

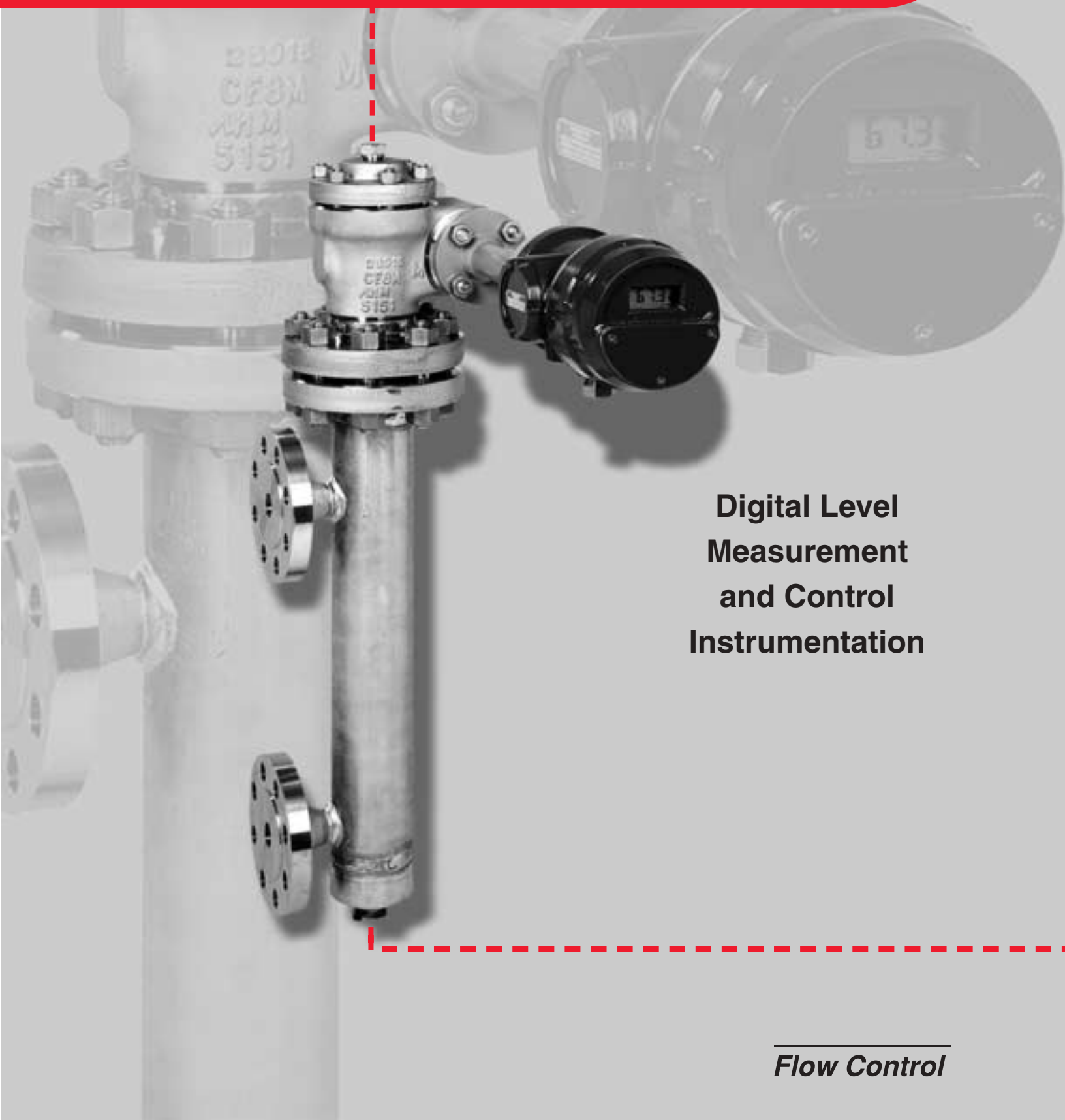
Masoneilan® 12300 Series

Digital Level Transmitter & Controller

Specification Data

CU3000

02/02



**Digital Level
Measurement
and Control
Instrumentation**

Flow Control

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General Description

The Masoneilan 12300 Series Instrument is a 2-wire loop powered digital displacement type level Transmitter or Controller* with HART Communication. This high performance instrument is easily set-up and calibrated by use of either a hand-held communicator or local pushbuttons and digital display. This versatility allows the operator to configure, calibrate, and perform other functions either at the instrument or from the control room.

Proven Technology

The displacer/torque tube level measurement system has been proven over many years to be a highly reliable system under the most adverse operating and installation conditions.

- Installation flexibility
The 12300 can be mounted directly to top or side of tank or to a displacer chamber. Use of a displacer chamber minimizes effects of surface turbulence, foam and agitation on accuracy of level measurement. Mounting of chambers to tank can be via top, side or bottom connections.
- Continuous level transmission
Displacer position is constantly monitored and converted into 4-20 mA and HART protocol signals.
- Wide process temperature range -210°C to + 450°C.
Torque tube extension required for temperatures higher than +150°C or lower than -100°C.

High Performance

The design of the 12300 Instrument offers the following features.

- Dual compartment case isolates process pressure from main compartment.
- Non-contacting, frictionless sensor provides 0.1 % resolution of measurement.
- No effect on calibration with ambient temperature changes.
- Thermal differential expansions are compensated by the torque rod mechanism.
- Supply voltage variations have negligible effects on output.
- High degree of weather protection.
Protected from dust, rain, snow, water jets, limited submersion and corrosive atmospheres.
- Flameproof/explosionproof and intrinsically safe design.
- Last configuration and calibration are always stored in non-volatile memory, even in the event of a power failure.

Simple Calibration and Set-up

The following functions provide significant timesaving during configuration and calibration.

- Calibration with or without fluid.
- Specific gravity calibration with or without fluid.
- Measurement of the liquid level of a fluid with unknown specific gravity.
- Liquid interface measurements.
- Independent, non-interactive zero and span adjustments.
- Zero and/or span adjustment with empty chamber.

Smart Features

- Digital filtering eliminates unwanted oscillations through the use of an adjustable smart filter. The filter does not damp or delay response to fast level changes.
- Adjustable low and high level alarms.
- Adjustable failsafe output signal.
- Continuous data logging - number of fill-ups, high level time, low level time, working time, etc.
- Software ambient temperature compensation.

