inches)	Impregnation	Continuous	ASTM/ANSI Sgl. Reading	Color-Code	Abrasion-Resistance	Moisture-Resistance	Notes
302	Double glass braid 0.12 wall	Modified resin	Glass braid 0.006	Modified resin	482 °C [900 °F]	538 °C [1000 °F]	Yes	Good	Good	Impregnation retained to 204 °C [400 °F]
304	Glass braid 0.006	Modified resin	Glass braid 0.006	Modified resin	482 °C [900 °F]	538 °C [1000 °F]	Yes	Fair	Good	Impregnation retained to 204 °C [400 °F]
305	Double glass wrap 0.005	High-temp. varnish	Glass braid 0.006	Modified resin	482 °C [900 °F]	538 °C [1000 °F]	Yes	Fair	Good	Impregnation retained to 204 °C [400 °F]
306	Glass braid 0.006	None	Glass braid 0.006	None	482 °C [900 °F]	538 °C [1000 °F]	No	Fair	Fair	Heat treated
307	TFE tape (not fused) 0.004 TFE coated glass, 0.006	None	TFE coated glass braid	None	482 °C [900 °F]	538 °C [1000 °F]	Yes	Good	Excellent	TFE good to 316 °C [600 °F]
313	Glass braid 0.008	Modified resin	Glass braid 0.006	Modified resin	482 °C [900 °F]	538 °C [1000 °F]	Yes	Good	Good	Impregnation retained to 204 °C [400 °F]
315	Glass braid 0.008	Modified resin	None twisted	None	482 °C [900 °F]	538 °C [1000 °F]	Yes	Good	Good	Impregnation retained to 204 °C [400 °F]
317	Heavy glass braid	High-temp. varnish	None twisted	None	482 °C [900 °F]	538 °C [1000 °F]	Yes	Good	Good	Impregnation retained to 204 °C [400 °F]

High Temperature Fiberglass Insulations

SINGLE CONDUCTOR			DUPLEX CONDUCTOR		TEMP. RATING		PHYSICAL PROPERTIES			
Type	Insulation (Inches)	Impregnation	Insulation (Inches)	Impregnation	Continuous	ASTM/ANSI Sgl. Reading	Color-Code	Abrasion-Resistance	Moisture-Resistance	Notes
309	High-temp. glass braid 0.012	None	High-temp. glass braid 0.012	Modified resin	704 °C [1300 °F]	871 °C [1600 °F]	Tracer	Good	Fair	Impregnation retained to 204 °C [400 °F]
311	High-temp. glass braid 0.012	None	High-temp. glass braid 0.012	Light lacquer	704 °C [1300 °F]	871 °C [1600 °F]	No	Fair	Fair	Coating retained to 149 °C [300 °F]
314	High-temp. glass braid 0.008	High-temp. varnish	None twisted	None	704 °C [1300 °F]	871 °C [1600 °F]	Yes	Good	Good	Impregnation retained to 204 °C [400 °F]
321	High-temp. glass braid	High-temp. varnish	High-temp. glass braid	High temp. varnish	704 °C [1300 °F]	871 °C [1600 °F]	Yes	Good	Good	Impregnation retained to 204 °C [400 °F]

Vitreous Silica Insulation

SINGLE CONDUCTOR			DUPLEX CONDUCTOR		TEMP. RATING		PHYSICAL PROPERTIES			
Type	Insulation (Inches)	Impregnation	Insulation (Inches)	Impregnation	Continuous	ANSI Sg. Reading	Color-Code	Abrasion-Resistance	Moisture-Resistance	Notes
301	Vitreous Silica Fiber 0.015	None	Vitreous Silica Fiber 0.020	None	871 °C [1600 °F]	1093 °C [2000 °F]	No	Fair	Fair	

Ceramic Fiber Insulation

SINGLE CONDUCTOR			DUPLEX CONDUCTOR		TEMP. RATING[1]		PHYSICAL PROPERTIES			
Type	Insulation (Inches)	Impregnation	Insulation (Inches)	Impregnation	Continuous	ANSI Sg. Reading	Color-Code	Abrasion-Resistance	Moisture-Resistance	Notes
350	Ceramic Fiber Braid 0.018	None	Ceramic Fiber Braid 0.018	None	1204 °C [2200 °F]	1430 °C [2600 °F]	No	Good	Fair	

Polyvinyl Insulation

SINGLE CONDUCTOR			DUPLEX CONDUCTOR		TEMP. RATING		PHYSICAL PROPERTIES			
Type	Insulation (Inches)	Impregnation	Insulation	Impregnation	Continuous	ANSI Sg. Reading	Color-Code	Abrasion-Resistance	Moisture-Resistance	Notes
505	Polyvinyl Extr. 0.012-0.014	None	Singles Fused-Ripcord	None	(-29 to 105) °C [-20 to 221] °F	None	Yes	Good	Excellent	

Fluoropolymer Insulations

SINGLE CONDUCTOR			DUPLEX CONDUCTOR		TEMP. RATING		PHYSICAL PROPERTIES			
Type	Insulation (Inches)	Impregnation	Insulation (Inches)	Impregnation	Continuous	ANSI Sg. Reading	Color-Code	Abrasion-Resistance	Moisture-Resistance	Notes
506	FEP Extr. 0.005	None	FEP Extr. 0.005	None	204 °C [400 °F]	260 °C [500 °F]	Yes	Good	Excellent	
507	FEP Extr. 0.008	None	FEP Extr. 0.010	None	204 °C [400 °F]	260 °C [500 °F]	Yes	Good	Excellent	
508	TFE tape fused 0.005	None	TFE Tape fused 0.0075	None	260 °C [500 °F]	316 °C [600 °F]	Yes	Very Good	Excellent	
509	FEP Extr. 0.009	None	FEP Extr. 0.010 Twisted	None	204 °C [400 °F]	260 °C [500 °F]	Yes	Good	Excellent	Polyester shield w/ #20 drain wire
516	Extruded PFA	None	Extruded PFA	None	260 °C [500 °F]	316 °C [600 °F]	Yes	Good	Excellent	
517	Extruded PFA	None	Twisted; Extr. PFA Overall	None	260 °C [500 °F]	316 °C [600 °F]	Yes	Good	Excellent	Polyester shield w/ drain wire
595	FEP Extruded	None	FEP Extruded	None	204 °C [400 °F]	260 °C [500 °F]	Yes	Good	Excellent	Stainless steel overbraid inner

Polyimide Insulations

SINGLE CONDUCTOR			DUPLEX CONDUCTOR		TEMP. RATING		PHYSICAL PROPERTIES			
Type	Insulation (Inches)	Impregnation	Insulation (Inches)	Impregnation	Continuous	ANSI Sg. Reading	Color-Code	Abrasion-Resistance	Moisture-Resistance	Notes
511	Fused Polyimide Tape 0.004	None	None twisted	None	316 °C [600 °F]	427 °C [800 °F]	[2] [2]	Excellent	Excellent	FEP binder melts @ 260 °C [500 °F]
512	Fused Polyimide Tape 0.004	None	Fused Polyimide 0.004	None	316 °C [600 °F]	427 °C [800 °F]	[2]	Excellent	Excellent	FEP binder melts @ 260 °C [500 °F]
513	Fused Polyimide Tape, 0.006 Polyimide Enamel	None	Fused Polyimide 0.004	None	316 °C [600 °F]	427 °C [800 °F]	Yes singles only	Excellent	Excellent	FEP binder melts @ 260 °C [500 °F]

Fluoropolymer Insulation

SINGLE CONDUCTOR			DUPLEX CONDUCTOR		TEMP. RATING		PHYSICAL PROPERTIES			
Type	Insulation (Inches)	Impregnation	Insulation (Inches)	Impregnation	Continuous	ANSI Sg. Reading	Color-Code	Abrasion-Resistance	Moisture-Resistance	Notes
514	ETFE Extr. 0.008	None	ETFE Extr. 0.010	None	150 °C [302 °F]	200 °C [392 °F]	Yes	Good	Excellent	

[1] These wires have no impregnation on insulation
[2] Both legs have Tracer

Standard length spools are in 50 ft. increments. Non-standard lengths are available at an extra charge.

Duplex - ASTM/ANSI Type J

ASTM/ANSI Color Code: Negative wire, red; Positive wire, white; Overall brown, with Tracer where possible.

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
J20 - 1 - 304	20	Solid	Glass braid	Glass braid		Std.	0.059 x 0.097	8
J20 - 1 - S - 304	20	Solid	Glass braid	Glass braid	Stainless overbraid	Std.	0.080 x 0.119	17
J20 - 2 - 304	20	Solid	Glass braid	Glass braid		Spl.	0.059 x 0.097	8
J20 - 1 - 305	20	Solid	Glass wrap	Glass braid		Std.	0.054 x 0.095	8
J20 - 1 - 314	20	Solid	High-temp. glass braid	None - twisted		Std.	0.120	8
J20 - 2 - 321	20	Solid	High-temp. glass braid	High-temp. glass braid		Spl.	0.085 x 0.140	15
J20 - 1 - 507	20	Solid	FEP extruded	FEP extruded		Std.	0.072 x 0.124	11
J20 - 1 - 508	20	Solid	Fused TFE tape	Fused TFE tape		Std.	0.059 x 0.100	10
J20 - 2 - 513	20	Solid	Fused Polyimide tape	Fused Polyimide tape		Spl.	0.065 x 0.100	11
J20 - 3 - S - 302	20	Strd.	Double glass braid	Glass braid	Stainless overbraid	Std.	0.093 x 0.140	16
J20 - 3 - 304	20	Strd.	Glass braid	Glass braid		Std.	0.072 x 0.132	9
J20 - 3 - 507	20	Strd.	FEP extruded	FEP extruded		Std.	0.077 x 0.128	12
J20 - 3 - S - 507	20	Strd.	FEP extruded	FEP extruded	Stainless overbraid	Std.	0.092 x 0.144	15
J20 - 3 - 512	20	Strd.	Polyimide	Polyimide		Std.	0.055 x 0.1020	11
J24 - 1 - 304	24	Solid	Glass braid	Glass braid		Std.	0.047 x 0.081	4
J24 - 1 - S - 305	24	Solid	Glass wrap	Glass braid	Stainless overbraid	Std.	0.067 x 0.095	9
J24 - 1 - 508	24	Solid	Fused TFE tape	Fused TFE tape		Std.	0.047 x 0.078	5
J24 - 2 - 513	24	Solid	Fused polyimide tape	Fused polyimide tape		Spl.	0.060 x 0.085	6
J24 - 3 - 304	24	Strd.	Glass braid	Glass braid		Std.	0.043 x 0.082	8
J24 - 3 - S - 305	24	Strd.	Glass wrap	Glass braid	Stainless overbraid	Std.	0.074 x 0.104	11
J24 - 3 - 507	24	Strd.	FEP extruded	FEP extruded		Std.	0.065 x 0.110	8
J24 - 3 - 595	24	Strd.	FEP	FEP/Stainless OB	FEP	Std.	0.145	17
J30 - 1 - 304	30	Solid	Glass braid	Glass braid		Std.	0.037 x 0.059	3
J30 - 2 - 506	30	Solid	FEP extruded	FEP extruded		Spl.	0.030 x 0.050	4

Type J Thermocouple and Extension Wire Conductor Specifications

WIRE GAUGE	CONDUCTOR DIAMETER		OHMS PER DOUBLE FOOT	
	SOLID (inches)	STRANDED (inches)	SOLID (ohms)	STRANDED (ohms)
14	0.0641		0.086	
16	0.0508	0.0600	0.137	0.125
18		0.0490		0.185
20	0.0320	0.0390	0.357	0.343
24	0.0201	0.0250	0.877	0.842
28	0.0126		2.216	
30	0.0100		3.520	

Standard length spools are in 50 ft. increments. Non-standard lengths are available at an extra charge.

Duplex - ASTM/ANSI Type K
ASTM/ANSI Color Code: Negative wire, red; Positive wire, yellow; Overall brown, with Tracer where possible.

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
K20 - 2 - 301	20	Solid	Vitreous silica fiber braid	Vitreous silica fiber braid		Spl.	0.100 x 0.155	16
K20 - 1 - 304	20	Solid	Glass braid	Glass braid		Std.	0.059 x 0.097	8
K20 - 1 - S - 304	20	Solid	Glass braid	Glass braid	Stainless overbraid	Std.	0.080 x 0.119	17
K20 - 1 - 305	20	Solid	Glass wrap	Glass braid		Std.	0.054 x 0.095	8
K20 - 2 - 321	20	Solid	High-temp. glass braid	High-temp. glass braid		Spl.	0.085 x 0.140	15
K20 - 2 - S - 321	20	Solid	High-temp. glass braid	High-temp. glass braid	Stainless overbraid	Spl.	0.101 x 0.161	15
K20 - 2 - 350	20	Solid	Ceramic fiber braid	Ceramic fiber braid		Spl.	0.096 x 0.175	16
K20 - 2 - N - 350	20	Solid	Ceramic fiber braid	Ceramic fiber braid	Alloy 600 overbraid	Spl.	0.126 x 0.166	23
K20 - 1 - 507	20	Solid	FEP extruded	FEP extruded		Std.	0.072 x 0.124	11
K20 - 1 - 508	20	Solid	Fused TFE tape	Fused TFE tape		Std.	0.059 x 0.100	10
K20 - 2 - 509	20	Solid	FEP extruded	Twisted polyester	FEP	Spl.	0.132	16
K20 - 2 - 513	20	Solid	Fused polyimide tape	Fused polyimide tape		Spl.	0.065 x 0.100	11
K20 - 3 - 302	20	Strd.	Double glass braid	Glass braid		Std.	0.093 x 0.140	9
K20 - 3 - S - 302	20	Strd.	Double glass braid	Glass braid	Stainless overbraid	Std.	0.093 x 0.140	16
K20 - 3 - 304	20	Strd.	Glass braid	Glass braid		Std.	0.077 x 0.113	10
K20 - 3 - 507	20	Strd.	FEP extruded	FEP extruded		Std.	0.077 x 0.128	12
K20 - 3 - S - 507	20	Strd.	FEP extruded	FEP extruded	Stainless overbraid	Std.	0.110 x 0.130	13
K24 - 1 - 304	24	Solid	Glass braid	Glass braid		Std.	0.047 x 0.081	4
K24 - 1 - S - 305	24	Solid	Glass wrap	Glass braid	Stainless overbraid	Std.	0.067 x 0.095	13
K24 - 1 - 508	24	Solid	Fused TFE tape	Fused TFE tape		Std.	0.047 x 0.078	5
K24 - 3 - S - 305	24	Strd.	Glass wrap	Glass braid	Stainless overbraid	Std.	0.070 x 0.100	9

Type K Thermocouple and Extension Wire Conductor Specifications

AWG.	CONDUCTOR DIAMETER		OHMS PER DOUBLE FOOT	
	SOLID (inches)	STRANDED (inches)	SOLID (ohms)	STRANDED (ohms)
14	0.0641	0.0760	0.147	0.134
16	0.0508	0.0600	0.233	0.213
20	0.0320	0.0390	0.590	0.538
24	0.0201	0.0250	1.490	1.435
28	0.0126		3.770	
30	0.0100		5.980	
36	0.0050		24.080	

Standard length spools are in 50 ft. increments. Non-standard lengths are available at an extra charge.

