**Product Data Sheet**
00813-0600-2654, Rev AA
May 2021

# Rosemount™ 214A Temperature Sensor

- High accuracy resistance temperature detectors (RTD) and various thermocouple types offered in a variety of element and sensor build configurations
- Complements the Rosemount 214C offering with expanded industrial, cable, surface, and bearing sensors
- Customized, built-to-order products to meet specific temperature measurement needs

ROSEMOUNT™

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# Rosemount 214A Sensor

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

Features include:

- Temperature ranges of -196 to 600 °C For RTDs and -40 to 1200 °C for thermocouples
- Industry-standard and specialty sensor types: PT100 and PT1000 RTDs, thermocouple Type E, Type J, Type K, Type N and Type T
- Hazardous location product approvals and certification
- Sensor mounting styles with industrial, cable, surface and bearing designs
- Calibration services and certificates to give insight to sensor performance

# How to order

The Rosemount 214A line of sensors are customized, build-to-order products based on your specific temperature measurement needs. To request a quote for a Rosemount 214A temperature sensor, contact your local Emerson sales or customer care representative with the ordering information to discuss your application.

Specification and selection of product materials, options, or components must be made by the purchaser of the equipment and provided to your local Emerson sales or customer care representative.

### Ordering Information

Below is the information Emerson will need to process a request for quote for a Rosemount 214A temperature sensor. Include the desired specified option within each category.

**Note**
Offering may vary by world area. Table below is not all-inclusive:

**Table 1: Ordering Information**

| Description | Common examples |
|---|---|
| Sensor type | ■ RTD: PT100 Class A or B<br>■ Thermocouple Type E, J, K, T, or N class 1 or 2 |
| Wire configuration | ■ Single or dual element<br>■ 2, 3, or 4-wire |
| Measured temperature range | Specify lower and upper limits |

## Contents

**Table 1: Ordering Information *(continued)***

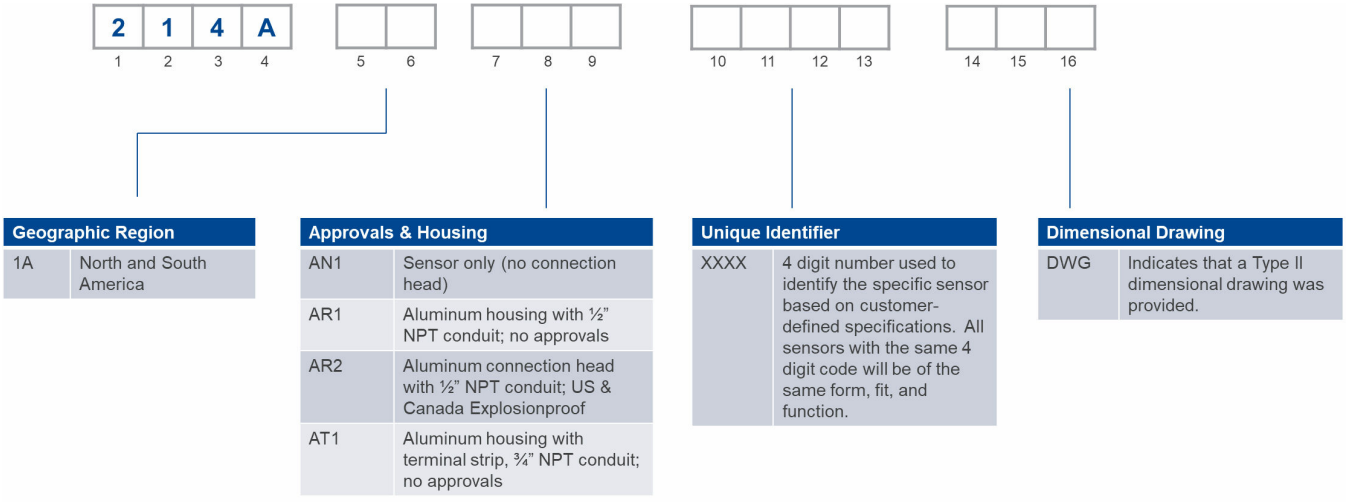
| Description | Common examples |
|---|---|
| Sensor mounting style | Industrial sensor design<br>■ Spring Loaded Adapter<br>■ Welded Adapter<br>■ DIN Mounting Plate with flying leads<br>■ DIN mounting plate with terminal block |
| | Cable sensor design<br>■ Screw-in with cable<br>■ Tubular with cable<br>■ MI sensor with flying leads<br>■ MI sensor with cable |
| | Surface sensor design<br>■ MI sensor with cable<br>■ MI sensor with connection head |
| | Bearing sensor design<br>■ Tubular with cable<br>■ Bayonet sensor<br>■ MI sensor with connection head and terminal block<br>■ MI sensor with Connection head and spring-loaded adapter<br>■ MI sensor with connection head and DIN plate with flying leads |
| Sensor dimensions | ■ Specify sensor insertion length<br>■ Specify sensor outer diameter (default 6 mm) |
| Sensor material | ■ 316 SST<br>■ Alloy 600<br>■ 321 SST<br>■ Other |
| Approvals | ■ None<br>■ ATEX Flameproof<br>■ ATEX Intrinsic Safety<br>■ ATEX Increased Safety<br>■ IECEx Flameproof<br>■ IECEx Intrinsic Safety<br>■ IECEx Increased Safety |

