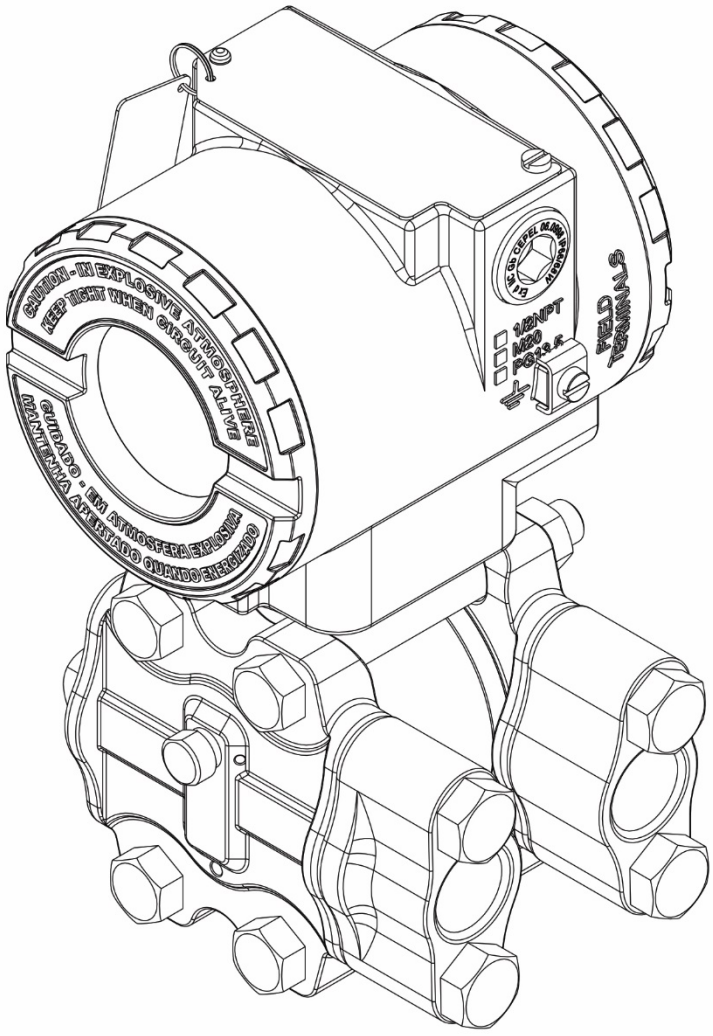
smar - LD301

OPERATION AND MAINTENANCE
INSTRUCTION / MANUAL

Intelligent Pressure Transmitter With Control Capability

HART COMMUNICATION PROTOCOL



MAR / 21
LD301
VERSION 7

LD301ME

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web: www.smar.com/contactus.asp

INTRODUCTION

LD301 is a smart pressure transmitter for differential, absolute, gauge, level and flow measurements. It is based on a field-proven capacitive sensor that provides reliable operation and high performance. The digital technology used in **LD301** enables the choice of several types of transfer functions, an easy interface between the field and the control room and several interesting features that considerably reduce installation, operation and maintenance costs.

Besides all the functions offered by other smart transmitters, **LD301**offers the following functions:

- ✓ $\sqrt{(\Delta P)^3}$ - used for trapezoidal weirs in open channel flow measurement.
- ✓ $\sqrt{(\Delta P)^5}$ - used for V-notch weirs in open channel flow measurement.
- ✓ **TABLE** - the pressure signal is linearly customized according to a 16-point table, freely configurable.
- ✓ **CONTROLLER** - the Process Variable is compared to a set point. The deviation acts on the output signal according to an optional PID algorithm.
- ✓ **PID OUTPUT CHARACTERIZATION** - the PID output signal (MV) follows a curve that is determined by 16 points, which can be freely configured
- ✓ **BIDIRECTIONAL FLOW FUNCTION -** used to measure the flow in the piping in both directions.

LOCAL ADJUSTMENT - It adjusts the lower and upper value using the magnetic key, input/output function, operating mode, indication, setpoint and PID parameters;

- ✓ **PASSWORD - three levels for different functions.**
- ✓ **OPERATION COUNTER** - shows the number of changes in each function.
- ✓ **TOTALIZATION** - flow totalization in volume or mass.
- ✓ **USER-UNIT** - indication in engineering unit of the property actually measured, e.g., level, flow or volume.
- ✓ **WRITE-PROTECT -** via hardware

Get the best results of the LD301 by carefully reading these instructions.

Smar pressure transmitters are protected by U.S. patents 6,433,791 and 6,621,443.

NOTE
This manual is compatible with version 7.XX.YY, where 7 indicates software version, XX software release, and YY software emission. The indication 7.XX means that this manual is compatible with any release of version 7 software

WARNING
To ensure that our products are safe and without risk to health, the manual must be read carefully before proceeding and warning labels on packages must be observed. Installation, operation, maintenance, and servicing must only be carried out by suitably trained personnel and in accordance with the **Operation and Maintenance Instruction Manual.**

Waiver of responsibility

The contents of this manual abides by the hardware and software used on the current equipment version. Eventually there may occur divergencies between this manual and the equipment. The information from this document are periodically reviewed and the necessary or identified corrections will be included in the following editions. Suggestions for their improvement are welcome.

Warning

For more objectivity and clarity, this manual does not contain all the detailed information on the product and, in addition, it does not cover every possible mounting, operation or maintenance cases.

Before installing and utilizing the equipment, check if the model of the acquired equipment complies with the technical requirements for the application. This checking is the user's responsibility.

If the user needs more information, or on the event of specific problems not specified or treated in this manual, the information should be sought from Smar. Furthermore, the user recognizes that the contents of this manual by no means modify past or present agreements, confirmation or judicial relationship, in whole or in part.

All of Smar's obligation result from the purchasing agreement signed between the parties, which includes the complete and sole valid warranty term. Contractual clauses related to the warranty are not limited nor extended by virtue of the technical information contained in this manual.

Only qualified personnel are allowed to participate in the activities of mounting, electrical connection, startup and maintenance of the equipment. Qualified personnel are understood to be the persons familiar with the mounting, electrical connection, startup and operation of the equipment or other similar apparatus that are technically fit for their work. Smar provides specific training to instruct and qualify such professionals. However, each country must comply with the local safety procedures, legal provisions and regulations for the mounting and operation of electrical installations, as well as with the laws and regulations on classified areas, such as intrinsic safety, explosion proof, increased safety and instrumented safety systems, among others.

The user is responsible for the incorrect or inadequate handling of equipments run with pneumatic or hydraulic pressure or, still, subject to corrosive, aggressive or combustible products, since their utilization may cause severe bodily harm and/or material damages.

The field equipment referred to in this manual, when acquired for classified or hazardous areas, has its certification void when having its parts replaced or interchanged without functional and approval tests by Smar or any of Smar authorized dealers, which are the competent companies for certifying that the equipment in its entirety meets the applicable standards and regulations. The same is true when converting the equipment of a communication protocol to another. In this case, it is necessary sending the equipment to Smar or any of its authorized dealer. Moreover, the certificates are different and the user is responsible for their correct use.

Always respect the instructions provided in the Manual. Smar is not responsible for any losses and/or damages resulting from the inadequate use of its equipments. It is the user's responsibility to know and apply the safety practices in his country.

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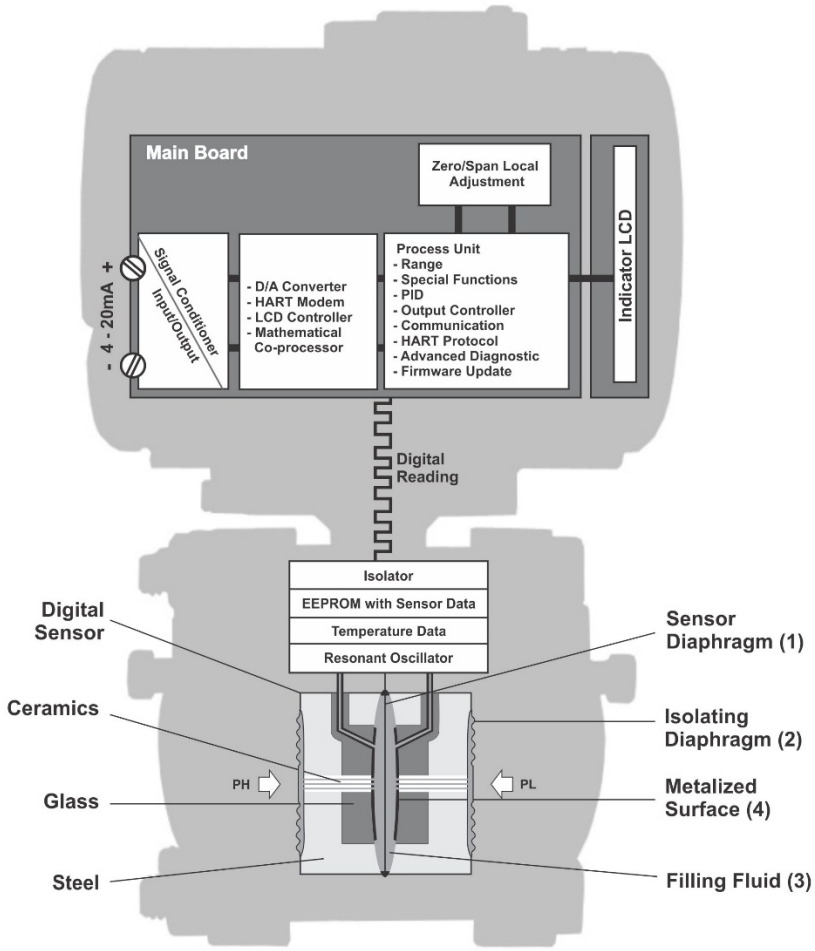
TRANSMITTER GENERAL VIEW

The **LD301** uses a highly proven technique for pressure measuring by capacitance reading. The block diagram of the **LD301** HART® pressure transmitter is shown below.

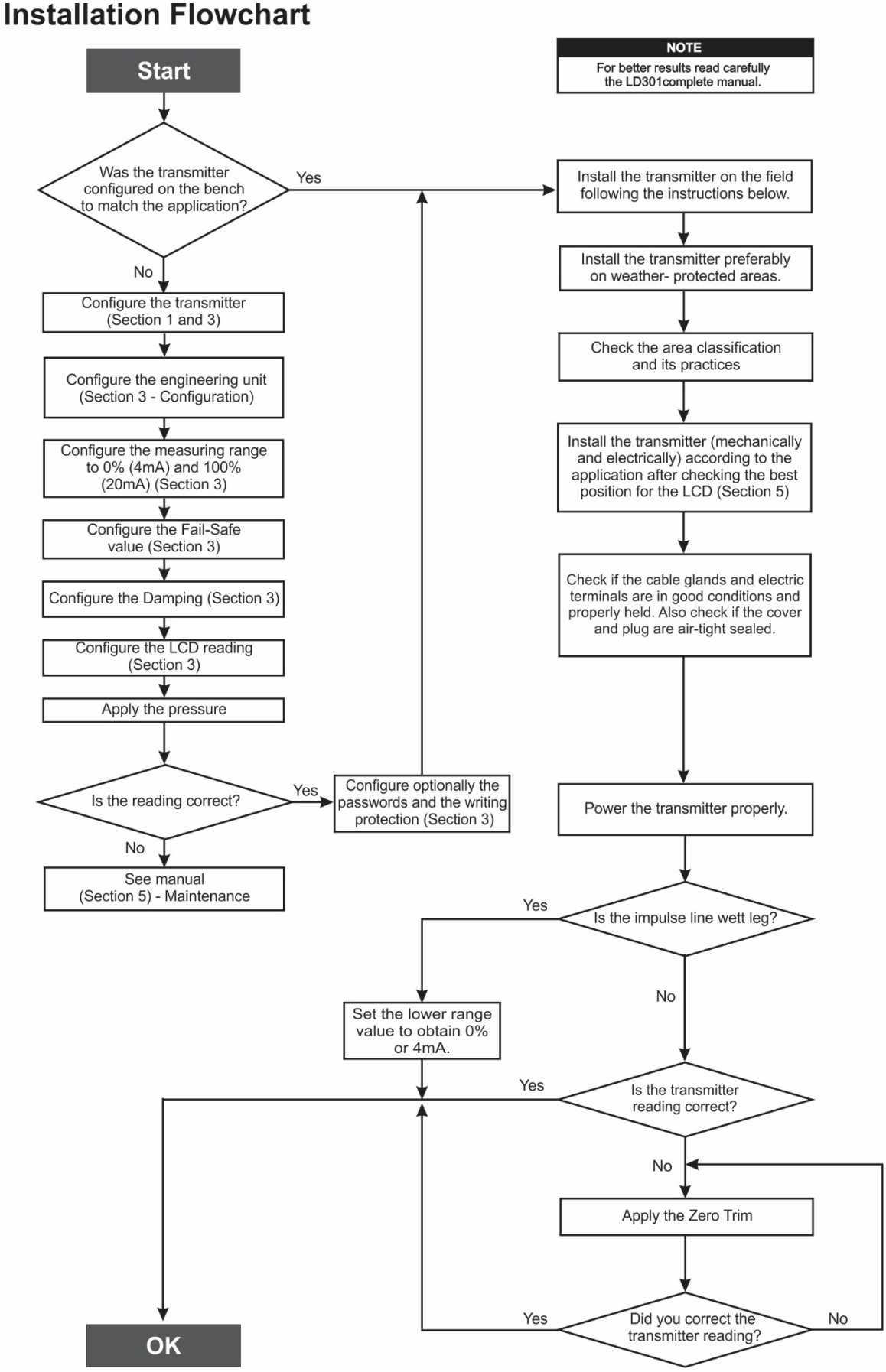


In the cell center is the sensor diaphragm (1). This diaphragm flexes in response to the different pressures applied on the LOW and HIGH sides of the cell (PL and PH). These pressures are directly applied on the isolator diaphragms (2), whose function is to isolate the sensor from the process and provides high resistance against corrosion caused by process fluids. The pressure is transmitted directly to the sensor diaphragm through the filling fluid (3) and causes its deflection. The sensor diaphragm is a mobile electrode whose two metal surfaces (4) are fixed electrodes. A deflection on the sensor diaphragm is read by the capacitance variation between both fixed and mobile electrodes.

The resonant oscillator reads the capacitance variations between the mobile and the fixed boards and generates a pressure output equivalent to the detected capacitance variation. This pressure value is informed in compliance with the transmitter communication protocol. As the conversion process does not involve an A/D converter, errors or deviations are eliminated during the process. Temperature compensation is done by a sensor, which combined with a precision sensor, results in high accuracy and range.
The process variable, as well as the diagnostic monitoring and information, are provided by the digital communication protocol. The **LD301** is available in the HART communication protocol.

Read carefully these instructions for better use of the **LD301**.

Installation Flowchart



Section 1

INSTALLATION

General

NOTE
Installations in hazardous areas must follow the recommendations of the applicable standards. Refer to Appendix A for this information.

The overall accuracy of a flow, level, or pressure measurement depends on several variables. Although the transmitter has an outstanding performance, proper installation is essential to maximize its efficiency.

Among all factors, which may affect transmitter accuracy, environmental conditions are the most difficult to control. There are, however, ways of reducing the effects of temperature, humidity and vibration.

The **LD301** has a built-in temperature sensor to compensate for temperature variations. At the factory, each transmitter is submitted to a temperature cycle, and the characteristics under different temperatures are recorded in the transmitter memory. At the field, this feature minimizes the temperature variation effect.

Mounting

Putting the transmitter in areas protected from extreme environmental changes can minimize temperature fluctuation effects.

In warm environments, the transmitter should be installed to avoid, as much as possible, direct exposure to the sun. Installation close to lines and vessels subjected to high temperatures should also be avoided. Use longer sections of impulse piping between tap and transmitter whenever the process fluid is at high temperatures. When necessary, use thermal insulation to protect the transmitter from external heat sources.

Installations where the process fluid can freeze inside the transmitter chamber, should be avoided. This could cause permanent damage to the capacitive cell.

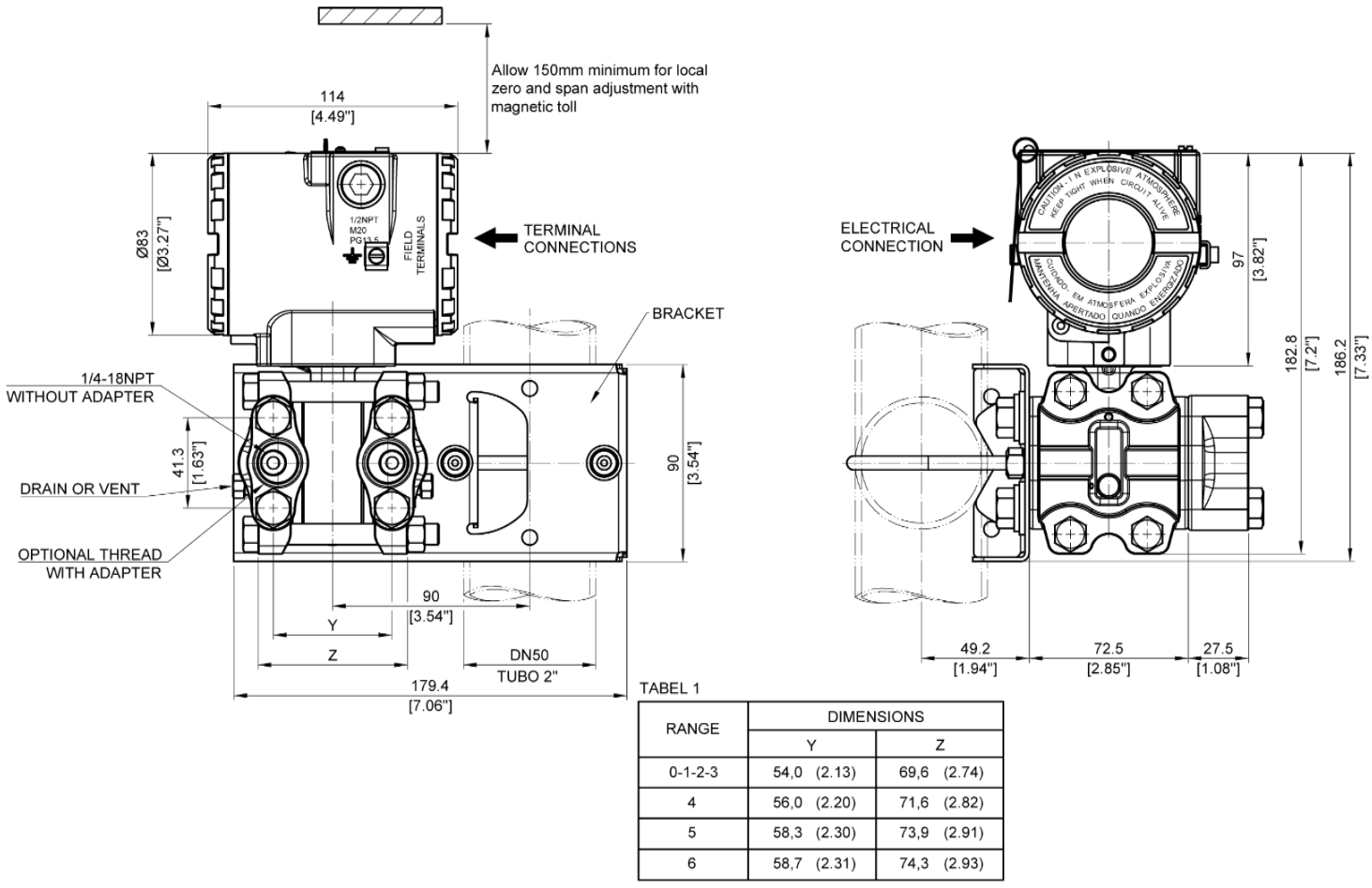
Although the transmitter is virtually insensitive to vibration, installation close to pumps, turbines or other vibrating equipment should be avoided.

The transmitter has been designed to be both rugged and lightweight at the same time. This makes its mounting easier. The mounting positions are shown in Figure 1.1.

Existing standards for the manifolds have also been considered, and standard designs fits perfectly to the transmitter flanges.

Should the process fluid contain solids in suspension, install valves or rod-out fittings regularly to clean out the pipes. The pipes should be internally cleaned by using steam or compressed air, or by draining the line with the process fluid, before such lines are connected to the transmitter (blow-down).

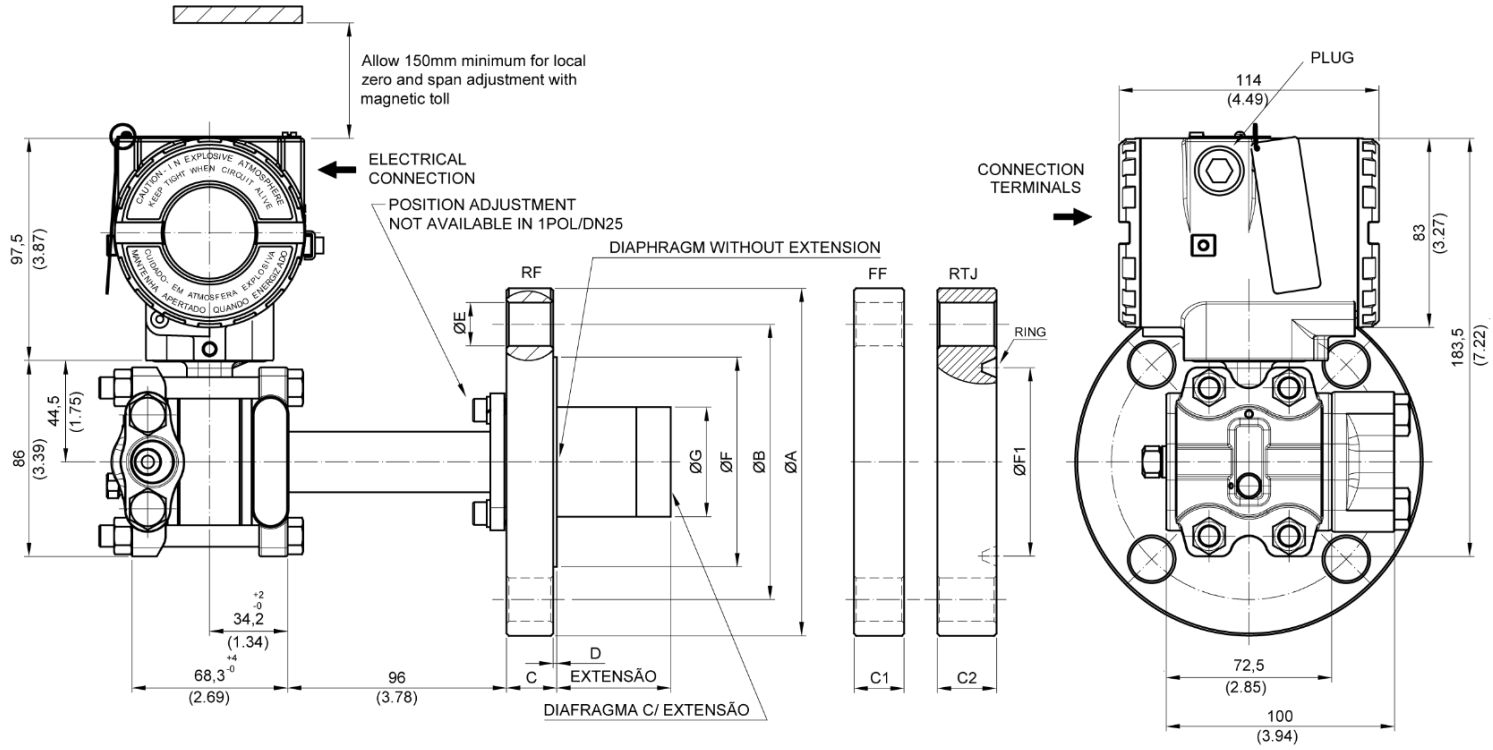
NOTE
When installing or storing the level transmitter, the diaphragm must be protected to avoid scratching-denting or perforation of its surface. The process flange of the level transmitters can be rotated ±45º. To do this just loosen the two screws (Figure 1.1) and rotate the flange. Do not take the screws out. There is a label (Figure 1.1) on the transmitter with these instructions.



TABEL 1

RANGE	DIMENSIONS	
	Y	Z
0-1-2-3	54,0 (2.13)	69,6 (2.74)
4	56,0 (2.20)	71,6 (2.82)
5	58,3 (2.30)	73,9 (2.91)
6	58,7 (2.31)	74,3 (2.93)

Figure 1.1 (a) – Dimensional Drawing and Mounting Position - Differential, Flow, Gage, Absolute and High Static Pressure Transmitters with Mounting Bracket



DIMENSIONS IN mm (inch)
EXTENSION LENGHTS: 0 , 50 , 100 , 150 or 200
EXTENSIONS AVAILABLE IN RF ONLY

ASME-B 16.5 - 2017 DIMENSIONS

DN	CLASS	A	B	C	C1 (FF)	C2 (RTJ)	D	E	F	F1 (RTJ)	RING	G	HOLES
1"	150	110 (4.33)	79,2 (3.12)	15 (0.59)	13 (0.59)	19 (0.75)	2 (0.06)	16 (0.63)	50,8 (2)	47,6 (1.87)	R15		4
	300	125 (4.92)	88,9 (3.50)	18 (0.71)	16 (0.63)	23,9 (0.94)	2 (0.06)	19 (0.75)	50,8 (2)	50,8 (2)	R16		4
	600	125 (4.92)	88,9 (3.50)	24,5 (0.96)		23,9 (0.94)	7 (0.25)	19 (0.75)	50,8 (2)	50,8 (2)	R16		4
1.1/2"	150	125 (4.92)	98,6 (3.88)	20 (0.78)	20 (0.79)	24,4 (0.96)	2 (0.06)	16 (0.63)	73,2 (2.88)	65,1 (2.56)	R19	40 (1.57)	4
	300	155 (6.10)	114,3 (4.5)	21 (0.83)	20 (0.79)	28,7 (1.13)	2 (0.06)	22 (0.87)	73,2 (2.88)	68,3 (2.68)	R20	40 (1.57)	4
	600	155 (6.10)	114,3 (4.5)	29,3 (1.15)		28,7 (1.13)	7 (0.25)	22 (0.87)	73,2 (2.88)	68,3 (2.68)	R20	40 (1.57)	4
2"	150	150 (5.90)	120,7 (4.75)	20 (0.79)	20 (0.79)	23,9 (0.94)	2 (0.06)	19 (0.75)	92 (3.62)	82,6 (3.25)	R22	48 (1.89)	4
	300	165 (6.50)	127 (5)	22,7 (0.89)	20,7 (0.81)	28,6 (1.13)	2 (0.06)	19 (0.75)	92 (3.62)	82,6 (3.25)	R23	48 (1.89)	8
	600	165 (6.50)	127 (5)	32,3 (1.27)		33,3 (1.31)	7 (0.25)	19 (0.75)	92 (3.62)	82,6 (3.25)	R23	48 (1.89)	8
3"	150	190 (7.48)	152,4 (6)	24,3 (0.96)	22,3 (0.88)	28,7 (1.13)	2 (0.06)	19 (0.75)	127 (5)	114,3 (4.5)	R29	73 (2.87)	4
	300	210 (8.27)	168,1 (6.62)	29 (1.14)	27 (1.06)	34,9 (1.37)	2 (0.06)	22 (0.87)	127 (5)	123,8 (4.87)	R31	73 (2.87)	8
	600	210 (8.27)	168,1 (6.62)	38,8 (1.53)		39,7 (1.56)	7 (0.25)	22 (0.87)	127 (5)	123,8 (4.87)	R31	73 (2.87)	8
4"	150	228,6 (9)	190,5 (7.5)	24,3 (0.96)	22,3 (0.88)	28,7 (1.13)	2 (0.06)	19 (0.75)	157 (6.19)	149,2 (5.87)	R36	89 (3.50)	8
	300	255 (10)	200 (7.87)	32,2 (1.27)	30,2 (1.19)	38,1 (1.50)	2 (0.06)	22 (0.87)	157 (6.19)	149,2 (5.87)	R37	89 (3.50)	8
	600	275 (10.83)	215,9 (8.5)	45,1 (1.77)		46 (1.81)	7 (0.25)	25 (1)	157 (6.19)	149,2 (5.87)	R37	89 (3.50)	8

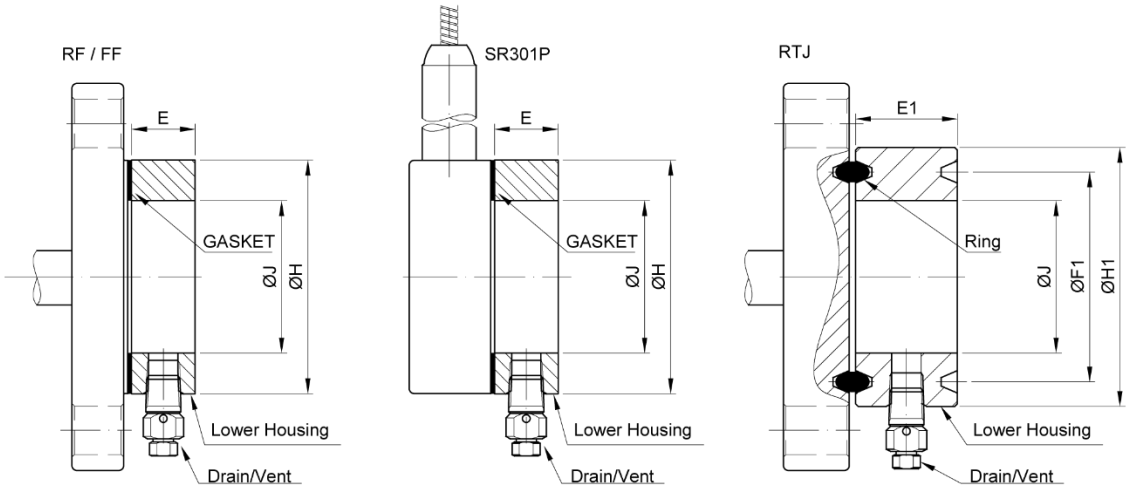
EN 1092-1-2008 DIMENSIONS

DN	PN	A	B	C	C1 (FF)		D	E	F		G	HOLES
25	10/40	115 (4.53)	85 (3.35)	18 (0.71)	18 (0.71)		2 (0.08)	14 (0.55)	68 (2.67)			4
40	10/40	150 (5.91)	110 (4.33)	20 (0.78)	20 (0.78)		3 (0.12)	18 (0.71)	88 (3.46)		40 (1.57)	4
50	10/40	165 (6.50)	125 (4.92)	20 (0.78)	20 (0.78)		3 (0.12)	18 (0.71)	102 (4.01)		48 (1.89)	4
80	10/40	200 (7.87)	160 (6.3)	24 (0.95)	24 (0.95)		3 (0.12)	18 (0.71)	138 (5.43)		73 (2.87)	8
100	10/16	220 (8.67)	180 (7.08)	20 (0.78)			3 (0.12)	18 (0.71)	158 (6.22)		89 (3.50)	8
	25/40	235 (9.25)	190 (7.5)	24 (0.95)			3 (0.12)	22 (0.87)	162 (6.38)		89 (3.50)	8

JIS B 2220 DIMENSIONS

	CLASS	A	B	C		D	E	F		G	HOLES
40A	20K	140 (5.5)	105 (4.13)	20 (0.78)		2 (0.08)	19 (0.75)	81 (3.2)		40 (1.57)	4
50A	10K	155 (6.1)	120 (4.72)	20 (0.78)		2 (0.08)	15 (0.59)	96 (3.78)		48 (1.89)	4
	20K	155 (6.1)	120 (4.72)	20 (0.78)		2 (0.08)	19 (0.75)	96 (3.78)		48 (1.89)	8
	40K	165 (6.5)	130 (5.12)	26 (1.02)		2 (0.08)	19 (0.75)	105 (4.13)		48 (1.89)	8
80A	10K	185 (7.28)	150 (5.9)	22 (0.87)		2 (0.08)	19 (0.75)	126 (4.96)		73 (2.87)	8
	20K	200 (7.87)	160 (6.3)	22 (0.87)		2 (0.08)	19 (0.75)	132 (5.2)		73 (2.87)	8
100A	10K	210 (8.27)	175 (6.89)	20 (0.78)		2 (0.08)	19 (0.75)	151 (5.95)		89 (3.50)	8

Figure 1.1 (b) – Dimensional Drawing and Mounting Position - Flanged Pressure Transmitter with Integral Flange

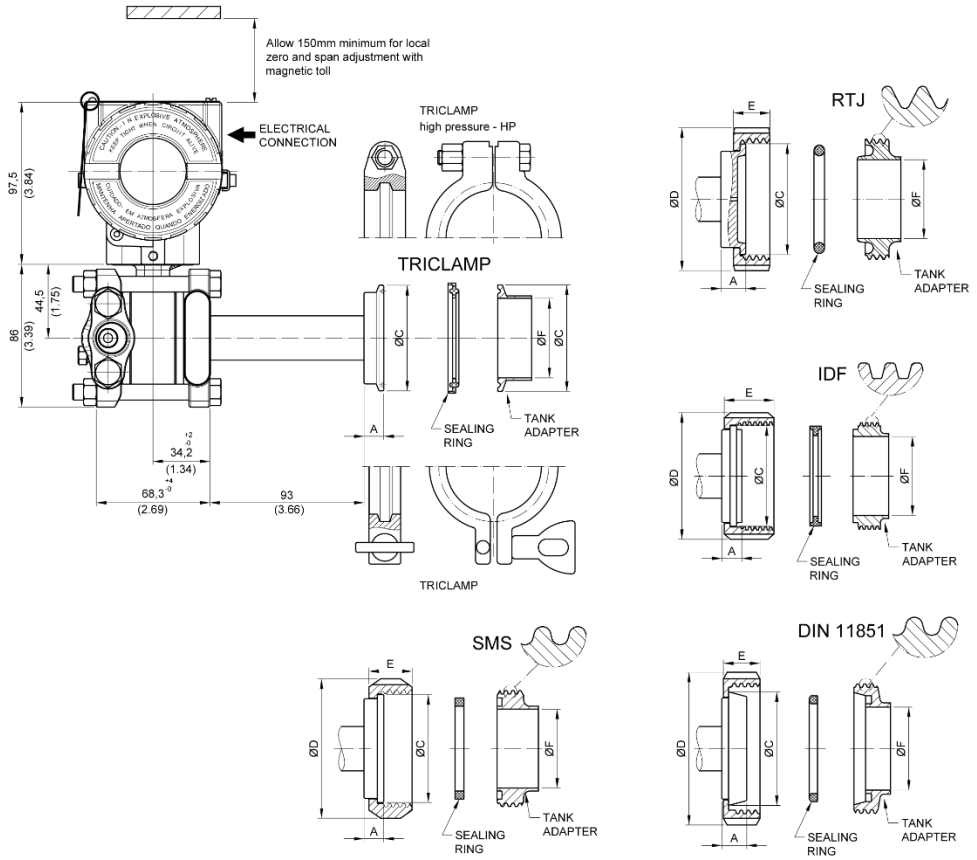


DIMENSIONS - RF / FF - mm (inch)						
STANDARD	DN	CLASS	H	J	E	
					1/4"NPT	1/2"NPT
ASME B16.5	1"	ALL	50,8 (2,00)	35 (1,38)	25	
	1.1/2"		73,2 (2,88)	48 (1,89)	25	35
	2"		91,9 (3,62)	60 (2,36)	25	35
	3"		127 (5,00)	89 (3,50)	25	35
	4"		158 (6,22)	115 (4,53)	25	35
DIN EN 1092-1	25	ALL	68 (2,68)	35 (1,38)	25	35
	40		88 (3,46)	48 (1,89)	25	35
	50		102 (4,02)	60 (2,36)	25	35
	80		138 (5,43)	89 (3,50)	25	35
	100		158 (6,22)	115 (4,53)	25	35
JIS B 2220	40A	20K	81 (3,19)	48 (1,89)	25	35
	50A	10K	96 (3,78)	60 (1,36)	25	35
		40K	105 (4,13)	60 (1,36)	25	35
	80A	10K	126 (4,96)	89 (3,50)	25	35
		20K	132 (5,20)	89 (3,50)	25	35
	100A	10K	151 (5,94)	115 (4,53)	25	35

DIMENSIONS - RTJ - mm (inch) - ASME B16.5							
DN	CLASS	F1	RING	H1	J	E1	
						1/4"NPT	1/2"NPT
1"	150	47,6 (1,87)	R15	63,5 (2,50)	35 (1,38)	40	45
	300	50,8 (2,00)	R16	70 (2,75)	35 (1,38)	40	45
	600	50,8 (2,00)	R16	70 (2,75)	35 (1,38)	40	45
	1500	50,8 (2,00)	R16	71,5 (2,81)	35 (1,38)	40	45
	2500	60,3 (2,37)	R18	73 (2,88)	35 (1,38)	40	45
1.1/2"	150	65,1 (2,56)	R19	82,5 (3,25)	48 (1,89)	40	45
	300	68,3 (2,69)	R20	90,5 (3,56)	48 (1,89)	40	45
	600	68,3 (2,69)	R20	90,5 (3,56)	48 (1,89)	40	45
	1500	68,3 (2,69)	R20	92 (3,62)	48 (1,89)	40	45
	2500	82,6 (3,25)	R23	114 (4,50)	48 (1,89)	40	45
2"	150	82,6 (3,25)	R22	102 (4,00)	60 (2,36)	40	45
	300	82,6 (3,25)	R23	108 (4,25)	60 (2,36)	40	45
	600	82,6 (3,25)	R23	108 (4,25)	60 (2,36)	40	45
	1500	95,3 (3,75)	R24	124 (4,88)	60 (2,36)	40	45
	2500	101,6 (4,00)	R26	133 (5,25)	60 (2,36)	40	45
3"	150	114,3 (4,50)	R29	133 (5,25)	89 (3,50)	40	45
	300	123,8 (4,87)	R31	146 (5,75)	89 (3,50)	40	45
	600	123,8 (4,87)	R31	146 (5,75)	89 (3,50)	40	45
4"	150	149,2 (5,87)	R36	171 (6,75)	115 (4,53)	40	45
	300	149,2 (5,87)	R37	175 (6,88)	115 (4,53)	40	45
	600	149,2 (5,87)	R37	175 (6,88)	115 (4,53)	40	45