Duplex - ANSI Type T

ASTM/ANSI Color Code: Negative wire, red; Positive wire, blue; Overall brown, with Tracer where possible.

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
T20 - 1 - 507	20	Solid	FEP extruded	FEP extruded		Std.	0.072 x 0.124	11
T20 - 3 - 507	20	Stranded	FEP extruded	FEP extruded		Std.	0.080 x 0.137	12
T24 - 1 - 304	24	Solid	Glass braid	Glass braid		Std.	0.047 x 0.081	4
T24 - 1 - 505	24	Solid	Polyvinyl	None (ripcord constr.)		Std.	0.048 x 0.086	3
T24 - 2 - 508	24	Solid	Fused TFE tape	Fused TFE tape		Spl.	0.047 x 0.078	5
T24 - 1 - 507	24	Stranded	FEP extruded	FEP extruded		Std.	0.065 x 0.110	8
T24 - 3 - 595	24	Stranded	FEP	FEP/stainless OB	FEP	Std.	0.145	17

Duplex - ANSI Type E

ASTM/ANSI Color Code: Negative wire, red; Positive wire, purple; Overall brown, with Tracer where possible.

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
E20 - 1 - 304	20	Solid	Glass braid	Glass braid		Std.	0.059 x 0.097	8
E20 - 1 - S - 304	20	Solid	Glass Braid	Glass braid	Stainless Overbraid	Std.	0.080 x 0.119	17

Type T Thermocouple and Extension

Wire Conductor Specifications

WIRE GAUGE	CONDUCTOR DIAMETER		OHMS PER DOUBLE FOOT	
	SOLID (inches)	STRANDED (inches)	SOLID (ohms)	STRANDED (ohms)
16	0.0508		0.118	
20	0.0320	0.0390	0.298	0.272
24	0.0201	0.0250	0.272	
30	0.0100		3.520	
36	0.0050		12.174	

Type E Thermocouple and Extension

Wire Conductor Specifications

WIRE GAUGE	CONDUCTOR DIAMETER		OHMS PER DOUBLE FOOT	
	SOLID (inches)	STRANDED (inches)	SOLID (ohms)	STRANDED (ohms)
16		0.0600		0.254
20	0.0320		0.704	

Type N Thermocouple and Extension

Wire Conductor Specifications

WIRE GAUGE	CONDUCTOR DIAMETER		OHMS PER DOUBLE FOOT	
	SOLID (inches)	STRANDED (inches)	SOLID (ohms)	STRANDED (ohms)
20	0.0320		0.352	
24	0.0201		1.980	

STANDARD INSULATED THERMOCOUPLE EXTENSION WIRE

On this and the following pages are the details of the standard insulated thermocouple extension wires generally available for base and noble metal thermocouple installations. By using the tabulated wire insulation data below, one can select a wire suitable for most process applications. When process conditions require the use of a special construction wire, please provide complete process requirements and specifications with your request for quotation. Minimums of 2,000 feet are generally required for special constructions.

Extension Wire Types, Construction and Characteristics

ServTex Insulations

SINGLE CONDUCTOR			DUPLEX CONDUCTOR		TEMP. RATING[1]		PHYSICAL PROPERTIES			
Type	**Insulation**	**Impregnation**	**Insulation**	**Impregnation**	**Continuous**	**ANSI Sgl. Reading**	**Color-Code**	**Abrasion-Resistance**	**Moisture-Resistance**	**Notes**
155	Heavy fiberglass braid single insulation	Moisture resistant impregnation	ServTex Braid	Ceramic-like impregnation	288 ºC [550 ºF]	343 ºC [650 ºF]	Yes	Good	Fair	Impregnation retained to 200 ºC [400 ºF]
157	TFE tape (not fused). Heavy fiberglass braid single insulation	Modified resin	ServTex Braid	Moisture-resistant compound	288 ºC [550 ºF]	343 ºC [650 ºF]	Yes	Good	Fair	Impregnation retained to 204 ºC [400 ºF]: TFE good to 260 ºC [500 ºF]

Fiberglass Insulation

303	Enamel/glass braid 0.006”	Modified resin	Glass braid 0.006”	Modified resin	482 ºC [900 ºF]	538 ºC [1000 ºF]	Yes	Good	Fair	Impregnation retained to 204 ºC [400 ºF]

Polyvinyl Insulations

SINGLE CONDUCTOR			DUPLEX CONDUCTOR		TEMP. RATING[1]		PHYSICAL PROPERTIES			
Type	**Insulation**	**Impregnation**	**Insulation**	**Impregnation**	**Continuous**	**ANSI Sg. Reading**	**Color-Code**	**Abrasion-Resistance**	**Moisture-Resistance**	**Notes**
502	Polyvinyl Extr. 0.012” to #20; #16 to 0.018”	None	Polyvinyl Extr., 0.016”	None	(-29 to 105) ºC [-20 to +221] ºF		Yes	Good	Excellent	
503	Polyvinyl Extr. 0.015”	None	Twisted w/cotton filler; PVC 0.030”	None	(-29 to 105) ºC [-20 to +221] ºF		Yes	Good	Excellent	Stranded conductors only
510	Polyvinyl Extr. 0.015”	None	Polyvinyl 0.020” Twisted	None	(-29 to 105) ºC [-20 to +221] ºF		Yes	Good	Excellent	Polyester shield for computer application #16 uses #18 drain wire; #20 uses #20 drain wire

Fluoropolymer Insulations

514	ETFE Extr., 0.008”	None	ETFE 0.0010”	None	150 ºC [302 ºF]	200 ºC [392 ºF]	Yes	Excellent	Excellent	
515	ETFE Extr., 0.008”	None	Twisted	None	150 ºC [302 ºF]	200 ºC [392 ºF]	Yes	Excellent	Excellent	Polyester shield w/20 AWG drain wire

[1] Thermocouple extension grade wire is only calibrated up to 204 ºC [400 ºF]

Standard length spools are in 50 ft. increments. Non-standard lengths are available at an extra charge.

Duplex - ASTM/ANSI Type JX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, white; Overall black.

CODE	AWG. GAUGE	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
J16 - 5 - 502	16	Solid	Polyvinyl	Polyvinyl		Std.	0.111 x 0.188	27
J16 - 5 - 510	16	Solid	Polyvinyl	Twisted Polyester	PVC	Std.	0.206	28
J18 - 7 - 503	18	Strd.	Polyvinyl	Twisted cotton filler	PVC	Spl.	0.254	35
J20 - 5 - 502	20	Solid	Polyvinyl	Polyvinyl		Std.	0.095 x 0.158	14
J20 - 5 - 510	20	Solid	Polyvinyl	Twisted Polyester	PVC	Std.	0.170	20
J20 - 7 - 502	20	Strd.	Polyvinyl	Polyvinyl		Std.	0.108 x 0.185	14
J20 - 7 - 510	20	Strd.	Polyvinyl	Twisted Polyester	PVC	Std.	0.176	24

Duplex - ASTM/ANSI Type KX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, yellow: Overall yellow.

K16 - 5 - 157	16	Solid	TFE heavy glass braid	ServTex braid		Std.	0.170 x 0.220	33
K16 - 5 - 303	16	Solid	Enamel glass braid	Glass braid		Std.	0.100 x 0.160	23
K16 - 5 - 502	16	Solid	Polyvinyl	Polyvinyl		Std.	0.111 x 0.188	27
K16 - 5 - 510	16	Solid	Polyvinyl	Twisted Polyester	PVC	Std.	0.206	28
K20 - 5 - 502	20	Solid	Polyvinyl	Polyvinyl		Std.	0.095 x 0.158	14
K20 - 5 - 510	20	Solid	Polyvinyl	Twisted Polyester	PVC	Std.	0.170	20
K20 - 7 - 502	20	Strd.	Polyvinyl	Polyvinyl		Std.	0.108 x 0.185	14
K20 - 7 - 503	20	Strd.	Polyvinyl	Twisted cotton filler	PVC	Std.	0.225	35
K20 - 7 - 510	20	Strd.	Polyvinyl	Twisted Polyester	PVC	Std.	0.198	20

Duplex - ASTM/ANSI Type TX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, blue; Overall blue.

T20 - 5 - 502	20	Solid	Polyvinyl	Polyvinyl		Std.	0.095 x .158	15
T20 - 5 - 510	20	Solid	Polyvinyl	Twisted Polyester	PVC	Std.	0.170	20

Type J Thermocouple and Extension

Wire Conductor Specifications

WIRE GAUGE	CONDUCTOR DIAMETER		OHMS PER DOUBLE FOOT	
	SOLID (inches)	STRANDED (inches)	SOLID (ohms)	STRANDED (ohms)
14	0.0641		0.086	
16	0.0508	0.0600	0.137	0.125
18		0.0490		0.185
20	0.0320	0.0390	0.357	0.343
24	0.0201	0.0250	0.877	0.842
28	0.0126		2.216	
30	0.0100		3.520	

Type T Thermocouple and Extension

Wire Conductor Specifications

WIRE GAUGE	CONDUCTOR DIAMETER		OHMS PER DOUBLE FOOT	
	SOLID (inches)	STRANDED (inches)	SOLID (ohms)	STRANDED (ohms)
16	0.0508		0.118	
20	0.0320	0.0390	0.298	0.272
24	0.0201		0.272	
30	0.0100		3.025	
36	0.0050		12.174	

Type K Thermocouple and Extension

Wire Conductor Specifications

WIRE GAUGE	CONDUCTOR DIAMETER		OHMS PER DOUBLE FOOT	
	SOLID (inches)	STRANDED (inches)	SOLID (ohms)	STRANDED (ohms)
14	0.0641	0.0760	0.147	0.134
16	0.0508	0.0600	0.233	0.213
20	0.0320	0.0390	0.590	0.538
24	0.0201	0.0250	1.490	1.435
28	0.0126		3.770	
30	0.0100		5.980	
36	0.0050		24.080	

Standard length spools are in 50 ft. increments. Non-standard lengths are available at an extra charge.

Duplex - ASTM/ANSI Type NX
ASTM/ANSI Color Code: Negative wire, red; Positive wire, orange; Overall orange.

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
N20 - 5 - 502	20	Solid	Polyvinyl	Polyvinyl		Std.	0.111 x 0.188	15

Duplex - ASTM/ANSI Type SX and RX
ASTM/ANSI Color Code: Negative wire, red; Positive wire, black; Overall green; Compensating extension wires for Type R, S thermocouples

S16 - 5 - 157	16	Solid	TFE tape/heavy glass braid	ServTex braid		Std.	0.170 x 0.220	30
S20 - 5 - 304	20	Solid	Glass braid	Glass braid		Std.	0.056 x 0.096	8
S20 - 5 - 502	20	Solid	Polyvinyl	Polyvinyl		Std.	0.095 x 0.158	13
S20 - 5 - 507	20	Solid	FEP extruded	FEP extruded		Std.	0.070 x 0.120	13
S20 - 5 - 510	20	Solid	Polyvinyl	Twisted Polyester	PVC	Std.	0.170	20

Duplex - ASTM/ANSI Type BX
ASTM/ANSI Color Code: Negative wire, red; Positive wire, grey; Overall grey; Compensating extension wires for ANSI Type B thermocouples

B20 - 5 - 304	20	Solid	Glass braid	Glass braid		Std.	0.056 x 0.096	8

Type N Thermocouple and Extension Wire Conductor Specifications

WIRE GAUGE	CONDUCTOR DIAMETER		OHMS PER DOUBLE FOOT	
	SOLID (inches)	STRANDED (inches)	SOLID (ohms)	STRANDED (ohms)
20	0.0320		0.352	
24	0.0201		1.980	

Type S Thermocouple and Extension Wire Conductor Specifications

WIRE GAUGE	CONDUCTOR DIAMETER		OHMS PER DOUBLE FOOT	
	SOLID (inches)	STRANDED (inches)	SOLID (ohms)	STRANDED (ohms)
16	0.0508	0.0600	0.016	0.014
20	0.0320		0.040	
24	0.0201		0.087	

Type B Thermocouple and Extension Wire Conductor Specifications

WIRE GAUGE	CONDUCTOR DIAMETER		OHMS PER DOUBLE FOOT	
	SOLID (inches)	STRANDED (inches)	SOLID (ohms)	STRANDED (ohms)
20	0.0320		0.069	

Type C Thermocouple and Extension Wire Conductor Specifications

WIRE GAUGE	CONDUCTOR DIAMETER		OHMS PER DOUBLE FOOT	
	SOLID (inches)	STRANDED (inches)	SOLID (ohms)	STRANDED (ohms)
24	0.0201		0.940	

Special Construction RTD Wire and Cable

Pyromation offers several special construction thermocouple wire and RTD cables for process applications. Those listed below, because of their specialized construction, have been used in many unusual applications to solve problems where standard "off-the-shelf" wire and cable would not suffice. The listed wire and cable is normally carried in stock. Other non-standard wire and cable is available on special order. Please contact us with your specifications for a quotation. Minimum order quantities may apply on special construction items.

