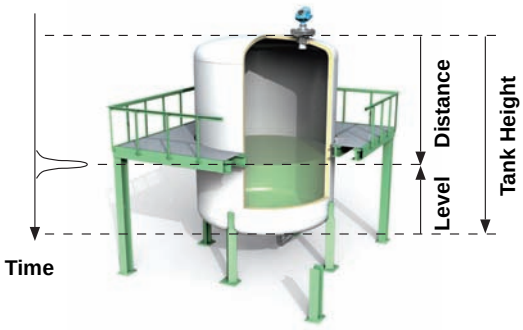
Product Data Sheet
00813-0100-4026, Rev IA
March 2012

Superior Performance Two-Wire Non-Contacting Radar Level Transmitter

- *Accurate and reliable, direct level measurement, virtually unaffected by process conditions*
- *Best performance and uptime provided by dual port technology, advanced surface tracking capability, and condensation- and dirt-resistant antennas*
- *Easy installation and commissioning through circular polarization and powerful, easy-to-use configuration tools*
- *High application flexibility with a wide range of process connections, materials, antennas, and low and high frequency models*
- *Minimized maintenance with no contact and no moving parts; no re-calibration required*
- *Increased safety. Third party approved for overfill protection and safety integrated system suitability*

Contents

Innovation that Delivers Clear Business Results

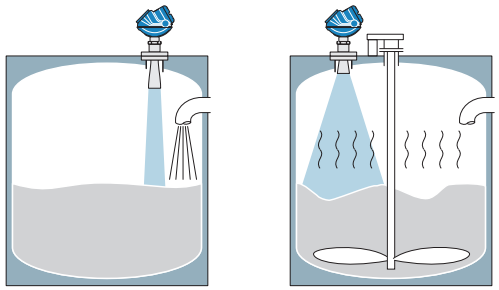


Storage and buffer tanks

Reactor and mixing tanks

Pipes, stilling wells, and underground tanks

5402 (26 GHz) **5401 (6 GHz)**



Low frequency is preferred when measuring in vapor and foam. High frequency is preferred in most other applications due to greater mounting flexibility.

Cone **Extended Cone** **Process Seal** **Rod Antenna** **Bracket mount**

High application flexibility

MEASUREMENT PRINCIPLE

The distance to the surface is measured by short radar pulses, which are transmitted from the antenna at the tank top. When a radar pulse reaches a media with a different dielectric constant, part of the energy is reflected back to the transmitter. The time difference between the transmitted and the reflected pulse is proportional to the distance to the product surface, from which the level, volume, and level rate are calculated.

Applications with, for example, turbulence, foam, long measuring ranges, disturbing objects, and low dielectric constants can reduce the energy reflecting back, and in worst case eliminate it completely with the result that no surface can be detected. The reflection intensity can however be improved by using a high performance radar with dual port technology, and thereby detect the surface in challenging applications.

RADAR TECHNOLOGY BENEFITS

- Highly accurate and reliable direct level measurement with no compensation needed for changing process conditions (such as density, conductivity, viscosity, pH, dielectric, temperature, and pressure)
- Top down installation minimizes risk for leakages and allows for installation with liquid in the tank
- No moving parts and no re-calibration needed result in minimized maintenance
- Non-contacting technology is ideal for dirty, coating, and corrosive applications

SPECIAL 5400 FEATURES

High Application Flexibility

- Suitable for most liquid and slurry level applications and process conditions from challenging reactor tanks to storage and buffer tanks
- Low and high frequency models
- A wide selection of materials, process connections, antenna styles, and accessories
- Dual port technology to increase the signal strength and provide measurement in challenging applications
- Can be isolated by valves

Best Performance and Uptime

- Dual port technology ensures reliability, even with disturbing factors, longer measuring ranges, and lower dielectrics
- Advanced surface tracking provides the ability to handle weak echoes reliably by identifying the true echo and registering false echoes
- Condensation- and dirt- resistant antennas maximize uptime
- Uninterrupted process monitoring reduces downtime

Robust Design Reduces Costs and Increases Safety

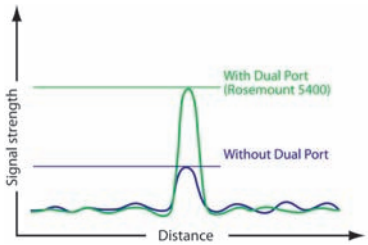
- Robust, shock-resistant, and vibration-proof design
- Detachable transmitter head allows the tank to remain sealed
- Dual Compartment housing separates cable connections and electronics for safer handling and improved moisture protection

Easy Installation and Plant Integration

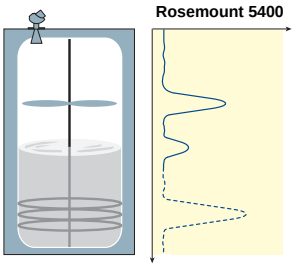
- Circular polarization minimizes installation constraints
- MultiVariable™ device reduces the number of process penetrations
- Seamless system integration with HART®, FOUNDATION™ fieldbus, Modbus®, or IEC 62591 (*Wireless*HART®) with the Smart Wireless THUM™ adapter
- MultiVariable™ output includes the choice of level, distance, volume, and signal strength
- Pre-configured or easy configuration in Rosemount Radar Master with a five-step wizard, auto connect, and online help
- Supports DD compatible configuration tools such as AMS Device Manager, and Field Communicator
- Enhanced DD with step-by-step configuration and echo curve capability (HART)
- DTM with echo curve capability for use in FDT/DTM compatible configuration tools such as PACTWare™, Yokogawa® FieldMate/PRM

Minimized Maintenance Reduces Cost

- No contact with media and no mechanical moving parts
- No re-calibration or compensation needed
- Easy online troubleshooting with user friendly software, utilizing powerful echo curve and logging tools
- Predictive maintenance with advanced diagnostics and PlantWeb® alerts

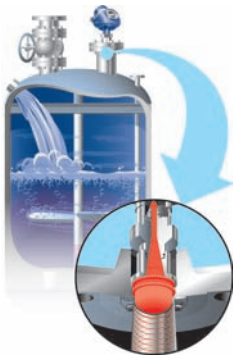


The unique dual microwave ports for sending and receiving radar signals yield a 75 % stronger signal than single port transmitters.

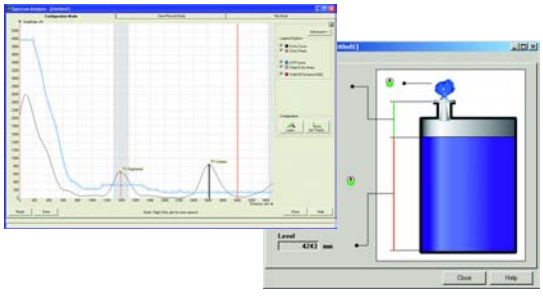


Smart surface tracking utilizes advanced mathematical algorithms and EchoLogics to correctly identify the surface.

Robust Modular Design



Larger sealing surface towards the process connection, making the transmitter less sensitive to condensation and dirt. Circular polarization will automatically reduce the disturbance effect close to tank walls and obstacles.



Rosemount Radar Master enables easy configuration and service with a wizard, an echo curve tool with the "Measure and Learn" function, offline/online configuration, an extensive online help, logging capabilities, and more.

Rosemount 5402 High Frequency Radar Level Transmitter

5402 Radar Level Transmitter

Rosemount 5402 High Frequency Radar Level Transmitter is a reliable 2-wire radar level transmitter designed for outstanding performance in a wide range of applications and process conditions. Characteristics include:

- The preferred choice for most applications especially where the nozzle size is 4 in. or less
- High frequency (26 GHz) meaning a concentrated radar beam resulting in smaller antenna diameters
- The narrow beam means suitable for mounting on valves, taller nozzles, smaller openings, and that it is easier to avoid unwanted reflections from mechanical obstacles such as agitators and heating coils
- Build-up resistant cone antenna
- Condensation resistant process seal antenna

Additional Information

Specifications: page 12
Certifications: page 28
Dimensional Drawings: page 31

TABLE 1. 5402 High Frequency Radar Level Transmitter Ordering Information

★The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Model	Product Description	
5402	High frequency version (~26 GHz)	
Housing Material		
Standard		**Standard**
A	Polyurethane-covered Aluminum	★
Expanded		
S	Stainless Steel, Grade CF8M (ASTM A743)	
Signal Output		
Standard		**Standard**
H	4-20 mA with HART® communication	★
F	FOUNDATION™ fieldbus	★
M	RS-485 with Modbus communication	★
Conduit / Cable Threads		
Standard		**Standard**
1	½ in. - 14 NPT	★
2	M20 x 1.5 adapter	★
E	M12, 4-pin, Male Connector (eurofast®)(1)	★
M	A size Mini, 4-pin, Male Connector (minifast®)(1)	★
Product Certifications		
Standard		**Standard**
NA	No Product Certificates	★
E1	ATEX Flameproof(1)	★
I1	ATEX Intrinsic Safety	★
IA	ATEX FISCO Intrinsic Safety(2)	★
E5	FM Explosion-proof(1)	★
I5	FM Intrinsic Safety and Non-incendive	★
IE	FM FISCO Intrinsic Safety(2)	★

TABLE 1. 5402 High Frequency Radar Level Transmitter Ordering Information

★The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

E6	CSA Explosion-proof[1]	★
I6	CSA Intrinsic Safety	★
IF	CSA FISCO Intrinsic Safety[2]	★
E7	IECEx Flameproof[1]	★
I7	IECEx Intrinsic Safety	★
IG	IECEx FISCO Intrinsic Safety[2]	★
Expanded		
E2	INMETRO Flameproof	
I2	INMETRO Intrinsic Safety	
IB	INMETRO FISCO Intrinsic Safety	
E3	NEPSI Flameproof[1]	
I3	NEPSI Intrinsic Safety	
IC	NEPSI FISCO Intrinsic Safety	
E4	TIIS Flameproof[3]	
Antenna - Size and Material (for process connection availability, refer to "Dimensional Drawings and Mechanical Properties" on page 31)		
Cone Antennas		
Standard		**Standard**
2S	2 in. DN 50, 316L SST (EN 1.4404)	★
3S	3 in. DN 80, 316L SST (EN 1.4404)	★
4S	4 in. DN 100, 316L SST (EN 1.4404)	★
Expanded		
2H	2 in. DN 50, Alloy C-276 (UNS N10276) with protective plate	
3H	3 in. DN 80, Alloy C-276 (UNS N10276) with protective plate	
4H	4 in. DN 100, Alloy C-276 (UNS N10276) with protective plate	
2M	2 in. DN 50, Alloy 400 (UNS N04400) with protective plate	
3M	3 in. DN 80, Alloy 400 (UNS N04400) with protective plate	
4M	4 in. DN 100, Alloy 400 (UNS N04400) with protective plate	
2N	2 in. DN 50, 316L SST (EN 1.4404), with protective plate. Complies with guidelines in NACE® MR0175/ISO 15156 and NACE® MR0103.	
3N	3 in. DN 80, 316L SST (EN 1.4404), with protective plate. Complies with guidelines in NACE® MR0175/ISO 15156 and NACE® MR0103.	
4N	4 in. DN 100, 316L SST (EN 1.4404), with protective plate. Complies with guidelines in NACE® MR0175/ISO 15156 and NACE® MR0103.	
Process Seal Antennas		
Expanded		
2P	2 in. (DN50), PTFE (requires Tank Sealing code NA)	
3P	3 in. (DN80), PTFE (requires Tank Sealing code NA)	
4P	4 in. (DN100), PTFE (requires Tank Sealing code NA)	
Other Antennas		
Expanded		
XX	Customer specific	
Tank Sealing		
Standard		**Standard**
PV	PTFE with Viton® fluoroelastomer O-rings	★
PK	PTFE with Kalrez® 6375 perfluoroelastomer O-rings	★
PE	PTFE with EPDM O-rings	★
PB	PTFE with Buna-N O-rings	★
NA	None[4]	★

