User Manual & Quick Start Guide
100001, Rev 0
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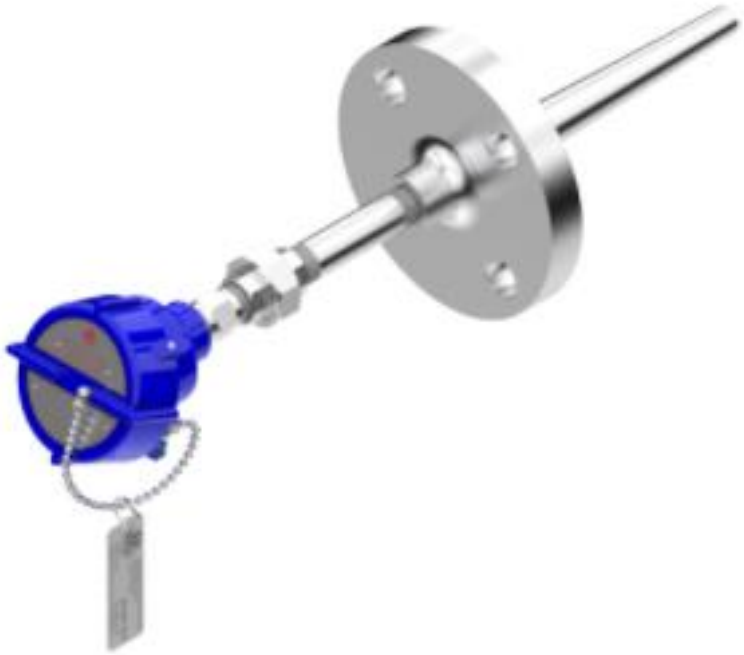
JMS Southeast, Inc.'s

4E Ex Rated Flame Path Spring-Loaded & Welded Thermocouple & RTD Temperature Sensors

User Manual & Quick Start Guide



NOTICE

This guide provides basic guidelines for JMS Southeast, Inc.'s 4E Sensor models.

If the sensor was ordered assembled to a temperature thermowell or transmitter, see the appropriate product literature for information on configuration and hazardous locations certifications.

⚠ WARNING

Explosions could result in death or serious injury.

Installation of this sensor in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices.

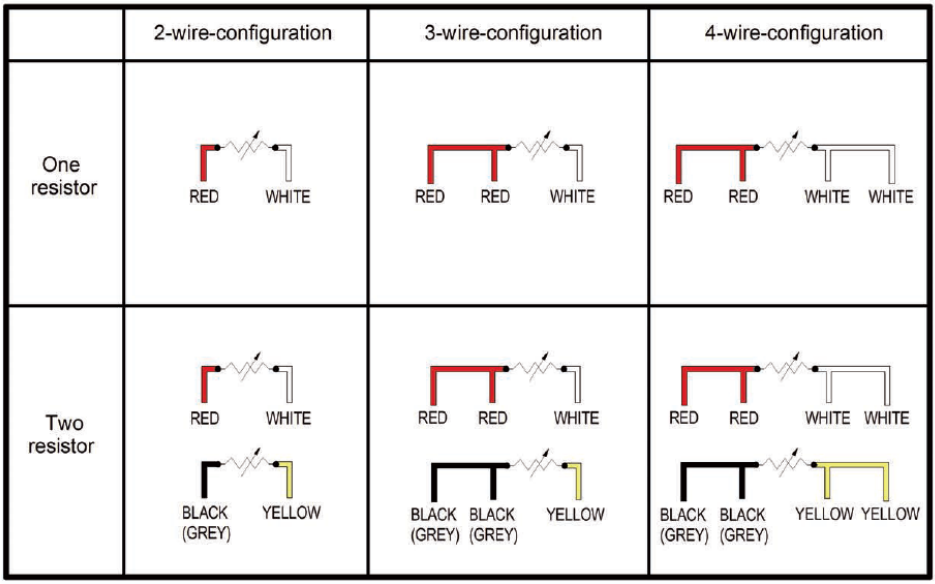
Conduit/cable entries

- Unless marked, the conduit/cable entries in the transmitter housing use a 1/2-14 NPT thread form. Entries marked "M20" are M20 × 1.5 thread form. On devices with multiple conduit entries, all conduit entries will have the same thread form.
- When installing in a hazardous location, use only appropriately listed or Ex certified flameproof/dust plugs, adapters, or glands in cable/conduit entries.
- Only use plugs, adapters, glands, or conduit with a compatible thread form when closing these entries.

Contents

1.0 Wiring diagram for RTDs

Figure 1-1. RTD Lead Wire Configuration per ASTM 1137 & IEC 60751



Note

To configure a single element, 4-wire RTD as a 3-wire system, connect only one white lead. Insulate or terminate the unused white lead in a manner that prevents shorting to the ground. To configure a single element, 4-wire RTD as a 2-wire system, connect matching colored wires first and then connect the paired wires to the terminal.

It is always recommended, however, to order the wire construction (2 wire, 3 wire or 4 wire) needed to avoid potential for shorting or other inadvertent damage potentially resulting from mis-wiring.

1.1 Lead wire Configuration Explanation

A resistance temperature detector determines the temperature by measuring resistance. The sensing element is usually a small diameter wire manufactured so that its resistance will change in a known and consistent manner. To measure the resistance accurately and consistently, other extraneous resistances must be compensated for or minimized. A major cause of extraneous resistance is lead wire in series with the RTD. The readout is the sum of the bulb resistance and the lead wire resistance. The lead wire resistance can be compensated in most applications by a three wire RTD lead wire configuration.

In the three-wire configuration, the power supply is taken to one side of the resistance temperature detector. This puts the other two lead wires in opposite arms of the Wheatstone bridge so that they cancel each other out and have little effect on the bridge output voltage. In the 3-wire configuration, the resistance of the lead wire length is compensated for in the Wheatstone bridge. This design is recommended for most industrial applications.

An even more accurate wire configuration is the 4-wire design. In this design, lead wires #1 and #2 are on one side of the power supply while lead wires #3 and #4 are on the other side of the power supply. All four lead wire resistances in this case are negated and the bulb resistance stands as the resistance input alone. We strongly recommend this design. You must have a good 4 wire input device. Call us for recommendations.

1.2 RTD Operation & Installation Instructions

Series 4E RTD's are installed by means of welded or spring-loaded NPT fittings. Follow these instructions for installation of an RTD with a 1/2" x 1/2" NPT fitting:

(1) Insert RTD into process hole or thermowell / protection tube instrument connection opening. Spring loaded probes must be assembled to a thermowell or protection tube to maintain their Ex-rating. Thermowell / protection tube should be designed so as to maintain the pressure boundary over its entire range of operating temperatures.