Special Construction RTD Cables

CODE	CONSTRUCTION STYLE	GAUGE AND TYPE	OHMS[1]	INSULATIONS			TEMP. RATING	COLOR CODE	OUTER JACKET	NOMINAL SIZE (inches)
				EACH COND.	INNER JACKET	OUTER JACKET				
RT24-3-595	Triplex	24 - stranded (silver-plated copper)	0.066	Fluoropolymer	FEP & stainless steel overbraid	Fluoropolymer	204 ºC [400 °F]	Red, red, white	White	0.160 O.D.
RT24-3-527	Triplex	24 - stranded (silver-plated copper)	0.066	Fluoropolymer	None	Fluoropolymer	204 ºC [400 °F]	Red, red, white	White	0.110 O.D.
RT28-6-527	Six conductor	28 - stranded (silver-plated copper)	0.175	Fluoropolymer	None	Fluoropolymer	204 ºC [400 °F]	Red, red, white, black, black, green	White	0.132 O.D.
RT24-2-S-330	Duplex	24 - stranded (nickel-plated copper)	0.060	Glass braid	Glass braid	Stainless steel overbraid	482 ºC [900 °F]	Red, white	-	0.110 O.D.
RT24-3-S-330	Triplex	24 - stranded (nickel-plated copper)	0.090	Glass braid	Glass braid	Stainless steel overbraid	482 ºC [900 °F]	Red, red, white	-	0.120 O.D.
RT24-3-330	Triplex	24 - stranded (nickel-plated copper)	0.090	Glass braid	None	Glass braid	482 ºC [900 °F]	Red, red, white	White	0.072 O.D.
RT22-3-502	Triplex	22 - stranded tinned copper	0.044	PVC	None	PVC	105 ºC [221 °F]	Red, red, white	White	0.160 O.D.
RT22-4-502	Four conductor	22 - stranded tinned copper	0.059	PVC	None	PVC	105 ºC [221 °F]	Red, red white, white	White	0.175 O.D.
RT24-3-509	Triplex	24 - stranded tinned copper	0.066	Fluoropolymer	Polyester shield with drain wire	Fluoropolymer	204 ºC [400 °F]	Red, red, white	White	0.150 O.D.
RT24-4-509	Four conductor	24 - stranded tinned copper	0.066	Fluoropolymer	Polyester shield with drain wire	Fluoropolymer	204 ºC [400 °F]	Red, red, white, white	White	0.150 O.D.

[1] Ohms per double or triple foot @ 20 ºC [68 ºF]

Multi-Pair Thermocouple Extension Wire

Cables made up of multi-pairs of thermocouple extension wire have gained wide acceptance as a cost effective means of running thermocouple extension wire from the process area to central control locations. Installation cost reductions are achieved by running one or more cables containing many pairs of wires rather than individual pairs in separate conduits. Pyromation offers two standard constructions of multi-pair cable as listed below, however special made-to-order cables are also available. Contact us with your complete specifications for a quotation. Minimum order quantities will apply on special cables.

900 SERIES STANDARD MULTI-PAIR THERMOCOUPLE EXTENSION CABLE SPECIFICATIONS

Single Conductor Insulation: Extruded PVC (pairs twisted)

Shield: Spiral wrapped aluminized polyester tape over all pairs w/copper drain wire

Overall Insulation: Extruded PVC jacket with a jacket splitting ripcord

Communication Wire: Insulated copper wire

Color Coding: ASTM/ANSI standard color codes

Numbering: Each pair

Temperature Rating: [-20° to 221] °F (-29° to 105) °C

Physical Properties:

Abrasion-resistance:	good
Moisture-resistance:	excellent
Chemical-resistance:	good

ASTM/ANSI Type JX Pairs

ASTM/ANSI Color Code:
Negative wire, red; Positive wire, white; Overall black

CODE	NUMBER OF PAIRS	B & S GAUGE	APPROX. O.D. (inches)	APPROX. SHIP WT. PER 1000 FT. (pounds)
J20-5-904	4 - Twisted	20	0.350	83
J20-5-908	8 - Twisted	20	0.420	131
J20-5-912	12 - Twisted	20	0.495	198
J20-5-924	24 - Twisted	20	0.665	338

ASTM/ANSI Type KX Pairs

ASTM/ANSI Color Code:
Negative wire, red; Positive wire, yellow; Overall yellow

CODE	NUMBER OF PAIRS	B & S GAUGE	APPROX. O.D. (inches)	APPROX. SHIP WT. PER 1000 FT. (pounds)
K20-5-904	4 - Twisted	20	0.350	83
K20-5-908	8 - Twisted	20	0.420	131
K20-5-912	12 - Twisted	20	0.495	198
K20-5-924	24 - Twisted	20	0.665	338

1000 SERIES STANDARD MULTI-PAIR THERMOCOUPLE EXTENSION CABLE SPECIFICATIONS

Single Conductor Insulation: Extruded PVC (pairs twisted)

Shield: Spiral wrapped aluminized polyester tape over each pair w/copper drain wire

Overall Insulation: Extruded PVC jacket with a jacket splitting ripcord

Communication Wire: Insulated copper wire

Color Coding: ASTM/ANSI standard color codes

Numbering: Each pair

Temperature Rating: [-20° to 221] °F (-29° to 105) °C

Physical Properties:

Abrasion-resistance:	good
Moisture-resistance:	excellent
Chemical-resistance:	good

ASTM/ANSI Type JX Pairs

ASTM/ANSI Color Code:
Negative wire, red; Positive wire, white; Overall black

CODE	NUMBER OF PAIRS	B & S GAUGE	APPROX. O.D. (inches)	APPROX. SHIP WT. PER 1000 FT. (pounds)
J20-5-1004	4 - Twisted	20	0.395	94
J20-5-1008	8 - Twisted	20	0.455	142
J20-5-1012	12 - Twisted	20	0.550	220
J20-5-1024	24 - Twisted	20	0.842	428

ASTM/ANSI Type KX Pairs

ASTM/ANSI Color Code:
Negative wire, red; Positive wire, yellow; Overall yellow

CODE	NUMBER OF PAIRS	B & S GAUGE	APPROX. O.D. (inches)	APPROX. SHIP WT. PER 1000 FT. (pounds)
K20-5-1004	4 - Twisted	20	0.395	94
K20-5-1008	8 - Twisted	20	0.455	142
K20-5-1012	12 - Twisted	20	0.550	220
K20-5-1024	24 - Twisted	20	0.842	428

Minumum order quantities apply to all multi-pair cables. Consult factory for minimum purchase quantities, price and availability.

The thermocouple wire types listed below are not stocked at the factory, but may be available on a special order basis. Minimum order quantities may apply.

Duplex - ASTM/ANSI Type J

ASTM/ANSI Color Code: Negative wire, red; Positive wire, white; Overall brown, with Tracer where possible. Non-stock wire

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
J14-1-309	14	Solid	High-temp. glass braid	High-temp. glass braid		Std.	0.125 x 0.195	36
J20-1-509	20	Solid	FEP extruded	Twisted polyester	FEP	Std.	0.059 x 0.100	10
J20-1-511	20	Solid	Fused Polyimide tape	Twisted		Std.	0.087	10
J20-1-516	20	Solid	Extruded PFA	Extruded PFA		Std.	0.070 x 0.120	11
J20-1-517	20	Solid	Extruded PFA	Extruded PFA		Std.	0.131	16
J20-2-305	20	Solid	Glass braid	Glass braid		Spl.	0.054 x 0.095	8
J24-3-508	24	Strd.	Fused TFE tape	Fused TFE tape		Std.	0.047 x 0.086	7
J24-1-511	24	Solid	Fused Polyimide tape	Twisted		Std.	0.063	5
J30-2-513	30	Solid	Fused Polyimide tape	Fused Polyimide tape		Spl.	0.048 x 0.058	4

Duplex - ASTM/ANSI Type K

ASTM/ANSI Color Code: Negative wire, red; Positive wire, yellow; Overall brown, with Tracer where possible. Non-stock wire

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
K20-1-311	20	Solid	High-temp. glass braid	High-temp. glass braid		Std.	0.100 x 0.150	16
K20-1-314	20	Solid	High-temp. glass braid	None - twisted		Std.	0.120	8
K20-1-509	20	Solid	FEP extruded	Twisted Polyester	FEP	Std.	0.132	16
K20-1-516	20	Solid	Extruded PFA	Extruded PFA		Std.	0.070 x 0.120	11
K20-1-517	20	Solid	Extruded PFA	Extruded PFA		Std.	0.131	16
K20-2-355	20	Solid	Ceramic fiber braid	Ceramic fiber braid		Spl.	0.090 x 0.135	14
K20-2-511	20	Solid	Fused Polyimide tape	Fused Polyimide tape		Spl.	0.087	10
K24-2-513	24	Solid	Fused Polyimide tape	Fused Polyimide tape		Spl.	0.060 x 0.085	6
K24-3-508	24	Strd.	Fused TFE tape	Fused TFE tape		Std.	0.047 x 0.085	6
K28-1-304	28	Solid	Glass braid	Glass braid		Std.	0.039 x 0.064	3
K28-1-305	28	Solid	Glass wrap	Glass braid		Std.	0.036 x 0.057	3
K30-1-305	30	Solid	Glass wrap	Glass braid		Std.	0.043 x 0.067	2
K30-2-506	30	Solid	FEP extruded	FEP extruded		Spl.	0.030 x 0.050	4
K30-2-513	30	Solid	Fused Polyimide tape	Fused Polyimide tape		Spl.	0.048 x 0.058	4
K36-2-506	36	Solid	FEP extruded	FEP extruded		Spl.	0.029 x 0.042	2

The thermocouple wire types listed below are not stocked at the factory, but may be available on a special order basis. Minimum order quantities may apply.

Duplex - ASTM/ANSI Type T
ASTM/ANSI Color Code: Negative wire, red; Positive wire, blue; Overall brown, with Tracer where possible. Non-stock wire

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
T20-1-S-304	20	Solid	Glass braid	Glass braid	Stainless overbraid	Std.	0.080 x 0.097	17
T20-1-305	20	Solid	Glass braid	Glass braid		Std.	0.054 x 0.095	8
T20-1-508	20	Solid	Fused TFE tape	Fused TFE tape		Std.	0.059 x 0.100	10
T20-1-509	20	Solid	FEP extruded	Twisted polyester	FEP	Std.	0.132	16
T20-1-516	20	Solid	Extruded PFA	Extruded PFA		Std.	0.070 x 0.120	11
T20-1-517	20	Solid	Extruded PFA	Extruded PFA		Std.	0.070 x 0.120	16
T20-2-513	20	Solid	Fused Polyimide tape	Fused Polyimide tape		Spl.	0.065 x 0.100	11
T20-3-512	20	Strd.	Polyimide	Polyimide		Std.	0.055 x 0.102	11
T24-1-S-304	24	Solid	Glass braid	Glass braid	Stainless overbraid	Std.	0.067 x 0.095	13
T24-1-305	24	Solid	Glass wrap	Glass braid		Std.	0.045 x 0.077	4
T24-2-513	24	Solid	Fused Polyimide tape	Fused Polyimide tape		Spl.	0.060 x 0.085	5
T30-1-305	30	Solid	Glass wrap	Glass braid		Std.	0.043 x 0.067	2
T30-2-506	30	Solid	FEP extruded	FEP extruded		Spl.	0.030 x 0.050	4
T30-2-513	30	Solid	Fused Polyimide tape	Fused Polyimide tape		Spl.	0.048 x 0.058	4
T36-2-506	36	Solid	FEP extruded	FEP extruded		Spl.	0.029 x 0.042	2

Duplex - ASTM/ANSI Type E
ASTM/ANSI Color Code: Negative wire, red; Positive wire, purple; Overall brown, with Tracer where possible. Non-stock wire

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
E20-1-508	20	Solid	Fused TFE tape	Fused TFE tape		Std.	0.059 x 0.100	10
E20-1-516	20	Solid	Extruded PFA	Extruded PFA		Std.	0.070 x 0.120	11
E20-1-517	20	Solid	Extruded PFA	Extruded PFA		Std.	0.070 x 0.120	16

Duplex - ASTM/ANSI Type N
ASTM/ANSI Color Code: Negative wire, red; Positive wire, orange; Overall brown, with Tracer where possible. Non-stock wire

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
N20-1-304	20	Solid	Glass braid	Glass braid		Std.	0.059 x 0.097	8
N20-2-301	20	Solid	Vitreous silica fiber braid	Vitreous silica fiber braid		Spl.	0.100 x 0.155	16
N24-1-304	24	Solid	Glass braid	Glass braid		Std.	0.047 x 0.081	4
N20-1-S-304	20	Solid	Glass braidTFE impregnated	Glass braid/TFE impregnated	Stainless overbraid	Std.	0.075 x 0.117	11
N20-1-S-307	20	Solid	Impregnated glass braid	Glass braid	Stainless overbraid	Std.	0.095 x 0.138	13

Non-Stock Thermocouple Extension Wire

The thermocouple extension wire types listed below are not stocked at the factory, but may be available on a special order basis. Minimum order quantities may apply.