TABLE 1. 5402 High Frequency Radar Level Transmitter Ordering Information

★The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Process Connection and Material (for antenna availability, refer to "Dimensional Drawings and Mechanical Properties" on page 31)		
ANSI Flanges (316 / 316L SST)		
Standard		**Standard**
AA	2 inch, 150 lb	★
AB	2 inch, 300 lb	★
BA	3 inch, 150 lb	★
BB	3 inch, 300 lb	★
CA	4 inch, 150 lb	★
CB	4 inch, 300 lb	★
DA	6 inch, 150 lb	★
EA	8 inch, 150 lb	★
EN (DIN) Flanges (EN 1.4404 SST)		
Standard		**Standard**
HB	DN 50 PN 40	★
IB	DN 80 PN 40	★
JA	DN 100 PN 16	★
JB	DN 100 PN 40	★
KA	DN 150 PN 16	★
LA	DN 200 PN 16	★
JIS Flanges (EN 1.4404 SST)		
Standard		**Standard**
UA	50A 10K	★
VA	80A 10K	★
XA	100A 10K	★
YA	150A 10K	★
ZA	200A 10K	★
Other Flanges		
Expanded		
BR	Bracket Mounting, 316L / EN 1.4404 SST(5)	
XX	Customer specific	
Options		
Standard		**Standard**
M1	Integral digital display	★
GC	Transparent meter glass protection cover made of PTFE / FEP	★
T1	Transient Protection Terminal Block (standard with FISCO options)	★
Factory Configuration		
Standard		**Standard**
C1	Factory configuration (CDS required with order)	★
Alarm Limit Configuration		
Standard		**Standard**
C4	NAMUR alarm and saturation levels, high alarm	★
C8	Low alarm(6) (standard Rosemount alarm and saturation levels)	★
Overfill		
Standard		**Standard**
U1	WHG Overfill Approval(9)	★
Special Certifications		
Standard		**Standard**
Q4	Calibration Data Certificate	★
Q8	Material Traceability Certification per EN 10204 3.1(7)	★

TABLE 1. 5402 High Frequency Radar Level Transmitter Ordering Information

★The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Expanded		
N2	Certificate of compliance with guidelines in NACE® MR0175/ISO 15156 and NACE® MR0103(8)	
QG	GOST Primary Verification Certificate	
Safety Certifications		
Expanded		
QS	Prior use certificate of FMEDA data(9)	
Special Procedures		
Standard		**Standard**
P1	Hydrostatic testing(5)	★
Antenna Extension		
Expanded		
S3	Cone antenna extension in 316 / 316L / EN 1.4404 SST. To be used if there are irregularities in the nozzle. Fits nozzles up to 20 in. (500 mm)(10).	
Typical Model Number: 5402 A H 1 E5 4S PV CA - M1 C1		

(1) Options E (eurofast®) and M (minifast®) are not available with Explosion-proof or Flameproof approvals.
(2) Requires FOUNDATION™ fieldbus signal output (U_i parameter listed in "Product Certifications" on page 28).
(3) G ½ in. SST cable gland is included in delivery.
(4) Requires Process Seal Antenna (2P-4P). O-rings are not wetted.
(5) Bracket mounting (BR) is not available with hydrostatic testing (P1).
(6) The standard alarm setting is high.
(7) Certificate includes all pressure retaining wetted parts.
(8) Requires protective plate cone antennas (2H-4H, 2M-4M, 2N-4N) or process seal antennas (2P-4P).
(9) Only available with 4-20 mA HART signal Output.
(10) Requires a SST cone antenna (2S-4S).

Rosemount 5401 Low Frequency Radar Level Transmitter

5401 Radar Level Transmitter

Rosemount 5401 Low Frequency Radar Level Transmitter is a reliable 2-wire radar level transmitter designed for use in applications with some specific process conditions. Characteristics include:

- Low frequency (6 GHz) meaning a wider radar beam resulting in larger cone antenna diameters
- Ideal for applications with obstacles, turbulence, condensation, vapor, dust, contamination, and foam, or where there is a risk of deposits forming on the antenna
- Condensation resistant cone or rod antennas

Additional Information

Specifications: page 12
Certifications: page 28
Dimensional Drawings: page 31

TABLE 2. 5401 Low Frequency Radar Level Transmitter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Model	Product Description	
5401	Low frequency version (~6 GHz)	
Housing Material		
Standard		**Standard**
A	Polyurethane-covered Aluminum	★
Expanded		
S	Stainless Steel, Grade CF8M (ASTM A743)	
Signal Output		
Standard		**Standard**
H	4-20 mA with HART® communication	★
F	FOUNDATION™ fieldbus	★
M	RS-485 with Modbus communication	★
Conduit / Cable Threads		
Standard		**Standard**
1	½ in. - 14 NPT	★
2	M20 x 1.5 adapter	★
E	M12, 4-pin, Male Connector (eurofast®)(1)	★
M	A size Mini, 4-pin, Male Connector (minifast®)(1)	★
Product Certifications		
Standard		**Standard**
NA	No Product Certificates	★
E1	ATEX Flameproof(1)	★
I1	ATEX Intrinsic Safety	★
IA	ATEX FISCO Intrinsic Safety(2)	★
E5	FM Explosion-proof(1)	★
I5	FM Intrinsic Safety and Non-incendive	★
IE	FM FISCO Intrinsic Safety(2)	★
E6	CSA Explosion-proof(1)	★

TABLE 2. 5401 Low Frequency Radar Level Transmitter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

I6	CSA Intrinsic Safety	★
IF	CSA FISCO Intrinsic Safety(2)	★
E7	IECEx Flameproof(1)	★
I7	IECEx Intrinsic Safety	★
IG	IECEx FISCO Intrinsic Safety(2)	★
Expanded		
E2	INMETRO Flameproof	
I2	INMETRO Intrinsic Safety	
IB	INMETRO FISCO Intrinsic Safety	
E3	NEPSI Flameproof(1)	
I3	NEPSI Intrinsic Safety	
IC	NEPSI FISCO Intrinsic Safety	
E4	TIIS Flameproof(3)	
Antenna - Size and Material (for process connection availability, refer to "Dimensional Drawings and Mechanical Properties" on page 31)		
Cone Antennas		
Standard		**Standard**
3S	3 in. DN 80, 316L SST (EN 1.4404), pipe installations only	★
4S	4 in. DN 100, 316L SST (EN 1.4404)	★
6S	6 in. DN 150, 316L SST (EN 1.4404)	★
8S	8 in. DN 200, 316L SST (EN 1.4404)	★
Expanded		
3H	3 in. DN 80, Alloy C-276 (UNS N10276) with protective plate, pipe installations only	
4H	4 in. DN 100, Alloy C-276 (UNS N10276) with protective plate	
6H	6 in. DN 150, Alloy C-276 (UNS N10276) with protective plate	
8H	8 in. DN 200, Alloy C-276 (UNS N10276) with protective plate	
3M	3 in. DN 80, Alloy 400 (UNS N04400) with protective plate, pipe installations only	
4M	4 in. DN 100, Alloy 400 (UNS N04400) with protective plate	
6M	6 in. DN 150, Alloy 400 (UNS N04400) with protective plate	
8M	8 in. DN 200, Alloy 400 (UNS N04400) with protective plate	
3N	3 in. DN 80, 316L SST (EN 1.4404), with protective plate, pipe installations only. Complies with guidelines in NACE® MR0175/ISO 15156 and NACE® MR0103.	
4N	4 in. DN 100, 316L SST (EN 1.4404), with protective plate. Complies with guidelines in NACE® MR0175/ISO 15156 and NACE® MR0103.	
6N	6 in. DN 150, 316L SST (EN 1.4404), with protective plate. Complies with guidelines in NACE® MR0175/ISO 15156 and NACE® MR0103.	
8N	8 in. DN 200, 316L SST (EN 1.4404), with protective plate. Complies with guidelines in NACE® MR0175/ISO 15156 and NACE® MR0103.	
Rod Antennas		
Expanded		
1R	Short version, all-PFA(4)(5), with protective plate, max. nozzle height 4 in. (100 mm), free propagation only	
2R	Long version, all-PFA(4)(5), with protective plate, max. nozzle height 10 in. (250 mm), free propagation only	
3R	Short version, SST+PFA(4), max. nozzle height 4 in. (100 mm), free propagation only	
4R	Long version, SST+PFA(4), max. nozzle height 10 in. (250 mm), free propagation only	
Other Antennas		
Expanded		
XX	Customer specific	

TABLE 2. 5401 Low Frequency Radar Level Transmitter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Tank Sealing		
Standard		**Standard**
PV	PTFE with Viton® fluoroelastomer O-rings	★
PK	PTFE with Kalrez® 6375 perfluoroelastomer O-rings	★
PE	PTFE with EPDM O-rings	★
PB	PTFE with Buna-N O-rings	★
PD	All-PFA(4) rod antennas (O-rings are not wetted)	★
Process Connection and Material (for antenna availability, refer to "Dimensional Drawings and Mechanical Properties" on page 31)		
ANSI Flanges (316 / 316L SST)		
Standard		**Standard**
AA	2 in. 150 lb	★
AB	2 in. 300 lb	★
BA	3 in. 150 lb	★
BB	3 in. 300 lb	★
CA	4 in. 150 lb	★
CB	4 in. 300 lb	★
DA	6 in. 150 lb	★
EA	8 in. 150 lb	★
EN (DIN) Flanges (EN 1.4404 SST)		
Standard		**Standard**
HB	DN 50 PN 40	★
IB	DN 80 PN 40	★
JA	DN 100 PN 16	★
JB	DN 100 PN 40	★
KA	DN 150 PN 16	★
LA	DN 200 PN 16	★
JIS Flanges (EN 1.4404 SST)		★
Standard		**Standard**
UA	50A 10K	★
VA	80A 10K	★
XA	100A 10K	★
YA	150A 10K	★
ZA	200A 10K	★
Tri-Clamp Connection (316/316L)		
Expanded		
AT	2 in. Tri-Clamp(6)	
BT	3 in. Tri-Clamp(6)	
CT	4 in. Tri-Clamp(6)	
Threaded (316L / EN 1.4404 SST)		
Expanded		
RA	1.5-in. NPT(7)	
Other		
Expanded		
BR	Bracket Mounting, 316L / EN 1.4404 SST(7)	
XX	Customer specific	
Options		
Standard		**Standard**
M1	Integral digital display	★
T1	Transient Protection Terminal Block (standard with FISCO options)	★

TABLE 2. 5401 Low Frequency Radar Level Transmitter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Expanded		
GC	Transparent meter glass protection cover made of PTFE / FEP	
Factory Configuration		
Standard		**Standard**
C1	Factory configuration (CDS required with order)	★
Alarm Limit Configuration		
Standard		**Standard**
C4	NAMUR alarm and saturation levels, high alarm	★
C8	Low alarm(8) (standard Rosemount alarm and saturation levels)	★
Overfill		
Standard		**Standard**
U1	WHG Overfill Approval(9)	★
Special Certifications		
Standard		**Standard**
Q4	Calibration Data Certificate	★
Q8	Material Traceability Certification per EN 10204 3.1(9)	★
Expanded		
N2	Certificate of compliance with guidelines in NACE® MR0175/ISO 15156 and NACE® MR0103(10)	
QG	GOST Primary Verification Certificate	
Safety Certifications		
Expanded		
QS	Prior use certificate of FMEDA data(11)	
Special Procedures		
Standard		**Standard**
P1	Hydrostatic testing(7)	★
Antenna Extension		
Expanded		
S3	Extended Cone Antenna in 316 / 316L / EN 1.4404 SST. Maximum recommended nozzle height is 20 in. (500 mm).(12)	
Typical Model Number: 5401 A H 1 NA 4S PV CA - M1 C1		

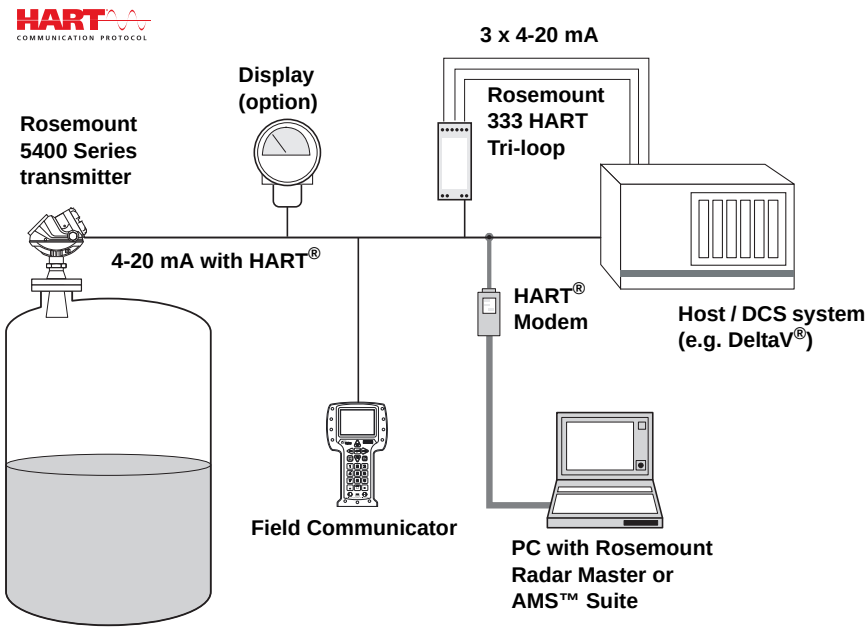
(1) Options E (eurofast®) and M (minifast®) are not available with Explosion-proof or Flameproof approvals.
(2) Requires FOUNDATION™ fieldbus signal output (U_i parameter listed in "Product Certifications" on page 28).
(3) G ½ in. SST cable gland is included in delivery.
(4) PFA is a fluoropolymer with properties similar to PTFE.
(5) All-PFA Rod antennas (1R or 2R) require all-PFA tank seal (PD).
(6) Only available with Rod Antenna (3R and 4R)
(7) Certain process connections are not available with hydrostatic testing (P1).
(8) The standard alarm setting is high.
(9) Certificate includes all pressure retaining wetted parts.
(10) Requires protective plate cone antennas (3H-8H, 3M-8M, 3N-8N) or rod antennas (1R-4R).
(11) Only available with 4-20 mA HART signal Output
(12) Requires a SST cone antenna (4S-8S).

