



The smart idea for optimised tank measurement.

The Honeywell Enraf SmartRadar FlexLine establishes new levels of precision and flexibility in tank inventory management. By combining wholly new software algorithms with Honeywell Enraf's internationally acclaimed planar antenna technology, SmartRadar FlexLine ensures the levels of precision demanded for custody transfer accuracy.

In the most challenging circumstances, like dome roofs and on bad stilling wells, the SmartRadar FlexLine maintains its ultra-high performance level. The Enhanced Performance Signal processing makes it possible to provide accurate level reading even when a free space antenna is installed close to the tank shell. With the OneWireless extension, Honeywell Enraf gauges use the OneWireless universal mesh network to seamlessly integrate any supervisory system such as Entis or Experion to optimise plant productivity and reliability, improve safety and security, and ensure regulatory compliance. The FlexLine is also approved by the TÜV to be used in SIL (Safety Integrity Level) rated loops. That means that the FlexLine can be used in overfill protection loops to prevent spillage.

Technical specifications

Measuring specifications

Measuring range	: up to 75 m (246 ft)
Instrument accuracy	: Xtreme Precision SmartRadar ± 0.4 mm (0.016") * : High Precision SmartRadar ± 1 mm (0.04") * : Advanced Precision SmartRadar ± 3 mm (0.12") *
Measuring resolution	: 0.1 mm (0.001 ft)

Principles

Measuring principle	: FMCW / Synthesized Pulse Reflectometer
Signal processing	: Enhanced Performance Signal processing (EPS)
Operating frequency	: Xband (9.538 GHz to 10.561 GHz) R&TTE, FCC compliant

Mechanical

Dimensions	: See drawing opposite
Weight	: 10 kg excluding antenna and separator
Cable entries	: 3/4" NPT or M20

Environmental

Ambient temperature	: -40 °C to +65 °C (-40 °F to +149 °F)
Storage temperature	: -50 °C to +75 °C (-58 °F to +167 °F)
Protection class	: IP66 / IP67 according to EN 60529 (NEMA 4X)
Safety	: Explosionproof <ul style="list-style-type: none">- ATEX II 1/2 G Ex d IIB T6 or Ex d [ia] IIB T6 or Ex de IIB T6 or Ex de [ia] IIB T6- IEC Ex Zone 0/1 Ex d IIB T6 or Ex d [ia] IIB T6 or Ex de IIB T6 or Ex de [ia] IIB T6- Class I, Division 1, Groups C and D, acc. to ANSI / NFPA 70 (FM, CSA)

Materials

Instrument unit housing	: Aluminum alloy according to EN1706
Instrument unit finish	: Hard anodising according to MIL A8625-E Type III
O-rings	: NBR 70

Electrical

Power supply	: autoselect 65 Vac to 240 Vac (+10 % to -15 %) 50 / 60 Hz autoselect 24 Vdc to 65 Vdc (+10 % to -15 %)
Power rating	: Typical 15 W max. 23 W with options

Safety & approvals

ATEX, CE, IECEx, OIML, CB Scheme, FM, CSA, FCC, API, NMi, TÜV certified Overfill Protection, DIBT Overfill Protection

Wireless communication

Wireless Communication	: 2,400 to 2,483.5 MHz (2.4 GHz) Industrial, Scientific and Medical (ISM) band Modulation: DSSS – Discrete Sequential Spread Spectrum per FCC 15.247 / IEEE802.15.4-2006
DSSS RF Transmitter Power	: NA Selection – 125 mW (20.9 dBm) maximum transmit power not including antenna per FCC/IC, or 400 mW (26.0 dBm) maximum EIRP including antenna for USA and Canadian locations EU Selection – 10 mW (10.0 dBm) maximum EIRP including antenna per RTTE/ETSI for EU locations
Signal Range Nominal	: Per FCC/IC 2800 m (9000 feet) Per RTTE/ETSI 600 m (1970 feet) between Field Transmitter and Infrastructure Unit (Multinode) or Gateway Unit when using 8 dBi Integral antenna with a clear line of sight

Options

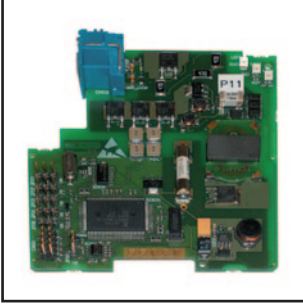
5 module slots available, for all type of interface solutions see next page

Note:

*) Under reference conditions

Options

Temperature and Water Level Measurement (FII-VT)



The heterogeneous thermal expansion and subsequent stratified temperature build-up in tanks of 5000 barrels and larger require an averaging of the vertical temperature to calculate the liquid's volume at reference conditions (15°C, 1 bar). As the vertical temperature gradient in tanks is rarely linear (differences of 5°C are considered common) the accuracy of the average temperature definition depends on the number of spot elements. Higher tanks as a result require more spot elements, not only to better define the total volume but also to more adequately compensate for tank storage side effects, such as tank shell temperature expansion and liquid in the vapor phase, as these become more evident in large storage tanks.