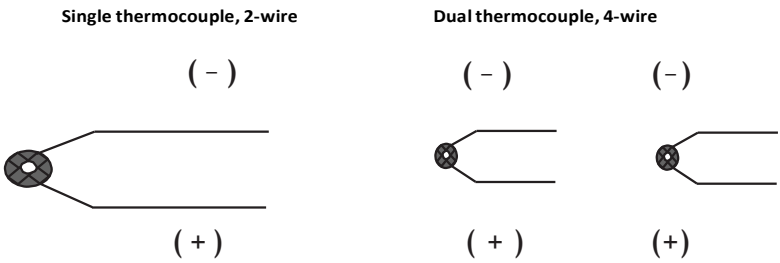
(2) Tighten probe into place by turning probe into threaded connection. If cold-end termination of the RTD is wired into head and you have a spring-loaded fitting, then the wires should be disconnected from the terminal block to prevent twisting and shorting.

Make sure the extension wire is clean so that a good electrical connection will result at the terminal block. We recommend the use of lacquer, cement, or other moisture proof sealing to prevent oxidation and the loosening of terminals. Connect the positive extension wire to the positive RTD wire and the negative extension wire to the negative RTD wire. Wires are color coded for identification as shown in the table at the beginning of this section.

The user of this device should take care to ensure that at no time does the temperature experienced by the enclosure exceed the ambient temperature ratings stated on the enclosure itself. Conduction and radiation effects should be considered. *See*, 3.0 General Installation Ambient Temperature Conditions for additional information.

2.0 Wiring diagram for thermocouples

Figure 2-1. Thermocouple Lead Wire Configuration



2.1 Thermocouple Operation & Installation Instructions

4E Series thermocouples are installed by means of welded 1/2" x 1/2" NPT fittings, or spring-loaded fittings. Follow these instructions for installation of a thermocouple with a 1/2" x 1/2" NPT fitting:

(1) Insert thermocouple into process hole or thermowell / protection tube instrument connection opening. Spring loaded probes must be assembled to a thermowell or protection tube appropriate to process conditions including pressure and temperature to maintain their ex-rating. Thermowell / protection tube should be designed so as to maintain the pressure boundary over its entire range of operating temperatures.

(2) Tighten probe into place by turning probe into threaded connection. When installing a spring-loaded sensor, the wires should be disconnected from the terminal block to prevent twisting, breaking and/or shorting during installation.

Spring loaded probes should never be installed in ceramic protection tubes!

INSTALLATION: Place thermocouple in area not too close to heating element or direct flame. When measuring very high temperatures, install thermocouple vertically, if possible, to avoid protection tube element sagging.

Always use thermocouple extension wire to correlate with calibration of thermocouple and instrumentation being used.

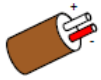
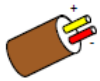
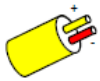
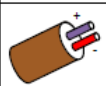
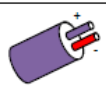
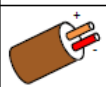
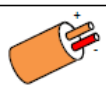
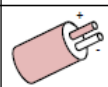
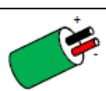
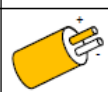
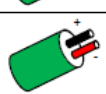
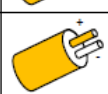
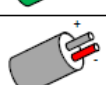
Install thermocouple away from AC power lines, preferably more than one foot away. Do not run thermocouple wires in the same conduit with other electrical wires.

Apply lacquer or silicon resin to screws to prevent effects of vibration and oxidation.

Make sure the extension wire is clean so a good electrical connection will result at the terminal block. Connect the positive extension wire to the positive thermocouple wire and the negative extension wire to the negative thermocouple wire. Wires are color coded for identification as indicated in Table 2.1-1. Notice that in the USA (ASTM type) the negative leg is always red and that elsewhere (IEC type) the negative leg is always white.

The user of this device should take care to ensure that at no time does the temperature experienced by the enclosure exceed the ambient temperature ratings stated on the enclosure itself. Conduction and radiation effects should be considered. *See*, 3.0 General Installation Ambient Temperature Conditions for additional information.

Table 2.1-1 –Thermocouple Wiring Color Codes By Type

ANSI CODE	CONDUCTOR COMBINATION		COLOR CODING		MAXIMUM USEFUL TEMPERATURE RANGE *		MAXIMUM THERMOCOUPLE GRADE TEMPERATURE	EMF (mV) OVER MAXIMUM TEMP RANGE	STANDARD LIMITS OF ERROR (ABOVE 0°C)	SPECIAL LIMITS OF ERROR (ABOVE 0°C)	INTERNATIONAL CODE IEC 584-3	ANSI CODE
	+ LEAD	- LEAD	THERMOCOUPLE GRADE	EXTENSION GRADE	THERMOCOUPLE GRADE	EXTENSION GRADE						
J	IRON Fe (magnetic)	CONSTANTAN COPPER-NICKEL Cu-Ni			32 to 1400°F 0 to 760°C	32 to 400°F 0 to 200°C	-346 to 2192°F -210 to 1200°C	-8.095 to 69.553	greater of 2.2°C or 0.75%	greater of 1.1°C or 0.4%		J
K	CHROMEL NICKEL-CHROMIUM Ni-Cr	ALUMEL NICKEL-ALUMINUM Ni-Al (magnetic)			32 to 2300°F 0 to 1260°C	32 to 400°F 0 to 200°C	-454 to 2500°F -270 to 1372°C	-6.458 to 54.886	greater of 2.2°C or 0.75%	greater of 1.1°C or 0.4%		K
T	COPPER Cu	CONSTANTAN COPPER-NICKEL Cu-Ni			32 to 700°F 0 to 370°C	-75 to 200°F -60 to 100°C	-454 to 752°F -270 to 400°C	-6.258 to 20.872	greater of 1.0°C or 0.75%	greater of 0.5°C or 0.4%		T
E	CHROMEL NICKEL-CHROMIUM Ni-Cr	CONSTANTAN COPPER-NICKEL Cu-Ni			32 to 1600°F 0 to 870°C	32 to 400°F 0 to 200°C	-454 to 1832°F -270 to 1000°C	-9.835 to 76.373	greater of 1.7°C or 0.5%	greater of 1.0°C or 0.4%		E
N	NICROSIL Ni-Cr-Si	NISIL Ni-Si-Mg			32 to 2300°F 0 to 1260°C	32 to 400°F 0 to 200°C	-454 to 2372°F -270 to 1300°C	-4.345 to 47.513	greater of 2.2°C or 0.75%	greater of 1.1°C or 0.4%		N
R	PLATINUM- 13% RHODIUM Pt-13% Rh	PLATINUM Pt	NONE ESTABLISHED		32 to 2700°F 0 to 1480°C	32 to 400°F 0 to 200°C	-58 to 3214°F -50 to 1768°C	-0.226 to 21.101	greater of 1.5°C or 0.25%	greater of 0.6°C or 0.1%		R
S	PLATINUM- 10% RHODIUM Pt-10% Rh	PLATINUM Pt	NONE ESTABLISHED		32 to 2700°F 0 to 1480°C	32 to 400°F 0 to 200°C	-58 to 3214°F -50 to 1768°C	-0.236 to 18.693	greater of 1.5°C or 0.25%	greater of 0.6°C or 0.1%		S
B	PLATINUM- 30% RHODIUM Pt-30% Rh	PLATINUM- 6% RHODIUM Pt-6% Rh	NONE ESTABLISHED		1600 to 3100°F 870 to 1700°C	32 to 200°F 0 to 100°C	32 to 3308°F 0 to 1820°C	0.000 to 13.820	0.50%	0.25%	NO STANDARD USE COPPER CONDUCTORS	B
C	TUNGSTEN- 5% RHENIUM W-5% Re	TUNGSTEN- 26% RHENIUM W-26% Re	NONE ESTABLISHED		32 to 4200°F 0 to 2315°C	32 to 400°F 0 to 200°C	32 to 4200°F 0 to 2315°C	0.000 to 37.070	greater of 4.4°C or 1.0%	N/A	NO STANDARD	C