**Table 1: Ordering Information *(continued)***

| Description | Common examples |
|---|---|
| Extension type | ■ None<br>■ Nipple<br>■ Nipple-union<br>■ Nipple-union-nipple<br>■ Barstock<br>■ Other |
| Extension length | Specify extension length (if applicable) |
| Other requirements | Specify other requirements not noted above including:<br>■ Connection heads/housings<br>■ Drawings<br>■ Calibration<br>■ Other |

## Americas

Below is a breakdown of Rosemount 214A model numbers that are ordered in North or South America:




| Geographic Region | |
|---|---|
| 1A | North and South America |

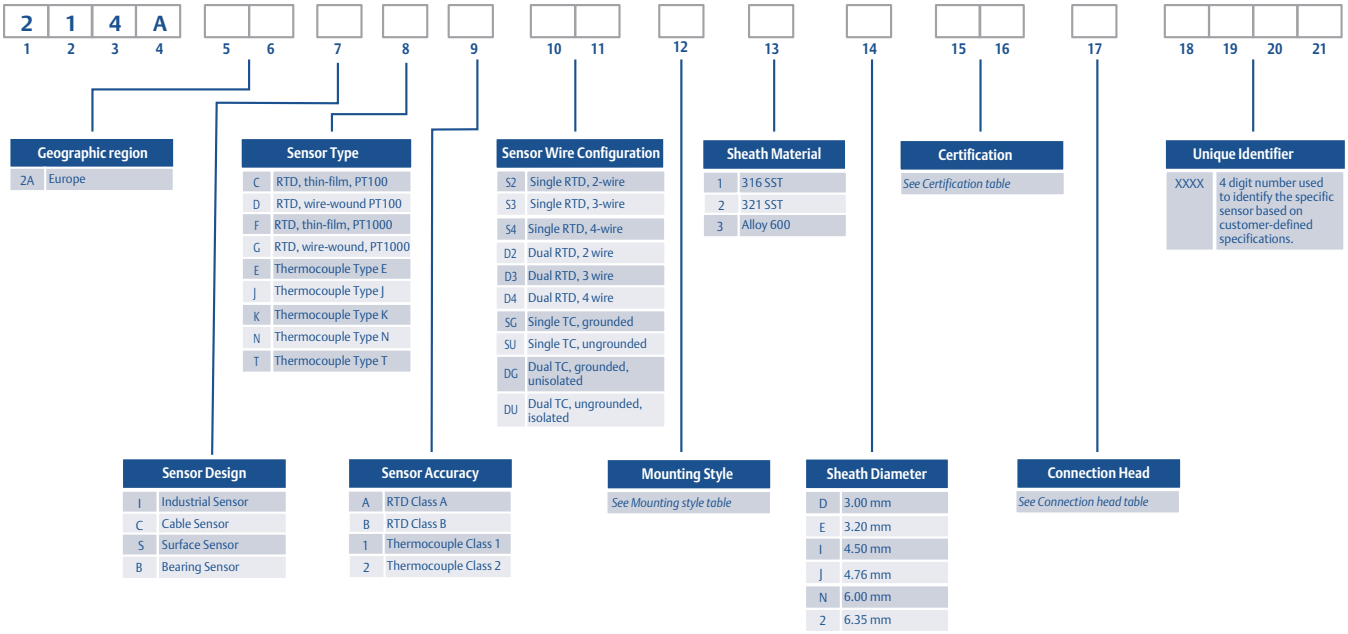
| Approvals & Housing | |
|---|---|
| AN1 | Sensor only (no connection head) |
| AR1 | Aluminum housing with ½" NPT conduit; no approvals |
| AR2 | Aluminum connection head with ½" NPT conduit; US & Canada Explosionproof |
| AT1 | Aluminum housing with terminal strip, ¾" NPT conduit; no approvals |