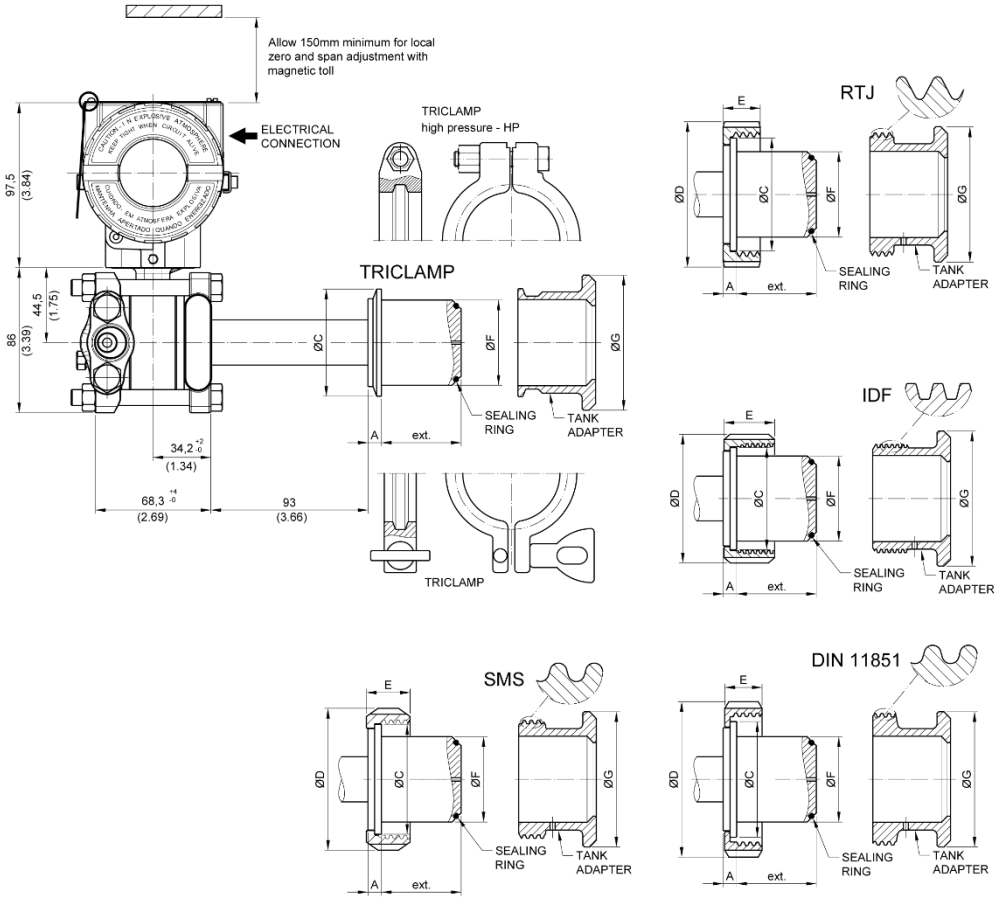
LOWER HOUSING 1/2NPT SUPPLIED WITH PLASTIC PROTECTION
NOT LOWER HOUSING 1/2 NPT FOR 1 INCH

Figure 1.1 (c) - Dimensional Drawing and Mounting Position - Lower Housing



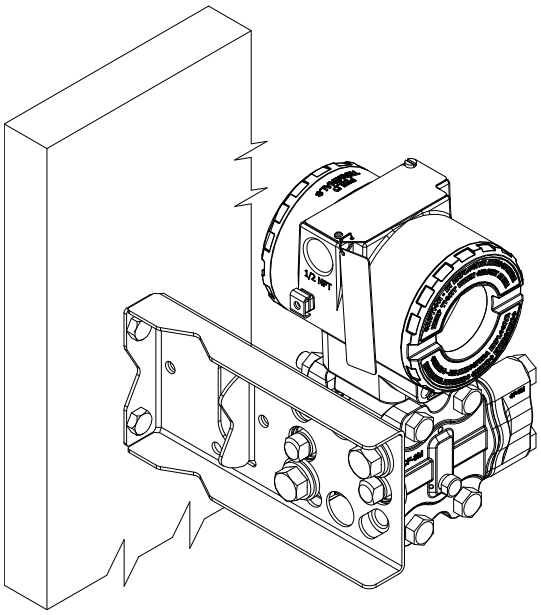
SR301S / LD30xS / LD400S							
CONNECTIONS WITHOUT EXTENSION	Dimensions in mm (inch)						
	A	ØC	ØD	E	ØF	ØG	EXT.
Tri-Clamp - 1 1/2" - without extension	12 (0.47)	50 (1.96)	---	---	35 (1.38)	---	---
Tri-Clamp - 1 1/2" HP - without extension	12 (0.47)	50 (1.96)	---	---	35 (1.38)	---	---
Tri-Clamp - 2" - without extension	12 (0.47)	63,5 (2.5)	---	---	47,6 (1.87)	---	---
Tri-Clamp - 2" HP - without extension	12 (0.47)	63,5 (2.5)	---	---	47,6 (1.87)	---	---
Tri-Clamp - 3" - without extension	12 (0.47)	91 (3.58)	---	---	72 (2.83)	---	---
Tri-Clamp - 3" HP - without extension	12 (0.47)	91 (3.58)	---	---	72 (2.83)	---	---
Thread DN40 - DIN 11851 - without extension	13 (0.51)	56 (2.2)	78 (3.07)	21 (0.83)	38 (1.5)	---	---
Thread DN50 - DIN 11851 - without extension	15 (0.59)	68,5 (2.7)	92 (3.62)	22 (0.86)	50 (1.96)	---	---
Thread DN80 - DIN 11851 - without extension	16 (0.63)	100 (3.94)	127 (5)	29 (1.14)	81 (3.19)	---	---
Thread SMS - 1 1/2" - without extension	12 (0.47)	55 (2.16)	74 (2.91)	25 (0.98)	35 (1.38)	---	---
Thread SMS - 2" - without extension	12 (0.47)	65 (2.56)	84 (3.3)	26 (1.02)	48,6 (1.91)	---	---
Thread SMS - 3" - without extension	12 (0.47)	93 (3.66)	113 (4.45)	32 (1.26)	73 (2.87)	---	---
Thread RJT - 2" - without extension	15 (0.59)	66,7 (2.63)	86 (3.38)	22 (0.86)	47,6 (1.87)	---	---
Thread RJT - 3" - without extension	15 (0.59)	92 (3.62)	112 (4.41)	22,2 (0.87)	73 (2.87)	---	---
Thread IDF - 2" - without extension	12 (0.47)	60.5 (2.38)	76 (2.99)	30 (1.18)	47,6 (1.87)	---	---
Thread IDF - 3" - without extension	12 (0.47)	87,5 (3.44)	101,6 (4)	30 (1.18)	73 (2.87)	---	---

Figure 1.1 (d) – Dimensional Drawing and Mounting Position - Sanitary Transmitter without Extension



SR301S / LD30XS / LD400S							
CONNECTIONS WITH EXTENSION	Dimensions in mm (inch)						
	A	ØC	ØD	E	ØF	ØG	EXT.
Tri-Clamp DN50 - with extension	8 (0.315)	64 (2.52)	---	---	50,5 (1.99)	80 (3.15)	48 (1.89)
Tri-Clamp DN50 HP - with extension	8 (0.315)	64 (2.52)	---	---	50,5 (1.99)	80 (3.15)	48 (1.89)
Tri-Clamp - 2" - with extension	8 (0.315)	64 (2.52)	---	---	50,5 (1.99)	80 (3.15)	48 (1.89)
Tri-Clamp - 2" HP -with extension	8 (0.315)	64 (2.52)	---	---	50,5 (1.99)	80 (3.15)	48 (1.89)
Tri-Clamp - 3" - with extension	8 (0.315)	91 (3.58)	---	---	72,5 (2.85)	100 (3.94)	50 (1.96)
Tri-Clamp - 3" HP - with extension	8 (0.315)	91 (3.58)	---	---	72,5 (2.85)	100 (3.94)	50 (1.96)
Thread DN25 - DIN 11851 - with extension	6 (0.24)	47,5 (1.87)	63 (2.48)	21 (0.83)	43,2 (1.7)	80 (3.15)	26,3 (1.03)
Thread DN40 - DIN 11851 - with extension	8 (0.315)	56 (2.2)	78 (3.07)	21 (0.83)	50,5 (1.99)	80 (3.15)	48 (1.89)
Thread DN50 - DIN 11851 - with extension	8 (0.315)	68,5 (2.7)	92 (3.62)	22 (0.86)	50,5 (1.99)	80 (3.15)	48 (1.89)
Thread DN80 - DIN 11851 - with extension	8 (0.315)	100 (3.94)	127 (5)	29 (1.14)	72,5 (2.85)	100 (3.94)	50 (1.96)
Thread SMS - 2" - with extension	8 (0.315)	65 (2.56)	84 (3.3)	26 (1.02)	50,5 (1.99)	80 (3.15)	48 (1.89)
Thread SMS - 3" - with extension	8 (0.315)	93 (3.66)	113 (4.45)	32 (1.26)	72,5 (2.85)	100 (3.94)	50 (1.96)
Thread RJT - 2" - with extension	8 (0.315)	66,7 (2.63)	86 (3.38)	22 (0.86)	50,5 (1.99)	80 (3.15)	48 (1.89)
Thread RJT - 3" - with extension	8 (0.315)	92 (3.62)	112 (4.41)	22,2 (0.87)	72,5 (2.85)	100 (3.94)	50 (1.96)
Thread IDF - 2" - with extension	8 (0.315)	60.5 (2.38)	76,2 (3)	30 (1.18)	50,5 (1.99)	80 (3.15)	48 (1.89)
Thread IDF - 3" - with extension	8 (0.315)	87,5 (3.44)	101,6 (4)	30 (1.18)	72,5 (2.85)	100 (3.94)	50 (1.96)

Figure 1.1 (e) – Dimensional Drawing and Mounting Position - Sanitary Transmitter with Extension



WALL OR PANEL MOUNTING
(See Section 5 – spare parts list
for mounting brackets available)

Figure 1.2 – Drawing of LD301 Mounted on the Panel or Wall

Observe operating safety rules during wiring, draining or blow-down.

WARNING
Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature. **Electrical shock can result in death or serious injury.** Avoid contact with the leads and terminals. **Process leaks could result in death or serious injury.** Do not attempt to loosen or remove flange bolts while the transmitter is in service. **Replacement equipment or spare parts not approved by Smar could reduce the pressure retaining capabilities of the transmitter and may render the instrument dangerous.** Use only bolts supplied or sold by Smar as spare parts.

Some examples of installation, illustrating the transmitter position in relation to the taps, are shown in Figure 1.3. The pressure taps location and the relative positions of the transmitter are indicated in Table 1.1.

Process Fluid	Location of	Location of LD301 in Relation to the Taps
Gas	Top or Side	Above the Taps
Liquid	Side	Below the Taps or at the Piping Centerline
Steam	Side	Below the Taps using Sealing (Condensate) Pots

Table 1.1 - Location of Pressure Taps

NOTE
For liquids, condensates, wet vapors and gases the impulse lines must be tilted on the ratio 1:10 to prevent bubbles from accumulating; The transmitter and its impulse lines must be tightly fixed; If necessary, install the condensate and mud pots; Use manifold valves to facilitate maintenance and adjustments.

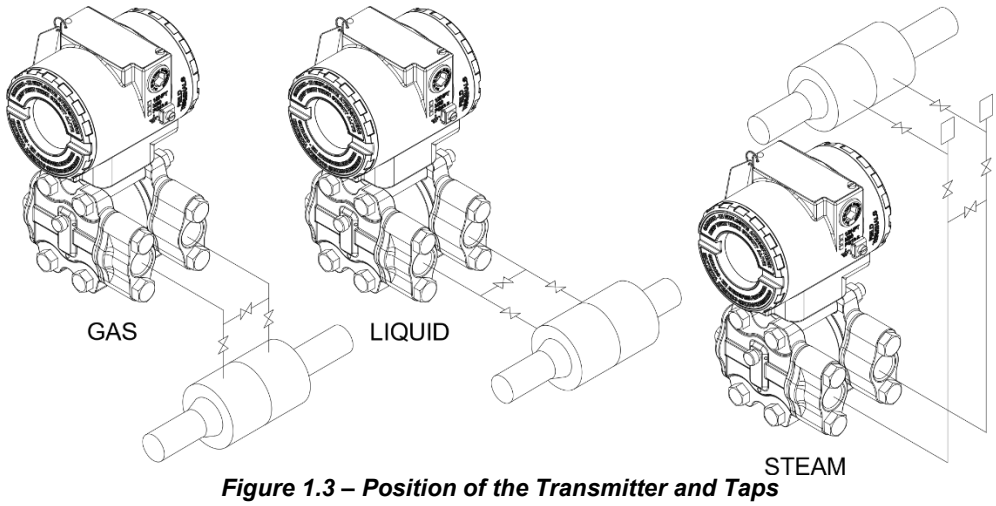
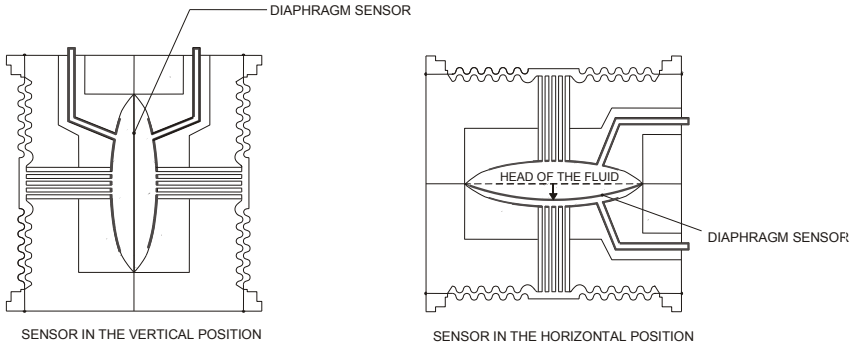


Figure 1.3 – Position of the Transmitter and Taps

NOTE

The transmitters are calibrated in the vertical position and a different mounting position displaces the zero point. Consequently, the indicator will indicate a different value from the applied pressure. In these conditions, it is recommended to do the zero pressure trim. The zero trim compensates the final assembly position and its performance, when the transmitter is in its final position. When the zero trim is executed, make sure the equalization valve is open and the wet leg levels are correct.

For the absolute pressure transmitter, the assembly effects correction should be done using the Lower trim, due to the fact that the absolute zero is the reference for these transmitters, so there is no need for a zero value for the Lower trim.



Electronic Housing

Humidity is fatal to electronic circuits. In areas subjected to high relative humidity, the O-rings for the electronic housing covers must be correctly placed and the covers must be completely closed by tighten them by hand until you feel the O-rings being compressed. Do not use tools to close the covers. Removal of the electronics cover in the field should be reduced to the minimum necessary, since each time it is removed; the circuits are exposed to the humidity.

The electronic circuit is protected by a humidity proof coating, but frequent exposures to humidity may affect the protection provided. It is also important to keep the covers tightened in place. Every time they are removed, the threads are exposed to corrosion, since painting cannot protect these parts. Sealing methods should be employed on conduit entering the transmitter. The unused outlet connection should be properly plugged.

WARNING

The unused cable entries should be plugged and sealed accordingly to avoid humidity entering, which can cause the loss of the product's warranty.

The electronic housing can be rotated to adjust the digital display on a better position. To rotate it, loose the Housing Rotation Set Screw, see Figure 1.4 (a). To prevent humidity entering, the electric housing and the sensor joint must have a minimum of 6 fully engaged threads. The provided joint allows 1 extra turn to adjust the position of the display window by rotating the housing clockwise. If the thread reaches the end before the desired position, then rotate the housing counterclockwise, but not more than one thread turn. See Section 5, Figure 5.2.

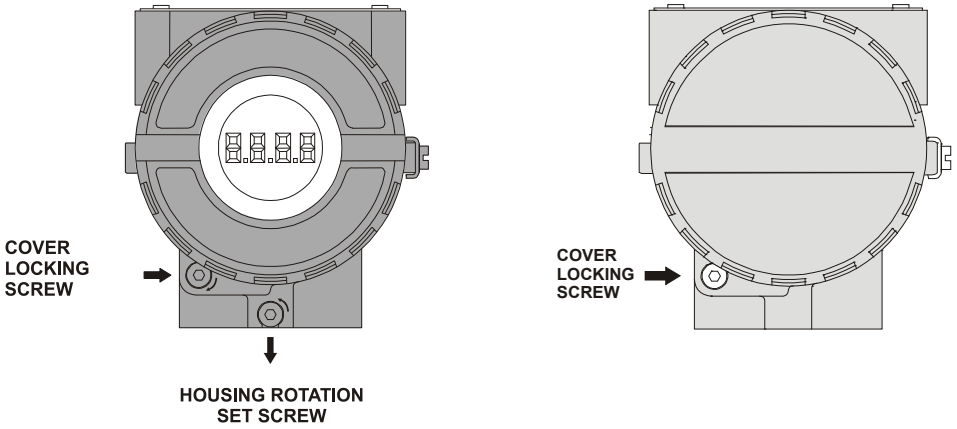


Figure 1.4 - Cover Locking and Housing Rotating Set Screw (a) Electronic Board Side (b) Terminal Connection Side

Wiring

To access the wiring block, loosen the cover locking screw to release the cover. See Figure 1.4 (b).

Test and **Communication terminals** allow, respectively, to measure the current in the 4 - 20 mA loop, without opening the circuit, and also to communicate with the transmitter. The “Test Terminals” must be used to measure the current. The “COMM” terminal must be used for HART communication. The terminal block has screws where fork-type or ring-type terminals can be fastened. See Figure 1.5.

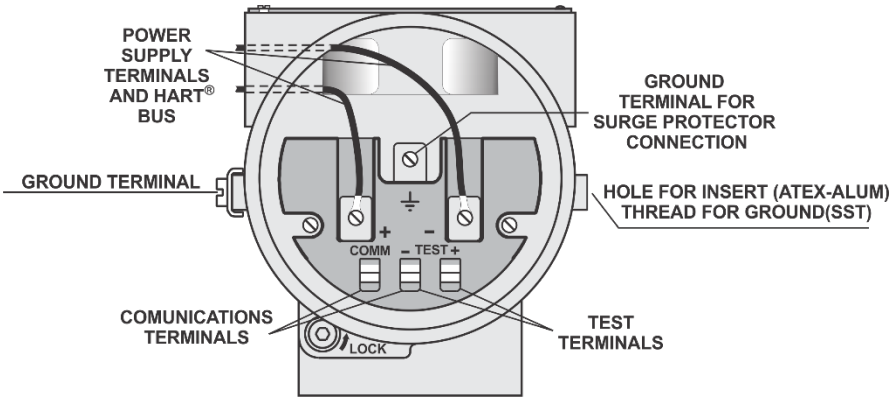


Figure 1.5 – Terminal Block

The **LD301** is protected against reverse polarity.

For convenience there are three ground terminals: one inside the cover and two external, located close to the conduit inlets.

Use of twisted pair (22 AWG or greater than) cables is recommended. For sites with high electromagnetic levels (EMI above 10 V/m) shield conductors are recommended. Ground the shield only at one end.

Avoid routing signal wiring near to power cables or switching equipment.

The Figure 1.6 shows the correct conduit installation, to avoid penetration of water or other substance, which may cause equipment malfunction.

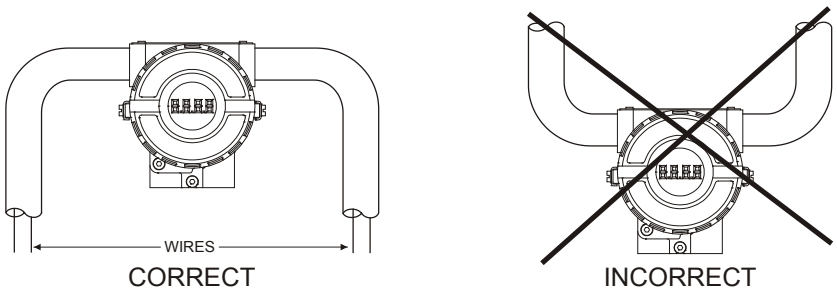


Figure 1.6 - Conduit Installation

Loop Connections

Figures 1.7 and 1.8 show **LD301**'s wiring diagrams to work as transmitter and controller, respectively.

Figure 1.9 shows the **LD301**'s wiring diagrams to work in the multi-drop network. Note that a maximum of 15 transmitters can be connected on the same line and that they should be connected in parallel. Take care to the power supply as well, when many transmitters are connected on the same line. The current through the 250 Ohm resistor will be high causing a high voltage drop. Therefore make sure that the power supply voltage is sufficient.

The Hand-Held Terminal can be connected to the communication terminals of the transmitter or at any point of the signal line by using the alligator clips. It is also recommended to ground the shield of shielded cables at only one end. The ungrounded end must be carefully isolated. On multi-drop connections, the circuit loop integrity must be assured, with special care to prevent short-circuit between the shield and the housing.

NOTE
For HART transmitters to operate in multi-drop mode each transmitter must be configured with a different identity Device ID. In addition, if the transmitter identification mode on the loop is done through the Command 0 address, the HART address must also be different. If it is done through the Tag (Command 11) the tags must be similar.

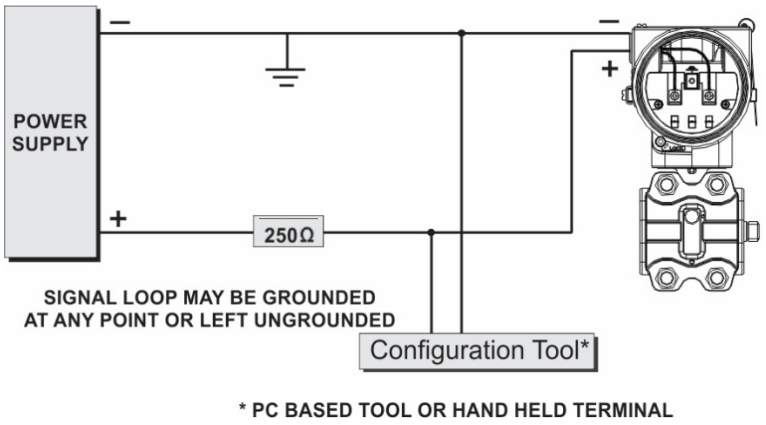


Figure 1.7 - Wiring Diagram for the LD301 Working as a Transmitter

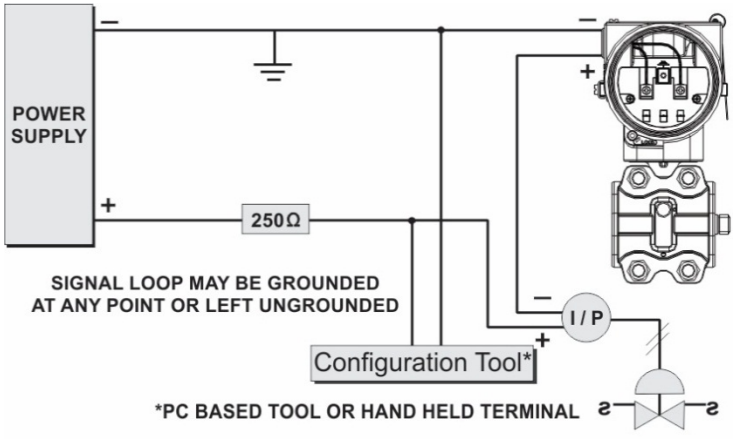


Figure 1.8 - Wiring Diagram for the LD301 Working as a Controller

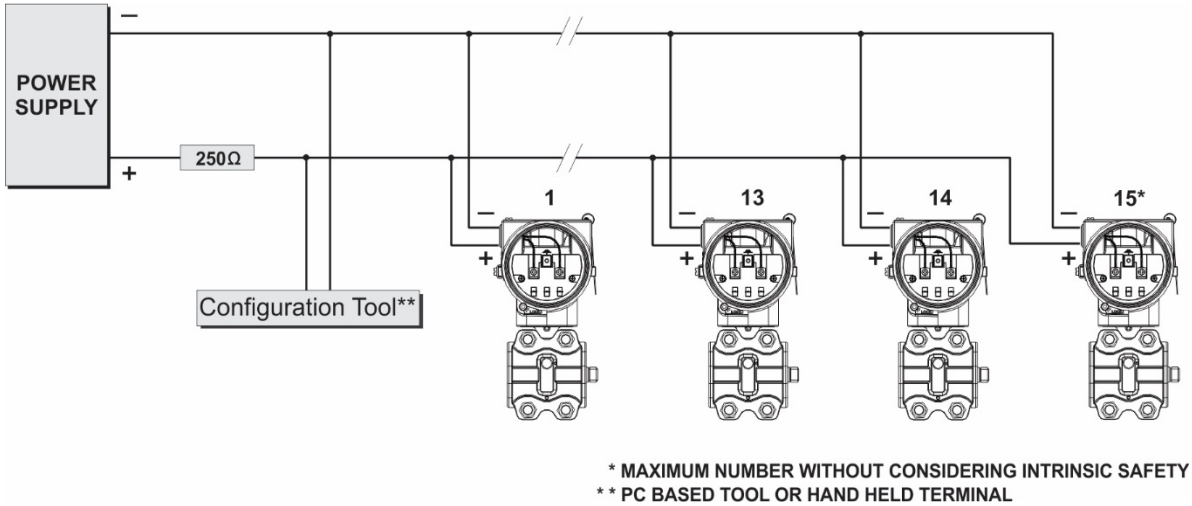


Figure 1.9 - Wiring Diagram for the LD301 in Multidrop Configuration

NOTE
Make sure that the transmitter is operating within the operating area as shown on the load curve (Figure 1.10). Communication requires a minimum load of 250 Ohm and voltage equal to 17 Vdc.

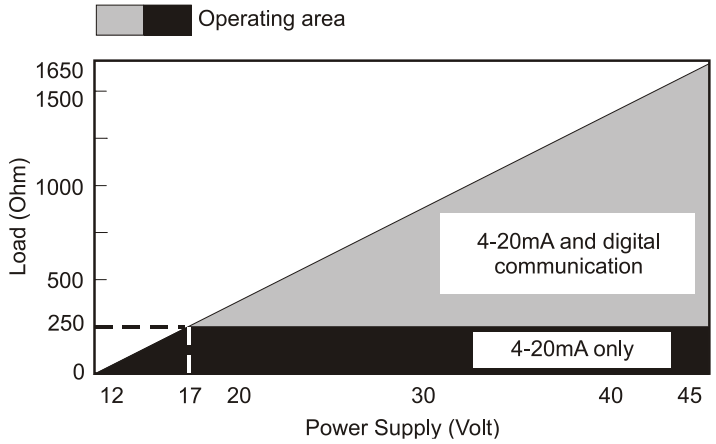


Figure 1.10 – Load Limitation

Installation in Hazardous Areas

Consult the Appendix A for Hazardous Location Approvals.

Section 2

OPERATION

Functional Description - Sensor

The **LD301** Series Intelligent Pressure Transmitters use capacitive sensors (capacitive cells) as pressure sensing elements, as shown in Figure 2.1.

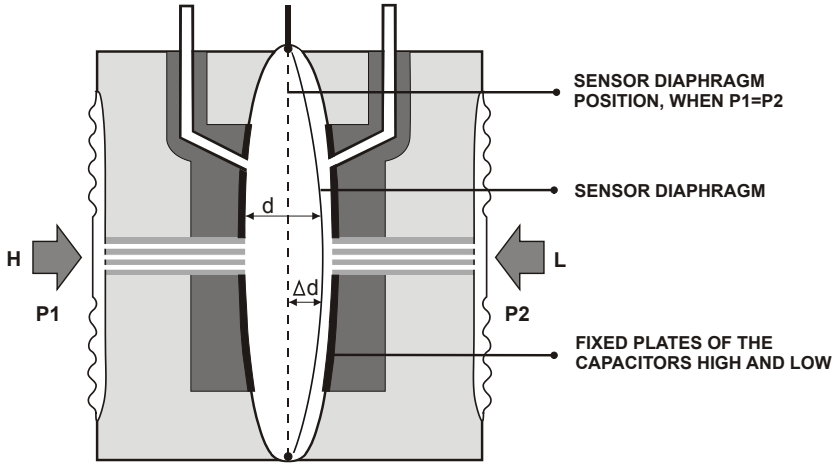


Figure 2.1 – Capacitive Cell

Where,

P_1 and **P_2** are the pressures in chambers **H** and **L**.

CH = capacitance between the fixed plate on **P_1** side and the sensing diaphragm.

CL = capacitance between the fixed plate on the **P_2** side and the sensing diaphragm.

d = distance between **CH** and **CL** fixed plates.

Δd = sensing diaphragm's deflection due to the differential pressure $\Delta P = P_1 - P_2$.

Knowing that the capacitance of a capacitor with flat, parallel plates may be expressed as a function of plate area (A) and distance (d) between the plates as:

$$C = \frac{\in A}{d}$$

Where,

$\in$**=** dielectric constant of the medium between the capacitor's plates.

Should ***CH*** and ***CL*** be considered as capacitances of flat and parallel plates with identical areas, then:

$$CH = \frac{\in .A}{(d/2) + \Delta d} \quad \text{and} \quad CL = \frac{\in .A}{(d/2) - \Delta d}$$

However, should the differential pressure (ΔP) apply to the capacitive cell not deflect the sensing diaphragm beyond d/4, it is possible to assume ΔP as proportional to Δd, that is:

ΔP is proportional Δd.

By developing the expression (CL - CH)/(CL + CH), it follows that:

$$\Delta P = \frac{CL - CH}{CL + CH} = \frac{2\Delta d}{d}$$

As the distance (d) between the fixed plates CH and CL is constant, it is possible to conclude that the expression (CL - CH)/(CL + CH) is proportional to Δd and, therefore, to the differential pressure to be measured.

Thus it is possible to conclude that the capacitive cell is a pressure sensor formed by two capacitors whose capacitances vary according to the applied differential pressure.

Functional Description - Hardware

Refer to the block diagram Figure 2.2. The function of each block is described below.

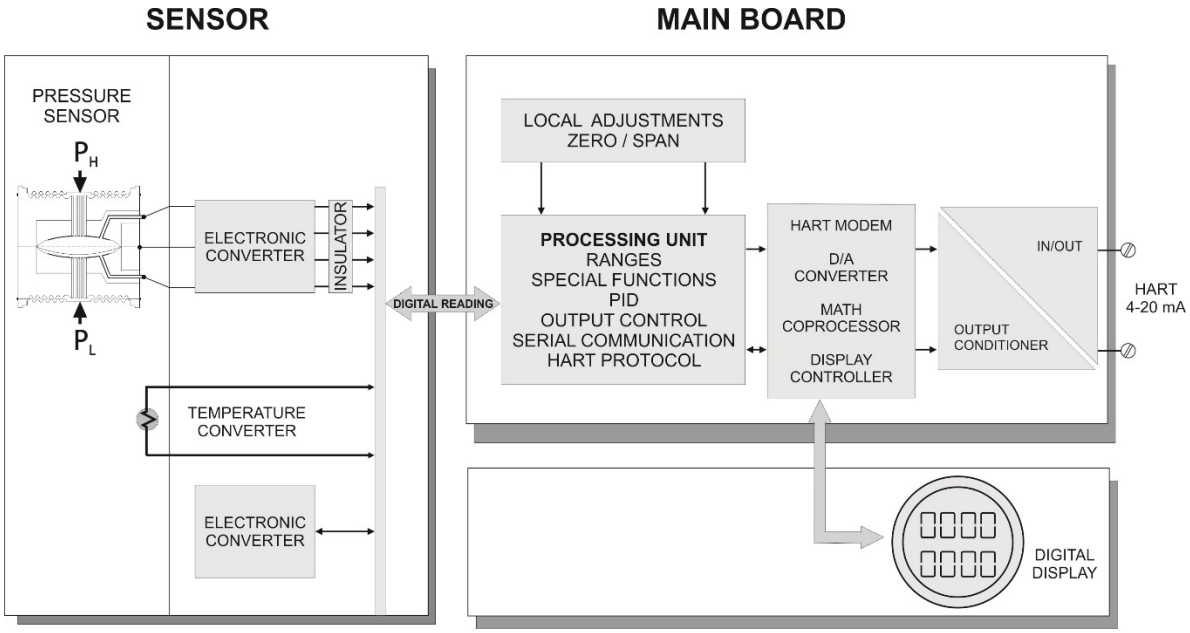


Figure 2.2 – LD301 Block Diagram Hardware

Oscillator
This oscillator generates a frequency as a function of sensor capacitance.

Signal Isolator
The Control signals from the CPU are transferred through optical couplers, and the signal from the oscillator is transferred through a transformer.

Central Processing Unit (CPU) and PROM
The CPU is the intelligent portion of the transmitter, being responsible for the management and operation of all other blocks, linearization and communication.

The program is stored in an external PROM. For temporary storage of data the CPU has an internal RAM. The data in the RAM is lost, if the power is switched off, although the CPU also has an internal nonvolatile EEPROM where data that must be retained is stored. Examples of such data are: calibration, configuration and identification data.

EEPROM
Another EEPROM is located within the sensor assembly. It contains data pertaining to the sensor's characteristics at different pressures and temperatures. This characterization is done for each sensor at the factory.

D/A Converter
It converts the digital data from the CPU to an analog signal with 16-bits resolution.

Output
It controls the current in the line that powers the transmitters.
It acts as a variable resistive load whose value depends on the voltage from the D/A converter.

Modem
This system provides the data exchanged between the Master-Slave digital communications. The transmitter demodulates information from the current line, and after treating it adequately, modulates over the line the answer to be sent. A "1" is represented by 1200 Hz and "0" by 2200 Hz. The frequency signal is symmetrical and does not affect the DC-level of the 4-20 mA signal.

Power Supply
Power shall be supplied to the transmitter circuit using the signal line (2-wire system). The transmitter quiescent consumption is 3.6 mA; during operation, consumption may be as high as 21 mA, depending on the measurement and sensor status.

The **LD301** in the transmitter mode shows failure indication at 3.6 mA if configured for low signal failure; at 21 mA, if configured for high signal failure; 3.8 mA in the case of low saturation; 20.5 mA in the case of high saturation and measurements proportional to the applied pressure in the range between 3.8 mA and 20.5 mA. 4 mA corresponds to 0% of the working range and 20 mA to100 % of the working range.

Power Supply Isolation
The sensor power supply is isolated from the main circuit by this module.

Display Controller
It receives the data from the CPU and actives the LCD segments. It also activates the back plane and the control signals for each segment.

Local Adjustment
Two switches on the main board are magnetically activated by inserting the magnetic tool.

Functional Description - Software

Refer to the block diagram Figure 2.3. The function of each block is described below.

Digital Filter
The digital filter is a low pass filter with an adjustable time constant. It is used to smooth noisy signals. The Damping value is the time required for the output reaching 63.2% for a step input of 100%. This value (in seconds) may be freely configured by the user.

Factory Characterization
The actual pressure obtained from the sensor's capacitance and temperature readings, can be calculated by using the factory characterization data stored in the sensor EEPROM.

User Linearization
The characterization TRIM points P1 - P5 can be used to complement the transmitter original characterization.

Pressure Trim
It corrects the measured pressure due to possible deviation caused by overpressure, over temperature or mounting position. The correction can be made for both zero offset and span offset.

Ranging
It is used to set the pressure values corresponding to the 4-20 mA output. In transmitter mode the LOWER-VALUE is the point corresponding to 4 mA, and the UPPER-VALUE is the point corresponding to 20 mA. In PID mode the LOWER-VALUE corresponds to MV = 0% and the UPPER-VALUE corresponds to MV = 100%, where, MV is the Manipulated Variable.

Function
Depending on the application, the transmitter output or controller PV may have the following characteristics according to the applied pressure: *Linear* (for pressure, differential pressure and level measurement); *Square-root* (for flow measurement with differential pressure producers) and *Square-root of the Third and Fifth power* (for flow measurements in open channels). The function is selected with FUNCTION. In addition, a 16-point table is available so that the percentage value can be linearized before or after the application of the above mentioned function.

Points Table
This block relates the output (4-20 mA or Process Variable) to the input (applied pressure) according to a table from 2 to 16 points. The output is calculated by the interpolation of these points. The points are given in the function "TABLE POINTS" in percent of the range (X_i) and in percent of the output (Y_i). It may be used to convert, e.g., a level measurement to volume or mass. In flow measurement it can be used to correct varying Reynolds numbers.

Setpoint
Is the desired value in the process variable when the controller is activated. The operator in the \CONTR\INDIC option adjusts it.

PID
First, the error is calculated: PV-SP (DIRECT ACTION) or SP-PV (REVERSE ACTION), then the MV

(manipulated value) is calculated, according to the algorithm of the PID. The PID output signal may follow a user-determined curve, in up to 16 configurable points. If the table is enabled, there will be a display indication with the F(X) character

Auto/Manual
The Auto/Manual mode is configured in CONTR/INDIC. With the PID in Manual, the MV can be adjusted by the user in the LOW LIMIT to HIGH LIMIT range in the CONTR/LIM-SEG option. The POWER-ON option is used here to set in which mode (AUTO or MANUAL) the controller will return after a power failure.

Limits
This block makes sure that the MV does not go beyond its minimum and maximum limits as established by the HIGH-LIMIT and LOW-LIMIT.

Output
It calculates the current proportional to the process variable or manipulated variable to be transmitted on the 4-20 mA output depending on the configuration in OP-MODE. This block also contains the constant current function configured in OUTPUT. The output is physically limited to 3.6 to 21 mA. The current output complies with NAMUR NE-43.

Current Trim
The 4 mA TRIM and 20 mA TRIM adjustment is used to make the transmitter current comply with a current standard, should a deviation arise.

User Unit
It converts 0 and 100% of the process variable to the desired engineering unit reading available for display and communication. It is used, e.g., to get a volume or flow indication from a level or differential pressure measurement, respectively. A unit for the variable can also be selected.

