

# Rosemount 1154 Series H Alphaline® Nuclear Pressure Transmitter

## INDUSTRY LEADING PERFORMANCE

- Qualified per IEEE Std. 323-1974 and IEEE Std. 344-1975
- $1.1 \times 10^8$  rads TID gamma radiation
- 8.5 g's ZPA seismic
- 420 °F (215.6 °C) steam temperature
- 0.25% accuracy



CE

## Product Discontinued

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# Rosemount 1154 Series H

## Results Driven by Proven Measurement

### INTRODUCTION

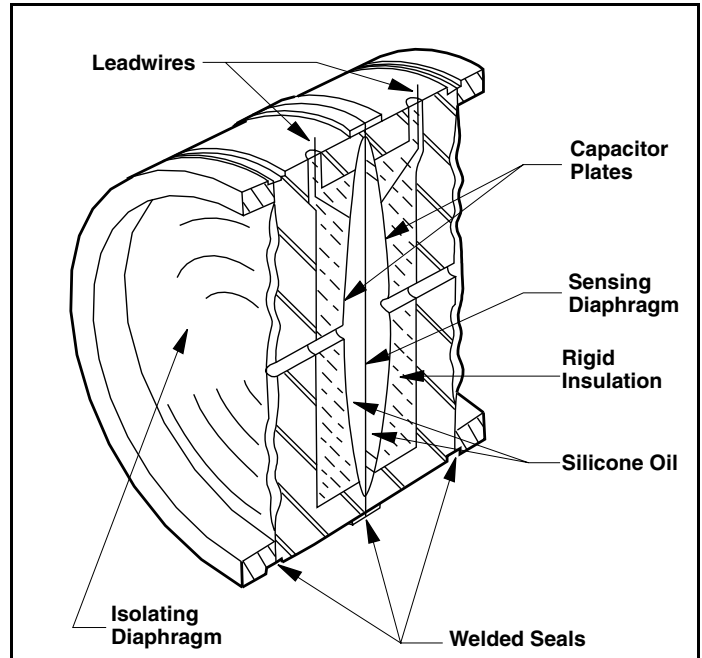
Rosemount 1154 Series H Alphaline<sup>®</sup> Pressure Transmitters are designed for precision pressure measurements in nuclear applications requiring reliable performance and safety over a specified qualified life. These transmitters have been qualified to IEEE Std. 323-1974 and IEEE Std. 344-1975 at radiation levels of 110 megarads TID gamma radiation, seismic levels of 8.5 g's, and for steam-pressure performance. Stringent quality control during the manufacturing process includes traceability of pressure retaining parts, special nuclear cleaning, and hydrostatic testing.

### TRANSMITTER DESCRIPTION

Rosemount 1154 Series H transmitters are uniquely built for Class 1E nuclear service while retaining the working concept and design parameters of the Rosemount 1151 transmitters that have set industry standards for reliable service. Transmitters are available in sealed reference (S), differential (D), and high-line differential (H) configurations, with a variety of pressure range choices.

Direct electronic sensing with the completely sealed  $\delta$ -Cell<sup>™</sup> capacitance sensing element eliminates mechanical force transfer and problems associated with shock and vibration. Installation and commissioning are simplified by the compact design and 2-wire system compatibility. Wiring terminals and electronics are in separate compartments, so the electronics remain sealed during installation.

FIGURE 1. The  $\delta$ -Cell Sensor.