| Unique Identifier | |
|---|---|
| XXXX | 4 digit number used to identify the specific sensor based on customer-defined specifications. All sensors with the same 4 digit code will be of the same form, fit, and function. |

| Dimensional Drawing | |
|---|---|
| DWG | Indicates that a Type II dimensional drawing was provided. |

## Europe

Below is a breakdown of Rosemount 214A model numbers that are ordered in Europe:




## Sensor type

| Code | Description | |
|---|---|---|
| C | RTD, thin-film, PT100 | |
| D | RTD, wire-wound PT100 | |
| F | RTD, thin-film, PT1000 | |
| G | RTD, wire-wound, PT1000 | |
| E | Thermocouple Type E | |
| J | Thermocouple, Type J | |
| K | Thermocouple, Type K | |
| N | Thermocouple, Type N | |
| T | Thermocouple, Type T | |

## Sensor wire configuration

| Code | Description | |
|---|---|---|
| S2 | Single RTD, 2 wire | |
| S3 | Single RTD, 3 wire | |
| S4 | Single RTD, 4 wire | |

| Code | Description | |
|---|---|---|
| D2 | Dual RTD, 2 wire | |
| D3 | Dual RTD, 3 wire | |
| D4 | Dual RTD, 4 wire | |
| SG | Single TC, Grounded | |
| SU | Single TC, Ungrounded | |
| DG | Dual TC, Grounded, Unisolated | |
| DU | Dual TC, Ungrounded, Isolated | |

## Mounting style

| Code | Description | |
|---|---|---|
| **Industrial sensors** | | |
| A | Spring-loaded adapter | |
| B | Welded adapter | |
| C | DIN mounting plate with flying leads | |
| D | DIN mounting plate with terminal block | |
| E | Sensor only | |
| **Cable sensors** | | |
| I | Screw-In with cable | |
| J | Tubular with cable | |
| K | MI sensor with flying leads | |
| L | MI sensor with cable | |
| **Surface sensors** | | |
| P | MI sensor with cable | |
| Q | MI sensor with connection head | |
| **Bearing sensors** | | |
| U | Tubular with cable | |
| V | Bayonet sensor | |
| W | MI sensor with connection head and terminal block | |
| X | MI sensor with connection head and spring-loaded adapter | |
| Y | MI sensor with connection head and DIN plate with flying leads | |

## Certifications

| Code | Description | |
|---|---|---|
| NA | None | |
| E1 | ATEX Flameproof | |
| I1 | ATEX Intrinsic Safety | |
| N1 | ATEX Increased Safety | |
| E7 | IECEx Flameproof | |
| I7 | IECEx Intrinsic Safety | |
| N7 | IECEx Increased Safety | |

## Connection head

| Code | Description | |
|---|---|---|
| N | No connection head | |
| B | Rosemount aluminum M20 x M24 | |
| C | Rosemount aluminum M20 x ½-in. NPT | |
| D | Rosemount aluminum ½-in. NPT x ½-in. NPT | |
| G | Rosemount stainless steel M20 x ½-in. NPT | |

# Ordering information detail

## Product certifications

Rev 1.0

### 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 Emerson.com/Rosemount.

### E1 ATEX Flameproof

| | |
|---|---|
| **Certificate** | DEKRA 20ATEX0045X |
| **Standards** | EN 60079-0:2012+A11:2013, EN 60079-1:2014 |
| **Markings** | Ⓔx II 2 G Ex db IIC T6...T1 Gb |

### E7 IECEx Flameproof

| | |
|---|---|
| **Certificate** | IECEx DEK 20.0023X |
| **Standards** | IEC 60079-0:2011, IEC 60079-1:2014-06 |
| **Markings** | Ex db IIC T6...T1 Gb |

The process side of the assembly is for the responsibility of the user. The assembly should always be used in a closed system.