Totalization
Used for flow application to totalize the accumulated flow since the last reset, getting the volume or mass transferred. In the lack of power, the totalized value is saved and continues totalizing after its re-establishment. Only the residual value of the totalization is discarded.

Display
The two indications configured in the DISPLAY alternates between the primary and secondary variable as configured by the user. Extensive units with more than 5 letters are rotated.

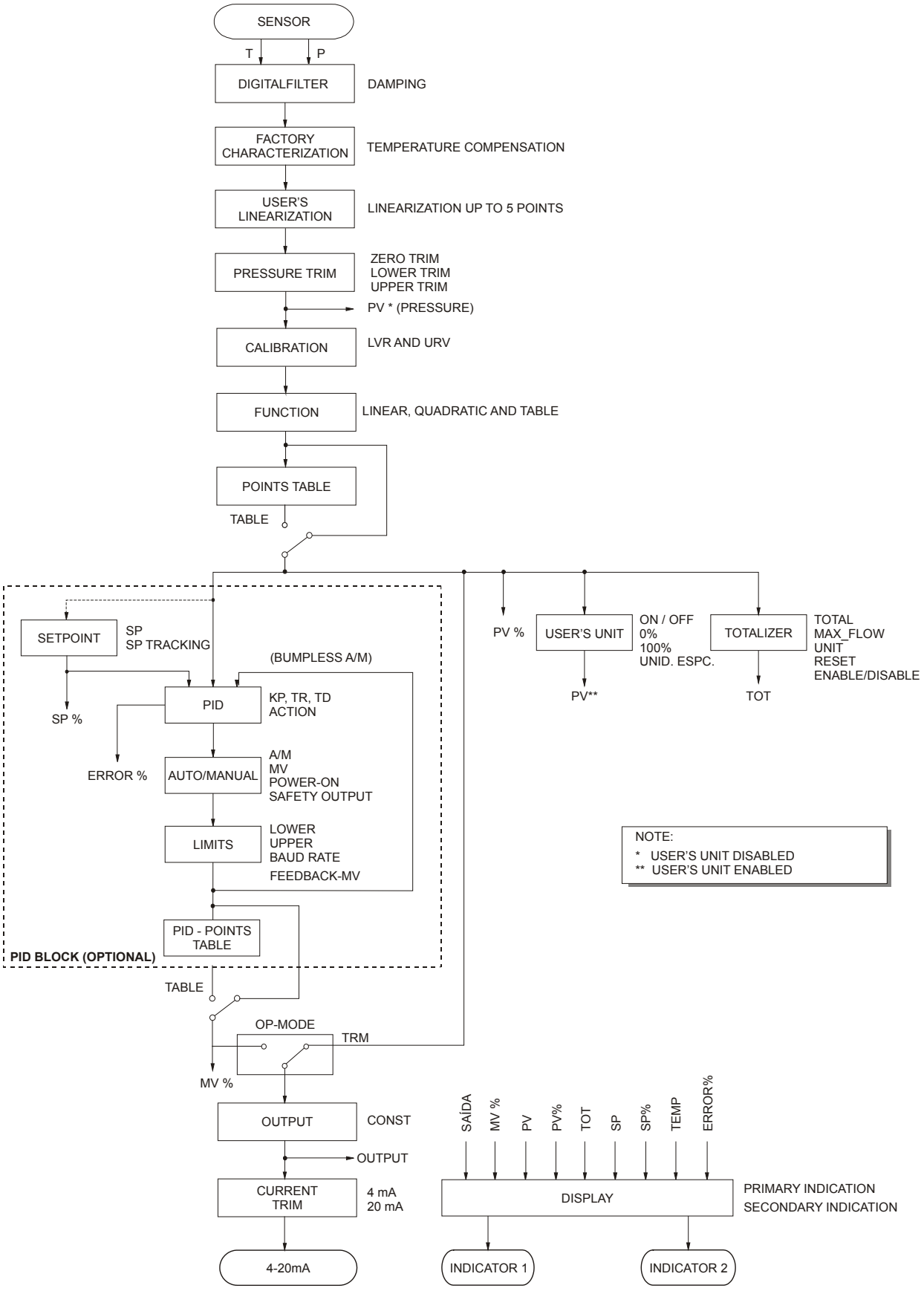


Figure 2.3 – LD301 – Software Block Diagram

The Display

The local indicator is able to display one or two variables, which are user-selected. When two variables are chosen, the display will alternate between both with an interval of 3 seconds.

The liquid crystal display includes a field with 4 ½ numeric digits, a field with 5 alphanumeric digits and an information field, as shown on Figure 2.4.

When the totalization is displayed, the most significant part appears in the numeric field (upper) and the least significant part in the alphanumeric field (lower). See Total Value in Section 3.

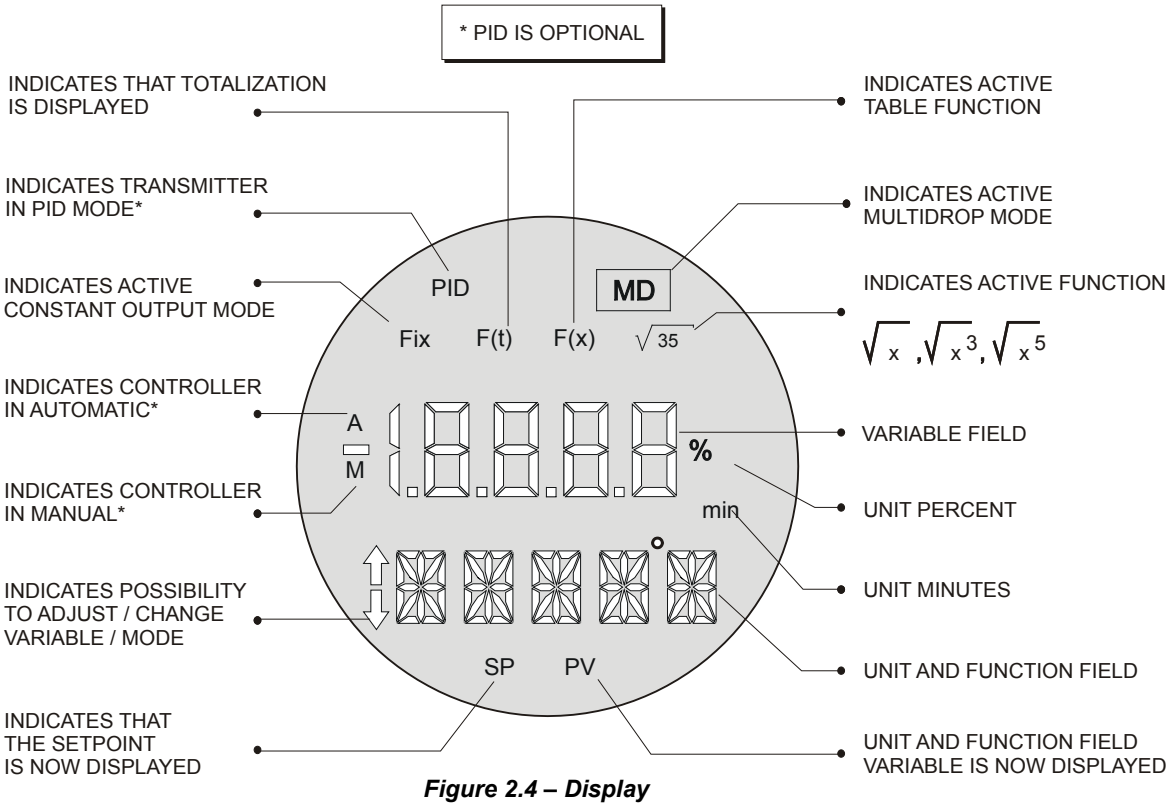


Figure 2.4 – Display

Monitoring
During normal operation, the **LD301** is in the monitoring mode. In this mode, indication alternates between the primary and the secondary variable as configured by the user. See Figure. 2.5. The display indicates engineering units, values and parameters simultaneously with most status indicators.

The monitoring mode is interrupted when the user does complete local adjustment.

The LCD may also display errors and other messages (See table 2.1).

Figure 2.5 – Typical Monitoring Mode Display Showing PV, in this case 25.00 mmH$_2$0

INDICATOR		DESCRIPTION
Numeric	**Alphanumeric**	
Version and protocol address	LD301	The **LD301** is initialized after powering.
	CHAR	The **LD301** is on characterization mode (see Section 3 – TRIM).
Variable Value	SAT / Unit	Output current saturated on 3.8 or 20.5 mA. (see section 5 – Maintenance).
CH / CL alternating with current value.	SFAIL / Unit	Failure on one sensor side or on both.
	FAIL and Init	Transmitter failed on initialization (sensor memory failure or sensor is disconnected).

Table 2.1 – Messages Displayed

CONFIGURATION

The **LD301** Intelligent Pressure Transmitter is a digital instrument with the most up-to-date features a measurement device can possibly have. Its digital communication protocol (HART®) enables the instrument to be connected to a computer in order to be configured in a very simple and complete way. Such computers connected to the transmitters are called HOST computers. They can either be Primary or Secondary Masters. Therefore, even the HART® being a master-slave protocol, it is possible to work with up to two masters in a bus. The Primary HOST plays the supervisory role and the Secondary HOST plays the configuration tool role.

The transmitters may be connected in a point-to-point or multidrop type network. In a point-to-point connection, the equipment must be in its "0" address so that the output current may be modulated in 4 to 20 mA, as per the measurement. In a multidrop network, if the devices are recognized by their addresses, the transmitters shall be configured with a network address between "1" and "15". In this case, the transmitter output current is kept constant, with a consumption of 4 mA each. If the acknowledgement mechanism is via Tag, the transmitter addresses may be "0" while their output current is still being controlled, even in a multidrop configuration.

In the case of the **LD301**, which can be configured both as Transmitter and as a Controller; the HART® addressing is used as follows:

TRANSMITTER MODE - The "**0**" address causes the **LD301** to control its output current and addresses "**1**" through "**15**" place the **LD301** in the multidrop mode with current control.

CONTROLLER MODE - The **LD301** always controls the output current, in accordance with the value calculated for the Controlled Variable, regardless of its network address.

The **LD301** Intelligent Pressure Transmitter includes a very encompassing set of HART® Command functions that make it possible to access the functionality of what has been implemented. Such commands comply with the HART® protocol specifications, and are grouped as Overall Commands, Common Practice Controls Commands and Specific Commands. A detailed description of such commands may be found in the manual entitled HART® Command Specification - **LD301** Intelligent Pressure Transmitter.

Smar has developed the **DEVCOMDROID** (Android DDL Interpreter) software, used with HART interfaces, such as the **HI331** (Bluetooth Interface), in addition to **AssetView** (based on DTM**)** to configure the HART® equipment.

However, the old **PALM** with **HPC301** or **CONF401**, which are obsolete, remains operable even with the latest updates in HART transmitters.

They provide easy configuration and monitoring of field devices, capability to analyze data and to modify the performance of these devices. The operation characteristics and use of each one of the configuration tools are stated on their respective manuals.

It is also compatible to use configurators that support DDL (Device Description Language) or DTM (Device Type Manager).

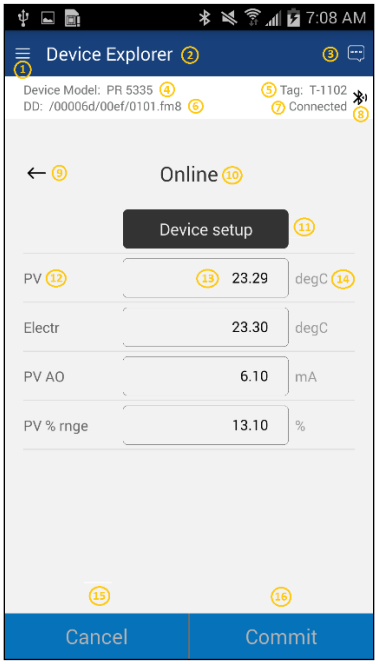


Figure 3.1 – DEVCOMDROID configurator

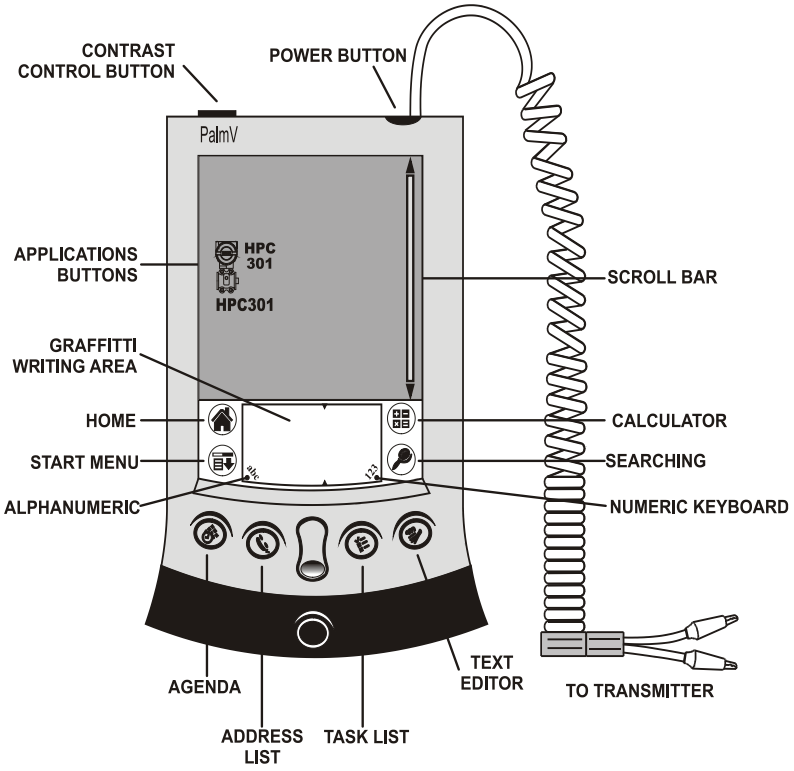


Figure 3.2 – PALM configurator

Figures 3.3 and 3.4 show the menu tree used for configuration, based on version 4.02 DD, and configuration with Smar Hand Held Tool, respectively.

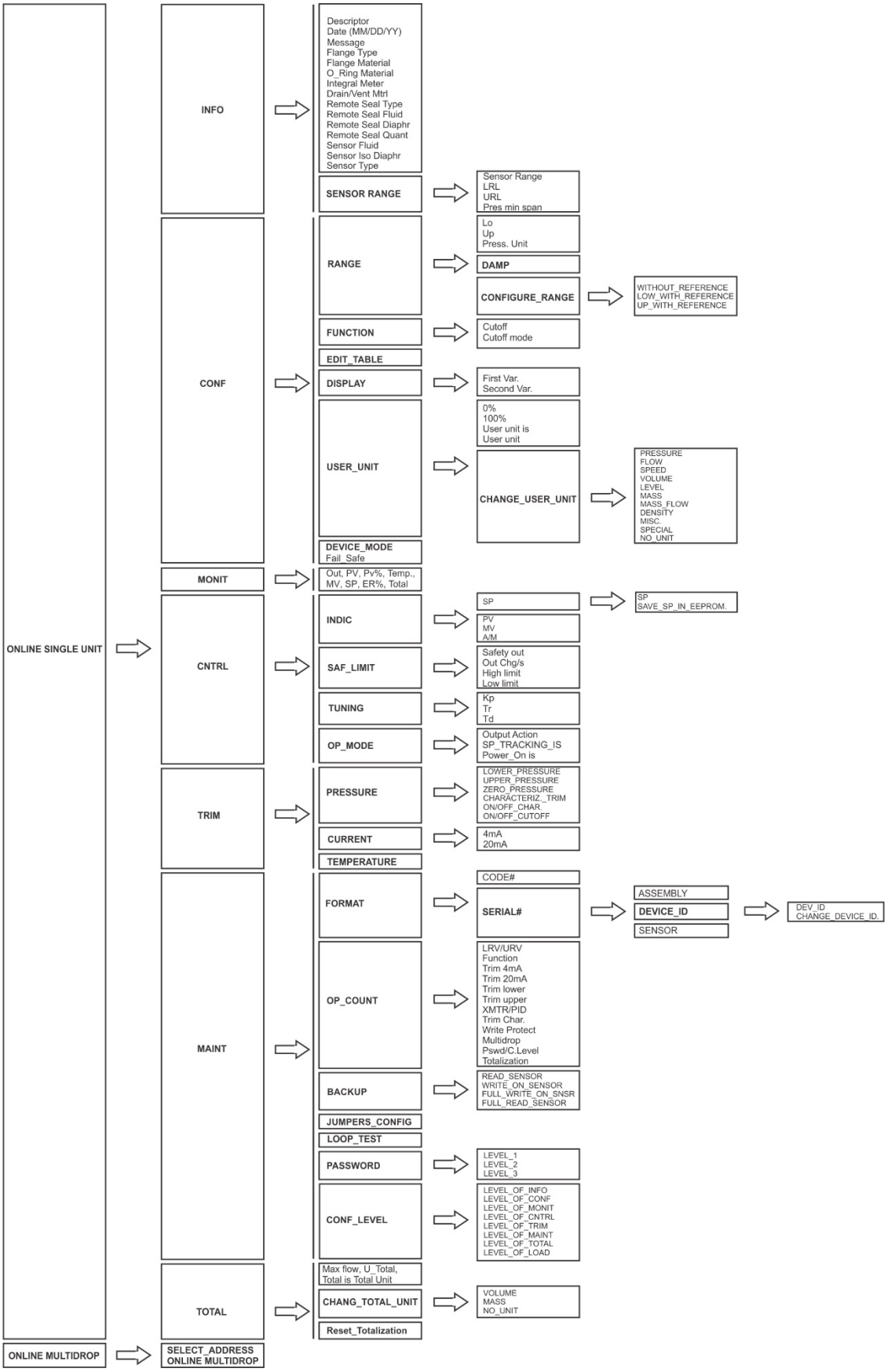


Figure 3.3 –Menu Tree used for Configuration based on Version 4.02 DD (E.g.: HH275, DDCON 100, etc.)

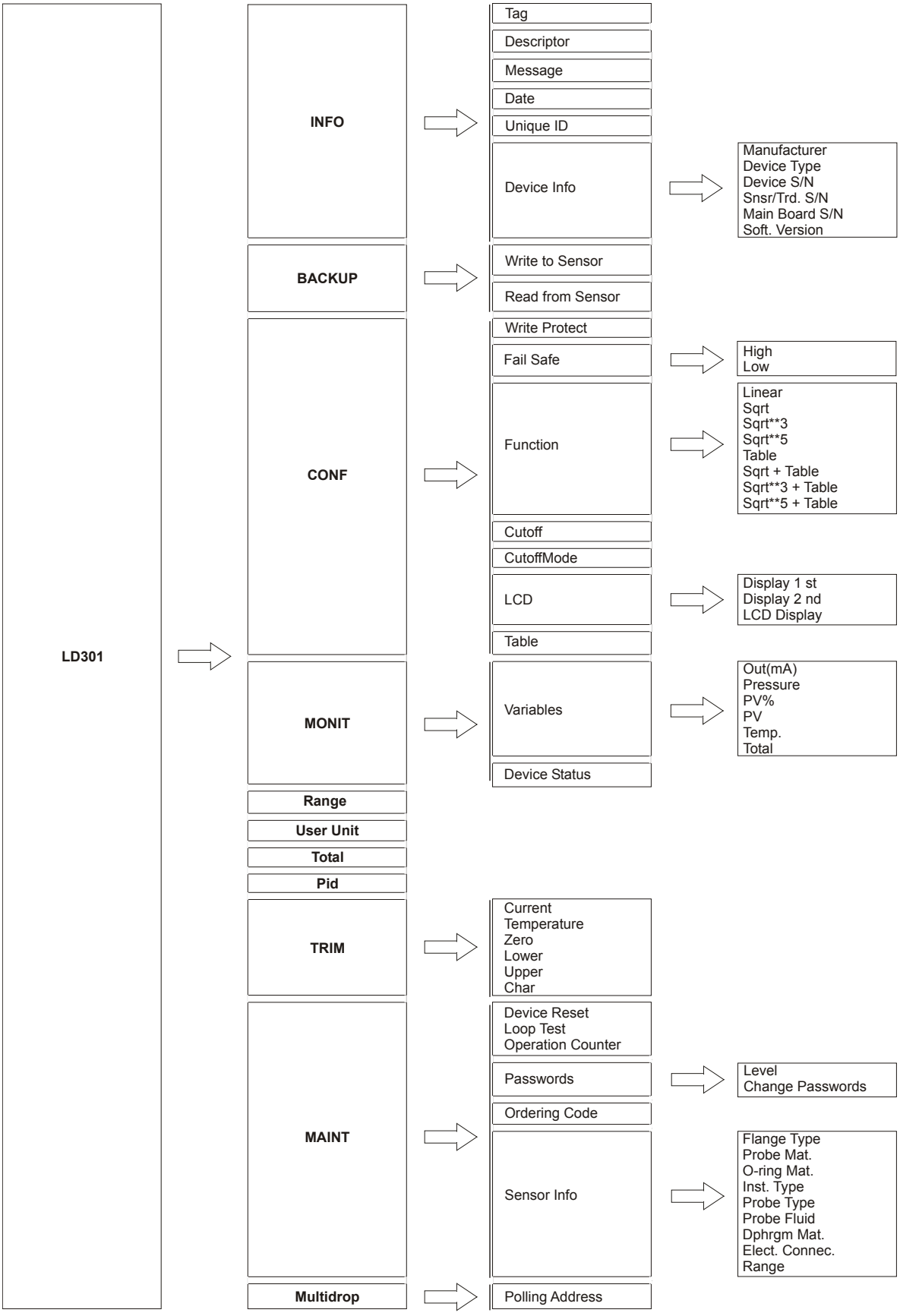


Figure 3.4 – Menu tree used for configuration with Smar Hand Held Tool

Configuration Features

By means of the HART® configuration tool, the **LD301** firmware allows the following configuration features to be accessed:

- ✓ Transmitter Identification and Manufacturing Data;
- ✓ Primary Variable Trim – Pressure;
- ✓ Primary Variable Trim – Current;
- ✓ Transmitter Adjustment to the Working Range;
- ✓ Engineering Unit Selection;
- ✓ Transference Function for Flow Measurement;
- ✓ Linearization Table;
- ✓ Totalizer Configuration;
- ✓ PID Controller Configuration and MV% Characterization Table;
- ✓ Device Configuration;
- ✓ Equipment Maintenance.

The operations, which take place between the configuration tool and the transmitter do not interrupt the Pressure measurement, and do not disturb the output signal. The configuration tool can be connected on the same pair of wires as the 4-20 mA signals, up to 2 km away from the transmitter.

Manufacturing Data and Identification

The following information about the **LD301** manufacturing and identification data is available:

- ✓ **TAG –** 8 characters alphanumeric field for transmitter identification

- ✓ **DESCRIPTOR** - 16-character alphanumeric field for additional transmitter identification. May be used to identify service or location.

- ✓ **DATE** - The date may be used to identify a relevant date as the last calibration, the next calibration or the installation. The date is presented in the form of bytes where DD = [1,..31], MM = [1..12], AA = [0..255], where the effective year is calculated by [Year = 1900 + AA].

- ✓ **MESSAGE** - 32-character alphanumeric field for any other information, such as the name of the person who made the last calibration, some special care to be taken, or if a ladder is needed for accessing.

- ✓ **FLANGE TYPE** - Conventional, Remote Seal,
Level 3 in # 150, Level 4 in # 150, Level 3 in # 300, Level 4 in # 300, Level DN80 PN10/40, Level DN100 PN10/16, Level DN100 PN25/40, Level 2 in # 150, Level 2 in # 300, Level DN50 PN10/40, None, Unknown and Special.

- ✓ **FLANGE MATERIAL** - Carbon Steel, 316 SST, Hastelloy C, Monel, Undefined, Tantalum, None and Special.

- ✓ **O-RING MATERIAL** - PTFE, Viton, Buna-N, Ethyl-prop, None, Unknown, Undefined and Special.

- ✓ **INTEGRAL METER** - Installed, None and Unknown.

- ✓ **DRAIN/VENT MATERIAL** - 316 SST, Hastelloy C, Monel, None, Unknown, Undefined and Special.

- ✓ **REMOTE SEAL TYPE** – T Type, Flanged Extended, Pancake, Flanged, Threaded, Sanitary, Sanitary Tank Spud, None, Union Connection, Unknown, Undefined and Special.

- ✓ **REMOTE SEAL FLUID** - Silicone, Syltherm 800, Glycerin/H20, Prop gly/H20, Neobee-M20, Fluorolube, Undefined, None, Unknown and Special.

- ✓ **REMOTE SEAL DIAPHRAGM** - 316L SST, Hastelloy C, Tantalum, None, Unknown, Undefined and Special.

- ✓ **REMOTE SEAL QUANTITY** - One, Two, None, Undefined, and Special.

- ✓ **SENSOR FLUID*** - Silicone, Fluorolube, Special, Unknown, and None.

- ✓ **SENSOR ISOLATING DIAPHRAGM*** - 316 SST, Hastelloy C, Monel, Tantalum and Special

- ✓ **SENSOR TYPE*** – It shows the sensor type.

- ✓ **SENSOR RANGE*** - It shows the sensor range in user-chosen engineering units. See Configuration Unit.

NOTE
Items marked with asterisk cannot be changed. They are read directly from the sensor memory.

Primary Variable Trim - Pressure

Pressure, defined as a Primary Variable, is determined from the sensor reading by means of a conversion method. Such a method uses parameters obtained during the fabrication process. They depend on the electric and mechanical characteristics of the sensor, and on the temperature change to which the sensor is submitted. These parameters are recorded in the sensor's EEPROM memory. When the sensor is connected to the transmitter, such information is made available to the transmitter microprocessor, which sets a relationship between the sensor signal and the measured pressure.
Sometimes, the pressure shown on the transmitter display is different from the applied pressure. This may be due to several reasons, among which the following:

- ✓ The transmitter mounting position;

- ✓ The user pressure standard differs from the factory standard;

- ✓ Sensor original characteristics shifted by overpressure, over temperature or by other special conditions of use.

NOTE
Some users prefer to use this feature for zero elevation or suppression when the measurement refers to a certain point of the tank or tap (wet leg). Such practice, however, is not recommended when frequent laboratory calibrations are required, because the equipment adjustment refers to a relative measurement, and not to an absolute one, as per a specific pressure standard.

The Pressure Trim, as described on this document, is the method used in order to adjust the measurement both in relation to the applied pressure and the user's pressure standard. The most common discrepancy found in transmitters is usually due to Zero displacement. This may be corrected by means of the zero trim or the lower trim.

There are four types of pressure trim available:

- ✓ **LOWER TRIM**: Is used to trim the reading at the lower range. The user informs the transmitter the correct reading for the applied pressure via HART® configuration tool.

NOTE
Check on section 1, the note on the influence of the mounting position on the indicator. For better accuracy, the trim adjustment should be made in the lower and upper values of the operation range values.

- ✓ **UPPER TRIM:** Is used to trim the reading at the upper range. The user informs the transmitter the correct reading for the applied pressure via HART® configuration tool.

WARNING
The upper pressure trim shall always be applied after the zero trim.

- ✓ **ZERO TRIM:** is similar to the LOWER TRIM, but is assumed that the applied pressure is zero. The reading equal to zero must be active when the pressures of differential transmitter cameras are equalized or when a gage transmitter opens to atmosphere or when the absolute transmitter is applied to the vacuum. Therefore, the user does not need to enter with any value.

NOTE
The pressure taps on the transmitter must be equalized when zero trim is applied.

- ✓ **CHARACTERIZATION:** this is used to correct any possible intrinsic non-linearity to the conversion process. Characterization is done by means of a linearization table, with up to five points. The user shall apply pressure and use the HART® configuration tools to inform the pressure value applied to each point of the table. In most cases, characterization is not required, due to the efficiency of the production process. The transmitter will display "CHAR", thus indicating that the characterization process has been activated. The **LD301** is fitted with an internal feature to enable or disable the use of the Characterization Table.

WARNING
The characterization trim changes the transmitter characteristics. Read the instructions carefully and make sure that you work with a pressure standard that is accurate to your metrological system. A pressure standard that is compatible with the transmitter or its application need is recommended. Calibrations performed with inadequate accuracy standards will seriously affect the accuracy of the transmitter.

Primary Variable Current Trim

When the microprocessor generates a 0% signal, the Digital to Analog converter and associated electronics are supposed to provide a 4 mA output. If the signal is 100%, the output should be 20 mA.

There might be differences between the Smar current standards and your current plant Standard. In this case, the Current Trim adjustment shall be done with a precision ammeter as measurement reference. Two Current Trim types are available:

- ✓ **4 mA TRIM:** this is used to adjust the output current value corresponding to **0%** of the measurement;
- ✓ **20 mA TRIM:** this is used to adjust the output current value corresponding to **100%** of the measurement;

The Current Trim shall be carried out as per the following procedure:

- ✓ Connect the transmitter to the precision ammeter;
- ✓ Select one of the Trim types;
- ✓ Wait a while for the current to stabilize and inform the transmitter the current reading of the precision ammeter.

NOTE
The transmitter presents a resolution that makes it possible to control currents as low as microamperes. Therefore, when informing the current reading to the transmitter, it is recommended that data input consider values up to tenths of microamperes.

Transmitter Adjustment to the Working Range

This function directly affects the transmitter 4-20 mA output. It is used to define the transmitter working range; in this document it is referred to as the transmitter calibration. The **LD301** transmitter includes two calibration features:

- ✓ **CALIBRATION WITH REFERENCE:** this is used to adjust the transmitter working range, using a pressure standard as reference;

- ✓ **CALIBRATION WITHOUT REFERENCE:** this is used to adjust the transmitter working range, simply by having user-informed limit values.

Both calibration methods define the Working Range Upper and Lower values, in reference to some applied pressure or simply informed by entered values. CALIBRATION WITH REFERENCE differs from the Pressure Trim, since CALIBRATION WITH REFERENCE establishes a relationship between the applied pressure and the 4 to 20 mA signal, and the Pressure Trim is used to correct the measurement.

In the transmitter mode, the Lower Value always corresponds to 4 mA and the Upper Value to 20 mA. In the controller mode, the Lower Value corresponds to PV=0% and the Upper Value to PV=100%.

The calibration process calculates the LOWER and the UPPER values in a completely independent way. The adjustment of values does not affect one another. The following rules shall, however, be observed:

- ✓ The Lower and Upper values shall be within the range limited by the Minimum and Maximum Ranges supported by the transmitter. As a tolerance, values exceeding such limits by up to 25% are accepted, although with some accuracy degradation.
- ✓ The Working Range Span, determined by the difference between the Upper and Lower Values. Values up to 0.90 of the minimum span are acceptable with slight accuracy degradation.

NOTE
Should the transmitter operate with a very small span, it will be extremely sensitive to pressure variations. Keep in mind that the gain will be very high and that any pressure change, no matter how small, will be amplified.

If it is necessary to perform a reverse calibration, that is, to work with an UPPER VALUE smaller than the LOWER VALUE, proceed as follows:

✓ Place the Lower Limit in a value as far as possible from the present Upper Value and from the new adjusted Upper value, observing the minimum span allowed. Adjust the Upper Value at the desired point and, then, adjust the Lower Value.

This type of calibration is intended to prevent the calibration from reaching, at any moment, values not compatible with the range. For example: lower value equals to upper value or separated by a value smaller than the minimum span.

This calibration procedure is also recommended for zero suppression or elevation in those cases where the instrument installation results in a residual measurement in relation to a certain reference. This is the specific case of the wetted tap.

NOTE
In most applications with wetted taps, indication is usually expressed as a percentage. Should reading in engineering units with zero suppression be required, it is recommended to use the User Unit feature for such conversion.

Engineering Unit Selection

Transmitter **LD301** includes a selection of engineering units to be used in measurement indication.

For pressure measurements, the **LD301** includes an option list with the most common units. The internal reference unit is inH_2O @ 20 ºC; should the desired unit be other than this one, it will be automatically converted using conversion factors included in Table 3.1.

CONVERSION FACTOR	NEW UNITS	RECOMMEND RANGE
1,00000	inH_2O @20 ºC	1, 2, 3 and 4
0,0734241	inHg @ 0 ºC	all
0,0833333	ftH_2O @ 20 ºC	all
25,4000	mmH_2O @ 20 ºC	1 and 2
1,86497	mmHg @ 0 ºC	1, 2, 3 and 4
0,0360625	psi	2, 3, 4, 5 and 6
0,00248642	bar	3, 4, 5 and 6
2,48642	mbar	1, 2, 3 and 4
2,53545	gf/cm^2	1, 2, 3 and 4
0,00253545	kg/cm^2	3, 4, 5 and 6
248,642	Pa	1
0,248642	kPa	1, 2, 3 and 4
1,86947	Torr @ 0 ºC	1, 2, 3 and 4
0,00245391	atm	3, 4, 5 and 6
0,000248642	MPa	4, 5 and 6
0,998205	inH_2O @ 4 ºC	1, 2, 3 and 4
25,3545	mmH_2O @ 4 ºC	1 and 2
0,0254	mH_2O @ 20 ºC	1, 2, 3 and 4
0,0253545	mH_2O @ 4 ºC	1, 2, 3 and 4

Table 3.1 – Available Pressure Units

In applications where the **LD301** will be used to measure variables other than pressure or in the cases where a relative adjustment has been selected, the new unit may be displayed by means of the User Unit feature. This is the case of measurements such as level, volume, and flow rate or mass flow obtained indirectly from pressure measurements.

The User Unit is calculated adopting the working range limits as a reference, which is, defining a value corresponding to 0% and another corresponding to 100% of the measurement:

- ✓ **0%** - Desired reading when the pressure is equal to the Lower Value (PV% = 0%, or transmitter mode output equal to 4 mA);
- ✓ **100%** - Desired reading when the pressure is equal to the Upper Value (PV% = 100%, or transmitter mode output equal to 20 mA).

The user unit may be selected from a list of options included in the **LD301**. Table 3.2 makes it possible to associate the new measurement to the new unit so that all supervisory systems fitted the HART® protocol can access the special unit included in this table. The user will be responsible for the consistency of such information. The **LD301** does not verify if the values corresponding to the 0% and 100% inserted by the user are compatible with the selected unit.

VARIABLE	UNITS
Pressure	inH_2O, inHg, ftH_2O, mmH_2O, mmHg, psi, bar, mbar, gf/cm^2, kgf/cm^2, Pascal, Torriceli, atm, Mpa, inH_2O @ 4 ºC, mmH_2O @ 4 ºC, mH_2O, mH_2O @ 4 ºC.
Volumetric Flow	ft^3/min, gal/min,Gal/min, m^3/h, gal/s, l/s, Ml/d, ft^3/d, m^3/s, m^3/d, Ga/h, Ga/d, ft^3/h, m^3/min, bbl/s, bbl/min, bbl/d, gal/s, l/h, gal/d.
Velocity	ft/s, m/s, m/h.
Volume	gal, l, Gal, m^3, bbl, bush, Yd^3, ft^3, In^3, hl.
Level	ft, m, in, cm, mm.
Mass	g, kg, Ton, lb, Sh ton, Lton.
Mass Flow	g/s, g/min, g/h, kg/s, kg/min, kg/h, kg/d, Ton/min, Ton/h, Ton/d, lb/s, lb/min, lb/h, lb/d
Density	SGU, g/m^3, kg/m^3, g/ml, kg/l, Twad, Brix, Baum L, API, % Solw, % Solv, Ball.
Others	CSo, cPo, mA, %.
Special	5 characters. (See HART® Special Units in section 5).

Table 3.2 – Available User Units

Should a special unit other than those presented on Table 3.2 be required, the **LD301** allows the user to create a new unit by entering up to 5 alphanumeric digits of the name with 253 code. The **LD301** includes an internal feature to enable and disable the User Unit.

The measure resulting from the user unit is called PV, different from the primary measure which is pressure (pressure subjected to a transfer function). Thus, if the user unit is not enabled, the PV measurement will display its value in percentage. In order to discern between the display of a pressure from a PV, the display will activate the PV icon when the PV is being displayed.

Example: transmitter **LD301** is connected to a horizontal cylindrical tank (6 meters long and 2 meters in diameter), linearized for volume measurement using camber table data in its linearization table. Measurement is done at the high-pressure tap and the transmitter is located 250 mm below the support base. The fluid to be measured is water at 20 °C. Tank volume is: $[(\pi.d2)/4].l = [(\pi.22)/4]\pi.6 = 18.85$ m3.
The wet tap shall be subtracted from the measured pressure in order to obtain the tank level. Therefore, a calibration without reference shall be carried out, as follows:

In Calibration:
Lower = 250 mmH_2O
Upper = 2250 mmH_2O
Pressure unit = mmH_2O

In User Unit:
User Unit 0% = 0
User Unit 100% = 18.85 m^3
User Unit = m^3
When activating the User's Unit, **LD301** it will start to indicate the new measurement.

Transfer Function for Flow Measurement

The transfer function can be used to convert the measured pressure to flow or volume. The following functions are available:

NOTE
• Use the lowest required damping to prevent measurement delays; • If the square root extraction for flow measurement is carried out externally by other loop element, do not enable this function on the transmitter

SQRT - Square Root. Considering the pressure input **X** varying between 0 and 100%, the output will be $10\sqrt{x}$. This function is used in flow measurement with, e.g., orifice plate or Venturi tube etc.

The Square Root has an adjustable cutoff point. Below this point the output is linear, if the cutoff mode is bumpless with the differential pressure as indicated by the Figure 3.5. If the cutoff mode is hard the output will be 0% below the cutoff point. The default value for Cutoff is 6% of ranged pressure input. The maximum value for cutoff is 100%. Cutoff is used to limit the high gain, which results from square root extraction on small values. This gives a more stable reading at low flows.

In order to find the square root, the **LD301** configurable parameters are: cutoff point defined at a certain pressure expressed as % and the cutoff mode, hard or bumpless.