Honeywell Enraf offers a complete portfolio of Automatic Tank Thermometers (ATT) that provides an accurate average product temperature measurement and, as an option, vapor temperature measurement and/or a temperature profile. The Versatile In-tank Temperature Observer (VITO) portfolio consists of two types, comprising 16 or 9 elements, with or without water-bottom measurement. The 16 elements version is used for W&M approved average temperature measurement; the 9 elements version can be used in less demanding applications. Both product lines are fully compliant with industrial standards such as ISO and API.

The FII-VT option provides averaged and/or individual temperature and water-bottom readings for inventory management purposes. The intrinsically safe module provides immediate, fast and complex calculations and uses HART communication.

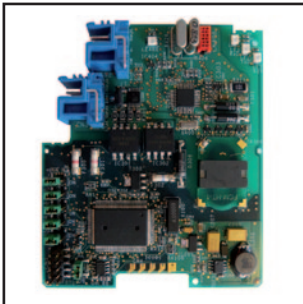
Benefits

- VITO exceeds Weight & Measures requirements and therefore guarantees cost efficiency
- Lower installed costs because of integrated water bottom measurement
- Integrated tank shell temperature, vapor phase temperature and profiling

Technical Specifications

Max. instruments per line	: 1
Communications	: Proprietary HART (Ex-i)
Cable characteristics	: 2 wire shielded 0.5 mm ²
Max. cable length	: Compliant to HART specifications

Spot Temperature Interface RTD (FII-RTD)



New to the SmartRadar FlexLine offering is the RTD temperature sensor support.

As all available options, this is an integrated solution where the sensors can be connected directly without interface equipment. The RTD offering is the most accurate temperature measurement available this option is fully W&M approved and conforms to the applicable API standards. The high diagnostic coverage allows automatic compensation in case one of the temperature sensors fails. The RTD interface in the FlexLine is compatible with all temperature sensors available on the market today. Up to 6 elements can be connected. Migration from existing level measurements to the FlexLine is easy, straightforward and cost effective.

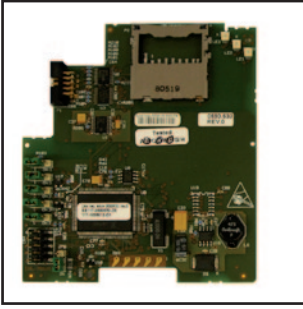
Benefits

- Lower installed cost: does not require additional interfacing equipment
- Integrated diagnostics allow automatic compensation if one spot fails
- Compatible with all temperature sensors available

Technical Specifications

Cable characteristics	: Shielded Rmax = 100 Ω / line
Max. cable length	: 150 meter

Wireless Connectivity (HCI-1WL)



The Honeywell Enraf FlexLine establishes new levels of precision and flexibility in tank inventory management. By combining wholly new software algorithms with Honeywell Enraf's internationally acclaimed planar antenna technology, FlexLine ensures the levels of precision demanded for custody transfer accuracy. In the most challenging circumstances, like dome roofs and on bad stilling wells, the SmartRadar FlexLine maintains its ultra-high performance level. The Enhanced Performance Signal processing makes it possible to provide accurate level reading even when a free space antenna is installed close to the tank shell. With the OneWireless extension, Honeywell Enraf gauges use the OneWireless universal mesh network, to seamlessly integrate with any supervisory system such as Entis or Experion. OneWireless helps optimize plant productivity and reliability, improve safety and security, and ensure regulatory compliance. The FlexLine integrated with the OneWireless is simple to manage and efficient to operate.

Benefits

- Slash installation cost by 50% or more through wireless connectivity
- Improve measurement accuracy by inexpensively migrating to high-precision radar measurements
- Reduce operational costs by integrating wired and wireless devices in the same tank management software

Technical Specification

Frequency Band : 2,400 to 2,483.5 MHz (2.4 GHz) Industrial, Scientific and Medical (ISM) band,
DSSS Modulation – per FCC 15.247 / IEEE 802.15.4–2006

Connectivity

Publication data : Level and temperature data block.
Publish Cycle Time : Configurable as 1, 5, 10 or 30 seconds
Protocol Tunnels : GPU and FlexConn protocol

Transmitter power

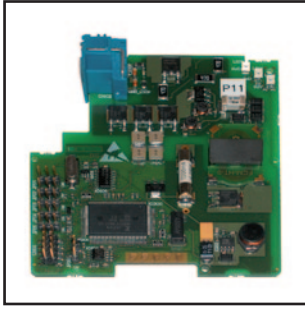
NA : 100 mW (20 dBm) maximum transmit power not including antenna per FCC/IC,
or 36.0 dBm maximum EIRP including antenna for USA and Canada
EU : 10 mW (10.0 dBm) maximum EIRP including antenna per RTTE/ETSI