No changes are allowed on the product.

### Flameproof enclosure “d”;

In type of explosion protection Ex d, certified entry devices shall be used that are suitable for the application and correctly installed.

Unused openings shall be closed by suitable blanking elements. Only suitable thread adapters shall be used. Thread adapters will not be used in combination with blanking elements.

Verify the entry size (M20, ½-in. ¾-in., etc).

The degree of protection of IP66 or IP67 to EN 60529 is only achieved if certified Ex d entry devices are used that are suitable for the application and correctly installed.

Only use approved inserts.

For external earthing or bonding connection of the connection head a cable lug shall be used so that the conductor is secured against loosening and twisting and that contact pressure is permanently secured.

#### Electrical data

| | |
|---|---|
| **Thermocouple sensing element** | 5 Vdc, 10 mA |
| **RTD sensing element** | 5 Vdc, 10 mA |
| **Transmitter data** | max. 45 Vdc, max 50 mA, max 1.9 W |

For the electrical data of a sensor in combination with a transmitter, see electrical data of the transmitter.

### Special Conditions for Safe Use:

1. Ambient temperature range of sensor assembly with PTFE cable insulation: -40 to +80 °C, and for Silicon cable insulation: -25 to +80 °C.
2. Service temperatures wire: Silicon -25/+160 °C, PTFE -40/+180 °C.

3. Service temperatures connection box and head: -40 to +80 °C, except for T6 maximum temperature is 70 °C.
4. When the process temperature range exceeds the service temperature range of the connection head, the connection box and the cable (the maximum ambient temperature (Tamax) is +80 °C except for T6 (Tamax) is +70 °C), it shall be verified by on-site temperature measurements, taking the worst case conditions into account, that the service temperature of these parts does not exceed the range as listed above.
5. The measurement report with the conclusions shall be filed together with the certificate to prove that this condition is met.
6. For information about the dimensions of the flameproof joints, contact the manufacturer.
7. When a flameproof nipple is used (e.g. ISSeP06ATEX042 U) use thread sealant with connection to connection head or transmitter.
8. Inserts with a diameter smaller than 3 mm and inserts with not-armored wire shall be protected against mechanical danger.
9. For an ambient temperature exceeding 70 °C, heat resistant cables and cable glands suitable for at least 90 °C shall be used.
10. For parameters see transmitter or by terminal block U-max: 5V, I-max: 10mA p/channel.
11. The inserts should always be used with a mechanical protection.
12. Minimum and maximum wire temperature: Silicon -25/+160 °C, PTFE -40/+180 °C. Maximum transition temperature: +80 °C.

### Thermal data

The maximum surface temperature due to process conditions (Tp) is the maximum surface temperature of any part of the assembly in contact with the explosive atmosphere.

The temperature class and the maximum surface temperature of the assembly depend on Tp, as listed in the table.

| Tp (°C) | Temperature class of the assembly | Maximum surface temperature of the assembly (°C) |
|---|---|---|
| 80 | T6 | 85 |
| 95 | T5 | 100 |
| 130 | T4 | 135 |
| 195 | T3 | 200 |
| 295 | T2 | 300 |
| 445 | T1 | 450 |
| >445 | - | Tp + 5 |

## I1 ATEX Intrinsic Safety

| | |
|---|---|
| **Certificate** | DEKRA 20ATEX0047X |
| **Standards** | EN 60079-0:2012+A11:2013, EN 60079-11:2012 |
| **Markings** | Ⓔx II 2 G Ex ia IIC T6...T1 Gb (SEE CERTIFICATE FOR SCHEDULE) |

## I7 IECEx Intrinsic Safety

| | |
|---|---|
| **Certificate** | IECEx DEK 20.0023X |
| **Standards** | IEC 60079-0:2011, IEC 60079-11:2011 |
| **Markings** | Ex ia IIC T6...T1 Gb (SEE CERTIFICATE FOR SCHEDULE) |

Any type of connection head can be used, only during installation the proper certified cable and cable gland should be used. Any type of extension can be used which insures a protection for the connection head of minimum IP20. Any type of insert can be used,

the terminal-block must have Ex approved terminals. Any type of thermowell can be used. The process side of the assembly is for the responsibility of the user. The assembly should always be used in a closed system.