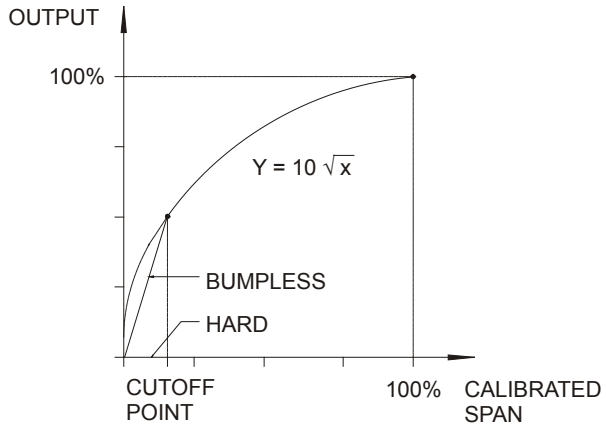


Figure 3.5 – Square Root curve with Cutoff point

NOTE
In bumpless cutoff mode the gain below the cutoff point is given by the equation: $$G = \frac{10}{\sqrt{cutoff}}$$ For example, at **1%** the gain is **10**, i.e., a **0.1%** error in differential pressure, gives a **1%** error in Flow reading. The lower the cutoff, the higher is the gain.

The measurement of the bidirectional flow is useful when it is needed to measure the flow in the pipe in both directions. For example, in tank there are several pipes where the direction of the fluid may vary. In this case, **LD301** has the bidirectional flow measurement function. This function treats the flow, no matter what its direction is, as if it were positive. Thus, it is possible to extract the square root and measure the bidirectional flow.

- ✓ **SQRT**3** - Square Root of the Third Power;
  The output will be $0.1\sqrt{x^3}$. This function is used in open channel Flow measurement with weirs or flumes.
- ✓ **SQRT**5** - Square Root of the Fifth Power. The output will be $0.001\sqrt{x^5}$. This function is used in open channel Flow measurement with V-notch weirs.

It is possible to combine the previous functions with a table. The flow can be corrected according to the table to compensate, for example, the variation of Reynolds number at the flow measurement.

- ✓ **TABLE** - The output is a curve formed by **16** points. These points may be edited directly on the **XY** Table of the **LD301**. For example, it may be used as a camber table for tanks in applications where the tank volume is not linear in relation to the measured pressure;
- ✓ **SQRT & TABLE** - Square root and Table. Same application as square roots, but also allows additional compensation of, e.g., varying Reynolds number.
- ✓ **SQRT**3 & TABLE** - Square Root of the Third Power and table;
- ✓ **SQRT**5 & TABLE** - Square Root of the Fifth Power and table.
- ✓ **TABLE & SQRT –** This function provides bidirectional flow measurement (piping flow measurement in both ways). This function is available for version 6.05 or above firmware.

Example:
There is a flow on the positive direction (high pressure on the H side) with a 0 to 400 mbar ΔP and a flow on the negative direction (high pressure on the L side) from 0 to 100 mbar. For these data make the range lower value equal to -100 mbar, and higher value +400 mbar. Always including the 0 per cent pressure value, namely 20 per cent. Insert the data on the transmitter.

X	Y
0 % (-100 mbar)	100 %
20 % (0 mbar)	0 %
100 % (400 mbar)	100 %

NOTE
To configure a symmetrical bidirectional flow, double the number of calibration points to get a better performance.

Next, configure the cutting point. Refer to the previous Root item.

Table Points

If the option TABLE is selected, the output will follow a curve given in the option TABLE POINTS. If the user wants to have your 4-20 mA proportional to the fluid volume or mass inside a tank, the user must transform the pressure measurement "**X**" into volume (or mass) "**Y**" using the tank strapping table, as the example shown in Table 3.3.

POINTS	LEVEL (PRESSURE)	X	VOLUME	Y
1	-	-10 %	-	-0.62 %
2	250 mmH_2O	0 %	0 m^3	0 %
3	450 mmH_2O	10 %	0.98 m^3	5.22 %
4	750 mmH_2O	25 %	2.90 m^3	15.38 %
5	957.2	35.36 %	4.71 m^3	25 %
6	1050	40 %	7.04 m^3	37.36 %
7	1150	45 %	8.23 m^3	43.65 %
8	1250	50 %	9.42 m^3	50 %
:	:	:	:	:
15	2250	100 %	18.85 m^3	100 %
16	-	110 %	-	106 %

Table 3.3 - Tank Strapping Table

As shown on the previous example, the points may be freely distributed for any desired value of X. In order to achieve a better linearization, the distribution should be concentrated in the less linear parts of the measurement.

The **LD301** includes an internal feature to enable and disable the Linearization Table.

Totalization Configuration

When the **LD301** works in flow applications it is often desirable to totalize the flow in order to know the accumulated volume or mass that has flown through the pipe/channel.

The totalizer integrates the PV% along time, working with a time scheduling based on seconds, as per the following formula:

$$TOT = \int \frac{MAXIMUM\ \ FLOWRATE}{TOTALIZATION\ \ INCREMENT}\ PV\%\ dt$$

The method uses such totalization and, through three parameters (MAXIMUM FLOWRATE, TOTAL INCREMENT and TOTAL UNIT), converts it to the user-defined totalizing unit:

- ✓ **MAXIMUM FLOW RATE -** this is the maximum flow rate expressed in volume or mass units per second, corresponding to the measurement (PV%=100%). For example: m3/s, bbl/s, kg/s, lb/s;
- ✓ **TOTALIZATION INCREMENT** - this is used to convert the flow rate base unit into a multiple unit

of mass or volume. For example, a flow rate totalized in gallons/s may be converted to a volume in m3; a mass flow rate of g/s may be converted to kilos, etc.

- ✓ **TOTALIZATION UNIT -** this is the engineering unit. It shall be associated to the totalized value. It may be a standard unit or a special unit with up to five characters.

WARNING
The totalizer shall be disabled so that any of these parameters can be configured.

The largest totalized value is 99.999.999 totalizing units. When the totalization is displayed, the most significant part is shown on the numeric field, and the less significant part is shown on the alphanumeric field. Figure 3.6 shows a typical display indication.

NOTE
F(t) indication is activated every time the totalized value is shown on the digital display.

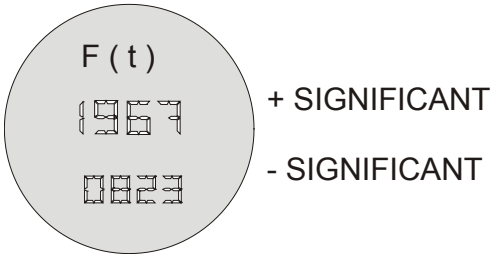


Figure 3.6 – Typical Monitoring Mode Display Showing the Total, in this case 19.6708.23

The following services are associated with the Totalizer:

- ✓ **INITIALIZATION** - Totalization is reinitialized from value "0";
- ✓ **ENABLING / DISABLING -** this allows the totalization function to be enabled or disabled.

WARNING
From Version V6.00 on, with the use of the new main board, the totalized value is persistent, i.e., there is no longer the risk of losing this information in case of power failure.

Example: A differential pressure of 0 - 20 inH_2O represents a flow of 0 - 6800 dm^3/minute.

In CONF set Lower = 0 inH_2O and Upper = 20 inH_2O.
Select the engineering unit as inH_2O

In order to adjust the MAX._FLOW, the maximum flow must be converted to cubic decimeters per second: 6800 / 60 = 113.3 dm3 /s.

The selection of the totalization unit (U_TOTAL) is made in function of the maximum flow and the minimum time allowable for the counter overrun, i.e., the totalization must be less than 99.999.999 in a reasonable observation time.

In the example, if U_TOTAL = 1, the totalization increment is 1 dm^3. The time required for the overrun with maximum flow rate (113.3 dm^3/s) is 245 hours, 10 minutes and 12.5 seconds.

On the other hand, in case a TOTALIZATION INCREMENT equal to 10 is used, the totalized unit will be deciliter (dal) and the totalizer will receive one increment at every 10 dm^3. Considering the maximum flow rate (113.3 dm^3/s), the totalizer will reach its maximum value and return to zero in 102 days, 3 hours, 42 minutes, and 5.243 seconds.

PID Controller Configuration

The **LD301** may be factory -configured to work as Transmitter only or as Transmitter / Controller. In case the **LD301** is configured as a Transmitter / Controller, the end user may change its operation mode at any time simply by configuring an internal status variable.

As a PID Controller, the **LD301** may run a PID type control algorithm, where its 4 to 20 mA will represent the status of the Manipulated variable (MV). In such a mode, output is 4 mA when the MV = 0% and 20 mA when MV= 100%.

The PID implementation algorithm is:

$$MV = Kp\ (e + 1/Tr \int e\,dt + Td\ dPV/dt)$$

Where:

e(t) = PV-SP (direct) SP-PV (reverse)
SP = Setpoint
PV = Process Variable (Pressure, Level, Flow, etc.)
Kp = Proportional Gain
Tr = Integration Time
Td = Derivative Time
MV = Manipulated Variable (output)

The three configuration groups below are pertinent to the PID controller:

- ✓ **SAFETY LIMITS** - this group enables the configuration of: Safety Output, Output Rate and Output Lower and Upper Limits.

  The Safety Output defines the value of the output in the case of equipment failure.

  Output Rate is the maximum variation Rate allowed for the output, expressed in %/s.

  The Lower and Upper Limits define the output range.

- ✓ **TUNING** - this group enables the PID tuning to be performed. The following parameters may be adjusted: Kp, Tr and Td.

  Parameter Kp is the proportional gain (not the proportional band) that controls the PID proportional action. It may be adjusted from 0 to 100.

  Parameter Tr is the integral time that controls the PID integral action. It may be adjusted from 0 to 999 minutes per repetition.

  Parameter Td is the derivative time controlling the PID derivative action. It may be adjusted from 0 to 999 seconds.

NOTE
All these parameters accept zero as input. Such value simply nullifies the corresponding PID control actions.

- ✓ **OPERATION MODES** - this group enables the configuration of: Control Action, Setpoint Tracking and Power On.

  The Control Action Mode enables the selection of the desired output action: direct or reverse. In direct action, a PV increase causes an output increase; in reverse action, a PV increase causes an output decrease.

  When the Setpoint Tracking mode is enabled, it is possible for the Setpoint to follow the PV while in Manual Control. Thus, when control passes to Auto, the Setpoint value will be the last PV prior to the switching.

  When the PID is enabled, the Power On mode allows the adjustment of the mode in which the PID controls shall return after a power failure: Manual mode, Automatic mode or the last mode prior to the power failure.

- ✓ **TABLE** – If the table option is selected, the MV output will follow a curve according to the values typed in the **LD301**'s characterization table. The points can freely be configured as percentage values. For a better linearization, it is recommendable that the points are the closest possible, in the less linear regions of the curve. The **LD301** has an internal variable to enable and disable the characterization table of the MV output of the PID.

Equipment Configuration

The **LD301** enables the configuration not only of its operational services, but also its self-configuration. This group includes services related to: Input Filter, Burnout, Addressing, Display Indication, Writing Protection and Passwords.

- ✓ **INPUT FILTER** - The Input Filter, also referenced to as damping, is a first class digital filter implemented by the firmware. User configurable from any value from zero to 128 seconds in addition to intrinsic total sensor response time (140 ms), via digital communication.

- ✓ **BURN OUT** - The output current may be programmed to go to the maximum limit of 21 mA (Full Scale) or to the minimum limit of 3.6 mA in case of transmitter failure. Configuring the BURNOUT parameter for Upper or Lower may do this.

  The BURNOUT configuration is only valid in the transmitter mode. When a failure occurs in the PID mode, the output is driven to a safety Output value, between 3.8 and 20.5 mA.

- ✓ **ADDRESSING** - The **LD301** includes a variable to define the equipment address in a HART® network. Addresses may go from value "0" to "15"; but addresses from "1" to "15" are specific for multidrop connections. This means that, in a multidrop configuration, the **LD301** will display the message MDROP.

NOTE
The output current will be 4 mA as soon as the **LD301** address, in the Transmitter mode, is changed to another value than "0" (this does not happen when the **LD301** is configured in the Controller mode).

The **LD301** is factory-configured with address "0".

- ✓ **DISPLAY INDICATION -** the **LD301** digital display has three distinct fields: an information field with icons indicating the active configuration status, a 4 ½ digit numeric field for value indication and a 5 digits alphanumeric field for units and status information.

The **LD301** may work with up to two display configurations to be alternately displayed at 3 second intervals. Parameters that may be selected for visualization are those listed on Table 3.4, below.

PARAMETER	DESCRIPTION
CURRENT	Current in milliamperes.
PV%	Process Variable in percentage.
PV	Process Variable in engineering units.
MV% (*)	Output in percentage.
PRES	Pressure in pressure unit.
TEMP	Ambient temperature.
TOTAL	Total accumulated by the totalizer.
SP% (*)	Setpoint in percentage.
SP (*)	Setpoint in engineering units.
ER% (*)	Error in percentage (PV% - SP %).
NONE	Used to cancel the second indication.

Table 3.4 – Variables for Display Indication

NOTE
Items marked with an asterisk can only be selected in the PID mode. Total can only be selected if enabled.

- ✓ **WRITING PROTECTION -** This feature is used to protect the transmitter configuration from changes via communication. All configuration data are writing-protected.

  The **LD301** includes two write protection mechanisms: software and hardware locking.

  When the **LD301** writing software protection mechanism is enabled, it is possible, by means of specific commands, to enable or disable the write protection.

- ✓ **PASSWORDS -** this service enables the user to modify the operation passwords used in the **LD301**. Each password defines the access for a priority level (1 to 3); such configuration is stored in the **LD301** EEPROM. Password Level 3 is hierarchically superior to password level 2, which is superior to level 1. The levels 1 and 2 are available for external access allowing configurator to create its proper access structure.

Equipment Maintenance

Here are grouped maintenance services related with the collection of information required for equipment maintenance. The following services are available: Order Code, Serial Number, Operation Counter and Backup/Restore.

- ✓ **ORDER CODE** - The Order Code is the one used for purchasing the equipment, in accordance with the User specification. There are 22 characters available in the **LD301** to define this code.

EXAMPLE:

#	OPTION	DESCRIPTION
1	**L**	Differential pressure transmitter
2	**D**	
3	**3**	
4	**0**	
5	**1**	
6	**D**	
7	**2**	Range 2: -50 to 50 kPa
8	**1**	SST 316L diaphragm – Silicon oil
9	**I**	SST 316 Flanges, adapters and Drain/vent
10	**B**	Nitrile O'ring
11	**U**	Upper Drain/vent
12	**1**	Local indicator
13	**0**	Process connection 1/4NPT
14	**0**	Electrical connection 1/2NPT
15	**1**	Local adjust Z S
16	**1**	Carbon Steel bracket and accessories
17;18	**A0**	Flange's Bolts and Nuts in Carbon steel
19;20	**C5**	Materials conforming NACE standard
21;22	**D0**	Flange thread: 7/16”UNF (Smar default)
	G0	Output signal: 4-20mA
	H0	Aluminum Housing Material
	I6	Identification Plate without certification
	M0	Configuration Memory With PID
	P0	Electronic Housing and covers with gray paint
	S0	Manufacturing Standard: Smar
	Y2	LCD1:pressure (engineering units)
	J0	With Tag plate
	Z0	Without special standard
	E0	Electronic Housing Standard
	BD	Initial scale
	OP	Standard performance
	X0	Without certification
	R0	Standard flange position

Table 3.5 – Differential Pressure Transmitter Ordering Code

✓ **SERIAL NUMBER -** Three serial numbers are stored:

Circuit Number - This number is unique to each main circuit board and cannot be changed.

Sensor Number - The serial number of the sensor connected to the **LD301** and cannot be changed. This number is read from the sensor every time a new sensor is inserted in the main board.

Transmitter Number - the number that is written at the identification plate in each transmitter.

NOTE
The transmitter number must be changed whenever there is the main plate change to avoid communication problems.

✓ **OP_COUNT -** Every time a change is made, there is an increment in the respective change counter for each monitored function, according to the table 3.6. The counter is cyclic, from 0 to 255. The monitored items are:

VARIABLE	DESCRIPTION
Lower Value/Upper Value	When any type of calibration is done.
Function	When any change in the transference function is done, e.g., linear, square root, constant, or table.
Trim_4mA	When the current trim is done at 4mA.
Trim_20mA	When the current trim is done at 20mA.
Trim_Zero/Lower	When pressure trim is done at Zero or Lower Pressure.
Trim Upper Pressure	When the trim is done at Upper Pressure.
Temperature Trim	When the Temperature Trim is done.
TRM/PID	When the operation mode is changed, i.e., from PID to TRM or vice-versa.
Characterization	When any change occurs at any point of the pressure characterization table in trim mode.
Multidrop	When the communication mode is changed, for example, multidrop or single transmitter.
Pswd/C-Level	When any change occurs in the password or the level configuration.
Totalization	When any change occurs in unit, configuration or totalization reset.

Table 3.6 – Functions Monitored by the Operation Counter

✓ **BACKUP**
When the main board is changed, after assembling and powering it, the data saved in the sensor memory are automatically copied to the main board memory, allowing its operation.

Most of the parameters are transferred automatically, however, the calibration parameters remain intact on the main board, so as not to risk inadvertently changing the working range. If the replaced part is the sensor, there is a need to transfer the calibration from the main board to the sensor and vice versa if the main board was exchanged.

✓ **RESTORE**
This option allows copying the data saved in the sensor memory to the main board memory. It also allows restoring to the main board the data stored in the sensor.

PROGRAMMING USING LOCAL ADJUSTMENT

The Magnetic Tool

The digital display enables the local adjustment function.

The local adjustment function may be used only through the digital display. The **LD301** on transmitter mode, without display and jumper-configured for simple mode, executes only the calibration function.

Figure 4.1 shows the location of the local adjustment female pins to connect the Local Adjustment Jumpers.

NOTE
Smar has developed the **DEVCOMDROID** (Android DDL Interpreter) software, used with HART interfaces, such as the **HI331** (Bluetooth Interface), in addition to **AssetView** (based on DTM) to configure the HART® equipment. However, the old **PALM** with **HPC301** or **CONF401**, which are obsolete, remains operable even with the latest updates in HART transmitters. They provide easy configuration and monitoring of field devices, capability to analyze data and to modify the performance of these devices. The operation characteristics and use of each one of the configuration tools are stated on their respective manuals. It is also compatible to use configurators that support DDL (Device Description Language) or DTM (Device Type Manager).

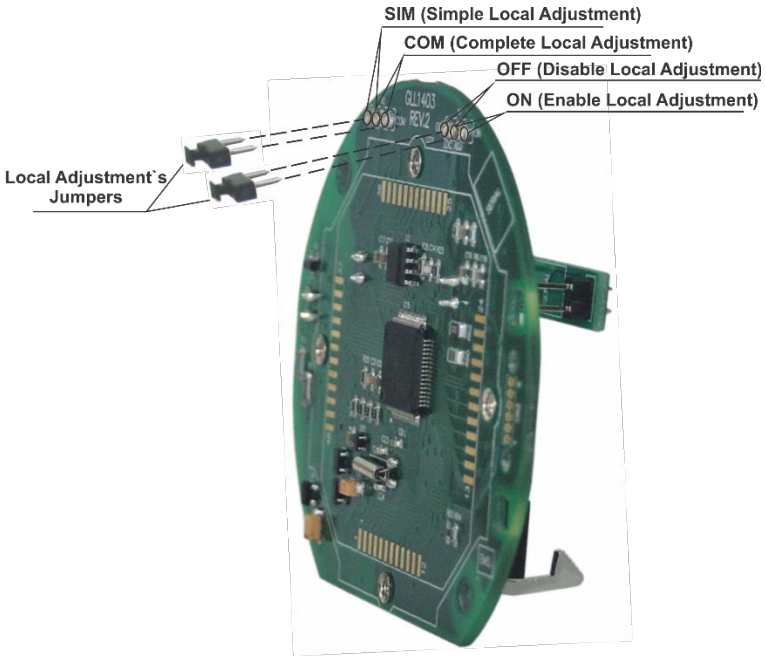
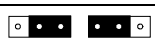


Figure 4.1 - Main Board with Jumpers

To select the function mode of the magnetic switches, configure the jumpers located at the top of the main circuit board as indicated in Table 4.1.

SIM/COM OFF/ON	NOTE	WRITE PROTECT	SIMPLE LOCAL ADJUSTMENT	COMPLETE LOCAL ADJUSTMENT
		Disables	Disables	Disables
	**1**	**Enables**	Disables	Disables
	**2**	Disables	Enables	Disables
		Disables	Disables	Enables

Notes: **1** - If the hardware protection is selected, the writing in memory will be protected.
2 - The local adjustment default condition is simple enabled and write protect disabled.

Table 4.1 – Local Adjustment Selection

The transmitter has, under the identification plate, holes for two magnetic switches activated by the magnetic tool (See Figure 4.2).

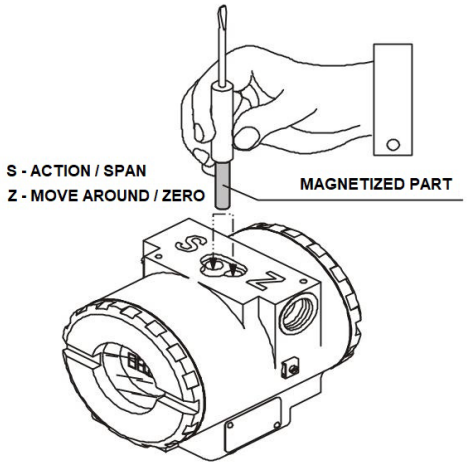


Figure 4.2 – Local Zero and Span Adjustment holes and Local Adjustment Switches

The holes are marked with **Z** (Zero) and **S** (Span) and from now on will be designated simply by (**Z**) and (**S**), respectively. Table 4.2 shows the action performed by the magnetic tool while inserted in (**Z**) and (**S)** in accordance with the selected adjustment type.

Browsing the functions and their branches works as follows:

1 - Inserting the handle of the magnetic tool in (**Z**), the transmitter passes from the normal measurement state to the transmitter configuration state. The transmitter software automatically starts to display the available functions in a cyclic routine. The set of functions displayed depends on whether or not the PID is selected for the LD301.

2 - In order to reach the desired option, browse the options, wait until they are displayed and move the magnetic tool from (**Z)** to (**S).** Refer to Figure 4.3 – Local Adjustment Programming Tree, in order to know the position of the desired option. By placing the magnetic tool once again in (**Z)**, it is possible to browse other options within this new branch.

3 - The procedure to reach the desired option is similar to the one described on the previous item, for the whole hierarchical level of the programming tree.

ACTION	SIMPLE LOCAL ADJUSTMENT	COMPLETE LOCAL ADJUSTMENT
Z	Selects the Lower Range Value	Moves among all the options
S	Selects the Upper Range Value Activates the selected Functions	Activates the selected Functions

Table 4.2 - Local Adjustment Description

Simple Local Adjustment

The Simple Local Adjustment is as follows:

- ✓ **Zero Adjustment**: when placing the magnetic key in the hole marked with (Z), the measured pressure will be the pressure corresponding to the current of 4 mA;;
- ✓ **Span Adjustment:** when placing the magnetic key in the hole marked (S), the measured pressure will be the pressure corresponding to the current of 20 mA.

NOTE
In order for the calibration to occur properly, it is necessary to pay attention to the minimum span for each range and types of measurement defined in the Technical Specification (Section 3).

Zero calibration with reference shall be done as follows:

- ✓ Apply the Lower Value pressure.
- ✓ Wait for the pressure to stabilize.
- ✓ Insert the magnetic tool in the ZERO adjustment hole. (See Figure 4.2)
- ✓ Wait 2 seconds and soon the transmitter should be reading 4 mA.
- ✓ Remove the tool.

Zero calibration with reference does not affect the span. In order to change the span, the following procedure shall be observed:

- ✓ Apply the Upper Value pressure.
- ✓ Wait for the pressure to stabilize.
- ✓ Insert the magnetic tool in the **S** adjustment hole.
- ✓ Wait 2 seconds. The transmitter should be reading 20 mA.
- ✓ Remove the tool.

Zero adjustment causes zero elevation or suppression and a new upper value (URV) are calculated in accordance with the effective span. In case the resulting URV is higher than the Upper Limit Value (URL), the URV will be limited to the URL value, and the span will be automatically affected.

NOTE
On elevation or suppression measuring configure the user unit to facilitate the local reading.

Complete Local Adjustment

The Complete Local Adjustment is as described in the Local Adjustment Programming Tree below.

WARNING
When programming using local adjustment, the transmitter will not prompt "Control loop should be in manual!" as it does when using the HART® configurator for programming. Therefore it is a good idea, before configuration, to switch the loop to manual. And do not forget to return to auto after configuration is completed.

Local Programming Tree

The local adjustment uses a tree structure where, by placing the magnetic tool in (**Z**) it is possible to browse the options of a branch and, by placing it in (**S**); details of the chosen option are shown. Figure 4.3 - Local Adjustment Programming Tree shows the **LD301** available options.

NOTA
From version 7.00.00 of LD301 the local adjustment tree has been changed to that shown in figure 4.3.

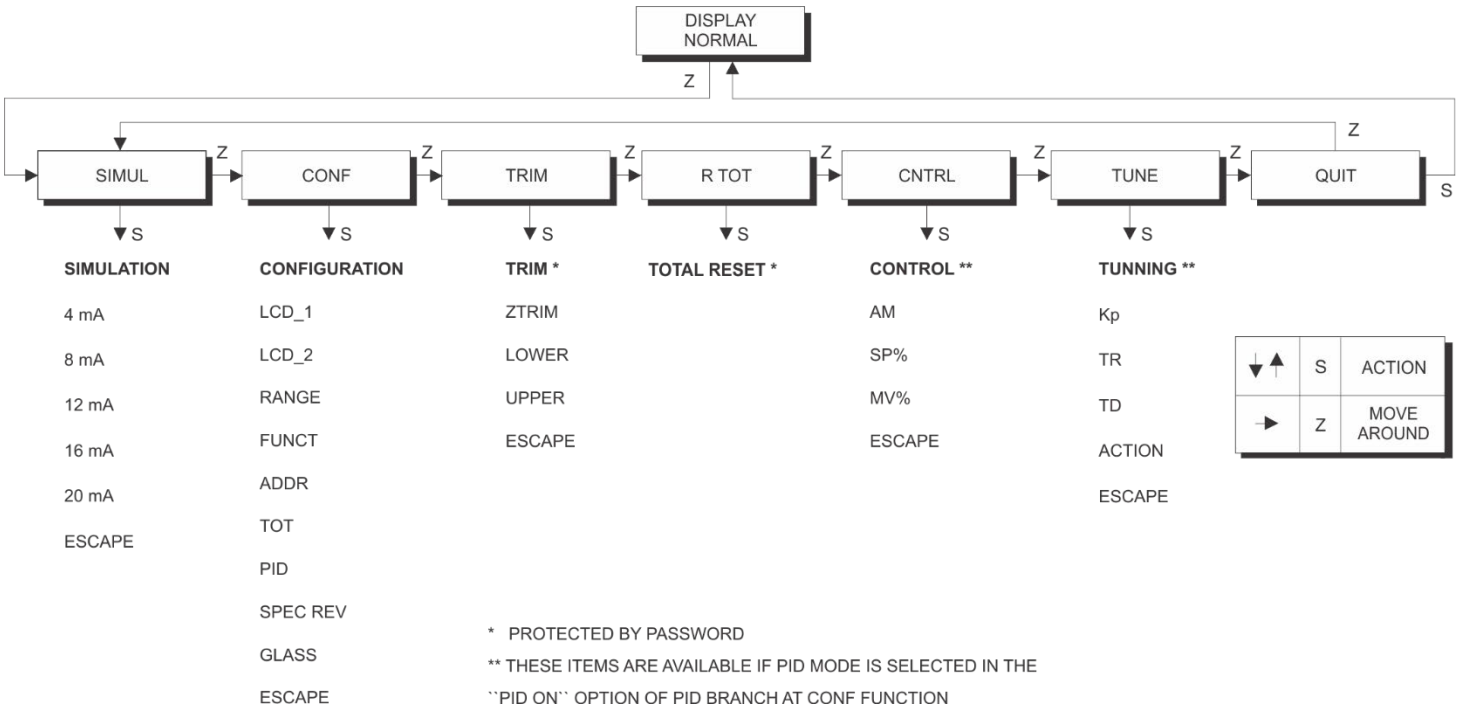


Figure 4.3 – Local Adjustment Programming Tree – Main Menu

Actuating in (**Z**) activates local adjustment. With the PID disabled, CNTRL and TUNE options are unavailable.

SIMULATION (SIMUL) – Is the current simulation option for loop test. Options: 4 mA, 8 mA, 12 mA, 16 mA or 20 mA.

CONTROL (CNTRL) - Is the option where the operation related parameters of the controller are configured: Auto/Manual, Setpoint and Manual output.

TUNNING (TUNE) - Is the option where the PID-Algorithm related parameters are configured: Action, Kp, Tr and Td.

CONFIGURATION (CONF) - Is the option where the output and display related parameters are configured: unit, primary and secondary display, calibration, function, operation mode, address, totalization, device revision version, and display type.

TOTAL RESET (R TOT) – The totalization value is zeroed.

TRIM (TRIM) - Is the option used to transmitter characterization, adjusting its digital reading.

QUIT (QUIT) - Is the option used to go back to normal monitoring mode.

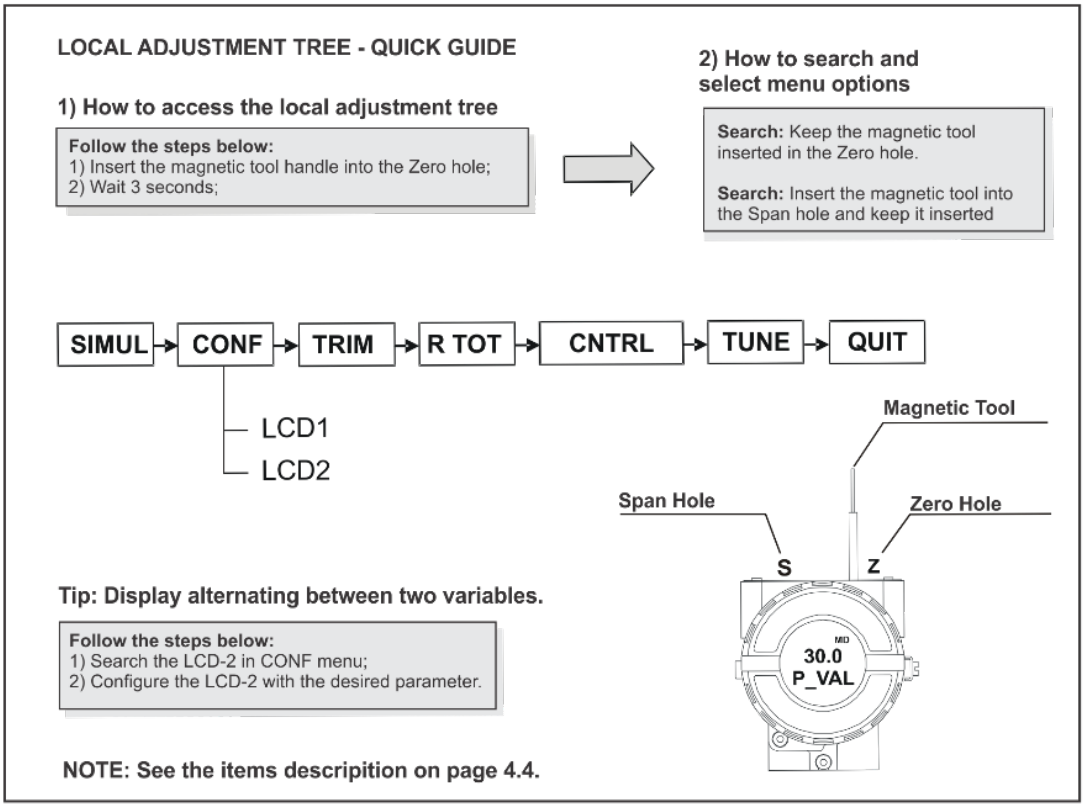


Figure 4.4 – Quick guide of Local Adjustment

Simulation [SIMUL]

This operation has the function of simulating the output current for the loop test. Value options to be simulated: 4 mA, 8 mA, 12 mA, 16 mA or 20 mA.

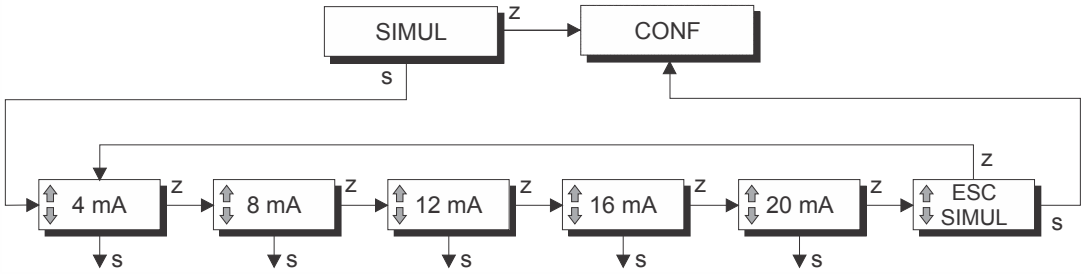
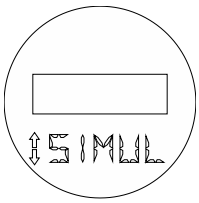


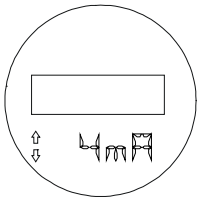
Figure 4.5 – Simulation branch Local Adjustment Programming Tree

RAMO DE SIMULAÇÃO (SIMUL)



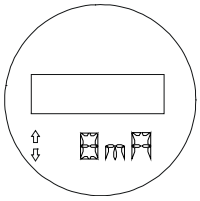
Z: Moves to **CONFIGURATION (CONF)** branch.

S: Activates the **Current Simulation** branch **(SIMUL)**, starting with **4 mA**



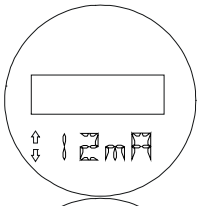
Z: Move around the options of available simulation values.

S: Enter the **4 mA** value for simulation.



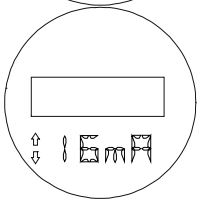
Z: Move around the options of available simulation values

S: Enter the **8 mA** value for simulation.



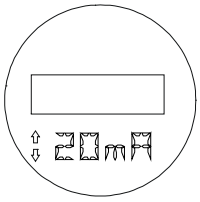
Z: Move around the options of available simulation values

S: Enter the **12 mA** value for simulation.



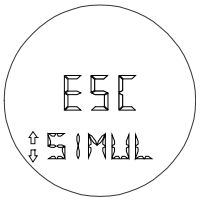
Z: Move around the options of available simulation values

S: Enter the **16 mA** value for simulation



Z: Move around the options of available simulation values

S: Enter the **20 mA** value for simulation



Z: Move to simulation current value **4 mA**.

S: Escapes to the **Configuration** option **(CONF)**.

Configuration [CONF]

This branch is common for both PID enabled and disabled condition. Configuration functions affect directly the 4-20 mA output current and the display indication. The configuration options implemented in this branch are the following:

- ✓ Selection of the variable to be shown on Display 1 and on Display 2.
- ✓ Working range calibration for PID enabled or disabled. Options With and Without Reference options are available.
- ✓ Digital filter damping time configuration of the reading signal input.
- ✓ Selection of the transference function to be applied to the measured variable.
- ✓ Selection of PID enabled or disabled for the **LD301**.

- ✓ Address selection.
- ✓ Totallization
- ✓ Selection of Device Revision
- ✓ Selection of Display option

The next figure shows branch CONF with the available options.

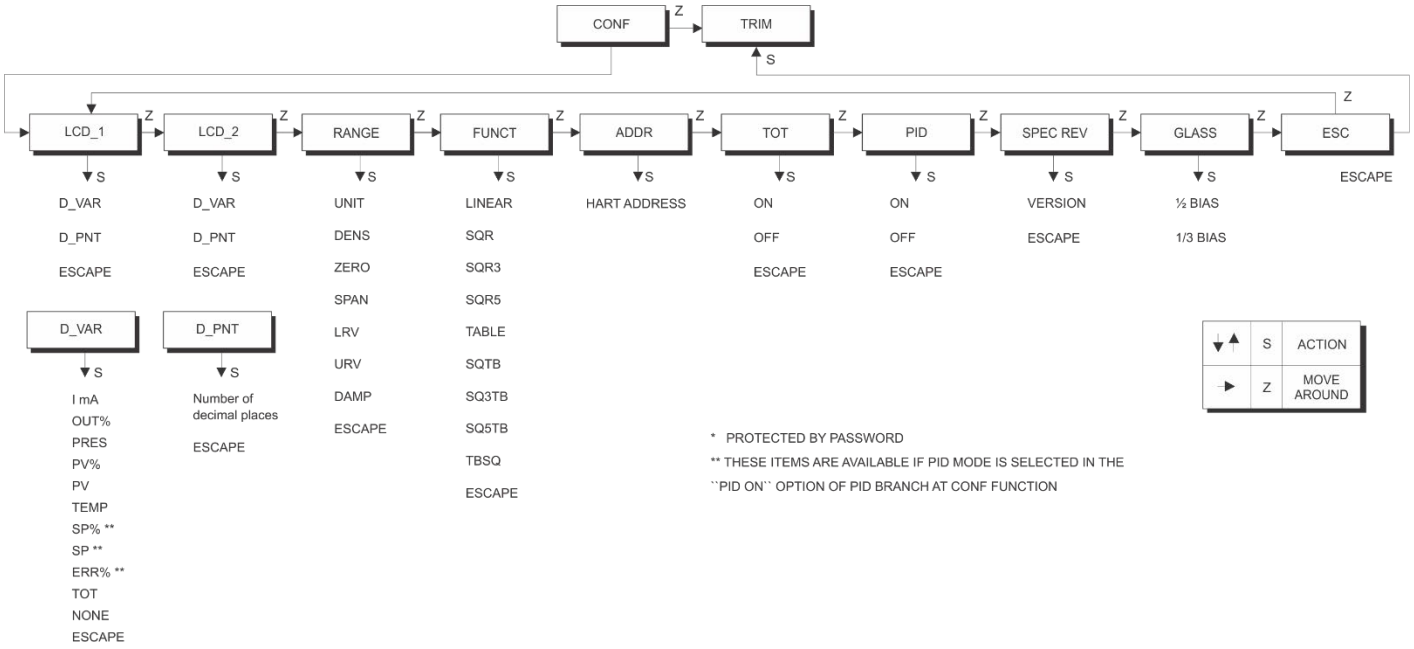
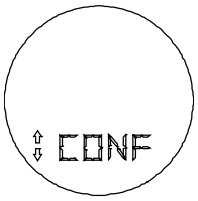


Figure 4.6 – Local Adjustment Configuration Tree

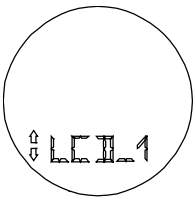
CONFIGURATION BRANCH (CONF)



Z: Moves to the PRESSURE TRIM (TRIM) branch.

