Product Data Sheet
00813-0100-4148, Rev CA
May 2009

Rosemount 148 Temperature Transmitter

- *"Ready-to-install" solution for temperature monitoring applications*
- *Increased measurement accuracy and reliability*
- *Accepts 2-, 3-, and 4-wire RTD, thermocouple, and ohm sensor inputs*
- *Configurable using the Rosemount PC Programmer interface device*
- *Decreased installation costs over direct wired sensors*

Content

The Rosemount 148 Temperature Transmitter

The Rosemount 148 is a low cost temperature transmitter used with multiple sensor type inputs in monitoring applications. The Rosemount 148 saves money in cabling and installation costs over wiring directly and delivers superior measurement accuracy and reliability.

INSTALLATION READY SOLUTIONS

The Rosemount 148 offers a complete point solution that guarantees the transmitter, housing, sensor, extension, and thermowell can be shipped from the factory as an installation-ready assembly.

INCREASED PERFORMANCE

The Rosemount 148 offers better measurement accuracy and improved reliability over wiring a temperature sensor directly back to the DCS.

FLEXIBILITY

The Rosemount 148 is compatible with 2-, 3-, and 4-wire nickel and platinum RTDs, a variety of thermocouple sensors, and ohm inputs.

LOW INSTALLED COST

The Rosemount 148 reduces overall installation costs when compared to wiring sensors direct. In addition, the 148 can eliminate the use of expensive extension wires and multiplexers.

PROGRAMMABLE

The Rosemount 148 PC Programmer interface consists of a programmer, cables, and configuration software. The configuration software, when used in conjunction with the interface, provides the tools necessary to select the sensor type, sensor range, and sensor error action in addition to many other options.

ROSEMOUNT TEMPERATURE SOLUTIONS

Rosemount 3144P

Field mount style HART® or FOUNDATION™ fieldbus protocol. Dual sensor input with advanced diagnostics.

Rosemount 644 Smart Temperature Transmitter

Head mount styles available with HART® or FOUNDATION™ fieldbus protocol. Rail mount style available for *HART* protocol.

Rosemount 848T High Density Temperature Measurement Family

Measure temperature points in close proximity with the 848T architecture, with WirelessHART™ or FOUNDATION fieldbus protocols.

Rosemount 3420 Fieldbus Interface Module

Provides an interface between FOUNDATION™ fieldbus instruments and systems without fieldbus capability using standard interface protocols.

Rosemount 248 Temperature Transmitter

Head mount (DIN B) and Rail mount style with HART® protocol.

Rosemount sensors, thermowells, and extensions

Rosemount has a broad offering of RTD and thermocouples that are designed to meet plant requirements.

Temperature Solutions

SINGLE POINT MEASUREMENT

Real Results

Rosemount single point transmitters deliver exceptional results by utilizing innovative designs and advance diagnostics. A comprehensive and versatile portfolio provides solutions for single point measurement needs.

Single Point. Single Provider.

Every one of the 200,000+ temperature transmitters Emerson delivers each year possesses the quality and reliability that you expect from Rosemount instrumentation.

- Simplify installation with complete assemblies that are configured and calibrated to your specifications
- Maximize process efficiency with industry-leading accuracy and stability
- Optimize your limited resources with preventative maintenance diagnostics
- Simplify safety compliance with SIS certified transmitters and prior-use safety documentation

GLOBAL REACH. LOCAL SUPPORT.

Worldwide Manufacturing

With numerous Rosemount Temperature manufacturing sites located worldwide and continued expansion of our operations, Emerson is ready to respond to all your project and daily needs. Our world-class manufacturing provides:

- Globally consistent product from every factory
- A single provider for transmitters, sensors and thermowells
- Capacity to fulfill the needs of your largest projects
- Overnight deliveries for emergency needs

Local Expertise

When you need a temperature expert, Emerson is there. Our experienced Instrumentation Consultants help you find the right product for your temperature application and advise you on best installation practices to ensure you see real results. With our extensive global network of service and support personnel, we can be on site to help when and where you need us.

Transmitter Specifications

FUNCTIONAL SPECIFICATIONS

Inputs

User-selectable; sensor terminals rates to 42.4 V dc. See "Transmitter Accuracy and Ambient Temperature Effects" on page 4 for sensor options.