- Inserts with RTD sensing elements
  Output circuits in type of protection intrinsic safety Ex ia IIC, only to be connected to a certified intrinsically safe circuit, with the following maximum values for each insert:
  $U_i$ = 14 V, $I_i$ = 1.2 A, $P_i$ = 140 mW, $C_i$ ≤60 nF, $L_i$ = 0 mH.
- Inserts with thermocouple sensing elements
  Output circuits in type of protection intrinsic safety Ex ia IIC, only to be connected to a certified intrinsically safe circuit, with the following maximum values for each insert:
  $U_i$ = 14 V, $I_i$ = 1.2 mA, $P_i$ = 140 mW, $C_i$ ≤60 nF, $L_i$ = 0 mH.
- Transmitters data: $U_i$ =45 Vdc max., $I_i$ = 50 mA max., $P_i$ = 2.25 W max.
  In type of protection intrinsic safety Ex ia IIC or Ex ib IIC, only to be connected to a certified intrinsically safe circuit, with the maximum values according to the data listed in the certificate of the transmitter. The sensor input parameters of the transmitter shall comply with the parameters of the inserts.

### Thermal data

The maximum surface temperature due to process conditions (Tp) is the maximum surface temperature of any part of the assembly in contact with the explosive atmosphere.

The temperature class and the maximum surface temperature of the assembly depend on Tp and, when mounted, on the temperature class of the integrally mounted transmitter, as listed in the table.

| Tp (°C) | Temperature class of the transmitter | Temperature class of the assembly | Maximum surface temperature of the assembly (°C) |
|---|---|---|---|
| 75 | T6 | T6 | 85 |
| 90 | T5 | T5 | 100 |
| 125 | T4 | T4 | 135 |
| 190 | T3 | T3 | 200 |
| 290 | T2 | T2 | 300 |
| 440 | T1 | T1 | 450 |
| >440 | T1 | - | Tp + 10 |

## Installation instructions

In order to prevent voltage and/or current addition, the output circuits of each insert shall be wired separately, in accordance with EN 60079-11 and EN 60079-14.

If a temperature transmitter is mounted, the data of the transmitter shall be taken from the instructions of the transmitter. The level of protection Ex ia IIC or Ex ib IIC of the assembly is determined by the level of protection of the transmitter. The equipment category is 2 G.

During installation the proper cable and cable gland should be used, mounted in the conduit (M20, ½-in., ¾-in., etc.).

## Special Conditions for Safe Use:

1. Ambient temperature range of sensor assembly with PTFE cable insulation: -40 to +75 °C, and for Silicon cable insulation: -25 to +75 °C.
2. For versions with an integrally mounted certified intrinsically safe transmitter:
   - The highest minimum ambient temperature as mentioned above and as mentioned on the transmitter, is decisive. The maximum ambient temperature (Tamax) is +80 °C.
   - The maximum ambient temperature of the assembly is +75 °C or the maximum ambient temperature as mentioned on the transmitter -10 K, which ever is smaller.

3. When the process temperature range exceeds the specified ambient temperature range, it shall be verified by on-site temperature measurements, taking the worst case conditions into account, that the service temperature of the connection head and the connection box does not exceed the ambient temperature range. The measurement report with the conclusions shall be filed together with the certificate to prove that this condition is met.
4. From a safety point of view,
   - The thermocouple inserts with a nominal tip diameter less than 3.0 mm,
   - All inserts with a grounded thermocouple, and
   - The RTD inserts with a nominal tip diameter less than 4.8 mm

   shall be considered to be connected to ground.
5. Minimum and maximum wire temperature: Silicon -25/+160 °C, PTFE -40/+180 °C.
6. Maximum transition temperature: +80 °C.