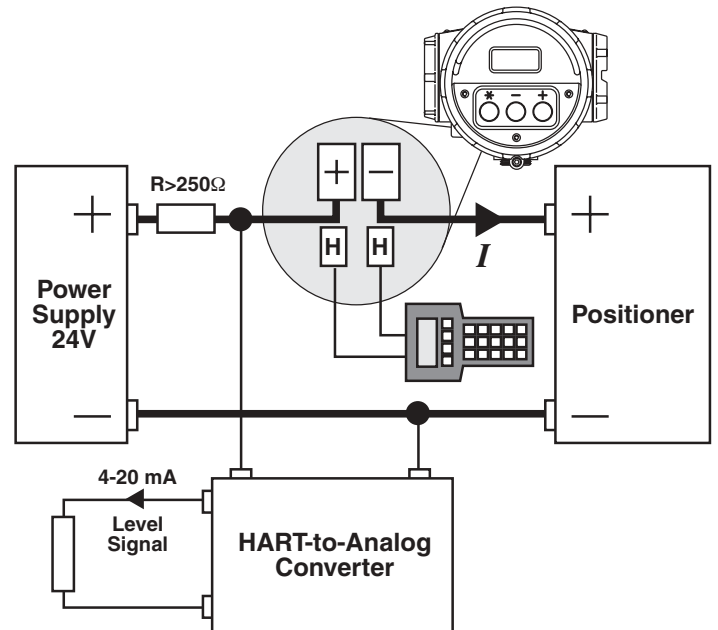
Retrofit

Retrofit of older model electropneumatic level transmitters or controllers is accomplished by replacing the housing sub-assembly. In some cases, replacement of the torque tube is also required.

General Description

Level Controller

The 12300 Digital Level Controller outputs a 4-20 mA electrical signal to a smart or conventional valve positioner. Please note the level controller output signal is NOT the level of the measured liquid. In order to use the controller function and transmit a level signal you will need to use a HART-to-Analog converter. The Handheld Communicator allows the user to configure, adjust PID coefficients, and set the local controller's set-point using the HART protocol.



Principle of Operation

The Masoneilan 12300 series level transmitter utilizes field proven buoyancy and torque tube principles (See Figure 1). A change in liquid level varies the net weight of the displacer (130), increasing or decreasing the load on the torque tube (136) by an amount directly proportional to the change in liquid level. The resultant rotation of the torque rod (138) and attached magnet (140) modifies the magnetic field surrounding a Hall effect sensor (141), generating an analog signal proportional to liquid level. This sensing method is non-contacting, frictionless, and provides total isolation between the sensed motion and sensor output.

Operation Diagram

Sketch showing the arrangement of the different parts.

In blue: torque tube, arm and displacer.

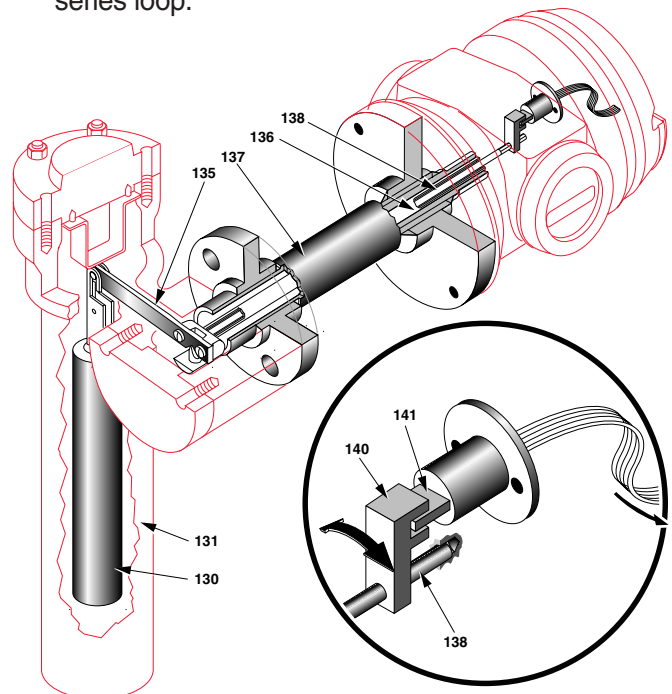
In color: case, mechanism and displacer chamber.

- 130 - Displacer
- 131 - Displacer chamber
- 135 - Torque arm
- 136 - Torque tube
- 137 - Torque tube housing
- 138 - Torque rod
- 140 - Magnets
- 141 - Hall effect sensor

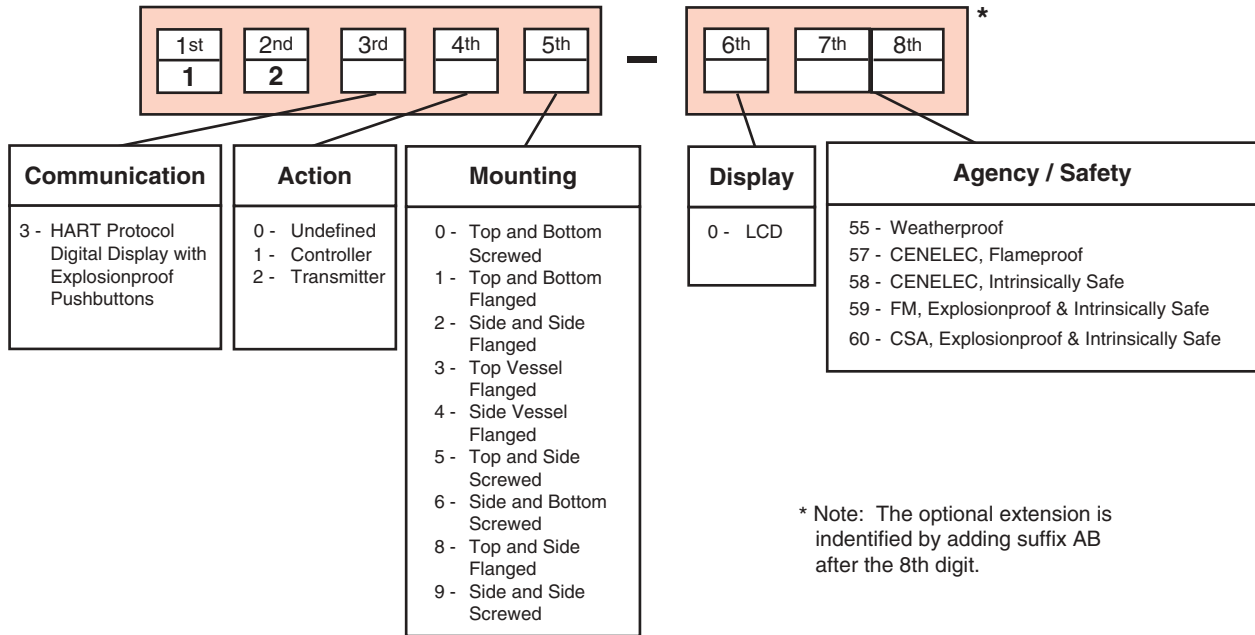
Trade names noted throughout are for reference only. Masoneilan reserves the right to supply trade name material or its equivalent.