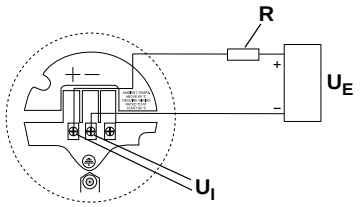
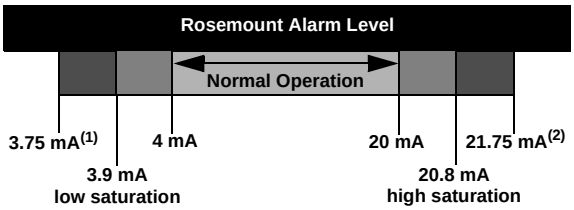
TABLE 3. Accessories

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery**.**
The Expanded offering is subject to additional delivery lead time.

Code		
Standard		**Standard**
03300-7004-0001	Viator HART Modem and cables (RS232 connection)	★
03300-7004-0002	Viator HART Modem and cables (USB connection)	★

Functional Specification

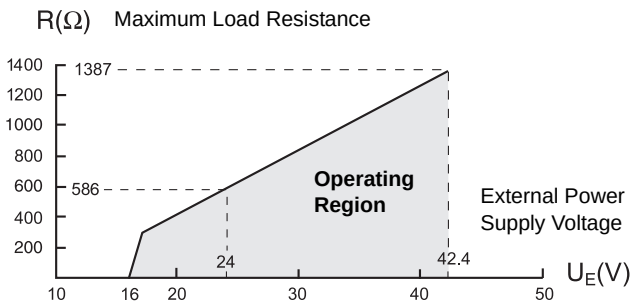
General	
Field of Application	Ideal for liquids and slurries in tanks, vessels, containers, reactor vessels, and underground tanks. Applications with sticky, viscous, corrosive, condensing, and crystallizing product. • Model 5402, best choice for a broad range of applications and suitable for mounting in valves and bridles/stilling wells • Model 5401, suitable for some extreme process conditions such as condensing vapors, product build-up, and heavy turbulence
Measurement Principle	Pulsed, free propagating radar. Low Frequency (Model 5401, 6 GHz) and High Frequency (Model 5402, 26 GHz). (See “Measurement Principle” on page 2 for details)
Microwave Output Power	< 1 mW
Internal Power Consumption	< 50 mW in normal operation
Humidity	0 - 100% Relative Humidity, non-condensating
Start-up Time	< 40 s
4-20 mA HART (Output Option Code H) - (See Ordering Information in Table 1 on page 4 and Table 2 on page 8)	
Output	HART® 4-20 mA current loop. 
Signal Wiring	Recommended output cabling is twisted shielded pairs, 18-12 AWG
HART Tri-loop	 By sending the digital HART signal to the optional HART Tri-loop, it is possible to have up to three additional 4–20 mA analog signals. See the Rosemount 333 HART Tri-loop Product Data Sheet (Document No. 00813-0100-4754) for additional information.
Smart Wireless THUM Adapter	 The optional Smart Wireless THUM adapter can be mounted directly on the transmitter or by using a remote mounting kit. IEC 62591 (*Wireless*HART) enables access to multi-variable data and diagnostics, and adds wireless to almost any measurement point. See the Rosemount Smart Wireless THUM adapter Product Data Sheet (Document No. 00813-0100-4075) and Smart Wireless THUM Adapter for Rosemount Process Level Transmitter Applications (Document No. 00840-0100-4026).

External Power Supply	The input voltage U_I for HART® is 16-42.4 Vdc (16-30 Vdc in IS applications, and 20-42.4 Vdc in Explosion-proof / Flameproof applications).  R = Load Resistance (Ω); U_E = External Power Supply Voltage (Vdc); U_I = Input Voltage (Vdc)
IS Electrical Parameters	See “Product Certifications” on page 28.
Signal on Alarm (configurable)	High = 21.75 mA (standard Rosemount setting) Low = 3.75 mA (Option code C8) Namur NE43: High = 22.5 mA (Option code C4)
Saturation Levels	Standard: Low=3.9 mA, High=20.8 mA Namur NE43: Low=3.8 mA, High=20.5 mA  *(1) Transmitter Failure, hardware or software alarm in Low position.* *(2) Transmitter Failure, hardware or software alarm in High position.*

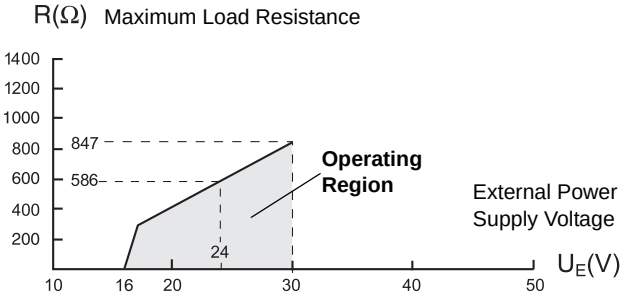
Load Limitations

Maximum load resistance (R) is determined by the voltage level of the external power supply (U_E), as described by:

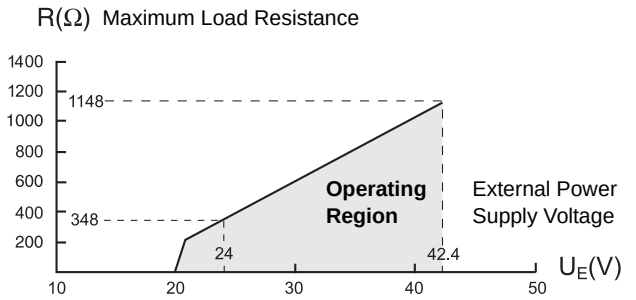
Non-Hazardous Installations



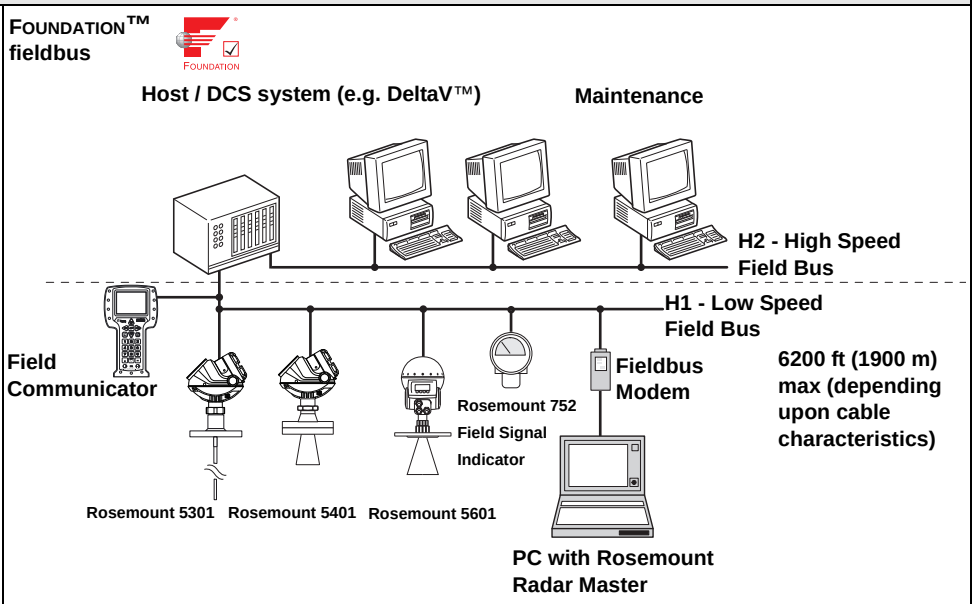
Intrinsically Safe Installations

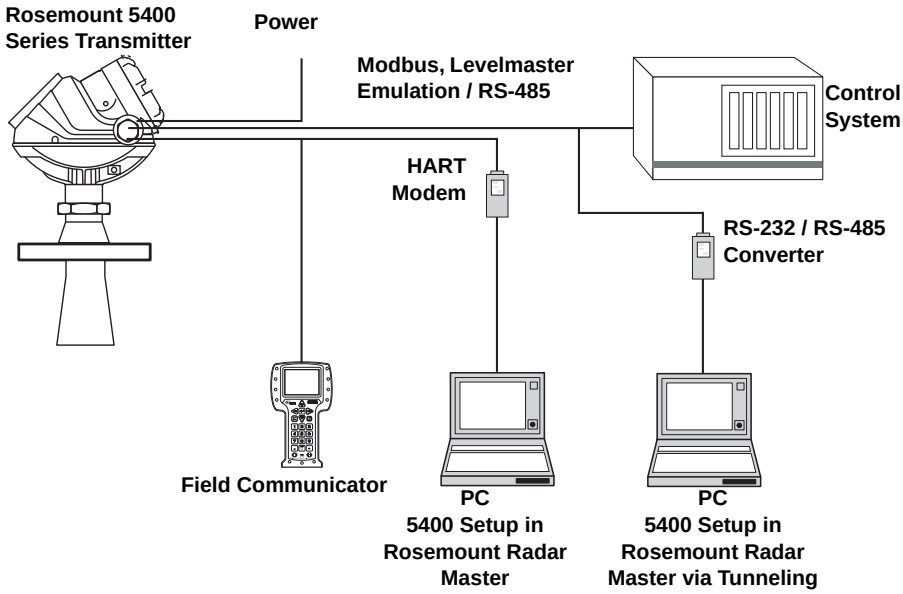
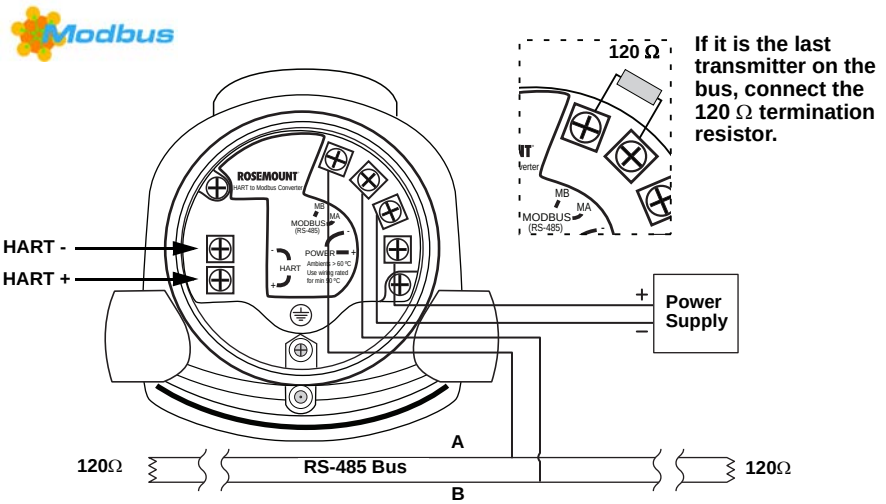


