Masoneilan®
12300 Series
Level Transmitter / Controller

A Smart Instrument
with
HART®
Communication Protocol

Specification Data
CU3000 E
10/00
### 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

<table>
<thead>
<tr>
<th>1st 2nd 3rd 4th 5th 6th 7th</th>
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</thead>
<tbody>
<tr>
<td>Communication</td>
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<tr>
<td>3. HART protocol</td>
</tr>
<tr>
<td>with explosionproof</td>
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<tr>
<td>push-buttons</td>
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<tr>
<td>Action</td>
</tr>
<tr>
<td>0 - Undefined</td>
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<tr>
<td>1 - Controller</td>
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<td>2 - Transmitter</td>
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<tr>
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<td>1 - Top and bottom</td>
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<tr>
<td>Flanged</td>
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<td>2 - Side and side</td>
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<td>3 - Top vessel</td>
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<td>Display</td>
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<tr>
<td>0 - LCD</td>
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<tr>
<td>Safety</td>
</tr>
<tr>
<td>55 - Weatherproof</td>
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<tr>
<td>57 - Flameproof CENELEC</td>
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<tr>
<td>58 - Intrinsically Safe CENELEC</td>
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<tr>
<td>59 - Explosionproof and Intrinsically Safe FM</td>
</tr>
<tr>
<td>60 - Explosionproof and Intrinsically Safe CSA</td>
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</tbody>
</table>

Note: The optional extension is identified by AB suffix after the 8th digit.

Pressure envelope characteristics

**Rating**
ANSI class 150 to 2500
PN 16 to PN 420

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

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

**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

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

**Temperature limits**

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.

<table>
<thead>
<tr>
<th>Model</th>
<th>Connections</th>
</tr>
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<tbody>
<tr>
<td>12300</td>
<td>Screwed NPT - 1 1/2” and 2”</td>
</tr>
<tr>
<td>12301</td>
<td>Flanged - 1 1/2” and 2” - DN 40 and DN 50</td>
</tr>
<tr>
<td>12309</td>
<td>Screwed NPT - 1 1/2” and 2”</td>
</tr>
<tr>
<td>12302</td>
<td>Flanged - 1 1/2” and 2” - DN 40 and DN 50</td>
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<tr>
<td>12305</td>
<td>Screwed NPT - 1 1/2” and 2”</td>
</tr>
<tr>
<td>12308</td>
<td>Flanged - 1 1/2” and 2” - DN 40 and DN 50</td>
</tr>
<tr>
<td>12306</td>
<td>Screwed NPT - 1 1/2” and 2”</td>
</tr>
<tr>
<td>12307</td>
<td>Flanged - 1 1/2” and 2” - DN 40 and DN 50</td>
</tr>
<tr>
<td>12303</td>
<td>Flanged - 3” and 4” - DN 80 and DN 100</td>
</tr>
<tr>
<td>12304</td>
<td>Flanged - 4” - DN 100</td>
</tr>
</tbody>
</table>
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
\[
R_{\text{max}} = \frac{U - 9.5}{I_{\text{max}}}
\]

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 µAV

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.

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

Factory Mutual (FM)

- 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
  Classe II
  Classe III
  T4, T amb = 80° C
  T5, T amb = 60° C
  T6, T amb = 50° C

Canadian Standards

- IP 66 / IP 67
- NEMA 4X - 6 - 6P

Enclosure rating

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

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

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

<table>
<thead>
<tr>
<th>12306</th>
<th>RANGE</th>
<th>12307</th>
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<tbody>
<tr>
<td>FF</td>
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**12306**
- FF: 33, MR: 192, Range: 235, Flange description: 4” ANSI 150, 4” ANSI 300

**12307**
- FF: 33, MR: 192, Range: 235, Flange description: 4” ANSI 150, 4” ANSI 300

**12303**
- FF: 86, MR: 493, Top view: (all models except 12304)

**12304**
- FF: 86, MR: 493, Top view: (all models except 12304)

*Unless otherwise specified*

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

<table>
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<tr>
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<th>356 mm 14&quot;</th>
<th>813 mm 32&quot;</th>
<th>1219 mm 48&quot;</th>
<th>1524 mm 60&quot;</th>
<th>1829 mm 72&quot;</th>
<th>2134 mm 84&quot;</th>
<th>2438 mm 96&quot;</th>
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</table>
### Specification Data

**12300 SERIES HART LEVEL TRANSMITTER/CONTROLLER**

**E. N°**

**QUOTATION N°**

**PAGE:**

**REVISION:**

**DATE:**

**CUSTOMER:**

**Reference:**

**TAG:**

**ITEM:**

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**DATE AND SERVICE CONDITIONS**

<table>
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<th>RANGE</th>
<th>LEVEL AND AUXILIARY EQUIPMENT CODIFICATION</th>
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<tbody>
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<td>355.5 mm</td>
<td>813 mm</td>
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<tr>
<td>(14&quot;)</td>
<td>(32&quot;)</td>
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**INSTRUMENT**

<table>
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<tbody>
<tr>
<td>OPT</td>
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</tbody>
</table>

**DISPLACER**

- **MATERIAL:** STAINLESS STEEL
- **HANGER EXTENSION**
  - **TOP AND SIDE VESSEL ONLY**
- **VENT - DRAIN**
  - **TYPE:** VENT
  - **CONNECTION(S):** SCREWED + PLUG
  - **SIZE:** DN 20 (3/4")

**ELECTRIC CONN:**

- **1/2' NPT**

**CASE TYPE**

- WEATHERPROOF
- FLAMPROOF
- INTRINSICALLY SAFE
- CENELEC
- FM
- CSA

**DRAIN**

**MOUNTING**

- LEFT HAND
- RIGHT HAND

**CASE ORIENT.**

- POSITION NR ______

**ORIENTATION**

- LEFT HAND
- RIGHT HAND

**SIGNAL**

- 4-20 mA

**ACTION**

- DIRECT
- REVERSE

**TRANSMITTER**

- WITHOUT INSTRUMENT
- WITH DISPLACER

**CONTROLLER**

- WITHOUT INSTRUMENT
- WITH DISPLACER

**CABLE Ø**

**TORQUE TUBE**

- WITHOUT CHAMBER
- WITH DISPLACER CHAMBER

**CHAMBER MATERIAL**

- CARBON STEEL
- STAINLESS STEEL

**TORQUE TUBE MATERIAL**

- INCONEL
- STAINLESS STEEL

**TEMPERATURE STANDARD**

- H.T. / L.T. EXTENSION

**PROTECTION**

- SINGLE FORCE
- DOUBLE FORCE
- QUADRUPLE FORCE

**MOUNTING**

- LEFT HAND
- RIGHT HAND

**SIGNAL**

- 4-20 mA

**LEVEL**

- DIRECT
- REVERSE

**DISPLACER**

- WITHOUT INSTRUMENT
- WITH DISPLACER

**Material**

- CARBON STEEL
- STAINLESS STEEL

**ARM HOUSING STD. LENGTH**

- 11''

**CONNECTIONS**

- FLANGED
- SCREWED
- BW/SW

**MECHANISM & DISPLACER CHAMBERS**

- WITH DISPLACER CHAMBER
- WITHOUT DISPLACER CHAMBER
- CONNECTORS DETAIL (IF FLANGED)

**MECHANISM & DISPLACER MATERIAL**

- CARBON STEEL
- STAINLESS STEEL

**REMARKS**

- HANDHELD COMMUNICATOR

**UNIT PRICE :**

**TOTAL PRICE :**