

**Masoneilan®
12300 Series
Level Transmitter / Controller**

Specification Data

CU3000 E

10/00



**A Smart
Instrument
with
HART®
Communication
Protocol**

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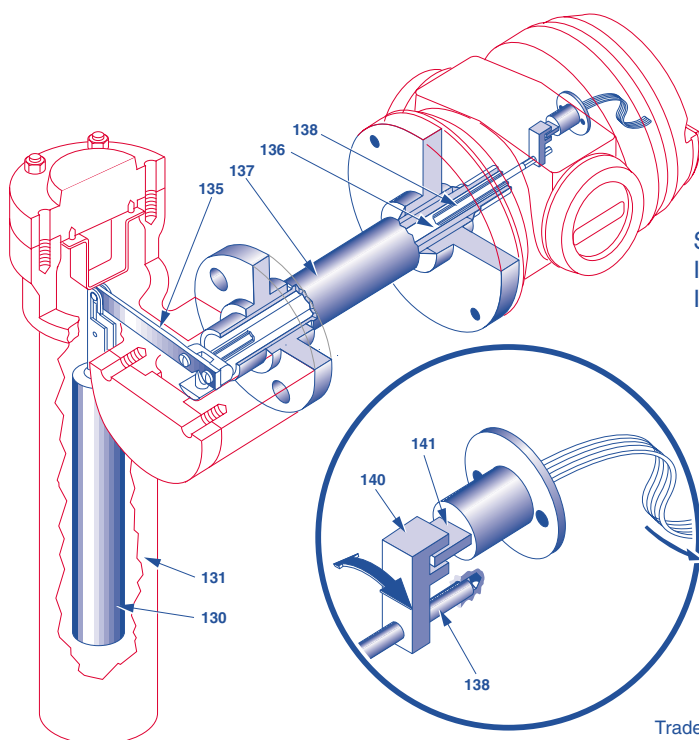
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Principle of operation

The Masoneilan 12300 series instrument is a 2 wire, loop-powered Level Transmitter or Controller with HART Communication, that operates according to the fully proven liquid displacement and torque tube principles. A change in liquid level varies the net weight of the displacer, increasing or decreasing the load on the torque tube by an amount directly proportional to the change in liquid level.

The subsequent rotation of the torque rod is used to modify the magnetic field around a Hall effect sensor, producing an analog signal proportional to the level in the vessel. This analog signal is converted into 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.

Descriptive sketch



Sketch showing the arrangement of the different parts.
In blue : torque tube, arm and displacer.
In colour : 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 named material or its equivalent.

The 12300 Series Instrument is a digital level Transmitter or Controller with HART communication. It is designed for ease of calibration and set-up, with superior technical performance. A handheld communicator and three push-buttons with a digital display offer the operator the potential to communicate remotely or locally with the instrument. This versatility permits the users to perform calibration, configuration of alarms... without ever leaving the control room.

This instrument does not need a separate power supply and offers the following :

Proven technology

The highly reliable displacer/torque tube system has been very popular for decades because of its excellent features under the most severe conditions :

- Installation flexibility
Requirements of almost every installation are met with top, side or bottom connections and a full rotation in the horizontal plane to accommodate process structures
- Continuous level transmission and large process temperature range
- Excellent stability

When installed inside a chamber, surface turbulence and foam do not impede the displacer. Moreover, measurement is unaffected by agitation of the process fluid.

Simple calibration and set-up

The following functions help the user to realize significant savings :

- Calibration with or without fluid
- Independent, non-interactive zero and span
- Zero shift and/or reduced span adjustment, even with empty chamber
- Measurement of the liquid level of a fluid with unknown specific gravity

Level controller

The 12300 level controller is a full featured process controller. Its current output signal controls the control valve positioner to automate level applications. Additional features include : Advanced control, remote setpoint control and level transmission using the HART protocol.

Smart features

- Smart filtering :
Unwanted oscillations can be eliminated through the use of an adjustable smart filter. This smart filter does not damp or delay response to fast level changes.
- Adjustable low and high level alarms.
- Adjustable failsafe output signal.
- Continuous data recording : number of filling up, high level time, low level time, working time,...
- Software ambient temperature compensation.