S: Enters the CONFIGURATION branch, starting with function display (LCD_1).

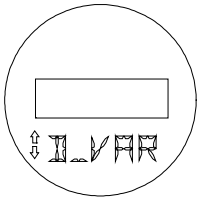
Display 1 (LCD_1)



Z: Moves to the function Display 2 (LCD_2).

S: Activates the **LCD_1** function, allowing the operation in (S) to go through the functions Display Variables **D_VAR** and Decimal Places **D_PNT**.

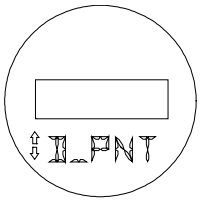
Display Variables (D_VAR)



Z: Moves to the function Decimal Place D_PNT.

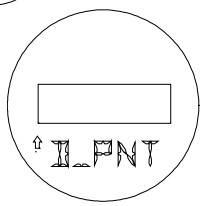
S: Actuating with the magnetic tool in (S) once activates the Display Variables function D_VAR, allowing with the operation in (Z) to pass through the variables available for the LCD_1. The desired variable is activated using (S). Escape ESC SEL_VAR leaves the primary display unchanged. See Table 4.3.

Decimal Place (D_PNT)



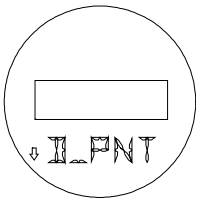
Z: Moves to Escape **ESC SEL_VAR**.

S: Moves to the **Increase Decimal Place** option **D_PNT**.



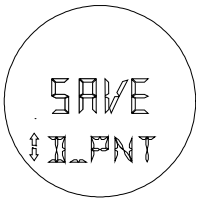
Z: Moves to the **Decrease Decimal Place** option **D_PNT**.

S: Increase the number of decimal places until the magnetic tool is removed or the upper limit of decimal places is reached.



Z: Moves to the **SAVE D_PNT** function.

S: Decrease the number of decimal places until the magnetic tool is removed or the lower limit of decimal places is reached.



Z: Moves to the **ESC INC** function.

S: Saves the **D_PNT** value on the transmitter main bord memory.

Z: Moves to the **Increase Decimal Place** option **D_PNT**.

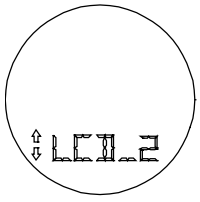
S: Returns to the **Decimal Point** (**D_PNT**).

Variables Selection Escape (ESC SEL_VAR)

Z: Moves to **Display Variables** option **D_VAR**.

S: Returns to the **Display LCD_2** function.

Display 2 (LCD_2)



Z: Moves to the RANGE function.

S: Activates the **LCD_2** function, allowing the operation in (S) to go through the functions Display Variables **D_VAR** and Decimal Places **D_PNT**. The procedure for selection is the same as for LCD_1, above.

Display LCD_1/LCD_2 (D_VAR)	Description
ImA	Analog Output Current in mA
OUT (%)	Output in percentage
PRES	Pressure in pressure unit
PV (%)	Process Variable in percentage
PV	Process Variable in user unit
TEMP	Temperature in Celsius degree
SP (%)	Setpoint in percentage
SP	Setpoint in user unit
ERR	Error in percentage
TOT	Totalization
NONE*	No variable on display (only LCD_2)
ESCAPE	Escape

**In this condition only one variable is indicated in the Display, in this case the parameter configured for LCD_1*

Table 4.3 - Display Indication

NOTE
With the PID disabled, only the ImA, OUT%, PRES, PV%, PV, TEMP and TOT can be displayed. Besides, it is also possible to select option **None** for **Display 2**.

Calibration (RANGE)

Function Calibration (RANGE) presents the calibration options as a tree branch, as described on Figure 4.7.

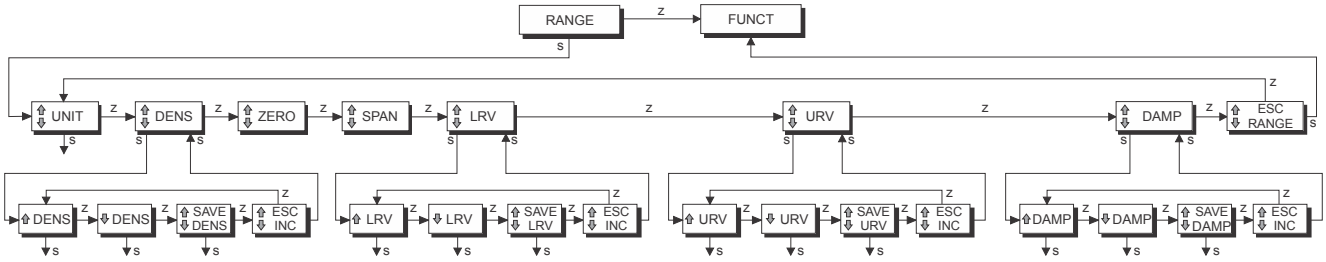
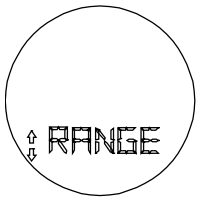


Figure 4.7 – Local Adjustment of Calibration Function

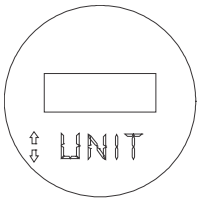
RANGE BRANCH (RANGE)



Z: Moves to the FUNCT function, CONF branch.

S: Enters the RANGE branch, starting with the function UNIT.

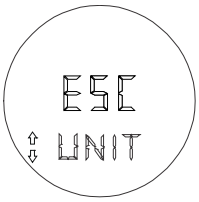
Unit (UNIT)



Z: Moves to the Density function (DENS).

S: Starts selection of engineering unit for process variable and setpoint indication. You can move around the options available in the table below by activating (**Z**).

Unit Escape (ESC UNIT)



Z: Moves to the first unit option.

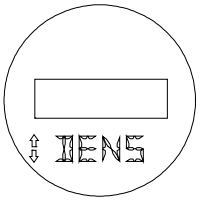
S: Escapes to the Density function (DENS).

UNIT	
DISPLAY	**DESCRIPTION**
InH_2O	inches water column at 20 ºC
InHg	inches mercury column at 0 ºC
ftH_2O	feet water column at 20 ºC
mmH_2O	millimeter water column at 20 ºC
mmHg	millimeter mercury column at 0 ºC
psi	pounds per square inches
bar	Bar
mbar	millibar
Kgf/cm^2	Kilogram-force per square centimeter
kPa	Kilopascal
mH2O	meter water column
atm	atmosphere
MPa	megapascal
ft	feet
m	meter
In	inches

Table 4.4 – Units

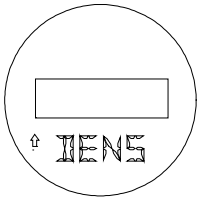
The desired unit is activated by inserting the magnetic tool into (S).

Density (DENS)



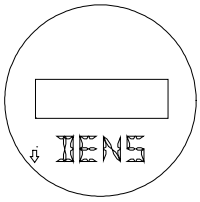
Z: Moves to **Zero Adjustment with reference (ZERO).**

S: Moves to **INCREASE DENS VALUE**.



Z: moves to **DECREASE DENS VALUE**.

S: increases the density value until the magnetic tool is removed or the upper limit is reached.

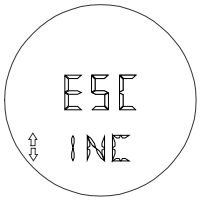


Z: moves to **SAVE DENS** function.

S: decreases the density value until the magnetic tool is removed or the lower limit is reached.

Z: Moves to **ESC INC** function.

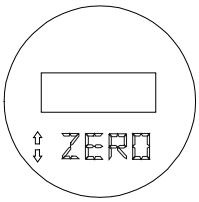
S: Saves the density value on the transmitter main board memory.



Z: Moves to **INCREASE DENS VALUE**.

S: Escapes to **Density (DENS)** function.

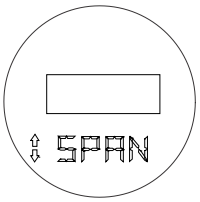
Zero Adjust with Reference {ZERO}



Z: Moves to the Span with reference Adjustment function (SPAN).

S: Adjusts the Lower Range Value

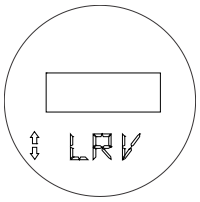
Span with reference adjustment (SPAN)



Z: Moves to Lower range value adjustment without reference **(LRV)**.

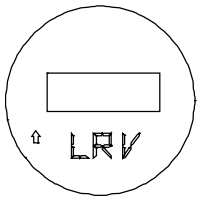
S: Increases the Span value.

Lower Range Value Adjustment without Reference (LRV)



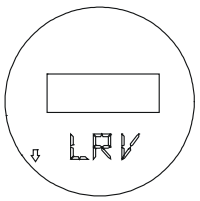
Z: Moves to the Upper range value adjustment without reference function (URV).

S: Moves to INCREASE LRV function..



Z: Moves to the DECREASE LRV function.

S: Increases the Lower Value until the magnetic tool is removed or the upper limit of the Lower Value is reached.

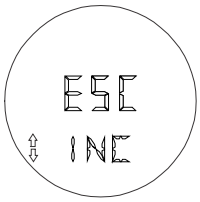


Z: Moves to the SAVE LRV function.

S: Decreases the Lower Value until the magnetic tool is removed or the minimum Lower Value is reached.

Z: Moves to **ESC INC** function.

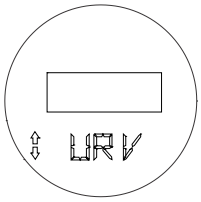
S: Saves the LRV value on the transmitter main board memory.



Z: Moves to **INCREASE LRV** option.

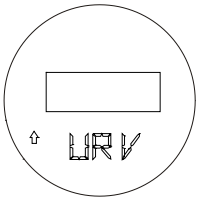
S: Escapes to **Lower Range Value Adjustment without Reference (LRV)** function.

Upper Range Value Adjust without Reference {URV}



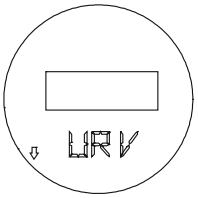
Z: Moves to the Damping (DAMP) function.

S: Moves to INCREASE URV option.



Z: Moves to the DECREASE URV function.

S: Moves to INCREASE URV, and increases the Upper Value until the magnetic tool is removed or the maximum Upper Value is reached.

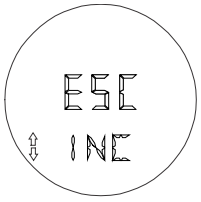


Z: Moves to the SAVE URV function.

S: Decreases the Upper Value until the magnetic tool is removed or the minimum Upper Value is reached.

Z: Moves to the ESC INC function.

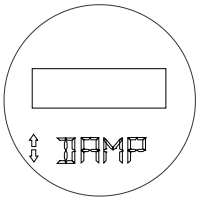
S: Saves the URV value on the transmitter main board memory



Z: Moves to **INCREASE URV** option.

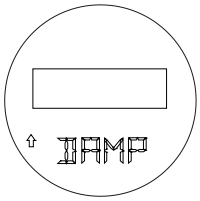
S: Escapes to Upper **Range Value Adjustment without Reference (URV)** function.

Damping (DAMP)



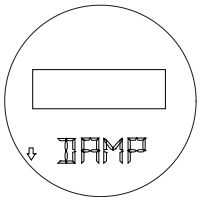
Z: Moves to **ESC RANGE** function.

S: Moves to **INCREASE DAMPING**.



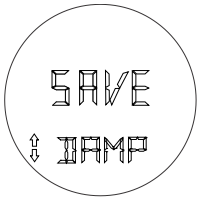
Z: Moves to **DECREASE DAMPING**.

S: Increase the time constant of damping until the magnetic tool is removed or 128 seconds is reached.



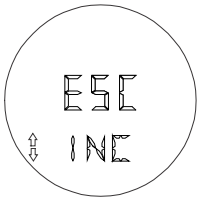
Z: Moves to **SAVE DAMP** function.

S: Decrease the time constant of damping until the magnetic tool is removed or 0 seconds is reached.



Z: Moves to **ESC INC** function.

S: Saves the **DAMPING** value on the transmitter main board memory.



Z: Moves to **INCREASE DAMPING** function.

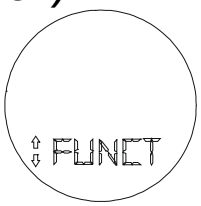
S: Escapes to **DAMPING (DAMP)** function.

Calibration Escape (ESC RANGE)

Z: Returns to **Unit** function **(UNIT)**.

S: Returns to **Function (FUNCT)** function of Configuration branch (CONF).

Function (FUNCT)



Z: Moves to the ADDRESS function.

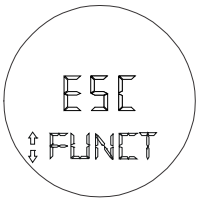
S: Starts selection of transfer function. After activating (**Z**), you can move around the available options in the table 4.5.

FUNCTIONS	
DISPLAY	**DESCRIPTION**
LINE	Linear to Pressure
SQR	$\sqrt{x}$
SQR3	$\sqrt{x^3}$
SQR5	$\sqrt{x^5}$
TABLE	16 Point Table
SQTB	$\sqrt{x}$ + 16 Point Table
SQ3TB	$\sqrt{x^3}$ + 16 Point Table
SQ5TB	$\sqrt{x^5}$ + 16 Point Table
TBSQ	16 Point Table + $\sqrt{x}$
ESC	escape

Table 4.5 – Functions

The desired function is activated using (**S**). Escape leaves function unchanged.

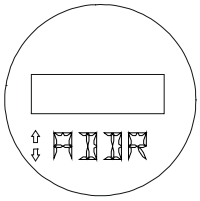
Escape (ESC FUNCT)



Z: Moves to the first option of the transfer function.

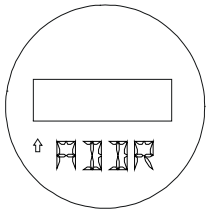
S: Returns to the ADDR function of the Configuration branch (CONF).

Address (ADDR)



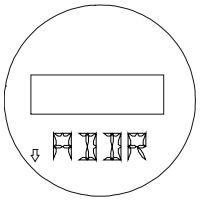
Z: Moves to Totalization (TOT) function.

S: Moves to **INCREASE ADDRESS ADDR** option.



Z: Moves to **DECREASE ADDRESS ADDR** option.

S: Increases the address value until the magnetic tool is removed or until the address 15 is reached.



Z: Moves to SAVE ADDR function.

S: Decrease the address value until the magnetic tool is removed or until the address 0 is reached.

Z: Moves to ESC INC function.

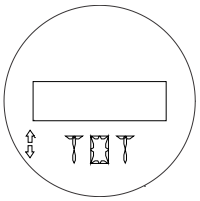
S: Saves the adderss value on the transmitter main board memory.

Z: Moves to INCREASE ADDRESS ADDR option.

S: Escape to ADDRESS function (ADDR).

Totalization (TOT)

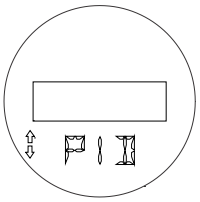
The totalization parameters are configured via HART configurator, as they require a more elaborate man-machine interface as described in Section 3.



Z: Moves to **Mode PID** function.

S: Switches the totalization TOT from ON to OFF or from OFF to ON.

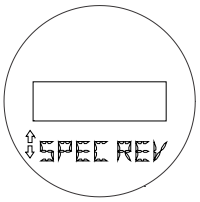
PID Mode (PID)



Z: Moves to **SPEC REV** function.

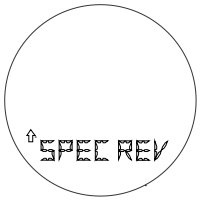
S: Switches the PID mode from ON to OFF or from OFF to ON.

Specific Device Revision **(SPEC REV)**



Z: Moves to **GLAS** function.

S: Moves to **INCREASE SPEC REV** option.



Z: Moves to **DECREASESPEC REV** function.

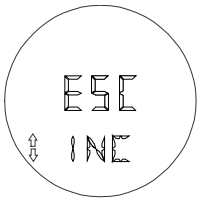
S: Increase the version until the magnetic tool is removed or until the highest numbered version is reached.

Z: Moves **SAVE SPEC REV** function.

S: Decrease the version until the magnetic tool is removed or until the lowest numbered version is reached.

Z: Moves to **ESC INC** function.

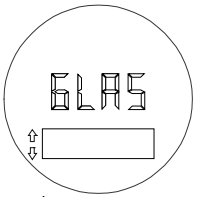
S: Saves the specific revision on the transmitter main board memory.



Z: Moves to **INCREASE SPEC REV** function.

S: Escapes to **SPEC REV** function.

Display type (GLAS)



Z: Returns to **ESC CONF** option.

S: Switches between **1/2 Bias** or **1/3 Bias** display options according to which display is used.

Configuration Escape (ESC CONF)

Z: Returns to **display 1 (LCD1)** function.

S: Escapes to **TRIM** branch.

Pressure Trim [TRIM]

This field of the tree is used to adjust the digital reading according to the applied pressure. The pressure TRIM differs from RANGING WITH REFERENCE, since the TRIM is used to correct the measure and RANGING WITH REFERENCE reach only the applied pressure with the output signal of 4 to 20 mA. Figure 4.8 shows the options available to run the pressure TRIM.

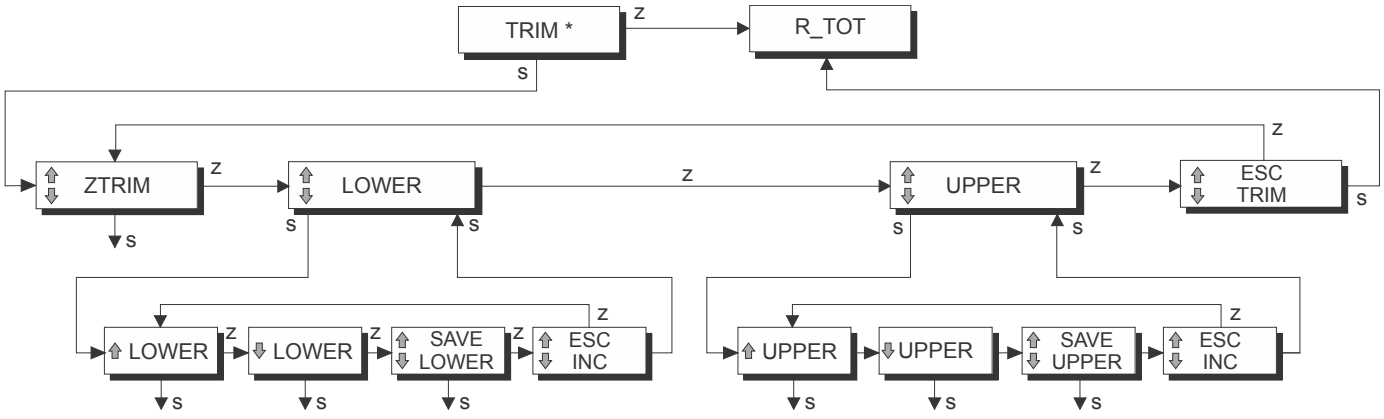
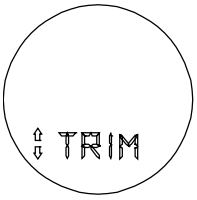


Figure 4.9 – Pressure Trim Tree

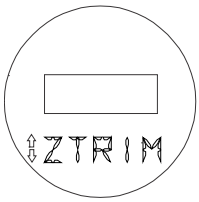
TRIM BRANCH (TRIM)



Z: Moves to R TOT function.

S: These functions are protected by a "password." When prompted PSWD, enter the password. The password code consists of inserting and removing the magnetic tool 2 times in (S). The first time changes the password value from 0 to 1 and the second, allows you to enter the available options, starting with the Zero Pressure Trim.

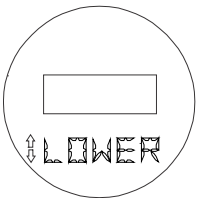
Zero Pressure Trim (ZERO)



Z: Moves to the lower pressure trim function (LOWER).

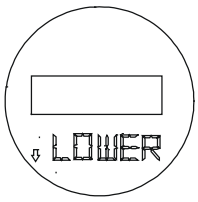
S: Adjusts the transmitter internal reference to read 0 at the applied pressure.

Lower Pressure Trim (Lower)



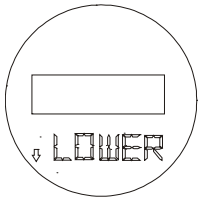
Z: Moves to upper pressure trim option (UPPER).

S: Moves to INCREASE LOWER PRESSURE VALUE and adjusts the transmitter internal reference, increasing the displayed value that will be interpreted as the Lower Pressure value corresponding to the applied pressure.



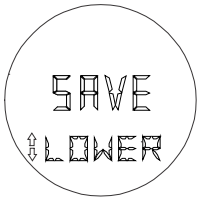
Z: Moves to DECREASE LOWER PRESSURE VALUE function.

S: Adjusts the transmitter internal reference, increasing the displayed value that will be interpreted as the Lower Pressure value corresponding to the applied pressure.



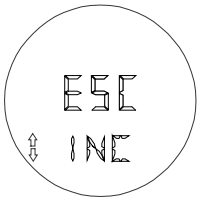
Z: moves to **SAVE LOWER** function.

S: Adjusts the transmitter internal reference, decreasing the displayed value that will be interpreted as the Lower Pressure value corresponding to the applied pressure.



Z: Moves to **ESC INC** function.

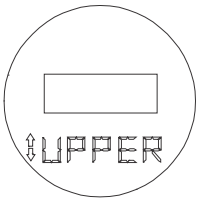
S: Saves the points of Lower trim on the transmitter main board memory and updates the internal parameters of pressure measurement



Z: Moves to **INCREASE LOWER PRESSURE VALUE** option.

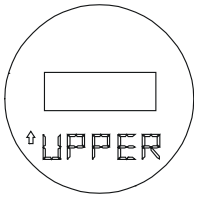
S: Returns to Lower pressure trim function **(LOWER)**

Upper Pressure Trim (UPPER)



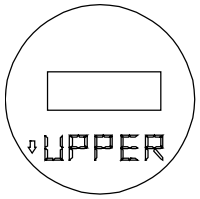
Z: Moves to ESC TRIM function.

S: Moves to INCREASE UPPER PRESSURE VALUE and adjusts the transmitter internal reference, increasing the displayed value that will be interpreted as the Upper Pressure value corresponding to the applied pressure.



Z: Moves to DECREASE UPPER PRESSURE VALUE function.

S: Adjusts the transmitter internal reference, increasing the displayed value that will be interpreted as the Upper Pressure value corresponding to the applied pressure.

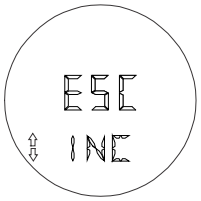


Z: Moves to the SAVE UPPER function.

S: Adjusts the transmitter internal reference decreasing to the value on the display, that will be interpreted as the Upper Pressure value corresponding to the applied pressure.

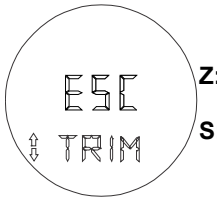
Z: Moves to the ESC INC function.

S: Saves the UPPER TRIM points on the transmitter main board memory and updates the internal parameters of pressure measurement.



Z: Moves to **INCREASE UPPER PRESSURE VALUE** option.

S: Returns to Upper pressure trim function **(UPPER)**



Z: Moves to the ZERO TRIM function (ZTRIM).

S: Escapes to the MAIN menu, Reset Total branch (R TOT).

Totalization Reset [R TOT]

This is the branch which the totalization value is zeroed.

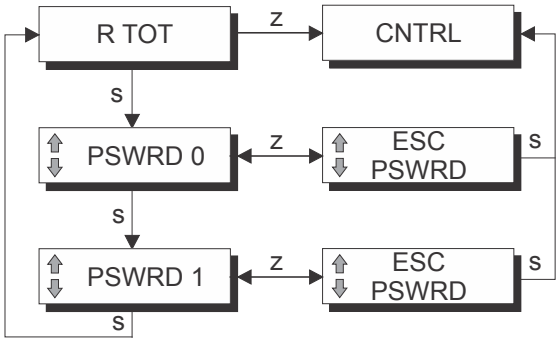
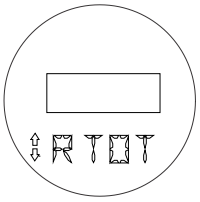
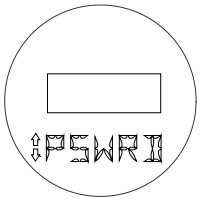


Figure 4.9 – Total Reset branch of the local adjustment tree



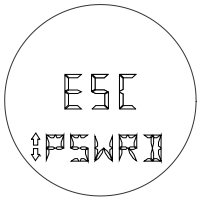
Z: Moves to **CONTROL** function **(CONTROL)**.

S: Moves to password option (PSWRD) with value 0.



Z: Moves to ESC PSWRD option.

S: When the 0 PSWD appears, enter the password. The password code consists of inserting the magnetic tool in (S) and wait until the number 0 changes to 1. After that, when the magnetic tool is pressed again in (S), the totalization value will be reset to zero.



Z: Moves between **0** or **1 PSWRD**.

S: Exits the **PSWRD** branch and enters the Control option (CNTRL).

Control [CNTRL]

This adjustment option is applicable to the **LD301** configured with PID enabled. It allows the control state to be changed from Automatic to Manual and vice versa, and also to adjust the Setpoint and Manipulated Variable values. Figure 4.10 shows branch CNRTL with the available options.

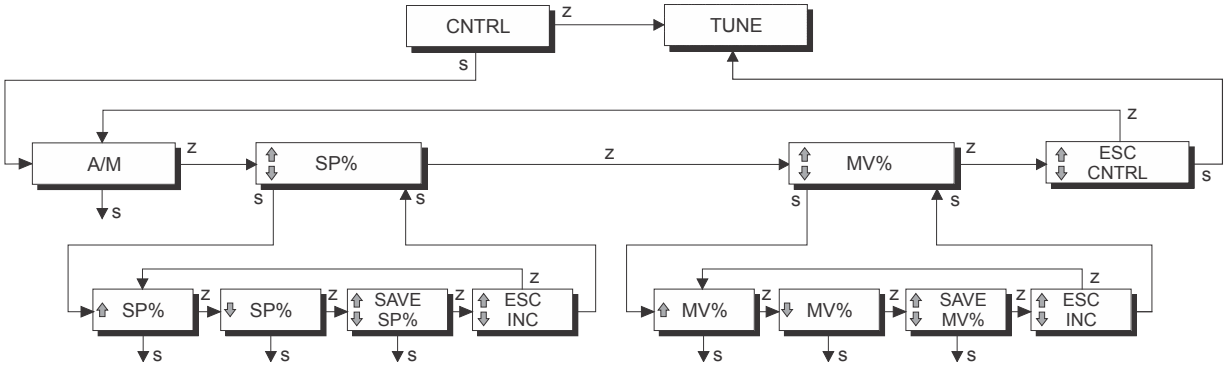
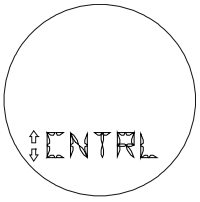


Figure 4.10 – Local Adjustment Control Tree

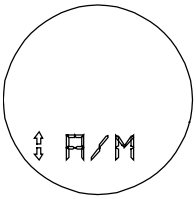
CONTROL BRANCH (CNTRL)



Z: Moves to the next branch (TUNE).

S: Enters the CONTROL branch, starting the function AUTO/ MANUAL.

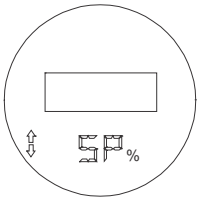
Auto/Manual (A/M)



Z: Moves to the setpoint adjustment function (SP).

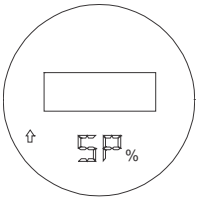
S: Switches the controller status, Automatic to Manual or Manual to Automatic. A and M letters indicate status.

Setpoint Adjustment (SP)



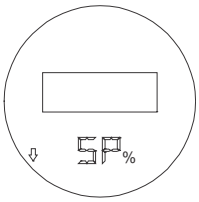
Z: Moves to the manipulated variable adjustment function.

S: Changes to Increase setpoint option.



Z: Moves to the Decreases setpoint function.

S: Increases the setpoint until the magnetic tool is removed or 100% is reached.

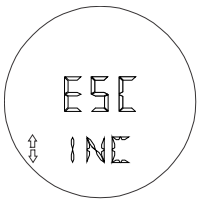


Z: Moves to **SAVE SETPOINT** function.

S: Decreases the setpoint until the magnetic tool is removed or 0% is reached.

Z: Moves to **ESC INC** function**.**

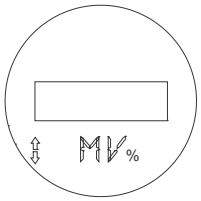
S: Saves the Setpoint value on the transmitter main board memory to use when the SP is requested.



Z: Moves to **INCREASE SETPOINT** function.

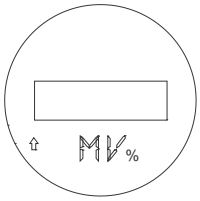
S: Returns to **Setpoint adjustment** option**(SP)**

Manipulated Variable Adjustment (MV)



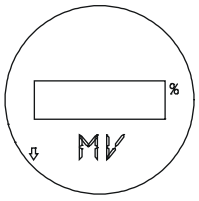
Z: Moves to the control escape function (CNTRL).

S: Changes to Increase Manipulated Variable option.



Z: Moves to **DECREASE MANIPULATED VARIABLE function**.

S: Increase the manipulated variable of PID until the magnetic tool is removed or the output upper limit is reached.

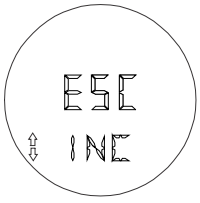


Z: Moves to the SAVE MV% function.

S: Decreases the manipulated variable of PID until the magnetic tool is removed or the lower output limit is reached.

Z: Moves to ESC INC function.

S: Saves the Manipulated Variable value on the transmitter main board memory to use when the MV is requested.



Z: Moves to **INCREASE MANIPULATED VARIABLE** function.

S: Returns to manipulated variable adjustment (MV**)**.

Control Escape (ESC CNTRL)

Z: Moves to the AUTO/ MANUAL function (A/M).

S: Returns to the MAIN menu to the tuning branch (TUNE).

Tuning [TUNE]

This adjustment option is applicable to the **LD301** configured with the PID enabled. It allows the control loop to be tuned, acting on the Proportional, Integral and Derivative terms, and also to change the PID mode. The implemented algorithm is a PID type, with the following characteristics:

- ✓ The proportional action is given by the Proportional Gain and not by the proportional band. Range: 0 - 100.
- ✓ Integral action is expressed in minutes per repetition.
- ✓ The derivative constant is obtained in seconds.

It is possible to cancel the Integral and Derivative actions by adjusting Tr and Td, respectively to 0.

Figure 4.11 shows branch TUNE with the available options.

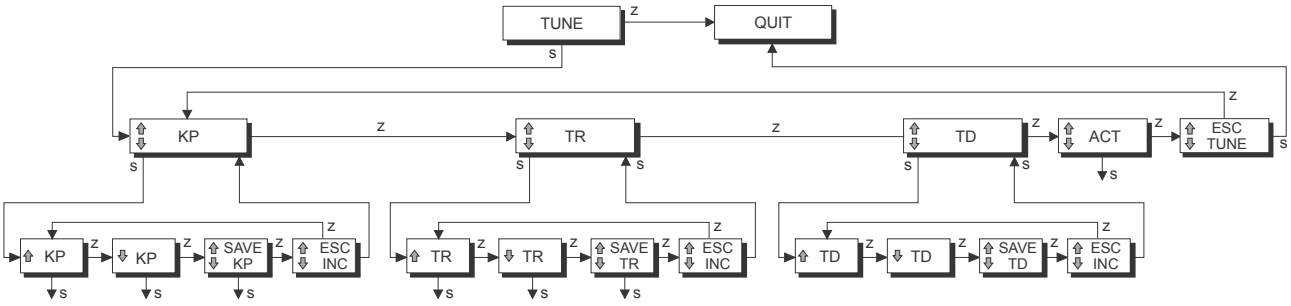
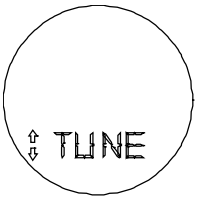


Figure 4.11 - Local Adjustment Tuning Tree

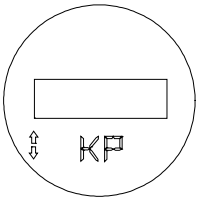
TUNING BRANCH (TUNE)



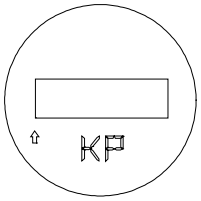
Z: Moves to the QUIT branch.

S: Enters the TUNE branch, starting with function KP-ADJUSTMENT option.

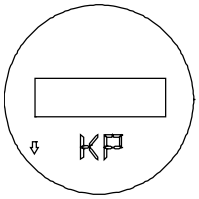
Kp - Adjustment (KP)



Z: Moves to the Tr adjustment (TR)..
S: Changes to increase proportional gain option.



Z: Moves to the Decrease Proportional Gain option.
S: Increases the proportional gain until the magnetic tool is removed or until the limit is reached.

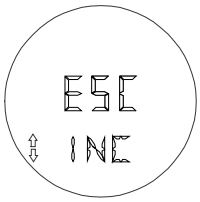


Z: Moves to the Save KP function.

S: Decreases the proportional gain until the magnetic tool is removed or 0 value is reached.

Z: Moves to **ESC INC** function.

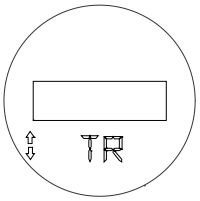
S: Saves the KP constant on the transmitter main board memory.



Z: Moves to **INCREASE PROPORTIONAL GAIN** option.

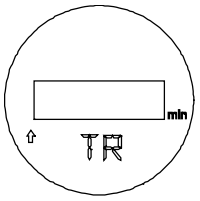
S: Returns to Kp Adjustment (KP) function.

Tr - Adjustment (TR)



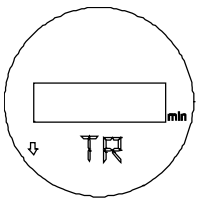
Z: Moves to Td adjustment (TD) function.

S: Changes to **INCREASE INTEGRAL TIME option**.



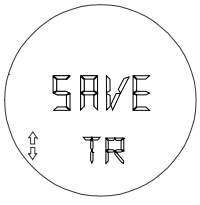
Z: Moves to the INTEGRAL TIME DECREASE function.

S: Increases the integral time until the magnetic tool is removed or until the upper limit is reached.



Z: Moves to the SAVE TR function.

S: Decreases the integral time until the magnetic tool is removed or 0 minute per repetition is reached.



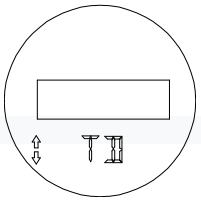
Z: Moves to the **ESC INC** function.

S: Saves the TR constant on the transmitter main board memory.

Z: Moves to **INCREASE INTEGRAL TIME** option.

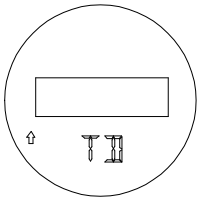
S: Returns to Tr Adjustment (TR) function.

Td Adjustment (TD)



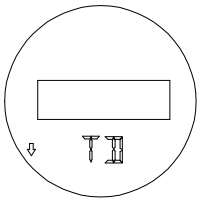
Z: Moves to the Action **function (Act)**

S: Switches to **DERIVATIVE TIME INCREASE.**



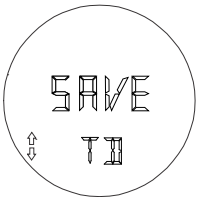
Z: Move to the **DECREMENT DERIVATIVE TIME** option.

S: Increases the derivative time until the magnetic screwdriver is removed or until the limit is reached.



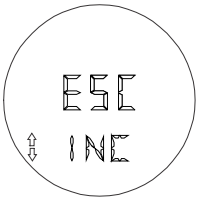
Z: Moves to the **SAVE TD** function.

S: Decrease DERIVATIVE TIME until the magnetic screwdriver is removed or until 0 seconds is reached.



Z: Moves to ESC function **INC.**

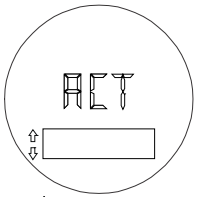
S: Records the TD constant in the transmitter's main board memory.



Z: Move to the **INCREASE DERIVATIVE TIME** option.

S: Returns to the function Td (TD)

Action (ACT)



Z: Moves to the Escape function of tuning menu (ESC TUNE).

S: Switches the direct action to reverse or reverse to direct indicated on display.

Tuning Escape (ESC TUNE)

Z: Moves to the KP-ADJUSTMENT function.

S: Escapes to the MAIN menu (QUIT).