The analog signal is converted to an error-free digital signal that is processed by the on-board micro-controller. After processing, the digital result is converted to a 4-20 mA analog output signal. The HART communication signal is superimposed on the 4-20 mA analog signal.

The instrument is powered through the 2-wire series loop.



Model Numbering System



Pressure Envelope Characteristics

Rating

ANSI class 150 to 2500
PN 16 to PN 420

Options : 316 type stainless steel
K Monel, Hastelloy, etc.

Materials

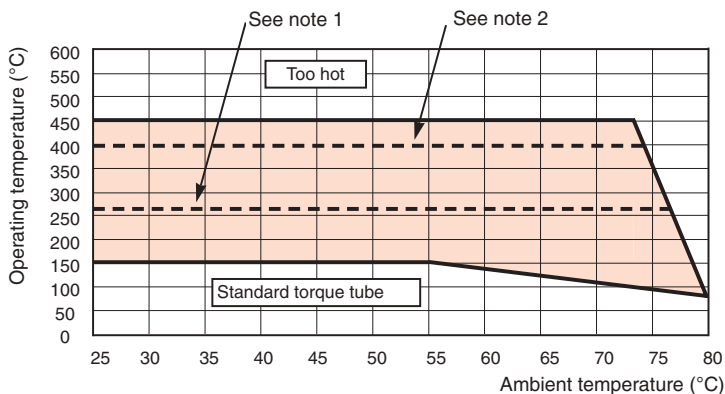
Mechanism chamber, displacer chamber, torque tube housing
Carbon steel
Stainless steel
Options : alloy steels, etc.
Torque tube
Inconel

Displacer
316 type stainless steel
Other materials optional

Ranges

356, 813, 1219, 1524, 1829, 2134,
2438, 3048 mm
(14", 32", 48", 60", 72", 84", 96", 120")
Other ranges on request

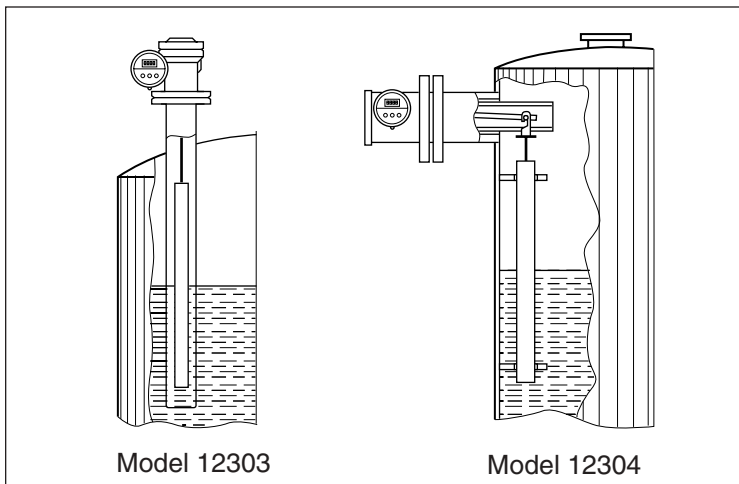
Temperature Limits



Use an extension between case and torque tube for temperatures included in shaded area

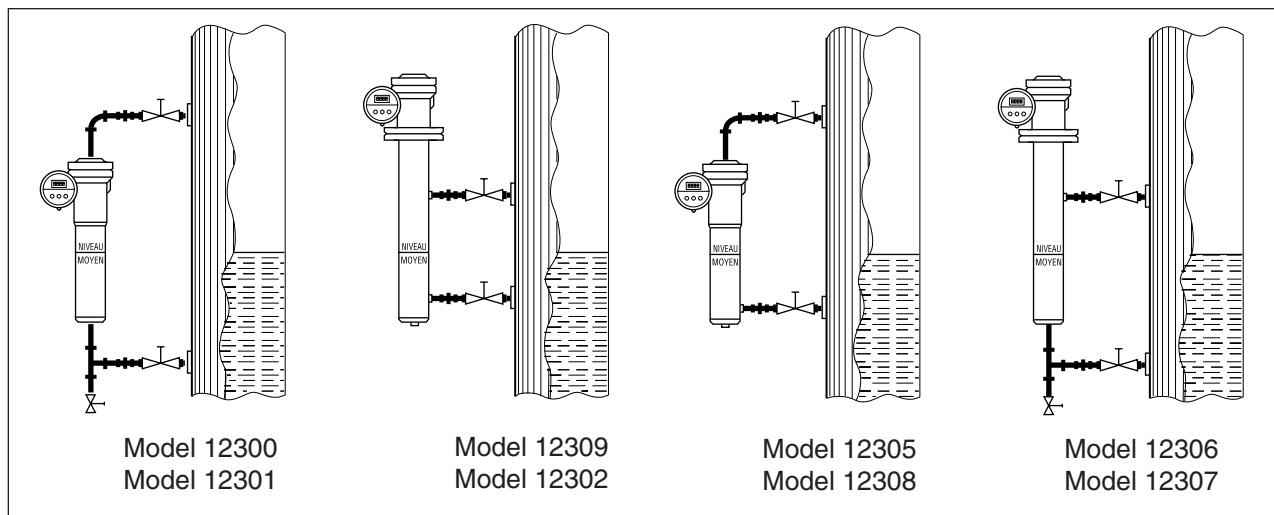
Notes : 1 - Must use Inconel torque tube above 260°C
2 - Stainless steel version can be used between +400°C and +450°C (only models 12302, 12306, 12307 and 12309)

Mounting



In case of internal mounting, the instrument has no displacer chamber; the mechanism chamber flange is bolted directly on the vessel flange (stilling wells or internal cages are recommended).

In case of liquid turbulence, it is recommended that the displacer is isolated with a damping chamber to prevent oscillations.



In case of external mounting, the instrument is connected to the vessel either with flanges or with screwed connections.

The instrument is constructed so that the mid-range level reference on the displacer chamber coincides with the normal level in the vessel.

It is recommended that shut-off valves are inserted between the level connections and the vessel with a drain valve on the lower part of the level.