Outstanding characteristics

The design of the 12300 Instrument offers the following performance features :

- Non-contacting, frictionless sensor offering 0.1% resolution of measurement.
- No effect on calibration with ambient temperature variations.
- Compensation of thermal differential expansions by the torque rod mechanism.

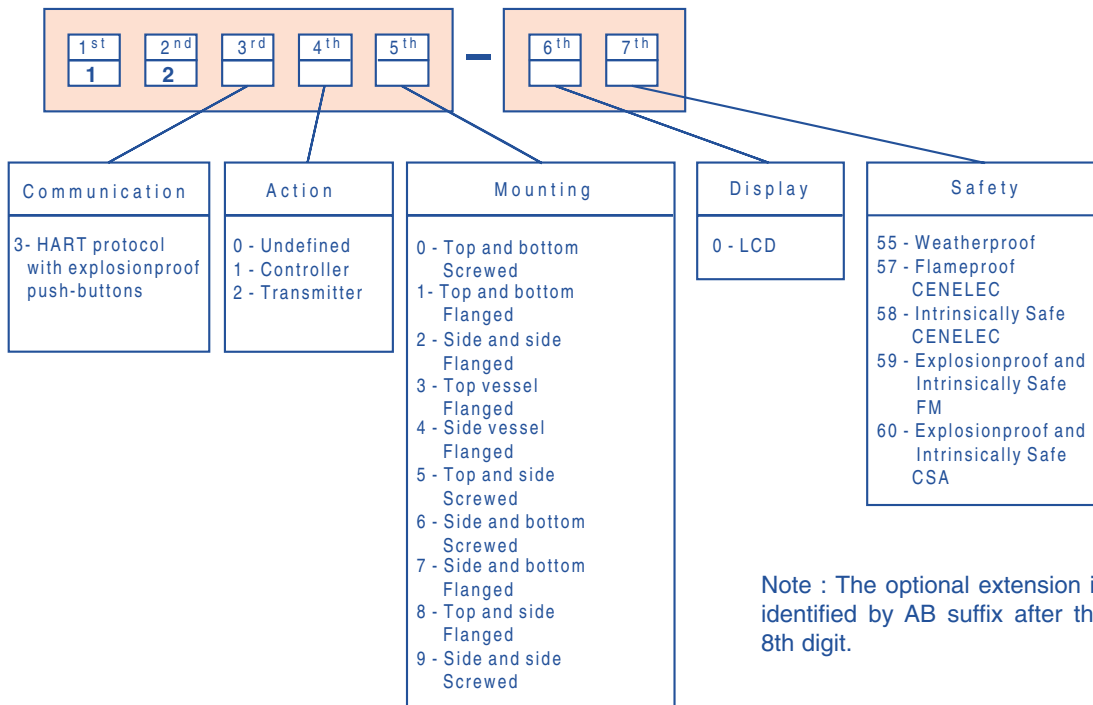
Last configuration and calibration data are always stored (in a non volatile memory), even in the event of a power failure.

Retrofit

Retrofit of analog electronic and pneumatic level transmitters or controllers is performed by replacing the housing sub-assembly, if necessary replacing the torque tube.

Retrofit of duplex pneumatic cases is also achievable with 12300 instruments associated with SVIs.

