ENRAF
SMART SERVO 954

Industry's Best Servo Gauge Is Now Even Better

Honeywell

INTRODUCING THE SMART SERVO 954

Honeywell Enraf has ensured that the industry's best tank gauging solution is now even better. Designed for measuring varied liquids in any type of storage tank, our new Smart Servo 954 is a reliable, versatile and accurate automatic tank gauge. This instrument advances the art of tank gauging by combining proven technology with enhanced electronics and software, as well as increased intelligence. And, it stands up to the most demanding process conditions.

THE INNOVATIVE DESIGN OF THE SMART SERVO 954 INCORPORATES:

- Patented algorithms for greater precision in all applications
- Adaptive dynamic compensations to improve measurement under adverse conditions
- Unique force transducer technology to optimize stable operation
- Advanced drum calibration for guaranteed accuracy
- "SIL-by-design" features with unique diagnostics for reliable operation (IEC 61508)
- Separate terminal compartment for ease of wiring
- Safety approvals and certifications from legal metrology institutes worldwide
  - NMi approvals
  - OIML R85 and varied liquids compliance

State-of-the-art Features

The Smart Servo 954 was designed to incorporate a host of innovative, best-in-class features.

For example, its unique, fully capable software supports diagnostics on SIL-rated loops. An option slot for additional functionalities allows the connection of temperature measuring elements for spot/average product and vapor phase temperature, as well as product temperature profiles.

The new gauge is equipped with a Servo Auto Test feature, which increases safety, integrity and diagnostic coverage, and enables usage in overfill protection loops. It can be included in SIL-2 safety loops, and if used in a redundant configuration, is suitable for SIL-3-rated loops.

A FLEXIBLE AND ADAPTABLE SOLUTION

Honeywell Enraf servo gauging systems provide a flexible and adaptable solution for a wide range of terminal operations. They are suitable for:

- Product and gas temperature with spot or average temperature measurement, or temperature profiling
- Product level
- Interface level
- Density measurement and profiling
- Direct water bottom measurement or via capacitive probes
- Average continuous density monitoring connecting one or more HART pressure transmitters
- TUV SIL certified NO/NC alarm relay contact and/or 4-20mA Analog output for direct connection to Safety or Distributed control system
- Easy integration with Honeywell Experion DCS system & Safety Manager ESD system
- Measurement ranges up to 150 m
- Working pressure up to 40 bar

BENEFITS TO YOUR BOTTOM LINE

Honeywell Enraf Smart Servo 954 is the most reliable, versatile and accurate automatic tank gauge available.

- Accurate measurement in liquids including vaporized applications
- Improve reliability under dynamic conditions
- Maximize storage capacity with lowest safety diagnostic cycle time
- Enhanced safety with SIL certified AO/DO options for overfill prevention
- Modular design for ease of maintenance
- Simple & cost effective migrations for legacy & 3rd party gauge
- One stop integrated gauging solution for all your terminal needs

Technical Specifications

DATA COMMUNICATION

Honeywell Bi-phase mark (Pos 7 = B)	
Baud rate	1200 / 2400 bps
Cable characteristics	2 wires, twisted pair, Rmax = 200 Ohm / line, Cmax = 1uF; cable length: 10 km (6 miles) or more *1
Isolation voltage	> 1,500 V
Lightning protection	Full galvanic separation via isolating transformers
Protocol	Standard Honeywell fieldbus (Serial, ASCII, GPU protocol)
Common mode rejection	> 150 dB
TRL/2 Communication Protocol TRL/2 Communication Protocol TRL/2 Communication Protocol (Pos 7 = T)	
Protocol	Modbus RTU; Communication: TRL/2 100/90 KHz FSK
Baud rate	4800, 8 bits and 1 stop bit.
Lightning protection	Opto-isolators
Cabling	18 AWG (minimum) with shielded twisted pair, max 4 km with max 8 multi drop Gauge connections
Physical layer	Logic 1 is represented by 100kHz and Logic 0 by 90khz:(+/-3%)
Voltage levels	3.6V +/- 10%.
Power rating	At 12V Nominal current drawn by TRL/2 module alone is 40mA (+/- 10%), [power consumption is 480mW (+/- 10%)]. The worst case current/power drawn with below mentioned conditions is 60mA.
HART® Slave – Multidrop and/or 4-20 mA (Pos 7 = H)	
Protocol	Communications: HART® 7
Analog output loop (non-I.S.)	Active or Passive; selectable by jumper – Active: output voltage: 20V ±5% – Passive: minimum external supply voltage: 11.5 V maximum external supply voltage: 30 V (55 V with serial resistor)
Accuracy	±0.1% of actual measurement
Cable characteristics	2 wires, shielded, twisted pair