*EXCEPT AS RESTRICTED BY CONDUCTOR SIZE AND INSULATION PER ASTM VOLUME 14.03 AND OTHER APPLICABLE STANDARDS

3.0 General Installation Ambient Temperature Considerations

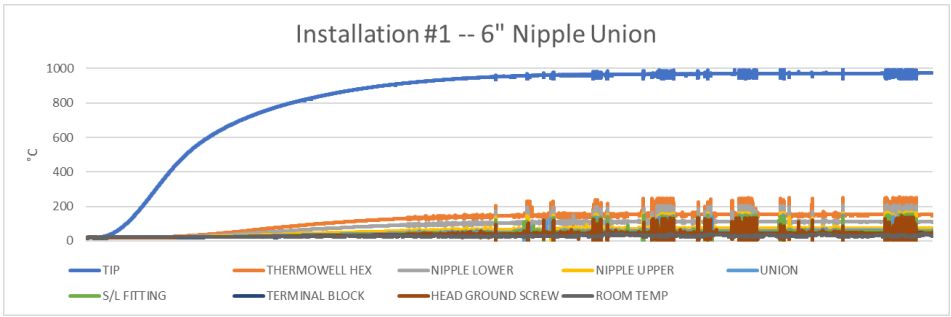
Series 4E Thermocouples and RTDs for use in Hazardous Environments maintain maximum ambient temperature ratings as described in Section 4.0 Product Considerations of this Quick Guide and User Manual. Owners should be careful to consider all possible ambient temperature influences that might arise from sources of radiation, conduction or convection depending on the details of a given installation.

Installation #1 - 6" Nipple-Union

JMS Southeast, Inc. performed temperature monitoring and testing on the below three installations to assess temperature migration into and around the head of the thermocouple. The Series 4E designs were all spring loaded into a thermowell installed into a furnace. Installation #1 incorporated a 6" Nipple Union design, Installation #2 incorporated a 4" nipple union design and Installation #3 relied upon the spring-loaded fitting being mounted directly into the thermowell.

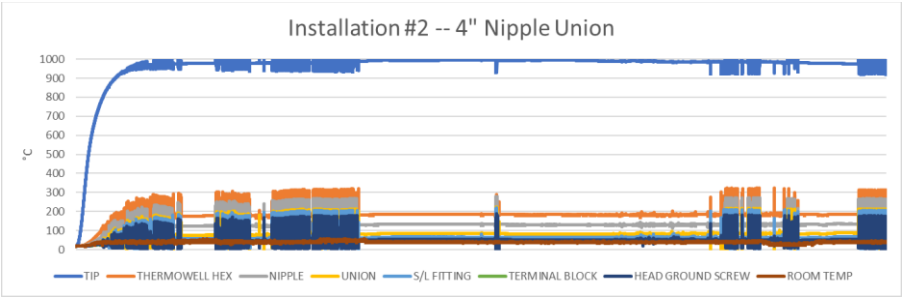
The charts below graph temperature rises over time as the furnace temperature rises from room temperature to just below 1000°C.

The results of this testing should not be viewed as universally applicable to every installation as they are particular to conditions prevailing when these tests were performed. JMS presents this as information only and users should exercise their independent engineering judgment as to the appropriate weight to give this information when determining the suitability of a 4E design for a given installation.



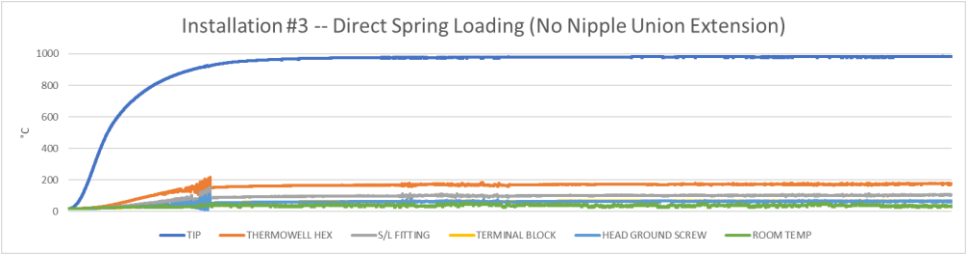
Installation #1 final Temperatures obtained (°C) for:

Sensor tip:	973.31	Thermowell Hex:	153.21	Lower Nipple:	110
Union:	57.59	S/L Fitting:	50.19	Terminal Block:	45.7
Encl Ground Screw:	45.4	Room Temp:	28.29		



Installation #2 final Temperatures obtained (°C) for:

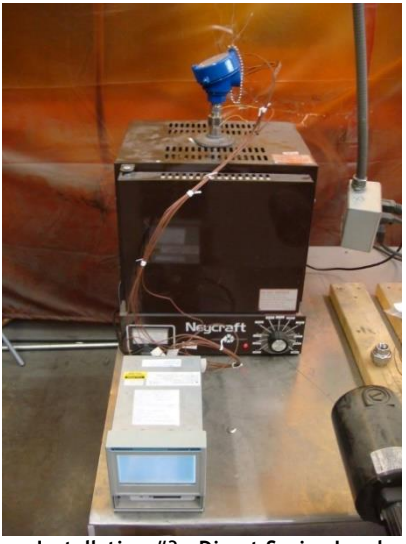
Sensor tip:	971.11	Thermowell Hex:	184.51	Lower Nipple:	134.9
Union:	87.8	S/L Fitting:	67.4	Terminal Block:	53.9
Encl Ground Screw:	54.4	Room Temp:	44.39		



Installation #3 final Temperatures obtained (°C) for:

Sensor tip:	984.62	Thermowell Hex:	217.91	S/L Fitting:	67.4
Terminal Block:	67.6	Encl Ground Screw:	108.3	Room Temp:	53.41

. **Installation #2 - 4" Nipple Union**



Installation #3 - Direct Spring Load

4.0 Product Certifications

4.1 REACH & ROHS Certifications

JMS Southeast, Inc's 4E sensors have been reviewed to determine compliance with REACH & ROHS. A copy of the REACH & ROHS Declaration of Conformity can be found at the end of this User Manual and Quick Start Guide.

4.2 North America (USA & Canada)

The US National Electrical Code® (NEC) and the Canadian Electrical Code (CEC) permit the use of Division marked equipment in Zones and Zone marked equipment in Divisions. The markings must be suitable for the area classification, gas, and temperature class. This information is clearly defined in the respective codes.