## N1 ATEX Increased Safety

| | |
|---|---|
| **Certificate** | DEKRA 20ATEX0046X |
| **Standards** | EN 60079-0:2012, EN 60079-7:2007 |
| **Markings** | Ⓔx II 2 G Ex e IIC T6...T1 Gb |

## N7 IECEx Increased Safety

| | |
|---|---|
| **Certificate** | IECEx DEK 20.0023X |
| **Standards** | IEC 60079-0:2011, IEC 60079-7:2006-07 |
| **Markings** | Ex e IIC T6...T1 Gb |

### Increased safety enclosure “e”;

In type of explosion protection Ex e, the degree of protection of at least IP54 to EN 60529 is only achieved if certified Ex e cable entries are used that are suitable for the application and correctly installed.

The degree of protection of IP66 or IP67 to EN 60529 is only achieved if certified Exe cable entries are used that are suitable for the application and correctly installed.

When connection head is used the cover will be locked with a lock screw.

### Special Conditions for Safe Use:

1. Ambient temperature range of sensor assembly with PTFE cable insulation: -40 to +80 °C, and for Silicon cable insulation: -25 to +80 °C.
2. Service temperatures transition: -25 to +80 °C for Silicon wire and -40 to +80 °C for PTFE wire.
3. Service temperatures wire: Silicon -25/+160 °C, PTFE -40/+180 °C.
4. Service temperatures connection box and head: -40 to +80 °C.
5. When the process temperature range exceeds the service temperature range of the transition part, the connection head, the connection box and the cable (the maximum ambient temperature (Tamax) is +80 °C), it shall be verified by on-site temperature measurements, taking the worst case conditions into account, that the service temperature of these parts does not exceed the range as listed above.
6. The measurement report with the conclusions shall be filed together with the certificate to prove that this condition is met.
7. The sensor assembly with connection head and extension part shall have a degree of protection of at least IP54, provided by the user with a thermowell or equivalent component at the process side of the assembly, or direct mounted sensor.

### Electrical data

| | |
|---|---|
| **Thermocouple sensing element** | 5 Vdc, 10 mA |
| **RTD sensing element** | 5 Vdc, 10 mA |

## Installation instructions

The degree of protection of at least IP 54 to EN 60529 is only achieved if certified Exe cable glands or conduit entry devices are used that are suitable for the application and correctly installed.

Unused openings shall be closed by suitable blanking elements.

Inserts with a diameter smaller than 3mm and inserts with not-armored wire shall be protected against mechanical danger.

For an ambient temperature exceeding 80 °C, heat resistant cables and cable glands suitable for at least 90 °C shall be used.

During installation the proper certified cable and cable gland should be used, mounted in the conduit (M20, ½-in., ¾-in., etc.).

For parameters see terminal block U-max: 5 V, I-max: 10 mA p/channel.

## Torque values and wire size

For torque values end wire size for terminal blocks, see Examination Certificate FTZU 04 ATEX 0003U and EN 60079-0:2012 and EN 60079-7:2007, for rail mounted terminals see IEC 60947-1/EN 60947-1.

### Thermal data

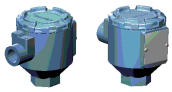
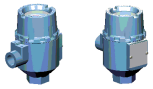
The maximum surface temperature due to process conditions (Tp) is the maximum surface temperature of any part of the assembly in contact with the explosive atmosphere.

The temperature class and the maximum surface temperature of the assembly depend on Tp, as listed in the table.

| Tp (°C) | Temperature class of the assembly | Maximum surface temperature of the assembly (°C) |
|---|---|---|
| 80 | T6 | 85 |
| 95 | T5 | 100 |
| 130 | T4 | 135 |
| 195 | T3 | 200 |
| 295 | T2 | 300 |
| 445 | T1 | 450 |
| >445 | - | Tp + 5 |

## Connection heads

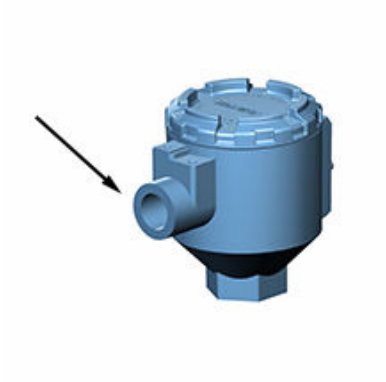
The connection heads provide high-level durability and mechanical protection for harsh environments. All connection heads are rated IP66/68 and NEMA® 4X.