Escape Local Adjustment [QUIT]

This branch of the main tree is used to leave the Local Adjustment mode, placing the Transmitter in the monitoring mode.

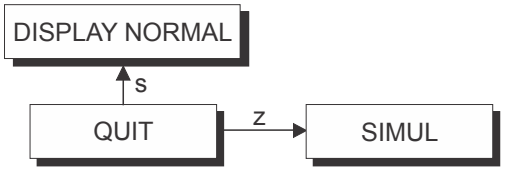
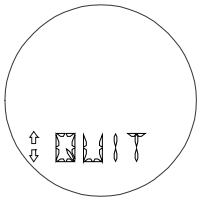


Figure 4.12 – Quit branch (QUIT) of Local Adjustment Tree



Z: Returns to Simulation branch (SIMUL).

S: Escapes to NORMAL DISPLAY mode, placing the LD301 in monitoring mode.

Section 5

MAINTENANCE

General

NOTE
Installations in hazardous areas must follow the recommendations of the applicable standards. Refer to Appendix A for this information.

Below, there are some important maintenance procedures that should be followed in order to have safer plant and easy maintenance.

In general, it is recommended that end users do not try to repair printed circuit boards. Spare circuit boards may be ordered from **SMAR** whenever necessary.

The sensor has been designed to operate for many years without malfunctions. Should the process application require periodic cleaning of the transmitter, the flanges may be easily removed and reinstalled.

Should the sensor eventually require maintenance, it may not be done on the field. In this case, the possibly damaged sensor should be returned to **SMAR** for evaluation and, if necessary, repair. Refer to the "Returning Materials" item at the end of this Section.

Diagnostic using Configuration Tool

Should any problem be noticed regarding the transmitter output, the configurator can be used to verify what is the problem (see Table 5.1).

The configurator should be connected to the transmitter according to the wiring diagram shown on Section 1, Figures 1.7, 1.8 and 1.9.

Error Messages

When communicating using the CONFIGURATOR the user will be informed about any problem found by the transmitter self-diagnostics.

Table 5.1 presents a list of error messages with details for corrective actions that may be necessary.

ERROR MESSAGES	POTENTIAL SOURCE OF PROBLEM
UART RECEIVER FAILURE: • PARITY ERROR • OVERRUN ERROR • ERROR CHECK SUM • FRAMING ERROR	• The line resistance is not according to load limitation. • Excessive noise or ripple in the bus. • Low level signal. • Interface damaged. • Power supply with inadequate voltage.
CONFIGURATOR DOES NOT RECEIVE ANSWER FROM TRANSMITTER	• Transmitter bus resistance is not according to load limitation. • Transmitter not powered. • Interface not connected or damaged. • Repeated bus address. • Transmitter polarity is reversed. • Interface damaged. • Power supply with inadequate voltage.
CMD NOT IMPLEMENTED	• Software version not compatible between configurator and transmitter. • Configurator is trying to carry out a **LD301** specific command in a transmitter from another manufacturer.
TRANSMITTER BUSY	• Transmitter carrying out an important task, e.g., local adjustment.
TRANSMITTER FAILURE	• Sensor disconnected. • Sensor failure.
COLD START	• Start-up or Reset due to power supplies failure.
OUTPUT FIXED	• Output in Constant Mode. • Transmitter in Multidrop mode.
OUTPUT SATURATED	• Pressure out of calibrated Span or in fail-safe state (Output current in 3.8 or 20.5 mA).

ERROR MESSAGES	POTENTIAL SOURCE OF PROBLEM
SV OUT OF LIMITS	• Temperature out of operating limits. • Temperature sensor damaged.
PV OUT OF LIMITS	• Pressure out of operation limits. • Sensor damaged or sensor module not connected. • Transmitter with wrong configuration.
LOWER RANGE VALUE TOO HIGH	• Lower value exceeds 25% of the Upper Range Limit.
LOWER RANGE VALUE TOO LOW	• Lower value exceeds 25% of the Lower Range Limit.
UPPER RANGE VALUE TOO HIGH	• Upper value exceeds 25% of the Upper Range Limit.
UPPER RANGE VALUE TOO LOW	• Upper value exceeds 25% of the Lower Range Limit.
UPPER & LOWER RANGE VALUES OUT OF LIMITS	• Lower and Upper Values are out of the sensor range limits.
SPAN TOO SMALL	• The difference, between the Lower and Upper values is less than the minimum span.
APPLIED PRESURE TOO HIGH	• The pressure applied was above the 25% upper range limit.
APPLIED PRESURE TOO LOW	• The pressure applied was below the 25% lower range limit.
EXCESS CORRECTION	• The trim value entered exceeded the factory-characterized value by more than 20%.
PASSED PARAMETER TOO LARGE	• Parameter above operating limits.
PASSED PARAMETER TOO SMALL	• Parameter below operating limits.

Table 5.1 - Error Messages and Potential Source

Diagnostic via Transmitter

NOTE
D0 and M0 ranges are available only for 6.05 versions or greater.

Symptom: NO LINE CURRENT

Probable Source of Trouble:

✓ **Transmitter Connections**

- Check wiring polarity and continuity.
- Check short circuit or ground loops.
- Check if the power supply connector is connected to main board.

✓ **Power Supply**

- Check power supply output. The voltage must be between 12 and 45 Vdc at transmitter terminals.

✓ **Electronic Circuit Failure**

- Check the main board for defect by using a spare one.

Symptom: NO COMMUNICATION

Probable Source of Trouble:

✓ **Terminal Connections**

- Check the terminal interface connection of the configurator.
- Check if the interface is connected to the wires leading to the transmitter or to the terminals [**+**] and [**-**].
- Check if the interface is HPI311 (for HART protocol).

✓ **Transmitter Connections**

- Check if connections are according to wiring diagram.
- Check if there is resistance in the 250 Ω line. See load limitation in Section 1.

✓ **Power Supply**

- Check output of power supply. The voltage at the **LD301** terminals must be between 12 and 45 Vdc, and ripple less than 500 mV.

✓ **Electronic Circuit Failure**

- Locate the failure by alternately testing the transmitter circuit and the interface with spare parts.

✓ **Transmitter Address**

- Check if the transmitter address is compatible with the one expected by the configurator.

Symptom: CURRENT in 21.0 mA or 3.6 mA

Probable Source of Trouble:

✓ **Pressure Tap (Piping)**

- Verify if blocking valves are fully open.
- Check for gas in liquid lines or for liquid in dry lines.
- Check the density of process fluid.
- Check for sedimentation in the transmitter chambers.
- Check the pressure connection.
- Check if bypass valves are closed.
- Check if pressure applied is not above upper limit of the transmitter range.

✓ **Sensor to Main Circuit Connection**

- Sensor connection to the Main Board.
- Check connection (male and female connectors).

✓ **Electronic Circuit Failure**

- Check the sensor circuit for damage by replacing it with a spare one.
- Replace sensor.

Symptom: INCORRECT OUTPUT

Probable Source of Trouble:

✓ **Transmitter Connections**

- Check power supply voltage.
- Check for intermittent short circuits, open circuits and grounding problems.

✓ **Process Fluid Oscillation**

- Adjust damping

✓ **Pressure Tap**

- Check for gas in liquid lines and for liquid in steam or gases lines.
- Check the integrity of the circuit by replacing it with a spare one.

✓ **Calibration**

- Check calibration of the transmitter.

NOTE
A 21.0 or 3.6 mA current indicates that the transmitter is in Burnout (TRM) or safety output (PID). Use the configurator to investigate the source of the problem.

Symptom: DISPLAY INDICATES "FAIL SENS"

Probable Source of Trouble:

✓ **Sensor Connection to the Main Board**
Check the connection (flat cable, male and female connectors).

✓ **Type of Sensor Connected to the Main Board**
Check if the sensor connected to the main board is the one specified for the **LD301** HART mode.

✓ **Electronic Circuit Failure**
Check if the sensor set is damaged, replacing it for a spare one.

Disassembly Procedure

WARNING
Do not disassemble with power on.

Figure 5.2 shows a transmitter exploded view and will help you to visualize the following:

Sensor

In order to have access to the sensor for cleaning purposes, the transmitter should be removed from its process connections. The transmitter should be isolated from the process by means of manifolds or valves; then, the drain must be opened to vent any remaining pressure.

After this, the transmitter may be removed from the standpipe. The flange bolts may now be loosened, one at a time. After removing bolts and flanges, the isolating diaphragms will be easily accessible for cleaning.

Cleaning should be done carefully in order to avoid damaging the delicate isolating diaphragms. Use of a soft cloth and a nonacid solution is recommended.

To remove the sensor from the electronic housing, the electrical connections (in the field terminal side) and the main board connector must be disconnected.

Loosen the hex screw and carefully unscrew the electronic housing from the sensor, observing if the flat cable is not excessively twisted.

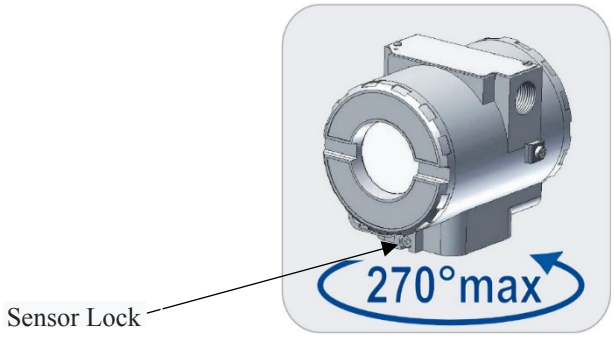


Figure 5.1 – Sensor Safety Rotation

WARNING
To avoid damage do not rotate the electronic housing more than 270º starting from the fully threaded without disconnecting the electronic circuit from the sensor and from the power supply. See Figure 5.1.

Electronic Circuit

To remove the circuit board (**3**), loosen the two screws, that anchor the board and hold the spacers in the other side to avoid losing them.

WARNING
The board has CMOS components, which may be damaged by electrostatic discharges. Observe correct procedures for handling CMOS components. It is also recommended to store the circuit boards in electrostatic-proof cases.

Pull the main board out of the housing and disconnect the power supply and the sensor connectors.

Mounting Procedure

WARNING
Do not assemble with power on.

Sensor

When mounting the sensor, make use of a new set of o-rings compatible with the process fluid. The bolts, nuts, flanges and other parts should be inspected for corrosion or other eventual damage. Damaged parts should be replaced.

The O-rings should be lightly lubricated with silicon oil before they are fitted into place. Use halogen grease on applications having inert filling fluid. The flanges must be positioned on a flat surface. Insert the o-rings in the sensor. Set the four bolts and nuts initially with manual tightening, keeping the flanges in parallel through the whole mounting and finalize with an adequate tool, remembering to tighten them crosswise.

O'RINGS AND BACKUP RINGS FOR HIGH PRESSURE
Except for special cases, the new standard flanges do not use parbak. For specials that still use it, proceed as follows: Do not bend the parback ring and check that it has no biting. Mount it carefully. The flat side must press the o-ring in the mounting.

Procedure for tightening the flange screws

- Tighten one nut till the flange seats;
- Tighten the nuts diagonally across with a torque of approximately 2.75 ±0.25 Kgf.m;
- Tighten the first nut with the same torque;
- Verify the flanges alignment;
- Check torque on the four bolts.

Should the adapters be removed, it is recommended to replace o-rings and to connect the adapters. Optimum torque is 2.75 ±0.25 Kgf.m.

The fitting of the sensor must be done with the main board out of the electronic housing. Mount the sensor to the housing turning it clockwise until it stops. Then turn it counterclockwise until the cover is parallel to the process flange. Tighten the screw to lock the sensor.

Electronic Circuit

Plug sensor connector and power supply connector to main board. If there is a display, attach it to the main board by means of 4 screws (**3**). The display can be installed in any of the 4 possible positions (See next Figure).

The "▲" mark indicates up position.

Pass the screws through the main board holes and the spacers as shown on Figure 5.2 and tighten them to the housing.

After tightening the protective cover (**1**), mounting procedure is complete. The transmitter is ready to be energized and tested. It is recommended that adjustment be done on the ZERO TRIM and on the UPPER PRESSURE TRIM.

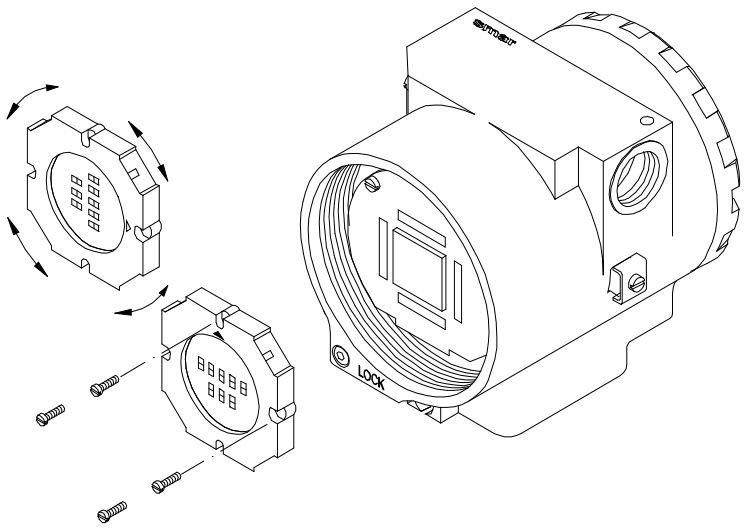


Figure 5.2 – Four Possible Positions of the Display

Interchangeability

In order to obtain an accurate and better temperature compensated response, the sensor data must be transferred to the EEPROM of the main board. This is done automatically when the transmitter is powered.

The main circuit, in this operation, reads the sensor serial number and compares it with the number stored in the main board. In case they do not match, the circuit considers that the sensor has been changed and will search in the new sensor memory for the following information:

- ✓ Temperature compensation coefficients.
- ✓ Sensor trim data, including characterization curve.
- ✓ Sensor characteristics: type, range, diaphragm material and fill fluid.

Information not transferred during sensor replacement will remain unchanged in the main board memory. Thus, information such as Upper Value, Lower Value, Damping, Pressure Unit and replaceable transmitter parts (Flange, O-ring, etc.) shall be updated, depending on whether the correct information is that of the sensor or the main board. In the case of a new sensor, the main board will have the most updated information; in the opposite case, the sensor will have the correct information. Depending on the situation, the updating shall be from one or the other.

Data transference from the main board to the sensor or vice versa can also be forced by function BACKUP/RESTORE of the sensor, respectively.

Returning Materials

Should it become necessary to return the transmitter and/or configurator to SMAR, simply contact our office, informing the defective instrument serial number, and return it to our factory.

In order to speed up analysis and solution of the problem, the defective item should be returned with the Service Request Form (SRF – Appendix B) properly filled with a description of the failure observed and with as much details as possible. Other information concerning to the instrument operation, such as service and process conditions, is also helpful.

Instruments returned or to be revised outside the guarantee term should be accompanied by a purchase order or a quote request.

Application with Halar

Technical Specification

Halar® is chemically one of the most resistant fluoropolymer. It is a thermoplastic of the melting process manufactured by Solvay Solexis, Inc. For its chemical structure, a 1:1 alternating ethylene copolymer and chlorinetrifluoroethylene, Halar® (ECTFE) offers an only combination of useful properties.

The diaphragms in 316L Stainless Steel covered with Halar®, are ideal for applications in contact with aggressive liquids. They offer excellent resistance to the chemic and abrasion with a wide temperature range. Halar® does not contaminate liquids of high purity and it is not affected by most of corrosive chemists, usually found in the industries, including strong minerals, oxidant acids, alkalis, liquid oxygen and some organic solvents.

Halar® is trademark of *Solvay Solexis, Inc*.

TPE – Total Probable Error (Software)

Software to calculate the assembly error of the Pressure Transmitters with the possible connections to the process.

TPE was developed to a fast and effective aid of the products related the pressure measurement. The users are the Applications Engineer and Commercial Areas. The customer can request a report of performance estimate to Smar.

This product allows doing simulations of possible assemblies, verifying important data as the error estimates of the response time, capillary length analysis and diaphragms mechanical resistance with temperature variation. See an example in the next Figure.

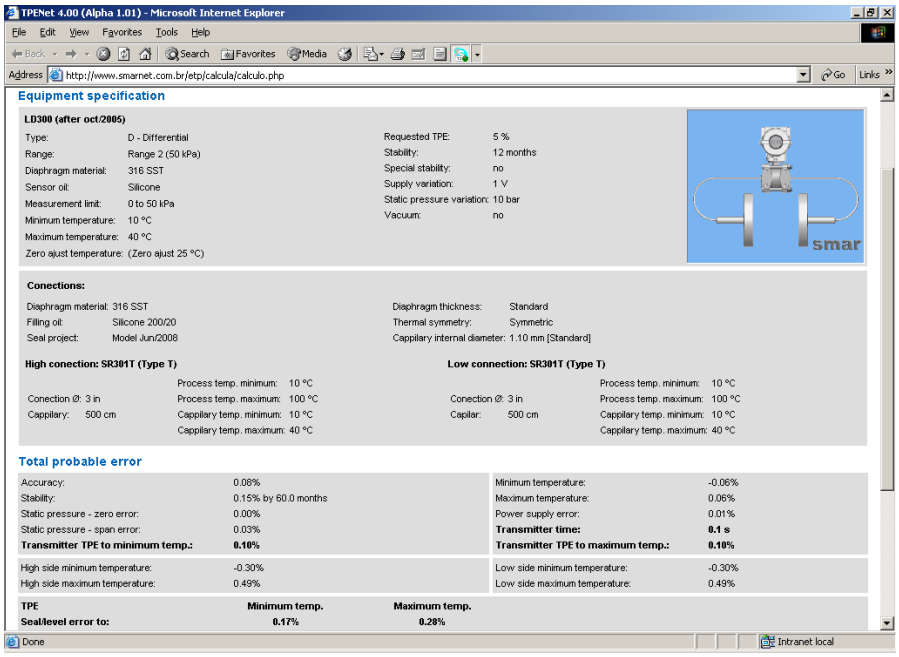


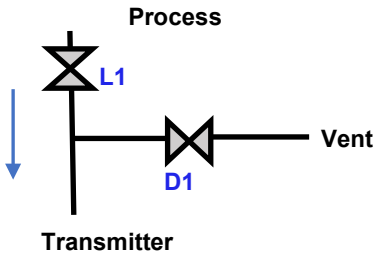
Figure 5.3 – TPE Software Screen

Use of Manifolds – Transmitter Operational Safety

Importance of using manifolds

- Use of manifolds increases safety in maintenance maneuvers on transmitters;
- Following the indicated procedures, it avoids maneuvers that can cause overpressure in differential transmitters;
- When necessary, complementary operational actions must be implemented.

2-Way Manifold



Operation

- Usually used to measure gauge or absolute pressure in which the fluid is drained through the manifold drain screw;
- During normal operation, the line valve must be opened and the drain valve closed;
- In case of dangerous, toxic, and corrosive fluids, high temperature, high pressure, etc., it is recommended to connect the drain outlet pipe, when it exists, directing the fluid to a safe place.

Maintenance

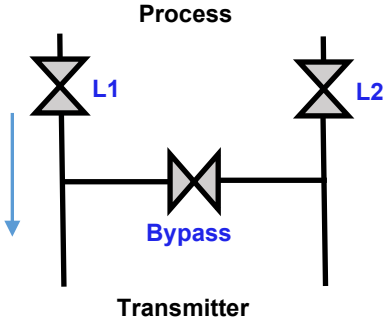
Start of operation - mounting the transmitter to the manifold

- Initial positions: L1 valve closed and D1 valve opened;
- Mount the transmitter on the manifold;
- Close D1 valve;
- Open L1 valve.

Removing the transmitter or zero adjustment

• Close the L1 valve;
• Open valve D1, making sure that all liquid fluid has drained;
• Set the zero or remove the transmitter;
• Return the instrument to operation following the steps for starting the operation.

3-Way Manifold



Operation

- Usually used for differential pressure measurement;
- During normal operation, both L1 and L2 valves must be opened and the Bypass valve closed;
- It has a disadvantage that there are no drain valves, so it is recommended the use of transmitters with drain screws. The risk of handling hazardous fluids must be considered.

Maintenance

Start of operation - mounting the transmitter to the manifold

- Initial positions: L1 and L2 valves closed and Bypass valve opened;
- Mount the transmitter on the manifold;
- Make sure that the drain screws of the transmitter are closed;
- Open L2 valve;
- Close Bypass valve;
- Open L1 valve.

Removing the transmitter or zero adjustment (without static pressure)

NOTE
This procedure is recommended for non-high static pressures.

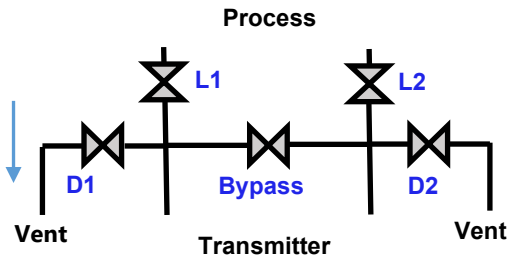
- Close L1 valve;
- Open Bypass valve;
- Close L2 valve;
- If the transmitter has drains, open them to atmosphere;
- Set the zero or remove the transmitter;
- Return the instrument to operation following the steps for starting the operation.

Removing the transmitter or zero adjustment (with static pressure)

NOTE
This procedure is recommended when you want to compensate the deviation caused by static pressure.

- Close L1 valve;
- Open Bypass valve;
- Set the zero or remove the transmitter;
- Return the instrument to operation following the steps for starting the operation.

5-Way Manifold



Operation

- Usually used to measure differential pressure in which the fluid is drained through the manifold drain screws;
- During normal operation, both line valves must be opened, the Bypass valve and both drain valves must be closed;

- In case of dangerous, toxic, and corrosive fluids, high temperature, high pressure, etc., it is recommended to connect the drain outlet pipe, when it exists, directing the fluid to a safe place.

Maintenance

Start of operation - mounting the transmitter to the manifold

- Initial positions: L1 and L2 valves closed, Bypass valve opened, and D1 and D2 opened;
- Mount the transmitter on the manifold;
- Close the D1 and D2 drain valves;
- Open L2 valve;
- Close Bypass valve;
- Open L1 valve.

Removing the transmitter or zero adjustment (without static pressure)

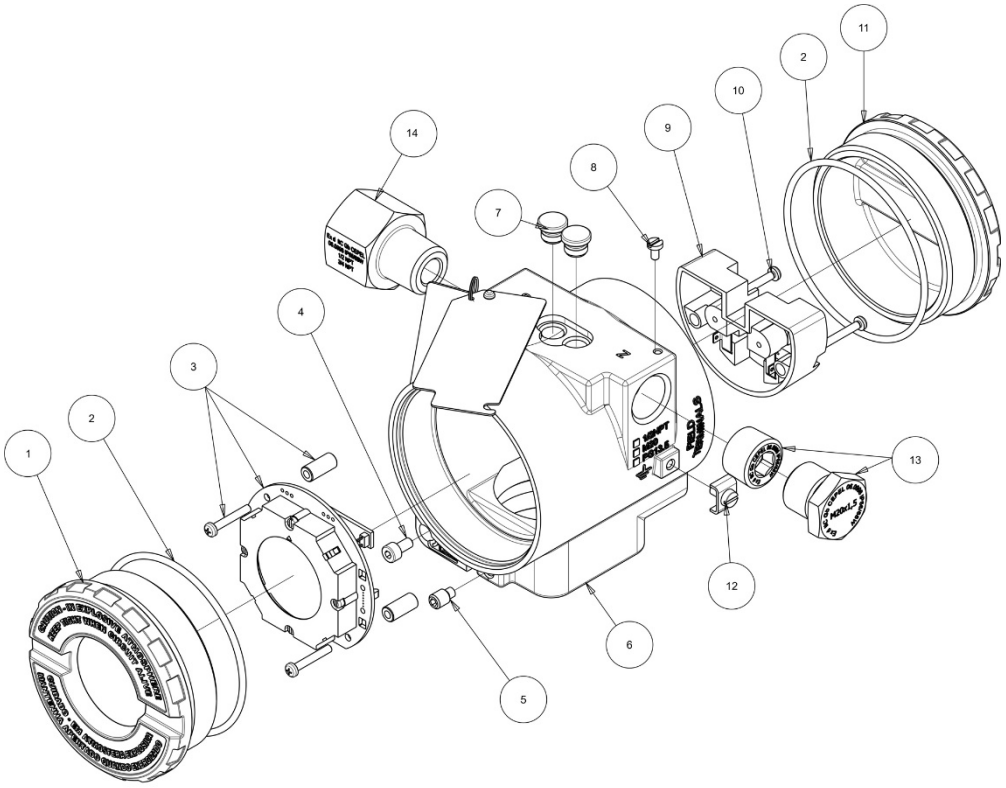
NOTE
This procedure is recommended for non-high static pressures.

- This procedure **does not take into account** static pressure compensation;
- Close L1 valve;
- Open Bypass valve;
- Close L2 valve;
- Open D1 and D2 valves, making sure that all liquid fluid has drained;
- Set the zero or remove the transmitter;
- Return the instrument to operation following the steps for starting the operation.

Removing the transmitter or zero adjustment (with static pressure)

- Adjust zero;
- Close L1 valve;
- Open Bypass valve;
- Close L2 valve;
- Keep both vent valves closed;
- Set the zero of the transmitter;
- Return the instrument to operation following the steps for starting the operation.

Spare parts



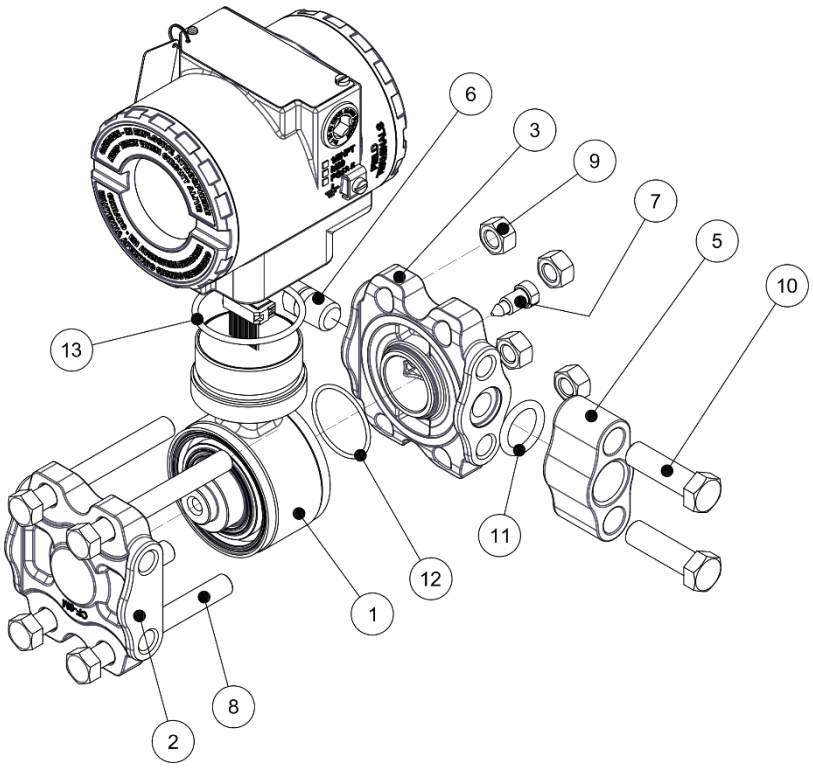
The letters x, after the codes indicate continuation, see complete code in the manual.

ITEM	QTY	DESCRIPTION	CODE
14	1	3/4NPT AISI316 adapter BR-Exd	400-0812
13	1	PG13.5 plug AISI 316	400-0811
13	1	M20x1,5 plug AISI 316 BR-EXD	400-0810
13	1	1/2NPT plug AISI316 BR-EXD	400-1484
12	1	ground screw	204-0124
11	1	cover without window	400-1307-0xx
10	1	terminal block insulator screw	204-0119
9	1	terminal block insulator	400-0058
8	1	identitification plate screw	204-0116
7	2	local adjust (Z e S) cover	204-0114
6	1	Electronic Housing	400-1314-1xxxxxx
5	1	sensor lock screw	400-1121
4	2	cover lock screw	204-0120
3	1	etectronic board	Note
2	1	cover oring	204-0122
1	1	cover with window	400-1307-1xx

Figure 5.4 – Exploded View

ITEM 3 NOTE
Go to www.smar/en/support. In general support, check for compatibility note and refer to the document.

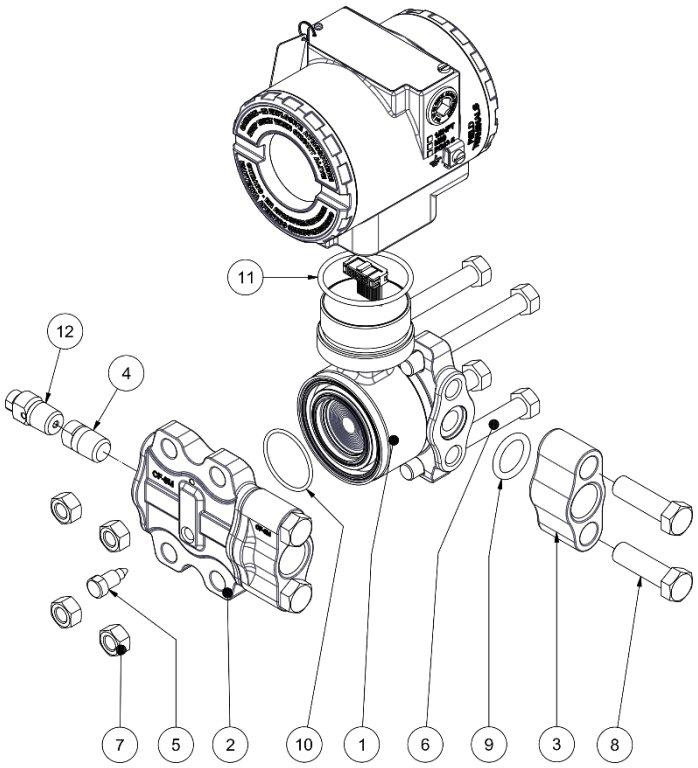
ITEM 13 NOTE
The spare part 400-1484, Internal Hexagonal Plug 1/2" NPT SST316 BR-Ex-d, was standardized in SST316 material and will be used in all line of housings (aluminum, copper free aluminum or SST316). With or without CEPEL certificate.



the campanula ID 4 only used in absolute model, welded on the sensor.
the letter "x" in codes, see complete code in manual.
The part numbers of electronic housing are in other figure

ITEM	QTY	DESCRIPTION	CODE
13	1	oring sensor / housing buna N	204-0113
12	1	oring sensor etileno	203-0404
12	1	oring sensor teflon	203-0403
12	1	oring sensor viton	203-0402
12	1	oring sensor buna N	203-0401
11	1	oring adapter etileno	203-0704
11	1	oring adapter teflon	203-0703
11	1	oring adapter viton	203-0702
11	1	oring adapter buna N	203-0701
10	2	Adapter's screw SS316	203-0351
10	2	Adapter's screw carbon steel bicromatized	203-0350
9	4	Flange's Nut SS316	203-0312
9	4	Flange's Nut carb bicromatized	203-0302
8	4	Flange's screw SS316	203-0310
8	4	Flange's screw carbon steel bicromatized	203-0300
7	1	Drain Screw Monel	203-1403
7	1	Drain Screw Hastelloy	203-1402
7	1	Drain Screw SS 316	203-1401
6	1	Plug 1-4NPT monel	203-0554
6	1	Plug 1-4NPT hastelloy	203-0553
6	1	Plug 1-4NPT SS 316	203-0552
5	1	Adapter 1/2NPT monel 400 bar	203-0604
5	1	Adapter 1/2NPT HS CW-12MW (hast)	203-0603
5	1	Adapter 1/2NPT SS CF-8M (316)	203-0602
5	1	Adapter 1/2NPT carbon steel	203-0601
3	1	Differential Flange	400-1330-xxx
2	1	Absolute/Gage Flange SS	204-1102
1	1	Gage Sensor (without campanula)	204-0301-M-xxx
1	1	Absolute Sensor	204-0301-A-xxx

Figure 5.5 –Manometric/Absolute Mounting LD301M



The letters x after codes see complete code in manual
the parbak rings 203-0710 are use only flanges with sealing 45°,
This new version use radial sealing, not use parbak rings.
A drain valve can be used with flanges without drain, in place of 1/4NPT plug.

12	1	drain valve monel	400-0794
12	1	drain valve hastelloy	400-0793
12	2	drain valve SS 316	400-0792
11	1	oring sensor / housing buna N	204-0113
10	2	oring sensor etileno	203-0404
10	2	oring sensor teflon	203-0403
10	2	oring sensor viton	203-0402
10	2	oring sensor buna N	203-0401
9	1	oring adapter etileno	203-0704
9	2	oring adapter teflon	203-0703
9	2	oring adapter viton	203-0702
9	2	oring adapter buna N	203-0701
8	4	Adapter's screw SS316	203-0351
8	4	Adapter's screw carbon steel bicromatized	203-0350
7	4	Flange's Nut SS316	203-0312
7	4	Flange's Nut carb bicromatized	203-0302
6	4	Flange's screw SS316	203-0310
6	4	Flange's screw carbon steel bicromatized	203-0300
5	2	Drain Screw Monel	203-1403
5	2	Drain Screw Hastelloy	203-1402
5	4	Drain Screw SS 316	203-1401
4	2	Plug 1-4NPT monel	203-0554
4	2	Plug 1-4NPT hastelloy	203-0553
4	2	Plug 1-4NPT SS 316	203-0552
3	2	Adapter 1/2NPT monel 400 bar	203-0604
3	2	Adapter 1/2NPT HS CW-12MW (hast)	203-0603
3	2	Adapter 1/2NPT SS CF-8M (316)	203-0602
3	2	Adapter 1/2NPT carbon steel	203-0601
2	2	differential Flange Standard	400-1330-xxx
1	1	Sensor	204-0301-Dxxxxx
ITEM	QTY	DESCRIPTION	PART NUMBER

Figure 5.6 – Differential Mounting LD301D

ACCESSORIES	
ODERING CODE	**DESCRIPTION**
SD-1	Magnetic Tool for local adjustment.
DEVCODROID	Uses DDs to access the data stored in memory and configure the HART equipment.
HPI311*	HART® interface.