Output

2-wire 4–20 mA, linear with temperature or input.

Isolation

Input/Output isolation tested to 500V ac rms (707 V dc) at 50/60 Hz.

Supply Voltage DC

Standard: 12 to 35 V

Intrinsic Safety: 12 to 28 V

Minimum Voltage Across Terminals

12 V dc

Humidity Limits

0 - 95% relative humidity, non-condensing

NAMUR Recommendations

The 148 meets the following NAMUR recommendations:

- NE 21 - Electromagnetic compatibility (EMC) for Process and Laboratory Apparatus
- NE 43 - Standard of the signal level breakdown information of digital transmitters

Transient Protection

The optional rosemount 470 Transient Protector prevents damage from transients induced by lightning, welding, heavy electrical equipment, or switch gears. Refer to the 470 Product Data Sheet (document number 00813-0100-4191) for more information.

Temperature Limits

Operating Limit

- -40 to 185 °F (-40 to 85 °C)

Storage Limit

- -58 to 248 °F (-50 to 120 °C)

Turn-on Time

Performance within specifications is less than 5.0 seconds after power is applied to the transmitter, when damping value is set to zero seconds.

Update Rate

Less than 0.5 seconds

Damping

32 seconds maximum, 5 seconds default.

Recommended Minimum Measuring Span

18 °F (10 °C)

Software Detected Failure Mode

The values at which the transmitter drives its output in failure mode depends on device configuration. The device can be configured to meet NAMUR-compliant (NAMUR recommendation NE 43) operation. The values for standard and NAMUR-compliant operation are as follows:

TABLE 1. Operation Parameters

	Standard(1)	NAMUR NE43-Complaint(1)
Linear Output:	$3.9 \leq I \leq 20.5$	$3.8 \leq I \leq 20.5$
Fail High:	$21 \leq I \leq 23$ (default)	$21 \leq I \leq 23$ (default)
Fail Low:	$I \leq 3.75$	$I \leq 3.6$

(1) Measured in milliamperes

Certain hardware failures, such as microprocessor failures, will always drive the output to greater than 23 mA.

PERFORMANCE SPECIFICATIONS

EMC (ElectroMagnetic Compatibility) NAMUR NE21 Standard

The 148 meets the requirements for NAMUR NE21 Rating

Susceptibility	Parameter	Influence
ESD	• 6 kV contact discharge • 8 kV air discharge	None
Radiated	• 80 – 1000 MHz at 10 V/m AM	None
Burst	• 1 kV for I.O.	None
Surge	• 0.5 kV line–line • 1 kV line–ground (I.O. tool)	None
Conducted	• 150 kHz to 80 MHz at 10 V	None

CE Mark

The 148 meets all of the requirements listed under IEC 61326: Amendment 1, 2006.

Power Supply Effect

Less than ±0.0055 of span per volt.

Vibration Effect

The 148 is tested to the following specifications with no effect on performance:

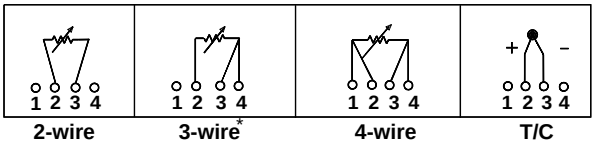
Frequency	Vibration
10 to 60 Hz	0.21 mm displacement
60 to 2000 Hz	3 g peak acceleration

Stability

For RTD and thermocouple inputs, the transmitter will have a stability of ±0.15% of reading or 0.15 °C (whichever is greater) for twelve months.

Sensor Connections

148 Sensor Connections Diagram



2-wire RTD and Ω | **3-wire* RTD and Ω** | **4-wire RTD and Ω** | **T/C**

* *Rosemount Inc. provides 4-wire sensors for all single element RTDs. You can use these RTDs in 3-wire configurations by leaving the unneeded leads disconnected and insulated with electrical tape.*

Transmitter Accuracy and Ambient Temperature Effects

NOTE
The accuracy and ambient temperature effect is the greater of the fixed and percent of span values (see example below).