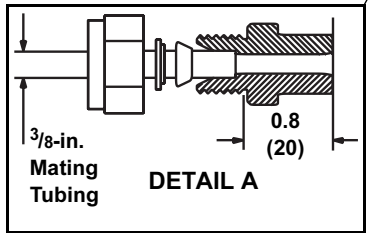
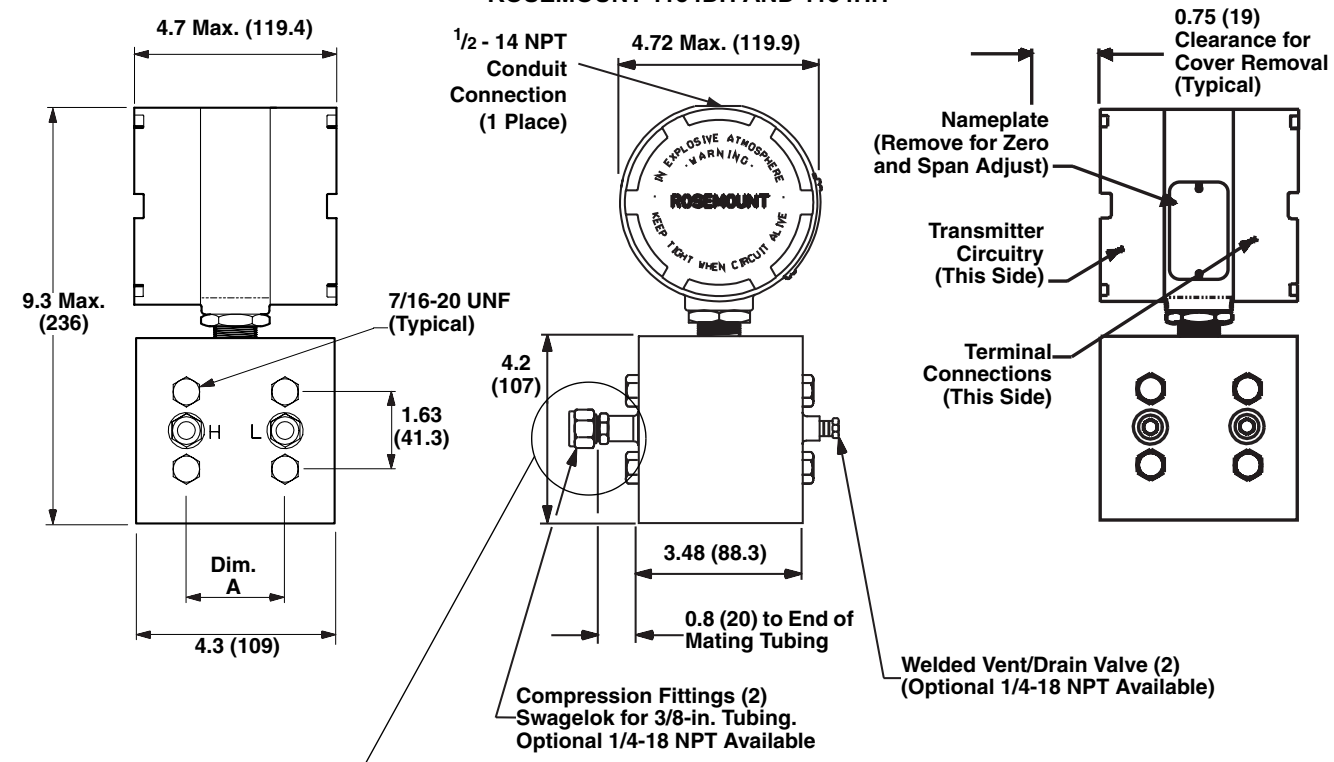
### OPERATION

The completely sealed  $\delta$ -Cell capacitance sensing element is the key to the unequalled performance and reliability of the Rosemount 1154 Series H transmitters. Its simple design concept is recognized as a landmark in transmitter engineering. As shown in Figure 1, process pressure is transmitted through an isolating diaphragm and silicone oil fill fluid to a sensing diaphragm in the center of the  $\delta$ -Cell. A reference pressure is transmitted in like manner to the other side of the sensing diaphragm. Displacement of the sensing diaphragm, a maximum motion of 0.004 inches (0.1 mm), is proportional to the pressure differential across it.

The position of the sensing diaphragm is detected by capacitor plates on both sides. Differential capacitance between the sensing diaphragm and the capacitor plates is converted electronically to a 2-wire, 4-20 mA dc signal.