Detailed Code for Ordering Spare Parts

CODE	DESCRIPTION
400-1314-1	**HOUSING; LD301**
	Option — **Communication Protocol**
	H — HART & 4-20 mA
	Option — **Electrical Connection**
	0 — ½ NPT
	A — M20 X 1,5
	B — PG13,5
	Option — **Material**
	H0 — Aluminum (IP/Type)
	H1 — SST (IP/Type)
	H2 — Aluminum for saline atmosphere (IPW/Type X)
	H4 — Aluminum Copper Free (IPW/Type X)
	Option — **Painting**
	P0 — Gray Munsell N 6,5 Polyester
	P8 — Without painting
	P9 — Safety Blue Epoxy

400-1314-3	*	*	*	*	**TYPICAL MODEL**

*Select the desired option

CODE	DESCRIPTION
400-1307	**Covers**
	Option — **Type**
	0 — Without window
	1 — With window
	Option — **Material**
	H0 — Aluminum (IP/TYPE)
	H1 — SST (IP/TYPE)
	Option — **Painting**
	P0 — Gray Munsell N6.5 Polyester
	P8 — Without painting
	P9 — Safe Blue Base Epoxy

400-1307	*	*	*	**TYPICAL MODEL**

*Select the desired option

CODE	DESCRIPTION
400-1330	DIFFERENTIAL FLANGE STANDARD 1/4 NPT CONNECTION

Option	Drain valve
0	Without drain valve
1	With drain valve

Option	Thread for fixing
0	7/16 - 20 UNF
1	M10 X 1.5
2	M12 X 1.75

Option	Flange Material
A	SST 304L / CF-3
H	HASTELLOY C276 / CW-12MW
I	SST 316 / CF-8M

400-1330 1 0 I

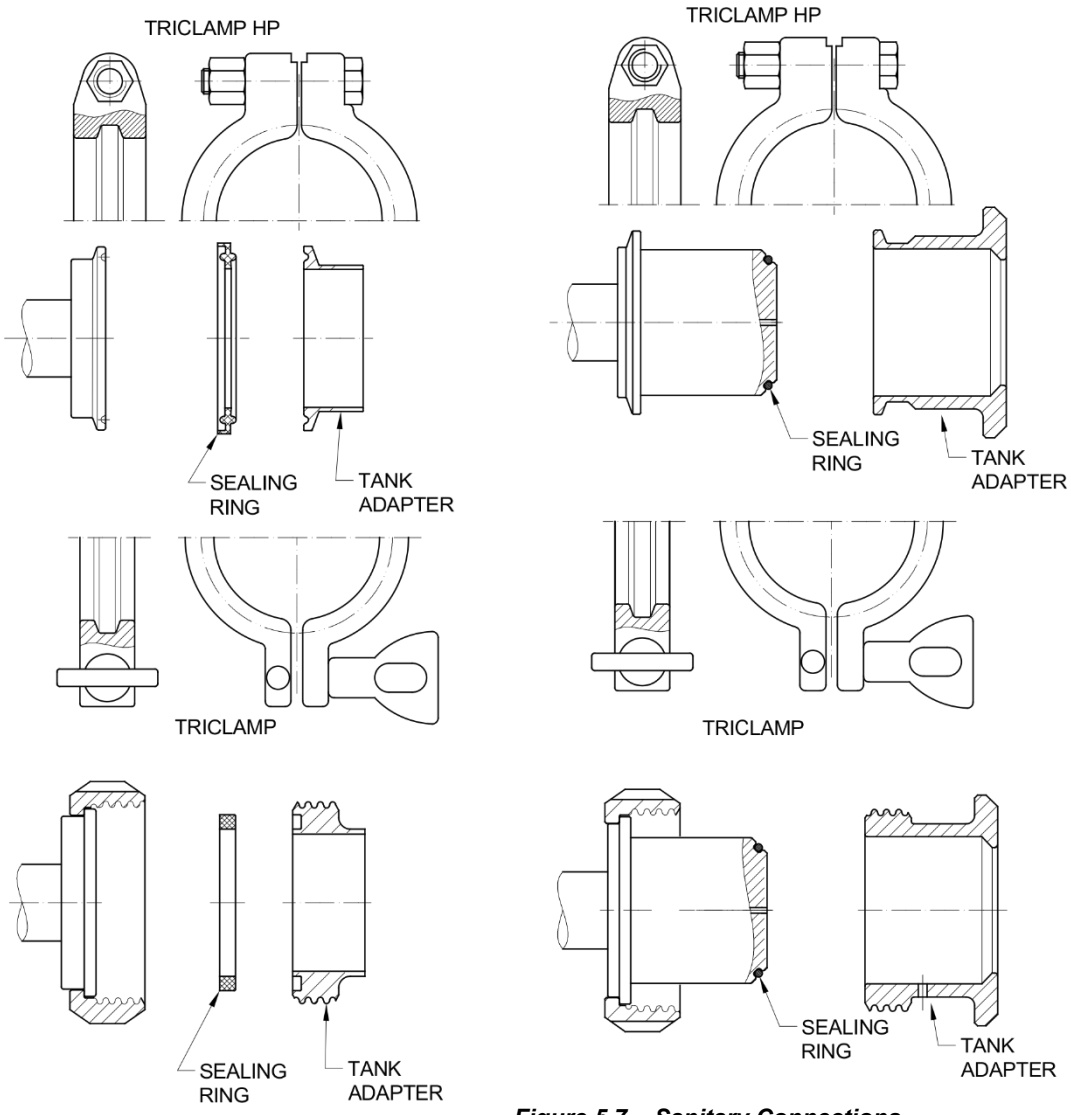


Figure 5.7 – Sanitary Connections

400-1331 SANITARY SEALING RING

Option	Mounting
0	Without Extension
1	With Extension

Option	Nominal Diameter
0	DN25
1	1 ½”
2	2”
3	3”
4	DN40
5	DN50
6	DN80

Option	Connection
1	Tri-clamp
2	SMS
3	RJT
4	IDF
5	DIN

Option	Material
B	Buna N
T	Teflon
V	Viton

400-1331	0	2	2	B

400-1332 SANITARY TANK ADAPTER

Option	Mounting
0	Without Extension
1	With Extension

Option	Nominal Diameter
0	DN25
1	1 ½”
2	2”
3	3”
4	DN40
5	DN50
6	DN80

Option	Connection
1	Tri-clamp
2	SMS
3	RJT
4	IDF
5	DIN

400-1331	0	2	2

400-1333 TRI-CLAMP

Option	Diameter
1	1 ½”
2	2”
3	3”

Option	Pressure
H	HP (High pressure)
N	Standard

400-1333	2	N

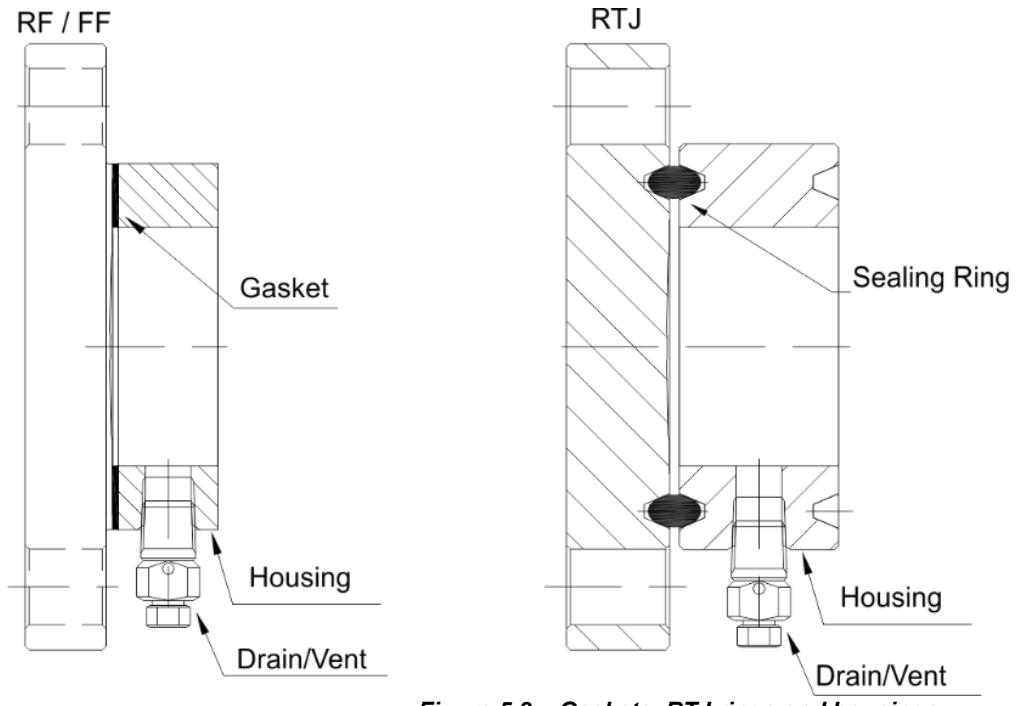


Figure 5.8 – Gaskets, RTJ rings and housings

400-1337	SEALING GASKET FOR FLANGE ASME/DIN – FACE RF-FF (PACKAGE WITH 10 UNITS);			
	Option	**Diameter**		
	1	1” (ASME)	**6**	DN25 (DIN)
	2	1 1/2” (ASME)	**7**	DN40 (DIN)
	3	2” (ASME)	**8**	DN50 (DIN)
	4	3” (ASME)	**9**	DN80 (DIN)
	5	4” (ASME)	**A**	DN100 (DIN)
	Option	**Material**		
	G	Grafoil		
	T	Teflon		

400-1337	3	T

Drain Valve (Plug 1/4 NPT + Vent screw)	
400-0792	SST AISI 316L
400-0793	Hastelloy C276
400-0794	Monel 400

RTJ SPARE PARTS (ANSI B 16.20)			
ØN	**CLASS**	**RING**	**METALLIC RING**
			SST 316L
1”	**150**	**R15**	400-0887
	300	**R16**	400-0888
	600	**R16**	400-0888
	1500	**R16**	400-0888
	2500	**R18**	400-0889
1.1/2”	**150**	**R19**	400-0890
	300	**R20**	400-0891
	600	**R20**	400-0891
	1500	**R20**	400-0891
	2500	**R23**	400-0893
2”	**150**	**R22**	400-0892
	300	**R23**	400-0893
	600	**R23**	400-0893
	1500	**R24**	400-0894
	2500	**R26**	400-0895
3”	**150**	**R29**	400-0896
	300	**R31**	400-0897
	600	**R31**	400-0897
4”	**150**	**R36**	400-0900
	300	**R37**	400-0901
	600	**R37**	400-0901

Table 5.3 - LD301L – Spare parts codes for SST gasket (without extension)

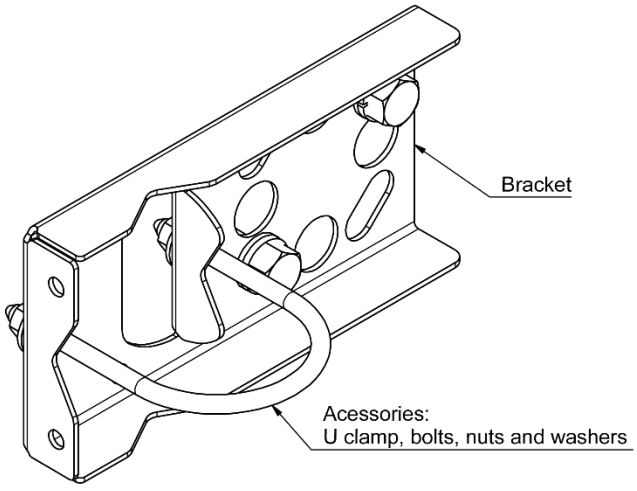
400-0258	HOUSING OF FLANGED REMOTE SEAL				
CODE	Size				
1	1" ASME B16.5		6	DN25 DIN EN 1092-1	
2	1.1/2" ASME B16.5		7	DN40 DIN EN 1092-1	
3	2" ASME B16.5		8	DN50 DIN EN 1092-1	
4	3" ASME B16.5		9	DN80 DIN EN 1092-1	
5	4" ASME B16.5		A	DN100 DIN EN 1092-1	
CODE	Pressure Class				
0	Do Not Vary With Pressure Class		3	600 # ANSI B-16.5	
1	150 # ANSI B-16.5		4	1500 # ANSI B-16.5	
2	300 # ANSI B-16.5		5	2500 # ANSI B-16.5	
CODE	Housing Material				
1	SST 316				
2	Hastelloy C276				
3	Super Duplex (UNS 32750)				
4	Duplex (UNS 31803)				
CODE	Gasket Material				
0	Without Gasket		T	Teflon	
G	Grafoil				
I	SST 316L				

400-0258	1	0	1	T

Special Options		
CODE	Size	
ZZ	See notes	
CODE	Housing Connection	
G0	WITH 1 1/4" NPT FLUSH CONNECTION (IF SUPPLIED WITH HOUSING)	
G1	WITH 2 1/4" NPT TO 180 DEGREES FLUSH CONNECTIONS	
G3	WITH 2 1/2"- 14 NPT TO 180 DEGREES CONNECTIONS (WITH PLASTIC PLUG)	
G5	WITH 1 1/2'' NPT FLUSH CONNECTION	
CODE	Face	
H0	Grooved Face RF FF (ANSI, DIN) **(1)**	
H2	Flat Face With Sealing Channel - RTJ (ANSI B 16.20) **(1)**	

ZZ	1	0

Note
(1) Only housing RTJ face change according to pressure class.



PART NUMBER	DESCRIPTION
203-0801	CARBON STEEL BRACKET AND ACESSORIES
203-0802	STAINLESS STEEL BRACKET AND ACESSORIES
203-0803	CARBON STEEL BRACKET AND SS ACESSORIES

Figure 5.9 – Flat Support LD301

Ordering Code for the Sensor

204 – 0301 — **SENSOR FOR DIFFERENTIAL, FLOW, GAGE, ABSOLUTE AND HIGH STATIC PRESSURE TRANSMITTER**

COD	Type	Range Limits Min.	Range Limits Max.	Min. Span	Unit	Range Limits Min.	Range Limits Max.	Min. Span	Unit
D0	Differential and Flow	-1	1	0.05	kPa	-4	4	0,05	inH_2O
D1	Differential and Flow	-5	5	0.10	kPa	-20	20	0,4	inH_2O
D2	Differential and Flow	-50	50	0.42	kPa	-200	200	0,42	inH_2O
D3	Differential and Flow	-250	250	2.08	kPa	-36	36	2,08	psi
D4	Differential and Flow	-2500	2500	20.83	kPa	-360	360	20,83	psi
M0	Gage	-1	1	0.05	kPa	-4	4	0,05	inH_2O
M1	Gage	- 5	5	0.10	kPa	-20	20	0,4	inH_2O
M2	Gage	- 50	50	0.42	kPa	-200	200	0,42	inH_2O
M3	Gage	-100	250	2.08	kPa	-14,5	36	2,08	psi
M4	Gage	-100	2500	20.83	kPa	-14,5	360	20,83	psi
M5	Gage	- 0.1	25	0.21	Mpa	-14,5	3600	0,21	psi
M6	Gage	- 0.1	40	0.33	Mpa	-14,5	5800	0,33	psi
A1	Absolute	0	5	2.00	kPa	0	20	2,00	inH_2O
A2	Absolute	0	50	2.50	kPa	0	200	2,50	inH_2O
A3	Absolute	0	250	5.00	kPa	0	36	5,00	psi
A4	Absolute	0	2500	20.83	kPa	0	360	20,83	psi
A5	Absolute	0	25	0.21	Mpa	0	3600	0,21	psi
A6	Absolute	0	40	0.33	Mpa	0	5800	0,33	psi
H2	Differential – High Static Pressure	-50	50	0.42	kPa	-200	200	0,42	inH_2O
H3	Differential – High Static Pressure	-250	250	2.08	kPa	-36	36	2,08	psi
H4	Differential – High Static Pressure	-2500	2500	20.83	kPa	-360	360	20,83	psi
H5	Differential – High Static Pressure	-25	25	0.21	Mpa	-3600	3600	0,21	psi

NOTE: The range can be extended up to 0.75 LRL* and 1.2 URL* with small degradation of accuracy. For range 6, the pressure range above URL must be assessed according to the maximum pressure approved in the competent hazardous area certification.
*LRL = Lower Range Limit.
*URL = Upper Range Limit.

COD.	Diaphragm Material	Fill Fluid
1	316 SST	Silicone Oil **(4)**
2	316 SST	Inert Oil Fluorolube **(2) (5)**
3	Hastelloy C276	Silicone Oil **(1) (4)**
4	Hastelloy C276	Inert Oil Fluorolube **(1)(2)(5)**
5	Monel 400	Silicone Oil **(1) (3) (4)**
7	Tantalum	Silicone Oil **(3) (4)**
8	Tantalum	Fluorolube Oil **(2)(3)(5)**
9	316L SST	Fomblim Oil
A	Monel 400	Fomblim Oil **(1) (3)**
D	316L SST	Inert Oil Krytox **(3) (5)**
E	Hastelloy C276	Inert Oil Krytox **(1)(3)(5)**
G	Tantalum	Inert Oil Krytox **(3) (5)**
K	Monel 400	Inert Oil Krytox **(1)(3)(5)**
M	Monel 400 Gold Plated	Silicone Oil **(1) (3) (4)**
P	Monel 400 Gold Plated	Inert Oil Krytox **(1) (3) (5)**
Q	316 SST	Inert Oil Halocarbon 4.2 **(2) (3) (5)**
R	Hastelloy C276	Inert Oil Halocarbon 4.2 **(2) (3) (5)**
S	Tantalum	Inert Oil Halocarbon 4.2 **(2) (3) (5)**
U	316L SST Integral Plate	Silicone Oil
V	316L SST Integral Plate	Fluorolube Oil
W	316L SST Integral Plate	Oil Krytox

COD	Special Procedure
C0	Standard
C1	For use in oxygen / hydrogen peroxide / chlorine
C6	Test of Overpressure at 380 bar and static pressure at 480 bar (6)

204 – 0301	D2	1	

⬅ TYPICAL MODEL NUMBER

NOTES

(1) Meets NACE MR – 01 – 75/ISO 15156 recommendations.
(2) Not available for absolute models nor for vacuum applications.
(3) Not available for range 0 and 1.
(4) Silicone Oil is not recommended for oxygen (O_2) or Chlorine service.
(5) Inert Fluid: Oxygen Compatibility, safe for oxygen service.
(6) Available only for H Class.

204-0301L SENSOR FOR FLANGED TRANSMITTER

COD.	Range Limits Min.	Range Limits Max.	Min. Span	Unit
2	-50	50	1,25	kPa
3	-250	250	2,08	kPa
4	-2500	2500	20,83	kPa
5	-25000	25000	208,30	kPa

Range Limits Min.	Range Limits Max	Min. Span.	Unit
-200	200	5	inH_2O
-36	36	0,3	psi
-360	360	3	psi
-3625	3625	30,2	ps

Note: The range can be extended up to 0.75 LRL and 1.2 URL with small degradation of accuracy. The Upper range value must be limited by flange rating.

COD. Diaphragm Material and Fill Fluid

COD.		
1	316L SST	Silicone Oil **(2)**
2	316L SST	Fluorolube Oil **(3) (12)**
3	Hastelloy C276	Silicone Oil **(1) (2)**
4	Hastelloy C276	Fluorolube Oil **(1) (3) (12)**
5	Monel 400	Silicone Oil **(1) (2)**
7	Tantalum	Silicone Oil **(2)**
8	Tantalum	Fluorolube Oil **(3) (12)**
9	316L SST	Fomblim Oil
A	Monel 400	Fomblim Oil (1)
D	316L SST	Krytox Oil **(12)**
E	Hastelloy C276	Krytox Oil **(10 (12)**
G	Tantalum	Krytox Oil **(12)**
H	Titanium	Krytox Oil
I	Integral 316L SST Gold Plated	Silicone Oil
J	Integral 316L SST Gold Plated	Fluorolube Oil
K	Monel 400	Krytox Oil **(1) (12)**
L	Integral 316L SST Gold Plated	Krytox Oil
M	Monel 400 Gold Plated	Silicone Oil **(1) (2)**
P	Monel 400 Gold Plated	Krytox Oil **(1) (12)**
Q	316L SST	Halocarbon 4.2 Oil
R	Hastelloy C276	Halocarbon 4.2 Oil
S	Tantalum	Halocarbon 4.2 Oil
T	Integral 316L SST Gold Plated	Halocarbon 4.2 **(12)** Oil
U	Integral 316L SST	Silicone Oil
V	Integral 316L SST	Fluorolube Oil
W	Integral 316L SST	Krytox Oil
X	Integral 316L SST	Halocarbon 4.2 Oil

COD. Flange, Adapter, and Drain Vent Material (Low Side) (16)

COD.	
C	Plated Carbon Steel (SST Drain/Vent) **(13)**
H	Hastelloy C276 (CW-12MW, ASTM - A494) **(1)**
I	316 SST - CF8M
M	Monel 400 **(1)**
N	316 SST (Hastelloy C276 Drain/Vent) **(1)**

COD. O-rings Material (Wetted parts – Low side)

COD.	
0	Without O-ring
B	Buna-N
E	Ethylene - Propylene
T	Teflon
V	Viton

Note: O-rings are not applicable on remote seal side.

COD. Drain Vent Position

COD.	
0	Without drain/vent
A	Drain/Vent (Opposite to process connection)
D	Bottom
U	Top

Note: Drain/vent valve is recommended for better operation. Drain/vent valves are not applicable on remote seal side.

COD. Process Connection (Low Side)

COD.	
0	1/4 - 18 NPT
1	1/2 - 14 NPT (With Adapter)
3	Remote Seal (With Plug)
9	Remote Seal (Low Volume Flange) **(3)(4)(7)**
T	1/2 - 14 BSP (With Adapter)
V	Without Connection (Gage reference)

COD. Process Connection (Level Tap)

COD.		COD.	
U	1" 150 # (ANSI B16.5)	C	3" 600 # (ANSI B16.5)
V	1" 300 # (ANSI B16.5)	3	4" 150 # (ANSI B16.5)
W	1" 600 # (ANSI B16.5)	4	4" 300 # (ANSI B16.5)
O	1.1/2" 150 # (ANSI B16.5)	D	4" 600 # (ANSI B16.5)
P	1.1/2" 300 # (ANSI B16.5)	5	DN 25 PN 10/40
Q	1.1/2" 600 # (ANSI B16.5)	R	DN 40 PN 10/40
9	2" 150 # (ANSI B16.5)	E	DN 50 PN 10/40
A	2" 300 # (ANSI B16.5)	6	DN 80 PN 10/40
B	2" 600 # (ANSI B16.5)	7	DN 100 PN 10/16
1	3" 150 # (ANSI B16.5)	8	DN 100 PN 25/40
2	3" 300 # (ANSI B16.5)	Z	Special – See notes

COD. Material and Type of Flange (Level Tap)

COD.		COD.	
2	316L SST (Fixed Flange)	S	Super Duplex (UNS S32750/S32760)
D	Duplex (UNS S31803/S32205)	Z	Special – See notes

COD. Extension Length

COD.		COD.	
0	0 mm (0")	3	150 mm (6")
1	50 mm (2")	4	200 mm (8")
2	100 mm (4")	Z	Special – See notes

COD. Diaphragm Material / Extension (Level Tap)

COD.		COD.	
1	316L SST / 316L SST	7	316L SST Gold Plated (Only Diaphragm)
2	Hastelloy C276 / 316L SST	L	316L SST with Halar coated
3	Monel 400 / 316 SST	S	Super Duplex (UNS S32750/S32760) (Only Diaphragm)
4	Tantalum / 316 SST		
5	Titanium / 316L SST		

COD. Fill Fluid (Level Tap)

COD.		COD.	
1	Silicone DC 200/20 Oil	B	Fomblim 06/06
2	Fluorolube Oil	H	Halocarbon 4.2
3	Silicone DC 704 Oil	N	Neobee Max. 200ºC
4	Krytox	T	Syltherm

COD. Flange Face Finish

COD.	
0	Face RF (Raised Face)
1	Face FF (Flat Face)
2	Face RTJ (Ring Joint Face)

COD. Continues next page

204-0301	L2	1	I	B	U	0	1	2	2	1	1	1	

⬅ TYPICAL MODEL

MODEL	SENSOR FOR FLANGED PRESSURE TRANSMITTER (CONTINUATION)		
	COD.	Special Procedure	
	C0	Without special procedure	
	C1	Decrease cleaning	
	C2	Vacuum service	
	COD.	Manufacturing Standard	
	S0	SMAR	
		COD.	Bolts and Nuts Material
		A0	Plated Carbon Steel
		A1	316 SST
		A2	CS compatible with NACE **(1) (1a)**
		A3	SST compatible with NACE **(1)**
		A5	Hastelloy C276 compatible with NACE **(1) (1a)**

204-0301L	C0	S0	A0	⬅ TYPICAL MODEL

NOTES

(1) Meets NACE MR-0175 / ISO15156 standard.
(1a) Meets NACE MR-0103
(2) Silicone Oil is not recommended for Oxygen (O_2) or Chlorine service.
(3) Not applicable for vacuum service.
(4) Fluorolube fill fluid is not available for Monel diaphragm.
(5) Attention, check the corrosion rate for the process, extension AISI 316L thickness 3-6mm. Titanium, Monel and Tantalum diaphragm thickness 0.1 mm.
(6) Item by inquiry.
(7) Supplied without Gasket.
(8) Degreaser's cleaning is not available for carbon steel flanges.
(10) Finishing of the flange faces according to specific standards.
(11) Halar applicable only to:
- Faces: RF and FF;
- Temperature Range: +10 to 100 ºC
  + 101 to 150 ºC (by inquiry)
- Not applicable for housing;

(12) Inert Fluid is safe for oxygen service.
(14) Not applicable for saline atmosphere.
(16) Flanges material refers to wetted part (process contact), seal adaptation flange, level and gauge made only in 316 SST.

204-0301S — **SENSOR FOR DIFFERENTIAL PRESSURE TRANSMITER WITH SANITARY CONNECTION**

COD.	Range Limits Min.	Range Limits Max.	Min. Span	Unit	Range Limits Min.	Range Limits Max	Min. Span	Unit
2	-50	50	1,25	kPa	-200	200	5	inH_2O
3	-250	250	2,08	kPa	-36	36	0,3	psi
4	-2500	2500	20,83	kPa	-360	360	3	psi
5	-25000	25000	208,30	kPa	-3625	3625	30,2	ps

Note: The range can be extended up to 0.75 LRL and 1.2 URL with small degradation of accuracy. The Upper range value must be limited by flange rating.

COD. — Diaphragm Material and Fill Fluid (Low Side)

1	316L SST	Silicone Oil **(2)**
2	316L SST	Fluorolube Inert Oil **(3)**
3	Hastelloy C276	Silicone Oil **(1) (2)**
4	Hastelloy C276	Fluorolube Inert Oil **(1) (3)**

COD. — Flange, Adapter, and Drain Vent Material (Low Side)

I	316 SST - CF8M (ASTM - A351)

COD. — O-rings Material (Wetted parts – Low side)

0	Without O-ring	T	Teflon
B	Buna-N	V	Viton
E	Ethylene - Propylene		

Note: O-rings are not applicable on remote seal side.

COD. — Drain Vent Position (Low side)

0	Without drain/vent	D	Bottom
A	Drain/Vent (Opposite to process connection)	U	Top

Note: Drain/vent valve is recommended for better operation. Drain/vent valves are not applicable on remote seal side.

COD. — Process Connection (Low side)

0	1/4 - 18 NPT (With Adapter)	9	Remote Seal (Low Volume Flange) **(3)(4)(7)**
1	1/2 - 14 NPT (With Adapter)	T	1/2 - 14 BSP (With Adapter)
3	Remote Seal (With Plug)	V	Without Connection (Gage reference)

COD. — Process Connection

8	Thread DN25 DIN 11851 - with extension **(6)**	E	Thread SMS 2" **(6)**
9	Thread DN40 DIN 11851 - with extension **(6)**	M	Thread SMS 3" - with extension **(6)**
H	Thread DN40 DIN 11851 **(6)**	1	Thread SMS 3" **(6)**
V	Thread DN50 DIN 11851 - with extension **(6)**	F	Tri-Clamp 1 1/2"
U	Thread DN50 DIN 11851 **(6)**	Q	Tri-Clamp 1 1/2" HP (High Pressure) **(5)**
X	Thread DN80 DIN 11851 - with extension **(6)**	6	Tri-Clamp 2" - with extension
W	Thread DN80 DIN 11851 **(6)**	D	Tri-Clamp 2"
4	Thread IDF 2" - with extension **(6)**	N	Tri-Clamp 2" HP (High Pressure) - with extension **(5)**
B	Thread IDF 2" **(6)**	P	Tri-Clamp 2" HP (High Pressure) **(5)**
K	Thread IDF 3" - with extension **(6)**	I	Tri-Clamp 3" - with extension
3	Thread IDF 3" **(6)**	G	Tri-Clamp 3"
5	Thread RJT 2" - with extension **(6)**	J	Tri-Clamp 3" HP (High Pressure) - with extension **(5)**
C	Thread RJT 2" **(6)**	R	Tri-Clamp 3" HP (High Pressure) **(5)**
L	Thread RJT 3" - with extension **(6)**	A	Tri-Clamp DN50 - with extension
2	Thread RTJ 3" **(6)**	Z	Special – See notes
S	Thread SMS 1 1/2" **(6)**		
7	Thread SMS 2" - with extension **(6)**		

COD. — Diaphragm Material (Level Tap)

H	Hastelloy C276
I	316L SST

COD. — Fill Fluid

D	Silicone DC-704 Oil
F	Fluorolube MO-10 Oil **(3)**
N	Neobee Max. 200ºC
S	Silicone DC-200/20 Oil Max. 150ºC
T	Syltherm 800 Oil

COD. — O-rings Material (Level Tap)

0	Without O-ring
B	Buna N
Y	Teflon
V	Viton
Z	Special – See notes

COD. — Tank Adapter

0	No (Supplied by Client)
1	316L SST Tank Adapter

COD. — Tri-Clamp

0	Without Tri-Clamp
2	304 SST Tri-Clamp
Z	Special – See notes

COD. — Continues next page

204-0301S	2	1	I	B	U	0	1'	H	S				

⬅ MODELO TÍPICO

MODEL	SENSOR FOR SANITARY PRESSURE TRANSMITTER (CONTINUATION)

COD.	Special Procedure
C0	Without special procedure
C1	Decrease cleaning

COD.	Manufacturing Standard
S0	SMAR

COD.	Bolts and Nuts Material
A0	Carbon Steel
A1	316 SST
A2	CS compatible with NACE **(1) (1a)**
A3	SST compatible with NACE **(1)**
A5	Hastelloy C276 compatible with NACE **(1) (1a)**

204-0301S	C0	S0	A0

⬅ TYPICAL MODEL

NOTES

(1) Meets NACE MR-0175 / ISO15156 standard.
(1a) Meets NACE MR-0103
(2) Silicone Oils not recommendations for Oxygen (O_2) or Chlorine service.
(3) Not applicable for vacuum service.
(4) Drain/Vent not applicable.
(5) HP – High Pressure.
(6) Not available for tri-clamp connections.
(7) Item by inquiry
(8) Inert Fluid: safe for oxygen service.

HART® Special Units

VARIABLE	CODE	UNIT	DESCRIPTION
PRESSURE	1	inH_2O (68ºF)	inches of water at 68 degrees F
	2	inHg (0ºC)	inches of mercury at 0 degrees C
	3	ftH_2O (68ºF)	feet of water at 68 degrees F
	4	mmH_2O (68ºF)	millimeters of water at 68 degrees F
	5	mmHg (0ºC)	millimeters of mercury at 0 degrees C
	6	lb/in^2	pounds per square inch
	7	bar	bars
	8	mbar	millibar
	9	gf/cm^2	Gram force per square centimeter
	10	kgf/cm^2	Kilogram force per square centimeter
	11	Pa	pascal
	12	kPa	kilopascal
	13	torr	torr
	14	atm	atmosphere
	145	inH^2O (60ºF)	inches of water at 60 degrees F
	237	MPa	megapascal
	238	inH^2O (4ºC)	inches of water at 4 degrees C
	239	mmH^2O (4ºC)	millimeters of water at 4 degrees C
VOLUMETRIC FLOW	15	CFM	cubic feet per minute
	16	GPM	gallons per minute
	17	l/min	liters per minute
	18	ImpGal/min	imperial gallons per minute
	19	m^3/h	cubic meters per hour
	22	gal/s	gallons per second
	23	Mgal/d	million gallons per day
	24	l/s	liters per second
	25	Ml/d	million liters per day
	26	ft^3/s	cubic feet per second
	27	ft^3/d	cubic feet per day
	28	m^3/s	cubic meters per second
	29	m^3/d	cubic meters per day
	30	ImpGal/h	imperial gallons per hour
	31	ImpGal/d	imperial gallons per day
	121	Nm^3/h	normal cubic meters per hour
	122	Nl/h	normal liters per hour
	123	ft^3/min	standard cubic feet per minute
	130	CFH	cubic feet per hour
	131	m^3/h	cubic meters per hour
	132	bbl/s	barrels per second
	133	bbl/min	barrels per minute
	134	bbl/h	barrels per hour
	135	bbl/d	barrels per day
	136	gal/h	gallons per hour
	137	ImpGal/s	imperial gallons per second
	138	l/h	liters per hour
	235	gal/d	gallons per day

VARIABLE	CODE	UNIT	DESCRIPTION
VELOCITY	20	ft/s	feet per second
	21	m/s	meters per second
	114	in/s	inches per second
	115	in/min	inches per minute
	116	ft/min	feet per minute
	120	m/h	meters per hour
TEMPERATURE	32	ºC	degrees Celsius
	33	ºF	degrees Fahrenheit
	34	ºR	degrees Rankine
	35	K	degrees Kelvin
ELECTRO MAGNETIC FORCE	36	mV	millivolts
	58	V	volts
ELECTRIC RESISTANCE	37	ohm	ohms
	163	kohm	kilo ohms
ELECTRIC CURRENT	39	mA	milliamperes
VOLUME	40	gal	gallons
	41	l	liters
	42	ImpGal	imperial gallons
	43	m^3	cubic meters
	46	bbl	barrels
	110	bushel	bushels
	111	yd^3	cubic yards
	112	ft^3	cubic feet
	113	in^3	cubic inches
	124	bbl(liq)	liquid barrels
	166	Nm^3	normal cubic meter
	167	Nl	normal liter
	168	SCF	standard cubic feet
	236	hl	hectoliters
LENGTH	44	ft	feet
	45	m	meters
	47	in	inches
	48	cm	centimeters
	49	mm	millimeters
	151	$ftin^{16}$	feet in sixteenths
TIME	50	min	minutes
	51	s	seconds
	52	h	hours
	53	d	days
MASS	60	g	grams
	61	kg	kilograms
	62	t	metric tons
	63	lb	pounds
	64	Shton	short tons (2000 pounds)
	65	Lton	long tons (2240 pounds)
	125	oz	ounce

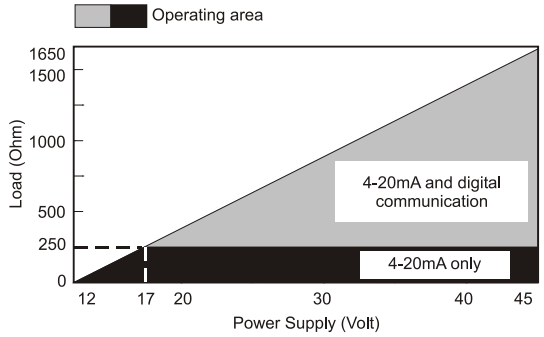
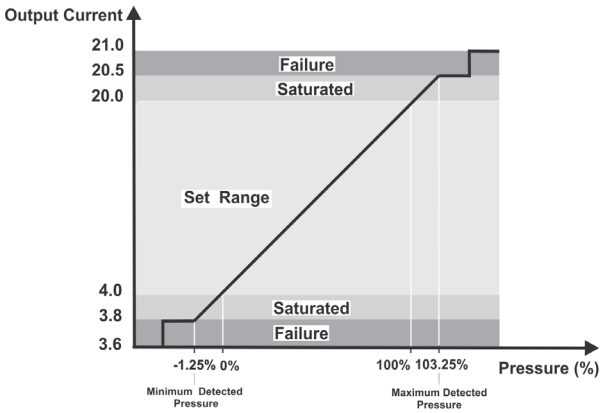
VARIABLE	CODE	UNIT	DESCRIPTION
VISCOSITY	54	cSt	centistokes
	55	cP	centipoises
ENERGY (INCLUDES WORK)	69	N-m	newton meter
	89	decatherm	deka therm
	126	ft-lb	foot pound force
	128	KWH	kilo watt hour
	162	Mcal	mega calorie
	164	MJ	mega joule
	165	Btu	british thermal unit
MASS FLOW	70	g/s	grams per second
	71	g/min	grams per minute
	72	g/h	grams per hour
	73	kg/s	kilograms per second
	74	kg/min	kilograms per minute
	75	kg/h	kilograms per hour
	76	kg/d	kilograms per day
	77	t/min	metric tons per minute
	78	t/h	metric tons per hour
	79	t/d	metric tons per day
	80	lb/s	pounds per second
	81	lb/min	pounds per minute
	82	lb/h	pounds per hour
	83	lb/d	pounds per day
	84	Shton/min	short tons per minute
	85	Shton/h	short tons per hour
	86	Shton/d	short tons per day
	87	Lton/h	long tons per hour
	88	Lton/d	long tons per day
MASS PER VOLUME	90	SGU	specific gravity units
	91	g/cm³	grams per cubic centimeter
	92	kg/m³	kilograms per cubic meter
	93	lb/gal	pounds per gallon
	94	lb/ft³	pounds per cubic foot
	95	g/ml	grams per milliliter
	96	kg/l	kilograms per liter
	97	g/l	grams per liter
	98	lb/in³	pounds per cubic inch
	99	ton/yd³	short tons per cubic yard
	100	degTwad	degrees twaddell
	102	degBaum hv	degrees Baume heavy
	103	degBaum lt	degrees Baume light
	104	deg API	degrees API
	146	µg/l	micrograms per liter
	147	µg/m³	micrograms per cubic meter
	148	%Cs	percent consistency

VARIABLE	CODE	UNIT	DESCRIPTION
ANGULAR VELOCITY	117	°/s	degrees per second
	118	rev/s	revolutions per second
	119	RPM	revolutions per minute
POWER	127	kW	kilo watt
	129	hp	horsepower
	140	Mcal/h	mega calorie per hour
	141	MJ/h	mega joule per hour
	142	Btu/h	British thermal unit per hour
MISCELLANEOUS	38	Hz	hertz
	56	µS	micro siemens
	57	%	percent
	59	pH	pH
	66	mS/cm	milli siemens per centimeter
	67	µS/cm	micro siemens per centimeter
	68	N	newton
	101	degbrix	degrees brix
	105	%sol/wt	percent solids per weight
	106	%sol/vol	percent solids per volume
	107	degBall	degrees balling
	108	proof/vol	proof per volume
	109	proof/mass	proof per mass
	139	ppm	parts per million
	143	°	degrees
	144	rad	radian
	149	%vol	volume percent
	150	%stm qual	percent steam quality
	152	ft³/lb	cubic feet per pound
	153	pF	picofarads
	154	ml/l	milliliters per liter
	155	µl/l	microliters per liter
	160	% plato	percent plato
	161	LEL	percent lower explosion level
	169	ppb	parts per billion
GENERIC	240 to 249	-	May be used for manufacturer specific definitions
	250	-	Not Used
	251	-	None
	252	-	Unknown
	253	-	Special

Note: Information extracted from HART® Protocol Specification.

Section 6

TECHNICAL CHARACTERISTICS

Functional Specifications	
Process Fluid	Liquid, gas or steam.
Output	Two-wire, 4 - 20 mA controlled according to NAMUR NE-43 specification, with superimposed digital communication (HART® Protocol).
Power Supply	12 to 45 Vdc.
Indicator	4 1/2 -digit numerical and 5-character alphanumerical LCD indicator (optional).
Hazardous Area Certifications	Consult the Appendix A for Hazardous Location Approvals.
Zero and Span Adjustments	No interactive, via local adjustment and digital communication. Jumper of local adjustment with three positions: simple, disable, and complete.
Load Limitation	
Failure Alarm (Diagnostics)	In case of sensor or circuit failure, the self-diagnostics drives the output to 3.6 or 21.0 mA, according to the user's choice and NAMUR NE43 specification. Detailed diagnostic through HART© communication. 
Temperature Limits	Ambient: -40 a 85 °C (-40 a 185 °F) Process: -40 a 100 °C (-40 a 212 °F) (Silicone oil) 0 a 85 °C (32 a 185 °F) (Fluorolube oil) -20 a 100 °C (-4 a 212 °F) (Krytox Oil and Fomblim) -40 a 150 °C (-40 a 302 °F) (Level Model)* Storage: -40 a 85 °C (-40 a 212 °F) Display: -20 a 80 °C (-4 a 176 °F) -40 a 85 °C (-40 a 185 °F) (Without damange) *Attention with the fluid of Level
Turn-on Time	Performs within specifications in less than 3 seconds after power is applied to the transmitter.
Configuration	By digital communication (HART protocol) using configuration DD and FDT/DTM tools, and can be partially configured through local adjustment
Volumetric Displacement	Less than 0.15 cm^3 (0.01 in^3)

Functional Specifications

Static Pressure Limits

70 psi (5 bar) for range 0
1200 psi (80 bar) for range 1
2300 psi (160 bar) for ranges 2, 3 and 4
4600 psi (320 bar) for models H2 to H5
Except for LD301A and LD301M models

Static pressure, in differential pressure measurement, is the pressure applied on both measuring chambers, simultaneously. For example, in flow measurement with restriction elements, the static pressure is the line pressure, present in both measuring chambers, simultaneously.