Antennas

Integral : 4 dBi omnidirectional monopole with lightning surge arrestor – 8 dBi omni-directional
monopole with lightning surge arrestor
Remote : – 8 dBi omnidirectional monopole with cable and lightning surge arrestor
Surge Arrestor : Gas tube element breakdown voltage: 90V +/- 20%,
Impulse breakdown voltage : 1000V +/- 20%. Maximum withstand current 5 KA

HART and Analog Input Connectivity (FCI-HT)

Master



HART is widely recognized as the industry standard for digitally enhanced 4-20mA instrument communication. It enables digital communication while maintaining the integrity of the 4 to 20 mA signal and results in the availability of information beyond the normal variable (PV) communicated. Hydrostatic Tank Gauging and Hybrid Inventory Measuring Systems, based on density in combination with level measurement for accurate inventory determination, comprise HART capable (spot) temperature and pressure transmitters. Water bottom detection is one of the other alternative examples of HART communication.

The FCI-HT module is a HART master module that can be installed inside the FlexLine and supports all HART capable device.

Benefits

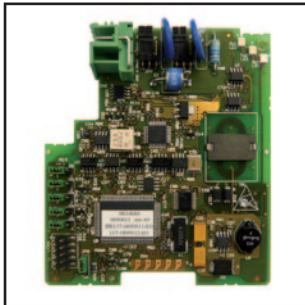
- Allows further inventory optimization by integration of temperature and pressure measurements
- Multiple HART devices and modules can be installed into one FlexLine gauge
- Can be used as data-concentrator for other measurements such as roof tilt indication, (rim) fire detection, ambient temperature measurement, floating roof compensation, etc.

Technical Specification

Max. instruments per line	: 5 (digital), 1 (analog)
Communications	: HART (Ex-i)
Cable characteristics	: Shielded, twisted pair
Cable length	: Compliant to HART specifications

HART and Analog Output Connectivity (HCI-HAO)

Slave



The FlexLine series is now available as a HART compatible device. This allows the FlexLine to be connected to any operational interface or other device that supports HART. All level information, parameters and diagnostics can be transferred to the operator HMI via this interface stack. The HART information can also be routed via the OneWireless infrastructure. Due to the modular architecture of the FlexLine, multiple HART interfaces can be integrated into one gauge.

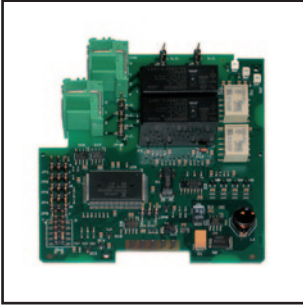
Benefits

- Lower installed cost
 - Multiple supervisory systems can connect up to one FlexLine
 - Connection to any HART capable HMI
 - Installed next to regular BPM communication

Technical Specification

Communications	: HART
Cable characteristics	: Shielded, twisted pair
Cable length	: Compliant to HART specifications

Alarm and Overfill Digital Outputs (FII-DO)



Digital outputs are typically used to provide on/off control for valves, dampers, motors, pumps and external signaling devices, such as alarm bells and indicator lights. The most common devices associated with digital outputs are relays, contactors, starters and two-position actuators. The FII-DO module provides multiple relay contacts that can be controlled remotely or switched automatically and linked to any software property available setting in the FlexLine. When any of the primary values (level) or secondary values (product level, water level, product temperature, density, vapor pressure etc.) reaches a certain configured value, the digital outputs can be activated or deactivated. All contact outputs thereby provide automatic read-back functionality for higher safety and increased diagnostics. The FII-DO provides 4 Single Pole Single Throw (SPST) relays that can be manually set to normally open or normally closed. All 4 relays have been certified by the TÜV. Due to the modular architecture of the FlexLine, multiple digital output modules can be integrated into one gauge.

SIL-2

FlexLine is approved by the TÜV to be used in SIL (Safety Integrity Level) rated loops. That means that the FlexLine can be used in overfill protection loops to prevent spillage. FlexLine gauge has a SFF (Safe Failure Fraction) > 90% which allows it to be used in SIL-2 safety loops. Diagnostics within the gauge have improved such that the safety proof-test interval can be extended to 5 years. This will bring down the operational cost. On top of that, the safety function in the gauge makes use of dual redundancy which will automatically detect failures in the safety circuitry, report those failures, but still allows the gauge to continue to function as a safety device without interrupting the process. This allows for a higher availability compared with competitive offerings. The SIL-2 option is only available when the FII-DO is used in redundant module configuration.