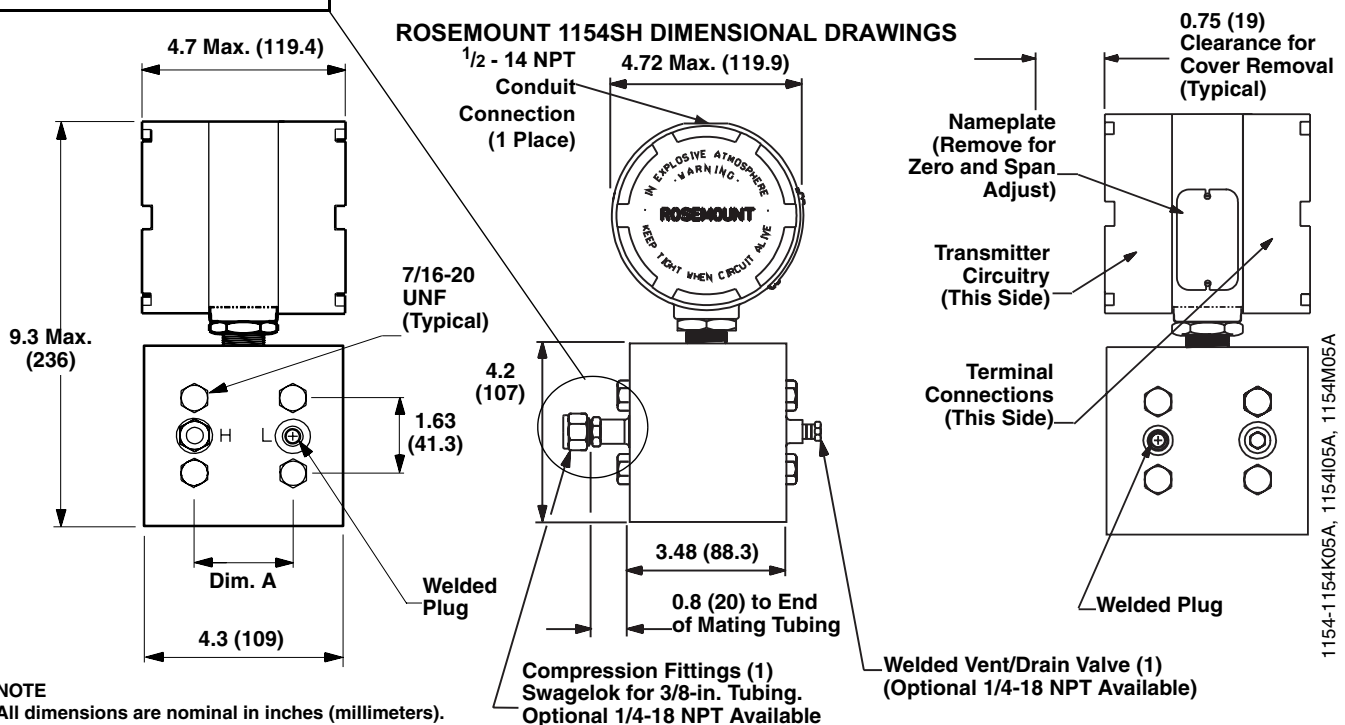
**DIMENSIONAL DRAWINGS**

**ROSEMOUNT 1154DH AND 1154HH**



Pressure Range Code	Dimension A
4, 5	2.13 (54)
6, 7	2.19 (55.6)
8	2.25 (57.2)
9	2.28 (57.9)

**ROSEMOUNT 1154SH DIMENSIONAL DRAWINGS**



**NOTE**  
 All dimensions are nominal in inches (millimeters).

1154-1154H05A, 1154105A, 1154J05A

1154-1154K05A, 1154105A, 1154M05A

# Rosemount 1154 Series H

## SPECIFICATIONS

### Nuclear Specifications

Qualified per IEEE Std. 323-1974 and 344-1975 as stated in Rosemount Report D8700096.

### Radiation

Accuracy within  $\pm(0.25\%$  of upper range limit +  $0.75\%$  of span) during first 30 minutes;  $\pm(0.5\%$  of upper range limit +  $1.0\%$  of span) thereafter up to 55 megarads total integrated dosage (TID);  $\pm(0.75\%$  of upper range limit +  $1.0\%$  of span) after 110 megarads TID gamma radiation exposure.

### Seismic

Accuracy within  $\pm 0.5\%$  of upper range limit during and after a disturbance defined by a required response spectrum with a horizontal ZPA of 8.5 g's, and a vertical ZPA of 5.2 g's.

### Steam Pressure/Temperature

Accuracy within  $\pm(1.0\%$  of upper range limit +  $1.0\%$  of span) for range codes 4-8;  $\pm(2.0\%$  of upper range limit +  $0.5\%$  of span) for range code 9 during and after sequential exposure to steam at the following temperatures and pressures, concurrent with chemical spray for the first 24 hours.

- 420 °F (215.6 °C), 85 psig for 3 minutes
- 350 °F (176.6 °C), 85 psig for 7 minutes
- 320 °F (160 °C), 75 psig for 8 hours
- 265 °F (129.4 °C), 24 psig for 56 hours

### Chemical Spray

Chemical spray composition is 0.28 molar boric acid, 0.064 sodium thiosulfate, and sodium hydroxide to make an initial pH of 11.0 and a subsequent pH ranging from 8.5 to 11.0. Chemical spray is sprayed at a rate of 0.25 gal/min/ft<sup>2</sup>.

### Post DBE Operation

Accuracy at reference conditions shall be within  $\pm 2.5\%$  of upper range limit for one year following DBE.

### Quality Assurance Program

In accordance with NQA-1, 10CFR50 Appendix B, and ISO 9001:2000.

### Nuclear Cleaning

To 1 ppm maximum chloride content.

### Hydrostatic Testing

To 150% of maximum working pressure or 2,000 psi (13.8 MPa), whichever is greater.

### Traceability

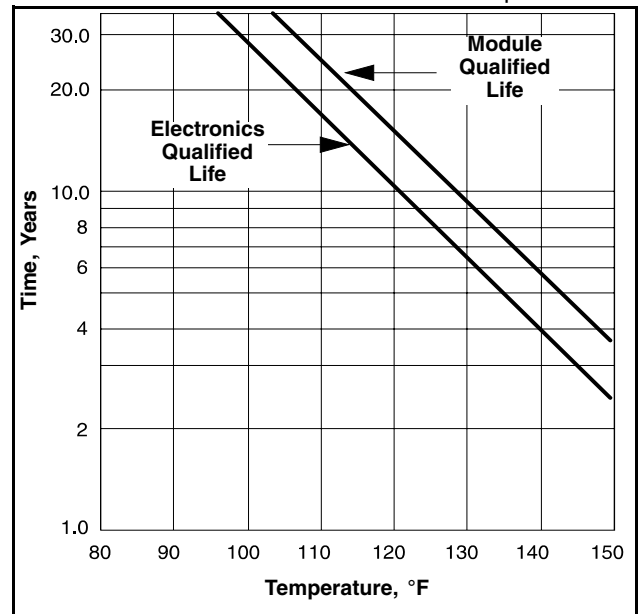
In accordance with NQA-1 and 10CFR50, Appendix B; chemical and physical material certification of pressure retaining parts.