TABLE 2. 148 Transmitter Input Options, Accuracy, and Ambient Temperature Effects

Sensor	Transmitter Input Ranges(1)		Accuracy		Temperature Effects per 1.0 °C (1.8 °F) Change in Ambient Temperature(2)()	
	°C	°F	Fixed	% of Span	Fixed	% of Span
2-, 3-, 4-wire RTDs						
Pt 100(3) (α = 0.00385)	–200 to 850	–328 to 1562	0.3 °C (0.54 °F)	±0.15	0.009 °C (0.016 °F)	±0.006
Pt 100(4) (α = 0.003916)	–200 to 645	–328 to 1193	0.3 °C (0.54 °F)	±0.15	0.009 °C (0.016 °F)	±0.006
Ni 120(5)	–70 to 300	–94 to 572	0.2 °C (0.36 °F)	±0.15	0.006 °C (0.011 °F)	±0.006
Cu 10(6)	–50 to 250	–58 to 482	3 °C (5.40 °F)	±0.15	0.09 °C (0.16 °F)	±0.006
Thermocouples(7)						
Type B(8) (9)	100 to 1820	212 to 3308	2.3 °C (4.05 °F)	±0.15	0.084 °C (0.150 °F)	±0.006
Type J(8)	–180 to 760	–292 to 1400	0.8 °C (1.35 °F)	±0.15	0.03 °C (0.054 °F)	±0.006
Type K(8) (10)	–180 to 1372	–292 to 2502	0.8 °C (1.35 °F)	±0.15	0.03 °C (0.054 °F)	±0.006
Type N(8)	–200 to 1300	–328 to 2372	1.2 °C (2.16 °F)	±0.15	0.03 °C (0.054 °F)	±0.006
Type R(8)	0 to 1768	32 to 3214	1.8 °C (3.24 °F)	±0.15	0.09 °C (0.16 °F)	±0.006
Type S(8)	0 to 1768	32 to 3214	1.5 °C (2.70 °F)	±0.15	0.09 °C (0.16 °F)	±0.006
2-, 3-, 4-wire Ohm Input	0 to 2000 ohms		1.1 ohm	±0.15	0.042 ohm	±0.009

(1) Input ranges are for transmitter only. Actual sensor (RTD or Thermocouple) operating ranges may be more limited. See "Sensor Specifications" on page 84 for temperature ranges.

(2) Change in ambient is with reference to the calibration temperature of the transmitter at 68 °F (20 °C) from factory.

(3) IEC 751, 1995

(4) JIS 1604, 1981

(5) Edison Curve No. 7

(6) Edison Copper Winding No. 15

(7) Total accuracy for thermocouple measurement: sum of accuracy +0.5 °C.

(8) NIST Monograph 175, IEC 584

(9) Fixed accuracy for NIST Type B is ±5.4 °F (±3.0 °C) from 212 to 572 °F (100 to 300 °C).

(10) Fixed accuracy for NIST Type K is ±1.3 °F (±0.7 °C) from -292 to -130 °F (-130 to -90 °C).

Transmitter Accuracy Example

When using a Pt 100 (a = 0.00385) sensor input with a 0 to 100 °C span, use the greater of the two calculated values. In this case the accuracy would be +/-0.3 °C.

Transmitter Temperature Effects Example

Transmitters can be installed in locations where the ambient temperature is between –40 and 85 °C (–40 and 185 °F). In order to maintain excellent accuracy performance, each transmitter is individually characterized over this ambient temperature range at the factory.

When using a Pt 100 (a = 0.00385) sensor input with a 0–100 °C span at 30 °C ambient temperature:

- Temperature Effects: 0.009 °C x (30 - 20) = 0.09 °C

Total Transmitter Error

Worst Case Transmitter Error: Accuracy + Temperature Effects = 0.3 °C + 0.09 °C = 0.39 °C

Total Probable Transmitter Error: $\sqrt{0.3^2 + 0.09^2} = 0.31°C$

Product Certifications

APPROVED MANUFACTURING LOCATIONS

Rosemount Inc. – Chanhassen, Minnesota, USA

Emerson Process Management Temperature GmbH – Karlstein, Germany

Emerson Process Management Asia Pacific – Singapore

EUROPEAN UNION DIRECTIVE INFORMATION

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount website at www.rosemount.com. A hard copy may be obtained by contacting your local sales representative.

ATEX Directive (94/9/EC)

Rosemount Inc. complies with the ATEX Directive.