Model	Connections
12300	Screwed NPT - 1 1/2" and 2"
12301	Flanged - 1 1/2" and 2" - DN 40 and DN 50
12309	Screwed NPT - 1 1/2" and 2"
12302	Flanged - 1 1/2" and 2" - DN 40 and DN 50
12305	Screwed NPT - 1 1/2" and 2"
12308	Flanged - 1 1/2" and 2" - DN 40 and DN 50
12306	Screwed NPT - 1 1/2" and 2"
12307	Flanged - 1 1/2" and 2" - DN 40 and DN 50
12303	Flanged - 3" and 4" - DN 80 and DN 100
12304	Flanged - 4" - DN 100

General Data

Case and cover

Material

Anodized cast aluminum with epoxy paint

Instrument

User interface

- Handheld Communicator
- Push-buttons operation with digital display

Transmitter

- Level transmitter
- Interface level transmitter
- Specific gravity measurement and display (only with the displacer fully immersed)
- Zero and span digital calibration:
 - independent zero and span adjustment
 - current loop range independent from zero/span calibration (can be changed at any time without zero/span re-calibration)
 - manual or automatic calculation for reduced span and zero shift for interface service
- Self-tuning for smart filtering
- Optional low and high level alarms
- Software lock for push-buttons
- Adjustable failsafe output signal in case of a failure detection
- Continuous self-diagnostic with special test procedure for Hall effect sensor
- Continuous data logging: number of fill-ups, low level time, high level time, working time
- Configuration check: analysis of 12300 data base to avoid bad mounting, out of range use
- Storage and display of alarms that have appeared
- Simulate current output for loop check

Level controller*:

- With PID parameters
- Low and high level alarms
- Other function same as transmitter where applicable

Electrical characteristics (2 wire instrument)

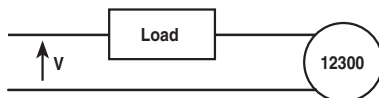
Signal : 4-20 mA
Current loop limits : 3.6 - 23 mA

Action : Direct or reverse by software

Supply voltage (DC voltage)

V min = 9.5 V
V max = 30 V (intrinsically safe mode)
V max = 50 V (flameproof envelope)

Maximum load



$$R \text{ max (ohms)} = \frac{V \text{ (volts)} - 9.5}{I \text{ max (amps)}}$$

Operating limits

Ambient temperature limits

- Operating : -40°C to +80°C
- Storage and transportation : -45°C to +93°C

Process temperature limits

- -210°C to +450°C
- For temperatures higher than +150°C or lower than -100°C, an extension is required between the case and the torque tube.
- Note : See diagram (page 4) for ambient and operating temperatures limits.

Specific gravity range

- 0.1 to 1.4 with a standard displacer **
- Other specific gravities with a special displacer.

Performances

Accuracy : ± 0.5 %
Hysteresis : ± 0.3 %
Repeatability : ± 0.2 %
Deadband : ± 0.1 %

Output signal filtering

- First order filtering of output signal with adjustable time constant
- Smart filtering of Hall effect sensor output signal, to eliminate noise before digital signal processing

Temperature influence

For 55°C ambient temperature variations:

- zero setting : ± 0.25 %
- span setting : ± 0.25 %

For 55°C operating temperature variations:

- zero setting : ± 1.0 %
- span setting : ± 1.0 %

Software temperature compensation:
electronic head and Hall effect sensor/
sub-assembly.

Supply voltage influence : 0.1 µA/V

Output signal ripple for a static input signal

10 mV maximum peak-to-peak for a 5 V, 20 mA signal.

Electromagnetic compatibility

complies with EMC Directive 89/336 EEC.

Over-voltage protection (at 25°C)

10 kW for 8/20 µs pulse wave form.
1.5 kW for 10/1000 µs pulse wave form.
(Based on protection diode rating)

* Consult Masoneilan for date of availability.

** Performance is slightly below the normal performance specified above for specific gravities below 0.2.

Hazardous Location Protection

CENELEC Certifications:

Intrinsic safety according to EN 50014:1992
 EN 50020:1994 (CENELEC)
 EEx ia IIC T6, Tamb = -40°C to 50°C
 EEx ia IIC T5, Tamb = -40°C to 60°C
 EEx ia IIC T4, Tamb = -40°C to 80°C

The main feature of this protection system is no spark nor any thermal effect produced under the test conditions required by the standard is capable of causing ignition of a given explosive atmosphere. The complete circuit and installation criteria are defined in the approval document issued by the certifying agency.

Conformity Certificate: Sira No. Ex 98E2107

Flameproof enclosure according to EN 50014:1977
 EN 50018:1977 (CENELEC)
 EEx d IIC T6, Tamb = -40°C to 75°C
 EEx d IIC T5, Tamb = -40°C to 85°C

This protection system allows ignition of an explosive gas mixture inside of the case due to an internal failure. The case, however, can resist the pressure developed by the internal explosion and prevent it from propagating to the outside explosive atmosphere.

Conformity Certificate: INERIS No.98.D 5018 X.

Factory Mutual (FM) approvals:

Explosionproof: Class I, Division 1, Groups B, C, and D T6, Tamb = 75°C, T5, Tamb = 82°C

Dust-ignitionproof: Class II, Division 1, Groups E, F, and G, Class III.
 Non-incendive: Class I, Division 2, Groups A, B, C, and D T4, Tamb = 80°C
 Suitable for: Class II, III Division 2, Groups F and G T4, Tamb = 80°C
 Intrinsically safe: Class I, Division 1, Groups A, B, C, D, E, F, and G T4, Tamb = 80°C per ES 628/9-18-98 T5, Tamb = 60°C T6, Tamb = 50°C

Canadian Standards Association (CSA) approvals:

Explosionproof: Class I, Groups C and D; Class II, Groups E, F, and G; Class III Supply 50 Vdc, 4-20 mA; Temp. Code T6; Max Ambient 80°C
 Division 2: Class I, Div. 2, Groups A, B, C, and D; Class II, Div. 2, Groups F and G; Class III Supply 50 Vdc, 4-20 mA; Temp. Code T4; Max Ambient 80°C
 Intrinsically Safe: Class I, Groups A, B, C, and D; Class II, Groups E, F, and G; Class III