### Qualified Life

Dependent on continuous ambient temperature at the installation site, illustrated in Figure 2.

Replacement of amplifier and calibration circuit boards at the end of their qualified life permits extension of the transmitter's qualified life to the module's qualified life. See Rosemount Report D8700096.

FIGURE 2. Qualified Life vs. Ambient Temperature



## Performance Specifications

(Based on Zero-based ranges under reference Conditions)

### Accuracy

±0.25% of calibrated span. Includes combined effects of linearity, hysteresis and repeatability.

### Deadband

None.

### Drift

±0.2% of upper range limit for thirty months.

### Temperature Effect

#### Ranges 4-8:

±(0.15% upper range limit + 0.35% span) per 50 °F (27.8 °C) ambient temperature change between 40 °F (4.4 °C) and 130 °F (54.4 °C).

#### Range 9:

±(0.25% of upper range limit + 0.5% span) per 50 °F (27.8 °C) ambient temperature change between 40 °F (4.4 °C) and 130 °F (54.4 °C).

#### All Ranges:

±(0.75% of upper range limit + 0.5% span) per 100 °F (55.6 °C) ambient temperature change between 40 °F (4.4 °C) and 200 °F (93.3 °C).

### Overpressure Effect

#### Rosemount 1154DH

Maximum zero shift after 2,000 psi (13.8 MPa) overpressure:

Range Code	Overpressure Effect
4	±0.25% of upper range limit
5	±1.0% of upper range limit
6-7	±3.0% of upper range limit
8	±6.0% of upper range limit

#### Rosemount 1154HH

Maximum zero shift after 3,000 psi (20.68 MPa) overpressure:

Range Code	Overpressure Effect
4	±1.0% of upper range limit
5	±2.0% of upper range limit
6-7	±5.0% of upper range limit

#### Rosemount 1154SH

Maximum zero shift after 4,500 psi (31.0 MPa) overpressure:

Range Code	Overpressure Effect
9	±0.5% of upper range limit

### Static Pressure Zero Effect

#### Rosemount 1154DH

Per 1,000 psi (6.89 MPa)

Range Code	Static Pressure Zero Effect
4-5	±0.2% of upper range limit
6-8	±0.5% of upper range limit

#### Rosemount 1154HH

Per 1,000 psi (6.89 MPa)

Range Code	Static Pressure Zero Effect
4-7	±0.66% of upper range limit

### Static Pressure Span Effect

Effect is systematic and can be calibrated out for a particular pressure before installation. Correction uncertainty: ±0.5% of input reading/1,000 psi (6.89 MPa).

### Power Supply Effect

Less than 0.005% of output span/volt.

### Load Effect

No load effect other than the change in voltage supplied to the transmitter.

### Mounting Position Effect

No span effect. Zero shift of up to 1.5 inH<sub>2</sub>O (372 Pa), which can be calibrated out.

### Response Time

Fixed time constant (63%) at 100 °F (37.8 °C) as follows:

Range 4: 0.5 seconds or less.

All other ranges: 0.2 seconds or less.

Adjustable damping option available through special N-Option.

## Functional Specifications

### Service

Liquid, gas, or vapor.

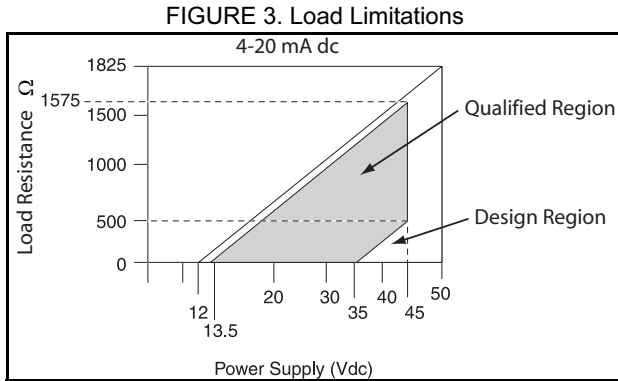
### Output

4-20 mA dc.

# Rosemount 1154 Series H

## Power Supply

Design limits as shown in Figure 3. See Rosemount Report D8700096 for additional detail.



## Span and Zero

Continuously adjustable externally.

## Zero Elevation and Suppression

Maximum zero elevation: 600% of calibrated span  
Maximum zero suppression: 500% of calibrated span  
Zero elevation and suppression must be such that neither the calibrated span nor the upper or lower range value exceeds 100% of the upper range limit.

## Temperature Limits

Normal operating design limits:  
40 to 200 °F (4.4 to 93.3 °C)

Qualified storage limits:  
-40 to 120 °F (-40.0 to 48.9 °C)

## Humidity Limits

0 to 100% relative humidity (NEMA 4X)

## Volumetric Displacement

Less than 0.01 in<sup>3</sup> (0.16 cm<sup>3</sup>)

## Turn-on Time

Two seconds maximum. No warm-up required.

