### Product Data Sheet 00813-0500-2654, Rev HE September 2024

# **Rosemount<sup>™</sup> 214C Temperature Sensors**



### **Primary product benefits**

- High accuracy resistance temperature detectors (RTD) and various thermocouple types offered in a variety of element configurations
- Calibration capabilities for increased measurement accuracy for RTDs



ROSEMOUNT

# **Rosemount 214C Temperature Sensors**

# Optimize plant efficiency and increase measurement reliability with industry-proven design and specifications

- All sensor styles and lengths available as standard in ¼-in. (6 mm) nominal diameter
- State-of-the-art manufacturing processes providing robust element packaging, increasing reliability
- Industry-leading calibration capabilities allowing for Callendar-Van Dusen values giving increased RTD accuracy when paired with Rosemount transmitters
- Optional Class A accuracy RTDs or Class 1/Special Tolerances thermocouples for critical temperature measurement points

# Explore the benefits of a Complete Point Solution<sup>™</sup> from Emerson

- "Transmitter assembled to sensor" and "Thermowell assembled to sensor" options enable Emerson to provide a complete point temperature solution, delivering processready or hand-tight transmitter, sensor, and/or thermowell assemblies
- Complete portfolio of Single Point and Multi-Input Temperature Measurement solutions, allowing effective measurement and processes control with the trusted reliability from Rosemount products



### Contents

Rosemount 214C Temperature Sensors	2
Rosemount 214C Sensor	4
RTD ordering information	5
Thermocouple ordering information	22
Ordering information detail	36
Product certifications	52
Additional RTD specifications	79
Additional thermocouple specifications	81

# Experience global consistency and local support from numerous worldwide Emerson manufacturing sites

- World-class manufacturing provides globally consistent product from every factory and the capacity to fulfill needs of any project, large or small
- Experienced instrumentation consultants help select the right product for any temperature application and offer advice on best installation practices
- Extensive global network of Emerson service and support personnel can be on-site when and where they are needed



# Rosemount 214C Sensor

The Rosemount 214C Sensors are designed to provide flexible and reliable temperature measurements in process monitoring and control environments.

Features include:

- Temperature ranges of -321 to 1112 °F (-196 to 600 °C) for RTDs and -321 to 2192 °F (-196 to 1200 °C) for thermocouples
- Industry-standard sensor types: PT100 RTDs; thermocouple Type E, Type J, Type K, Type N, and Type T
- Spring-loaded and compact spring-loaded sensor mounting styles
- Hazardous location product approvals and certification
- Calibration services to give insight to sensor performance
- Calibration certificate to accompany sensor

Specification and selection of product materials, options, or components must be made by the purchaser of the equipment.

### Figure 1: Model Number Ordering Example



The numbers below the model string example in <u>Figure 1</u> correlate to the character place numbers in the ordering table.

# **Ensure sensor fits thermowell**

Rosemount 114C Head length (H) + Immersion length (U) = Rosemount 214C Sensor insertion length (L).



# **RTD ordering information**

Table 1: Rosemount 214C RTD Quick Order Table



# **Online product configurator**

Many products are configurable online using our product configurator.

Select the **Configure** button or visit <u>Emerson.com/global</u> to start. With this tool's built-in logic and continuous validation, you can configure your products more quickly and accurately.

# **Specifications and options**

Specification and selection of product materials, options, and/or components must be made by the purchaser of the equipment.

# **Optimizing lead time**

The starred offerings ( $\star$ ) represent the most common options and should be selected for the fastest delivery times. The non-starred offerings are subject to additional delivery lead time.

# **Required model components**

### Model

Plac	e #s 1-4	Description
*	214C	Temperature sensor core base model (made with standard outside diameter of ¼-in. [6 mm])

### Sensor type

Plac 5	e #s -6	Description	Details	Ref. page
*	RT	RTD, PT100; α = -58 to 842 °F (0.00385; -50 to 450 °C)	Thin-film element is better in vibration and physical shock	<u>page</u> <u>37</u>
*	RW	RTD, PT100; α = -321 to 1112 °F (0.00385; -196 to 600 °C)	Wire wound element is better for low temperature applications	<u>page</u> <u>37</u>
*	RH	RTD, PT100; α = -76 to 1112 °F (0.00385; -60 to 600 °C)	High temperature thin-film element is better in vibration and physical shock	<u>page</u> <u>37</u>

### Note

The sensor type temperature range is the full operating range of the sensor type and is not specific to the tolerance class or interchangeability.

### Sensor sheath material

Place #s Description 7-8		Description	Details	Ref. page
*	SM	321 SST	Maximum operating temperature limit of 1500 °F (816 °C)	<u>page</u> <u>41</u>

### Sensor accuracy

Place #s 9-10	Description	Details	Image	Ref. page
*	A1	Class A accuracy is available		page 37
*	B1	with wire-wound element Option Code: RW over -148 to 842 °F (-100 to 450 °C) and thin film element Option Code: RT over 32 to 572 °F (0 to 300 °C)	IEC 60751   I GARGACE Area Class A   Class A   Class A   I Jaser John or crc 450°C 660°C	<u>page 37</u>

# Number of elements

Plac 11	e #s -12	Description	Details	Image	Ref. page
*	53	Single, 3-wire	Good measurement results	Red Red White	<u>page</u> <u>43</u>
*	S4	Single, 4-wire	Excellent measurement results	Red Red White	<u>page</u> <u>43</u>
*	D3	Dual, 3-wire	Added measurement redundancy	Black Black Yellow Red Red Red White	<u>page</u> <u>43</u>

## **Dimension units**

Place	e # 13	Description	Details	Ref. page
*	E	English/U.S. customary units (inches)	Only applies to lengths	<u>page</u> <u>45</u>
*	М	Metric units (mm)	Only applies to lengths	<u>page</u> <u>45</u>

## Sensor insertion length

Place #s 14-17		Description	Ref. page
*	xxxx	xxx.x inches, 0 to 78.5 inches in ¼-in. increments (when ordered with Dimension units code E)	page
		Example of a 6.25-in. length where the second decimal is dropped off: 0062	
*	xxxx	xxxx mm, 0 to 2000 mm in 1 mm increments (when ordered with Dimension units code M)	page
		Example of a 50 mm length: 0050	45

### Sensor mounting style

Welded adapters are built several millimeters shorter than specified length to ensure that the sheath will not be damaged by contact with the bottom of a thermowell if overtightened. Conversely, Spring-loaded adapters are built several millimeters longer than specified to ensure contact with the bottom of a thermowell.