Enclosure Rating

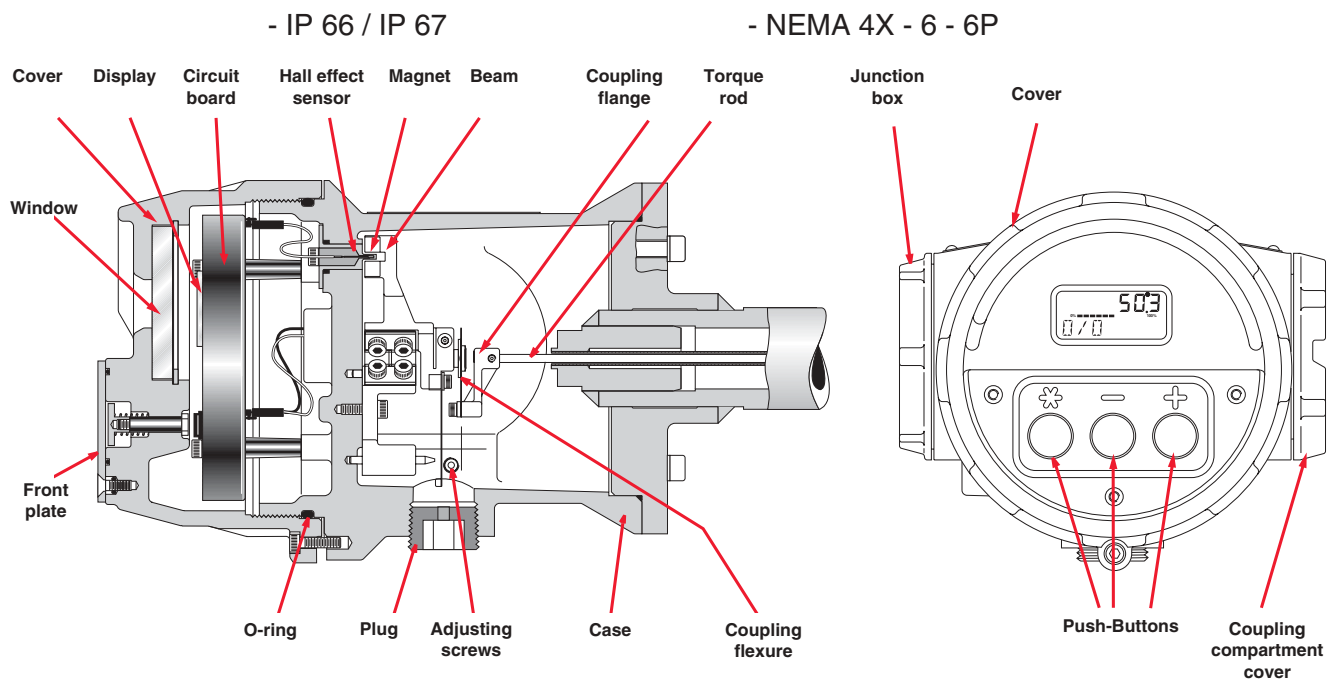
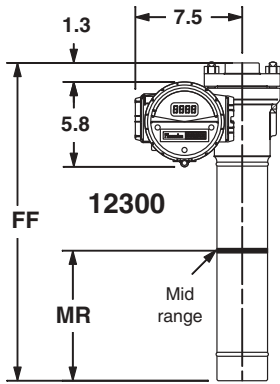


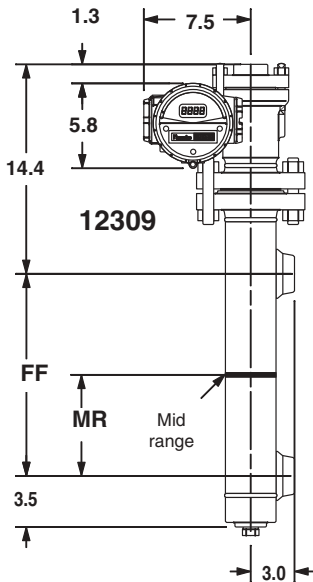
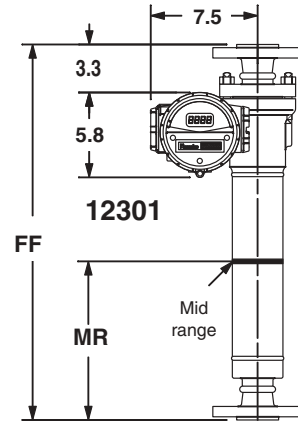
Figure 2 - Cross Section and Front View of 12300 Transmitter

Dimensions (inches)

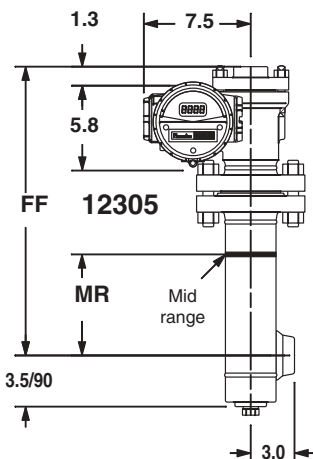
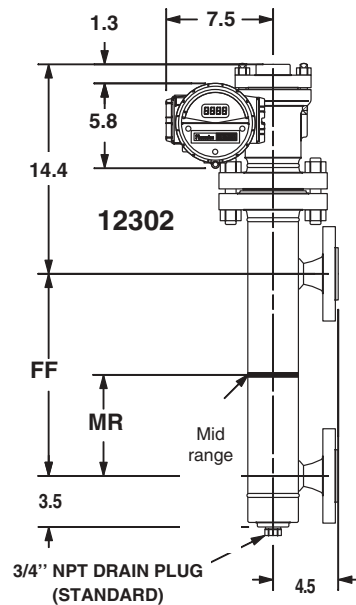
Models: 12300, 12301, 12309, 12302, 12305 & 12308, ANSI 300 and PN 50



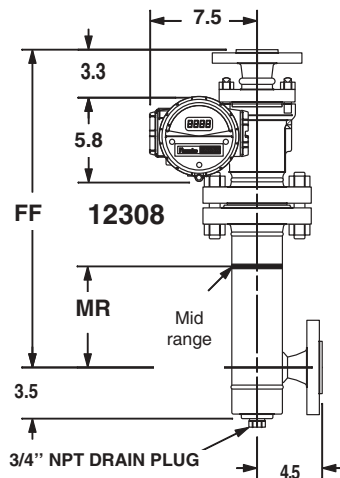
12300		RANGE		12301	
FF	MR	inch	mm	FF	MR
22	9	14	356	26	11
32	13	24	610	36	14
40	18	32	813	44	24
56	26	48	1219	60	28
68	32	60	1524	72	34
80	38	72	1829	84	40
92	44	84	2134	96	46
104	50	96	2438	108	52
128	62	120	3048	132	64



12309		RANGE		12302	
FF	MR	inch	mm	FF	MR
14	7	14	356	14	7
24	12	24	610	24	12
32	16	32	813	32	16
48	24	48	1219	48	24
60	30	60	1524	60	30
72	36	72	1829	72	36
84	42	84	2134	84	42
96	48	96	2438	96	48
120	60	120	3048	120	60

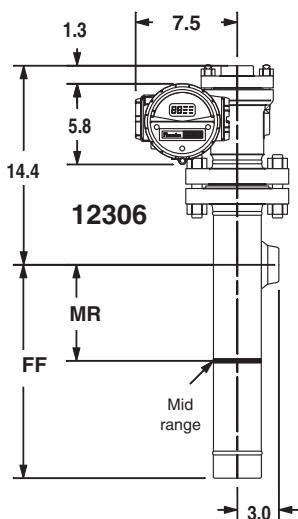


12305		RANGE		12308	
FF	MR	inch	mm	FF	MR
20	7	14	356	22	7
30	12	24	610	32	12
38	16	32	813	40	16
54	24	48	1219	56	24
66	30	60	1524	68	30
78	36	72	1829	80	36
90	42	84	2134	92	42
102	48	96	2438	104	48
126	60	120	3048	128	59