## Pressure Ranges

### Rosemount 1154DH and 1154HH:

Range Code	Pressure Range
4	0-25 to 0-150 inH <sub>2</sub> O (0-6.22 to 0-37.3 kPa)
5	0-125 to 0-750 inH <sub>2</sub> O (0-31.08 to 0-186.4 kPa)
6	0-17 to 0-100 psi (0-0.12 to 0-0.69 MPa)
7	0-50 to 0-300 psi (0-0.34 to 0-2.07 MPa)
8	0-170 to 0-1,000 psi (Rosemount 1154 D only) (0-1.17 to 0-6.89 MPa)

### Rosemount 1154SH:

Range Code	Pressure Range
9	0-500 to 0-3,000 psi (0-3.45 to 0-20.68 MPa)

## Maximum Working Pressure

### Rosemount 1154DH and 1154HH:

Static Pressure Limit

### Rosemount 1154SH:

Upper range limit

## Static Pressure and Overpressure Limits

### Rosemount 1154DH:

0.5 psia to 2,000 psig (3.4 kPa abs to 13.8 MPa)  
maximum rated static pressure for operation within specifications; overpressure limit is 2,000 psig (13.8 MPa) on either side without damage to the transmitter

### Rosemount 1154HH:

0.5 psia to 3,000 psig (3.4 kPa abs to 20.7 MPa)  
maximum rated static pressure for operation within specifications; overpressure limit is 3,000 psig (20.7 MPa) on either side without damage to the transmitter

## Overpressure Limits

### Rosemount 1154SH:

Operates within specification from 0.5 psia (3.4 kPa abs) to upper range limit; overpressure limit is 4,500 psig (31.0 MPa) for Range Code 9, without damage to the transmitter

## Product Data Sheet

00813-0100-4631, Rev BA  
April 2007

# Rosemount 1154 Series H

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## Physical Specifications

### Materials of Construction

#### Isolating Diaphragms

316L SST.

#### Drain/Vent Valves

316 SST.

#### Process Flanges

CF-8M (cast version of 316 SST)

#### Process O-rings

316L SST.

#### Electronics Housing O-rings

Ethylene Propylene.

#### Fill Fluid

Silicone Oil.

#### Flange Bolts

Plated Alloy Steel, per ASTM A-540.

#### Electronics Housing

316 SST.

#### Module Shroud

304L SST.

#### Module Shroud Potting

Silicone RTV.

#### Mounting Bracket

316L SST

#### Mounting Bolts

Carbon Steel, SAE J429 Grade 2 or Grade 5.

### Weight

26.6 lb (12.1 kg) including mounting bracket.

### Electrical Connections

1/2-14 NPT conduit with screw terminals.

### Process Connections

3/8-inch Swagelok® compression fitting, 316 SST,  
(1/4-18 NPT optional).