Plac 18	e #s -19	Description	Details	Image	Ref. page
*	SL	Spring-loaded adapter	Ensures sensor contact with thermowell tip		<u>page</u> <u>47</u>
*	SC	Compact Spring-loaded adapter	Non-explosionproof adapter that is 1.17-in. (29.72 mm) shorter than standard Spring-loaded adapter (currently not available with Division 2/Zone 2 approvals)		<u>page</u> <u>48</u>
*	SW	Spring-loaded adapter with thermowell contact indication	Spring-loaded adapter with a small opening on the side of the adapter for visual indication of sensor contact with the tip of a thermowell		<u>page</u> <u>48</u>
*	WA	Welded adapter	Welded joint between sensor capsule and adapter allows for direct immersion of sensor into the process. If thermowell is used, this welded joint acts as a secondary process seal.		<u>page</u> <u>49</u>
*	WC	Compact-welded adapter	Non-explosionproof adapter that is 1.17-in. (29.72 mm) shorter than standard welded adapter (currently not available with Division 2/Zone 2 approvals)		<u>page</u> <u>49</u>
*	SA	Adjustable Spring-loaded fitting	Adjustable fitting that allows for installation along sensor capsule body. The Spring-loaded fitting ensures sensor contact to thermowell tip.		<u>page</u> <u>50</u>

Plac 18-	e #s -19	Description	Details	Image	Ref. page
*	CA	Compression fitting %-in. NPT	Adjustable fitting that allows		page
*	СВ	Compression fitting ¼-in. NPT	capsule body. (100 psig maximum)		50
*	СС	Compression fitting ½-in. NPT	(Default compression fitting material is stainless steel)		
*	CD	Compression fitting ¾-in. NPT			
*	DF	DIN mounting plate with flying leads	Allows for assembly with headmount temperature transmitters and designed for easy mounting and replacement.	000	<u>page</u> <u>50</u>
*	DT	DIN mounting plate with terminal block	Allows for remote mounting assembly and designed for easy mounting and replacement.		page 50
*	SO	Sensor only	Sensor capsule without any fittings or adapters for mounting		page <u>50</u>

# **Additional options**

### **316SST** material options

С	ode	Description	Details	Image	Ref. page
*	M1	316 SST wire on tag	Changes out the original 304SST wire on tag to a corrosion-resistant 316SST wire on tag		<u>page</u> <u>51</u>
*	M2	316 SST components	Replaces various components with corrosion-resistant 316SST material (review reference page for affected components)		<u>page</u> <u>51</u>

# **Product certification**

Co	de	Description	Ref. page
*	E1	ATEX Flameproof	<u>page</u> <u>53</u>
*	I1	ATEX Intrinsic Safety	<u>page</u> <u>54</u>
*	N1	ATEX Zone 2	<u>page</u> <u>54</u>
*	ND	ATEX Dust Ignitionproof	<u>page</u> <u>54</u>
*	E2	Brazil Flameproof	<u>page</u> <u>56</u>
*	I2	Brazil Intrinsic Safety	<u>page</u> <u>57</u>
*	E3	China Flameproof	<u>page</u> <u>57</u>
*	I3	China Intrinsic Safety	page <u>58</u>
*	E4	Japan Flameproof	<u>page</u> <u>59</u>
*	E5	USA Explosionproof	<u>page</u> <u>52</u>
*	N5	USA Division 2	<u>page</u> <u>52</u>
*	E6	Canada Explosionproof	<u>page</u> <u>52</u>
*	N6	Canada Division 2	<u>page</u> <u>53</u>
*	E7	IECEx Flameproof	<u>page</u> <u>54</u>
*	I7	IECEx Intrinsic Safety	<u>page</u> <u>55</u>

Co	ode	Description	
*	N7	IECEx Zone 2	<u>page</u> <u>55</u>
*	NK	IECEx Dust Ignitionproof	<u>page</u> <u>55</u>
*	EM	Technical Regulations Customs Union (EAC) Flameproof	page <u>60</u>
*	IM	Technical Regulations Customs Union (EAC) Intrinsic Safety	<u>page</u> <u>60</u>
*	EP	Korea Flameproof	<u>page</u> <u>60</u>
*	IP	Korea Intrinsic Safety	<u>page</u> <u>60</u>
*	K1	Combination of ATEX Flameproof, Intrinsic Safety, Zone 2, and Dust Ignitionproof	<u>page</u> <u>61</u>
*	К3	Combination of China Flameproof, Intrinsic Safety, Zone 2, and Dust Ignitionproof	<u>page</u> <u>61</u>
*	K7	Combination of IECEx Flameproof, Intrinsic Safety, Zone 2, and Dust Ignitionproof	<u>page</u> <u>61</u>
*	KM	Combination of Technical Regulations Customs Union (EAC) Flameproof, Intrinsic Safety, and Dust Ignitionproof	<u>page</u> <u>61</u>
*	KP	Combination of Korea Flameproof, Intrinsic Safety, and Dust Ignitionproof	<u>page</u> <u>61</u>
*	KA	Combination of ATEX Flameproof and Canada Explosionproof	<u>page</u> <u>61</u>
*	КВ	Combination of USA and Canada Explosionproof	<u>page</u> <u>61</u>
*	КС	Combination of ATEX Flameproof and USA Explosionproof	<u>page</u> <u>61</u>
*	KD	Combination of ATEX Flameproof, USA and Canada Explosionproof	<u>page</u> <u>61</u>
*	KE	Combination of ATEX and IECEx Flameproof, USA and Canada Explosionproof	page <u>61</u>
*	KN	Combination of ATEX and IECEx Zone 2, and USA and Canada Division 2	<u>page</u> <u>61</u>

# **Connection heads**

Co	ode	Description	Details	Image	Ref. page
*	AR1	Rosemount aluminum	<ul> <li>Conduit connection: ½-in. NPT; M20</li> <li>Instrument connection: ½-in. NPT; M20; M24</li> <li>Optional terminal block, stainless steel cover chain, external ground screw, or low temperature options also available</li> </ul>		<u>page</u> <u>62</u>

# Rosemount 214C

Co	de	Description	Details	Image	Ref. page
*	AR2	Rosemount aluminum with display cover	<ul> <li>Conduit connection: ½-in. NPT; M20</li> <li>Instrument connection: ½-in. NPT; M20; M24</li> <li>Optional terminal block, external ground screw, or low temperature options also available</li> </ul>		<u>page</u> <u>62</u>
*	SR1	Rosemount SST	<ul> <li>Conduit connection: ½-in. NPT; M20</li> <li>Instrument connection: ½-in. NPT; M20; M24</li> <li>Optional terminal block, stainless steel cover chain, external ground screw, or low temperature options also available</li> </ul>		<u>page</u> <u>62</u>
*	SR2	Rosemount SST with display cover	<ul> <li>Conduit connection: ½-in. NPT; M20</li> <li>Instrument connection: ½-in. NPT; M20; M24</li> <li>Optional terminal block, external ground screw, or low temperature options also available</li> </ul>		page 62
*	AD1	Dual entry aluminum	<ul> <li>Conduit connections: ½-in. NPT, M20 x 1.5, or ¾-in. NPT</li> <li>Instrument connection: ½-in. NPT, M20 x 1.5, or M24</li> <li>Comes with cover chain.</li> </ul>		page <u>62</u>
*	SD1	Dual entry SST	<ul> <li>Conduit connection: ½-in. NPT, M20 x 1.5, or ¾-in. NPT</li> <li>Instrument connection: ½-in. NPT, M20 x 1.5, or M24</li> <li>Comes with cover chain.</li> </ul>		page <u>62</u>
*	AF1	BUZ aluminum	<ul> <li>Conduit connection: M20 x 1.5</li> <li>Instrument connection: ½-in. NPT or M24</li> </ul>		<u>page</u> <u>62</u>
*	AF3	BUZH aluminum	<ul> <li>Conduit connection: M20 x 1.5</li> <li>Instrument connection: ½-in. NPT or M24</li> </ul>		page 62

Co	ode	Description	Details	Image	Ref. page
*	AT1 <sup>(1)</sup>	Aluminum with terminal strip	<ul> <li>Conduit connection: ¾-in. NPT</li> <li>Instrument connection: ½-in. NPT</li> <li>Optional stainless steel cover chain or external ground screw available</li> </ul>		<u>page</u> <u>62</u>
*	AT3 <sup>(1)</sup>	Aluminum with terminal strip and extended cover	<ul> <li>Conduit connection: ¾-in. NPT</li> <li>Instrument connection: ½-in. NPT</li> <li>Optional stainless steel cover chain or external ground screw available</li> </ul>		<u>page</u> <u>62</u>
*	AJ1	Universal 3 entry aluminum junction box	<ul> <li>Conduit connection: ½-in. NPT or M20</li> <li>Instrument connection: ½-in. NPT</li> <li>Optional terminal block, external ground screw, and stainless steel cover chain available</li> </ul>		page <u>62</u>
*	AJ2	Universal 3 entry aluminum junction box with display cover	<ul> <li>Conduit connection: ½-in. NPT or M20</li> <li>Instrument connection: ½-in. NPT</li> <li>Optional terminal block and external ground screw</li> </ul>		<u>page</u> <u>62</u>

(1) Requires the WD option from Lead wire extensions: Termination style.