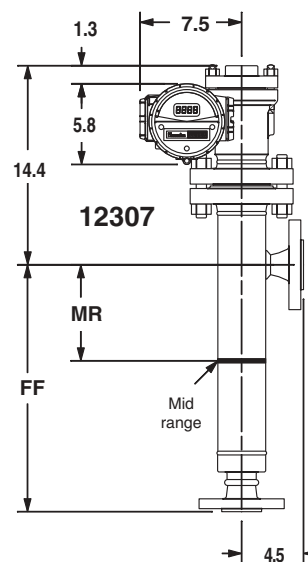


Please consult Masoneilan for ratings higher than ANSI 300 and PN 50.
See page 10 for Top View

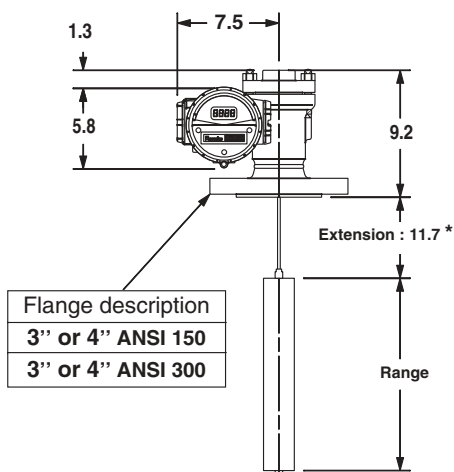
Models: 12306, 12307, 12303 & 12304, ANSI 300 and PN 50



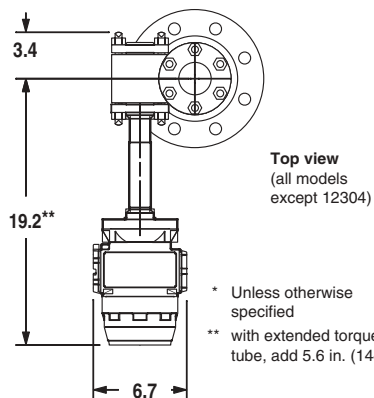
12306		RANGE		12307	
FF	MR	inch	mm	FF	MR
20	7	14	356	18	7
30	12	24	610	28	12
38	16	32	813	36	16
54	24	48	1219	52	24
66	30	60	1524	64	30
78	36	72	1829	76	36
90	42	84	2134	88	42
102	48	96	2438	100	48
126	60	120	3048	124	60



12303

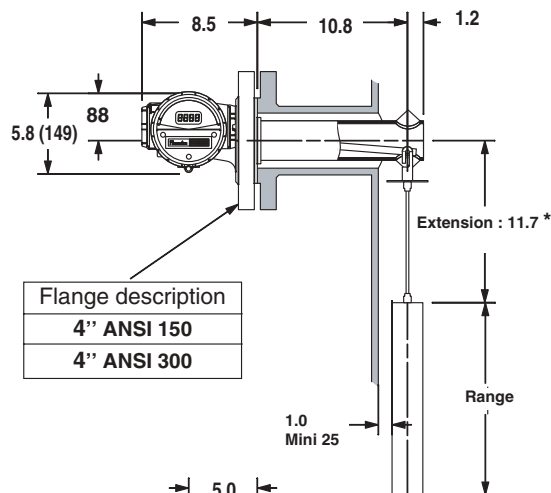


Flange description
3" or 4" ANSI 150
3" or 4" ANSI 300

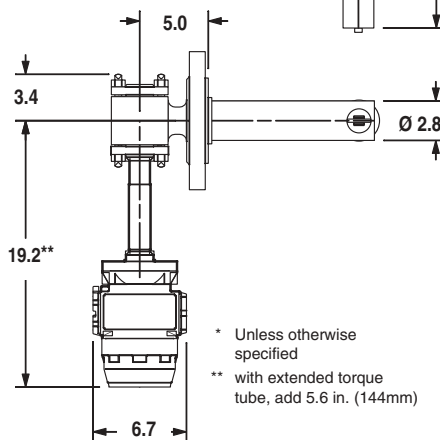


* Unless otherwise specified
** with extended torque tube, add 5.6 in. (144mm)

12304



Flange description
4" ANSI 150
4" ANSI 300

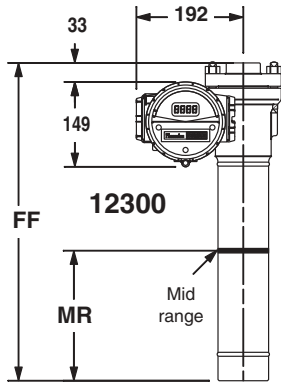


* Unless otherwise specified
** with extended torque tube, add 5.6 in. (144mm)

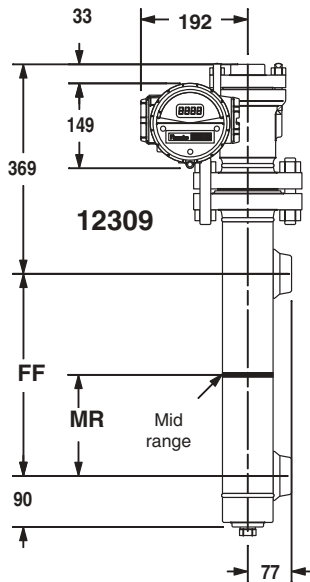
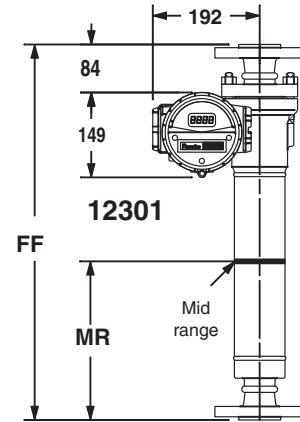
Please consult Masoneilan for ratings higher than ANSI 300 and PN 50. See page 10 for Top View

Dimensions (mm)

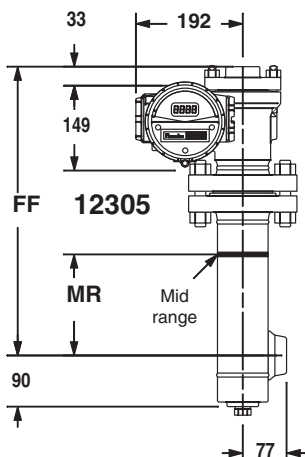
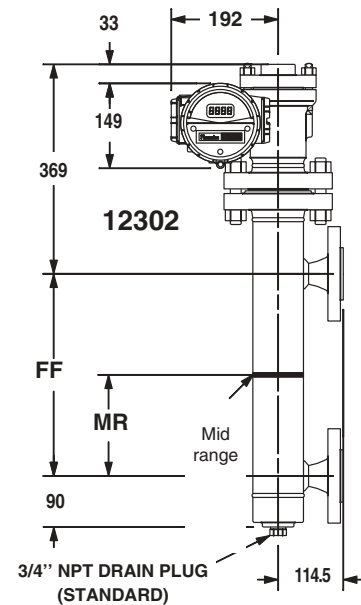
Models: 12300, 12301, 12309, 12302, 12305 & 12308, ANSI 300 and PN 50