# Rosemount 1154 Series H

FIGURE 4. Electrical Block Diagram

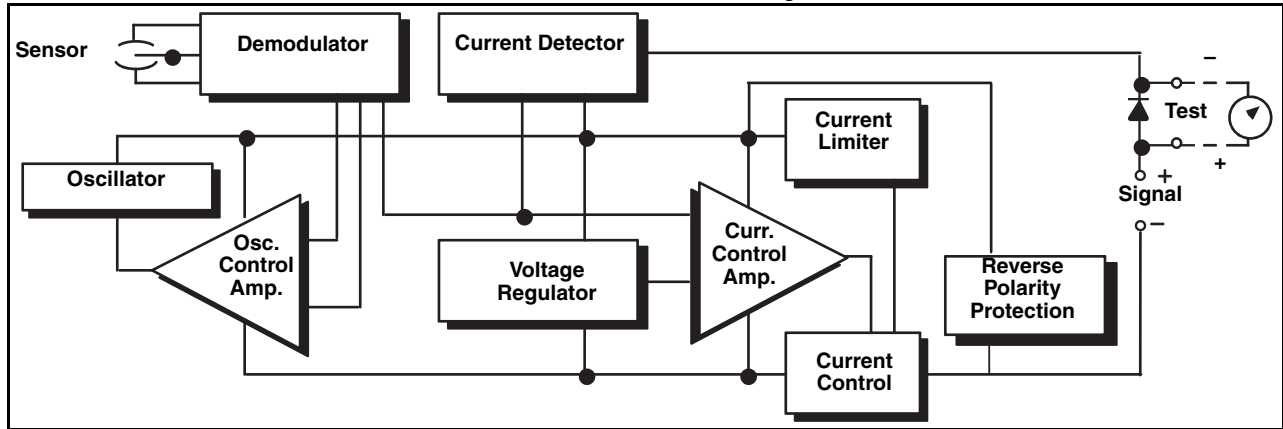


FIGURE 5. Typical Mounting Configuration