| Head description (code) | Corrosion resistance | Explosionproof design | Conduit options(1) | Conduit entries | Instrument connection(1) | Features |
|---|---|---|---|---|---|---|
| **Rosemount aluminum**  | ★★☆☆ | Yes | ½-in. NPT; M20 | 1 | ½-in. NPT; M24 x 1.5 | ■ Smallest explosion proof connection head<br>■ Fits either DIN A or DIN B size transmitter<br>■ Optional terminal block, stainless steel cover chain, external ground screw, or low temperature options also available |
| **Rosemount aluminum with display cover**  | ★★☆☆ | Yes | ½-in. NPT; M20 | 1 | ½-in. NPT; M24 x 1.5 | ■ Allows LCD display use on the transmitter<br>■ Allows you to see inside the connection head without removing cover<br>■ Fits either DIN A or DIN B size transmitter<br>■ Optional terminal block, external ground screw, or low temperature options also available |

(1) *Option codes for the conduit entry and instrument connection are denoted within the parentheses. The conduit entry is the threaded opening between the connection head and the input/output wires. The instrument connection is the threaded opening between the connection head and the sensors.*

## Conduit entry

The conduit entry is the threaded opening on the side of the connection head, often connected to wiring conduit. It allows the input/output wires to pass into the connection head.



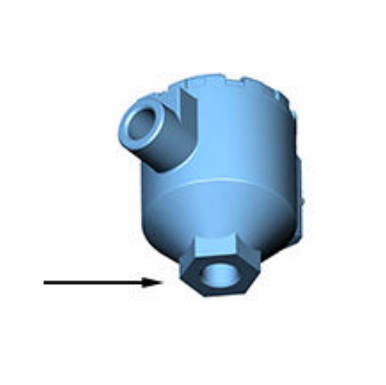
**½-in. NPT**

U.S. Standard connection thread with a ½-in. diameter

**M20 x 1.5**

Metric connection thread with a 20 mm diameter and a 1.5 mm fine pitch

## Instrument connection



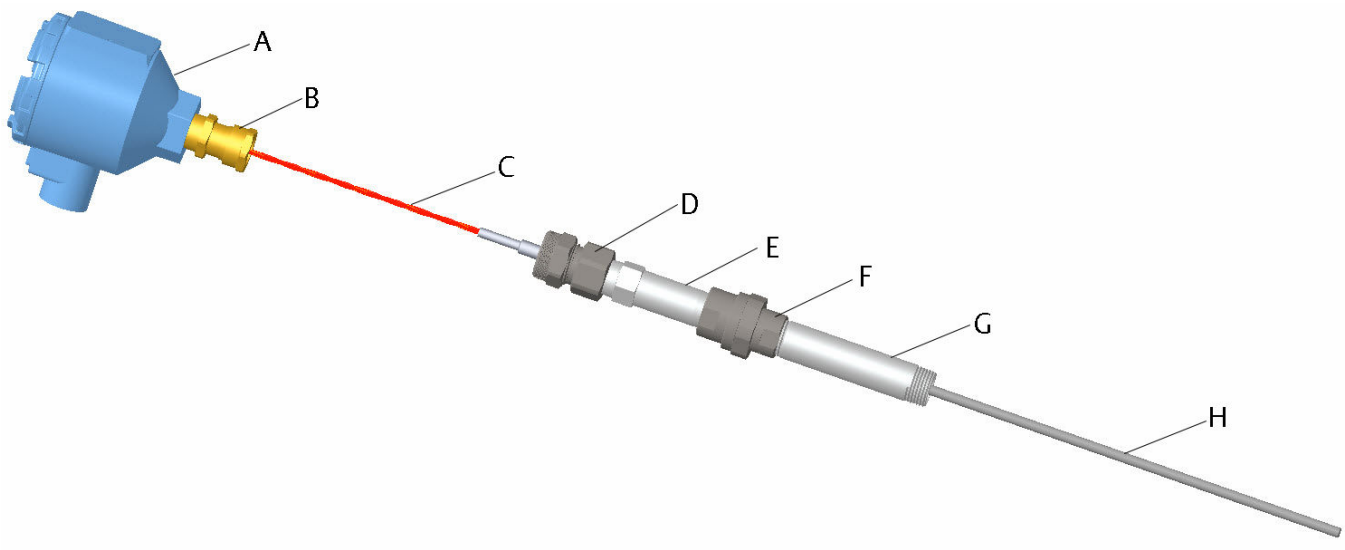
**½-in. NPT**

U.S. Standard connection thread with a ½-in. diameter

**M24 x 1.5**

DIN instrument standard connection with a 20 mm diameter.