# Conduit entry thread type

Co	de	Description	Image	
*	C1	½-in. NPT		<u>page</u> <u>65</u>
*	C2	M20 x 1.5		<u>page</u> <u>65</u>
*	C3	¾-in. NPT		<u>page</u> <u>65</u>

### Instrument connection thread type

Co	de	Description	Image	Ref. page
*	B1	½-in. NPT		<u>page</u> <u>65</u>
	B2	M20 x 1.5		<u>page</u> <u>65</u>
	B4	M24 x 1.5		<u>page</u> <u>65</u>

# Rosemount 214C

# Conduit cable glands

Code		Description	Image	Ref. page
*	GN1	Ex d, standard cable diameter		<u>page</u> <u>66</u>
*	GN2	Ex d, thin cable diameter		<u>page</u> <u>66</u>
*	GN6	EMV, standard cable diameter		<u>page</u> <u>66</u>
*	GP1	Ex e, standard cable diameter, polyamide		<u>page</u> <u>66</u>
*	GP2	Ex e, thin cable diameter, polyamide		<u>page</u> <u>66</u>

# Extension type

Code		Description	Details	Image	
*	UA	Union style, ½-in. NPT, ½-in. NPT	Contains union fitting, which allows orientation of the conduit entry during installation; also known as nipple-union style		<u>page</u> <u>67</u>
*	FA	Fixed style, ½-in. NPT, ½-in. NPT	Contains coupling fitting, which does not allow orientation of the conduit entry during installation; also known as nipple-coupling style		<u>page</u> <u>67</u>
	PD	DIN-style, 12 x 1.5, M24 x 1.5, M18 x 1.5			<u>page</u> <u>67</u>
	PE	DIN-style, 12 x 1.5, M24 x 1.5, M20 x 1.5			<u>page</u> <u>67</u>
	PH	DIN-style, 12 x 1.5, M24 x 1.5, M24 x 1.5			<u>page</u> <u>67</u>
	РК	DIN-style, 12 x 1.5, M24 x 1.5, G½- in. (BSPF)			<u>page</u> <u>67</u>
	PQ	DIN Style, 15 x 3, M24 x 1.5, M18 x 1.5	Contains one single piece	Ser.	<u>page</u> <u>67</u>
	PT	DIN-style, 15 x 3, M24 x 1.5, M24 x 1.5	extension		<u>page</u> <u>67</u>
	TC	DIN-style, 12 x 1.5, M24 x 1.5, ½-in. NPT			<u>page</u> <u>67</u>
	TD	DIN Style, 12 x 1.5, M24 x 1.5, ¾-in. NPT			<u>page</u> <u>67</u>
	TH	DIN-style, 12 x 1.5, M24 x 1.5, R ½-in. (BSPT)			<u>page</u> <u>67</u>
	TN	DIN Style, 15 x 3, M24 x 1.5, ½-in. NPT			<u>page</u> <u>67</u>

# Extension length (E)

Co	ode	Description	Ref. page
*	Exxx	xx.x inches, 2.5 to 20 inches in ½-in. increments (when ordered with Dimension units code E)	<u>page</u> <u>68</u>
*	Exxx	xxx mm, 65 to 500 mm in 5 mm increments (when ordered with Dimension units code M)	<u>page</u> <u>68</u>

# Lead wire extension: Wire type

C	Code	Description	Details	Image	Ref. page
	LA	Twisted lead wire extension	Allows addition of length to standard sensor wires.		<u>page</u> <u>70</u>
	LB	Shielded, PTFE wrapped cable lead wire extension	Standard sensor wires are braided to add ridgidity, strength, and robustness. They are wrapped in PTFE as a chemical shield for added wire protection.		page 70

# Lead wire extension: Wire length (T)

C	ode	Description	Ref. page
	0018	18-in. (1.5 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
	0036	36-in. (3.0 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
	0072	72-in. (6.0 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
	0144	144-in. (12.0 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
	0288	288-in. (24 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
	0600	600-in. (50 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
	0900	900-in. (75 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
	1200	1200-in. (100 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
	xxxx	xxxx-in., 12 to 3600 inches in 1 inch increments (when ordered with dimension units option "E") Example of an 18-in. wire length: 0018	page 70
	хххх	xxxx cm, 30 to 9144 cm in 1 cm increments (when ordered with dimension units option "M") Example of a 50 cm wire length: 0050	<u>page</u> <u>70</u>

### Lead wire extension: Armor type

Co	de	Description	Details	Image	Ref. page
	AN	Armored cable lead wire extension	Bare armored cable around wires to provide mechanical protection. There is no coating on the wires. Maximum length allowed is 1200 in. (3048 cm).	The second se	<u>page</u> <u>70</u>
	AC	PVC-coated armored cable lead wire extension	Armored cable around wires to provide mechanical protection. The armored cable is coated with Polyvinyl Chloride (PVC) coating. Maximum length allowed is 1200 in. (3048 cm).		page 70
	AP	PTFE-coated armored cable lead wired extension	Armored cable around wires to provide mechanical protection. The armored cable is coated with Polytetraflouroethylene (PTFE) coating. Maximum length allowed is 1200 in. (3048 cm).	Construction of the second sec	<u>page</u> 70

### Lead wire extension: Cable glands

Co	de	Description	Image	Ref. page
	J1	½-in. NPT		<u>page</u> <u>71</u>
	J2	M20 x 1.5		<u>page</u> <u>71</u>

# Lead wire extension: Shielded cable drain wire

Co	de	Description	Details	Image	Ref. page
	DW	Drain wire	Reduces resistance from ambient or electrical noise. It is only available with the shielded cable.		<u>page</u> <u>71</u>

# Lead wire extension: Adapter-mounted cable gland

Co	ode	Description	Details	Image	Ref. page
	F1	Adapter-mounted cable gland, ½- in. NPT	Prevents process fluid from exiting a non sealed adapter (ex. Spring- loaded adapter).		<u>page</u> <u>71</u>

# Lead wire extension: Termination style

Co	de	Description	Details	Image	Ref. page
	WB	Spade lugs	Terminals allow for ease of wiring.	-3-	<u>page</u> <u>72</u>
	WD	Bootlace ferrules	Ferrules provide ease in wiring and give better electrical contact where needed.		<u>page</u> <u>72</u>

# Temperature calibration

C	Code	Description	Ref. page
*	V20Q4	32 to 212 °F (0 to 100 °C)	<u>page</u> <u>74</u>
*	V21Q4	32 to 392 °F (0 to 200 °C)	<u>page</u> <u>74</u>
*	V22Q4	32 to 842 °F (0 to 450 °C)	<u>page</u> <u>74</u>
*	V23Q4	32 to 1112 °F (0 to 600 °C)	<u>page</u> <u>74</u>
*	V24Q4	–58 to 212 °F (–50 to 100 °C)	<u>page</u> <u>74</u>
*	V25Q4	–58 to 392 °F (–50 to 200 °C)	<u>page</u> <u>74</u>
*	V26Q4	–58 to 842 °F (–50 to 450 °C)	<u>page</u> <u>74</u>
*	V27Q4	-321 to 1112 °F (-196 to 600 °C)	<u>page</u> <u>74</u>