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

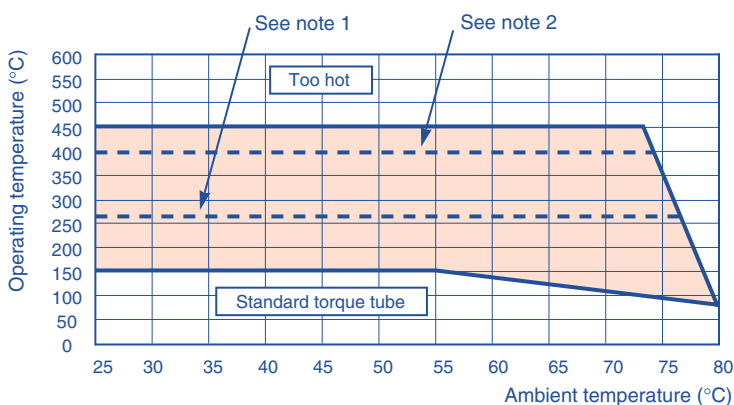
Displacer

316 type stainless steel
Other materials on option

Ranges

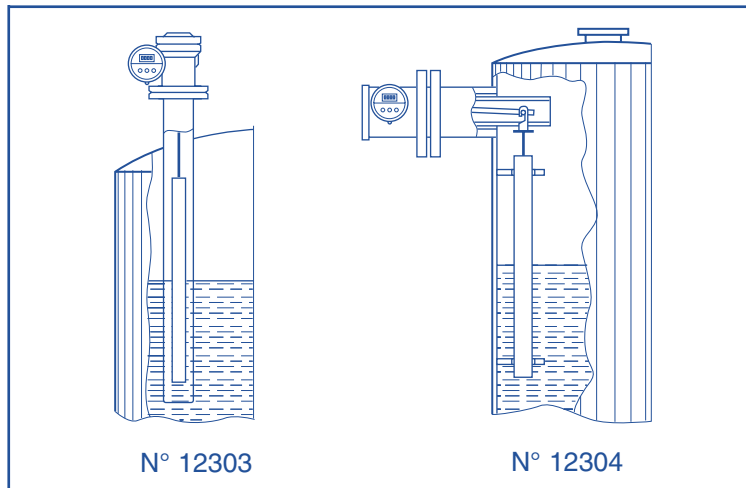
356, 813, 1219, 1524, 1829, 2134,
2438, 3048 mm
(14", 32", 48", 60", 72", 84", 96", 120")
Other ranges on request

Temperature limits



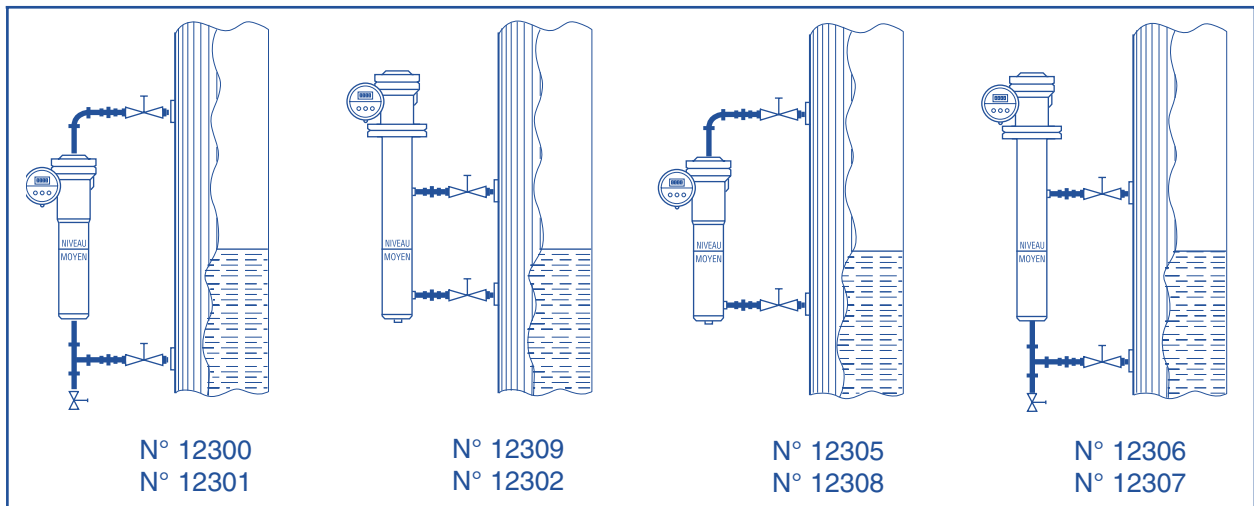
Use an extension between case and torque tube for temperatures included in coloured area

Nota : 1 - Above 260°C, torque tube must be in Inconel.
2 - 12302, 12306, 12307 and 12309 models only, for stainless steel version, can be used between +400°C and +450°C.