ALARM CONTACT OPTIONS

Hardware alarms (1x SPDT)	250 VAC, 2 A (40 VDC, 2 A)
Hardware alarms (2x SPDT)	250 VAC, 2 A (40 VDC, 2 A
Relay operation	– Normally Open/Normally Closed contact: selectable by jumper – Normally Energized / Normally De-energized: configurable by software setting – PV Monitor (any of the measured parameters, configurable by software setting) – Remote control (configurable by software setting)

SIL 2/3 SAFETY FUNCTIONS ALARM CONTACTS OPTIONS

SIL Digital Output	1 x SIL DO contact (1 x SPDT contact, 2 A at 250 Vac or 2 A at 40 Vdc, Pmax = 500 W) 2 x SIL DO contact (2 x SPDT contact, 2 A at 250 Vac or 2 A at 40 Vdc, Pmax = 500 W)
SIL Analog Output	SIL AO NAMUR NE43 compliant
SIL Digital Output + Analog Output	SIL AO + 1 SIL DO contact NAMUR NE43 compliant (1 x SPDT contact, 2 A at 250 Vac or 2 A at 40 Vdc, Pmax = 500 W) SIL AO + 2 SIL DO contacts NAMUR NE43 compliant (2 x SPDT contact, 2 A at 250 Vac or 2 A at 40 Vdc, Pmax = 500 W)

Continued....

Notes:

HART® is a registered trademark of the HART Communications Foundation.

*1 Distances of more than 10 km possible depending on amount of field instruments and cabling topology.

*2 Under reference conditions.

*3 With VITO temperature probe or Spot (PT100).

*4 Various generally available types of elements (RTD, MRT) can be selected.

*5 Under reference conditions

*6 Minimum product density between layers: 100 kg/m3 (6.25 lb/ft3)

*7 In extreme environments the accuracy could be affected depending on the thermal expansion coefficient of the wetted parts.

Technical Specifications (continued)

INPUT

VITO Input for Temperature and Water Probe	
Communications	Proprietary HART® (Ex-i
Cable characteristics	2 wires, shielded, twisted pair, Cmax = 1 µF, Lmax = 9 mH, Rmax = 25 Ω / line
Accuracy	– Temperature measurement: ±0.1 °C (±0.18 °F) *2, *3 – Water level measurement: ±2 mm (0.078") *3
Resolution	– Temperature measurement: 0.01 °C (0.01 °F) – Water level measurement: 0.1 mm (0.01")
Spot RTD Input	
Configurations	– 3 wire or 4 wire RTD, one element or two elements *4 – MPT or MRT up to 6 elements with 2 common ground wires *4
Cable characteristics	Shielded, Rmax = 100 Ω / line, Cmax = 1 µF, Lmax = 10.5 mH
Accuracy	±0.1 °C (±0.18 °F)
Resolution	0.01 °C (0.01 °F)
HART® Input	
Configurations	Options – 5 HART® inputs and / or HIMS density calculation – VITO sensors and / or 3 HART® inputs – 3 HART® input, HIMS density calculation and VITO sensors
Max. instruments per module	5 (digital) or 1 (analog)
Communications	HART® (revision 4)
Cable characteristics	2 wires, shielded, twisted pair, Cmax = 1 µF, Lmax = 9 mH, Rmax = 25 Ω / line
Other Options	
Cable entries	Adapters available to fit other sizes cable glands