### Temperature range calibration

Code		Description	Ref. page
*	X8Q4	Custom specified temperature range	<u>page</u> <u>75</u>

# Single-point calibration

Code		Description	Ref. page
*	X91Q4	Resistance of one specified temperature point	<u>page</u> <u>73</u>

### MID Custody Transfer Calibration

C	Code	Description	Ref. page
	MD1	MID Custody Transfer Calibration, –196 °C to 0 °C	<u>page</u> <u>75</u>
	MD2	MID Custody Transfer Calibration, –50 °C to 100 °C	<u>page</u> <u>75</u>
	MD3	MID Custody Transfer Calibration, 50 °C to 200 °C	<u>page</u> <u>75</u>

# **PAC Calibration Certificate**

Code		Description	Ref. page
	QG	Calibration Certificate and PAC Verification Certificate	<u>page</u> <u>75</u>

### **Ground screw**

Code		Description	Details	Image	Ref. page
*	G1	External ground screw	Allows for grounding of wires to the connection head		<u>page</u> <u>75</u>

### **Cover chain**

Code		Description	Details	Image	Ref. page
*	G3	Cover chain	Keeps the cover connected to the connection head when disassembled; not available with display covers		<u>page</u> <u>76</u>
*	G6	Extension ring	Aluminium Extension Ring for Dua Transmitter Mounting		<u>page</u> <u>76</u>

### **Terminal block**

Co	de	Description	Details	Images	Ref. page
*	ТВ	Terminal block	Available if wire termination in a connection head is required		<u>page</u> <u>78</u>

### Low temperature housing

Code		Description	Ref. page
*	LT	Low temperature connection head option down to –60 °F (–51 °C)	<u>page</u> <u>78</u>
	BR	-76 °F (-60 °C) cold temperature operation	<u>page</u> <u>78</u>

### **Product certifications**

#### Rev 2.23

### **European Directive information**

A copy of the EU Declaration of Conformity can be found at the end of the Quick Start Guide. The most recent revision of the EU Declaration of Conformity can be found at <u>Emerson.com/Rosemount</u>.

### **Ordinary Location Certification**

The Rosemount 214C has been examined and tested to determine that the design meets the basic electrical, mechanical, and fire protection requirements by a nationally recognized test laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

#### Note

The terminal strip in the Aluminum with Terminal Strip (AT1 or AT3) connection head requires sensor lead wires to have a wire termination (Ex: Bootlace ferrule or spade lug).

### **North America**

The US National Electrical Code<sup>®</sup> (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.

### Thermowell assembled to sensor

Code		Description	Details	Ref. page
*	XW	Process-ready assembly of sensor and thermowell	Ensures sensor is threaded into thermowell and torqued for process-ready installation	<u>page</u> <u>79</u>
*	ХТ	Hand-tight assembly of sensor and thermowell	Ensures sensor is threaded into thermowell but only hand tightened	<u>page</u> <u>79</u>

### **Extended product warranty**

Co	ode	Description	Details	Ref. page
*	WR3	3-year limited warranty	This warranty option is to extend your manufacturers warranty to three or five years for manufacturer	<u>page</u> <u>79</u>
*	WR5	5-year limited warranty	related defects	<u>page</u> <u>79</u>

# Thermocouple ordering information

Table 2: Rosemount 214C Thermocouple Quick Order Table



# **Online product configurator**

Many products are configurable online using our product configurator.

Select the **Configure** button or visit <u>Emerson.com/global</u> to start. With this tool's built-in logic and continuous validation, you can configure your products more quickly and accurately.

# **Specifications and options**

Specification and selection of product materials, options, and/or components must be made by the purchaser of the equipment.

# **Optimizing lead time**

The starred offerings ( $\star$ ) represent the most common options and should be selected for the fastest delivery times. The non-starred offerings are subject to additional delivery lead time.

# **Required model components**

### Model

Place #s 1-4		Description
*	214C	Temperature thermocouple sensor core base model (made with standard outside diameter of 6 mm [¼-in.])

### Sensor type

Place #s 5-6		Description	Details	Ref. page
*	TE	Thermocouple Type E, -40 to 1500 °F (-40 to 816 °C)	It is non-magnetic and has the highest output voltage vs. temperature change of any standard thermocouple type.	40
*	TJ	Thermocouple Type J, –40 to 1400 °F (–40 to 760 °C)	One of the most common thermocouples made of conductor materials iron and constantan.	40
*	ТК	Thermocouple Type K, –40 to 2192 °F (–40 to 1200 °C)	Commonly used for high temperature applications, Type K thermocouples contain Chromel <sup>®</sup> and Alumel <sup>®</sup> conductors (available with sheath material Option AK only).	41
*	ΤN	Thermocouple Type N, -40 to 2192 °F (-40 to 1200 °C)	Achieves considerably higher thermoelectric stability than the base-metal types E, J, K and T thermocouples.	41
*	тт	Thermocouple Type T, –321 to 698 °F (–196 to 370 °C)	Commonly used for low temperature applications, Type T thermocouples contain copper and constantan conductors.	41

# Sensor sheath material

Place #s 7–8		Description	Details	Ref. page
*	SM	321 SST	Maximum operating temperature limit of 1500 °F (816 °C) (For types TE, TJ and TT only.)	<u>page</u> <u>41</u>
*	AK	Alloy 600	Maximum operating temperature limit of 2192 °F (1200 °C) (For type TK and TN only.)	<u>page</u> <u>41</u>

### Sensor accuracy

Place #s 9-10		Description	Details	Ref. Page
*	T1	Class 1 per IEC 60584	Approximately half of accuracy error margin than Class 2; made with higher grade wire, which increases accuracy reading	<u>page</u> <u>42</u>
*	T2	Class 2 per IEC 60584	Wider accuracy error margin than Class 1; made with standard thermocouple grade wire	<u>page</u> <u>42</u>
*	SP	Special Tolerances per ASTM E230	Approximately half of accuracy error margin than Standard Tolerances; made with higher grade wire, which increases the accuracy reading	<u>page</u> <u>42</u>
*	ST	Standard Tolerances per ASTM E230	Wider accuracy error margin than Special Tolerances; made with standard thermocouple grade wire	<u>page</u> <u>42</u>

### Numbers of elements

Nun #s 1	nber 1-12	Description	Details	Image	Ref. page
*	SG	Single, grounded	Provides contact to sheath for faster response time than a single, ungrounded thermocouple; more susceptible to induced noise from ground loops	+	<u>page</u> <u>43</u>
*	SU	Single, ungrounded	Provides more accurate reading than a single grounded thermocouple, with a slower response time	+	<u>page</u> <u>43</u>
*	DG	Dual, grounded, unisolated	Provides faster response time than a dual ungrounded isolated thermocouple with added redundancy in the reading	++	<u>page</u> <u>43</u>
*	DU	Dual, ungrounded, isolated	Provides more accurate reading than a dual grounded unisolated thermocouple, with a slower response time		<u>page</u> <u>43</u>

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# **Dimension units**

Place # 13		Description	Details	Ref. page
*	E	English/U.S. customary units (inches)	Only applies to lengths	<u>page</u> <u>45</u>
*	м	Metric units (mm)	Only applies to lengths	<u>page</u> <u>45</u>

# Sensor insertion length

Plac 14	:e #s -17	Description	Ref. page
*	xxxx	xxx.x inches, 0 to 78.5 inches in ¼-in. increments (when ordered with Dimension units code E)	page
		Example of a 6.25-in. length where the second decimal is dropped off: 0062	<u>45</u>
*	xxxx	xxxx mm, 0 to 2000 mm in 1 mm increments (when ordered with Dimension units code M)	page
		Example of a 50 mm length: 0050	<u>45</u>

### Sensor mounting style

Welded adapters are built several millimeters shorter than specified length to ensure that the sheath will not be damaged by contact with the bottom of a thermowell if overtightened. Conversely, spring loaded adapters are built several millimeters longer than specified to ensure contact with the bottom of a thermowell.