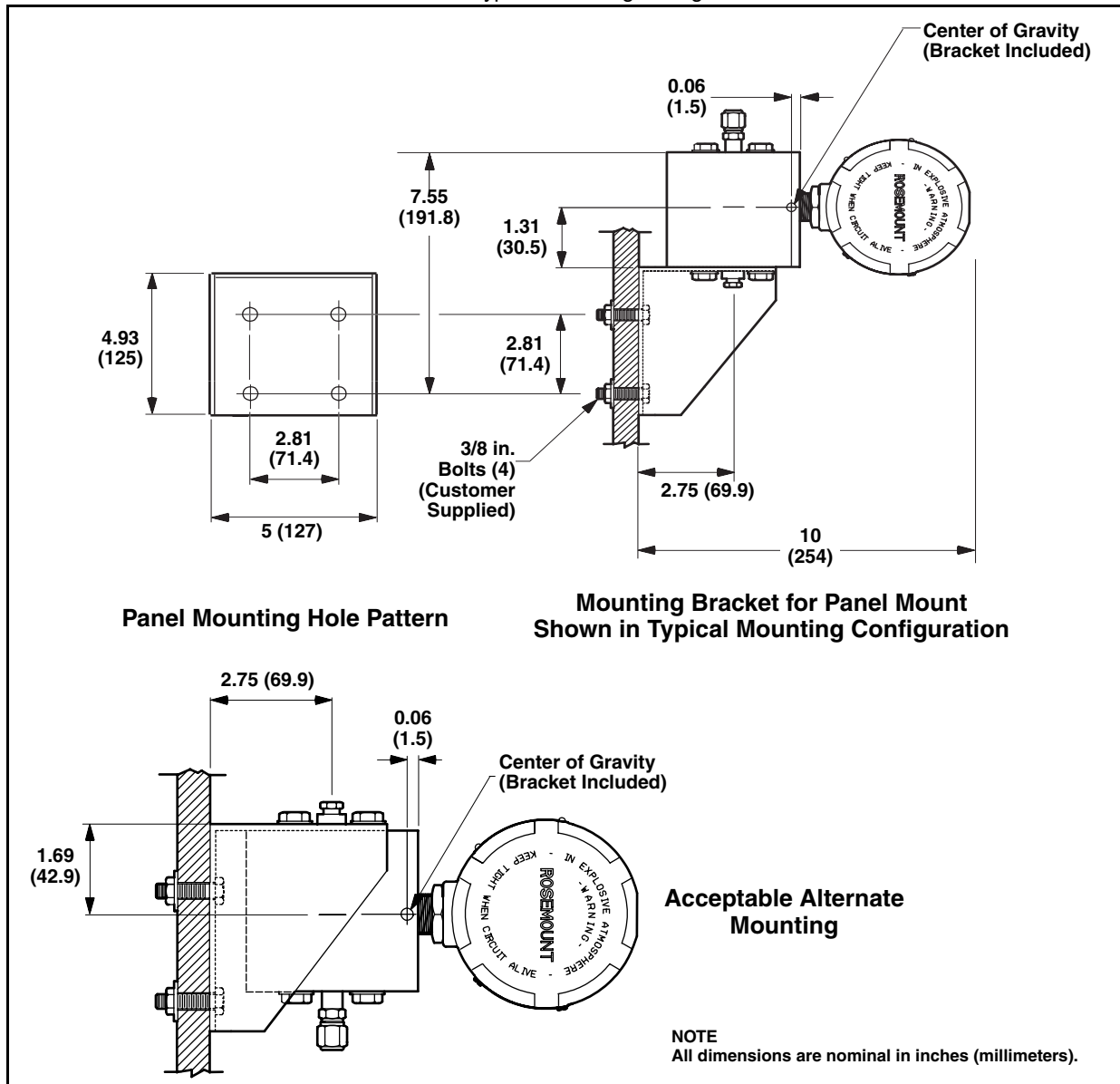




FIGURE 6. Wiring Connections

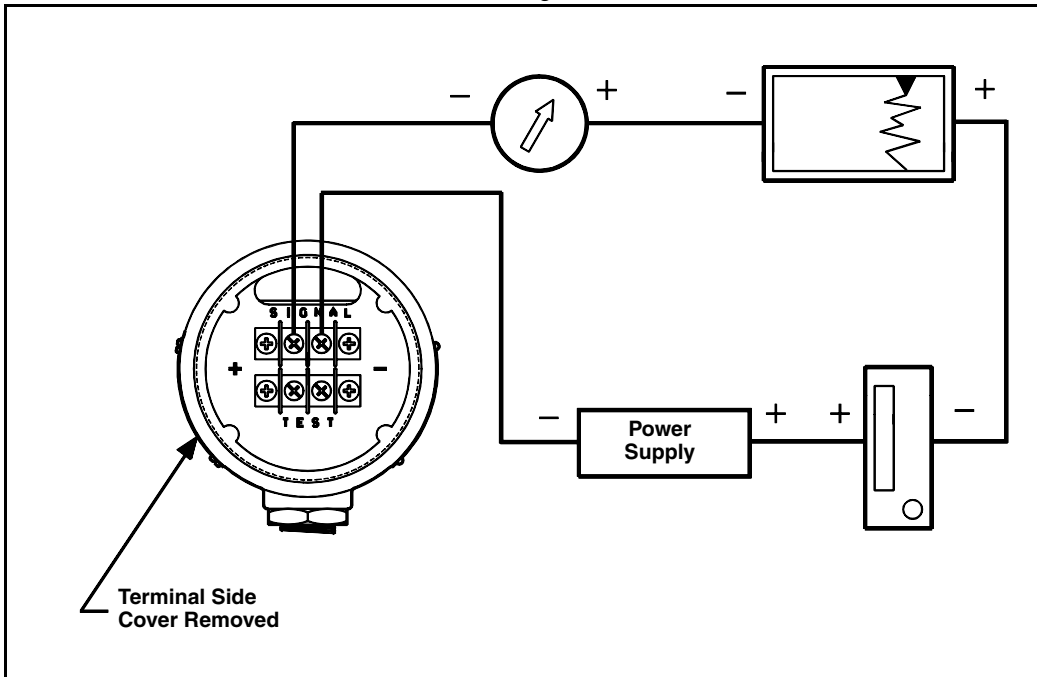
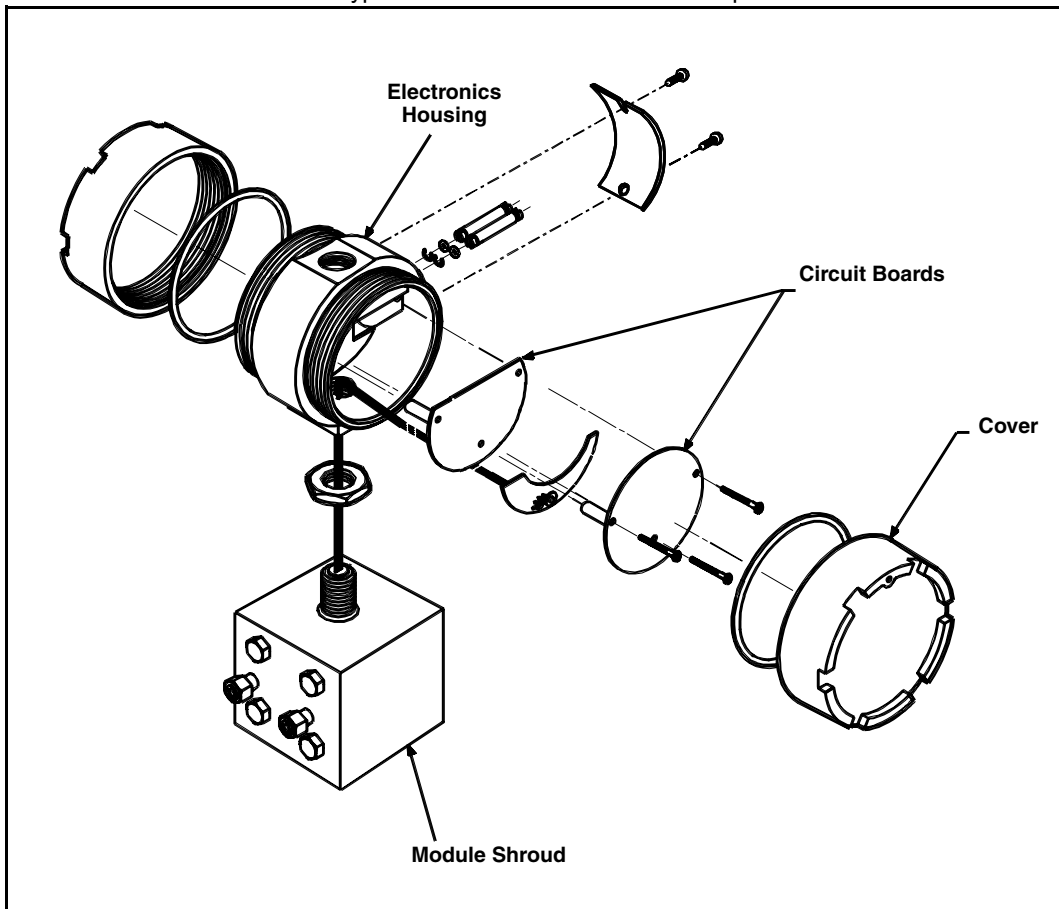