INSTRUMENT MEASURING SPECIFICATION

Level measuring range	
Standard	27 m (88 ft) Pos 18 = A, B, C
Extended	37 m (121 ft) Pos 18 = E, F 40 m (131 ft) Pos 18 = H, 45 m (147 ft) Pos 18 = K, 35 m (115 ft) (with measuring wire up to 150 m (492 ft)) Pos 18 = M; For longer ranges, please contact factory
Measuring accuracy level	40 m (131.2 ft): < ± 0.4 mm (± 0.016") *5; 40 m (131.2 ft): OIML R85 certified (Pos 5 = X); 45 meter with +- 1 mm accuracy last 35 meter with +- 1 mm accuracy on 150 m wire
Measuring accuracy interface	< ± 2 mm (± 0.08") *6
Measuring accuracy temperature	< ± 0.1 °C (± 0.18 °F) *5
Sensitivity	≤ 0.1 mm (± 0.004") *5
Repeatability	≤ 0.1 mm (± 0.004") *5
Density Measurement	
Density measurement	With density firmware (Pos 20 = D and density displacer (Pos 19 - E or F)
Measuring accuracy servo density	< ± 3 kg/m3 (± 0.19 lb/ft3)

MECHANICAL

Flange	See 'Identification Code' Pos 14-16
Dimensions	See 'Dimensional Drawing'
Weight	
Medium pressure version	16 kg (35 lb)
Chemical version	21 kg (46 lb)
High pressure version	26 kg (57 lb)
Cable entries	4 x ¾" NPT threaded (2* I.S. + 2* non-I.S.)

Technical Specifications (continued)

PROCESS

Operating pressure	
M and C versions	Up to 6 bar / 0.6 MPa (90 psi); Pos 14
H version	Up to 40 bar / 4 MPa (600 psi) (up to 25 bar / 2.5 MPa in acc. to PED); Pos 14
Temperature	
Max. process temperature	+200 °C (+392 °F), drum housing must be kept below +65 °C (+149 °F) *7
Min. process temperature	-200 °C (-328 °F), drum housing must be kept above -40 °C (-40 °F) *7

PROCESS WETTED MATERIALS

Drum compartment	Cast aluminum Int. reg. AA A356 EN1706 AC-AlSi7Mg0.3; Pos 14 = A or M
	Stainless steel ASTM A351, CF-8M, G-X6 CrNiMo 18 10 (1.4408); Pos 14 = H or C
Measuring drum, drum shaft	Stainless steel (1.4401) EN10088 AISI 316
Measuring wire	See 'Identification Code'; Pos 18
Magnet cap	Stainless steel (1.4401) EN10088 AISI 316
O-rings	Drum cover Silicone/FEP; others FPN (Viton®); Special O-ring (Perlas®) available for demanding chemical applications (such as Ammonia), part nr. S0854969

ENCLOSURE MATERIALS

Servo comp. and cover	All types cast aluminum Int. reg. AA A356 EN1706 AC-AlSi7Mg0.3
Finish aluminum parts	Conforms to MIL-DTL-5541F

ENVIRONMENTAL SAFETY

Ambient temperature	-40 °C to +65 °C (-40 °F to +149 °F)
Storage temperature	-50 °C to +70 °C (-58 °F to +158 °F)
Protection class	IP66 / IP67 accordingto EN 60529 (NEMA 4X)
Safety	Explosion proof
	– II 1/2 G Ex d IIB T6 Ga/Gb or Ex de IIB T6 Ga/Gb or Ex d [ia Ga] IIB T6 Ga/Gb or Ex de [ia Ga] IIB T6 Ga/Gb; acc. to ATEX KEMA
	– Class I, Division 1, Group C & D; acc. to FM
	– Class I, Group C & D acc. to CSA certificate
	Consult factory for other approvals and updates

ELECTRICAL

Power supply	Autoselect 65 Vac to 240 Vac, 50/60 Hz and/or 24 Vdc to 65 Vdc
Power rating	11 Wmax continuously

MIGRATION OPTION

Migration kit 954 (Pos 4: Option M)

Migration Kit 954 - Enraf Servo 854 ATG to Servo 954 hardware migration kit

For contact specification, refer to page 5.