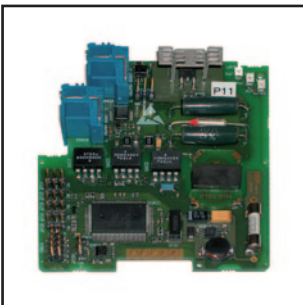
Benefits

- Approved by TÜV to be used in SIL-2 rated loops; SIL-3 if used in redundant Radar configuration
- Proof test interval of 5 years to reduce operational cost
- Dual redundant module configuration increases safety as well as availability
- Ultimate the flexibility: any radar measurement can be used to trigger external devices

Technical Specification

Relays	: 4 SPST contacts, NC or NO function selectable (default NO)
Relay 1&2	: Rated 0.5 A at 125 Vac or 0.3 A at 110 Vdc Pmax = 30 W
Relay 3&4	: Rated 3 A at 250 Vac or 3 A at 40 Vdc Pmax = 750 W
Time delay	: 5 to 10 ms duration

Remote and Integrated Display Connection to SmartView (FII-SMV)



Honeywell Enraf offers the SmartView LCD display interface as a standalone and integrated solution to its field instrumentation portfolio. The SmartView can be used to configure, monitor and trouble-shoot the FlexLine radar family.

FlexLine data as well as inventory related information is available with a maximum distance of 50 m from the instrument. Irrespective of the position of the interface the SmartView offers consistency, simplicity and direct access to last measured values, 24 hour trending, device and commissioning status, etc. The FII-SMV module enables the connection of a local or remote SmartView to any FlexLine in the facility. The special connection enables hot plug in hazardous areas.

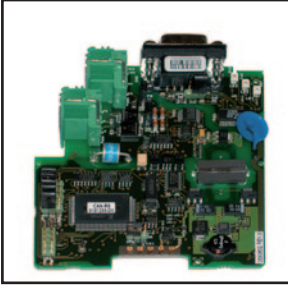
Benefits

- Standalone as well as integrated display
- One display can be used for multiple gauges and is hot pluggable
- Can be installed up to 250 m from actual instrument

Technical Specification

Max. displays that can be connected	: 2	Baudrate	: min 19200 bps
Communications	: isolated RS-485 port, propriety protocol (Ex-i)	Cable characteristics	: 4 wire shielded 0.5 mm2
		Max. cable length	: up to 250 m
		Power out display	: 9.4 Vdc (Ex-i)

Serial Host Communication Interface (HCI-GPU)



The HCI-GPU can be used in any field device provided with the FlexConn architecture such as the FlexLine and enables communications through the RS-232/485 physical layers. RS-232 is often used for direct point-to-point connection whereas RS-485 facilitates a multi-point network with up to 32 connected devices on a 2-wire or 4-wire bus. Used communication protocols are Modbus or the Gauge Processing Unit (GPU) protocol. GPU has become the standard in terminal automation. Both protocols are used to get data from the field instrumentation to supervisory level. The GPU protocol is unique because it is W&M approved, has error recovery mechanism and can be used for long distances. The advantages of using HCI-GPU board are:

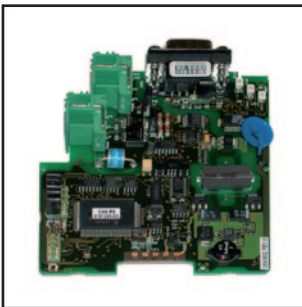
- Communication can be redundant for higher integrity and availability
- Can be used dual redundant with other communication protocols such as wireless, BPM or HART
- Short refresh rate (< 1 second) allowing more connected devices
- RS-485 can cover long distances and reduces the cost of infrastructure
- Modbus and GPU are open protocols and widely accepted
- Backwards compatible with Honeywell Enraf equipment
- Further enhances the data concentrator role to pass all tank related measurements to the operational level.
- It supports the automatic proof test which will increase the safety of a tank
- Unique protocol switch that allows 2 different protocols on one physical link
- W&M approved

Technical Specification

Connectivity : RS-232 (isolated & non isolated)
Max. instruments per line : 1, point to point
Baudrate : 1200, 2400, 4800, 9600, 19200, 38400bps, 56 Kbps, 115 Kbps, configurable by software
Cable Characteristics : Shielded / twisted pair
Max. cable length : 15 m
Protocol : GPU and Modbus

Connectivity : RS-485 (isolated)
Max. instruments per line : 32, multi point
Baudrate : 1200, 2400, 4800, 9600, 19200, 38400bps, 56 Kbps, 115 Kbps, configurable by software
Cable Characteristics : Shielded + twisted pair + signal ground, R 0.12 Ω / line, C 119 pF/m, L 1.45 mH
Max. cable length : 1200 m
Protocol : GPU and Modbus

Bi-Phase Mark Host Communication Interface (HCI-BPM)



Bi-Phase Mark (BPM) is the current industry standard in terminal automation systems. It allows for cable lengths up to 10 kilometer (6 miles), can run over existing infrastructure, and only needs 2-wires and can connect up to 15 devices per fieldbus. Bi-Phase Mark (BPM) has been applied in many installations world wide for data transmission between various instruments and Communication Interface Units (CIU). Honeywell Enraf offers BPM through a specially developed isolation transformer that is employed on both ends of the communication line, therefore no additional lightning protection is needed as this has been embedded in the design. The Honeywell Enraf HCI-BPM can be installed in any field device that uses the FlexConn architecture such as the FlexLine.