Explosion-proof / Flameproof Installations

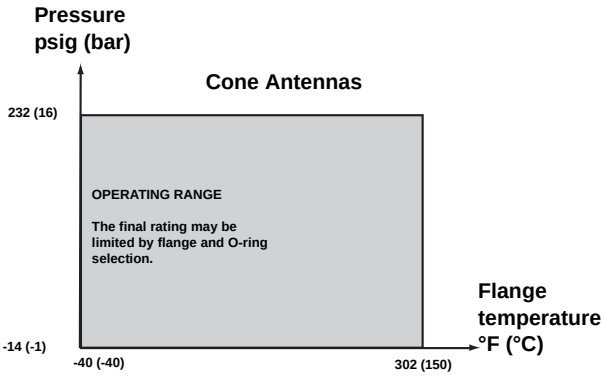
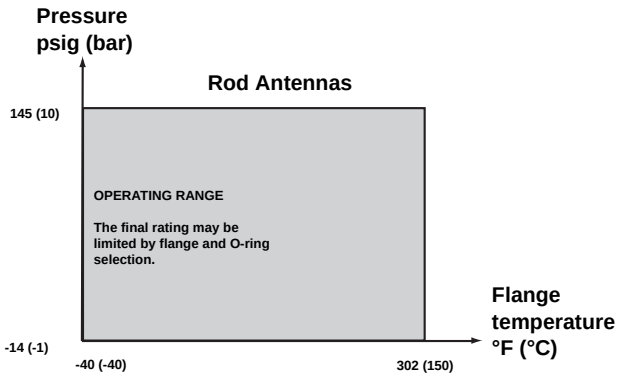
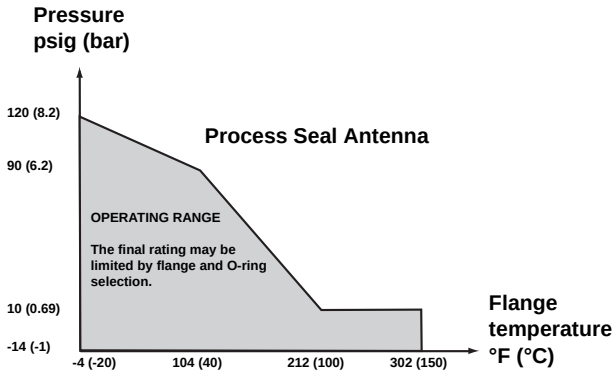


NOTE
The diagram is only valid if the HART® load resistance is at the + side and if the - side is grounded, otherwise the load resistance value is limited to 435 Ω.

FOUNDATION™ fieldbus (Output Option Code F) - (See Ordering Information in Table 1 on page 4 and Table 2 on page 8)	
Output	
Signal Wiring	Recommended output cabling is twisted shielded pairs, 18-12 AWG
External Power Supply	The input voltage U_I for FOUNDATION™ fieldbus is 9-32 Vdc (9-30 Vdc in IS applications, 9-17.5 Vdc in FISCO applications, and 16-32 Vdc in Explosion-proof / Flameproof applications)
Quiescent Current Draw	21 mA
FOUNDATION™ fieldbus Blocks	Resource block, 3 Transducer blocks, 6 Analog Input (AI) blocks, Proportional /Integral/Derivate (PID) block, Input Selector (ISEL) block, Signal Characterizer (SGCR) block, Arithmetic (ARTH) block, and Output Splitter (OS) block
FOUNDATION™ fieldbus Class (Basic or Link Master)	Link Master (LAS)
FOUNDATION™ fieldbus Block Execution Time	AI-block: 30 ms. PID-block: 40 ms. ARTH-, ISEL-, OSPL-block: 65 ms. CHAR-block: 75 ms
Conforming FOUNDATION™ fieldbus	ITK 4.6.1
FOUNDATION™ fieldbus PlantWeb® Alert Support	Yes

RS-485 with Modbus communication (Output Option Code M) - (See Ordering Information in Table 1 on page 4 and Table 2 on page 8)	
Output	The RS-485 Modbus version communicates by Modbus RTU, Modbus ASCII, and Level Master Protocols. 8 data bits, 1 start bit, 1 or 2 stop bits, and software configured parity Baud Rate: 1200, 2400, 4800, 9600 (default), and 19200 bits/s Address range: 1 to 255 (default device address is 246) HART communication is used for configuration via HART terminals, or tunneling via the RS-485. 
External Power Supply	The input voltage U_i for Modbus is 8-30 Vdc (max. rating) Power Consumption: < 0.5 W (with HART address=1) < 1.2 W (incl. four HART slaves) 
Signal Wiring	Two-wire half duplex RS-485 Modbus. Use shielded twisted pair wiring, preferably with an impedance of 120 Ω (typically 24 AWG), in order to comply with EIA-485 standard and EMC regulations.
Ground (Common Mode) Voltage Limit	± 7 V
Bus Termination	Standard RS-485 bus termination per EIA-485.

Display and Configuration	
Integral Display (Option code M1)	5-digit integral display. The process variables listed below can be presented. If more than one variable is chosen, carousel toggling of data is used. The display also shows diagnostics and error information.
Remote Display	Data can be read remotely by using the Rosemount 751 Field Signal Indicator (see Product Data Sheet, document number 00813-0100-4378) for 4-20 mA / HART®, or Rosemount 752 Remote Indicator for FOUNDATION™ fieldbus (see Product Data Sheet, document number 00813-0100-4377).
Configuration Tools	Emerson Field Communicator (e.g. 375/475 Field Communicator), Rosemount Radar Master (RRM) software package (included with delivery of transmitter), Emerson AMS™ Device Manager or any other EDDL or enhanced-EDDL host, or DeltaV or any other DD (Device Description) compatible host systems. Certificates are available from all major host system vendors.
	Notes: • DTM (compliant with version 1.2 of the FDT/DTM specification) supporting configuration in for instance Yokogawa Fieldmate/PRM, E+H™ FieldCare, and PactWare™ • To communicate using RRM or AMS Device Manager, a HART modem is required. The HART modem is available as an RS232 or USB version (see Table 3 on page 11) • The transmitter can be pre-configured by selecting option code C1 (see page 6), and sending a complete Configuration Data Sheet (CDS). The CDS is available from www.Rosemount.com
Diagnostics	Invalid measurement alerts, Configuration error alerts, Advanced Full / Empty Tank diagnostics, Hardware / Software Failures, Electronic Temperature, Online status report (advisory / warnings / errors), Signal Quality and Signal Strength Monitoring
Output Units	Level and Distance: ft, in., m, cm, or mm Volume: ft^3, $in.^3$, US gals, Imp gals, barrels, yd^3, m^3, or liters Level Rate: ft/s, m/s Temperature: °F, °C
Output Variables	Level, Distance, Volume, Level Rate, Signal Strength, Surface/Noise Margin, Internal Temperature, Analog Output Current(1), and % of Range(1)
Damping	0-60 s (2 s, default value)
Temperature and Pressure Limits	
Ambient Temperature	Non-Hazardous, HART communication: -40 °F to 176 °F (-40 °C to 80 °C) IS/EEx ia and XP/EEx d, HART communication: -40 °F to 158 °F (-40 °C to 70 °C) IS/EEx ia and XP/EEx d, FOUNDATION fieldbus: -40 °F to 140 °F (-40 °C to 60 °C) LCD readable in: -4 °F to 158 °F (-20 °C to 70 °C)
Storage Temperature	-58 °F to 194 °F (-50 °C to 90 °C) LCD: -40 °F to 185 °F (-40 °C to 85 °C)

Process Temperature and Pressure	Rosemount 5402 and 5401 with SST Cone Antenna (Model Code 2S-8S), Rosemount 5402 and 5401 with Protective Plate Cone Antenna (Model Code: 2H-8H, 2M-8M, and 2N-8N) The final rating depends on the antenna, the tank seal, and O-rings (if applicable). See Table 4, Table 5, and Table 6 on page 19.  Rosemount 5401 with Rod Antenna (Model Code 1R-4R)  Rosemount 5402 with Process Seal Antenna (Model Code (2P-4P) 
ASME / ANSI Flange Rating	316L SST flanges according to ASME B16.5 Table 2-2.3
EN Flange Rating	1.4404 according to EN 1092-1 material group 13E0
JIS Flange Rating	316L SST according to JIS B2220 material group 2.3
Flange Connection Rating	See Table 6 for the conditions used for flange strength calculations

(1) Not applicable for FOUNDATION™ fieldbus.

TABLE 4. Temperature restrictions due to O-ring selection - Rosemount 5402 and 5401 with SST Cone Antenna (Model Code 2S-8S) and with Protective Plate Cone Antenna (Model Code: 2H-8H, 2M-8M, and 2N-8N)

Tank seal with different O-ring materials[1]	Min. Temperature °F (°C) in air	Max. Temperature °F (°C) in air
Viton®	-4 (-20)	302 (150)
Ethylene Propylene (EPDM)	-40 (-40)	302 (150)
Kalrez® 6375	5 (-15)	302 (150)
Buna-N	-40 (-40)	230 (110)

(1) Always check the chemical compatibility of the O-ring material with your application

TABLE 5. Temperature restrictions due to O-ring selection (not applicable for 1R and 2R where no process O-ring is present) - Rosemount 5401 with Rod Antenna (Model Code 3R-4R)

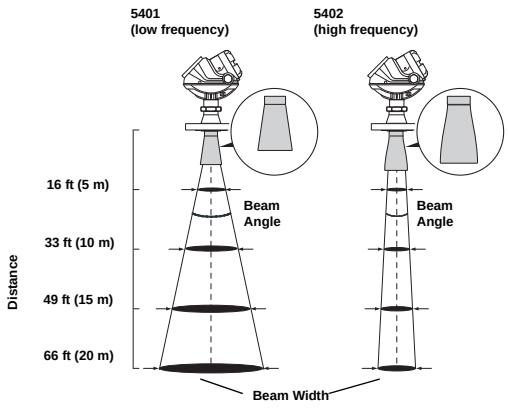
Tank seal with different O-ring materials[1]	Min. Temperature °F (°C) in air	Max. Temperature °F (°C) in air
Viton®	-4 (-20)	302 (150)
Ethylene Propylene (EPDM)	-40 (-40)	302 (150)
Kalrez® 6375	5 (-15)	302 (150)
Buna-N	-40 (-40)	230 (110)

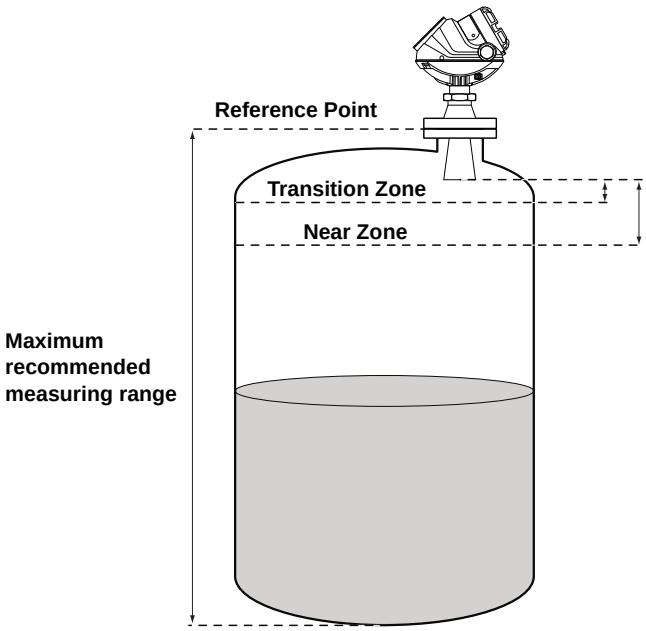
(1) Always check the chemical compatibility of the O-ring material with your application

TABLE 6. Conditions used for flange strength calculations

	Bolting material	Gasket	Flange material
ASME / ANSI	SST SA193 B8M Class 2	Soft (1a) with min. thickness 1.6 mm	SA/A182 316L
EN, JIS	EN 1515-1/-2 group 13E0, A4-70	Soft (EN 1514-1) with min. thickness 1.6 mm	EN 10222-5-1.4404

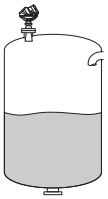
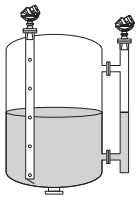
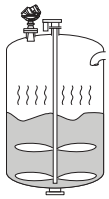
Performance Specification

General	
Reference Conditions	Ideal metal plate with no disturbing objects. Temperature: + 68 °F (20 °C). Pressure: 14-15 psi (960-1060 mbar). Humidity: 25-75 % RH.
Instrument Accuracy at reference conditions	5402: ± 0.1 in. (± 3 mm) 5401: ± 0.4 in. (± 10 mm)
Repeatability	± 0.04 in. (± 1 mm) at 16.4 ft (5 m) distance
Resolution	0.04 in. (1 mm)
Ambient Temperature Effect	0.05 %/10 K in temperature range -40 °F to 176 °F (-40 °C to 80 °C)
Update Interval	1 second
Measuring Range	
Measuring Range and Minimum Dielectric Constant	Maximum measuring range is 115 ft (35 m) from flange. The measuring range depends on: • microwave frequency • antenna size • the dielectric constant (ε_r) of the liquid (min. ε_r=1.4) • process conditions See Table 7 and Table 8 for measuring range and minimum dielectric constant. Due to the measuring range depending on the application and factors described below, the values are a guideline for clean liquids. For more information, ask your local Emerson Process Management representative.
Beam Angle and Beam Width	For a comparison between the beam angle and beam width for the Rosemount 5401 (~6 GHz) and 5402 (~26 GHz) transmitters with antennas of the same size and type, see Table 9 on page 22, Table 10 on page 23, and Table 11 on page 23. 