Identification Code

	Notes	Restr.	I.S Terminals	NON I.S Terminals	Boards
Pos 1, 2, 3 Instrument code					
9 5 4					
Pos 4 Servo main selections					
A Enraf Servo 954					
M Migration Kit 954	*5				
Pos 5 Performance and Legal metrology approvals					
X Accuracy ± 0.4 mm Xtreme Performance, Legal Metrology with OIML R85 report and sealing facilities.	*1,*3	*A		2	1
Y Accuracy ± 0.4 mm Xtreme Performance per OIML R85, with factory calibration report according to OIML				2	1
I Accuracy ± 1 mm High Performance, for custody transfer compliant to OIML R85, API 3.1B and ISO 4266 (1 & 3) with factory calibration report according to OIML				2	1
H Accuracy ± 1 mm High Performance, for custody transfer compliant to API 3.1B and ISO 4266 (1 & 3)				2	1
Pos 6 User interface (connector for portable HART SmartView standard for all selections)					
A With internal display					
B With internal display and terminals for stand-alone HART SmartView	*4		2		1
Pos 7 Data transmission					
B Enraf Fieldbus Bi-phase Mark (BPM)				2	1
H HART / 4-20 mA output		*B		2	1
T TRL2 field bus				2	1
Pos 8 Basic VITO and HART input options					
— None					
V VITO temperature and/or water sensor			2		
C VITO temperature and/or water sensor and 1 HART input			4		
H HART input (up to 3 HART devices)			2		
D HART input (up to 3 HART devices) and HIMS density calculations			4		
Pos 9 Additional VITO and HART input options					
— None					
A VITO temperature and/or water sensor			2		1
C VITO temperature and/or water sensor and 3 HART inputs			8		1
D VITO temperature and/or water sensor and 3 HART inputs and HIMS density calculations			8		1
E HART input (5 HART inputs)			4		1
F HART input (5 HART inputs) and HIMS density calculations			4		1
Pos 10 Temperature					
— None					
R RTD one spot element 3 wire			3		1
S 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
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
Pos 11 Alarm outputs					
— None					
K Hardware alarms (1x SPDT) 250 VAC, 2 A (40 VDC, 2 A)				2	1
L Hardware alarms (2x SPDT) 250 VAC, 2 A (40 VDC, 2 A)				4	1
Pos 12 SIL functionality					
— None					
L 1 x SIL DO contact (1 x SPDT contact, 2 A at 250 VAC or 2 A at 40 VDC, Pmax = 500 W)				2	1
M 2 x SIL DO contact (2 x SPDT contact, 2 A at 250 VAC or 2 A at 40 VDC, Pmax = 500 W)				4	1
N SIL AO NAMUR NE43 compliant				3	1
O SIL AO + 1 SIL DO contact NAMUR NE43 compliant (1 x SPDT contact, 2 A at 250 VAC or 2 A at 40 VDC, Pmax = 500 W)				5	1
P SIL AO + 2 SIL DO contacts NAMUR NE43 compliant (2 x SPDT contact, 2 A at 250 VAC or 2 A at 40 VDC, Pmax = 500 W)				7	1
Pos 13 - Additional communication					
— None or Select from Pos 7				0 or 2	0 or 1

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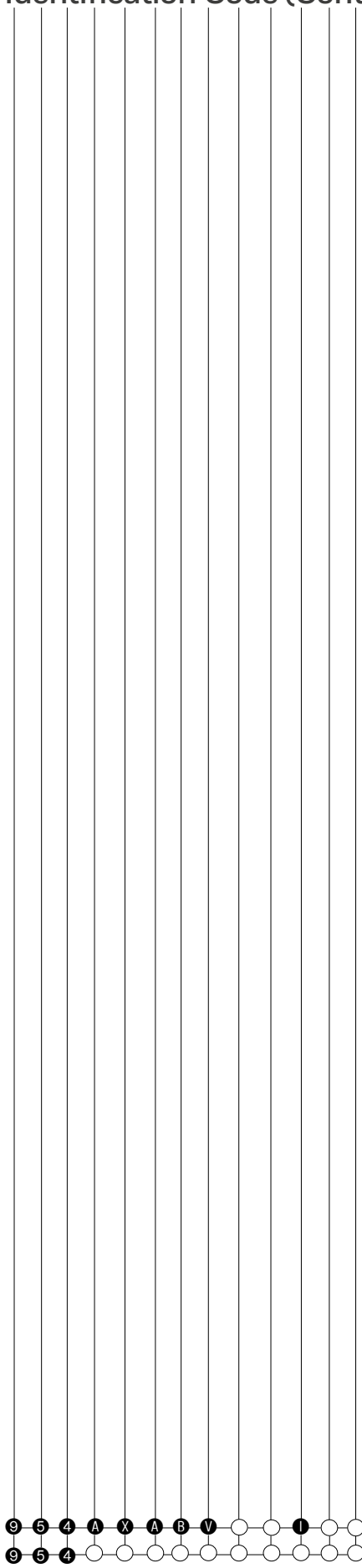
Identification Code (Continued)