Benefits

- Can use existing infra structure
- Robust
- Defacto standard in terminal automation

Technical Specification

Max. instruments per BPM line : 10 - 15
Baudrate : 1200, 2400 bps
Cable characteristics : twisted, Rmax 200 Ω / line, Cmax 1 μ F
Max. cable length : 10 km
Protocol : proprietary GPU

Identification code

Pos 1 Device selection		No. of terminals i.s.	No. of terminals non i.s.	No. of Slots
R	SmartRadar FlexLine			1
Pos 2 Type of gauge				
X	Xtreme Performance, W&M type approved with factory calibration report and sealing facilities ⁴⁾			
Y	Xtreme Performance, W&M type approved			
H	High Performance, for custody transfer acc. to OIML R85, API 3.1B and ISO 4266			
I	High Performance, for custody transfer acc. to OIML R85, API 3.1B and ISO 4266 with factory calibration report			
A	Advanced Performance, for inventory control acc. to API 3.1B and ISO 4266			
U	Advanced Performance, for inventory control acc. to API 3.1B and ISO 4266 with factory calibration report			
Pos 3 Display				
I	Including integrated SmartView display			1
V	With IS terminal for connecting stand alone SmartView	4		1
B	With integrated SmartView display and IS terminal for connecting stand alone SmartView	4		1
Z	No display			1
Pos 4 Data transmission				
B	Enraf Fieldbus Bi-Phase Mark (BPM), GPU protocol		2	1
G	RS-232, GPU / Modbus protocol		3	1
H	Combined HART and 4-20 mA output		2	1
1	One Wireless (this option board uses two slots on the CAN bus) ⁵⁾		0	2
W	RS-485, GPU / Modbus protocol		3	1
Pos 5 I/O Options				
-	None			0
V	VITO temp. and/or water sensor interface	2		1
Q	HART input for HART communications	2		1
R	HART input for HART communications + HTMS (HIMS) density calculations	2		1
C	Hardware alarms (SPDT NO/NC) contact outputs (2x) 125 Vac, 0.5 A (110 Vdc, 0.3A)		4	1
N	Hardware alarms (SPDT NO/NC) contact outputs (2x) 250 Vac, 3 A (40 Vdc, 3A)		4	1
O	Hardware alarms (SPDT NO/NC) contact outputs (4x) combination of options C and N		8	1
S	RTD one spot element 3-wire	3		1
T	RTD one spot element 4-wire	4		1
U	RTD two spot elements 3-wire	6		1
X	RTD two spot elements 4-wire	8		1
2	RTD 2 elements MRT / MPT	4		1
3	RTD 3 elements MRT / MPT	5		1
4	RTD 4 elements MRT / MPT	6		1
5	RTD 5 elements MRT / MPT	7		1
6	RTD 6 elements MRT / MPT	8		1
Z	SIL compliance (this option board uses two slots on the CAN bus)		2	2
Pos 6, 7, 8 Additional Data transmission and/or I/O Options				
	Select code from Pos. 4 and 5	Total:	*)	**)
	Select code from Pos. 5 ¹⁾ ²⁾ ⁶⁾			***)
	Select code from Pos. 5 ¹⁾ ³⁾ ⁶⁾			
Pos 9 Safety approvals				
A	ATEX / IEC Ex	Europe		
F	FM (only if pos. 10=C or M)	USA		
C	CSA	Canada		
I	INMETRO	Brazil		
Pos 10 Cable entries				
S	Ex e terminal compartment with 4 cable entries (4xM20) (only if Pos 9 = A, C or I)			
E	Ex e terminal compartment extended to 6 cable entries (6xM20) (only if Pos 9 = A, C or I)			
C	3x 3/4" NPT (Compound cable glands required)			
M	2x M20			
Pos 11, 12, 13 Radar Process Antenna version				
F	0 8	8" PAT, Free space		
W	0 6	6" x 12" WALP, Free space	(only if Pos 2 = A or U)	
T	0 6	6" x 12" Hinged WALP, Free space	(only if Pos 2 = A or U)	
D	0 4	RoD, Free space	(only if Pos 2 = A or U)	
S	0 6	6" PAT, Stilling well		
S	0 8	8" PAT, Stilling well		
S	1 0	10" PAT, Stilling well		
S	1 2	12" PAT, Stilling well		
H	0 4	4" Horn, High pressure		
Pos 14, 15 Stem length / Application type				
x	x	0 mm (only if Pos 11 = D)		
0	5	50 mm (Not if Pos 11 = D, H, W or T)		
3	0	300 mm (Not if Pos 11 = D or H)		
5	0	500 mm (Not if Pos 11 = D or H)		
8	0	800 mm (Not if Pos 11 = D or H)		
B	1	Installation on 6" 300 lbs nozzle with 4" Schedule 10 stilling well (only if Pos 11 = H)		
B	4	Installation on 4" 300 lbs full bore ball valve (only if Pos 11 = H)		
N	1	Installation on 6" 300 lbs nozzle with 4" Schedule 10 stilling well including 1" full bore ball valve (only if Pos 11 = H)		
N	4	Installation on 4" 300 lbs Schedule 40 nozzle including 1" full bore ball valve (only if Pos 11 = H)		
Pos 16 OneWireless Communication Antenna				
-		None (not if Pos 4, 6=1)		
A		4 dBi antenna (only if Pos 4, 6 = 1)		
B		8 dBi antenna (only if Pos 4, 6 = 1)		
Pos 17 Tag plate				
Z		No tag plate		
T		Tag plate (Material: CuNi alloy)		