Duplex - ASTM/ANSI Type J

ASTM/ANSI Color Code: Negative wire, red; Positive wire, white; Overall black. Non-stock extension wire

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
J14-6-502	14	Solid	Polyvinyl	Polyvinyl		Spl.	0.130 x 0.226	37
J16-5-303	16	Solid	Enamel glass braid	Glass braid		Std.	0.100 x 0.160	18
J16-7-155	16	Strd.	ServTex	ServTex braid		Std.	0.188 x 0.260	31
J16-7-515	16	Strd.	ETFE	Twisted polyester		Std.	0.185	29
J20-5-514	20	Solid	ETFE	ETFE	ETFE	Std.	0.080 x 0.130	10

Duplex - ASTM/ANSI Type KX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, yellow; Overall yellow. Non-stock extension wire

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
K14-5-502	14	Solid	Polyvinyl	Polyvinyl		Std.	0.130 x 0.226	38
K16-7-515	16	Strd.	ETFE	Twisted Polyester	ETFE	Std.	0.185	30
K20-5-514	20	Solid	ETFE	ETFE		Std.	0.080 x 0.130	10

Duplex - ASTM/ANSI Type TX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, blue; Overall blue. Non-stock extension wire

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
T16-5-502	14	Solid	Polyvinyl	Polyvinyl		Std.	0.111 x 0.188	38
T20-7-502	16	Strd.	Polyvinyl	Polyvinyl		Std.	0.108 x 0.185	30

Duplex - ASTM/ANSI Type EX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, purple; Overall purple. Non-stock extension wire

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
E16-7-515	16	Strd.	ETFE	Twisted polyester	ETFE	Std.	0.185	30
E20-5-502	20	Solid	Polyvinyl	Polyvinyl		Std.	0.095 x 0.158	15

Duplex - ASTM/ANSI Type NX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, orange; Overall orange. Non-stock extension wire

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
N20-5-510	20	Solid	Polyvinyl	Twisted polyester	PVC	Std.	0.170	20

Duplex - ASTM/ANSI Type SX and RX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, black: Overall green; Compensating extension wire for ANSI Types R, S thermocouples. Non-stock extension wire

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
S24-5-304	24	Solid	Glass Braid	Glass Braid		Std.	0.045 x 0.077	4

Tungsten/Tungsten Rhenium Type C

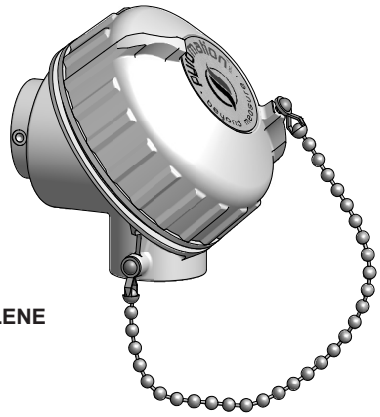
ASTM/ANSI Color Code: Negative wire, red; Positive wire, orange: Overall orange. Non-stock extension wire

CODE	AWG.	CONDUCTOR	INSULATIONS			LIMITS OF ERROR	NOMINAL SIZE (inches)	WEIGHT per 1000 FT. (pounds)
			EACH CONDUCTOR	OUTER JACKET	OVERALL			
C24-5-304	24	Solid	Glass Braid	Glass Braid		Std.	0.045 x0.072	7

The general-purpose, screw-cover connection heads listed below are NEMA/IP66 rated for indoor or outdoor use providing protection against dust, rain, splashing and hose-directed water. These Pyromation design-patented connection heads have easy access, one-turn caps; accept Pyromation 300 series and DIN terminal blocks and transmitters, and provides greater volume for ease of field wiring. When specified, the Series 31, 34 and 91 are rated for Class I Division II locations. Please refer to page AC-5 & 6 for additional head descriptions and complete specifications.

ALUMINUM

CAST IRON



POLYPROPYLENE

316 STAINLESS STEEL

ORDER CODES

Example Order Number: 1-1 **31C** - 1-2 **GS-OR** - 1-3 **343-3**

1-1 General-Purpose Aluminum

ORDER CODE	DESCRIPTION		
	Process Opening	*Conduit Opening*	*Standard Gasket*
31A	1/8" NPT	3/4" NPT	Graphite
31B	1/4" NPT	3/4" NPT	Graphite
31Q	3/8" NPT	3/4" NPT	Graphite
31C	1/2" NPT	3/4" NPT	Graphite
31D	3/4" NPT	3/4" NPT	Graphite
31E	1" NPT	3/4" NPT	Graphite

1-1 General-Purpose Cast Iron

ORDER CODE	DESCRIPTION		
	Process Opening	*Conduit Opening*	*Standard Gasket*
34C	1/2" NPT	3/4" NPT	Graphite
34D	3/4" NPT	3/4" NPT	Graphite
34E	1" NPT	3/4" NPT	Graphite

1-1 General-Purpose 316 Stainless Steel

ORDER CODE	DESCRIPTION		
	Process Opening	*Conduit Opening*	*Standard Gasket*
91C	1/2" NPT	3/4" NPT	Graphite
91D	3/4" NPT	3/4" NPT	Graphite

1-1 General-Purpose White Polypropolyene

ORDER CODE	DESCRIPTION		
	Process Opening	*Conduit Opening*	*Standard Gasket*
63C	1/2" NPT	3/4" NPT	Buna N O-ring

1-2 Head Options

ORDER CODE	DESCRIPTION
W [1]	White epoxy coating
PS	Process set screw
GS	Internal ground screw
OR	Buna N O-ring
HS	Security screw
D2 [2]	Class I Division II Rated Head

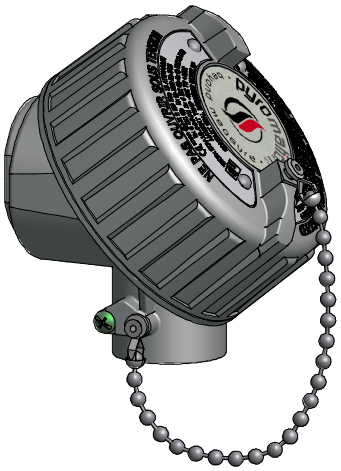
[1] Only available on 31C
[2] Not available with 63 series

1-3 Terminal Blocks

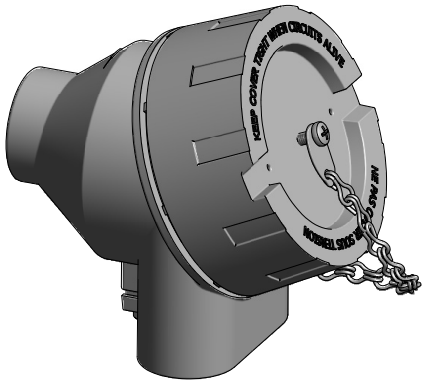
ORDER CODE	DESCRIPTION	CONDUCTOR SIZE
341	Single terminal block	Up to 8 AWG
342	Duplex terminal block	Up to 8 AWG
343-2	Triplex terminal block with 2 brass terminals	Up to 12 AWG
343-3	Triplex terminal block with 3 brass terminals	Up to 12 AWG
343-4	Triplex terminal block with 4 brass terminals	Up to 12 AWG
343-6	Triplex terminal block with 6 brass terminals	Up to 12 AWG

Refer to page AC-4 for block specifications.

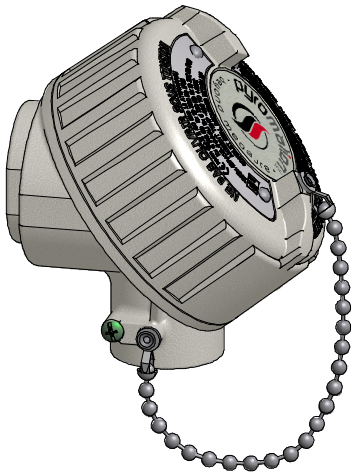
The explosion/flame proof connection heads shown below are designed for use in hazardous locations. Please refer to page AC-7 for descriptions, specifications and ratings for each head. See the "Overview of NEC Hazardous Location Classifications and Methods of Protection" table in the Explosion-Proof (XP) Sensors section of the Pyromation catalog for complete definitions of ratings.



93 Series XP Connection Heads



215807 Series XP Connection Head



94 Series XP Connection Heads

ORDER CODES

Example Order Number: 1-1 **93C** - 1-2 **341**

1-1 Explosion/Flame-Proof Aluminum

ORDER CODE	DESCRIPTION		
	Process Opening	*Conduit Opening*	*Standard Gasket*
93C	1/2" NPT	3/4" NPT	Buna N O-ring
93D	3/4" NPT	3/4" NPT	Buna N O-ring

1-1 Explosion/Flame-Proof 316 Stainless Steel

ORDER CODE	DESCRIPTION		
	Process Opening	*Conduit Opening*	*Standard Gasket*
94C	1/2" NPT	3/4" NPT	Buna N O-ring
94D	3/4" NPT	3/4" NPT	Buna N O-ring

1-1 Explosion/Flame-Proof Aluminum DIN Style

ORDER CODE	DESCRIPTION		
	Process Opening	*Conduit Opening*	*Standard Gasket*
215807	1/2" NPT	3/4" NPT	Buna N O-ring

1-2 Ceramic Terminal Blocks[1]

ORDER CODE	DESCRIPTION	CONDUCTOR SIZE
341	Single terminal block	Up to 8 AWG
342	Duplex terminal block	Up to 8 AWG
343-2	Triplex terminal block with 2 brass terminals	Up to 12 AWG
343-3	Triplex terminal block with 3 brass terminals	Up to 12 AWG
343-4	Triplex terminal block with 4 brass terminals	Up to 12 AWG
343-6	Triplex terminal block with 6 brass terminals	Up to 12 AWG

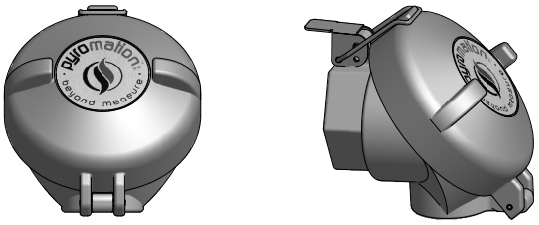
[1] Not available with 215807 head.

1-2 DIN Form B Style Ceramic Terminal Blocks

ORDER CODE	DESCRIPTION	CONDUCTOR SIZE
210304	Duplex terminal block	Up to 16 AWG
210332	Triplex terminal block with 2 brass terminals	Up to 16 AWG
210333	Triplex terminal block with 3 brass terminals	Up to 16 AWG
210334	Triplex terminal block with 4 brass terminals	Up to 16 AWG
210336	Triplex terminal block with 6 brass terminals	Up to 16 AWG

DIE-CAST ALUMINUM FLIP-TOP CONNECTION HEADS

The 49 series flip-top aluminum connection heads listed below meet NEMA 4 requirements for indoor or outdoor applications. The 49 series flip-top aluminum head utilize an EPDM O-ring seal with a maximum temperature rating of 400 ºF. The flip cover provides easy access to the terminals for wiring or maintenance. These connection heads accept the Pyromation 340 series terminal blocks, 400 series transmitters, and DIN Form B blocks and transmitters.



1-1 1-2 1-3

Example Order Number: **49C - GS - 343-3**

1-1 General-Purpose Aluminum Flip-Top

ORDER CODE	DESCRIPTION		
	Process Opening	*Conduit Opening*	*Standard Gasket*
49C	1/2" NPT	3/4" NPT	EPDM O-ring
49D	3/4" NPT	3/4" NPT	EPDM O-ring

1-2 Head Options

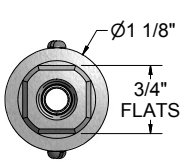
ORDER CODE	DESCRIPTION
GS	Internal ground screw

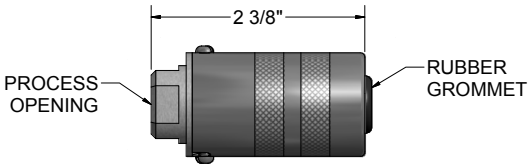
1-3 Terminal Blocks

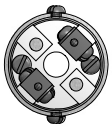
ORDER CODE	DESCRIPTION	CONDUCTOR SIZE
341	Single terminal block	Up to 8 AWG
342	Duplex terminal block	Up to 8 AWG
343-2	Triplex terminal block with 2 brass terminals	Up to 12 AWG
343-3	Triplex terminal block with 3 brass terminals	Up to 12 AWG
343-4	Triplex terminal block with 4 brass terminals	Up to 12 AWG
343-6	Triplex terminal block with 6 brass terminals	Up to 12 AWG

MINIATURE NICKEL-PLATED STEEL CONNECTION HEADS

The miniature nickel-plated connection heads listed below are for indoor or outdoor non-hazardous locations. They provide some degree of protection from dust, rain, and splashing water. The heads come standard with an O-ring moisture seal where the cap connects to the body, and a rubber grommet where the wire exits the cap. The nickel plating provides good corrosion protection. The 362 series connection heads are available with a 1/8" NPT or 1/4" NPT process connections, along with 2-, 3-, or 4-terminal configurations.







1-1

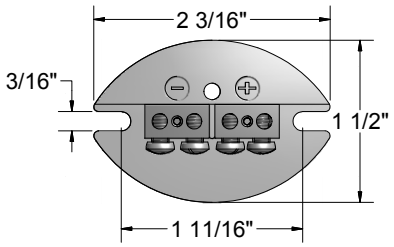
Example Order Number: **364A**

1-1 Complete Head Assemblies

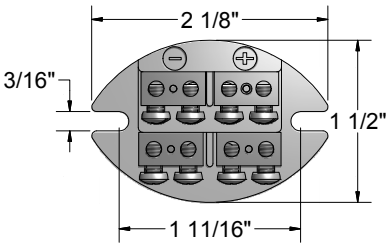
CODE	NO. OF TERMINALS	PROCESS OPENING (inches)	CODE	NO. OF TERMINALS	PROCESS OPENING (inches)
362A	2	1/8 NPT	362B	2	1/4 NPT
363A	3	1/8 NPT	363B	3	1/4 NPT
364A	4	1/8 NPT	364B	4	1/4 NPT

CERAMIC TERMINAL BLOCKS

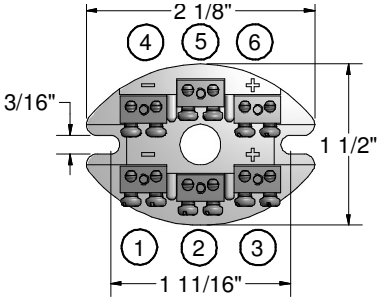
The terminal blocks, listed below, fit all Pyromation series 31, 34, 49, 63, 91 and 800 series connection heads. The terminal blocks are provided with a steatite ceramic base, brass terminal pieces, and stainless steel screws. These terminal blocks are not rated for high voltage use, but can be used in temperature sensor or low voltage Class 2 circuits. Series 341 and 342 terminal blocks accept up to an #8 gauge wire, and the series 343 accepts up to a #12 gauge wire.