				Notes	Restr.
Pos 14, 15, 16 Pressure, drum compartment & flange					
M – –	No feet, Medium pressure Migration KIT				*M
H – –	No feet, High pressure Migration KIT				*M
A 1 1	Atmospheric pressure, 2" Class 150 FF, Flanges acc. ASME B16.5, (Ra = 3.2-6.3 "m) , AL,				*A
M 2 1	Medium pressure, 2" Class 150 FF, Flanges acc. ASME B16.5, (Ra=3.2-6.3 "m), AL, Up to 6 Bar				*A
C 1 1	Chemical version, 2" Class 150 RF, Flanges acc. ASME B16.5, (Ra=3.2-6.3 "m), AISI 316, Up to 6 bar				*A
C 1 2	Chemical version, DN50, PN 6, Flanges acc. EN 1092-1, (Ra=3.2-12.5 "m), AISI 316, Up to 6 bar				*A
H 5 2	High pressure, 2" Class 300 RF, Flanges acc. ASME B16.5, (Ra=3.2-6.3 "m), AISI 316, Up to 40 Bar				*A
H 5 3	High pressure, DN50, PN 40, Flanges acc. EN 1092-1, (Ra=3.2-12.5 "m), AISI 316, Up to 40 Bar				*A
Pos 17 Safety approvals					
A	ATEX / IECEx				
F	FM	USA			*A
C	CSA	Canada			*A
K	KOSHA	Korea			*A
I	INMETRO	Brazil			*A
Pos 18 Measuring range & wire material					
–	No Drum				*L
A	27 m (88 ft)	AISI 316	0.2 mm		
B	27 m (88 ft)	Hastelloy C22	0.2 mm		
C	27 m (88 ft)	Tantalum	0.2 mm		
D	27 m (88 ft)	Tungsten	0.25 mm		
E	37 m (121 ft)	AISI 316	0.2 mm		
F	37 m (121 ft)	Invar	0.2 mm		
G	37 m (121 ft)	Tungsten	0.25 mm		
H	40 m (131 ft)	AISI 316	0.2 mm		
J	40 m (131 ft)	Tungsten	0.25 mm		
K	45 m (131 ft)	AISI 316	0.2 mm		*L
L	45 m (131 ft)	Tungsten	0.25 mm		*L
M	150 m (492 ft)	AISI 316 (35 m measuring range and ±1 mm accuracy with 150 m 0.2 mm wire for cavern installation)		*2	*L
Pos 19 Displacer					
–	None				
A	"U815C/223/CT/110 Carbon filled PTFE Hostaflon ™, weight 223 g.; ø 110 mm"				
B	"U815C/223/CT/90 Carbon filled PTFE Hostaflon ™, weight 223 g.; ø 90 mm"				
C	"U815C/223/CT/45 Carbon filled PTFE Hostaflon ™, weight 223 g.; ø 45 mm"				
D	"U815C/223/CT/25 Carbon filled PTFE Hostaflon ™, weight 223 g.; ø 25 mm"				*L
E	"U815C/260/S/90 AISI 316, weight 260 g.; ø 90 mm (for density measurement)"				
F	"U815C/260/S/45 AISI 316, weight 260 g.; ø 45 mm (for density measurement)"				
Pos 20 Servo density measurement					
–	No density option				
D	With Servo Density measurement				*C
Pos 21 Additional options					
–	None				
A	Air purge connection for drum compartment (1/4" BSP entry)				*A
Pos 22 Tag plate					
–	No tag plate				
T	Tag plate (Material: SS)				

9 5 4 A X A B V I A 1 1 A A A T	Typical Identification Code
9 5 4	Your Identification Code

Continued....

Notes:

1. Applicable for compliance to country specific Legal Metrology certificates (Like Netherlands, Germany etc.)
   For witnessed verification specify authority; for more information please contact factory
2. Contact factory for longer measuring ranges
3. The SmartServo FlexLine will always be delivered from the factory with the latest global approved Firmware for all boards (FlexConn modules).
   Please check if your local approvals require previous versions of the firmware for the legal metrology relevant FlexConn modules. If that is the case, please take provisions to downgrade the Firmware of the legal metrology relevant boards of the SmartRadar FlexLine!
4. The RMA805 "ENRAF Remote Indicator" is a remote display (level and temperature only) and available in combination with option B). This display can be ordered separate.
5. The Migration kit is without the Front Cover and the Terminal compartment cover. When also these covers need to be replaced, they must be ordered seperately.