In case of internal mounting the instrument has no displacer chamber, the mechanism chamber flange is bolted directly on the vessel flange.

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 aluminium, with epoxy painting

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
- Selftuning for smart filtering
- Selectable 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 record : number of filling up, 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 P, I, D,... parameters
- Low and high level alarms
- Other functionalities including same as transmitter, where applicable

Electric characteristics (transmitter/Controller)

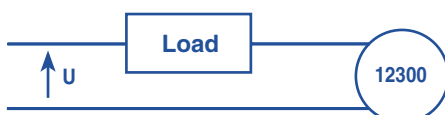
Signal : 4 - 20 mA
Current loop limits : 3.8 - 20.5 mA

Action : Direct or reverse by software

Supply voltage (DC voltage)

U min = 9.5 V
U max = 30 V (intrinsic safety)
U max = 50 V (flameproof envelope)

Maximum load



$$R_{\max} = \frac{U - 9.5}{I_{\max}}$$

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 temperature higher than +150°C or lower than -100°C, a spacer 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

Software lock

- Software lock for push buttons
- Software lock for HART communication

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 μ A/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 μ s pulse wave form.
1.5 kW for 10/1000 μ s pulse wave form.

*With specific gravity below 0.2, performance is slightly below the normal performance as specified above.

Hazardous location protection

CENELEC Certifications

- Intrinsic safety according to EN 50014 and EN 50020
 EEx ia II C T6
 (-40° C ≤ T amb < 50° C)
 EEx ia II C T5
 (-40° C ≤ T amb < 60° C)
 EEx ia II C T4
 (-40° C ≤ T amb < 80° C)
- Flameproof enclosure according to EN 50014 and EN 50018
 EEx d IIC T6
 (-40° C ≤ T amb ≤ 75° C)
 EEx d IIC T5
 (-40° C ≤ T amb ≤ 80° C)

Approvals

- Explosionproof
 Class I, Division 1,
 Groups B, C, D
 T6, T amb = 75° C
 T5, T amb = 80° C
- Dust-ignitionproof
 Class II, Division 1,
 Groups E, F, G
 Classe III
 T6, T amb = 75° C
 T5, T amb = 80° C
- Non-incendive
 Class I, Division 2,
 Groups A, B, C, D
 T4, T amb = 80° C
- Suitable for
 Class II, III, Division 2,
 Groups F, G
 T4, T amb = 80° C
- Intrinsically safe
 Class I, Division 1,
 Groups A, B, C, D, E, F, G
 Class II
 Class III
 T4, T amb = 80° C
 T5, T amb = 60° C
 T6, T amb = 50° C

Association (CSA) Approvals

- Explosionproof
 Class I, Division 1,
 Groups C, D
 T6, T amb = 75° C
 T5, T amb = 80° C
- Dust-ignitionproof
 Class II, Division 1,
 Groups E, F, G
 Class III
- Non-incendive, suitable for
 Class I, Division 2,
 Groups A, B, C, D
 Class II, Division 2,
 Groups E, F, G
 Class III
 T4, T amb = 80° C
- Intrinsically safe
 Class I, Division 1,
 Groups A, B, C, D
 Class II, Division 1,
 Groups E, F, G
 Class III

Factory Mutual (FM)