Series 341



Series 342



Series 343

Terminal Blocks

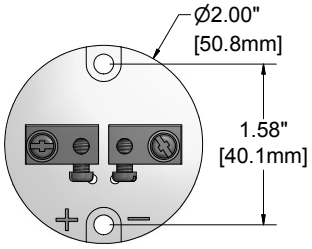
(See table for complete 343- Series)

CODE	DESCRIPTION	CONDUCTOR SIZE	TERMINAL POSITION AS SUPPLIED
341	Single terminal block	Up to 8 AWG	N/A
342	Duplex terminal block	Up to 8 AWG	N/A
343-2	Triplex terminal block with 2 brass terminals	Up to 12 AWG	①–③
343-3	Triplex terminal block with 3 brass terminals	Up to 12 AWG	②–④–⑥
343-4	Triplex terminal block with 4 brass terminals	Up to 12 AWG	①–③–④–⑥
343-6	Triplex terminal block with 6 brass terminals	Up to 12 AWG	All Positions

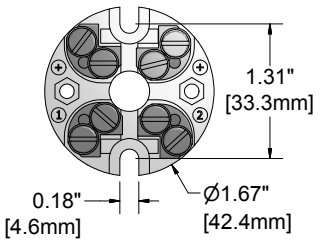
DIN FORM B STYLE CERAMIC TERMINAL BLOCKS

The DIN Style terminal blocks are 42 mm and 50 mm in diameter. The terminal blocks are supplied with a ceramic base. They can be provided in 2-, 3-, 4-, 6-, or 8-terminal configurations.

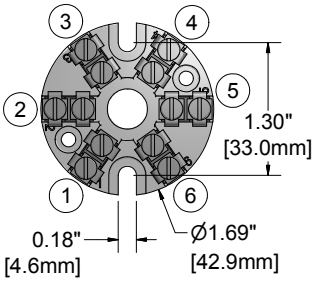
Dimensions In Inches [mm]



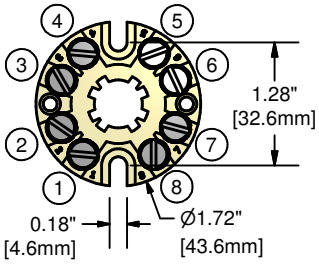
210412



210304



210336



210338

Terminal Blocks

(See table for complete 21033- Series)

CODE	DESCRIPTION	CONDUCTOR SIZE	TERMINAL POSITIONS
210412[1]	2-Pole terminal block (8, 11, 14 AWG)	Up to 8 AWG	N/A
210304	4-Pole terminal block	Up to 16 AWG	N/A
210332	2-Pole terminal block	Up to 16 AWG	1-3
210333	3-Pole terminal block	Up to 16 AWG	1-3-5
210334	4-Pole terminal block	Up to 16 AWG	1-3-4-6
210336	6-Pole terminal block	Up to 16 AWG	1-2-3-4-5-6
210338	8-Pole terminal block	Up to 16 AWG	All positions

[1] Not available with 215807

These general-purpose connection heads are designed and manufactured by Pyromation. The enhanced connection head series design provides[1]:

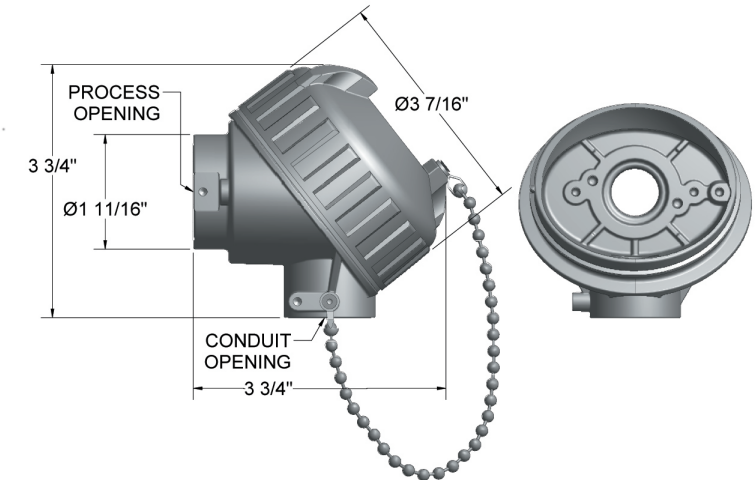
- Greater internal volume for easier wire termination and storage
- Elevated terminal block allowing easy access to terminals for attachment of extension wire
- Conduit stop to prevent damage to interior wiring/block/transmitter during installation
- Optional ground screw (not available on the polypropylene head) and process set screw positions
- Easy single-twist cap removal that maintains strong seal when closed

[1] The connection head series changes are not incorporated in the flip-top aluminum connection head.

GENERAL-PURPOSE, DIE-CAST ALUMINUM CONNECTION HEADS

The General-Purpose, Die-cast Aluminum connection heads are NEMA 4X/IP66 rated for indoor or outdoor use, providing protection against dust, rain, splashing and hose-directed water. When specified the heads are rated through FM/CSA; Non-Incendive Class I, Division II, Groups A, B, C, and D; Class II, Division II, Groups F and G; Class III.

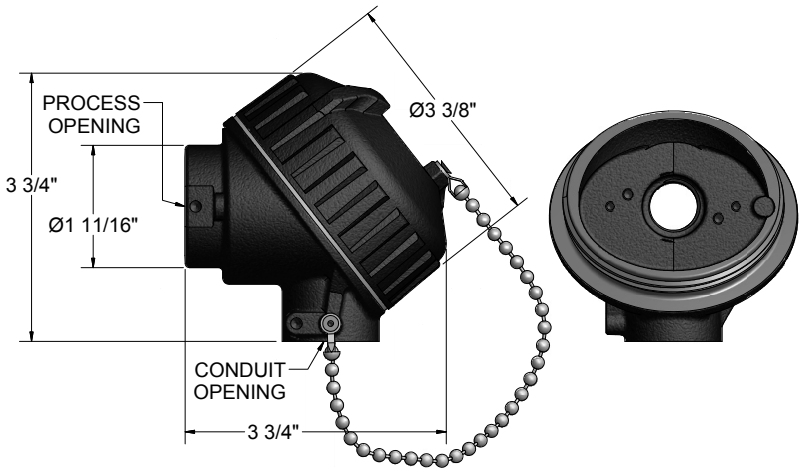
Some configurations are available in a white epoxy coating (which comes with an O-ring seal). All other units come with a standard graphite material gasket that provides good chemical stability, superior creep resistance and a maximum temperature rating of 825 ˚F. These heads accept Pyromation 340 series terminal blocks or 400 series transmitters and DIN Form B blocks or transmitters.



GENERAL-PURPOSE, CAST IRON CONNECTION HEADS

The General-Purpose, Cast Iron connection heads are NEMA 4X/IP66 rated for indoor or outdoor use, providing protection against dust, rain, splashing and hose-directed water. When specified the heads are rated through FM/CSA; Non-Incendive Class I, Division II, Groups A, B, C, and D; Class II, Division II, Groups F and G; Class III.

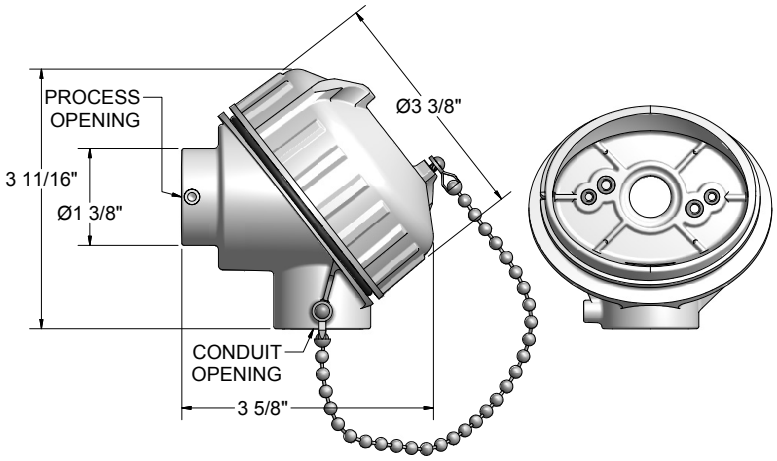
These heads have a black epoxy electrocoat that provides good corrosion- and chemical-resistance; however, it does not provide UV protection for outdoor applications. These heads include a standard graphite material gasket that provides good chemical stability, superior creep resistance and a maximum temperature rating of 825 ˚F. Pyromation 340 series terminal blocks or 400 series transmitters and DIN Form B blocks or transmitters can be mounted in these heads.



GENERAL-PURPOSE, POLYPROPYLENE (PLASTIC) CONNECTION HEADS

The plastic connection heads are molded from white polypropylene and include a stainless steel cap chain and pins. They have been tested and meet NEMA 4X wash-down and corrision requirements for indoor or outdoor use, providing protection against dust, rain, splashing and hose-directed water. The head material is FDA approved for food contact.

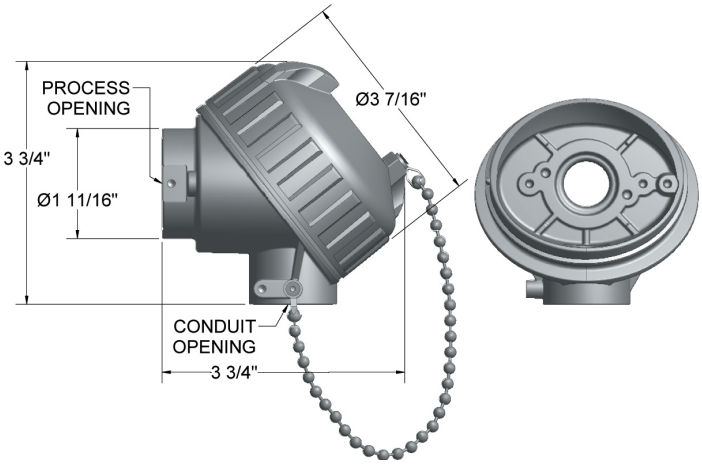
These heads come with an O-ring seal providing a maximum temperature rating of 250 ˚F. Each head has a ½" NPT process opening and a ¾" conduit opening. They will accept Pyromation 340 series blocks, 400 series transmitters and DIN Form B blocks or transmitters.



GENERAL-PURPOSE, STAINLESS STEEL CONNECTION HEADS

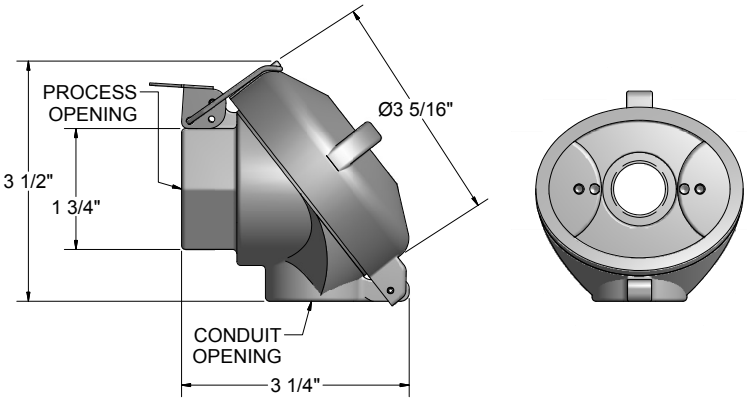
The General-Purpose, 316L Stainless Steel connection heads are NEMA 4X/IP66 rated for indoor or outdoor use, providing protection against dust, rain, splashing and hose-directed water. When specified the heads are rated through FM/CSA; Non-Incendive Class I, Division II, Groups A, B, C, and D; Class II, Division II, Groups F and G; Class III

The stainless steel heads offer excellent corrosion- and chemical-resistance. They include a standard graphite material gasket that provides good chemical stability, superior creep resistance and a maximum temperature rating of 825 ˚F. These heads accept Pyromation 340 series terminal blocks, 400 series transmitters and DIN Form B blocks or transmitters.



GENERAL-PURPOSE, FLIP-TOP ALUMINUM CONNECTION HEADS

These Flip-Top, Die-cast Aluminum connection heads feature an easy-to-open, flip-top cap that is hinged on one side so the cap cannot be lost. These heads come with a standard O-ring that provides good chemical stability, excellent wet/steam sealing characteristics and a maximum temperature rating of 400 ˚F. The heads accept Pyromation 340 series terminal blocks, 400 series transmitters and DIN Form B blocks or transmitters.



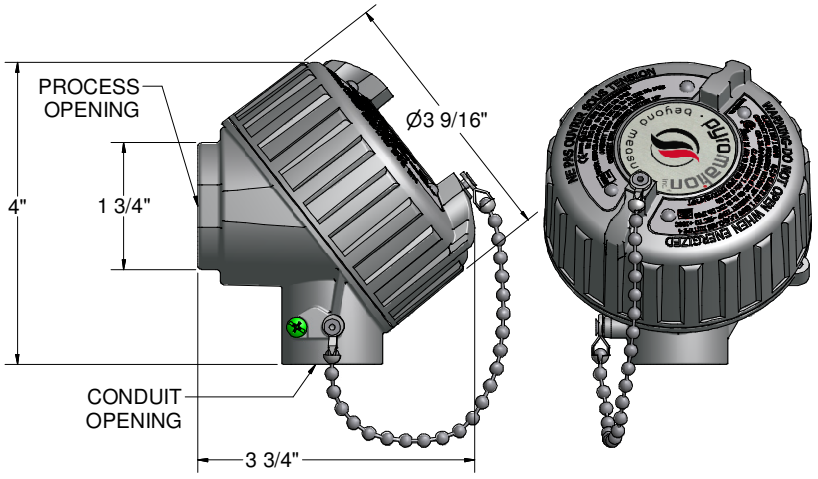
These connection heads are designed for use in hazardous locations; places where flammable or explosive conditions exist. The following connection head types meet standards for hazardous locations and, depending on application, can be used as part of explosion-proof (XP)/flameproof (FP) temperature sensor assemblies in most NEC and IEC hazardous locations.