Explosion proof (XP) and Dust-Ignition proof (DIP) Certificate:
LR1653
Standards: FM 3600:2018, FM 3615:2018, FM 3616:2011, FM 3611:2018, FM 3810:2018, CSA C22.2 No. 30:20, CSA C22.2 No. 25-17, CSA C22.2 No. 213-17, UL 121201, 9th Edition.
Markings: Per Certificate Labeling Code Key below.

4.2.1 Flameproof joints are not intended for repair.

4.2.2 Cable entries must be used which maintain the ingress protection of the enclosure. Unused cable entries must be filled with suitable blanking plugs.

4.2.3 Spring loaded sensor has reduced ingress and dust ratings. Spring loaded sensors must be installed in a thermowell or protection tube to maintain dust and ingress ratings.

Certificate Labeling Code Key (Table 4.2-1):

Code	Marking	Encl (#10) + Xmtr (#11)	Special Condition #(s
A	**XP:** Class I, Div 1 & 2, Groups BCD, T6/T5/T4; Tamb = -50°C to 70°C / 90°C / 125°C **S:** Class II & III, Div 1 & 2, Groups EFG, T6/T5/T4; Tamb = -50°C to 70°C / 90°C / 125°C **Encl:** Type 4X; IP 66/ 68 Umax = 60 V dc; Imax = 30 mA SELV or PELV	I+Z, J+Z	1, 2, 3, 4, 5, 6, 7, 9, 10
B	**XP:** Class I, Div 1 & 2, Groups BCD, T6/T5; Tamb = -50°C to 70°C / 80°C **S:** Class II & III, Div 1 & 2, Groups EFG, T6/T5; Tamb = -50°C to 70°C / 80°C **Encl:** Type 4X; IP 66/68 Umax = 60 V dc; Imax = 30 mA SELV or PELV	P+Z	1, 2, 3, 4, 5, 6, 7, 9, 10
C*	**XP:** Class I, Div 1 & 2, Groups BCD, T6; Tamb = -25°C to 40°C **S:** Class II & III, Div 1 & 2, Groups EFG, T6; Tamb = -25°C to 40°C **Encl:** Type 4; IP 66 Umax = 60 V dc; Imax = 30 mA SELV or PELV	SI+Z	1, 2, 3, 4, 5, 6, 8, 9, 10
C*	**XP:** Class I, Div 1 & 2, Groups BCD, T6; Tamb = -25°C to 40°C **S:** Class II & III, Div 1 & 2, Groups EFG, T6;	SI+8H, SI+8N	1, 2, 3, 4, 5, 6, 8, 9, 10

	Tamb = -25°C to 40°C **Encl:** Type 4; IP 66 8 to 36 VDC		
C*	**XP:** Class I, Div 1 & 2, Groups BCD, T6; Tamb = -25°C to 40°C **S:** Class II & III, Div 1 & 2, Groups EFG, T6; Tamb = -25°C to 40°C **Encl:** Type 4; IP 66 Ui≤30Vgc; Ii≤130mA; Pi≤0.8W; Ci=0.57nF; Li=160mH, Uo=6.5V; Io=17.8mA; Po=29mW; Co=1.65mF; Lo≤5.0mH	SI+8D, SI+8I, SI+300	1, 2, 3, 4, 5, 6, 8, 9, 10
C*	**XP:** Class I, Div 1 & 2, Groups BCD, T6; Tamb = -25°C to 40°C **S:** Class II & III, Div 1 & 2, Groups EFG, T6; Tamb = -25°C to 40°C **Encl:** Type 4; IP 66 Ui/Vmax=24V; Ii/Imax<250mA; Pi=1.2W; Ci=5nF; Li=10uH, Uo=7.2V, Io=25.9mA, Po=46.7mW, Grp AB resp IIC Co=13.5uF/Lo =59mH,Grp C resp IIB Co=240uF/Lo =238mH, Grp D resp IIA Co=1000uF/ Lo=477mH	SI+82	1, 2, 3, 4, 5, 6, 8, 9, 10
C*	**XP:** Class I, Div 1 & 2, Groups BCD, T6; Tamb = -25°C to 40°C **S:** Class II & III, Div 1 & 2, Groups EFG, T6; Tamb = -25°C to 40°C **Encl:** Type 4; IP 66 Vmax = 30 VDC, Imax = 23mA	SI+248	1, 2, 3, 4, 5, 6, 8, 9, 10
C*	**XP:** Class I, Div 1 & 2, Groups BCD, T6; Tamb = -25°C to 40°C **S:** Class II & III, Div 1 & 2, Groups EFG, T6; Tamb = -25°C to 40°C **Encl:** Type 4; IP 66 Vmax= 42.4 Vdc, Imax=23mA	SI+644 (4-20mA HART signal)	1, 2, 3, 4, 5, 6, 8, 9, 10
C*	**XP:** Class I, Div 1 & 2, Groups BCD, T6; Tamb = -25°C to 40°C **S:** Class II & III, Div 1 & 2, Groups EFG, T6; Tamb = -25°C to 40°C **Encl:** Type 4; IP 66 Vmax= 32Vdc, Imax= 23mA	SI+644**F** (Foundation Fieldbus or Profibus signal)	1, 2, 3, 4, 5, 6, 8, 9, 10
D	**XP:** Class I, Div 1 & 2, Groups BCD, T6/T5/T4; Tamb = -40°C to 55°C / 70°C / 80°C **S:** Class II & III, Div 1 & 2, Groups EFG, T6/T5/T4; Tamb = -40°C to 55°C / 70°C / 80°C **Encl:** Type 4X; IP 66/68 8 to 36 VDC	P+8N, P+8H, I+8N, I+8H, J+8N, J+8H	1, 2, 3, 4, 5, 6, 7, 9, 10