R	X	I	B	V	-	-	-	A	S	F	0	8	3	0	A	Z
R																

Typical identification code
Your identification code

Notes:

Green marked positions : express delivery
 Blue marked positions : normal delivery
 For delivery times please contact your local sales office

^{*)} Maximum sum of i.s. terminals is 10

^{**)} Maximum sum of non-i.s. terminals is 15

^{***)} Maximum number of slots = 7

¹⁾ Max. 2 identical I/O options

²⁾ Not available if SIL compliance and One Wireless is selected

³⁾ Not available if SIL compliance or One Wireless is selected

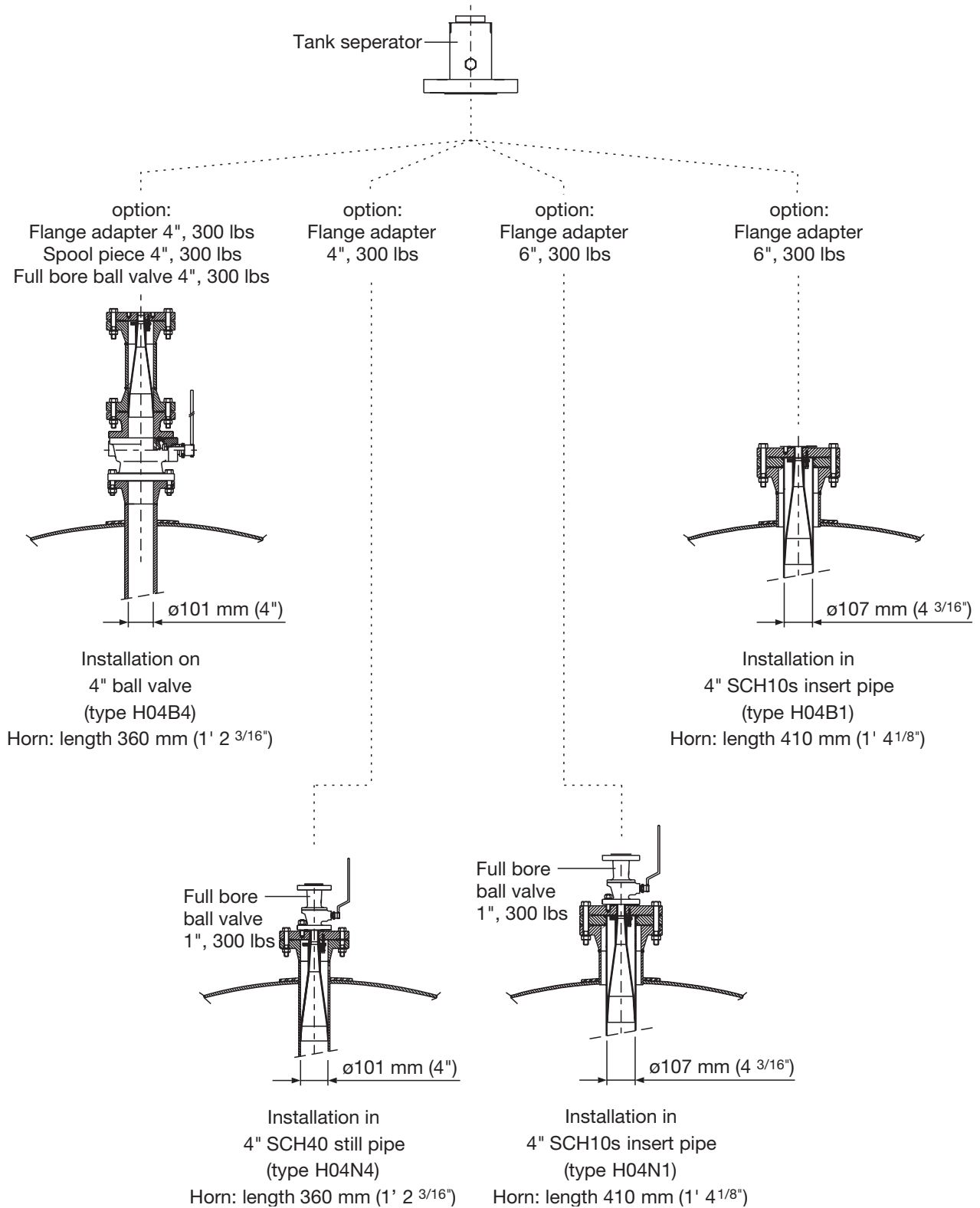
⁴⁾ For witnessed verification specify authority; for more information please contact factory