93 SERIES ALUMINUM CONNECTION HEADS

NEC Explosion-Proof Approvals:
- FM/CSA: Class I Division 1; Groups A,B,C,D; DIP Class II Division 1; Groups E,F,G; Class III; Type 4/4X
- CSA Canada: Ex d IIC Gb; Ex tb IIIC Db; IP66
- CSA U.S.: Class I Zone 1 AEx d IIC Gb; Zone 21 AEx tb IIIC Db; IP66

IEC Flameproof Approvals:
ATEX: Ⓔx II 2GD
Ex db IIC Gb; Ex tb IIIC Db; IP66
IECEx: Ex db IIC Gb; Ex tb IIIC Db; IP66
- Ta = -20 °C to 100 °C

These connection heads accommodate any of the 340 series or DIN Form B terminal blocks and a variety of transmitters.

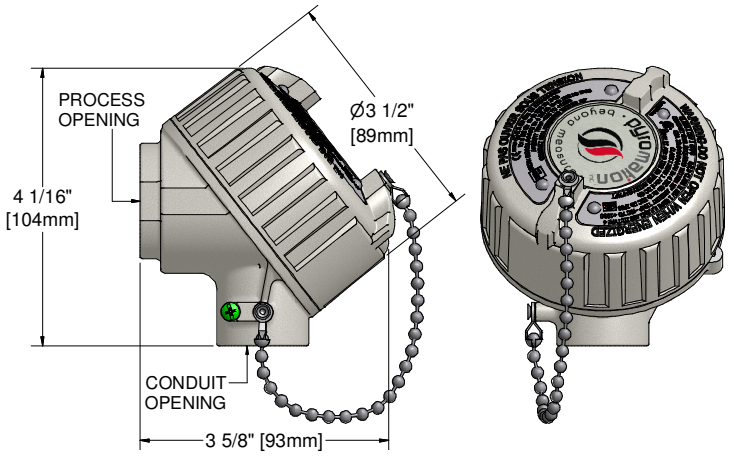


94 SERIES 316L STAINLESS STEEL SCREW-COVER CONNECTION HEADS

NEC Explosion-Proof Approvals:
- FM/CSA: Class I Division 1; Groups A,B,C,D; DIP Class II Division 1; Groups E,F,G; Class III; Type 4X
- CSA Canada: Ex d IIC Gb; Ex tb IIIC Db; IP66
- CSA U.S.: Class I Zone 1 AEx d IIC Gb; Zone 21 AEx tb IIIC Db; IP66

IEC Flameproof Approvals:
ATEX: Ⓔx II 2GD
Ex db IIC Gb; Ex tb IIIC Db; IP66
IECEx: Ex db IIC Gb; Ex tb IIIC Db; IP66
- Ta = -40 °C to 100 °C

These connection heads accommodate any of the 340 series or DIN Form B terminal blocks and a variety of transmitters.

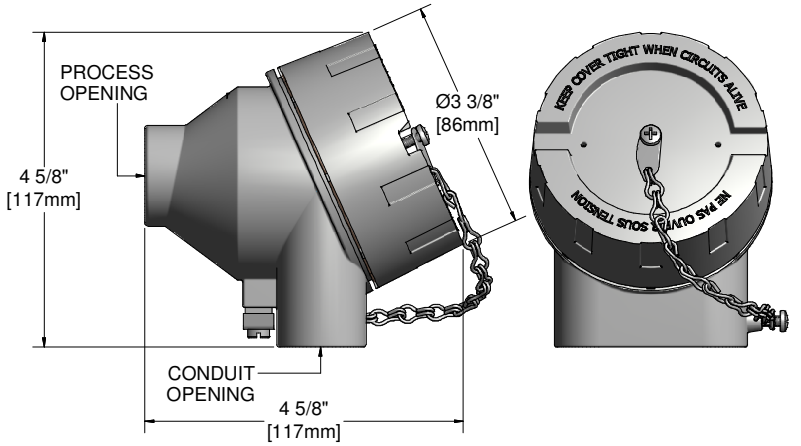


DIN STYLE SCREW-COVER CONNECTION HEADS

The 215807 is an aluminum DIN Style connection head with a ½" NPT process opening and a ¾" conduit connection. The second conduit opening is built-in for optional dual access.

NEC Explosion-Proof Approvals:
- FM/CSA: Class I Division 1; Groups A,B,C,D; DIP Class II Division I; Groups E,F,G; Class III; Type 4X
- CSA: Class I, Zone 1 Ex d II C, IP68

IEC Flameproof Approvals:
ATEX: Ⓔx II 2GD Ex d IIC Gb, Ext 111C Db, IP68
IECeX: Ex d II C, IP68
- Ta = -40 °C to 100 °C



STANDARD and MINIATURE PLUGS and JACKS

FIG. 1

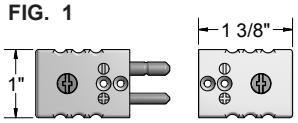


FIG. 2

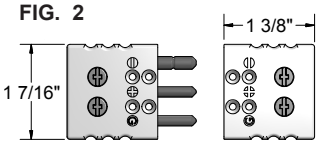


FIG. 3

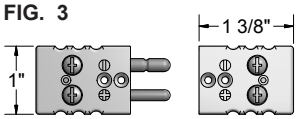


FIG. 4

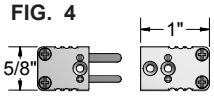
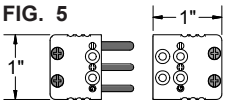


FIG. 5



EXAMPLE ORDER NUMBER: **81J or 81J-H**

Standard Plugs

CODE		DESCRIPTION			
STANDARD PLUGS	*STANDARD JACKS*	NO. PINS	PIN TYPE	TEMP RATING	FIG. NO.
81[1]	82[1]	2	Hollow	200 ºC	1
81U[1] - 3	82[1] - 3	3	Hollow	200 °C	2
81[1] - H	82[1] - H	2	Hollow	350 °C	1
2 Pin JAB - In Connectors					
81[1] - J	82[1] - J	14 ga. max		200 °C	3
61K - E	62K - E	8 ga. max		177 °C	3
[1] = Insert calibration code J, K, T, E, N, R, S, or U					

EXAMPLE ORDER NUMBER: **84K**

Miniature Plugs

CODE		DESCRIPTION		
MINIATURE PLUGS	*MINIATURE JACKS*	NO. PINS	TEMP RATING	FIG. NO.
83[1]	84[1]	2	200 ºC	4
83U[1] - 3	84[1] - 3	3	200 °C	5
[1] Insert calibration code J, K, T, E, N, R, S, or U				

MOUNTING HARDWARE FOR PLUGS AND JACKS

FIG. 6

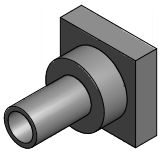


FIG. 7

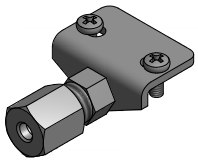


FIG. 9

FIG. 8

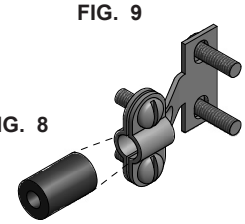
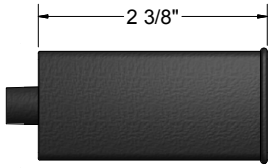


FIG. 10

FIG. 11



EXAMPLE ORDER NUMBER: **8S1 or 8S2-2**

Mounting Hardware

CODE	DESCRIPTION	FIG. NO.
8S1	Std. size cable clamp for 200 and 350 °C connectors	9
8S2 - [1]	Std. size brass crimp adaptor for 200 and 350 °C connectors	6
8S3 - [1]	Std. size compression bracket for 200 and 350 °C connectors	7
8M1	Mini cable clamp	9
8M2 - [1]	Mini brass crimp adaptor	6
[1] = Insert tube size code where required 1 = 1/16" 2 = 1/8" 3 = 3/16" 4 = 1/4" (1/4" O.D. is not available with mini brass crimp)		

Miscellaneous Hardware

CODE	DESCRIPTION	FIG. NO.
Standard Connectors		
811	Rubber boot for 200 °C connectors	11
816	Wire grommet for 200 °C connectors	10
629	Cable clamp bushing	8
Miniature Connectors		
821	Wire grommet	10
831	Rubber boot	11
629	Cable clamp bushing	8

THERMOCOUPLE AND RTD JACK PANELS FOR FS CONDUIT BOX MOUNTING

All listed panels are 2(3/4)" w x 4(1/2)" h aluminum plates

FIG. 1

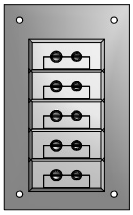
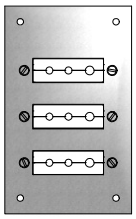


FIG. 2

FIG. 3



EXAMPLE ORDER NUMBER: FMF-K-3

Thermocouple Jack Panels

CODE		DESCRIPTION	
STANDARD SIZE	*MINIATURE SIZE*	NO. CIRCUITS	FIG. NO.
FSB - [1] - 1	FMF - [1] - 1	1	1
FSB - [1] - 2	FMF - [1] - 2	2	1
FSB - [1] - 3	FMF - [1] - 3	3	1
FSB - [1] - 4	FMF - [1] - 4	4	1
FSB - [1] - 5	FMF - [1] - 5	5	1
FSF - [1] - 6	FMF - [1] - 6	6	1
[1] = Insert calibration code J,K,T,E,N,R,S, or U (type N supplied in standard size only).			

3-Wire RTD Jack Panels

CODE	DESCRIPTION	
STANDARD SIZE	NO. CIRCUITS	FIG. NO.
FSF - U - 1 - T	1	3
FSF - U - 2 - T	2	3
FSF - U - 3 - T	3	3
FSF - U - 4 - T	4	3
FSF - U - 5 - T	5	3
FSF - U - 6 - T	6	3
Above panels are 3-pin connections.		

FS Conduit Boxes For Above Jack Panels

CODE	BOX MATERIAL	MAX. NUMBER OF CIRCUITS	CONDUIT OPENING (inches)	FIG. NO.
638	Diecast aluminum	4	3/4 NPT	2
640	Diecast aluminum	5	3/4 NPT	2
639	Glass/nylon	6	3/4 NPT	2

THERMOCOUPLE AND RTD JACK PANELS

FIG. 4

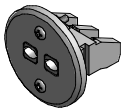


FIG. 5

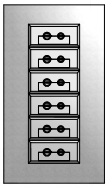
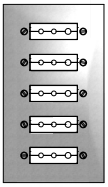


FIG. 6



EXAMPLE ORDER NUMBER: SSB-T-8

Thermocouple Jack Panels

CODE		DESCRIPTION	
STANDARD SIZE	*MINIATURE SIZE*	NO. CIRCUITS	FIG. NO
82[1] - R	84[1] - R	1	4
SSB - [1] - 6	SMF - [1] - 6	6	5
SSB - [1] - 8	SMF - [1] - 8	8	5
SSB - [1] - 10	SMF - [1] - 10	10	5
SSB - [1] - 12	SMF - [1] - 12	12	5
[1] = Insert calibration code J,K,T,E,N,R,S, or U. (type N supplied in standard size only)			

3-Wire RTD Jack Panels

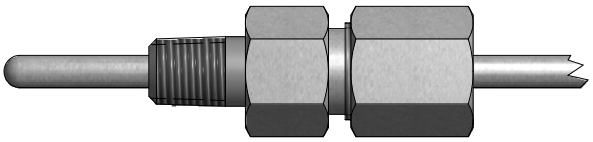
CODE	DESCRIPTION	
STANDARD SIZE	NO. CIRCUITS	FIG. NO
SSF - U - 6 - T	6	6
SSF - U - 8 - T	8	6
SSF - U - 10 - T	10	6
SSF - U - 12 - T	12	6
Above panels are 3-pin connections.		

Jack Panels Dimensions

NO. CIRCUITS	WIDTH (inches)	LENGTH (inches)	WIDTH (inches)	LENGTH (inches)
	STANDARD SIZE		*MINIATURE SIZE*	
6	3 1/4	5 3/4	2	5
8	3 1/4	7 1/4	2	6
10	3 1/4	8 3/4	2	7 1/4
12	3 1/4	10 1/4	2	8 1/2
1	Conduit knockout sizes for round panel jacks. Standard size: 3/4"Miniature size: 1/2"			

Standard and miniature jack panels can be custom designed to provide other dimensions, number of jacks, or mixed calibrations. Consult factory for availability.