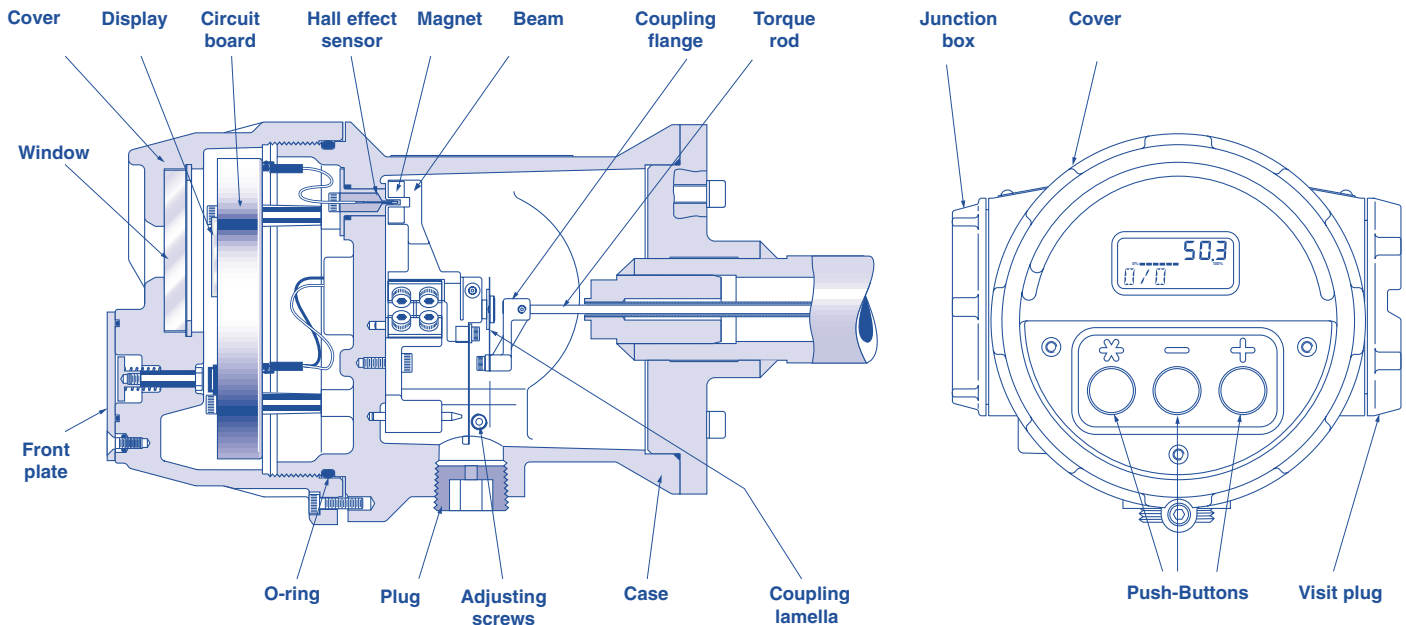
Canadian Standards

- IP 66 / IP 67

Enclosure rating

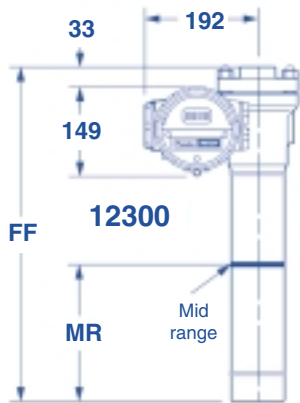
- NEMA 4X - 6 - 6P

Case sketch

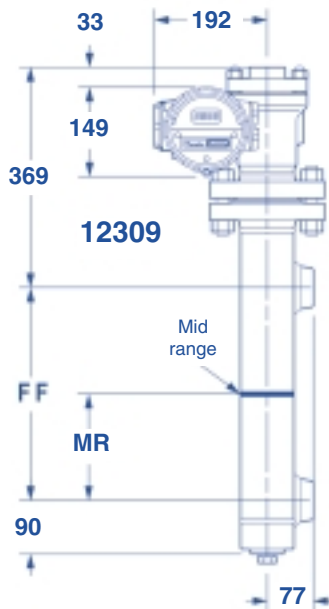
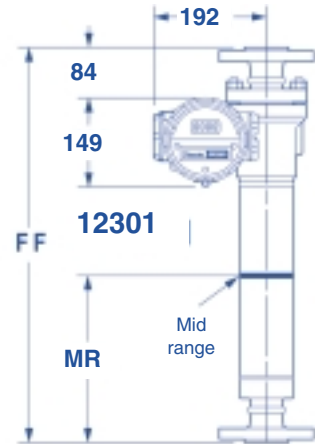


Dimensions (mm)