⁵⁾ Please make sure the wireless FlexLine complies to local radio regulations

⁶⁾ If additional data transmission options are needed please consult factory

Installation drawings

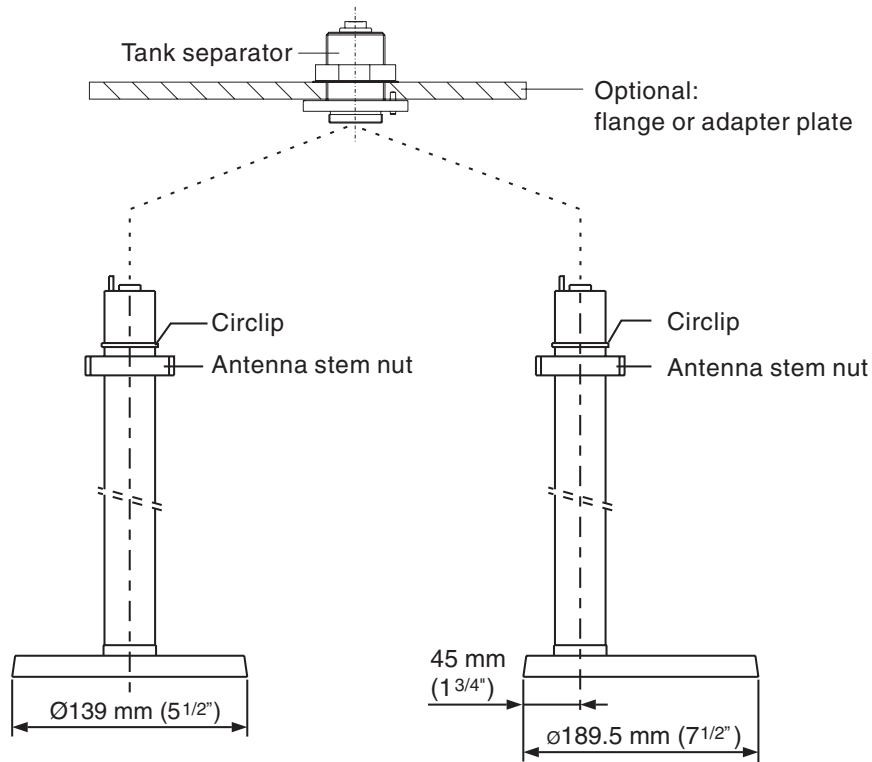
High pressure cone type H04



High pressure cone type H04

Measuring range	: Up to 75 m (246 ft)
Temperature range	: -200 °C to +250 °C (-330 °F to +482 °F)
Operating pressure	: Up to 40 bar / 4 MPa (580 psi)
Wetted parts	: AISI 316, PTFE and CF8M for optional ball valve