Plac 18-	e #s ·19	Description	Details	Image	Ref. page
*	SL	Spring-loaded adapter	Ensures sensor contact with thermowell tip		<u>page</u> <u>47</u>
*	SC	Compact spring-loaded adapter	Non-explosionproof adapter that is 1.17-in. (29.72 mm) shorter than standard spring-loaded adapter (currently not available with Division 2/Zone 2 approvals)		<u>page</u> <u>48</u>
*	SW	Spring-loaded adapter with thermowell contact indication	Spring-loaded adapter with a small opening on the side of the adapter for visual indication of sensor contact with the tip of a thermowell		<u>page</u> <u>48</u>
*	WA	Welded adapter	Welded joint between sensor capsule and adapter allows for direct immersion of sensor into the process. If thermowell is used, this welded joint acts as a secondary process seal.		<u>page</u> <u>49</u>
*	WC	Compact-welded adapter	Non-explosionproof adapter that is 1.17-in. (29.72 mm) shorter than standard welded adapter (currently not available with Division 2/Zone 2 approvals)		<u>page</u> <u>49</u>
*	SA	Adjustable spring loaded fitting	Adjustable fitting that allows for installation along sensor capsule body. The spring loaded fitting ensures sensor contact to thermowell tip.		page 50
*	CA	Compression fitting ½-in. NPT	Adjustable fitting that allows	$\left( \overline{} \right)$	page
*	СВ	Compression fitting ¼-in. NPT	for installation along the sensor capsule body. (100 psig maximum.)		<u>50</u>
*	СС	Compression fitting ½-in. NPT	(Default compression fitting material is stainless steel.)		
*	CD	Compression fitting ¾-in. NPT			

# Rosemount 214C

Plac 18-	e #s -19	Description	Details	Image	Ref. page
*	DF	DIN mounting plate with flying leads	Allows for assembly with headmount temperature transmitters and designed for easy mounting and replacement.	000	<u>page</u> <u>50</u>
*	DT	DIN mounting plate with terminal block	Allows for remote mounting assembly and designed for easy mounting and replacement.		<u>page</u> <u>50</u>
*	SO	Sensor only	Sensor capsule without any fittings or adapters for mounting	<u> </u>	page <u>50</u>

# **Additional options**

# **316SST material options**

С	ode	Description	Details	Image	Ref. page
*	M1	316 SST wire on tag	Changes out the original 304SST wire on tag to a corrosion-resistant 316SST wire on tag	S.	<u>page</u> <u>51</u>
*	M2	316 SST components	Replaces various components with corrosion-resistant 316SST material (review reference page for affected components)		<u>page</u> <u>51</u>

### **Product certification**

Code		Description	
*	E1	ATEX Flameproof	<u>page</u> <u>53</u>
*	I1	ATEX Intrinsic Safety	<u>page</u> <u>54</u>
*	N1	ATEX Zone 2	<u>page</u> <u>54</u>
*	ND	ATEX Dust Ignitionproof	<u>page</u> <u>54</u>
*	E2	Brazil Flameproof	<u>page</u> <u>56</u>
*	I2	Brazil Intrinsic Safety	<u>page</u> <u>57</u>
*	E3	China Flameproof	<u>page</u> <u>57</u>
*	I3	China Intrinsic Safety	<u>page</u> <u>58</u>
*	E4	Japan Flameproof	<u>page</u> <u>59</u>
*	E5	USA Explosionproof	<u>page</u> <u>52</u>
*	N5	USA Division 2	<u>page</u> <u>52</u>
*	E6	Canada Explosionproof	<u>page</u> <u>52</u>
*	N6	Canada Division 2	<u>page</u> <u>53</u>
*	E7	IECEx Flameproof	<u>page</u> <u>54</u>
*	17	IECEx Intrinsic Safety	<u>page</u> <u>55</u>
*	N7	IECEx Zone 2	<u>page</u> <u>55</u>
*	NK	IECEx Dust Ignitionproof	<u>page</u> <u>55</u>
*	EM	Technical Regulations Customs Union (EAC) Flameproof	<u>page</u> <u>60</u>
*	IM	Technical Regulations Customs Union (EAC) Intrinsic Safety	<u>page</u> <u>60</u>
*	EP	Korea Flameproof	page <u>60</u>
*	IP	Korea Intrinsic Safety	<u>page</u> <u>60</u>
*	K1	Combination of ATEX Flameproof, Intrinsic Safety, Zone 2, and Dust Ignitionproof	<u>page</u> <u>61</u>
*	К3	Combination of China Flameproof, Intrinsic Safety, Zone 2, and Dust Ignitionproof	<u>page</u> <u>61</u>

# Rosemount 214C

Code		Description	
*	K7	Combination of IECEx Flameproof, Intrinsic Safety, Zone 2, and Dust Ignitionproof	<u>page</u> <u>61</u>
*	KM	Combination of Technical Regulations Customs Union (EAC) Flameproof, Intrinsic Safety, and Dust Ignitionproof	<u>page</u> <u>61</u>
*	KP	Combination of Korea Flameproof, Intrinsic Safety, and Dust Ignitionproof	
*	KA	Combination of ATEX Flameproof and Canada Explosionproof	<u>page</u> <u>61</u>
*	КВ	Combination of USA and Canada Explosionproof	<u>page</u> <u>61</u>
*	КС	Combination of ATEX Flameproof and USA Explosionproof	<u>page</u> <u>61</u>
*	KD	Combination of ATEX Flameproof, USA and Canada Explosionproof	<u>page</u> <u>61</u>
*	KE	Combination of ATEX and IECEx Flameproof, USA and Canada Explosionproof	
*	KN	Combination of ATEX and IECEx Zone 2, and USA and Canada Division 2	<u>page</u> <u>61</u>

# **Connection heads**

Code		Description	Details	Image	Ref. page
*	AR1	Rosemount aluminum	<ul> <li>Conduit connection: ½-in. NPT; M20</li> <li>Instrument connection: ½-in. NPT; M20; M24</li> <li>Optional terminal block, stainless steel cover chain, external ground screw, or low temperature options also available</li> </ul>		page 62
*	AR2	Rosemount aluminum with display cover	<ul> <li>Conduit connection: ½-in. NPT; M20</li> <li>Instrument connection: ½-in. NPT; M20; M24</li> <li>Optional terminal block, external ground screw, or low temperature options also available</li> </ul>		<u>page</u> <u>62</u>
*	SR1	Rosemount SST	<ul> <li>Conduit connection: ½-in. NPT; M20</li> <li>Instrument connection: ½-in. NPT; M20; M24</li> <li>Optional terminal block, stainless steel cover chain, external ground screw, or low temperature options also available</li> </ul>		page 62