RE-ADJUSTABLE COMPRESSION FITTINGS



Stainless Steel with FEP Ferrule

CODE	TUBE SIZE (inches)	PROCESS THREAD (inches)	LENGTH (inches)
6109T-1A	1/16 O.D.	1/8 NPT	1 1/4
6109T-2A	1/8 O.D.	1/8 NPT	1 1/4
6109T-3A	3/16 O.D.	1/8 NPT	1 1/4
6109T-4B	1/4 O.D.	1/4 NPT	2 1/2
6109T-6B	3/8 O.D.	1/4 NPT	2 1/2
6109T-4C	1/4 O.D.	1/2 NPT	2 1/2
6109T-6C	3/8 O.D.	1/2 NPT	2 1/2

Stainless Steel Re-Adjustable Spring-Loaded Well Fittings with FEP Ferrule

CODE	TUBE SIZE (inches	PROCESS THREAD (inches)	LENGTH (inches)
6109TSL-3C	3/16 O.D.	1/2 NPT	2 3/8
6109TSL-4C	1/4 O.D.	1/2 NPT	2 3/8

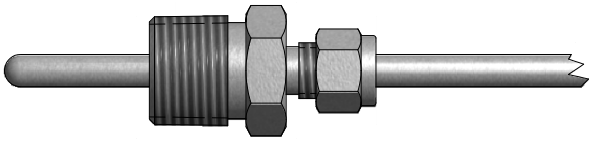
Brass with FEP Ferrule

CODE	TUBE SIZE (inches)	PROCESS THREAD (inches)	LENGTH (inches)
6122T-1A	1/16 O.D.	1/8 NPT	1
6122T-2A	1/8 O.D.	1/8 NPT	1 1/4
6122T-3A	3/16 O.D.	1/8 NPT	1 1/4
6122T-2B	1/8 O.D.	1/4 NPT	1 3/8
6122T-3B	3/16 O.D.	1/4 NPT	1 1/2
6122T-4B	1/4 O.D.	1/4 NPT	1 1/2
6122T-6B	3/8 O.D.	1/4 NPT	1 9/16
6122T-4C	1/4 O.D.	1/2 NPT	1 13/16
6122T-6C	3/8 O.D.	1/2 NPT	1 13/16

Ferrule Temperature Ratings

CODE	MATERIAL	MAX. TEMP.
T	FEP	450 °F
L	Lava	1600 °F
Substitute ferrule code L for the letter T for fittings supplied with other than FEP ferrules.		

ONE-TIME ADJUSTABLE COMPRESSION FITTINGS



Stainless Steel with SS Ferrule

CODE	TUBE SIZE (inches)	PROCESS THREAD (inches)	LENGTH (inches)
6009-1A	1/16 O.D.	1/8 NPT	1 1/4
6009-2A	1/8 O.D.	1/8 NPT	1 1/4
6009-3A	3/16 O.D.	1/8 NPT	1 1/4
6009-4A	1/4 O.D.	1/8 NPT	1 1/4
6008-2B	1/8 O.D.	1/4 NPT	1 7/16
6008-3B	3/16 O.D.	1/4 NPT	1 1/2
6008-4B	1/4 O.D.	1/4 NPT	1 9/16
6008-6B	3/8 O.D.	1/4 NPT	1 5/8
6008-2C	1/8 O.D.	1/2 NPT	1 5/8
6008-4C	1/4 O.D.	1/2 NPT	1 3/4
6008-6C	3/8 O.D.	1/2 NPT	1 7/8

Brass with Brass Ferrule

CODE	TUBE SIZE (inches)	PROCESS THREAD (inches)	LENGTH (inches)
6022-2A	1/8 O.D.	1/8 NPT	1 1/16
6022-3A	3/16 O.D.	1/8 NPT	1 1/16
6022-4A	1/4 O.D.	1/8 NPT	1 3/16
6022-3B	3/16 O.D.	1/4 NPT	1 3/16
6022-4B	1/4 O.D.	1/4 NPT	1 1/4
6022-6B	3/8 O.D.	1/4 NPT	1 5/16
6022-4C	1/4 O.D.	1/2 NPT	1 3/8
6022-6C	3/8 O.D.	1/2 NPT	1 1/2

FIG. 1

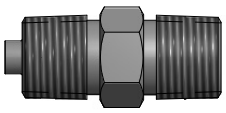


FIG. 2

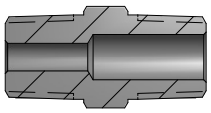


FIG. 3

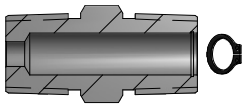


FIG. 4

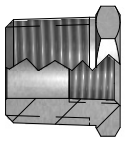


FIG. 5

Machined Double Thread Hex Fittings

CODE	SHEATH SIZE (inches)	DESCRIPTION	FIG. NO
CARBON STEEL 1/2" NPT x 1/2" NPT			
6HN-CC-125-B	0.125	Braze hub	1
6HN-CC-188-B	0.188	Braze hub	1
6HN-CC-250-B	0.250	Braze hub	1
6HN-CC-375-B	0.375	Braze hub	1
6HN-CC-188-SL	0.188	Spring-loaded	2
6HN-CC-250-SL	0.250	Spring-loaded	2
6HN-CC-188-SC[1]	0.188	Self contained spring-loaded	3
6HN-CC-250-SC[1]	0.250	Self contained spring-loaded	3
316SS 1/2" NPT x 1/2" NPT			
8HN-CC-125-W	0.125	Weld hub	1
8HN-CC-188-W	0.188	Weld hub	1
8HN-CC-250-W	0.250	Weld hub	1
8HN-CC-375-W	0.375	Weld hub	1
8HN-CC-188-SL	0.188	Spring-loaded	2
8HN-CC-250-SL	0.250	Spring-loaded	2
8HN-CC-188-SC[1]	0.188	Self contained spring-loaded	3
8HN-CC-250-SC[1]	0.250	Self contained spring-loaded	3
316SS 3/4" NPT x 1/2" NPT			
8HN-DC-250-W	0.250	Weld hub	1
[1] Requires snap-ring pliers to install.			

Hex Head Reducing Bushings

CODE		THREAD SIZE (inches)	LENGTH (inches)	FIG. NO
BRASS	*316SS*			
22RB-BA	8RB-BA	1/4 NPT x 1/8 NPT	11/16	4
22RB-CA	8RB-CA	1/2 NPT x 1/8 NPT	15/16	4
22RB-CB	8RB-CB	1/2 NPT x 1/4 NPT	15/16	4
22RB-DC	8RB-DC	3/4 NPT x 1/2 NPT	1	4
	8RB-EC	1 NPT x 1/2 NPT	1 3/16	4
	8RB-ED	1 NPT x 3/4 NPT	1 3/16	4
	8RB-FC	1 1/4 NPT x 1/2 NPT	1 1/8	4
	679	1 1/4-18 NEF x 1/2 NPT	15/16	4

Pipe Nipples (Schedule 40)

CODE		THREAD (inches)	LENGTH (inches)	FIG. NO
CARBON STEEL	*316SS*			
6PN - C - CL	8PN - C - CL	1/2 NPT	1	5
6PN - C - 2	8PN - C - 2	1/2 NPT	2	5
6PN - C - 3	8PN - C - 3	1/2 NPT	3	5
6PN - C - 4	8PN - C - 4	1/2 NPT	4	5
6PN - C - 5	8PN - C - 5	1/2 NPT	5	5
6PN - C - 6	8PN - C - 6	1/2 NPT	6	5

FIG. 6

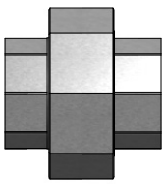
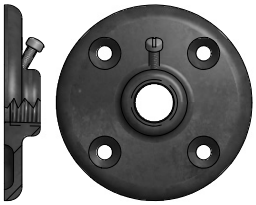


FIG. 7

FIG. 8

FIG. 9



Union Fittings

CODE	NPT SIZE (inches)	DESCRIPTION	FITTING MATERIAL	FIG. NO
6FU - C	1/2	Female union-150#	Malleable iron	6
8FU - C	1/2	Female union-150#	316 SS	6
6FU - C - X	1/2	Explosion-proof female union	Zinc plated steel	6
6UE - C	1/2	90° union elbow-150#	Malleable iron	7

Malleable Iron Mounting Flanges

CODE	NPT PIPE SIZE (inches)	DESCRIPTION	FIG. NO
6FF - B	1/4	Internal threads	8
6FF - C	1/2		8
6FF - D	3/4		8
6FF - E	1		8
6BF - B	1/4	Slip fit bore for indicated pipe size	9
6BF - C	1/2		9
6BF - D	3/4		9
6BF - E	1		9

BARE WIRE, INSULATORS, TERMINAL and SPADE LUGS

Bare Base Metal Thermocouple Wire

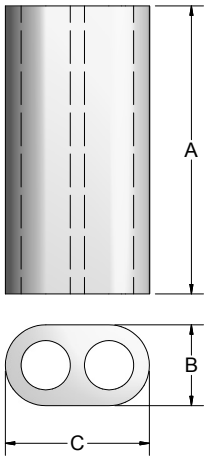
CODE	TYPE / POL.	MATERIAL	GA.	FT. / LB.
JP08B	J (+)	Iron	8	23
JN08B	J (-)	Constantan	8	20
JP14B	J (+)	Iron	14	91
JN14B	J (-)	Constantan	14	80
JP20B	J (+)	Iron	20	365
JN20B	J (-)	Constantan	20	323
KP08B	K (+)	Chromel®	8	21
KN08B	K (-)	Alumel®	8	21
KP14B	K (+)	Chromel®	14	83
KN14B	K (-)	Alumel®	14	83
KP20B	K (+)	Chromel®	20	333
KN20B	K (-)	Alumel®	20	333

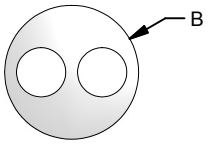
Bare Noble Metal Thermocouple Wire

CODE	TYPE / POL.	MATERIAL	GA.	IN. / TROY OZ.
RP24B	R (+)	Plat. 13% Rh	24	309
SP24B	S (+)	Plat. 10% Rh	24	302
PN24B	R S (-)	Pure Platinum	24	282
RP26B	R (+)	Plat. 13% Rh	26	482
SP26B	S (+)	Plat. 10% Rh	26	473
PN26B	R S (-)	Pure Platinum	26	440

NOTES: All wire supplied bright annealed. Wire orders must be for equal amounts of both legs. All listed wire is supplied as standard limits of error.

INSULATOR DIMENSIONS





Cordierite Insulators (2250 °F max)

CODE	STYLE	GA.	A DIM. (inches)	B DIM. (inches)	C DIM. (inches)	NO BORE(S)
408-1C	Oval	8	1	0.281	0.500	2
408-1R	Round	8	1	0.465		2
408-3C	Oval	8	3	0.281	0.500	2
408-3R	Round	8	3	0.465		2
408-12S[1]	Fish spine	8	12	0.260		1
411-1C	Oval	11	1	0.218	0.375	2
411-3C	Oval	11	3	0.218	0.375	2
414-1C	Oval	14	1	0.188	0.313	2
414-1R	Round	14	1	0.250		2
414-3C	Oval	14	3	0.188	0.313	2
414-12S[1]	Fish spine	14	12	0.200		1
420-1C	Oval	20	1	0.188	0.172	2

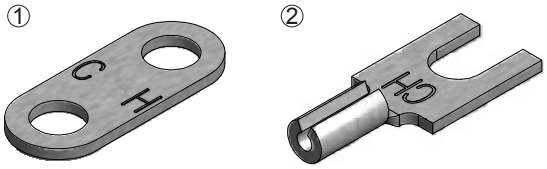
[1] 12S fish spine insulators supplied in continuous 12" sleeves.

Alumina Insulators (3400 °F max)

CODE	STYLE	GA.	A DIM. (inches)	B DIM. (inches)	C DIM. (inches)	NO BORE(S)
424-12	Round	24	12	0.188		4
424-18	Round	24	18	0.188		4
424-24	Round	24	24	0.188		4
424-30	Round	24	30	0.188		4

Thermocouple Alloy Terminal and Spade Lugs

TERMINAL LUG CODE [1]	SPADE LUG CODE [2]	ANSI LETTER DESIGNATION	THERMOCOUPLE ALLOY
460053	460060	KP, EP	Chromel®
460052	460059	KN	Alumel®
460056	460063	JP	Iron
460054	460061	JN, EN, TN	Constantan
460055	460062	TP, RP, SP	Copper
460051	460116	RN, SN	Alloy #11



[1] Terminal lugs fit Cinch Jones Series #141 and equivalent Barrier terminal blocks with 27/64" screw spacing and #6-32 terminal screws.

[2] Spade lugs are crimp-on style to fit #6-32 terminal screws and 18 awg. wire or smaller.

COMPLETE COMPENSATED TERMINAL BLOCKS

EXAMPLE ORDER NUMBER: **26 - 240 - 08**

Terminal Block Thermocouple Type

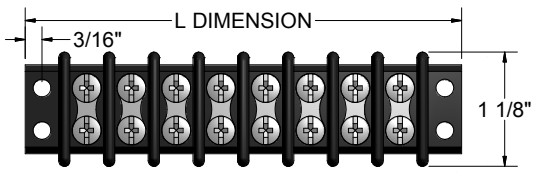
PREFIX CODE	T/C TYPE	THERMOCOUPLE ALLOY	
		POSITIVE	*NEGATIVE*
26 - 220	E	Chromel®	Constantan
26 - 230	J	Iron	Constantan
26 - 240	K	Chromel®	Alumel®
26 - 250	R-S	Copper	Alloy #11
26 - 260	T	Copper	Constantan
26 - 270	U	Copper	Copper

Consult factory for combination blocks.

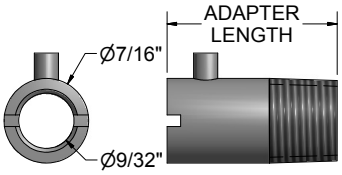
Number of Circuits

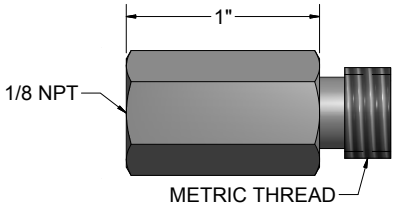
SUFFIX CODE	CIRCUITS (TERMINALS)	L DIMENSION (inches)
02	2 (4)	2 1/2
04	4 (8)	4 1/2
05	5 (10)	5 3/8
06	6 (12)	6
08	8 (16)	7 3/4
10	10 (20)	9 1/2

Consult factory for other number of circuits.

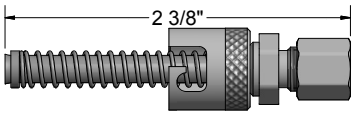


Chromel® and Alumel® are registered trademarks of Hoskins Manufacturing Company.