E	**XP:** Class 1, Div 1, Groups BCD, T6/T5/T4; Tamb = -40°C to 56°C / 71°C / 85°C **NI:** Class I, Div 2, Groups ABCD, T6/T5/T4; Tamb = -40°C to 56°C / 71°C / 85°C **S:** Class II & III, Div 2, Groups EFG, T6/T5/T4; Tamb = -40°C to 56°C / 71°C / 85°C **Encl:** Type 4X; IP 66/68 Ui≤30Vgc; Ii≤130mA; Pi≤0.8W; Ci=0.57nF; Li=160mH, Uo=6.5V; Io=17.8mA; Po=29mW; Co=1.65mF; Lo≤5.0mH	I+8D, I+8I, I+300, J+8D, J+8I, J+300, GA+300, GS+300	1, 2, 3, 4, 5, 6, 7, 9, 10
F	**XP:** Class 1, Div 1, Groups BCD, T6/T5/T4; Tamb = -40°C to 56°C / 71°C / 80°C **NI:** Class I, Div 2, Groups ABCD, T6/T5/T4; Tamb = -40°C to 56°C / 71°C / 80°C **S:** Class II & III, Div 2, Groups EFG, T6/T5/T4; Tamb = -40°C to 56°C / 71°C / 80°C **Encl:** Type 4X; IP 66/68 Ui≤30Vgc; Ii≤130mA; Pi≤0.8W; Ci=0.57nF; Li=160mH, Uo=6.5V; Io=17.8mA; Po=29mW; Co=1.65mF; Lo≤5.0mH	P+8D, P+8I, P+300,	1, 2, 3, 4, 5, 6, 9, 10
G	**NI:** Class I, Div 1 & 2, Groups ABCD, T5/T4; Tamb = -40°C to 60°C / 85°C **S:** Class II & III, Div 1 & 2, Groups EFG, T5/T4; Tamb = -20°C to 60°C / 85°C **Encl:** Type 4X; IP 66/68 Ui = 30V, Ii = 120mA, Pi = 0.84W, Ci = 2nF, Li = 0; Uo = 9.6V, Io = 28mA, Po = 67mW, Co = 3.5µF, Lo = 35mH	8+PA, 8+PS	1, 2, 3, 4, 5, 6, 9, 10
H	**XP:** Class 1, Div 1, Groups BCD, T6/T5/T4; Tamb = -50°C to 58°C / 75°C / 80°C**NI:** **NI:** Class I, Div 2, Groups ABCD, T6/T5/T4; Tamb = -50°C to 58°C / 75°C / 80°C **S:** Class II & III, Div 2, Groups EFG, T6/T5/T4; Tamb = -50°C to 58°C / 75°C / 80°C **Encl:** Type 4X; IP 66/68 Ui/Vmax=24V; Ii/Imax<250mA; Pi=1.2W; Ci=5nF; Li=10uH, Uo=7.2V, Io=25.9mA, Po=46.7mW, Grp AB resp IIC Co=13.5uF/Lo =59mH,Grp C resp IIB Co=240uF/Lo =238mH, Grp D resp IIA Co=1000uF/ Lo=477mH	P+82, I+82,J+82	1, 2, 3, 4, 5, 6, 7, 9, 10
I*	**XP:** Class I, Div 1, Groups ABCD, T5; Tamb = -50°C to 85°C **NI:** Class I, Div 2, Groups ABCD, T5; Tamb = -50°C to 85°C **S:** Class II & III, Div 2, Groups EFG, T5; Tamb = -50°C to 85°C **Encl:** Type 4X; IP 66 Vmax = 30 V, Imax = 300 mA, Pi = 1 W, Ci = 0.023 uF, Li = 0	E+3144P (4-20mA HART signal)	1, 2, 3, 4, 5, 6, 9, 10, 14

I*	**XP:** Class I, Div 1, Groups ABCD, T5; Tamb = -50°C to 85°C **NI:** Class I, Div 2, Groups ABCD, T5; Tamb = -50°C to 85°C **S:** Class II & III, Div 2, Groups EFG, T5; Tamb = -50°C to 85°C **Encl:** Type 4X; IP 66 Vmax = 30 V, Imax = 300 mA, Pi = 1.3 W, Ci = 2.1 nF, Li = 0	E+3144P**F** (Foundation Fieldbus or Profibus signal)	1, 2, 3, 4, 5, 6, 9, 10, 14
J*	**XP:** Class I, Div 1, Groups BCD, T5; Tamb = -50°C to 85°C **NI:** Class I, Div 2, Groups BCD, T5; Tamb = -50°C to 85°C **S:** Class II & III, Div 1, Groups EFG, T5; Tamb = -50°C to 85°C **Encl:** Type 4X; IP 66 Vmax= 42.4 Vdc, Imax= 23mA	E+644 (4-20mA HART signal)	1, 2, 3, 4, 5, 6, 9, 10, 15
J*	**XP:** Class I, Div 1, Groups BCD, T5; Tamb = -50°C to 85°C **NI:** Class I, Div 2, Groups BCD, T5; Tamb = -50°C to 85°C **S:** Class II & III, Div 1, Groups EFG, T5; Tamb = -50°C to 85°C **Encl:** Type 4X; IP 66 Vmax= 32 Vdc, Imax= 23mA	E+644**F** (Foundation Fieldbus or Profibus signal)	1, 2, 3, 4, 5, 6, 9, 10, 15
K	**XP:** Class 1, Div 1, Groups BCD, T6/T5/T4; Tamb = -40°C to 70°C / 80°C / 85°C **NI:** Class I, Div 2, Groups BCD, T6/T5/T4; Tamb = -40°C to 55°C / 70°C / 85°C **S:** Class II & III, Div 1, Groups EFG, T6/T5/T4; Tamb = -40°C to 55°C / 70°C / 55°C **Encl:** NEMA 4X; IP 66/68 Ui/Vmax=30V; Ii/Imax=130mA; Pi=800mW; Ci=0uF; Li=0uH, Uo=7.6V, Io=13mA, Po=24.7 mW, Grp AB resp IIC Co=10.4uF/Lo=236mH, Grp C resp IIB Co=160uF/Lo=946mH, Grp D resp IIA Co=1000uF/Lo=1.893H	GA+82, GS+82	1, 2, 3, 4, 5, 6, 9, 10
L	**XP:** Class 1, Div 1, Groups BCD, T6/T5; Tamb = -50°C to 60°C / 80°C **NI:** Class I, Div 2, Groups ABCD, T6/T5; Tamb = -50°C to 60°C / 80°C **S:** Class II & III, Div 2, Groups EFG, T6/T5; Tamb = -50°C to 60°C / 80°C **Encl:** Type 4X; IP 66/68 Vmax= 30 Vdc, Imax= 23mA	I+248, J+248, P+248	1, 2, 3, 4, 5, 6, 9, 10
M	**XP:** Class I, Div 1, Groups BCD, T5 Ta= +85 °C **NI:** Class I, Div 2, Groups ABCD, T5; Tamb = -50°C to 85°C **S:** Class II & III, Div 2, Groups EFG, T5; Tamb = -50°C to 85°C	E+248	1, 2, 3, 4, 5, 6, 7, 9, 10, 16

	Encl: Type 4X; IP 66/68 Vmax= 30 Vdc, Imax= 23mA		
N	**XP:** Class I, Div 1, Groups ****#11, T*#12 Tamb= -**#12 to +**#12 °C **NI:** Class I, Div 2, Groups ****#11, T*#12; Tamb= -**#12 to +**#12 °C **S:** Class II & III, Div 2, Groups ***#11, T5; Tamb= -**#12 to +**#12 °C	A + Z	1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13

***Note: Refer to Encl (#10) + Xmtr (#11) selection to determine applicability of marking. Electrical rating often differs between 4-20 ma HART output and Foundation Fieldbus / Profibus output signals.**

Special Conditions of Use (Table 4.2-2):