Electro Magnetic Compatibility (EMC) (89/336/EEC)

All Models: EN 50081-1: 1992; EN 50082-2:1995; EN 61326-1. 2006

CE Mark

The 148 meets all requirements listed under IEC 61326:Amendment 1,2006

HAZARDOUS LOCATIONS CERTIFICATIONS(1)

North American Certifications

Factory Mutual (FM)

I5 FM Intrinsic Safety and Non-incendive
Intrinsically Safe for Class I/II/III, Division 1, Groups A, B, C, D, E, F, and G. Non-incendive Field Circuit for Class I, Division 2, Groups A, B, C, and D. Intrinsically Safe and non-incendive when installed in accordance with Rosemount drawing 00148-1055.

Temperature Codes:
T5 (T_{amb} = –50 to 75 °C)
T6 (T_{amb} = –50 to 40 °C)

TABLE 3. Entity Parameters

Loop/Power	Sensor
U_i = 30 Vdc	U_o = 45 Vdc
I_i = 130 mA	I_o = 26 mA
P_i = 1.0 W	P_o = 290 mW
C_i = 3.6 nF	C_o = 0.4 nF
L_i = 13.8 μH	L_o = 49.2 mH

E5 FM Explosion-Proof
Explosion-Proof for Class I, Division 1, Groups B, C, and D. Dust Ignition Proof for Class II/III, Division 1, Groups E, F, G when installed in accordance with Rosemount drawing 00148-1065.

Temperature Code:
T5 (T_{amb} = –40 to 85 °C)

Combination Certifications

K5 Combination of I5 and E5.

Canadian Standards Association (CSA) Approvals

I6 CSA Intrinsically Safe and Class I, Division 2
Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D when installed in accordance with Rosemount drawing 00148-1056.

Temperature Codes:
T5 (T_{amb} = –50 to 60 °C)
T6 (T_{amb} = –50 to 40 °C)

Suitable for use in Class I, Division 2, Groups A, B, C, and D.

K6 CSA Intrinsically Safe, Explosion-Proof, and Class I, Division 2.
Combination of I6 and Explosion-Proof for Class I, Division 1, Groups B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 hazardous locations, when installed in accordance with Rosemount drawing 00644-1059.

Suitable for Class I, Division 2, Groups A,B, C, and D.
Ambient Temperature Limit: –50 to 85°C

European Certifications

I1 ATEX Intrinsic Safety
Certificate Number: Baseefa080ATEX0030X
ATEX Marking: ⟨Ex⟩ II 1 G
CE 1180
EEx ia IIC

Temperature Codes:
T5 (–60 ≤ T_{amb} ≤ 80 °C)
T6 (–60 ≤ T_{amb} ≤ 60 °C)

TABLE 4. Entity Parameters

Loop/Power	Sensor
U_i = 30 Vdc	U_o = 45 Vdc
I_i = 130 mA	I_o = 26 mA
P_i = 1.0 W	P_o = 290 mW
C_i = 3.6 nF	C_i = 2.1 nF
L_i = 0	L_i = 0

Special Conditions for Safe Use (X):
The apparatus must be installed in an enclosure which affords it a degree of protection of at least IP20.
Non-metallic enclosures must have a surface resistance of less than 1 GOHM; light alloy or zirconium enclosures must be protected from impact and friction when installed.

(1) Consult factory for availability.

E1 ATEX Flame-Proof
Certificate Number: KEMA99ATEX8715
ATEX Marking: II 2 G
CE 1180
EEx d IIC
TABLE 5. Input Parameters

U_{max} = 42.4 Vdc
I_{max} = 24 mA

Temperature Codes:
T6 (–40 ≤ T_{amb} ≤ 65 °C)

N1 ATEX Type n
Certificate Number: BAS00ATEX3145
ATEX Marking: II 3
EEx nL IIC
TABLE 6. Input Parameters

U_{max} = 45 V

Temperature Codes:
T5 (–40 ≤ T_{amb} ≤ 70 °C)

NC ATEX Type n Component
Certificate Number: Baseefa08ATEX0031U
ATEX Marking: II 3G
EEx nA IIC
TABLE 7. Input Parameters

U_i = 42.4 V
C_i = 3.6nF
L_i = 0

Temperature Codes:
T5 (–60 ≤ T_{amb} ≤ 80°C)
T6 (–60 ≤ T_{amb} ≤ 60°C)