NICKEL PLATED BRASS COMPRESSION FITTING



Bayonet Fitting Adapters

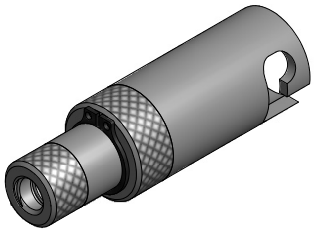
CODE	LENGTH (inches)	THREAD (inches)
705-0.88	7/8	1/8 NPT
705-1.25	1 1/4	1/8 NPT
705-1.5	1 1/2	1/8 NPT
705-2	2	1/8 NPT
705-2.25	2 1/4	1/8 NPT
705-2.5	2 1/2	1/8 NPT
705-3.5	3 1/2	1/8 NPT
735-0.88	7/8	3/8 - 24
735-1.5	1 1/2	3/8 - 24
735-2.5	2 1/2	3/8 - 24
735-3.5	3 1/2	3/8 - 24
The 300 series stainless steel bayonet adapter accommodates the bayonet lock cap assembly to bottom the hot junction in holes in machine walls, cylinder, or dies.		

Metric to 1/8" NPT Adapters

CODE	METRIC THREAD (mm)
40001	10 x 1.5
40002	12 x 1
40003	12 x 1.5
40004	14 x 1.5
40005	14 x 2
Adds 1" to bayonet adapter length.	

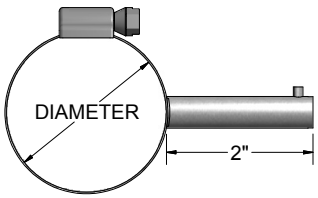
Adjustable Bayonet Cap

CODE	SHEATH SIZE (inches)	DESCRIPTION
718	1/16	Adjustable bayonet cap and spring
728	1/8	

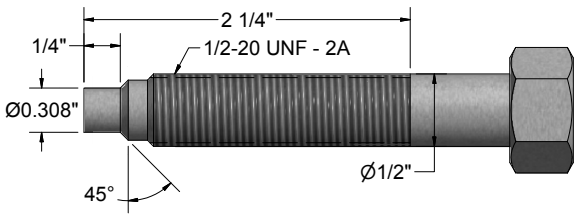


Positive Bottoming Indicating Bayonet Cap

CODE	DESCRIPTION
D702 - A - 2	Adjustable bayonet cap for 0.210" O.D. flex with red bottoming indication.



BLANK MELT BOLT



Pipe Clamp Adapters

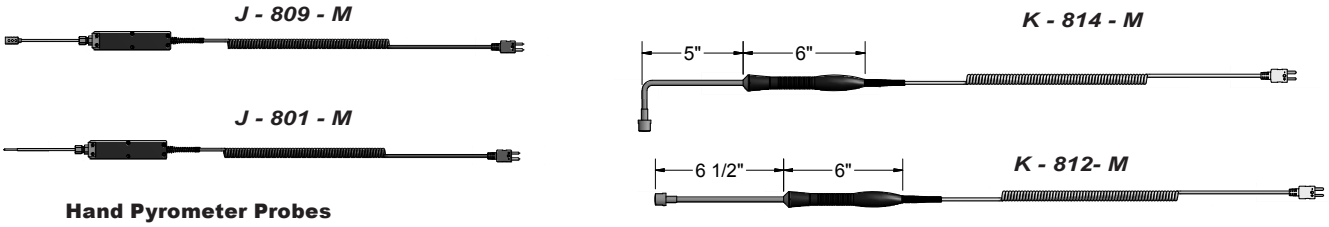
CODE	CLAMP DIA. MIN. / MAX. (inches)	PIPE SIZE (inches)	PIPE DIAMETER (inches)
PCA-075	11/16 - 1 1/4	1/2 - 3/4 IPS	0.840 - 1.050
PCA-150	1 1/16 - 2	1 - 1 1/2 IPS	1.315 - 1.900
PCA-250	2 1/16 - 3	2 - 2 1/2 IPS	2.375 - 2.875
PCA-350	3 5/16 - 4 1/4	3 - 3 1/2 IPS	3.500 - 4.000
PCA-400	4 1/8 - 7	4 IPS	4.500
Use 2(3/4)" sensor 'A' dimension when using fixed bayonet type thermocouples with above adapters.			

Blank Melt Bolts

CODE	DESCRIPTION
743	3" blank bolt
746	6" blank bolt

HANDHELD THERMOCOUPLE PROBES

The hand pyrometer thermocouple probes listed below are suitable for use in many process and laboratory applications for "spot checking" temperatures of a variety of products and air flows. The probes are designed for use with Pyromation's and other manufacturers' handheld pyrometers. All probes are supplied with retractable coiled cordset leads with an expandable length of 5 feet.



Hand Pyrometer Probes

CODES COMPLETE ASSEMBLY	PROBE STYLE	DESCRIPTION
J - 801 - M	Insertion probe	1/8" x 3" long sheath w/ a 1/16" x 3/4" long hypodermic needle tip
J - 803 - M	General-purpose probe	1/8" O.D. x 6" long pointed sheath
J - 805 - M	Heavy-duty general purpose	3/16" O.D. x 6" long pointed sheath
J - 809 - M	Air / gas shielded tip	1/8" O.D. x 6" long w/radiation shield
[1]K-812-M	Surface probe - straight	Heavy-Duty, Fast-Responding Tip 6 1/2" long
[1]K-814-M	Surface probe - 90° bend	Heavy-Duty, Fast-Responding Tip 6 1/2" long

[1] Only Available in Type "K"

To order other calibrations, change prefix letter to J or T.
All probes are supplied with 316 Stainless Steel sheaths.
To order thermocouples with sheath lengths other than what is specified, add the letter "X" after the calibration prefix and specify length. Example: JX-803-M X=12

MOLTEN NON-FERROUS METAL LANCES AND THERMOCOUPLE TIPS

FIG. 1

FIG. 2

FIG. 3

Lances and Tips

CODE	DESCRIPTION	FIG. NO.
26 - 101P[1]	Ladle type, straight lance handle with plastic grip, 43" long	1
26 - 501P [1]	Furnace type, 90° lance handle with plastic grip, 43" long	2
26 - 501T - 8	8" Type K 446SS thermocouple tip with 43" leads	3
26 - 501T - 12	12" Type K 446SS thermocouple tip with 43" leads	3
26 - 501T - 15	15" Type K 446SS thermocouple tip with 43" leads	3
26 - 501T - 18	18" Type K 446SS thermocouple tip with 43" leads	3
[1] Does not include sensor.		

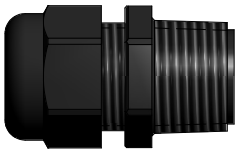


FIG. 1

FIG. 2

Nylon Weatherproof Cord Grips

CODE	CABLE SIZE RANGE (inches)	NPT SIZE (inches)
1399	0.197 to 0.348	1/2

Stainless Steel Square Lock Flexible Armor

CODE	I.D. (inches)	O.D. (inches)	COATING	FIG. NO.
FX188SL	3/16	0.275	None	1
FX125SL	1/8	0.207	None	1
FX250SL	1/4	0.345	None	1
FX188SLP	3/16	0.328	PVC (black)	2
FX188SLF	3/16	0.313	FEP (white)	2

FIG. 3

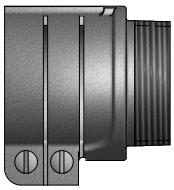


FIG. 4

Holding Fixtures for Silicon Carbide Tubes

CODE	DESCRIPTION	FIG. NO.
18J SERIES TUBES		
370006	3/4" NPT x 1(7/8)" I.D.	3
18JC SERIES TUBES		
370007	Support casting with flange	4

Coil Cords

CODE	DESCRIPTION	RETRACTED LENGTH (inches)	EXTENDED LENGTH (inches)
[1]32060-0	Polyurethane outer, PVC inner, 2 free ends,stripped	12	60
[1]32120-0	Polyurethane outer, PVC inner, 2 free ends,stripped	24	120
RTD32060-0	Polyurethane outer, PVC inner, 3 conductor with 2 free ends,stripped	12	60
[1] Insert calibration code: J, K, T, E, R, S, U Consult factory for availability of other lengths			

FIG. 6

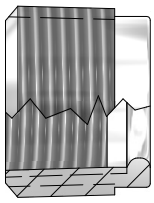
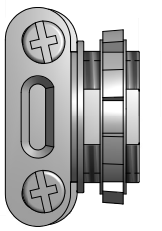


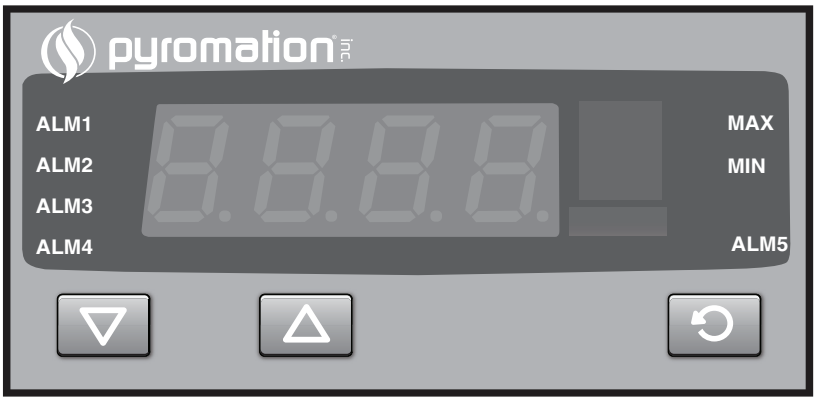
FIG. 7



Miscellaneous Items

CODE	DESCRIPTION	FIG. NO.
440017	3/4 oz. silicone rubber head sealant (RTV)	
440040	10cc heat transfer compound (300 °F max)	
6EB - DC	3/4" x 1/2" reducing face bushing	6
710	1/2" box connector	7

The Series 810 1/8 DIN Panel Indicator is loaded with standard and optional features that provide a flexible and economical solution for almost any application. Customize the unit with just the functions your application requires, minimizing your cost. Features flexible input/output options and large LED display. The digital indicator is fitted with one latchable relay as standard. Plug-in modules allow two additional relays, process variable retransmission, or transmitter power supply. Each alarm has its own LED indicator for fast identification of alarms. Configuration can be modified in the field through the front panel or through use of a computer interface.



Features and Benefits

- Four-digit LED display
- Up To 3 Alarms
- Transmitter power supply option
- Min/Max value hold
- Engineering units
- PC configuration
- Process variable retransmit option

TECHNICAL DATA

General

Output Configuration	Up to 3 total, max 3 for alarms, max 1 for retransmit of PV, max 1 transmitter power supply
Alarm Types	Process high, process low, direct acting, process high, process low reverse and logical OR
Human Interface	3 button operation, 4 digit 13 mm high red display, plus set-up alarm, min and max indicators
PC Configuration	Off-line configuration from serial port to dedicated configuration socket

Output and Options

Alarms Relay(s)	Contacts: SPDT 2 resistive at 240 V ac, > 500,000 operations, latching or non-latching
Retransmit Output	(0 to 20) mA or (4 to 20) mA, (0 to 10) V or (0 to 5) V into 500 Ω min. Accuracy typically ± 0.25%
Transmitter Power Supply	(20 to 28) V dc (24 V nominal) max load 910 Ω (22 mA at 20 V)

Inputs

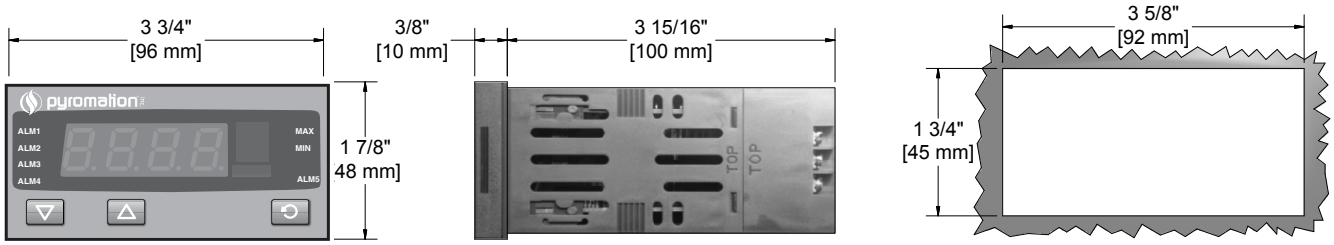
Thermocouple Types	J,K,R,S,T,B,L, & N
RTD	3-wire Pt100 (α = 0.003 85 $^{o}C^{-1}$), 50 Ω per lead maximum (balanced)
DC Linear	(0 to 20) mA or (4 to 20) mA, (0 to 50) mV or (10 to 50) mV, (0 to 5) V or (1 to 5) V, (0 to 10) V or (2 to 10) V. Scalable -1999 to 9999, decimal point available
Impedance	> 100 MΩ for Thermocouple and mV ranges, 47 KΩ for V ranges and 4.7 Ω for mA ranges
Accuracy	± 0.25% of input span ± 1 LSD (T/C CJC better than 0.7 ^{o}C)
Sampling	4 s, 14 bit resolution (approximately)
Sensor Break Detection	< 2 second (except zero based DC ranges), high alarms activate (low for RTD, mA or V)

Operating Conditions

Temperature & RH	(0 to 55) ˚C, 20% to 95% RH non-condensing, (-20 to 80) ˚C for storage
Power supply	(100 to 240) V ac 50/60 Hz 7.5VA
Front Panel Protection	IEC IP66 (Behind panel protection is IP20)

Approvals

CE marked	Unit complies with the legal requirements set forth by the EU regulations.
c UL us	UL recognized component.



ORDER CODES

Example Order Number: 1: **810** - 2: **1** 3: **1** - 4: **00**

1

CODE	DESCRIPTION
810	(100 to 240) V ac

2

CODE	DESCRIPTION
0	Not fitted
1	Relay
7	(4 to 20) mA Retransmit

3

CODE	DESCRIPTION
0	Not Fitted
1	Relay
8	Transmitter Power Supply

4

CODE	DESCRIPTION
00	Non-Configured