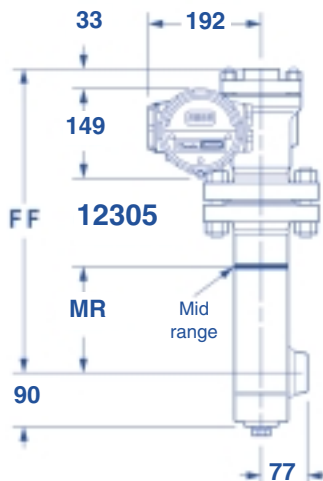
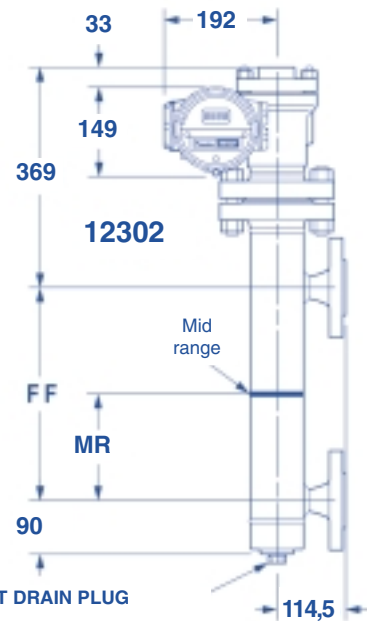
Models : 12300, 12301, 12309, 12302, 12305 & 12308, ANSI 300 and PN 50



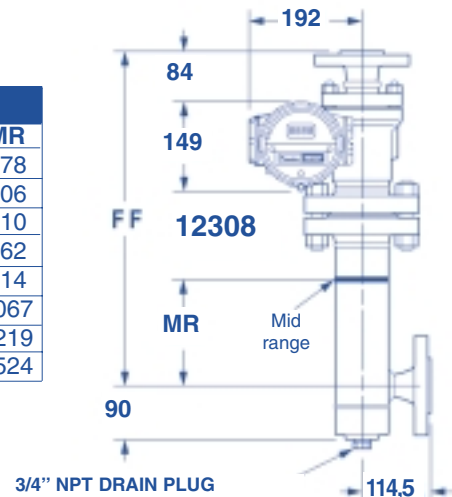
12300		RANGE		12301	
FF	MR	inch	mm	FF	MR
559	229	14	356	660	279
1016	457	32	813	1118	608
1422	660	48	1219	1524	711
1727	813	60	1524	1829	864
2032	965	72	1829	2134	1016
2337	1118	84	2134	2438	1168
2642	1270	96	2438	2743	1321
3251	1575	120	3048	3353	1626



12309		RANGE		12302	
FF	MR	inch	mm	FF	MR
356	178	14	356	356	178
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

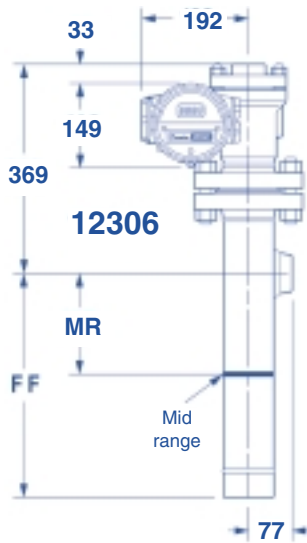


12305		RANGE		12308	
FF	MR	inch	mm	FF	MR
508	178	14	356	559	178
966	406	32	813	1016	406
1372	610	48	1219	1422	610
1677	762	60	1524	1727	762
1982	914	72	1829	2032	914
2286	1067	84	2134	2337	1067
2591	1219	96	2438	2642	1219
3201	1524	120	3048	3251	1524

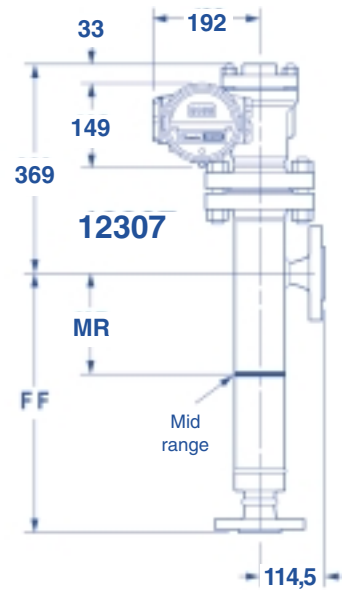


For ratings higher than ANSI 300 and PN 50, please consult Masoneilan.
See page 10 for Top view.