ND ATEX Dust Ignition Proof
Certificate Number: KEMA99ATEX8715
ATEX Marking: II 1 D
CE 1180
T95 C (-40 ≤ T_{amb} ≤ 85 °C)
IP66
TABLE 8. Input Parameters

U_{max} = 42.4 Vdc
I_{max} = 24 mA

Australian Certifications

Standard Australia Quality Assurance Service (SAA) Approvals

E7 SAA Explosion-Proof
Certificate Number: AUSEx3716X
Ex d IIC
Temperature Codes:
T6 (–40 ≤ T_{amb} ≤ 65 °C)

Special Conditions for Safe Use (X):

1. A thermowell must be utilized on installations incorporating a DIN style or a spring loaded sensor assembly, with all threaded connections sealed with sealing tape to maintain the IP rating of IP66/IP68 (3 meters).
2. When a gland is utilized on installation, the gland must be Standards Australia certified and must be capable of maintaining the IP rating. This also requires the use of thread sealing tape on all gland entries.

Brazilian Certifications

Centro de Pesquisas de Energia Eletrica (CEPEL) Approval

I2 CEPEL Intrinsic Safety

IECEx Certifications

I7 IECEx Intrinsic Safety (Zone 0)
Certificate Number: IECExBAS08.0011X
EEx ia nL IIC|

Temperature Codes:
T5 (-60 °C to 80°C)
T6 (-60 °C to 60°C)(

TABLE 9. Entity Parameters

Ex ia Terminals ±	Sensor
U_i = 30 Vdc	U_o = 45 Vdc
I_i = 130 mA	I_o = 26 mA
P_i = 1.0 W	P_o = 290 mW
C_i = 3.63 nF	C_i = 2.1 nF
L_i = 0 mH	L_i = 0 mH

Conditions of Certification:

1. It is a condition of safe use that the input entity parameters must be taken into account when connecting to a supply. For sensor output terminals, the sensor entity parameters shall be taken into account during installation.
2. It is a condition of safe use that the apparatus shall only be supplied from a galvanically isolated safety barrier with output current limited by a minimum 225 Ohms resistor.
3. It is a condition of safe use that the transmitter must be mounted in an enclosure that suits Group IIC application and affords a degree of protection of at least IP20 for Ex ia version, and of at least IP54 for Ex n version.
4. It is a condition of safe use that the apparatus shall be installed according to the installation drawing 00148-1057.

N7 IECEx Type n (Zone 2)
Certificate Number: IECExBAS07.0055
Ex nA NL IIC

Temperature Codes:
T5 (T_{amb} = -40 °C to 75 °C))

TABLE 10. Ex n Input Parameters

Ex n Terminals ±
U_i = 45 V

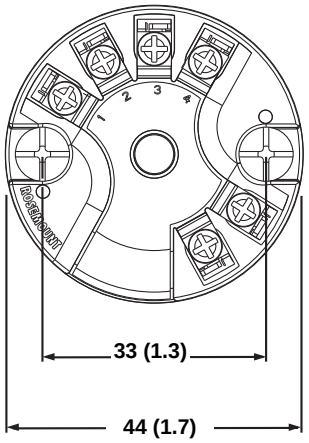
NG IECEx Type n Component
Certificate number: IECExBAS08.0012U
Ex na IIC

Temperature Codes
T5 (T_{amb} = -60 °C to 75 °C)
T6(T_{amb} = -60 °C to 60 °C)
TABLE 11. Input Parameters

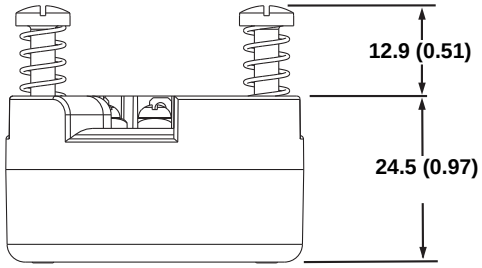
U_i = 42.4 V
C_i = 3.6nF (4–20 mA loop)
C_i = 2.1nF (Temperature Sensor Input)
L_i = 0