Transition Zone	Transition zones are areas where measurements are not recommended. Near Zones are areas where the accuracy is reduced. 
Transition Zone	6 in. (150 mm) from lower end of the antenna
Near Zone Distance	1.3 ft (0.4 m) from lower end of the antenna
Near Zone Accuracy	5402: ± 0.6 in. (± 15 mm) 5401: ± 1.2 in. (± 30 mm)
Max Level Rate	1.6 in./s (40 mm/s) as default, adjustable to 7.1 in./s (180 mm/s)
Environment	
Vibration Resistance[1]	Aluminum housing: IEC 60770-1 Level 1. SST housing: IACS E10.
Electromagnetic Compatibility[1]	Emission and Immunity: EMC directive 204/108/EC. EN 61326-1:2006. NAMUR recommendations NE21.
Transient / Built-in Lightning Protection[1]	IEC 61000-4-5:2001 T1 option: C62.41.2-2002 (IEEE), C37.90.1 (IEEE)
Pressure Equipment Directive (PED)	97/23/EC
Radio Approvals[2][3]	FCC part 15C (1998)[4], R&TTE (EU directive 99/5/EC), and IC (RSS210-5)

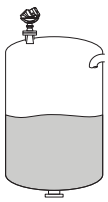
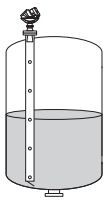
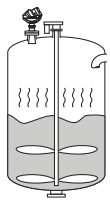
(1) The device may also comply with other standards. Consult your local Emerson Process Management representative.
(2) Only a limited selection is presented. Contact your local Emerson Process Management representative for more information.
(3) For Japan: "Install device on tanks or pipes made of metal".
(4) For 5402: "This device is authorized for use in tank-mounted applications, including metal tanks as well as concrete, plastic, glass, and other non-conductive tanks." No specific restrictions are stated for the 5401.

TABLE 7. Rosemount 5402, Maximum Recommended Measuring Range, ft (m)

High Frequency Antennas									
	Dielectric Constant[1]								
	A	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
2-in. Cone / Process Seal	33 (10)	49 (15)	66 (20)	82 (25)	115 (35)	115 (35)	9.8 (3)	20 (6)	33 (10)
3-in. Cone / Process Seal	49 (15)	66 (20)	98 (30)	82 (25)	115 (35)	115 (35)	13 (4)	30 (9)	39 (12)
4-in. Cone / Process Seal	66 (20)	82 (25)	115 (35)	82 (25)	115 (35)	115 (35)	23 (7)	39 (12)	49 (15)

(1) A. Oil, gasoline or other hydrocarbons, and petrochemicals (ε_r=1.9-4.0)
In pipes or with ideal surface conditions, for some liquefied gases (ε_r=1.4-4.0)
B. Alcohols, concentrated acids, organic solvents, oil/water mixtures, and acetone (ε_r=4.0-10.0)
C. Conductive liquids, e.g. water based solutions, dilute acids, and alkalis (ε_r>10.0)

TABLE 8. Rosemount 5401, Maximum Recommended Measuring Range, ft (m)

Low Frequency Antennas									
	Dielectric Constant[1]								
	A	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
3-in. Cone[2]	NA	NA	NA	82 (25)	115 (35)	115 (35)	NA	NA	NA
4-in. Cone / Rod[3]	23 (7)	39 (12)	49 (15)	82 (25)	115 (35)	115 (35)	13 (4)	26 (8)	39 (12)
6-in. Cone	43 (13)	66 (20)	82 (25)	82 (25)	115 (35)	115 (35)	20 (6)	33 (10)	46 (14)
8-in. Cone	66 (20)	82 (25)	115 (35)	82 (25)	115 (35)	115 (35)	26 (8)	39 (12)	52 (16)

(1) A. Oil, gasoline or other hydrocarbons, and petrochemicals (ε_r=1.9-4.0)
In pipes or with ideal surface conditions, for some liquefied gases (ε_r=1.4-4.0)
B. Alcohols, concentrated acids, organic solvents, oil/water mixtures, and acetone (ε_r=4.0-10.0)
C. Conductive liquids, e.g. water based solutions, dilute acids, and alkalis (ε_r>10.0)
(2) Pipe installations only. NA=not applicable.
(3) Pipe installations are not allowed with rod antennas.

TABLE 9. Beam Angle for Rosemount 5400 Series

Antenna Size	**Beam Angle 5402**	**Beam Angle 5401**
2-in. Cone / Process Seal[1]	19°	–
3-in. Cone / Process Seal[1]	14°	(Pipe only)
4-in. Cone / Process Seal[1], Rod[2]	9°	37°
6-in. Cone	–	23°
8-in. Cone	–	17°

(1) Only with 5402.
(2) Only with 5401.

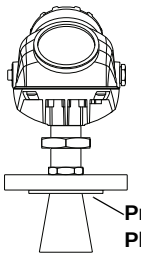
TABLE 10. Beam width at different distances from flange for 5402

	Antenna		
	2-in. Cone / Process Seal	3-in. Cone / Process Seal	4-in. Cone / Process Seal
Distance	Beam width, ft (m)		
16 ft (5 m)	4.9 (1.5)	3.3 (1.0)	3.3 (1.0)
33 ft (10 m)	9.8 (3.0)	6.6 (2.0)	4.9 (1.5)
49 ft (15 m)	14.8 (4.5)	9.8 (3.0)	8.2 (2.5)
66 ft (20 m)	19.7 (6.0)	13.1 (4.0)	9.8 (3.0)

TABLE 11. Beam width at different distances from flange for 5401

	Antenna		
	4-in. Cone / Rod	6-in. Cone	8-in. Cone
Distance	Beam width, ft (m)		
16 ft (5 m)	11.5 (3.5)	6.6 (2.0)	4.9 (1.5)
33 ft (10 m)	23.0 (7.0)	13.1 (4.0)	9.8 (3.0)
49 ft (15 m)	32.8 (10)	19.7 (6.0)	14.8 (4.5)
66 ft (20 m)	42.7 (13)	26.2 (8.0)	19.7 (6.0)

Physical Specification

Housing and Enclosure	
Product	Rosemount 5400 Series, Non-Contacting Radar
Type	Dual compartment (terminal compartment and the electronics are completely separated). Two entries for conduit or cable connections. The transmitter housing can be rotated in any direction
Electrical Connection	½ - 14 NPT for cable glands or conduit entries. Optional: M20 x 1.5 conduit / cable adapter, M12 4-pin male eurofast® connector or A size Mini 4-pin male minifast® connector. Recommended output cabling is twisted shielded pairs, 18-12 AWG.
Housing Material	Polyurethane-covered Aluminum, or Stainless steel Grade CF8M (ASTM A743)
Ingress Protection	Type 4X, IP66, IP67
Factory Sealed	Yes
Weight	Transmitter Head (TH): Aluminium 4.4 lb (2 kg), Stainless steel 10.8 lb (4.9 kg)
Tank Connection and Antennas	
Tank Connection	The tank connection consists of a tank seal, a flange, Tri-Clamp, or NPT thread. Certain models of tank connections have a tank connection design with a protective plate of the same material as the antenna. This is to prevent the 316L / EN1.4404 Stainless steel flange from being exposed to the tank atmosphere. See “Dimensional Drawings and Mechanical Properties” on page 31.  **Protective Plate**
Flange Dimensions	Follows ANSI B16.5, JIS B2220, and EN 1092-1 standards. For more information, see “Standard Flanges” on page 36.
Antennas	Cone, Process Seal, and Rod Antenna. Cone Antennas can be ordered in different materials. Extended Cone Antennas are available in Stainless steel 316L. **5402 Cone Antenna** • Suitable for stilling-well/bridle installation • Can be recessed in smooth nozzles. • Cone extensions are available **5402 Process Seal Antenna** • Ideal for small tanks and corrosive applications • Suitable for applications with heavy condensation/build-up **5401 Cone Antenna** • Suitable for applications with heavy condensation/build-up • Cone extensions are available **5401 Rod Antenna** • Suitable for small process connections and corrosive environments • Two versions; All PFA and PFA+SST
Antenna Dimensions	**Cone Antenna:** see “Rosemount 5402 and 5401 with SST Cone Antenna (model code 2S-8S)” on page 31 and “Rosemount 5402 and 5401 with Protective plate cone antenna (model code: 2H-8H, 2M-8M, and 2N-8N)” on page 32. **Rod Antenna:** see “Rosemount 5401 with Rod Antenna (model code 1R-4R)” on page 33. **Process Seal Antenna:** see “Rosemount 5402 with Process Seal Antenna (model code 2P-4P)” on page 34.

Material Exposed to Tank Atmosphere	**Cone Antenna** • 316 / 316 L SST (EN 1.4404) or Alloy 400 (UNS NO4400) or Alloy C-276 (UNS N10276). Alloy 400 and Alloy C-276 antennas have a protective plate design • PTFE fluoropolymer • O-ring material **Rod Antenna, Two versions** • All-PFA(1) fluoropolymer • PFA(1) fluoropolymer, 316 / 316 L SST (EN 1.4404) and O-ring material. **Process Seal Antenna** • PTFE fluoropolymer
Weight	**Antennas** Cone Antenna (Model Code 2S-8S, 2H-8H, 2M-8M, 2N-8N): 2.2 lb (1.0 kg) Process Seal Antenna (Model Code 2P-4P): 4.4 lb (2.0 kg) Rod Antenna (Model Code 1R-4R): 2.2 lb (1.0 kg) **Process Connections(2)** ANSI Flange, 2 in. 150 lb SST (AA): 6.6 lb (3.0 kg) EN (DIN) Flange, DN50 PN40 SST (HB): 8.8 lb (4.0 kg) JIS Flange 50A 10K SST (UA): 6.6 lb (3.0 kg) Bracket Mounting (BR): 4.4 lb (2.0 kg) Thread Adapter (RA): 1.1 lb (0.5 kg)
Minimum Clearance	No clearance distance needed.

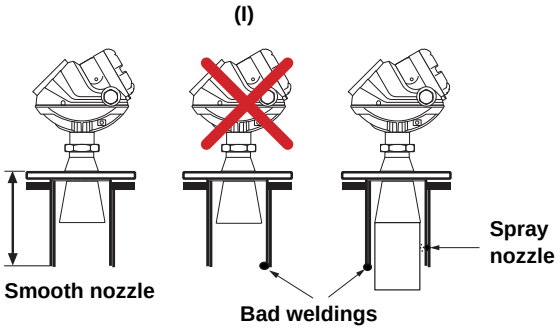
Installation and Mounting Considerations

Tank Installations

Special considerations may have to be taken due to the nozzle, depending on the selection of transmitter model and antenna.

5402 with Cone Antenna

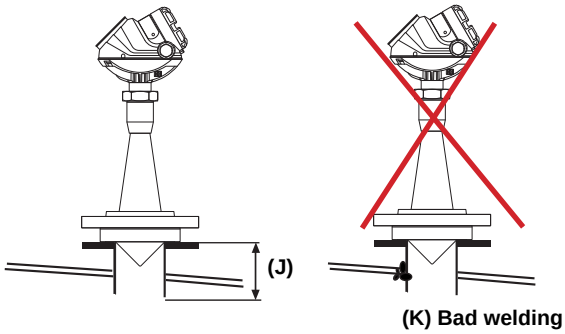
The antenna can be recessed in smooth nozzles up to 6 ft (2 m). If the inside of the nozzle contains disturbing objects, use the extended cone (I).