C	ode	Description	Details	Image	Ref. page
*	SR2	Rosemount SST with display cover	<ul> <li>Conduit connection: ½-in. NPT; M20</li> <li>Instrument connection: ½-in. NPT; M20; M24</li> <li>Optional terminal block, external ground screw, or low temperature options also available</li> </ul>		page 62
*	AD1	Dual entry aluminum	<ul> <li>Conduit connections: ½-in. NPT, M20 x 1.5, or ¾-in. NPT</li> <li>Instrument connection: ½-in. NPT, M20 x 1.5, or M24</li> <li>Comes with cover chain.</li> </ul>		<u>page</u> <u>62</u>
*	SD1	Dual entry SST	<ul> <li>Conduit connection: ½-in. NPT, M20 x 1.5, or ¾-in. NPT</li> <li>Instrument connection: ½-in. NPT, M20 x 1.5, or M24</li> <li>Comes with cover chain.</li> </ul>		<u>page</u> <u>62</u>
*	AF1	BUZ aluminum	<ul> <li>Conduit connection: M20 x 1.5</li> <li>Instrument connection: ½-in. NPT or M24</li> </ul>		<u>page</u> <u>62</u>
*	AF3	BUZH aluminum	<ul> <li>Conduit connection: M20 x 1.5</li> <li>Instrument connection: ½-in. NPT or M24</li> </ul>		page 62
*	AT1 <sup>(1)</sup>	Aluminum with terminal strip	<ul> <li>Conduit connection: ¾-in. NPT</li> <li>Instrument connection: ½-in. NPT</li> <li>Optional stainless steel cover chain or external ground screw available</li> </ul>		page <u>62</u>
*	AT3 <sup>(1)</sup>	Aluminum with terminal strip and extended cover	<ul> <li>Conduit connection: ¾-in. NPT</li> <li>Instrument connection: ½-in. NPT</li> <li>Optional stainless steel cover chain or external ground screw available</li> </ul>		<u>page</u> <u>62</u>
*	AJ1	Universal 3 entry aluminum junction box	<ul> <li>Conduit connection: ½-in. NPT or M20</li> <li>Instrument connection: ½-in. NPT</li> <li>Optional terminal block, external ground screw, and stainless steel cover chain available</li> </ul>		page 62

### Rosemount 214C

Co	ode	Description	Details	Image	Ref. page
*	AJ2	Universal 3 entry aluminum junction box with display cover	<ul> <li>Conduit connection: ½-in. NPT or M20</li> <li>Instrument connection: ½-in. NPT</li> <li>Optional terminal block and external ground screw</li> </ul>		<u>page</u> <u>62</u>

(1) *Requires the WD option from Lead wire extensions: Termination style.* 

# Conduit entry thread type

Co	de	Description	Image	
*	C1	½-in. NPT		<u>page</u> <u>65</u>
*	C2	M20 x 1.5		<u>page</u> <u>65</u>
*	С3	¾-in. NPT		<u>page</u> <u>65</u>

# Instrument connection thread type

Co	ode	Description	Image	Ref. page
*	B1	½-in. NPT		<u>page</u> <u>65</u>
	B2	M20 x 1.5		<u>page</u> <u>65</u>
	B4	M24 x 1.5		page <u>65</u>

# Conduit cable glands

Code		Description	Image	Ref. page
*	GN1	Ex d, standard cable diameter		<u>page</u> <u>66</u>
*	GN2	Ex d, thin cable diameter		<u>page</u> <u>66</u>
*	GN6	EMV, standard cable diameter		<u>page</u> <u>66</u>
*	GP1	Ex e, standard cable diameter, polyamide		<u>page</u> <u>66</u>
*	GP2	Ex e, thin cable diameter, polyamide		<u>page</u> <u>66</u>

# Extension type

Code		Description	Details	Image	
*	UA	Union style, ½-in. NPT, ½-in. NPT	Contains union fitting, which allows orientation of the conduit entry during installation; also known as nipple-union style		<u>page</u> <u>67</u>
*	FA	Fixed style, ½-in. NPT, ½-in. NPT	Contains coupling fitting, which does not allow orientation of the conduit entry during installation; also known as nipple-coupling style		<u>page</u> <u>67</u>
	PD	DIN-style, 12 x 1.5, M24 x 1.5, M18 x 1.5			<u>page</u> <u>67</u>
	PE	DIN-style, 12 x 1.5, M24 x 1.5, M20 x 1.5			<u>page</u> <u>67</u>
	PH	DIN-style, 12 x 1.5, M24 x 1.5, M24 x 1.5			<u>page</u> <u>67</u>
	РК	DIN-style, 12 x 1.5, M24 x 1.5, G½- in. (BSPF)			<u>page</u> <u>67</u>
	PQ	DIN Style, 15 x 3, M24 x 1.5, M18 x 1.5	Contains one single piece	1 Can	<u>page</u> <u>67</u>
	PT	DIN-style, 15 x 3, M24 x 1.5, M24 x 1.5	extension		<u>page</u> <u>67</u>
	TC	DIN-style, 12 x 1.5, M24 x 1.5, ½-in. NPT			<u>page</u> <u>67</u>
	TD	DIN Style, 12 x 1.5, M24 x 1.5, ¾-in. NPT			<u>page</u> <u>67</u>
	TH	DIN-style, 12 x 1.5, M24 x 1.5, R ½-in. (BSPT)			<u>page</u> <u>67</u>
	TN	DIN Style, 15 x 3, M24 x 1.5, ½-in. NPT			<u>page</u> <u>67</u>

# Extension length (E)

Code		Description	
*	Exxx	xx.x inches, 2.5 to 20 inches in $\frac{1}{2}$ -in. increments (when ordered with Dimension units code E)	<u>page</u> <u>68</u>
*	Exxx	xxx mm, 65 to 500 mm in 5 mm increments (when ordered with Dimension units code M)	<u>page</u> <u>68</u>

# Lead wire extension: Wire type

Code		Description	Details	Image	Ref. page
	LA	Twisted lead wire extension	Allows addition of length to standard sensor wires.		<u>page</u> <u>70</u>

C	Code	Description	Details	Image	Ref. page
	LB	Shielded, PTFE wrapped cable lead wire extension	Standard sensor wires are braided to add ridgidity, strength, and robustness. They are wrapped in PTFE as a chemical shield for added wire protection.		page 70

# Lead wire extension: Wire length (T)

Code	Description	
0018	18-in. (1.5 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
0036	36-in. (3.0 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
0072	72-in. (6.0 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
0144	144-in. (12.0 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
0288	288-in. (24 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
0600	600-in. (50 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
0900	900-in. (75 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
1200	1200-in. (100 ft.) (when ordered with dimension units option "E")	<u>page</u> <u>70</u>
XXXX	xxxx-in., 12 to 3600 inches in 1 inch increments (when ordered with dimension units option "E") Example of an 18-in. wire length: 0018	page 70
XXXX	xxxx cm, 30 to 9144 cm in 1 cm increments (when ordered with dimension units option "M") Example of a 50 cm wire length: 0050	page 70

# Lead wire extension: Armor type

Code		Description	Details	Image	Ref. page
	AN	Armored cable lead wire extension	Bare armored cable around wires to provide mechanical protection. There is no coating on the wires. Maximum length allowed is 1200 in. (3048 cm).		<u>page</u> 70
	AC	PVC-coated armored cable lead wire extension	Armored cable around wires to provide mechanical protection. The armored cable is coated with Polyvinyl Chloride (PVC) coating. Maximum length allowed is 1200 in. (3048 cm).	Card and and and and and and	<u>page</u> <u>70</u>

Co	de	Description	Details	Image	Ref. page
	AP	PTFE-coated armored cable lead wired extension	Armored cable around wires to provide mechanical protection. The armored cable is coated with Polytetraflouroethylene (PTFE) coating. Maximum length allowed is 1200 in. (3048 cm).		<u>page</u> <u>70</u>

# Lead wire extension: Cable glands

C	ode	Description	Image	Ref. page
	J1	½-in. NPT		<u>page</u> <u>71</u>
	J2	M20 x 1.5		<u>page</u> <u>71</u>