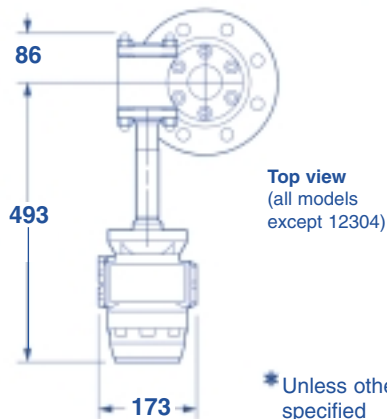
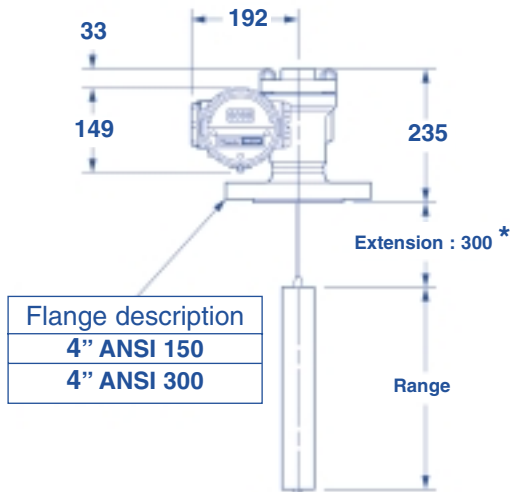
Models : 12306, 12307, 12303 & 12304, ANSI 300 et PN 50



12306		RANGE		12307	
FF	MR	inch	mm	FF	MR
395	178	14	356	457	178
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

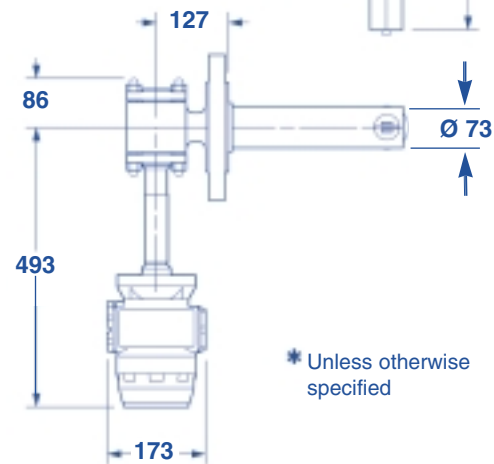
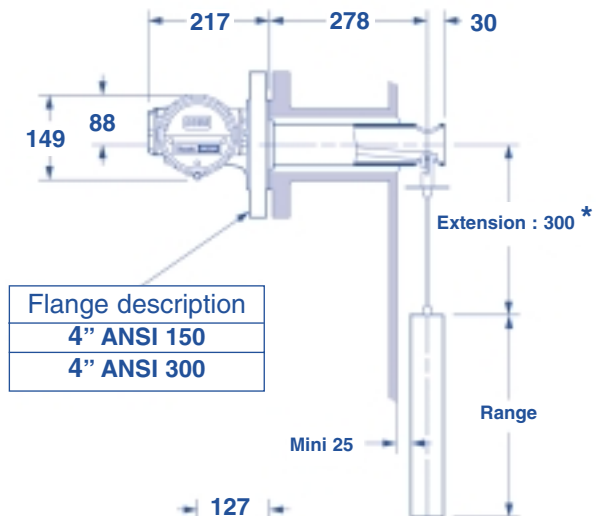