1	The TC, RTD Sensor Assembly Series 2E must be either connected to a SELV or PELV system, or directly connected to an apparatus compliant with IEC 60950 series, IEC 610101-1, or equivalent. Product rating is given on the marking plate of each individual assembly as well as in the IOM and shall be respected.
2	The assembly is designed for pressure and temperature limits as defined in the User Manual. These values shall not be exceeded.
3	Special attention shall be given to the source of heating the equipment is intended to be attached to, because it can contribute such to elevate the local ambient temperature for the cable. The end user shall read and follow the User Manual where this concern is given them to attention.
4	The cable glands must be properly selected to suit the final application of the assembly and/or to maintain the protection method marked thereon.
5	A special consideration regarding additional guarding shall be taken for long probes when the equipment is installed such that is in reach of stuff or falling objects. Metal sheath containing thermocouple and/or RTD wires within its thermowell and in particular the connection head should be additionally protected in such a case against impact.
6	The final assembly is considered approved with earlier editions of the standard(s) if the enclosure or cable gland is certified with them.
7	The Sensor Assembly of Class I, Div 1 & 2 permits conduits entries to be added in the field and they must be installed with a seal within 18 inches (0.46 m) of the enclosure.
8	In Class 1, Div. 1, Group B atmospheres all conduit runs must have a sealing fitting (not supplied) within 2 inches (0.05 m) to the enclosure.
9	In applications for Class I, Div. 2, and Class II, Div. 1, a certified cable gland, hazardous location rated for the intended application, shall be selected and installed as defined in CEC, Part I (C22.1:21, Section 18) and/or NEC (NFPA 70, Article 500).
10	All threaded joints shall be properly tightened in order to maintain the declared Type 4 or Type 4X ingress protection
11	In the case when a generic enclosure model is used (different from the listed connection enclosure models), the equipment must be assembled with a certified Class I, Div. 1, or Class II, Div. 1 enclosure, approved to the edition(s) of standard(s)

	that are, at the time of placing the assembly on the market, currently in use. The enclosure shall be of simple geometry and with a volume < 580 cm3. The final marking of the entire assembly is still the responsibility of the manufacturer JMS Southeast Inc. The final marking of the assembly may differ in terms of the marking of the gas group, which is dictated by the marking of the connection head in use with the particular assembly. The distance of the seal from the cable entry in this housing is dictated by the certificate for this housing, but it must not be further than 18 inches.
12	The connection head / transmitter defines the ambient temperature range for the TC / RTD sensor assembly. The ambient temperature of the assembly is determined either by the range of ambient temperature assigned to the connection head, or by the service temperature range of non-metallic materials that actively participating in the overall protection assigned to the connection head and the built-in transmitter.
13	Electrical ratings are dependent on the installed transmitter, but not higher than: Umax = 60 V dc; Imax = 30 mA SELV or PELV.
14	Product certification option must include one of the following E5, K5, KB, I5, NA.
15	Enclosure option must include one of the following: J2, J4, J6, J8, R2, R4, D1, D2
16	Enclosure option must include one of the following with ½" NPT conduit entries only: A, G, H, J, K or U.

JMS Transmitters & Terminal Blocks Certificate Labeling Code (Table 4.2-3):

JMS TRANSMITTERS & TERMINAL BLOCKS

	Option Code: / Brand:	 Z JMS	 8N JMS	 8H JMS	 8I JMS	 8D JMS	 PA JMS	 PS JMS
ENCLOSURES	 JMS Part #: 6IA JMS Option Code: I	A	D	D	E	E	N/A	N/A
	 JMS Part #: 6IAIEC JMS Option Code: P	B	D	D	F	F	N/A	N/A
	 JMS Part #: 6ISS JMS Option Code: J	A	D	D	E	E	N/A	N/A
	 JMS Part #: 6I JMS Option Code: SI	C	C	C	C	C	N/A	N/A
	 JMS Part #: 8PA/8PS JMS Option Code: 8	N/A	N/A	N/A	N/A	N/A	G	G

More Transmitter Options With Display Certificate Labeling Code (Table 4.2-4):

MORE TRANSMITTER OPTIONS (WITH DISPLAY)

ENCLOSURES	Part # w/ link to spec:	TTH300	TMT82	3144P	644
	Option Code:	300	82	3144P	644
	Brand:	ABB	E+H	Emerson	Emerson
	EX Cert:	Source	Source	Source	Source
	JMS Part #: 688A1 JMS Option Code: GA	E	K	N/A	N/A
	JMS Part #: 688S1 JMS Option Code: GS	E	K	N/A	N/A
	Part #: 3144P... JMS Option Code: E	N/A	N/A	I	N/A
	Part #: 644... JMS Option Code: E	N/A	N/A	N/A	J

More Transmitter Options With No Display Certificate Labeling Code (Table 4.2-5):

MORE TRANSMITTER OPTIONS (NO DISPLAY)

ENCLOSURES	Option Code:	300	82	3144P	644	248
	Brand:	ABB	E+H	Emerson	Emerson	Emerson
	JMS Part #: 6IA JMS Option Code: I	E	H	N/A	N/A	L
	JMS Part #: 6IAIEC JMS Option Code: P	F	H	N/A	N/A	L
	JMS Part #: 6ISS JMS Option Code: J	E	H	N/A	N/A	L
	JMS Part #: 6I JMS Option Code: SI	C	C	N/A	C	C
	Part #: 3144P... JMS Option Code: E	N/A	N/A	I	N/A	N/A
	Part #: 644... JMS Option Code: E	N/A	N/A	N/A	J	N/A
	Part #: 644... JMS Option Code: E	N/A	N/A	N/A	J	M

5.0 Product Specification Sheet (Cut Sheet) for Series 4E

Ex Rated Flame Path Spring Loaded & Welded Assemblies

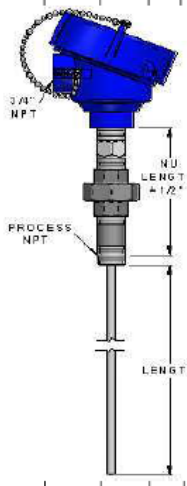
The 4E Series sets out the CSA and FM approved Ex Rated Flame Path Spring Loaded Assemblies. Selection 10, Option A "Bare ends" permits this Ex rated sensor to be used with any approved transmitter or enclosure that offers at least the same level of protection as that detailed at the bottom of the page. This allows the entire assembly to be CSA and FM approved for Class I, II and III, Divs A*, B,C,D,E,F & G . Both sides of the Nipple-Union extension assembly are 1/2" NPT threaded. Spring-loaded probes should be assembled with a protective tube assembly such as a thermowell for installation. For items requiring CSA certification any thermowell must be approved to Canadian standards and carry a CRN appropriate to the province of installation.