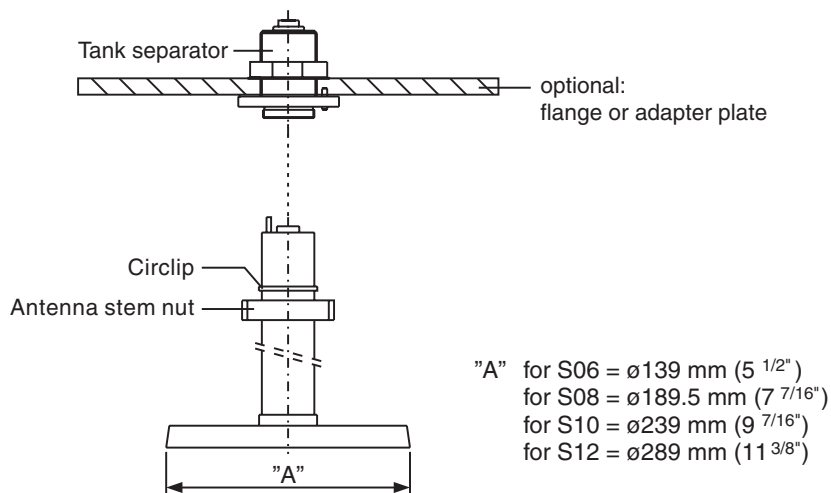
Free space type F06 and F08



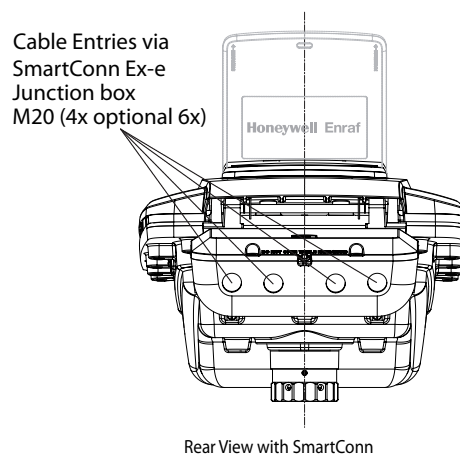
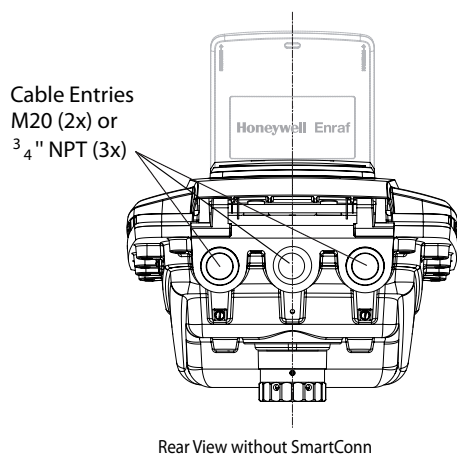
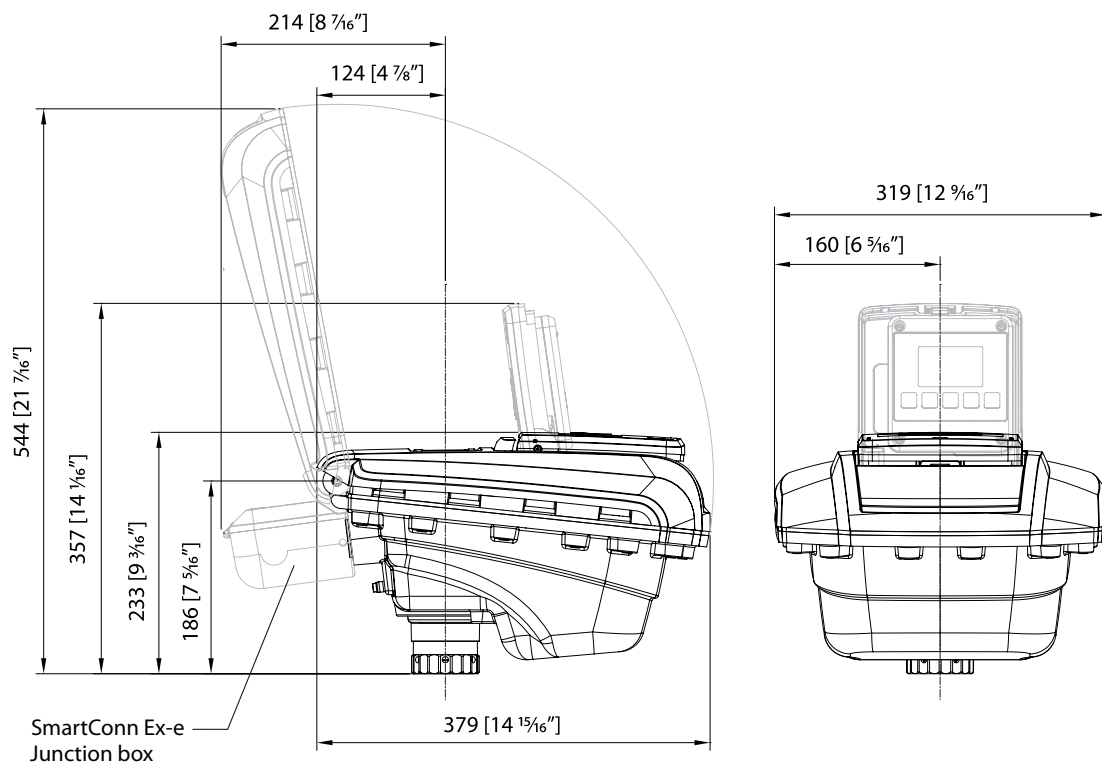
Free space types F06, F08 & Still pipe types S06, S08, S10 and S12

- Measuring range : Up to 75 m (246 ft)
- Temperature range : -40 °C to +100 °C (-40 °F to +212 °F)
- Operating pressure : Up to 6 bar / 0.6 MPa (87 psi)
- Wetted parts : AISI 316 and FEP

Still pipe types S06, S08, S10 and S12



Dimensional drawing



Dimensions in mm / inches

For More Information

To learn more about Honeywell Enraf's solutions, contact your Honeywell Enraf account manager or visit www.honeywellenraf.com.

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