12303



* Unless otherwise specified

12304



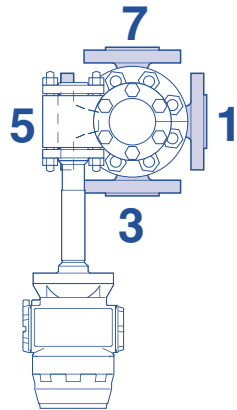
* Unless otherwise specified

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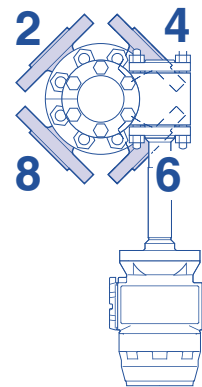
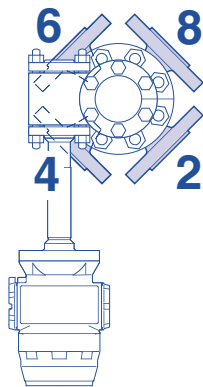
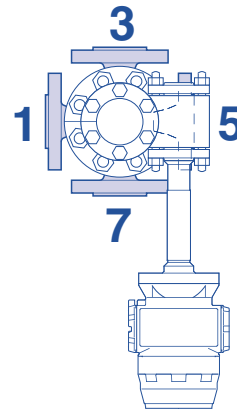
Orientation

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

Left hand instrument mounting



Right hand instrument mounting



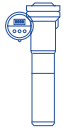
Note : Unless otherwise specified, the case will be position 1 left-mounted

Weight (kg)

Models : ANSI 300 and PN 50

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

Specification Data



12300 SERIES HART LEVEL TRANSMITTER/CONTROLLER

QUOTATION N°

PAGE : /

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		MINI	NORM
		PRESSURE		MINI	NORM
				MAXI	MAXI
RANGE			LEVEL AND AUXILIARY EQUIPMENT CODIFICATION		
355,5 mm	813 mm	1219 mm	1524 mm	1 2 3	
(14")	(32")	(48")	(60")		
LEVEL			OPT	LEVEL & AUXILIARY EQUIPMENT	
INSTRUMENT			DISPLACER	VENT - DRAIN	
WITHOUT INSTRUMENT			WITHOUT DISPLACER		
TRANSMITTER			MATERIAL	STAINLESS STEEL	
CONTROLLER			HANGER EXTENSION	WITHOUT	
CASE TYPE			(TOP AND SIDE VESSEL ONLY)	STANDARD (300 mm)	
WEATHERPROOF				SPECIAL (..... mm)	
FLAMEPROOF					
INTRINSICALLY SAFE					
CENELEC			FM	CSA	
LEFT HAND					
RIGHT HAND					
MOUNTING					
CASE ORIENT.					
POSITION NR					
SIGNAL					
4-20 mA					
ACTION					
DIRECT					
REVERSE					
ELECTRIC CONN.					
1/2" NPT					
CABLE Ø					
TORQUE TUBE			HANDHELD COMMUNICATOR		
WITHOUT TORQUE TUBE			REMARKS :		
CHAMBER MATERIAL					
CARBON STEEL					
STAINLESS STEEL					
TORQUE TUBE MATERIAL					
INCONEL					
STAINLESS STEEL					
TEMPERATURE PROTECTION					
STANDARD					
H.T. / L.T. EXTENSION					
SINGLE FORCE					
DOUBLE FORCE					
QUADRUPLE FORCE					
MECHANISM & DISPLACER CHAMBERS					
WITHOUT MECHANISM AND DISPLACER CHAMBER					
CONNECTIONS LAYOUT					
WITH DISPLACER CHAMBER					
TOP & BOTTOM					
SIDE & SIDE					
SIDE & BOTTOM					
WITHOUT CHAMBER					
TOP & SIDE					
TOP VESSEL					
SIDE VESSEL					
ARM HOUSING LENGTH (SIDE VESSEL ONLY)					
STD. LENGTH 11"					
CONNECTIONS TYPE					
FLANGED					
SCREWED					
BW/SW					
CONNECTIONS DETAILS (IF FLANGED)					
SIZE					
DN 50 (2") WITH DISPLACER CH.					
DN 100 (4") WITHOUT DISPLACER CH.					
CLASS/PN					
FACING & FINISH					
CHAMBERS MATERIAL					
CARBON STEEL					
STAINLESS STEEL					
E. N°	UNIT PRICE :		TOTAL PRICE :		

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