### Lead wire extension: Shielded cable drain wire

Code	•	Description	Details	Image	Ref. page
D	W	Drain wire	Reduces resistance from ambient or electrical noise. It is only available with the shielded cable.		<u>page</u> <u>71</u>

### Lead wire extension: Adapter-mounted cable gland

Code	Description	Details	Image	Ref. page
F1	Adapter-mounted cable gland, ½- in. NPT	Prevents process fluid from exiting a non sealed adapter (ex. Spring- loaded adapter).		<u>page</u> <u>71</u>

### Lead wire extension: Termination style

Co	de	Description	Details	Image	Ref. page
	WB	Spade lugs	Terminals allow for ease of wiring.		<u>page</u> 72
	WD	Bootlace ferrules	Ferrules provide ease in wiring and give better electrical contact where needed.		<u>page</u> <u>72</u>

### **Ground screw**

Co	ode	Description	Details	Image	Ref. page
*	G1	External ground screw	Allows for grounding of wires to the connection head		<u>page</u> <u>75</u>

### **Cover chain**

Code		Description	Details	Image	Ref. page
*	G3	Cover chain	Keeps the cover connected to the connection head when disassembled; not available with display covers		<u>page</u> <u>76</u>
*	G6	Extension ring	Aluminium Extension Ring for Dua Transmitter Mounting		page 76

# **Terminal block**

Code		Description	Details	Images	Ref. page
*	ТВ	Terminal block	Available if wire termination in a connection head is required		<u>page</u> 78

# Low temperature housing

Code		Description	
*	LT	Low temperature connection head option down to –60 °F (–51 °C)	<u>page</u> <u>78</u>

Code		Description			
	BR	-76 °F (-60 °C) cold temperature operation	<u>page</u> <u>78</u>		

# Transmitter assembled to sensor

Code		Description	Details	
*	ХА	Process-ready assembly of transmitter and sensor	Ensures sensor is threaded into connection head with transmitter and torqued for process-ready installation; sensor is wired to the transmitter	<u>page</u> <u>78</u>
*	ХС	Hand-tight assembly of transmitter and sensor	Ensures sensor is threaded into connection head with transmitter but only hand tightened; manual wiring is required	<u>page</u> <u>78</u>

# Thermowell assembled to sensor

Code		Description	Details	
*	XW	Process-ready assembly of sensor and thermowell	Ensures sensor is threaded into thermowell and torqued for process-ready installation	<u>page</u> <u>79</u>
*	ХТ	Hand-tight assembly of sensor and thermowell	Ensures sensor is threaded into thermowell but only hand tightened	<u>page</u> <u>79</u>

### **Extended product warranty**

Code		Description	Details	
*	WR3	3-year limited warranty	This warranty option is to extend your manufacturers warranty to three or five years for manufacturer	<u>page</u> <u>79</u>
*	WR5	5-year limited warranty	related defects	<u>page</u> <u>79</u>

# Ordering information detail

# Sensor type

Back to **RTD** ordering information.

### RTD

RTDs are based on the principle that the electrical resistance of a metal increases as temperature increases – a phenomenon known as thermal resistivity. Thus, a temperature measurement can be inferred by measuring the resistance of the RTD element.

RTDs are constructed of a resistive material with leads attached and usually placed into a protective sheath (see <u>Sheath material</u> for details). The resistive material can be a variety of materials. Emerson however, standardizes on platinum materials for all RTDs because of its high accuracy, excellent repeatability, and exceptional linearity over a wide temperature range. Platinum RTDs also exhibit a large resistance change per degree of temperature change.

The relationship between the resistance change of an RTD vs. temperature is called its Temperature Coefficient of Resistance (TCR) and is often referred to as the RTD's alpha curve. Emerson's PT100 RTDs all have a standard alpha coefficient of  $\alpha$  = 0.00385 which is the most popular option that is recognized nationally and internationally. Reference Figure 2 for typical behavior of the resistance of a platinum RTD over a range of temperature.

#### Figure 2: Resistance Change vs. Temperature for Platinum RTD (PT100)



Emerson offers the two most common styles of RTD sensors: thin-film and wire-wound. Wire-wound RTDs are manufactured by winding the resistive wire in a helical shape supported in a ceramic sheath – hence the name wire-wound. Thin-film RTDs are manufactured with a thin resistive coating that is deposited on a flat, usually rectangular ceramic substrate.

### **Figure 3: RTD Elements**





- A. Element leads
- B. Deposited platinum resistive pattern
- C. Ceramic substrate
- D. Glass encapulation
- E. Resistance trim area
- F. Coiled high purity platinum sensing wire
- G. High purity ceramic insulation

### Thin-film RTD (RT, RH)

Thin-film elements are generally better in vibration and physical shock. With a platinum construction (PT100) and a temperature coefficient  $\alpha$  =0.00385, these elements can be rated between –76 to 1112 °F (–60 to 600 °C).

#### Wire-wound RTD (RW)

When a lower temperature range is required for an RTD, the wire-wound element is a better choice. The RW option code is for wire-wound RTDs which are for –321 to 1112 °F (–196 to 600 °C). Similar to the thin-film element, this element has a platinum construction (PT100) and an alpha value of  $\alpha$  =0.00385. Because of its lower temperature range, this option should be chosen for low temperature applications (below –76 °F [–60 °C]).

### Table 3: RTD Comparison

Option code	Element type	Temperature range	Good for	Accuracy
RT	Thin film	(–58 to 842 °F) –50 to 450 °C	Higher vibration and physical shock	Class A; Class B
RW	Wire wound	(–321 to 1112 °F) –196 to 600 °C	Higher accuracy and low temperature applications	Class A; Class B
RH	High temperature thin film	(–76 to 1112 °F) –60 to 600 °C	Higher temperature applications, resistance to vibration, and physical shock	Class B

Back to Thermocouple ordering information.

### Thermocouple

A thermocouple (T/C) is a closed-circuit thermoelectric temperature sensing device consisting of two wires of dissimilar metals joined at both ends. A current is created when the temperature at one end or junction differs from the temperature at the other end. This phenomenon is known as the Seebeck effect, which is the basis for thermocouple temperature measurements.

One end is referred to as the hot junction whereas the other end is referred to as the cold junction. The hot junction measuring element is placed inside a sensor sheath and exposed to the process. The cold junction, or the reference junction, is the termination point outside of the process where the temperature is known and where the voltage is being measured (e.g. in a transmitter, control system input card, or other signal conditioner).

According to the Seebeck effect, a voltage measured at the cold junction is proportional to the difference in temperature between the hot junction and the cold junction. This voltage may be referred to as the Seebeck voltage, thermoelectric voltage, or thermoelectric EMF. As the temperature rises at the hot junction, the observed voltage at the cold junction also increases non-linearly with the rising temperature. The linearity of the temperature-voltage relationship depends on the combination of metals used to make the T/C.

There are many types of T/C that use various metal combinations. These combinations have different output characteristics that define the applicable temperature range it can measure and the corresponding voltage output. The higher the magnitude of the voltage output the higher the measurement resolution, which increases repeatability and accuracy. There are trade-offs between measurement resolutions and temperature ranges which suits individual T/C types to specific ranges and applications. Refer to Figure 4 for different thermocouple behavior over a range of temperatures.

### Figure 4: Thermocouple Temperature Ranges



Emerson offers a variety of thermocouples: Type E, Type J, Type K, Type N, and Type T.