5402 with Process Seal Antenna

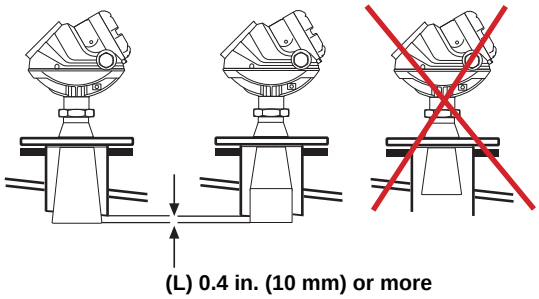
The antenna can be used on nozzles up to 6 ft (2 m), (J). Disturbing objects inside the nozzle (K) may impact the measurement, and should be avoided.

The flange on the tank should have a flat or raised face. Other tank flanges may be possible, please consult your local Emerson representative for advice.



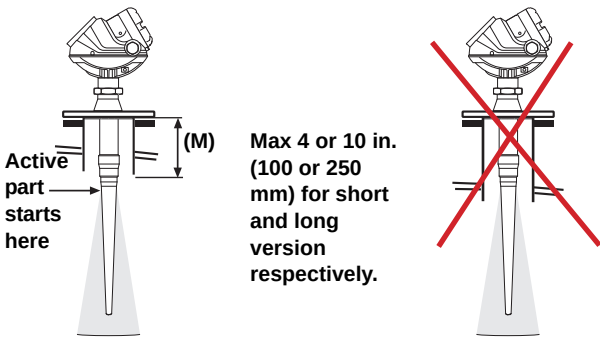
5401 with Cone Antenna

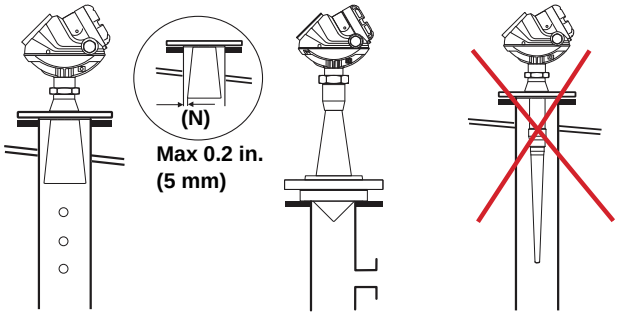
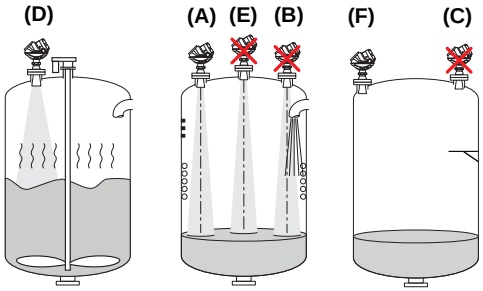
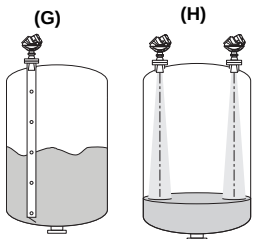
The antenna should extend 0.4 inches (10 mm), or more, below the nozzle (L). Use the extended cone solution.



5401 with Rod Antenna

The active part of the rod antenna should be placed under the nozzle (M).



Pipe / Chamber Installations	If used correctly, pipe or chamber measurement can be advantageous in many applications: • The 5402 is the preferred choice for pipe measurements • Use cone or process seal antennas – not the rod antenna • The gap between the cone antenna and the still-pipe is limited to 0.2 in. (5 mm). If required, order an oversized antenna and cut on location (N). • The inside of the chamber shall be of a constant diameter 
Ball-valve Installations	The 5400 Series transmitter can be isolated from the process by using a valve: • The 5402 is the preferred choice for pipe measurement • Use the largest possible antenna • Use a full-port ball valve • Ensure there is no edge between the ball valve and the nozzle / pipe, the inside should be smooth • Valves can be combined with pipes
Mechanical Mounting Considerations	• Filling inlets creating turbulence (B), and stationary metallic objects with horizontal surfaces (C) should be kept at a distance, outside the signal beam – see tables on page 23 for beam width information • Agitators with large horizontal blades may reduce the performance of the transmitter, so install the transmitter in a location where this effect is minimized. Vertical or slanted blades are often invisible to radar, but create turbulence (D) • Do not install the transmitter in the center of the tank (E) • Because of circular polarization, there is no clearance distance requirement from the tank wall if it is flat and free from obstructions such as heating coils and ladders (F). Usually, the optimal location is 1/3 of the radius from the tank wall  • The antenna is normally aligned vertically • A still-pipe can be used to avoid disturbing objects, turbulence, and foam (G) • The walls in non-metallic tanks are invisible to the radar signal, so nearby objects outside the tank may be detected • Choose the largest possible antenna diameter for installation. A larger antenna concentrates the radar beam, and will be less susceptible to obstruction interference. It also assures maximum antenna gain • Multiple 5400 transmitters can be used in the same tank without interfering with each other (H) 

(1) PFA is a fluoropolymer with properties similar to PTFE.
(2) Approximate weights for other 5400 Series process connection sizes than those in this table can be estimated:
First of all, find out the weight of the SST blind flange (slip-on for process seal antennas) that corresponds to the type and size shown in this table.
Find out the weight for the SST blind flange that corresponds to the specific 5400 Series flange size which is not represented in this table.
The 5400 Series flange weight can be estimated by adding the relative weight difference of these SST blind flanges.

Product Certifications

SAFETY NOTE

A safety isolator such as a zener barrier is always needed for intrinsic safety.

EU Conformity

The most recent revision of the EC declaration of conformity can be found at www.rosemount.com.

Safety Instrumented Systems (SIS)

The Rosemount 5400 Series has been evaluated by a third party, the SP (Technical Research Institute of Sweden), against hardware requirements according to IEC 61508. With a FMEDA (Failure Modes, Effects and Diagnostics Analysis) report with a Safe Failure Fraction (SFF) above 80%, 5400 is suitable in SIS according to the Prior Use methodology. For more information, go to: http://www.emersonprocess.com/rosemount/safety/. To order the certificate of FMEDA data use option code QS.

Canadian Registration Number (CRN)

Cert no: 0F06878.2

The product design has been accepted and registered for use in Canada.

ATEX Approvals CE

Nemko 04ATEX1073X

SPECIAL CONDITIONS FOR SAFE USE (X)

The intrinsically safe circuits do not withstand the 500 Vac test as specified in IEC 60079-11 clause 6.4.12.

Impact and friction hazards need to be considered according to EN 60079-0 clause 8.1.2 when the transmitter and part of antennas exposed to the exterior atmosphere of the tank is made with light metal alloys and of category II 1G EPL Ga.

Parts of the rod-antenna and the all PTFE antenna are non-conducting and the area of the non-conducting part exceeds the maximum permissible areas for Group IIC according to IEC 60079-0 clause 7.3: 20 cm^2 for II 2G EPL Gb and 4 cm^2 for II 1G EPL Ga. Therefore, when the antenna is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

The Ex ia version of model 5400 may be supplied by an Ex ib certified safety barrier. The whole circuit shall then be regarded type Ex ib. The antenna is classified EPL Ga and electrically separated from the Ex ia or ib circuit.

E1(1) Flameproof:

II 1/2 G T4.
II 1D T79°C(2)
Ex ia/db ia IIC T4 Ga/Gb (-40 °C≤T_a≤+70 °C(3)).
Ex ta IIIC T79°C(2) (-40 °C≤T_a≤+70 °C(3))
U_m=250 V
Approval valid for HART, FOUNDATION fieldbus, and Modbus options.

I1(1), IA(1)Intrinsically Safe:

II 1/2 G T4
II 1 D T79°C(2)
Ex ia IIC T4 Ga/Gb (-50 °C≤T_a≤+70 °C(3))
Ex ta IIIC T79°C(2) (-50 °C≤T_a≤+70 °C(3))
4-20 mA / HART model: U_i=30 Vdc, I_i=130 mA, P_i=1.0 W, C_i=7.26 nF, L_i=0 H.
FOUNDATION™ fieldbus model: U_i=30 Vdc, I_i=300 mA, P_i=1.5 W, C_i=0 nF, L_i=0 H.
FISCO model: U_i=17.5 Vdc, I_i=380 mA, P_i=5.32 W, C_i=0 nF, L_i<1 µH.
Installation Drawing: 9150079-907.
Approval valid for HART, FOUNDATION fieldbus, and FISCO options.

National Supervision and Inspection Center for Explosion Protection and Safety of Instrumentation (NEPSI) Approvals

SPECIAL CONDITIONS FOR SAFE USE (X)

Refer to Certificates:
GYJ06242X and GYJ06458X.

E3(1) Flameproof:

Ex iad IIC T4 (-40 °C<T_a<+70 °C(3)).
U_m=250 V

I3(1) Intrinsically Safe:

Ex ia IIC T4 (-40 °C<T_a<+70 °C(3)).
4-20 mA / HART® model: U_i=30 Vdc, I_i=130 mA, P_i=1.0 W, C_i=7.26 nF, L_i=0 H.
FOUNDATION™ fieldbus model: U_i=30 Vdc, I_i=300 mA, P_i=1.5 W, C_i=0 nF, L_i=0 H.
FISCO model: U_i=17.5 Vdc, I_i=380 mA, P_i=5.32 W, L_i=C_i=0.

(1) Ordering Information code for Product Certificates, see page 4 and page 8.
(2) +69 °C with FOUNDATION™ fieldbus or FISCO option.
(3) +60 °C with FOUNDATION™ fieldbus or FISCO option.

Technology Institution of Industrial Safety (TIIS) Approval

E4[1] Flameproof:
Transmitter: Ex d [ia] IIC T4
Antenna: Ex ia IIC T4
Installation Drawing: 05400-00375.
Approval valid for HART and FOUNDATION fieldbus options.

Factory Mutual (FM) Approvals

Project ID: 3020497

E5[1] Explosion Proof for Class I, Div. 1, Groups B, C, and D;
Dust Ignition Proof for Class II/III, Div. 1, Groups E, F, and G;
With Intrinsically Safe connections to
Class I, II, III, Div. 1, Groups B, C, D, E, F, and G.
Temp. Code T4
Ambient temperature limits: -50 °C to +70 °C[2].
Seal not required.
Approval valid for HART, FOUNDATION fieldbus, and Modbus options.

I5[1], IE[1]Intrinsically Safe for Class I, II, III, Div. 1, Groups A, B, C, D, E, F, and G,
Class I, Zone 0, AEx ia IIC T4 when installed per Control Drawing: 9150079-905.

Non-Incendive Class I, II, Div. 2, Groups A, B, C, D, F, and G Suitable for Class II, III.

4-20 mA / HART® model: U_i=30 Vdc, I_i=130 mA, P_i=1.0 W, C_i=7.26 nF, L_i=0 H.

FOUNDATION™ fieldbus model: U_i=30 Vdc, I_i=300 mA, P_i=1.3 W, C_i=0 nF, L_i=0 H.
FISCO model: U_i=17.5 Vdc, I_i=380 mA, P_i=5.32 W, L_i=C_i=0.

Temp. Code T4
Ambient temperature limits: -50 °C to +70 °C[2].
Approval valid for HART, FOUNDATION fieldbus, and FISCO options.

Canadian Standards Association (CSA) Approvals

This product meets the Dual Seal Requirements of ANSI/ISA 12.27.01-2003.

Cert. no.: 1514653

E6[1] Explosion-proof with internal Intrinsically Safe Circuits [Exia]
Class I, Div. 1, Groups B, C, and D;

Temp Code T4.

Class II, Div. 1 and 2, Groups E, F, and G;

Class III, Div. 1

Ambient temperature limits -50 °C to +70 °C[2]

Approval valid for HART, FOUNDATION fieldbus, and Modbus options.

I6[1], IF[1]Intrinsically Safe Exia:
Class I, Div. 1, Groups A, B, C, and D.

Temp Code T4.

4-20 mA / HART® model: U_i=30 Vdc, I_i=130 mA, P_i=1.0 W, C_i=7.26 nF, L_i=0 H.

FOUNDATION™ fieldbus model: U_i=30 Vdc, I_i=300 mA, P_i=1.3 W, C_i=0 nF, L_i=0 H.
FISCO model: U_i=17.5 Vdc, I_i=380 mA, P_i=5.32 W, L_i=C_i=0.

Installation Drawing: 9150079-906
Ambient temperature limits -50 °C to +70 °C[2].
Approval valid for HART, FOUNDATION fieldbus, and FISCO options.

(1) Ordering Information code for Product Certificates, see page 4 and page 8.
(2) +60 °C with FOUNDATION™ fieldbus or FISCO option.