#1	SERIES									
4E	CSA & FM Approved Assembly (See Certification System Details Below)									
#2	**SENSOR TYPE** More Options Available -- RTD prefix of 2, 3 or 4 denotes # of wires per element [1-8, 9, 10]									
K	Type K Thermocouple, Special Limits per ASTM E230									
J	Type J Thermocouple, Special Limits per ASTM E230									
E	Type E Thermocouple, Special Limits per ASTM E230									
N	Type N Thermocouple, Special Limits per ASTM E230									
T	Type T Thermocouple, Special Limits per ASTM E230									
3B	100 Ω Platinum RTD 0.00385 alpha (Ω/Ω/°C) per IEC 60751, Class B (Competitors' Standard), 3 Wire, ≥ F 0.30 [p 3-18]									
3E	100 Ω Platinum RTD 0.00385 alpha (Ω/Ω/°C) per IEC 60751, Class A (JMS Standard), 3 Wire ≥ F 0.15 [p 3-18]									
3P	100 Ω Platinum RTD 0.00385 alpha (Ω/Ω/°C) per IEC 60751, Class AA, 3 Wire ≥ 1/2 F 0.10 [p 3-18]									
4S	100 Ω Platinum RTD 0.00385 alpha (Ω/Ω/°C) per IEC 60751, Class 1/4 AA, 4 Wire, ≥ 1/10 F 0.10 [p 3-18]									
X	Other, specify									
#3	**NUMBER OF ELEMENTS**									
1	Single	2	Dual	X	Other, specify					
#4	**PROBE OUTSIDE DIAMETER** [1-11, 2-8, 4-17]									
B	1/4" (0.250")	R	6mm (0.236")	X	Other, specify					
#5	**SHEATH MATERIAL** [1-11]									
K	316 SS	H	304 SS	M	Inconel 600	Q	Hastelloy C-276	P	Pyrosil	
L	316L SS	I	304L SS	J	310 SS	V	Stabaloy	X	Other, specify.	
#6	**MEASURING JUNCTION** [1-12, 13, 14, 15]									
U	Ungrounded (standard)	I	Isolated							
G	Grounded (only available for thermocouples)	X	Other, specify							
#7	**LENGTH (L)** *See sketches for how length is calculated. See 5-1 and 5-3 for thermowell matching.*									
"	Length in inches*									
#8	**MAXIMUM TEMPERATURE AT WHICH TIP WILL BE EXPOSED**									
	Temp Range	**RTD Wire Insulation***	**Thermocouple Insulation**							
A	< 0°C (32°F)	Kapton	Swaged							
B	< 200°C (392°F)	Teflon	Swaged							
C	< 285°C (550°F)	Kapton	Swaged							
D	< 350°C (662°F)	Fiberglass	Swaged							
E	≤ 660°C (1220°F)	Swaged	Swaged							
F	> 660°C (1220°F)	N/A	Swaged							

*Swaged may be substituted for any of the other insulation types in the discretion of JMS.

#9	**Fitting Spring Loaded or Welded Stainless Steel Nipple Union Ext Assembly Length ("N" Length)**		
S	Spring Loaded Fitting Only (no union or nipple)	W*	Welded Double Threaded
S__"	State length of 4 or more in inches	W*__"	Welded Union Nipple, specify length in inches
		* US Ex Cert Only - No Canada	

#10	**ENCLOSURES**		
No Display Enclosures (Material, Encl. Cert., weather rating, content)			
P	Aluminum, FM/CSA/ATEX/IECEx, NEMA 4X (6IAIEC/6G4Z)		
I	Aluminum, FM/CSA, NEMA 4X (6IA/6G4Z)		
J	316 Stainless Steel, FM/CSA, NEMA 4X (6ISS/6G4Z)		
SI*	Cast Iron, NEMA 3, 4, UL / CSA (6I/6PT)		
Windowed Enclosures (Transmitter from #11 will be Display Version)			
8	Enclosure for JMS Indicating Transmitter FM/CSA/ATEX/IECEx (#11 options PA & PS)		
GA	JMS Alum. Windowed Encl. for Indicating Transmitter (#11 options 300 or 82)		
GS	JMS SS Windowed Encl. for Indicating Transmitter (6883S1/ 300 or 82)		
Other Options			
E	Transmitter OEM Enclosure	X	Other Specify
A	Bare Ends		



4E	K	2	B	K	U	12	F	S6	P

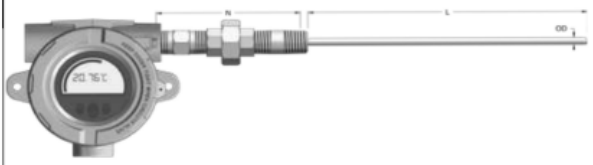
--> Continue to next page to complete Series 4E JMS part # -->

Ex Rated Flame Path Spring Loaded & Welded Assemblies

#11	TRANSMITTER	*Add span range after transmitter selection. Example: 8H(0-200C).*	
Z	N/A -- No Transmitter		* Where OEM Transmitter is selected, full OEM part # must follow JMS Part #. Example: 4EK28KU12FS6P300(0-200C)1; 300 =TTH300L1HBS
PA	JMS HART Indicating Transmitter with Aluminum housing (DWG22777A)		
PS	JMS HART Indicating Transmitter with Stainless Steel housing (DWG22777S)		
8D	JMS Intrinsically Safe HART Transmitter - 2 channel (8D)		
8I	JMS Intrinsically Safe Isolated Transmitter - 2 channel (8I)		
8H	JMS Isolated Transmitter - 2 channel (8H)		
8N	JMS NonIsolated Transmitter (8N)		** If #10 Encl = E, then Emerson Enclosure Spec must be one of: J2, J4, J6, J8, R2, R4, D1, D2.
3144P*	Specify Emerson 3144P Transmitter w/ **E5, K5, KB, I5, NA** Product Cert.		
644*	Specify Emerson 644 Transmitter**		
248*	Specify Emerson 248 Transmitter***		
82*	Specify Endress + Hauser TMT82 Transmitter		*** If #10 Encl = E, then Emerson Enclosure Spec must be one of: A, G, H, J, K or U.
300*	Specify ABB TTH300 Transmitter	Note: If Fieldbus or Profibus, add F suffix to selection (ex: 644F)	
X	Other, specify.		

#12	OPTIONS	Use only if applicable [INTRODUCTION]		
Marking / Tagging		**Calibration Options**		**Certifications**
1	SS Tag	5	Calibrate at specified point(s). Corrections data provided for each point	8*** Guide 17025 calibration certificate
2	Plastic Tag	5L*	Standard lot calibration - thermocouple only	M MTR (sheath / tubing TC measuring junction)
3	Paper Tag	5M	Material Calibration - thermocouple only	**Other Options**
4	Laser Etch	6**	Premium calibration report	S Ship straight (do not coil)
7	CE Mark	6L**	Premium lot calibration report Corrections data provided for temperatures within the range. Thermocouple only.	X Other, specify.
T	Calibration Tag	6C	Callendar-Van Dusen Calibration (RTD only)	

* Lot Calibration AMS 2750 F/G Compliant - Only Available for Thermocouples
** Must specify increments and range (Example: 0 to 300°F, 10° increments) - Thermocouple Only
*** Must choose calibration option other than 5M.



To complete the assembly, just add a flanged, threaded, socket weld, weld-in or sanitary thermowell using JMS catalog pages 5-1, 5-3, 4-3 or 4-5 or configure online!