### Table 4: Thermocouple Types

Option code	Element type	Metals	Temperature range	Good for
TE	Туре Е	Chromel-constantan	-40 to 1,500 °F (-40 to 816 °C)	Medium temperature ranges continuously oxidizing or inert atmospheres.
тј	Туре Ј	Iron-constantan	–40 to 1,400 °F (–40 to 760 °C)	Medium temperature ranges
тк	Туре К	Chromel-Alumel	–40 to 2,192 °F (–40 to 1,200 °C)	High temperature ranges

Table 4: Thermocouple	Types	(continued)
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Option code	Element type	Metals	Temperature range	Good for
TN	Туре N	Nicrosil-Nisil	-40 to 2,192 °F (-40 to 1,200 °C)	High temperature ranges with higher thermoelectric stability than Type K
тт	Туре Т	Copper-constantan	–321 to 698 °F (–196 to 370 °C)	Low (cryogenic) temperature ranges

### Type E (TE)

### Figure 5: Type E Thermocouple Colors

#### ASTM color codes



# IEC color codes



Constructed of Chromel and constantan, Type E thermocouples have a potential temperature range of -40 to 1500 °F (-40 to 816 °C), and a sensitivity of about  $68\mu$  V/°C. It also has a tendency to drift more than the other types. It is recommended for continuously oxidizing or inert atmospheres. Its limits of error have not been established for use below zero.

### Type J (TJ)

### Figure 6: Type J Thermocouple Colors

### ASTM color codes



**IEC color codes** 



Constructed of iron and constantan, Type J thermocouples have a potential temperature range of -40 to 1400 °F (-40 to 760 °C), and a sensitivity of about 50  $\mu$  V/°C. Type J thermocouples becomes brittle below 32 °F (0 °C) and are suitable for use in vacuum, reducing, or inert atmospheres. These thermocouples will have a reduced life if used in an oxidizing atmosphere.

### Туре К (ТК)

### Figure 7: Type K Thermocouple Colors

#### ASTM color codes







Constructed of Chromel and Alumel materials, Type K thermocouples are one of the most common general purpose thermocouples, have a potential temperature range of –40 to 2192 °F (–40 to 1200 °C), and a sensitivity of approximately 41  $\mu$  V/ °C. Type K thermocouples are relatively linear and may be used in continuously oxidizing or neutral atmospheres, and are typically used above 1000 °F (538 °C).

### Type N (TN)

### Figure 8: Type N Thermocouple Colors

#### ASTM color codes



IEC color codes

**IEC color codes** 



Constructed of Nicrosil and Nisil, Type N thermocouples have a potential temperature range of -40 to 2192 °F (-40 to 1,200 °C), and a sensitivity of about 39  $\mu$ V/°C. Some studies have shown that, in oxidizing atmospheres, the thermoelectric stability of the type N thermocouple is about the same as that of the noble-metal thermocouples of ANSI types R and S up to about 1200 °C (2192 °F) Type N thermocouples should not be placed in vacuums or reducing or alternating reducing/ oxidizing atmospheres.

### Type T (TT)

### Figure 9: Type T Thermocouple Colors

#### ASTM color codes





Constructed of copper and constantan, Type T thermocouples have a potential temperature range of –321 to 698 °F (–196 to 370 °C) and a sensitivity of 38  $\mu$  V/°C. Type T thermocouples demonstrate a good linearity and can be used in oxidizing, reducing or inert atmospheres, as well as in a vacuum. These thermocouples exhibit a high resistance to moisture corrosion, and are typically used in very low (cryogenic) to medium temperature ranges.

# **Sheath material**

Back to **RTD** ordering information.

(SM)

For RTDs, Emerson offers a protective sheath made of 316 SST. This material has an maximum operating temperature limit of 1650 °F (900 °C).

Back to Thermocouple ordering information.

### (SM)

For Type E, J, and T thermocouples, Emerson offers a protective sheath made of 321 SST. This material is a stainless steel stabilized by adding titanium. This gives it excellent resistance to intergranular corrosion after exposure to high temperatures (above 800 °F [427 °C]). Material 321 has a maximum operating temperature limit of 1500 °F (816 °C). The operating temperature range for the sensor element will constrain this limit. See <u>Table 3</u> and <u>Table 4</u> for the temperature range of the different sensor element types. This material is only available for Type E, J, and T thermocouples.

### (AK)

For Type K and N thermocouples, Emerson offers a protective sheath made of Alloy 600. This material is a nickel-chromium alloy with good oxidation resistance at higher temperatures. Alloy 600 is designed for use in the temperature range of –40 to 2192 °F (–40 to 1200 °C). The operating temperature range for the sensor element will be constrained by this limit. This material is only available for Type K and N thermocouples.

### **Sensor accuracy**

Back to **RTD** ordering information.

Back to Thermocouple ordering information.

### (A1, B1)

The thin-film option code RH is available in Class B accuracy only, whereas the thin-film option code RT is available in both Class A and Class B accuracy.

The wire-wound option code RW is intended for applications that require high accuracy and/or subjected to low temperatures. Option code RW is available with Class A accuracy over –148 to 842 °F (–100 to 450 °C).

<u>Table 5</u> shows the interchangeability of RTD sensors. It explains the tolerance for Class A and Class B accuracy RTDs over a specific temperature range. The performance of the option codes RT, RH, and RW sensors conform to the standard set by IEC 60751. Figure 10 is a graphical representation that demonstrates the Class A and Class B accuracy curve over temperature per IEC 60751. For maximum system accuracy, Emerson can provide sensor calibration and optional sensor-to-transmitter matching obtainable through the use of Callendar-Van Dusen constants. See <u>Calibration</u> for additional calibration offering.

°C (°F)	Tolerancer in °C (°F)						
	Class B for RTD Model Option RT	Class A for RTD Model Option RT	Class B for RTD Model Option RW	Class A for RTD Model Option RW	Class B for RTD Model Option RH		
-196 (-321)	N/A	N/A	±1.28 (2.30)	N/A	N/A		
-100 (-148)	N/A	N/A	±0.8 (1.44)	±0.35 (0.63)	N/A		
-50 (-58)	±0.55 (0.99)	N/A	±0.55 (0.99)	±0.25 (0.45)	±0.55 (0.99)		
0 (32)	±0.3 (0.54)	±0.15 (0.27)	±0.3 (0.54)	±0.15 (0.27)	±0.3 (0.54)		
100 (212)	±0.8 (1.44)	±0.35 (0.63)	±0.8 (1.44)	±0.35 (0.63)	±0.8 (1.44)		
200 (392)	±1.3 (2.34)	±0.55 (0.99)	±1.3 (2.34)	±0.55 (0.99)	±1.3 (2.34)		
300 (572)	±1.8 (3.24)	±0.75 (1.35)	±1.8 (3.24)	±0.75 (1.35)	±1.8 (3.24)		
450 (842)	±2.55 (4.59)	N/A	±2.55 (4.59)	±1.05 (1.89)	±2.55 (4.59)		
500 (932)	N/A	N/A	±2.8 (5.04)	N/A	±2.8 (5.04)		
600 (1112)	N/A	N/A	±3.3 (5.94)	N/A	±3.3 (5.94)		

### Table 5: Interchangeability Error for RTD per IEC 60751

### Figure 10: Sensor Accuracy Curve



### (T1, T2, SP, ST)

Similar to RTDs, thermocouples also can have tolerances as defined by national standards. According to IEC 60584, thermocouples can have a narrower tolerance (or higher accuracy) of Class 1. Class 1 thermocouples are manufactured with higher grade wire, which increases their accuracy reading. Class 2, on the other hand, has a wider accuracy error margin since they are manufactured with standard thermocouple grade wires.

Emerson also provides thermocouples that meet tolerances per ASTM E230 standards. Special Tolerances are approximately half of accuracy error margin than Standard Tolerances since they are made with higher grade wire.

# Number of elements

Back to <u>RTD ordering information</u>. Back to <u>Thermocouple ordering information</u>.