IECEx Approval

IECEx NEM 06.0001X

SPECIAL CONDITIONS FOR SAFE USE (X)

The intrinsically safe circuits do not withstand the 500 V AC test as specified in IEC 60079-11 clause 6.4.12.

Impact and friction hazards need to be considered according to EN 60079-0 clause 8.1.2 when the transmitter and part of antennas exposed to the exterior atmosphere of the tank is made with light metal alloys and of category II 1G EPL Ga.

Parts of the rod-antenna and the all PTFE antenna are non-conducting and the area of the non-conducting part exceeds the maximum permissible areas for Group IIC according to IEC 60079-0 clause 7.3: 20 cm^2 for II 2G EPL Gb and 4 cm^2 for II 1G EPL Ga. Therefore, when the antenna is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

The Ex ia version of model 5400 may be supplied by an Ex ib certified safety barrier. The whole circuit shall then be regarded type Ex ib. The antenna is classified EPL Ga and electrically separated from the Ex ia or ib circuit.

E7(1) Flameproof:
Ex ia/db ia IIC T4 Ga/Gb (-40 °C ≤ T_a ≤ +70 °C(2)).
Ex ta IIIC T79°C(3) (-40 °C ≤ T_a ≤ +70 °C(2))
U_m=250 V
Approval valid for HART, FOUNDATION fieldbus, and Modbus options.

I7(1), IG(1) Intrinsically Safe:
Ex ia IIC T4 Ga/Gb (-50 °C<T_a<+70 °C(2)).
Ex ta IIIC T79°C(3) (-50 °C<T_a<+70 °C(2)).
4-20 mA / HART model: U_i=30 Vdc, I_i=130 mA, P_i=1.0 W, C_i=7.26 nF, L_i=0 H.
FOUNDATION fieldbus model: U_i=30 Vdc, I_i=300 mA, P_i=1.5 W, C_i=0 nF, L_i=0 H.
FISCO model: U_i=17.5 Vdc, I_i=380 mA, P_i=5.32 W, C_i=0 nF, L_i<1 µH.
Installation Drawing: 9150079-907.
Approval valid for HART, FOUNDATION fieldbus, and FISCO options.

(1) Ordering Information code for Product Certificates, see page 4 and page 8.
(2) +60 °C with FOUNDATION™ fieldbus or FISCO option.
(3) +69 °C with FOUNDATION™ fieldbus or FISCO option.

NCC/INMETRO Approvals

SPECIAL CONDITIONS FOR SAFE USE (X)

Refer to Certificate:
3815/07X

E2 Flameproof:
BR-Ex ia Ga d Gb IIC T4 (-40 °C≤T_a≤+70 °C(2))
Approval valid for HART, FOUNDATION fieldbus, and Profibus options.

I2, IB Intrinsically Safe:
BR-Ex ia IIC T4 (-40 °C≤T_a≤+70 °C(2)) Ga
Approval valid for HART, FOUNDATION fieldbus, and Profibus options.

Overfill Protection

Cert no: Z-65.16-475

U1 TÜV-tested and approved by DIBt for overfill protection according to the German WHG regulations.
Approval valid for HART option.

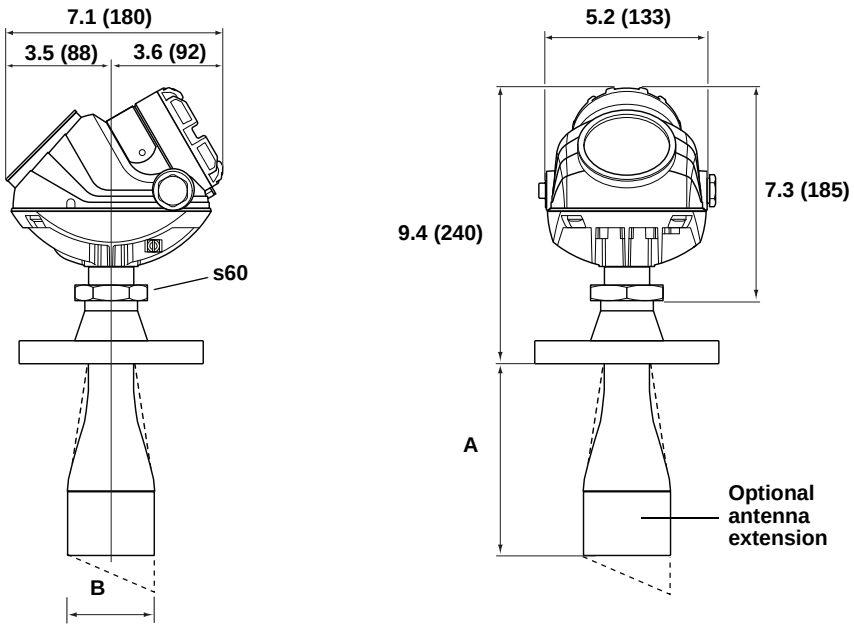
Suitability for Intended Use

Compliant with NAMUR NE 95, version 07.07.2006 “Basic Principles of Homologation”

For more information on product certificates, refer to the Reference Manual (document number 00809-0100-4026).

Dimensional Drawings and Mechanical Properties

ROSEMOUNT 5402 AND 5401 WITH SST CONE ANTENNA (MODEL CODE 2S-8S)



All dimensions are in inches (mm).

Process Connection Availability
● Available as standard
❍ Available as special, consult factory
– Not available

	Antenna Code	
Process Connection	**2S**	**3S, 4S, 6S, 8S**
2 in. / DN 50 / 50A	●	❍
3 in. / DN 80 / 80A	●	●
4 in. / DN 100 / 100A	●	●
6 in. / DN 150 / 150A	●	●
8 in. / DN 200 / 200A	●	●
Threaded Connection	-	-
Bracket Mounting	●	●

5402 Standard SST Cone

Cone size (inches)	A	B	Antenna Code
2	6.5 (165)	2.0 (50)	2S
3	5.9 (150)	2.6 (67)	3S
4	8.8 (225)	3.6 (92)	4S

5401 Standard SST Cone

Cone size (inches)	A	B	Antenna Code
3	3.3 (84)	2.6 (67)	3S
4	5.9 (150)	3.6 (92)	4S
6	7.3 (185)	5.5 (140)	6S
8	10.6 (270)	7.4 (188)	8S

5402 and 5401 Extended SST Cone(1)

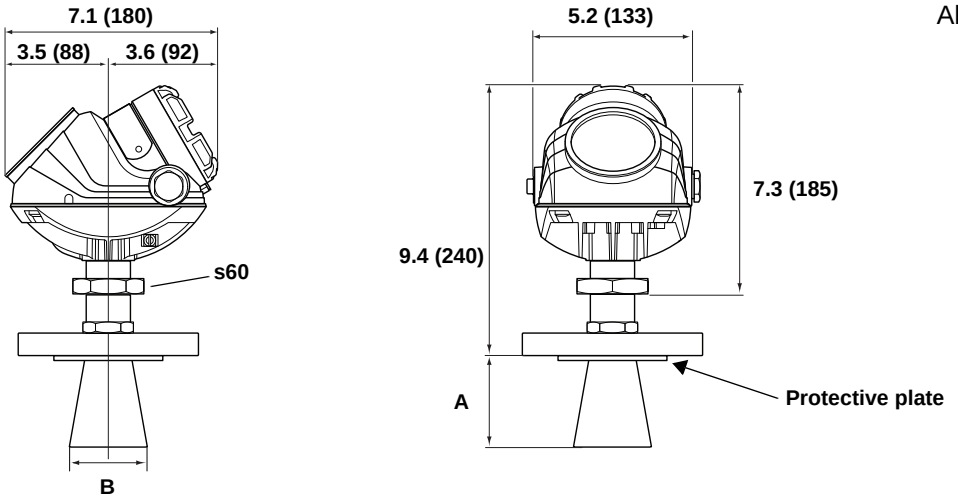
Max. nozzle height	A	Option Code
20 (500)	20.4 (518)	S3

(1) The extended cone antennas are available in 5-inch step increments from 10 to 50 inches. Consult your local Emerson Process Management representative for more information. Expect long lead times for other sizes than the 20 in. (500 mm) version.

Drawing: 9240030-970 (www.rosemount.com)

ROSEMOUNT 5402 AND 5401 WITH PROTECTIVE PLATE CONE ANTENNA (MODEL CODE: 2H-8H, 2M-8M, AND 2N-8N)

All dimensions are in inches (mm).



5402 Cone Antenna With Protective Plate

Cone size (inches)	A	B	Antenna Code
2	5.9 (150)	2.0 (50)	2H, 2M, 2N
3	6.9 (175)	2.6 (67)	3H, 3M, 3N
4	9.8 (250)	3.6 (92)	4H, 4M, 4N

5401 Cone Antenna With Protective Plate

Cone size (inches)	A	B	Antenna Code
3	3.3 (84)	2.6 (67)	3H, 3M, 3N
4	5.9 (150)	3.6 (92)	4H, 4M, 4N
6	7.3 (185)	5.5 (140)	6H, 6M, 6N
8	10.6 (270)	7.4 (188)	8H, 8M, 8N

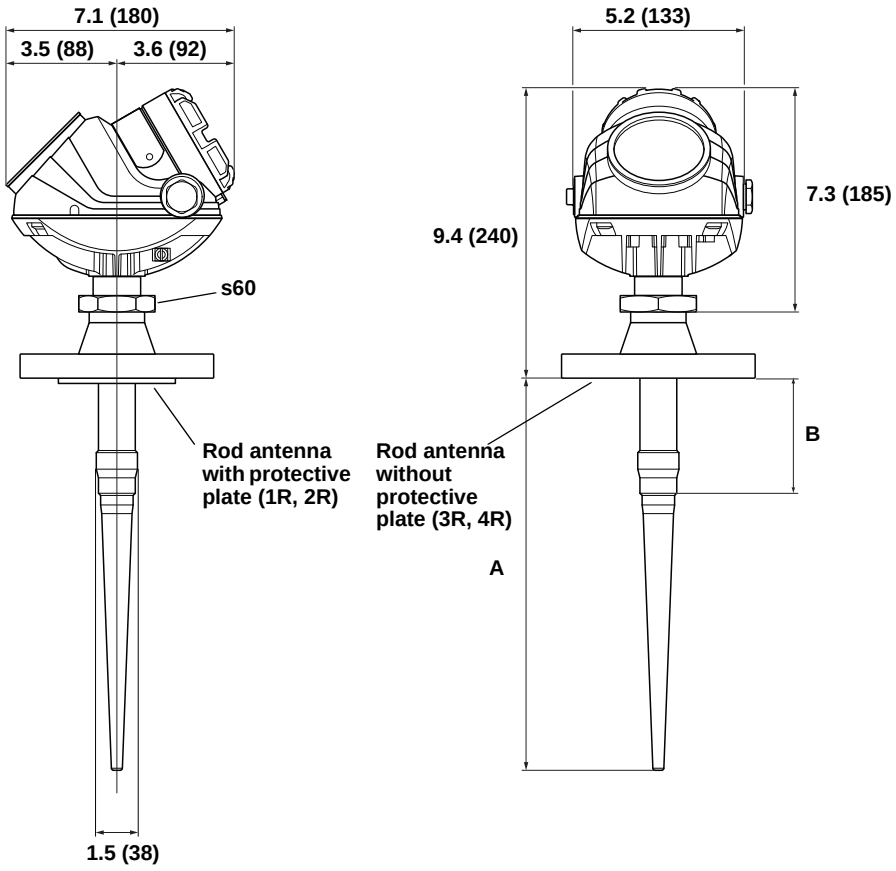
Process Connection Availability
● Available as standard
❍ Available as special, consult factory
– Not available

	Antenna Code				
Process Connection	**2H, 2M, 2N**	**3H, 3M, 3N**	**4H, 4M, 4N**	**6H, 6M, 6N**	**8H, 8M, 8N**
2 in. / DN 50 / 50A	●	❍	❍	❍	❍
3 in. / DN 80 / 80A	❍	●	❍	❍	❍
4 in. / DN 100 / 100A	❍	❍	●	❍	❍
6 in. / DN 150 / 150A	❍	❍	❍	●	❍
8 in. / DN 200 / 200A	❍	❍	❍	❍	●
Threaded Connection	-	-	-	-	-
Bracket Mounting	-	-	-	-	-

Drawing: 9240030-973 (www.rosemount.com)

ROSEMOUNT 5401 WITH ROD ANTENNA (MODEL CODE 1R-4R)

All dimensions are in inches (mm).