Dimensional Drawings

Rosemount 148 Top View



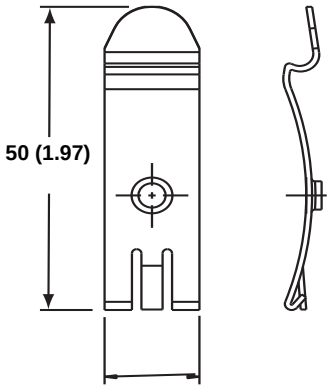
Rosemount 148 Side View



Dimensions are in millimeters (inches)

DIN Rail Mounting Kit

Dimensions



Dimensions are in millimeters (inches)

Ordering Information

TABLE 12. Rosemount 148 PC-Programmable Temperature Transmitter

Model	Product Description
148	DIN B PC Programmable Head Mount Temperature Transmitter
Code	**Mounting Style**
H	Head Mount
Code	**Output Protocol**
N	Analog Output
Code	**Product Certifications**
I1	ATEX Intrinsic Safety
E1(1)	ATEX Flameproof
N1(1)	ATEX Type n
NC	ATEX Type n Component
ND(1)	ATEX Dust Ignition Proof
I5	FM Intrinsic Safety and Class 1, Division 2
E5(1)	FM Explosion-Proof
K5(1)	FM Intrinsic Safety, Explosion-Proof, and Class 1, Division 2
I6	CSA Intrinsic Safety and Class 1, Division 2
K6(1)	CSA Intrinsic Safety, Explosion-Proof, and Class 1, Division 2
I7	IECEx Intrinsic Safety
E7(1)	SAA Flameproof
N7(1)	IECEx Type N
NG	IECEx Type n Component
NA	No approvals
Code	**Enclosure Options**
U	Universal Head (Junction Box), IP68, Aluminum
H	Universal Head (Junction Box), IP68, SST
N	No Enclosure
Code	**Cable/Conduit Entry**
1	M20 x 1.5
2	1/2-inch NPT
0	No Enclosure
Code	**Analog Output**
A1	Analog output levels compliant with NAMUR-recommendation NE 43: high alarm
CN	Analog output levels compliant with NAMUR-recommendation NE 43: low alarm
Code	**Line Voltage Filter**
F6	60 Hz line voltage filter
Code	**External Ground Option (Available w/Enclosures U, H)**
G1	External Ground Lug Assembly
Code	**Cover Chain Option (Available w/Enclosures U, H)**
G3	Cover Chain
Code	**Conduit Entry**
G2	Cable Gland–Explosion Proof–7.5 mm - 11.9 mm
G4	Cable Gland–Explosion Proof, Thin Wire - 3.0 mm - 8.0 mm
Code	**Interlinkbt Connector**
GE	Eurofast Interlinkbt Connector
GM	Minifast Interlinkbt Connector

TABLE 12. Rosemount 148 PC-Programmable Temperature Transmitter

Model	Product Description
Code	**External Label**
EL	External Label for ATEX Intrinsic Safety
Code	**Assemble-to Options**
XA	Sensor Specified Separately and Assembled to Transmitter
Typical Model Number: 148 H N I5 U1 A1 XA	

(1) Approval Codes E1, N1, N7, ND, E5, K5, K6, and E7 require an enclosure

Rosemount 148 PC Programmer

The Rosemount 148 PC Programmer is a portable, self-contained communication link between your PC and the 148 transmitter for use in non-hazardous environments. The 148 PC Programmer contains the following items:

- PC Programmer Unit
- Programming Software (CD-ROM)
- 9V Battery
- Transmitter Connectors

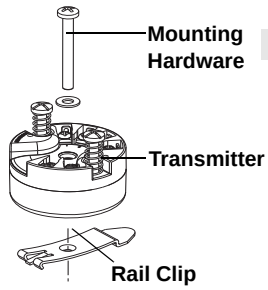
Rosemount 148 PC Programmer Software

The software makes the following parameters available:

- Process Variable
- Sensor Type
- Number of Wires
- Engineering Units
- Transmitter Tag Information)
- Damping
- Alarming Parameters

To order the 148 PC Programmer, use Part Number 00148-1601-0001.

TABLE 13. Rosemount 148 Transmitter Accessories



External Ground Screw Assembly Kit	00644-4431-0001
Kit, Hardware for Mounting a 148 to a DIN Rail (see left picture-top hat rail, symmetric)	00248-1601-0001
Snap Rings Kit (used for assembly to DIN Plate Style sensor)	00644-4432-0001

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