300	1	--> If OEM transmitter, state full OEM part # -->	; 300 = TTH300L1HBS

6.0 Installation Drawings, RoHS & REACH Compliance

Figure 6-1. JMS Southeast, Inc. 4E Sensors Hazardous Location (DWG24800)

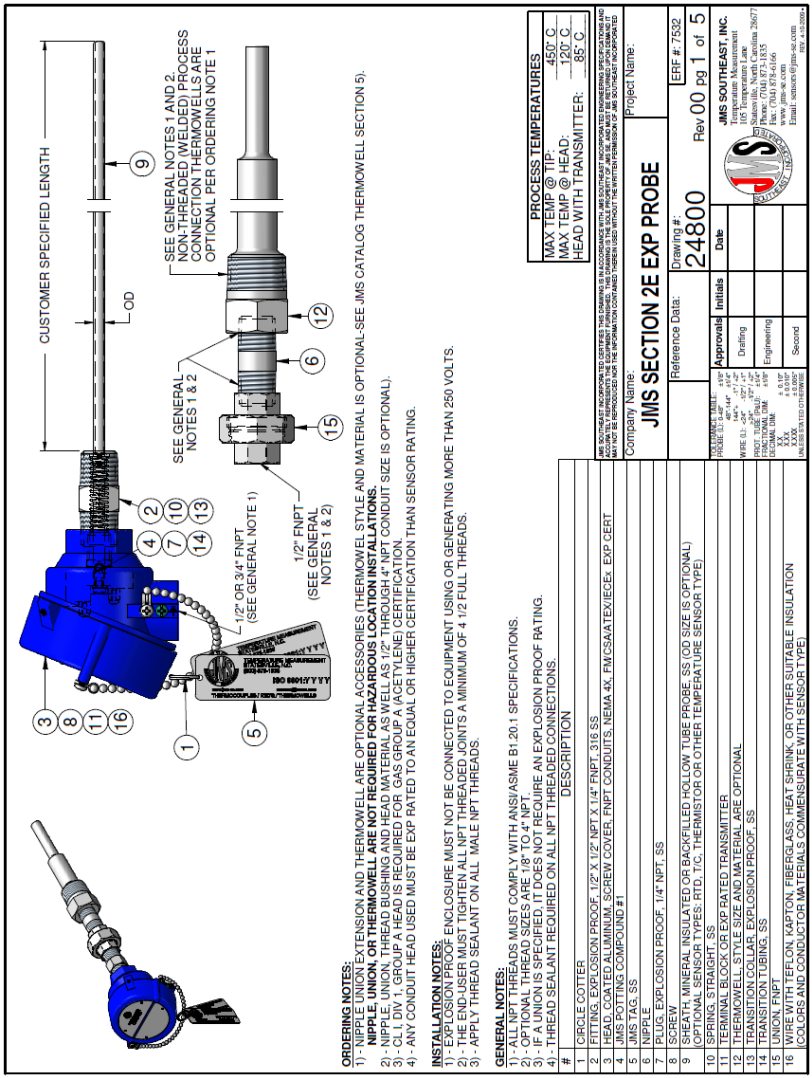


Figure 6-2. JMS ROHS Statement Regarding Series 4E Sensors

CE

JMS SOUTHEAST, INCORPORATED

Temperature Measurement www.jms-se.com

Restriction of Hazardous Substances (RoHS) Act Certificate of Compliance

The Restriction of Hazardous Substances Directive 2011/65/EU (RoHS2) became effective January 2, 2013 and RoHS3 Directive 2015/863 is effective July 22, 2019. In accordance with RoHS2, the RoHS Directive applies to products in previously excluded electrical and electronic equipment (EEE) categories 8 and 9 (medical devices and monitoring and control instruments). However, RoHS2 deals with the same hazardous substances and the same maximum concentration limits as Directive 2002/95/EC (RoHS1). RoHS3 applies to an even broader range of restricted substances to include four phthalates. Therefore, all products that were compliant with the substance restrictions of RoHS1 remain compliant with the substance restrictions of RoHS2. All products that were compliant with the substance restrictions of RoHS1 and RoHS2 remain compliant with the substance restrictions of RoHS3.

Like RoHS1 which was enacted to improve environmental quality, and RoHS2 which restricts the use of the following six substances (four heavy metals two brominated flame retardants), RoHS3 further restricts the use of phthalates (commonly uses as insulation plasticizers) in equipment distributed to member states of the European Union as a percent of weight of the finished product.

1. Lead (Pb) 0.1%
2. Mercury (Hg) 0.1%
3. Cadmium (Cd) 0.01%
4. Hexavalent Chromium (Cr VI) 0.1%
5. Polybrominated biphenyls (PBB) 0.1%
6. Polybrominated diphenyl ethers (PBDE) 0.1%
7. Bis(2-ethylhexyl) phthalate (DEHP) 0.1%
8. Butyl benzyl phthalate (BBP) 0.1%
9. Dibutyl phthalate (DBP) 0.1%
10. Diisobutyl phthalate (DIBP) 0.1%

As an environmentally responsible company, JMS Southeast, Inc. is committed to following the RoHS2 & RoHS3 directive through continual and diligent monitoring of our vast lines of temperature products.

JMS Southeast, Inc. hereby certifies that the following JMS products are RoHS Compliant:

JMS Southeast Part #	Description	Status	Date of Manufacture for Meeting RoHS Material Restrictions	Exemptions Used for Meeting RoHS Material Restrictions
Series 4E Ex Rated Assemblies	Thermocouples & RTDs	Meets EU-RoHS material restrictions without use of exemptions	November 2022 and forward	None

JMS Representative: Date: Rev. 04/08/19 Rev 1

ISO 9001 Registered
105 Temperature Lane, Statesville, North Carolina 28677-9620
(704) 873-1835 (800) 873-1835 Fax (704) 878-6166 E-Mail sensors@jms-se.com

Figure 6-3. JMS REACH Compliance Statement Regarding Series 4E Sensors

JMS SOUTHEAST, INCORPORATED
Temperature Measurement www.jms-se.com

Regulation Compliance Statement
REACH - Regulation (EC) 1907/2006

Statement Issue Date: October 12, 2020
Products Covered: All products manufactured by JMS Southeast unless the product is specifically stated otherwise.
Note: This is a General Statement – please contact JMS Southeast if you require a product specific (by Part Number) declaration.

REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals, EC 1907/2006) is the European Union's (EU) chemical substances regulatory framework. REACH requires JMS Southeast to provide customers with sufficient information on Substances of Very High Concern (SVHC) contained in products in concentration about 0.1% weight by weight (w/w) to allow safe use of the product.

To comply with this requirement, JMS Southeast certifies that to the best of its knowledge all products that it manufactures and supplies do not contain substances listed on the candidate List of Substances of Very high Concern, as of the issue date, in a concentration above 0.1% weight by weight.

Validation Method

JMS Southeast reviews MSDS sheets for components using an outside service, MSDSOnline. This service is used by JMS Southeast to validate the components used in our manufacturing process against various regulatory requirements, including REACH.

Signed: *April Hirons*

Name: April Hirons
Position: QA Manager Rev. 0

100001

User Manual & Quick Start Guide
100001, Rev 0
November 2022

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