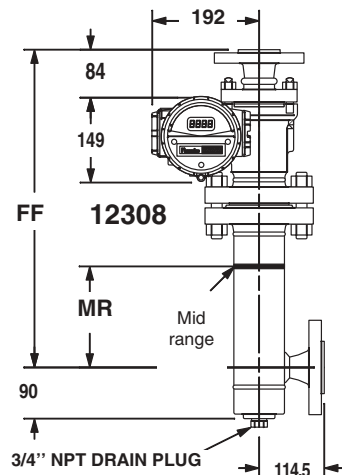
12300		RANGE		12301	
FF	MR	inch	mm	FF	MR
559	229	14	356	660	279
711	330	24	610	762	356
1016	457	32	813	1118	608
1422	660	48	1219	1524	711
1727	813	60	1524	1829	864
2032	965	72	1829	2134	1016
2337	1118	84	2134	2438	1168
2642	1270	96	2438	2743	1321
3251	1575	120	3048	3353	1626



12309		RANGE		12302	
FF	MR	inch	mm	FF	MR
356	178	14	356	356	178
610	305	24	610	610	305
813	406	32	813	813	406
1219	610	48	1219	1219	610
1524	762	60	1524	1524	762
1829	914	72	1829	1829	914
2134	1067	84	2134	2134	1067
2438	1219	96	2438	2438	1219
3048	1524	120	3048	3048	1524

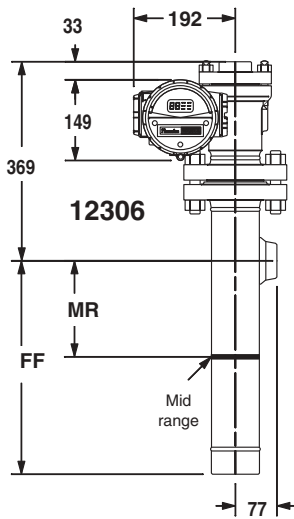


12305		RANGE		12308	
FF	MR	inch	mm	FF	MR
508	178	14	356	559	178
686	305	24	610	711	305
966	406	32	813	1016	406
1372	610	48	1219	1422	610
1677	762	60	1524	1727	762
1982	914	72	1829	2032	914
2286	1067	84	2134	2337	1067
2591	1219	96	2438	2642	1219
3201	1524	120	3048	3251	1524

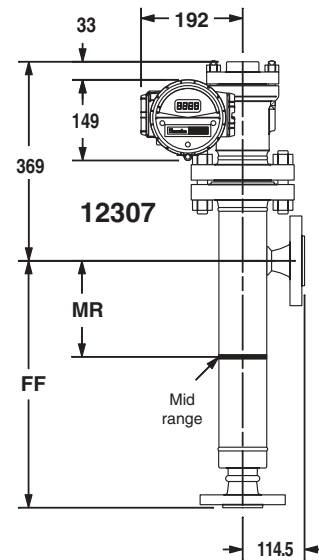


Please consult Masoneilan for ratings higher than ANSI 300 and PN 50.
See page 10 for Top View

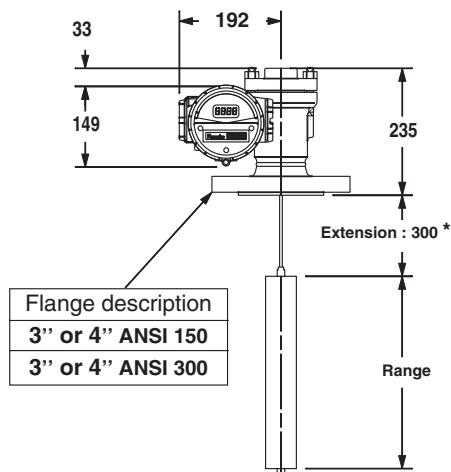
Models: 12306, 12307, 12303 & 12304, ANSI 300 and PN 50



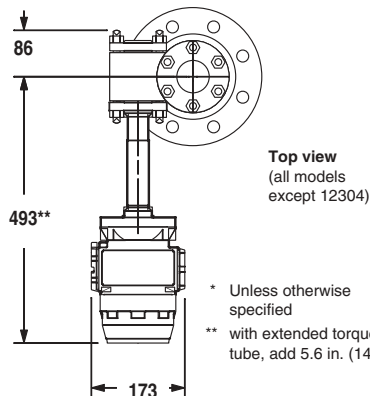
12306		RANGE		12307	
FF	MR	inch	mm	FF	MR
395	178	14	356	457	178
630	305	24	610	660	305
853	406	32	813	914	406
1259	610	48	1219	1321	610
1564	762	60	1524	1626	762
1859	914	72	1829	1930	914
2173	1067	84	2134	2235	1067
2478	1219	96	2438	2540	1219
3088	1524	120	3048	3150	1524



12303

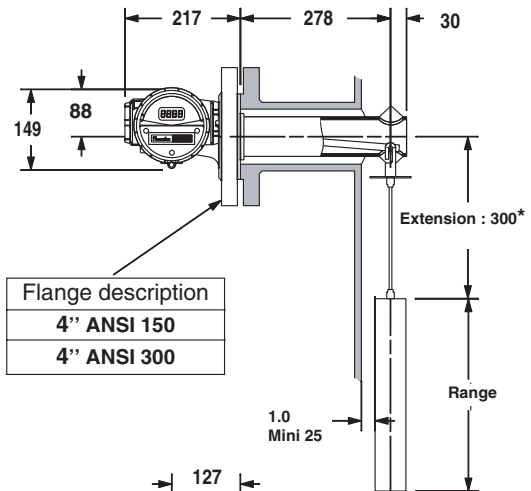


Flange description
3" or 4" ANSI 150
3" or 4" ANSI 300

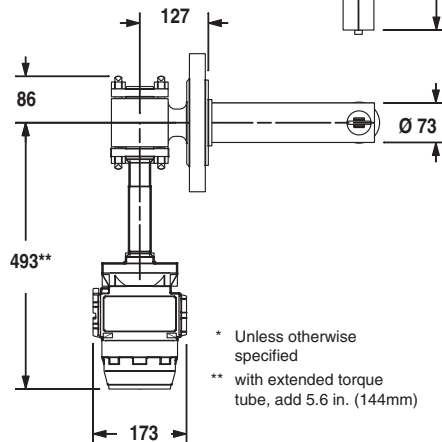


* Unless otherwise specified
** with extended torque tube, add 5.6 in. (144mm)