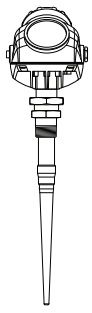
Rod	A	B[(1)]	Antenna Code
Short	14.4 (365)	4 (100)	1R, 3R
Long	20.3 (515)	10 (250)	2R, 4R

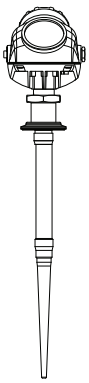
(1) The active part of the antenna must protrude into the tank. B is the maximum nozzle height.

Process Connection Availability
● Available as standard
❍ Available as special, consult factory
– Not available

	Antenna Code	
Process Connection	**1R, 2R**	**3R, 4R**
2 in. / DN 50 / 50A	●	●
3 in. / DN 80 / 80A	●	●
4 in. / DN 100 / 100A	●	●
6 in. / DN 150 / 150A	-	●
8 in. / DN 200 / 200A	❍	●
2 in. Tri-clamp	❍	●
3 in. Tri-clamp	❍	●
4 in. Tri-clamp	❍	●
Threaded Connection	-	●
Bracket Mounting	-	●

Threaded connection (RA) is available for rod antennas without protective plate (3R, 4R)



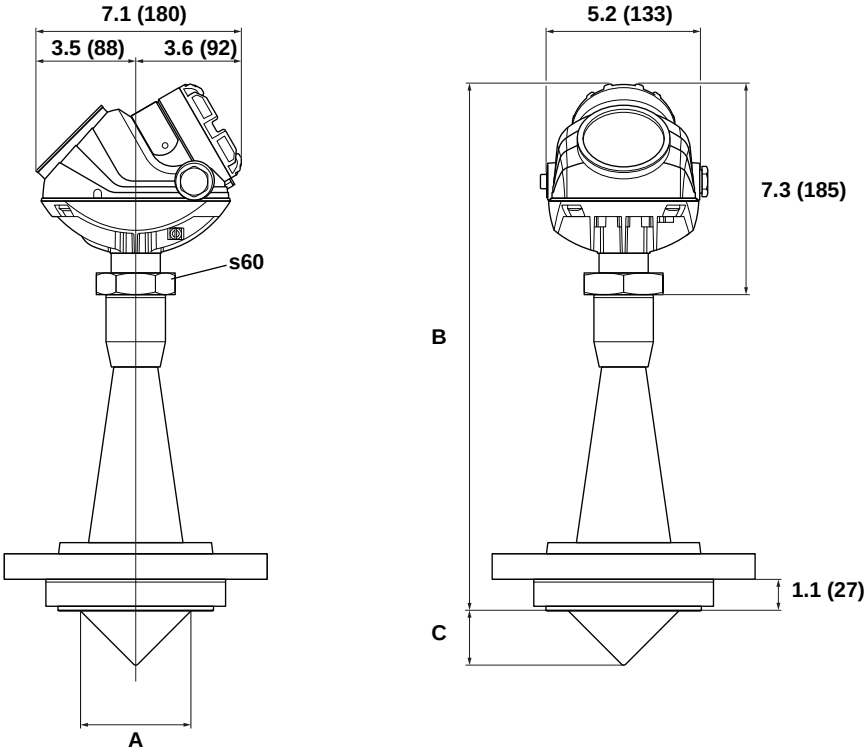


Tri-clamp connections (AT, BT, CT) are available for rod antennas without protective plate (3R, 4R)

Drawing: 9240030-977 (www.rosemount.com)

ROSEMOUNT 5402 WITH PROCESS SEAL ANTENNA (MODEL CODE 2P-4P)

All dimensions are in inches (mm).



Process Seal size (inches)	A	B	C	Antenna Code
2	1.8 (46)	14.2 (360)	0.9 (22)	2P
3	2.8 (72)	17.3 (440)	1.4 (35)	3P
4	3.8 (97)	18.9 (480)	1.9 (48)	4P

Process Connection Availability
● Available as standard
❍ Available as special, consult factory
– Not available

	Antenna Code		
Process Connection	**2P**	**3P**	**4P**
2 in. / DN 50 / 50A	●	-	-
3 in. / DN 80 / 80A	-	●	-
4 in. / DN 100 / 100A	-	-	●
6 in. / DN 150 / 150A	-	-	-
8 in. / DN 200 / 200A	-	-	-
Threaded Connection	-	-	-
Bracket Mounting	-	-	-

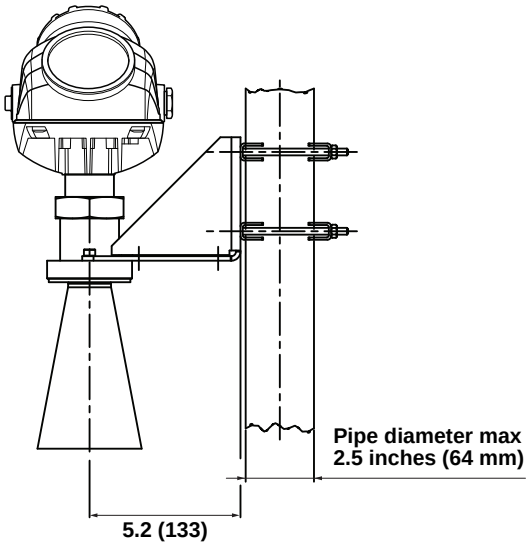
Drawing: 9240031-969 (www.rosemount.com)

PROCESS CONNECTIONS

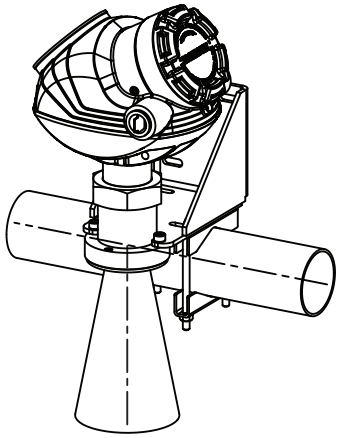
Bracket Mounting (model code BR)

Bracket mounting is available for Rosemount 5401 and 5402 with SST Cone Antenna (2S-8S) and Rosemount 5401 with Rod Antenna (3R-4R)

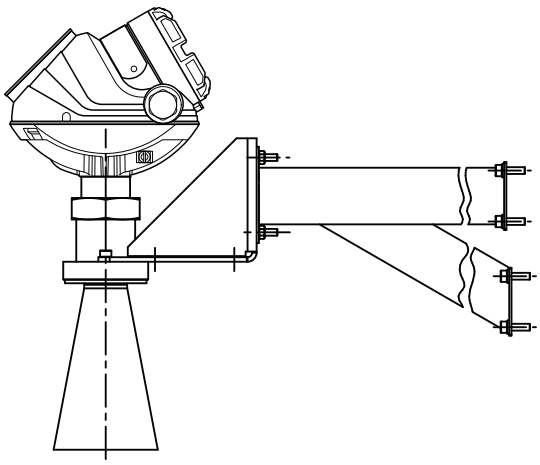
All dimensions are in inches (mm).



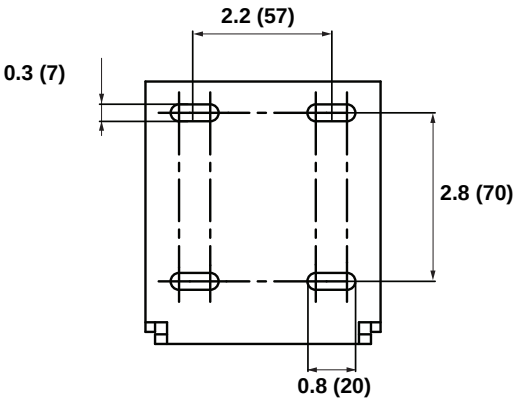
Pipe mounting (vertical pipe)



Pipe mounting (horizontal pipe)



Wall mounting

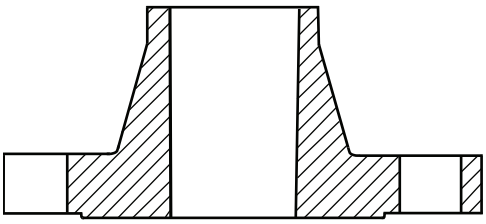


Hole pattern wall mounting

Drawing: 9240030-989 (www.rosemount.com)

Standard Flanges

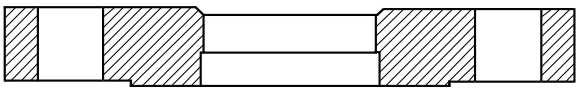
Cone and Rod Antennas (model code: 2S-8S and 1R-4R)



Designation	Mating Standard	Face Style(1)	Face Surface Finish	Material
ANSI	ASME B16.5	0.06 in. Raised Face	R_a = 125-250 µin	316 / 316L
EN (DIN)	EN 1092-1	2 mm Raised Face (Type B1)	R_a = 3.2-12.5 µm	EN 1.4404
JIS	JIS B2220	2 mm Raised Face	R_a = 3.2-6.3 µm	EN 1.4404

(1) Face gasket surface is serrated per mating standard.

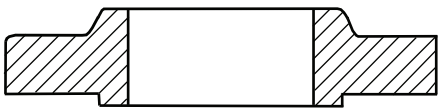
Cone Antennas with Protective Plate (model code: 2H-8H, 2M-8M, and 2N-8N)



Designation	Mating Standard	Face Style(1)	Face Surface Finish	Material
ANSI	ASME B16.5	0.06 in. Raised Face	R_a = 125-250 µin	316 / 316L
EN (DIN)	EN 1092-1	Flat Face (Type A)	R_a = 3.2-12.5 µm	EN 1.4404
JIS	JIS B2220	2 mm Raised Face	R_a = 3.2-6.3 µm	EN 1.4404

(1) Face gasket surface is serrated per mating standard.

Process Seal Antennas



Designation	Standard	Style	Material
ANSI	ASME B16.5	Slip-on	316 / 316L
EN (DIN)	EN 1092-1	Slip-on (Type 01)	EN 1.4404
JIS	JIS B2220	Slip-on plate (SOP)	EN 1.4404

Product Data Sheet
00813-0100-4026, Rev IA
March 2012

Rosemount 5400 Series

Rosemount Level Solutions

Emerson provides a complete range of Rosemount products for level measurement applications.

Vibrating Fork Switches – Point Level Detection

For high and low alarms, overfill protection, pump control, including wide pressure and temperature requirements, and hygienic applications. Flexible mounting. Immune to changing process conditions and suitable for most liquids.
The product line consists of:

- Rosemount 2160 Wireless
- Rosemount 2130 Enhanced
- Rosemount 2120 Full-featured
- Rosemount 2110 Compact

Ultrasonic – Level Measurement

Top mounted, non-contacting for simple tank and open-air process level measurements. Unaffected by fluid properties such as density, viscosity, dirty coating, and corrosiveness.

Intrinsically Safe versions are available for operating in hazardous areas.

- Rosemount 3100 Series Ultrasonic Level Transmitters
- Rosemount 3490 Series Universal Controllers

Pressure – Level or Interface Measurement

- Rosemount DP Level products are proven, reliable, and can be used in a variety of applications.
- Electronic Remote Sensors improve control on tall vessels and distillation towers
- Tuned-System Assemblies provide cost-efficient measurements and improved performance compared to traditional balanced systems
- 3051SAL, 3051L, and 2051L Level Transmitters combine world class pressure instrumentation with direct-mount seals
- 1199 Seal Systems enable measurements in broad range of process conditions and applications

Guided Wave Radar – Level and Interface Measurement

Multivariable, loop-powered Guided Wave Radar transmitters with a wide range of probe styles to fit different liquids and solids applications. The product line consists of:

- Rosemount 5300 Series – Accurate, superior performance transmitter with FOUNDATION™ fieldbus support
- Rosemount 3300 Series – Versatile and easy-to-use transmitter with proven reliability

Non-contacting Radar – Level Measurement

The Rosemount non-contacting radar family consists of:

- Rosemount 5400 Series Transmitters – Loop-powered superior performance transmitter with a wide range of antennas, for liquid level measurement in most applications and process conditions
- Rosemount 5600 Series Transmitters – Power of 4-wire give maximum sensitivity and performance for solids, challenging reactors, rapid level changes and excessive process conditions.

Chambers for Process Level Instrumentation

- Rosemount 9901 chambers for external mounting of process level measurement and control instrumentation on process vessels
- Global quality assured design and manufacturing
- Optimized for Rosemount 3300 and 5300 Series GWR

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