Restrictions:

Sum of boards = max 5

Sum of IS terminals = max 12

Sum of nonIS terminals = max 12

*M Only available when Pos4 = M

*A Only available when Pos4 = A

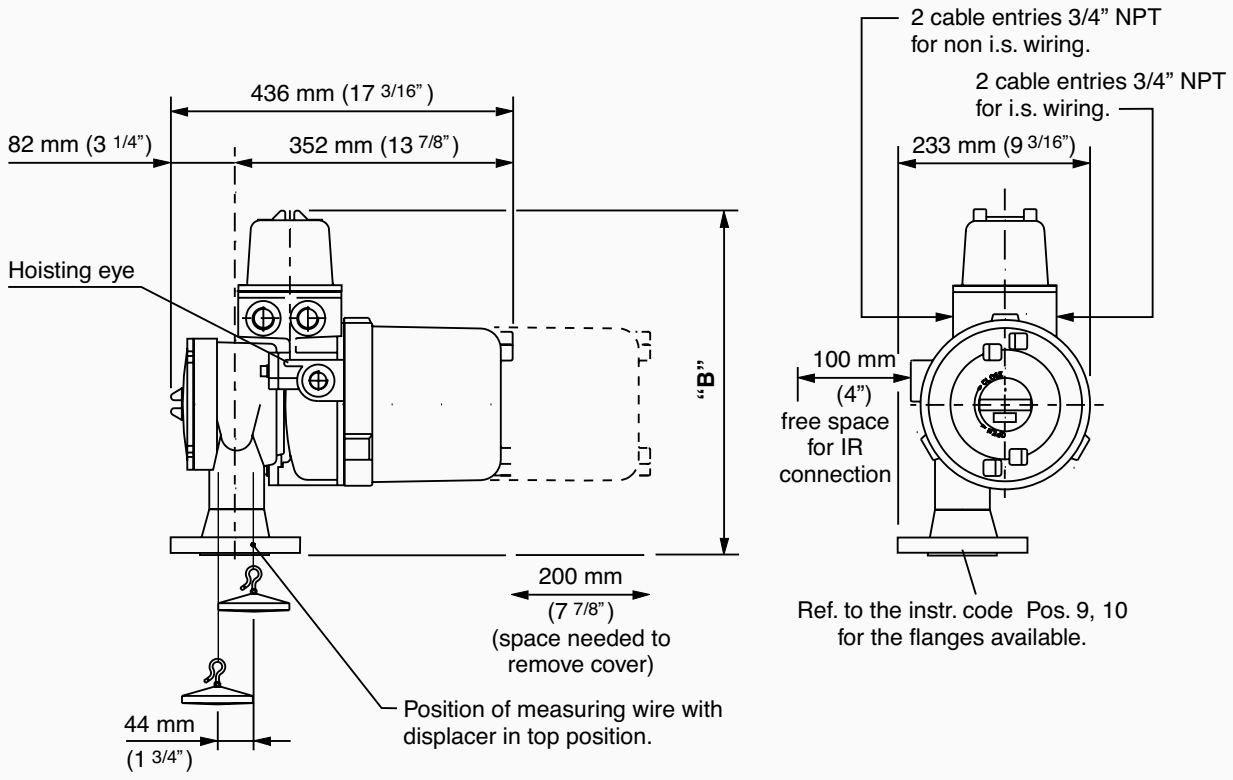
*B Only when pos 5 NOT X

*C Only when Pos19 = None, E or F

*L Only available when Pos5 = H

Global Experience. Locally Applied.

DIMENSIONAL DRAWING



	"B"
A, M and C versions	427 mm (16 13/16")
H versions	449 mm (17 11/16")

All technical specifications are subject to change without notice.

For more information
To learn more about Honeywell's Enraf product ranges, visit www.honeywellenraf.com or contact your Honeywell account manager.

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THE FUTURE IS WHAT WE MAKE IT

Honeywell