## Lead wire extension




*A. Connection head*
*B. Lead wire extension cable gland*
*C. Lead wire extension*
*D. Adapter-mounted cable gland*
*E. Mounting style*
*F. Union*
*G. Extension*
*H. Sensor*

Lead wire extensions allow sensors to be installed in processes that a standard sensor may not fit the needs. In hard to reach or elevated process, lead wire extensions enable the transmitter, local indicator and wiring terminations to be graded for easy access. In high temperature installations where ambient temperatures could exceed transmitter environment ratings, lead wire extensions allow the transmitter electronics to be situated further from the process heat sources.

The length of the extension is calculated from the end of the metal sheath to the head mounting fitting. At the end of the length, wiring is added to the end to allow for wiring of the sensor.

Lead wire extensions are available with twisted wire, Flex armor cable, PVC coated flex armor and strain relief. Lead wire extensions are only available with surface sensor designs. They are available on the 214C with industrial sensor designs.

RTD lead wires: –24 AWG wire, FEP insulated; color coded per IEC 60751.

Thermocouple lead wires: –24 AWG wire, FEP insulated; color coded per IEC 60584 or ASTM E230.

## Calibration

### Calibration options

Sensor calibration may be required for input to quality systems or for control system enhancement, based on the local regulation requirements for maintaining measurement accuracies. More frequently, it is used to improve the overall temperature measurement performance by matching the sensor to a temperature transmitter.

RTD temperature range calibration and single point temperature calibration is available with the 214A.

Thermocouple calibration is available in the Americas only.

### Callendar-Van Dusen constants

Significant temperature measurement accuracy improvement can be attained using a temperature sensor that is matched to a temperature transmitter. This matching process entails teaching the temperature transmitter the relationship between resistance and temperature for a specific RTD sensor. This relationship, approximated by the Callendar-Van Dusen equation, is described as:

Rt = Ro + Roα[t – δ(0.01t – 1)(0.01t) – β(0.01t – 1)(0.01t)3 ], where:

Rt = resistance (ohms) at temperature t (°C)

Ro = sensor-specific constant (resistance at t = 0 °C)

α = sensor-specific constant

δ = sensor-specific constant

β = sensor-specific constant (0 at t > 0 °C, 0.11 at t < 0 °C)

The exact values for R0, α, δ, β, – known as Callendar-Van Dusen (CVD) constants – are specific to each RTD sensor and are established by testing each individual sensor at various temperatures.

The calibration temperature values using the CVD equation are divided into two major temperature areas: above 0 °C and below 0 °C. The calibration for the temperature range is obtained from the following formula:

$$R_t = R_0\left\{1 + a\left[t - d\left(\frac{t}{100}\right)\left(\frac{t}{100} - 1\right)\right]\right\}$$

Note that this is a modification of the fourth-order CVD equation where b = 0 for temperatures greater than 0 °C. Since this modified equation is a second-order equation, at least three distinct temperature values are needed in order to curve fit the behavior of the RTD. For the temperature range from 0 to 100 °C, only these two end points are used, and an approximation is made to render the constants.

Once the sensor-specific constants are entered, the transmitter uses them to generate a custom curve to best describe the relationship between resistance and temperature for the particular sensor and transmitter system. Matching a Rosemount 214A temperature sensor to an Emerson temperature transmitter typically results in a three- or four-fold improvement in temperature measurement accuracy for the measurement point. This substantial system accuracy improvement is realized as a result of the transmitter's ability to use the sensor's actual resistance-vs.-temperature curve instead of an ideal curve.

## Terminal block (TB)

The terminal block is installed in the connection head and the sensor lead wires are terminated to one side of the terminal block. Terminal blocks are typically used when mounting remote transmitters.

## Others

Contact local Emerson sales or customer care representative with the ordering information to discuss additional options or specific requirements.

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For more information: **www.emerson.com**



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