FIGURE 7. Typical Rosemount 1154 Series H Exploded View



# Rosemount 1154 Series H

## ORDERING INFORMATION

<b>Model</b>	<b>Product Description</b>		
1154	Alphaline Pressure Transmitters for Nuclear Applications (qualified per IEEE Std 323-1974 and IEEE Std 344-1975)		
<b>Code</b>	<b>Pressure Measurement</b>		
D	Differential Pressure, 2,000 psig (13.8 MPa) Static Pressure Rating		
H	Differential Pressure, 3,000 psig (20.68 MPa) Static Pressure Rating		
S	Sealed Reference Pressure		
<b>Code</b>	<b>Series</b>		
H	Transmitter Enclosed in a Stainless Steel Module Shroud		
<b>Pressure Ranges at 68 °F</b>			
<b>Code</b>	<b>Rosemount 1154DH (Differential)</b>	<b>Rosemount 1154HH (Differential)</b>	<b>Rosemount 1154SH (Sealed Ref.)</b>
4	0–25 to 0–150 inH <sub>2</sub> O (0–6.22 to 0–37.3 kPa)	0–25 to 0–150 inH <sub>2</sub> O (0–6.22 to 0–37.3 kPa)	N/A
5	0–125 to 0–750 inH <sub>2</sub> O (0–31.08 to 0–186.4 kPa)	0–125 to 0–750 inH <sub>2</sub> O N/A (0–31.08 to 0–186.4 kPa)	N/A
6	0–17 to 0–100 psi (0–0.12 to 0–0.69 MPa)	0–17 to 0–100 psi N/A (0–0.12 to 0–0.69 MPa)	N/A
7	0–50 to 0–300 psi (0–0.34 to 0–2.07 MPa)	0–50 to 0–300 psi N/A (0–0.34 to 0–2.07 MPa)	N/A
8	0–170 to 0–1,000 psi (0–1.17 to 0–6.89 MPa)	N/A	N/A
9	N/A	N/A	0–500 to 3,000 psi (0–3.45 to 0–20.68 MPa)
<b>Code</b>	<b>Output</b>		
R <sup>(1)</sup>	Standard 4–20 mA		
<b>Code</b>	<b>Flange Option</b>		
A	Welded <sup>3</sup> / <sub>8</sub> in. Swagelok compression fitting process connection and welded drain/vent valve		
B <sup>(2)</sup>	<sup>1</sup> / <sub>4</sub> –18 NPT process connection and welded drain/vent valve		
C <sup>(2)</sup>	<sup>1</sup> / <sub>4</sub> –18 NPT process connection and drain hole (drain/vent valve not supplied)		
H	Welded <sup>3</sup> / <sub>8</sub> in. Swagelok compression fittings on both process connection and drain/vent connection		
<b>Typical Model Number: 1154DH 4 R A</b>			

(1) The Rosemount 1154 Series H with the R Output Code Electronics is also available with adjustable damping. Specify adjustable damping by adding "N0037" to the end of the complete model number, for example: 1154DH4RAN0037.

(2) Customer assumes responsibility for qualifying connection interfaces on these options. Contact Rosemount Nuclear Instruments, Inc. for details.

## Product Data Sheet

00813-0100-4631, Rev BA

April 2007

# Rosemount 1154 Series H

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### Standard Accessories

All Models are shipped with a mounting bracket. One instruction manual is included per shipment.

### Calibration

Transmitters are factory calibrated to customer's specified range. If calibration is not specified, transmitters are calibrated at maximum range. Calibration is at reference conditions (ambient temperature and pressure).

### Options

Consult N-Option Product Data Sheet, publication number 00813-0100-2655, or call Rosemount Nuclear Instruments, Inc. for special transmitter needs.

### Tagging

The transmitter will be tagged, at no charge, in accordance with customer requirements (96 characters maximum). All tags are SST. The standard tag is permanently attached to the transmitter. Standard tag character height is 0.125 in. (3.18 mm). A wire-on tag is available on request.

### Documentation

Certification is provided for each Rosemount 1154 Series H transmitter for accuracy, special cleaning, hydrostatic testing, and traceability. Chemical and physical reports and identification of pressure retaining parts will be on file at Rosemount Nuclear Instruments, Inc.

# Rosemount 1154 Series H

## IMPORTANT NOTICE -- ERRATA

Model 1154 Series H Product Data Sheet 00813-0100-4631 Rev BA (April 2007)

No.	Affected Pages	Description of Change	Effect. Date
1	7	Process Flange – <i>CF3M</i> (Cast version of 316L SST) Drain/Vent Valves –316L SST Process Connections – 3/8-inch Swagelok compression fitting, 316L SST (1/4-18 NPT optional)	10/21/09
2	4	Steam Pressure/Temperature specification is updated as follows: Steam Pressure/Temperature Accuracy as specified below, during and after sequential exposure to steam at the following temperatures and pressures, concurrent with chemical spray for the first 24 hours. 420 °F (215.6 °C), 85 psig for 3 minutes 350 °F (176.6 °C), 85 psig for 7 minutes 320 °F (160 °C), 75 psig for 8 hours 265 °F (129.4 °C), 24 psig for 56 hours Range codes 4-8: Accuracy within $\pm$ (1.0% of upper range limit + 1.0% of span) <sup>(1)</sup> Range code 9: Accuracy within $\pm$ (2.0% of upper range limit +0.5% span) Note (1) For Range codes 4-8, if pressure applied at the 4mA point is greater than 50% of the upper range limit, the specification is $\pm$ 2% of upper range limit.	4/13/12

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