12304



Flange description
4" ANSI 150
4" ANSI 300



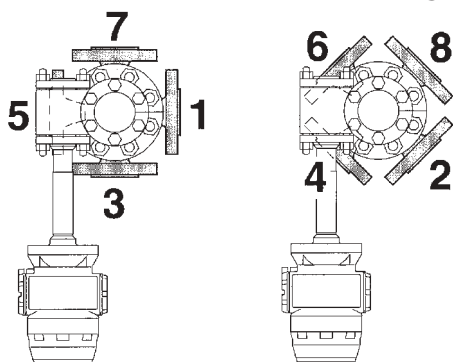
* Unless otherwise specified
** with extended torque tube, add 5.6 in. (144mm)

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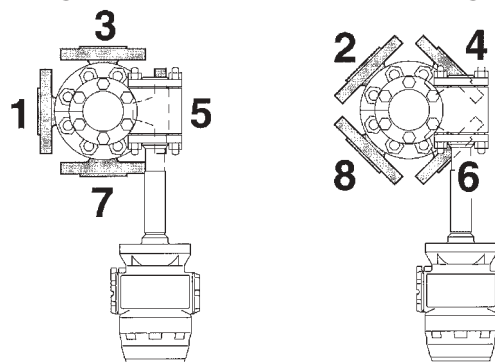
Orientation

Models: 12302, 12305, 12306, 12307, 12308 & 12309*

Left hand instrument mounting



Right hand instrument mounting



* High Pressure units (1500 & 2500) available in positions 1, 3, & 7 only.
Note: Unless otherwise specified, the case will be position 1 left-mounted

Weights (lbs)

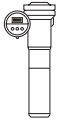
Models: ANSI 300 and PN50

Model	Level Ranges								
	356mm 14"	610mm 24"	813mm 32"	1219mm 48"	1524mm 60"	1829mm 72"	2134mm 84"	2438mm 96"	3048mm 120"
12300	79	90	90	101	108	117	123	130	146
12301	90	101	101	112	119	128	135	141	157
12309	112	123	123	135	141	150	157	163	179
12302	121	132	132	143	150	159	165	172	187
12305	110	121	121	132	139	148	154	161	176
12308	119	130	130	141	148	157	163	170	185
12306	110	121	121	132	139	148	154	161	176
12307	121	132	132	143	84	159	165	172	187
12303	88	88	88	88	88	88	88	88	88
12304	88	88	88	88	88	88	88	88	88

Weights (kg)

Models: ANSI 300 and PN50

Model	Level Ranges								
	356mm 14"	610mm 24"	813mm 32"	1219mm 48"	1524mm 60"	1829mm 72"	2134mm 84"	2438mm 96"	3048mm 120"
12300	36	41	41	46	49	53	56	59	66
12301	41	46	46	51	54	58	61	64	71
12309	51	56	56	61	64	68	71	74	81
12302	55	60	60	65	68	72	75	78	85
12305	50	55	55	60	63	67	70	73	80
12308	54	59	59	64	67	71	74	77	84
12306	50	55	55	60	63	67	70	73	80
12307	55	60	60	65	38	72	75	78	85
12303	40	40	40	40	40	40	40	40	40
12304	40	40	40	40	40	40	40	40	40



12300 SERIES HART LEVEL TRANSMITTER/CONTROLLER

QUOTATION NO. _____

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REVISION :

DATE :

CUSTOMER :

Reference :

ITEM :	Qty:	NO SERVICE CONDITIONS <input type="checkbox"/>	UNITS	LOWER FLUID	UPPER FLUID			
		STATE		LIQUID	LIQUID <input type="checkbox"/> GAS/VAPOR <input type="checkbox"/>			
TAG :		FLUID						
		SPECIFIC GRAVITY						
SERVICE :		TEMPERATURE		MIN.	NORM			
		PRESSURE		MIN.	NORM			
				MAX.	MAX.			
RANGE			LEVEL AND AUXILIARY EQUIPMENT CODIFICATION					
355,5 mm	610 mm	813 mm	1219 mm	1524 mm	Other			
(14")	(24")	(32")	(48")	(60")				
			1 2 3 -					
LEVEL			OPT	LEVEL & AUXILIARY EQUIPMENT				
				OPT				
INSTRUMENT	WITHOUT INSTRUMENT			DISPLACER	WITHOUT DISPLACER			
	TRANSMITTER				MATERIAL		STAINLESS STEEL	
	CONTROLLER				HANGER EXTENSION		WITHOUT	
	CASE TYPE		WEATHERPROOF		VESSEL ONLY)		STANDARD (300 mm)	
			FLAMEPROOF				SPECIAL (..... mm)	
			INTRINSICALLY SAFE					
	MOUNTING		CENELEC		VENT - DRAIN	WITHOUT		
			FM			TYPE	VENT	
			CSA				DRAIN	
	CASE ORIENT.		LEFT HAND		VENT + DRAIN			
RIGHT HAND			CONNECTION(S)		SCREWED + PLUG			
SIGNAL		POSITION NR		TYPE				
ACTION		4-20 mA		CONNECTION(S)		DN 20 (3/4")		
ELECTRIC CONN.		DIRECT		SIZE				
CABLE Φ		REVERSE		CLASS/PN				
		1/2" NPT		FACING &				
				FINISH				
TORQUE TUBE	WITHOUT TORQUE TUBE			HANDHELD COMMUNICATOR				
	CHAMBER MATERIAL		CARBON STEEL					
			STAINLESS STEEL	REMARKS :				
	TORQUE TUBE MATERIAL		INCONEL					
			STAINLESS STEEL					
	TEMPERATURE PROTECTION		STANDARD					
	SINGLE FORCE		H.T. / L.T. EXTENSION					
DOUBLE FORCE								
QUADRUPLE FORCE								
MECHANISM & DISPLACER CHAMBERS	WITHOUT MECHANISM AND DISPLACER CHAMBER							
	CONNECTIONS LAYOUT	WITH DISPLACER CHAMBER	TOP & BOTTOM					
			SIDE & SIDE					
		WITHOUT CHAMBER	SIDE & BOTTOM					
			TOP & SIDE					
	ARM HOUSING LENGTH (SIDE VESSEL ONLY)		STD. LENGTH 11"					
	CONNECTIONS TYPE		FLANGED					
			SCREWED					
			BW/SW					
	CONNECTIONS DETAILS (IF FLANGED)	SIZE	DN 40 or DN 50 (1-1/2" or 2") W/ DISPLACER CH.					
DN 80 or DN 100 (3" or 4") W/ DISPLACER CH.								
CLASS/PN								
FACING & FINISH								
CHAMBERS MATERIAL		CARBON STEEL						
		STAINLESS STEEL						
E. N°		UNIT PRICE :		TOTAL PRICE :				