Overpressure Limits

70 psi (5 bar) for range 0
1200 psi (80 bar) for range 1
2300 psi (160 bar) for ranges 2, 3 and 4
5800 psi (400 bar) for range 5
7500 psi (520 bar) for range 6

Flange Test Pressure (Burst Pressure): 68.95 MPa (10,000 psi)
Flange test is the maximum pressure applied to the transmitter without damage to the measuring set.

Overpressures above will not damage the transmitter, but a new calibration may be necessary
Overpressure is the pressure applied to only one of the transmitter chambers when this pressure is higher than the sensor's reading pressure limit (URL). The concept applies to differential, gauge or absolute pressure transmitters.

Pressure Limits for flanges

WARNING

It is described here only the maximum pressures of some materials referenced in each standard, other materials on request. Temperatures above 150 ° C are not available in standard models.

PRESSURES TABLE FOR SEAL AND LEVEL FLANGES DIN EN 1092-1 2008 STANDARD

Material Group	Pressure Class	Maximum Temperature Allowed						
		RT*	100	150	200	250	300	350
		Maximum Pressure Allowed (bar)						
10E0 AISI 304/304L	PN 16	16	13.7	12.3	11.2	10.4	9,6	9.2
	PN 25	25	21.5	19.2	17.5	16.3	15.1	14.4
	PN 40	40	34.4	30.8	28	26	24.1	23
	PN 63	63	54,3	48,6	44,1	41,1	38,1	36,3
	PN 100	100	86.1	77.1	70	65.2	60.4	57.6
	PN 160	160	137.9	123.4	112	104.3	96.7	92.1
	PN 250	250	215.4	192.8	175	163	151.1	144

Material Group	Pressure Class	Maximum Temperature Allowed						
		RT*	100	150	200	250	300	350
		Maximum Pressure Allowed (bar)						
14E0 AISI 316/316L	PN 16	16	16	14.5	13.4	12.7	11.8	11.4
	PN 25	25	25	22.7	21	19.8	18.5	17.8
	PN 40	40	40	36.3	33.7	31.8	29.7	28.5
	PN 63	63	63	57.3	53.1	50.1	46.8	45
	PN 100	100	100	90.9	84.2	79.5	74.2	71.4
	PN 160	160	160	145.5	134.8	127.2	118.8	114.2
	PN 250	250	250	227.3	210.7	198.8	185.7	178.5

Material Group	Pressure Class	Maximum Temperature Allowed						
		RT*	100	150	200	250	300	350
		Maximum Pressure Allowed (bar)						
16E0 1.4410 Super Duplex 1.4462 Duplex	PN 16	16	16	16	16	16	-	-
	PN 25	25	25	25	25	25	-	-
	PN 40	40	40	40	40	40	-	-
	PN 63	63	63	63	63	63	-	-
	PN 100	100	100	100	100	100	-	-
	PN 160	160	160	160	160	160	-	-
	PN 250	250	250	250	250	250	-	-

***RT = Reference Temperature (-10 to 50 ºC)*

Functional Specifications

Pressure Limits for flanges

PRESSURES TABLE FOR SEAL AND LEVEL FLANGES ASME B16.5 2017 STANDARD

Material Group	Pressure Class	Maximum Temperature Allowed								
		-29 to 38	50	100	150	200	250	300	325	350
		Maximum Pressure Allowed (bar)								
Hastelloy C276	150	20	19.5	17.7	15.8	13.8	12.1	10.2	9.3	8.4
	300	51.7	51.7	51.5	50.3	48.3	46.3	42.9	41.4	40.3
	600	103.4	103.4	103	100.3	96.7	92.7	85.7	82.6	80.4
	1500	258.6	258.6	257.6	250.8	241.7	231.8	214.4	206.6	201.1
	2500	430.9	430.9	429.4	418.2	402.8	386.2	357.1	344.3	335.3

Material Group	Pressure Class	Maximum Temperature Allowed								
		-29 to 38	50	100	150	200	250	300	325	350
		Maximum Pressure Allowed (bar)								
S31803 Duplex S32750 Super Duplex	150	20	19.5	17.7	15.8	13.8	12.1	10.2	9.3	8.4
	300	51.7	51.7	50.7	45.9	42.7	40.5	38.9	38.2	37.6
	600	103.4	103.4	101.3	91.9	85.3	80.9	77.7	76.3	75.3
	1500	258.6	258.6	253.3	229.6	213.3	202.3	194.3	190.8	188.2
	2500	430.9	430.9	422.2	382.7	355.4	337.2	323.8	318	313.7

Material Group	Pressure Class	Maximum Temperature Allowed								
		-29 to 38	50	100	150	200	250	300	325	350
		Maximum Pressure Allowed (bar)								
AISI316L	150	15.9	15.3	13.3	12	11.2	10.5	10	9.3	8.4
	300	41.4	40	34.8	31.4	29.2	27.5	26.1	25.5	25.1
	600	82.7	80	69.6	62.8	58.3	54.9	52.1	51	50.1
	1500	206.8	200.1	173.9	157	145.8	137.3	130.3	127.4	125.4
	2500	344.7	333.5	289.9	261.6	243	228.9	217.2	212.3	208.9

Material Group	Pressure Class	Maximum Temperature Allowed								
		-29 to 38	50	100	150	200	250	300	325	350
		Maximum Pressure Allowed (bar)								
AISI316	150	19	18.4	16.2	14.8	13.7	12.1	10.2	9.3	8.4
	300	49.6	48.1	42.2	38.5	35.7	33.4	31.6	30.9	30.3
	600	99.3	96.2	84.4	77	71.3	66.8	63.2	61.8	60.7
	1500	248.2	240.6	211	192.5	178.3	166.9	158.1	154.4	151.6
	2500	413.7	400.9	351.6	320.8	297.2	278.1	263.5	257.4	252.7

Material Group	Pressure Class	Maximum Temperature Allowed								
		-29 to 38	50	100	150	200	250	300	325	350
		Maximum Pressure Allowed (bar)								
AISI304	150	19	18.3	15.7	14.2	13.2	12.1	10.2	9.3	8.4
	300	49.6	47.8	40.9	37	34.5	32.5	30.9	30.2	29.6
	600	99.3	95.6	81.7	74	69	65	61.8	60.4	59.3
	1500	248.2	239.1	204.3	185	172.4	162.4	154.6	151.1	148.1
	2500	413.7	398.5	340.4	308.4	287.3	270.7	257.6	251.9	246.9

PRESSURES TABLE FOR SEAL AND LEVEL FLANGES JIS 2220 – 2012 STANDARD

Material Group	Pressure Class	Maximum Temperature Allowed			
		Tamb at 120º	220º	300º	350º
		Maximum Pressure Allowed (bar)			
AISI316L	10k	14	12	10	--
	20k	34	31	29	26
	40k	68	62	57	52

Functional Specifications

Pressure Limits for sanitary connections

PRESSURES TABLE FOR TRICLAMP CONNECTIONS BS4825 P3

DN	PN normal		HP High Pressure	
	20ºC (68ºF)	120ºC (248ºF)	20ºC (68ºF)	120ºC (248ºF)
	Maximum Pressure Allowed (bar)			
1.1/2”	34	20	100	60
2” – DN50	28	17	70	42
3”	22	13	70	42

PRESSURES TABLE FOR THREADED CONNECTIONS

Sanitary Threads – Temperature Limits				
DN	**RJT**	**IDF**	**SMS**	**DIN**
	120ºC (248ºF)	120ºC (248ºF)	120ºC (248ºF)	120ºC (248ºF)
	BS4825 P5	**BS4825 P4**	**SMS1145**	**DIN11851**
	Maximum Pressure Allowed (bar)			
DN25	--	--	--	40
1.1/2”-DN40	10	16	40	40
2–DN50	10	16	25	25
3-DN80	10	16	25	25

Humidity Limits	0 to 100% RH (Relative Humid).
Damping Adjustment	User configurable from 0 to 128 seconds (via digital communication).

Performance Specifications	
Reference Conditions	Span starting at zero, temperature of 25°C (77°F), atmospheric pressure, power supply of 24 Vcc, silicone oil fill fluid, isolating diaphragms in 316L SST and digital trim equal to lower and upper range values.
Accuracy	**For range 0, and differential or gage models and 316L SST or hastelloy diaphragm with silicon or halocarbon filling fluid:** **0.2 URL ≤ span ≤ URL:** ± 0.1% of span **0.05 URL ≤ span < 0.2 URL:** ± [0.025+0.015 URL/span]% of span **For ranges 1, 2, 3, 4, 5 or 6, differential or gage models, and 316L SST or hastelloy diaphragm with silicon or halocarbon filling fluid:** **0.1 URL ≤ span ≤ URL:** ± 0.075% of span **0.025 URL ≤ span < 0.1 URL:** ± [0.0375+0.00375.URL/span]% of span **0.0083 URL ≤ span < 0.025 URL:** ± [0.0015+0.00465.URL/span]% of span **For ranges 2 to 6 and absolute model. For tantalum or monel diaphragm. For fluorolube filling fluid:** **0.1 URL ≤ span ≤ URL:** ± 0.1% of span **0.025 URL ≤ span < 0.1 URL:** ± [0,05+0,005 URL/span]% of span **0.0083 URL ≤ span < 0.025 URL:** ± [0.01+0.006 URL/span]% of span **For range 1 and absolute model:** ± 0.2% of span **For ranges 2, 3 or 4 and level model and 316L SST diaphragm with silicon or halocarbon filling fluid with maximum pressure matching the flange pressure class:** **0.1 URL ≤ span ≤ URL:** ± 0.075% of span **0.025 URL ≤ span < 0.1 URL:** ± [0.0375+0.00375.URL/span]% of span **0.0083 URL ≤ span < 0.025 URL:** ± [0.0015+0.00465.URL/span]% of span Linearity effects, hysteresis and repeatability are included.
Stability	**For ranges 1, 2, 3, 4, 5 and 6**: ± 0.15% of URL for 5 years at 20 ºC temperature change and up to 7 MPa (1000 psi) of static pressure. **For ranges 0:** ± 0.2% of URL for 12 months at 20 ºC temperature change, and up to 100 kPa (1bar) of static pressure. **For Level model:** ± 0.2% of URL for 12 months at 20 ºC temperature change.
Temperature Effect	**For ranges 2, 3, 4 and 5:** **0.2 URL ≤ span ≤ URL:** ± [0.02% URL + 0.06% span] per 20 ºC (68 ºF) **0.0085 URL ≤ span < 0.2 URL:** ± [0.023% URL + 0.045% span] per 20 ºC (68ºF) **For range 1:** **0.2 URL ≤ span ≤ URL:** ± [0.08% URL + 0.05% span] per 20 ºC (68 ºF) **0.025 URL ≤ span < 0.2 URL:** ± [0.06% URL + 0.15% span] per 20 ºC (68 ºF) **For range 0:** **0.2 URL ≤ span ≤ URL:** ± [0.15% URL + 0.05% span] per 20 ºC (68 ºF) **0.05 URL ≤ span < 0.2 URL:** ± [0.1% URL + 0.3% span] per 20 ºC (68 ºF) **For level model:** 6 mmH_2O per 20 ºC for 4" and DN100 17 mmH_2O per 20 ºC for 3" and DN80 Consult Smar for other flange dimensions and fill fluid.
Static Pressure Effect	**Zero error:** **For ranges 2, 3, 4 and 5:** ± 0.033% of URL per 7MPa (1000 psi) **For range 1:** ± 0.05% of URL per 1.7 MPa (250 psi) **For range 0:** ± 0.1% of URL per 0.5 MPa (5 bar) **For Level model:** ± 0.1% of URL per 3.5 MPa (500 psi) The zero error is a systematic error that can be eliminated by calibrating at the operating static pressure. **Span error:** **For ranges 2, 3, 4, 5 and 6:** correctable to ± 0.2% of reading per 7MPa (1000 psi) **For range 1 and level transmitters:** correctable to ± 0.2% of reading per 3.5 MPa (500 psi) **For range 0:** correctable to ± 0.2% of reading per 0.5 MPa (5 bar) (70 psi)

Performance Specifications	
Power Supply Effect	± 0.005% of calibrated span per volt
Mounting Position Effect	Zero shift of up to 250 Pa (1 inH2O) which can be calibrated out. No span effect.
Electromagnetic Interference Effect	Approved according to IEC61326-1:2006, IEC61326-2-3:2006, IEC61000-6-4:2006, IEC61000-6-2:2005.

Physical Specifications	
Electrical Connection	1/2 - 14 NPT 3/4 - 14 NPT with 316 SST adapter for 1/2 - 14 NPT) 3/4 - 14 BSP with 316 SST adapter for 1/2 - 14 NPT) 1/2 - 14 BSP with 316 SST adapter for 1/2 - 14 NPT) M20 X 1.5 PG 13.5 DIN **Note:** Explosion Proof approvals do not apply to adapter, only to transmitter.
Process Connection	1/4 - 18 NPT or 1/2 -14 NPT (with adapter) For level models or other options, see the Ordering Code.
Wetted Parts	**Sensor Isolating Diaphragms:** 316L SST, Hastelloy C276, Monel 400 or Tantalum **Drain/Vent Valves and Plugs 1/4NPT:** 316 SST, Hastelloy C276 or Monel 400 **Drain / Vent Valves and 1/4 NPT Plug:** 316L SST, Hastelloy C276, Monel 400 **Transmitter's Flanges (1/4 NPT) and 1/2 NPT Adapter:** Plated Carbon Steel, 316 SST (ASTM - A351-CF8M), Hastelloy C276 ASTM – A494 CW-12MW) or Monel 400 **Wetted O-Rings (For Flanges and Adapters):** Buna N, Viton™ PTFE, Ethylene-Propylene, or Kalrez. **Level Flanges (LD301L – ASME / DIN / JIS)** 316L SST; 304L SST; Hastelloy C-276; Duplex UNS S31803 / S32205; Super Duplex UNS S32750 / S32760 **Flanges Isolating Diaphragms** 316L SST; 304L SST; Hastelloy C-276; Super Duplex UNS S32750 / S32760; 316L SST with Halar coating; 316L SST gold plated; Monel gold plated **Flange's Gaskets** PTFE; Grafoil **Sanitary connections (TC, SMS, RTJ, IDF, DIN 11851):** 316L SST (without extension) 316L SST; Hastelloy C-276 (extension end of connection) **Sanitary Diaphragms** 316L SST; Hastelloy C-276 **Sanitary connections - Sealing rings** Buna N; PTFE; Viton The **LD301** is available in NACE MR-0175/ISO 15156 compliant materials.
Nonwetted Parts	**Electronic Housing:** aluminum or 316 SST with polyester or epoxy painting or 316 SST without painting housing. Complies with NEMA 4X/6P, IP66 or IP66W*, IP68 or IP68W*. **The IP68 sealing test (immersion) was performed at 10m for 24 hours.* *The W condition or 4X was tested for 200h and refer to saline atmosphere.* **Absolute/Gage Flange; reduced volume flange and Plug Flange** 316 SST - CF8M (ASTM - A351 CF8M) **Fill Fluid:** Silicone, Fluorolube, Krytox, Halocarbon 4.2 or Fomblim oils

Physical Specifications

	O-Rings (cover/housing and sensor/housing) Buna-N **Mounting Bracket:** Plated carbon steel or 316 SST Accessories (bolts, nuts, washers and U-clamps) in plated carbon steel or 316 SST **Transmitter Flange Bolts and Nuts:** Plated carbon steel, Grade 8 or 316 SST For NACE applications: carbon steel B7M; Hastelloy; Super duplex **Identification Plate:** 316 SST The **LD301** is available in NACE MR-0175/ISO 15156 compliant materials.
Mounting	a) Flange mounted for Level and sanitary models. b) Optional universal mounting bracket for surface or vertical/horizontal 2"- pipe (DN 50). c) Manifold Valve integrated to the transmitter. d) Directly on piping for closely coupled transmitter/orifice flange combinations. e) L mounting bracket
Approximate Weights	3.15 kg (7 lb): all models, except L models. 4,6 to 23,5 kg (10 lb to 52 lb): L models depending of diameter; class and material flanges and extension.
Control Functions Characteristics (Optional)	Control Block (PID) and Totalizer (TOT)

Technical Characteristics of High Performance - CODE L1

High Performance option (code L1) is available under the following conditions only:

Application	**Differential and Gage**

Range

COD	Range Limits Min.	Range Limits Max.	Unit	Range Limits Min.	Range Limits Max.	Unit
D0	-1	1	kPa	-4	4	inH_2O
D1	-5	5	kPa	-20	20	inH_2O
D2	-50	50	kPa	-200	200	inH_2O
D3	-250	250	kPa	-36	36	psi
D4	-2500	2500	kPa	-360	360	psi
M0	-1	1	kPa	-4	4	inH_2O
M1	-5	5	kPa	-20	20	inH_2O
M2	-50	50	kPa	-200	200	inH_2O
M3	-100	250	kPa	-14,5	36	psi
M4	-100	2500	kPa	-14,5	360	psi
M5	-0,1	25	MPa	-14,5	3600	psi
M6	-0,1	40	MPa	-14,5	5800	psi
H2	-50	50	kPa	-200	200	inH_2O
H3	-250	250	kPa	-36	36	psi
H4	-2500	2500	kPa	-360	360	psi
H5	-25	25	MPa	-3600	3600	psi

Diaphragm Material	316L SST or Hastelloy C276
Fill Fluid	Silicone

Performance Specifications - CODE L1

Reference Conditions	Span starting at zero, temperature of 25 °C (77 °F), atmospheric pressure, power supply of 24 Vdc, silicone oil fill fluid, isolating diaphragms in 316L SST and digital trim equal to lower and upper range values.
Accuracy	**For all L1 ranges:** **0.2 URL ≤ span ≤ URL:** ± 0.04% of span **0.05 URL ≤ span < 0.2 URL:** ± [0.021667+0.003667URL/span]% of span **0.0085 URL ≤ span < 0.05 URL:** ± [0.0021+0.004645URL/span]% of span

Stability	**For range 2:** ± 0.05% of URL for 6 months **For range 3:** ± 0.075% of URL for 12 months **For range 4:** ± 0.1% of URL for 24 months For all M, D, and H transmitters: ± 0.15% of URL for 12 years, at 20 °C temperature change and up to 7 MPa (1000 psi) {70 bar} of static pressure, environment free of hydrogen migration.
Temperature Effect	**From -10 ºC to 50 ºC, protected from direct sun radiation:** **0.2 URL ≤ span ≤ URL:** ±[0.018% URL + 0.012% span] per 20 ºC (68 ºF) **0.0085 URL ≤ span < 0.2 URL:** ±[0.02% URL + 0.002% span] per 20 ºC (68 ºF)
Zero Error and Span Error	**Zero error:** ± 0.025% URL per 7 MPa (1000 psi) The zero error is a systematic error that can be eliminated by calibrating at the operating static pressure. **Span error:** Correctable to ± 0.2% of reading per 7 MPa (1000 psi).

NOTES

Hastelloy is a trademark of the Cabot Corp.
Monel is a trademark of International Nickel Co.
Viton and Teflon are trademarks of E. I. DuPont de Nemours & Co.
Fluorolube is a trademark of Gabriel Chemical Corp.
Halocarbon is a trademark of Halocarbon.
HART® is a trademark of HART® communication Foundation.
Smar Pressure Transmitters are protected by US patent number 6,433,791

Ordering Code

MODEL — **DIFFERENTIAL, FLOW, GAGE, ABSOLUTE AND HIGH STATIC PRESSURE TRANSMITTER**

COD.	Type	Range Limits Min.	Range Limits Max.	Min. Span	Unit	Range Limits Min.	Range Limits Max.	Min. Span	Unit
D0	Differential and Flow	-1	1	0.05	kPa	-4	4	0,2	inH_2O
D1	Differential and Flow	-5	5	0.10	kPa	-20	20	0,4	inH_2O
D2	Differential and Flow	-50	50	0.42	kPa	-200	200	1.67	inH_2O
D3	Differential and Flow	-250	250	2.08	kPa	-36	36	0.3	psi
D4	Differential and Flow	-2500	2500	20.83	kPa	-360	360	3	psi
M0	Gage	-1	1	0.05	kPa	-4	4	0,2	inH_2O
M1	Gage	- 5	5	0.10	kPa	-20	20	0,4	inH_2O
M2	Gage	- 50	50	0.42	kPa	-200	200	1.67	inH_2O
M3	Gage	-100	250	2.08	kPa	-14,5	36	0.3	psi
M4	Gage	-100	2500	20.83	kPa	-14,5	360	3	psi
M5	Gage	- 0.1	25	0.21	MPa	-14,5	3600	30	psi
M6	Gage	- 0.1	40	0.33	MPa	-14,5	5800	48.3	psi
A1	Absolute	0	5	2.00	kPa	0	20	8	inH_2O
A2	Absolute	0	50	2.50	kPa	0	200	10	inH_2O
A3	Absolute	0	250	5.00	kPa	0	36	0.72	psi
A4	Absolute	0	2500	20.83	kPa	0	360	3	psi
A5	Absolute	0	25	0.21	Mpa	0	3600	30	psi
A6	Absolute	0	40	0.33	MPa	0	5800	48.33	psi
H2	Differential – High Static Pressure	-50	50	0.42	kPa	-200	200	1.67	inH_2O
H3	Differential – High Static Pressure	-250	250	2.08	kPa	-36	36	0.3	psi
H4	Differential – High Static Pressure	-2500	2500	20.83	kPa	-360	360	3	psi
H5	Differential – High Static Pressure	-25	25	0.21	MPa	-3600	3600	30	psi

NOTE: The range can be extended up to 0.75 LRL* and 1.2 URL** with small degradation of accuracy.
For range 6, the pressure range above URL must be assessed according to the maximum pressure approved in the competent hazardous area certification.

*LRL = Lower Range Limit.
**URL = Upper Range Limit.

COD — Diaphragm Material and Fill Fluid

1	316L SST	Silicone Oil **(9) (19)**	**B**	Titanium	Silicone Oil	**L**	Int.316L SST, Gold Plated	Krytox Oil
2	316L SST	Inert Oil Fluorolube **(2) (15) (19)**	**C**	Titanium	Fluorolube Oil	**M**	Monel 400 Gold Plated	Silicone Oil **(1) (3) (9)**
3	Hastelloy C276	Silicone Oil **(1) (9)**	**D**	316L SST	Oil Krytox **(3) (15) (19)**	**P**	Monel 400 Gold Plated	Oil Krytox **(1) (3) (15)**
4	Hastelloy C276	Inert Oil Fluorolube **(1) (2) (15)**	**E**	Hastelloy C276	Oil Krytox **(1) (3) (15)**	**Q**	316L SST	Oil Halocarbon 4.2 **(2) (3) (15) (19)**
5	Monel 400	Silicone Oil **(1) (3) (9)**	**F**	Hastelloy C276	Silicone Oil **(9)**	**R**	Hastelloy C276	Oil Halocarbon 4.2 **(2) (3) (15)**
7	Tantalum	Silicone Oil **(3) (9)**	**G**	Tantalum	Oil Krytox **(3) (15)**	**S**	Tantalum	Oil Halocarbon 4.2 **(2) (3) (15)**
8	Tantalum	Inert Oil Fluorolube **(2) (3) (15)**	**H**	Titanium	Krytox Oil	**T**	Int. 316LSST Gold Plated	Halocarbon 4.2 Oil
9	316L SST	Fomblim Oil **(19)**	**I**	Int 316L SST, Gold Plated	Silicone Oil **(3) (9) (19)**	**U**	Integral 316L SST	Silicone Oil **(9) (19)**
A	Monel 400	Fomblim Oil **(1) (3)**	**J**	Int 316L SST, Gold Plated	Fluorolube Oil	**V**	Integral 316L SST	Fluorolube Oil
			K	Monel 400	Krytox Oil **(1) (3) (15)**	**W**	Integral 316L SST	Krytox Inert Oil **(3) (15) (19)**
						X	Integral 316L SST	Halocarbon 4.2 Oil

COD. — Flange(s), Adapter(s) and Drain/Vent Valves Material

C	Plated CS (Drain/Vent in Stainless Steel) **(16)**	**N**	316 SST – CF8M (ASTM A351) (Drain/Vent in Hastelloy C276) **(1)**	**F**	Monel Laminated Bar **(1)**
H	Hastelloy C276 (CW-12MW, ASTM-A494) **(1)**	**O**	316 SST – CF8M (Drain/Vent and plug in Monel)		
I	316 SST – CF8M (ASTM A351)	**P**	316 SST CF8M (ASTM A351) Flange with PVDF (Kynar) Insert **(4) (5) (7) (11)**		

COD. — Wetted O-Rings Materials

0	Without O'Rings	**K**	Kalrez **(3)**	**Note:** O-Rings are not available on the sides with remote Seals.
B	Buna N	**T**	Teflon	
E	Ethylene – Propylene **(12)**	**V**	Viton	

COD. — Drain/Vent Position

O	Without Drain/Vent	**D**	Bottom	**Note:** For better drain/vent operation, vent valves are strongly recommended.
A	Drain/Vent (Opposite to Process Connection)	**U**	Top	Drain/Vent valve are not available on the sides with remote seals

COD. — Local Indicator

0	Without Indicator	**1**	With Digital Indicator

COD. — Process Connections

0	1/4 - 18 NPT (Without Adapter)	**B**	High Side: 1/2 - 14 NPT and Low Side: Remote Seal (With Plug) **(10) (12)**
1	1/2 - 14 NPT With Adapter)	**D**	High Side: Remote Seal (With Plug) and Low Side – 1/2 - 14 NPT **(10) (12)**
2	CF-16 (Only Absolute)	**F**	High Side: 1/2 - 14 NPT and Low Side - Remote Seal (Low Volume Flange) **(10) (12)**
3	Remote Seal (With Plug) **(3) (7) (8)**	**H**	High Side: Remote Seal (Low Volume Flange) and Low Side -1/2 – 14 NPT **(10) (12)**
5	1/2 - 14 NPT Axial with PVDF Insert **(5) (7) (14)**	**Q**	8mm hole without thread. According to DIN 19213 **(13)**
9	Remote Seal (Low Volume Flange **(3) (4) (7) (8)**	**V**	Manifold Valve Integrated to the Transmitter
T	1/2 - 14 BSP (With Adapter) **(6)**	**Z**	User's specification

COD. — Electrical Connections

0	1/2 - 14 NPT **(17)**	**A**	M20 X 1.5 **(17)**
1	3/4 NPT x 1/2 NPT with 316 SST adapter **(18)**	**B**	PG 13.5 DIN **(6)**
2	3/4 BSP x 1/2 NPT with 316 SST adapter **(6)**	**Z**	User's specification
3	1/2 BSP x 1/2 NPT with 316 SST adapter **(6)**		

COD. — Local Adjustment

0	Without Local Indicator	**1**	With Local Indicator

COD. — Mounting Bracket for 2" Pipe or Surface Mounting

0	Without Bracket	**7**	Carbon steel bracket. Accessories: 316 SST
1	Carbon steel bracket and accessories	**9**	L Type, carbon steel bracket. Accessories: 316 SST
2	316 SST bracket and accessories	**Z**	User's specification
5	L type, carbon steel bracket and accessories		
6	L type, 316 SST bracket and accessories		

COD. — Continues next page

LD301	D2	1	I	B	U	1	0	0	1	2	*

⬅ TYPICAL MODEL NUMBER

LD301 — DIFFERENTIAL, FLOW, GAGE, ABSOLUTE AND HING STATIC PRESSURE TRANSMITTER (CONTINUATION)

CODE	Flanges Bolts and Nuts Material
A0	Plated Carbon Steel (Default) **(16)**
A1	316 SST
A2	Carbon Steel according to NACE **(1) (1a)(16)**
A3	SST according to NACE **(1)**
A6	Without Bolts and Nuts
A7	Super Duplex

CODE	Special Procedure
C1	Degrease Cleaning (oxygen or chlorine service)
C5	Assembly Conforming NACE
C6	Test of Overpressure at 380 bar and static pressure at 480 bar (20)

CODE	Flange thread for fixing accessories (adapters, manifolds, mounting brackets, etc.)
D0	7/16" UNF (Default)
D1	DIN19213 M10 X 1.5
D2	DIN19213 M12 X 1.75

CODE	Output Signal
G0	4–20 mA (Default)
G1	0–20 mA (4 wires) (**2**)
G2	0-50 mA
G3	NAMUR NE extended 4-20 mA (Burnout 3.55 to 22.8 mA)

CODE	Housing Material
H0	Aluminum (Default) (IP/TYPE)
H1	316 SST – CF8M (ASTM – A351) IP/TYPE)
H2	Aluminum for saline atmosphere (IPW/TYPEX) **(7)**
H3	316 SST for saline atmosphere (IPW/TYPEX) **(7)**
H4	Copper free Aluminum (IPW/TYPEX) **(7)**

CODE	Identification Plate
I1	FM: XP, IS, NI, DI (USA)
I3	CSA: XP, IS, NI, DI (CANADIAN)
I4	EXAM (DMT): Ex-ia, NEMKO: Ex-d (ATEX-GAS)
I5	CEPEL: Ex-d, Ex-ia (INMETRO – GAS)
I6	Without Certification
I7	EXAM : Ex-ia (ATEX – MINING)
IC	IECEX (MINING)
IE	IECEX (GAS)
IJ	NEMKO: EEx-d
IO	CEPEL: (INMETRO – DUST)
IR	GOST: Ex-d, Ex-ia (RUSSIA)

CODE	PID Configuration
M0	With PID (Default)
M1	Without PID
M3	Factory configured with square root extraction*

CODE	Painting
P0	Gray Munsell N 6.5 Polyester
P1	Safety Blue Epoxy – Immersion Condition **(21)**
P2	Safety Blue Epoxy – Atmospheric Zone **(21)**
P3	Black Polyester
P4	White Epoxy
P7	Beige Epoxy
P8	Without Painting
P9	Blue Safety Epoxy
PC	Blue Safety Polyester
PG	Orange Safety Epoxy
PH	Special Painting

CODE	Manufacturing Standard
S0	SMAR

CODE	LCD Indication
Y0	Percentage (Default)
Y1	Display1: Current – I (mA)
Y2	Display1: Pressure (Eng Unit)
Y3	Display1: Temperature (ºC)
Y4	Display2: Current – I (mA)
Y5	Display2: Pressure (Eng Unit)
Y6	Display2: Temperature (ºC)
YU	According to user – See notes **(4)**

CODE	Tag Plate
J0	With tag, when specified (Default)
J1	Blank

CODE	Special Characteristics
Z0	Standard
ZZ	See Notes *

CODE	Burn Out*
BD	Down Scale
BU	Up Scale

CODE	Performance
L1	High Performance
OP	Standard Performance

CODE	Flange Assembly
R0	Standard
R1	90º Rotated Flange

LD301																

Typical Model Number

Notes

(1) Meets NACE MR-0175 / ISO15156 standard.
(1a) Meets NACE MR-0103.
(2) Not available for absolute models nor vacuum applications.
(3) Not available for range 0 and 1.
(4) Not recommended for vacuum service.
(5) Maximum pressure 24 bar (350 psi).
(6) Options not certified for hazardous locations.
(7) Drain/Vent not applicable.
(8) For remote seal only 316 SST – CF8M flange (thread 7/16 20UNF).
(9) Silicone Oil is not recommended for oxygen (O2) or Chlorine service.
(10) Only available for differential pressure transmitters.
(11) O'Ring should be Viton or Kalrez.
(12) Not available for range 0.
(13) Only available for pressure transmitters D4 or H4, only 316/CF-8M.
(14) Only available for flange with PVDF (Kynar) insert.
(15) Inert Fluid: Safe for oxygen service.
(16) Not applicable for saline atmosphere.
(17) Certification Ex d for FM / ATEX / IECEx / INMETRO.
(18) Certification Ex d for INMETRO.
(19) 316L SST sensors range 0,1,2 has Hastelloy C276 diaphragm.
(20) Only applicable in class H.
(21) Petrobras N1021 Standard.

MODEL	FLANGED PRESSURE TRANSMITTER
LD301	HART®

COD	Range Limits Min.	Range Limits Max.	Min. Span	Unit	Range limits Min.	Range limits Max.	Min. Span	Unit
L2	-50	50	1.25	kPa	-200	200	5	inH_2O
L3	-250	250	2.08	kPa	-36	36	0,3	psi
L4	-2500	2500	20.83	kPa	-360	360	3	psi
L5	-25000	25000	208.3	kPa	-3625	3625	30.2	psi

Note: The range can be extended up to 0.75 LRL and 1.2 URL with small degradation of accuracy. The upper range value must be limited to the flange rating.

COD — Diaphragm material and Fill Fluid (Low Side)

COD			COD			COD			COD		
1	316L SST	Silicone Oil **(2) (20)**	A	Monel 400	Fomblim Oil **(1)**	I	Int.316L SST Gold Plated	Silicone Oil	S	Tantalum	Halocarbon 4.2 **Oil (18)**
2	316L SST	Inert Oil Fluorolube**(3)(18) (20)**	B	Titanium	Silicone Oil	J	Int.316L SST Gold Plated	Fluorolube Oil	T	316L Int Gold Plated	Halocarbon 4.2 Oil
3	Hastelloy C276	Silicone Oil **(1) (2)**	C	Titanium	Inert Oil Fluorolube	K	Monel 400	Krytox Oil **(1)(18)**	U	316L SST Integral	Silicone Oil
4	Hastelloy C276	Inert Oil Fluorolube **(1)(3)(18)**	D	316L SST	Inert Oil Krytox **(18) (20)**	L	Int.316L SST Gold Plated	Krytox Oil	V	316L SST Integral	Fluorolube Oil
5	Monel 400	Silicone Oil **(1) (2)**	E	Hastelloy C276	Inert Oil Krytox (1)**(18)**	M	Monel 400 Gold Plated	Silicone Oil **(1) (2)**	W	316L SST Integral	Krytox Oil
7	Tantalum	Silicone Oil **(2)**	G	Tantalum	Inert Oil Krytox **(18)**	P	Monel 400 Gold Plated	Krytox Oil **(1) (18)**	X	316L SST Integral	Halocarbon 4.2 Oil
8	Tantalum	Inert Oil Fluorolube **(3) (18)**	H	Titanium	Inert Oil Krytox	Q	316L SST	Halocarbon 4.2 **(18)**	Z	Special – See notes	
9	316L SST	Fomblim Oil **(20)**				R	Hastelloy C276	Halocarbon 4.2 **(18)**			

COD — Flange, Adapter and Drain/Vent Valves material (Low Side) (7)

COD		COD	
A	304L SST	F	Monel 400 (Round Bar)
C	Plated CS (Drain/Vent in Stainless Steel) **(19)**	N	316 SST – CF8M (ASTM – A351) (Drain/Vent in Hastelloy C276) **(1)**
H	Hastelloy C276 (CW – 12MW, ASTM – A494) **(1)**		
I	316 SST – CF8M (ASTM – A351)		

COD — Wetted O'Ring Material (Low Side)

COD		COD		Note: O'rings are not available on the sides with remote seals.
0	Without O'Rings	K	Kalrez	
B	Buna-N	T	Teflon	
E	Ethylene - Propylene	V	Viton	

COD — Drain/Vent Position (Low Side)

COD		COD		**Note**: For better Drain/Vent operation, vent valves are strongly recommended. Drain/Vent valve are not available on the sides with remote seals.
0	Without Drain/Vent	D	Bottom	
A	Drain/Vent (Opposite to Process Connection)	U	Top	

COD — Local Indicator

COD		COD	
0	Without Indicator	1	With Digital indicator

COD — Process Connection (Low Side)

COD		COD	
0	1/4 - 18 NPT (Without Adapter)	T	1/2 - 14 BSP (With Adapter)
1	1/2 - 14 NPT (With Adapter)	U	Low Volume Flange For Level **(4)**
3	Remote Seal (With Plug) **(4)**	V	Without Connection (Mounting With Gage Flange) **(4)**
9	Remote Seal (Low Volume Flange) **(3) (4)**	W	Without Connection (Absolut Reference) **(4)**

COD — Electrical Connection

COD		COD	
0	1/2 – 14 NPT **(7)**	A	M20 x 1.5 **(7)**
1	3/4 – 14 NPT (with 316 SST adapter for ½ - 14 NPT) **(7a)**	B	PG 13.5 DIN
2	3/4 – 14 BSP (with 316 SST adapter for ½ - 14 NPT)	Z	User's specification
3	1/2 – 14BSP (with 316 SST adapter for ½ - 14 NPT)		

COD — Zero and Span Adjust

COD	
1	With Adjustment

COD — Process Connection

COD		COD		COD	
U	1" 150 # (ANSI B16.5) **(21)**	C	3" 600 # (ANSI B16.5)	S	JIS 40A 20K **(9) (20)**
V	1" 300 # (ANSI B16.5) **(21)**	3	4" 150 # (ANSI B16.5)	F	JIS 50A 10K **(9) (20)**
W	1" 600 # (ANSI B16.5) **(21)**	4	4" 300 # (ANSI B16.5)	T	JIS 50A 40K **(9) (20)**
O	1.1/2" 150 # (ANSI B16.5)	D	4" 600 # (ANSI B16.5)	K	JIS 50A 20K **(9) (20)**
P	1.1/2" 300 # (ANSI B16.5)	5	DN25 PN 10/40 **(21)**	G	JIS 80A 10K **(9) (20)**
Q	1.1/2" 600 # (ANSI B16.5)	R	DN 40 PN 10/40	L	JIS 80A 20K **(9) (20)**
9	2" 150 # (ANSI B16.5)	E	DN 50 PN 10/40	H	JIS 100A 10K **(9) (20)**
A	2" 300 # (ANSI B16.5)	6	DN 80 PN 10/40	M	JIS 100A 20K **(9) (20)**
B	2" 600 # (ANSI B16.5)	7	DN 100 PN 10/16	Z	User's specification
1	3" 150 # (ANSI B16.5)	8	DN 100 PN 25/40		
2	3" 300 # (ANSI B16.5)				

COD — Type and Flange Material (Level Tap)

COD		COD	
1	316 SST (Integral flange) **(9)**	D	Duplex (UNS S31803/S32205 **(9)**
2	316L SST (Integral Flange)	S	Super Duplex UNS S32750/S32760 **(9)**
3	Hastelloy C276 (Integral Flange) **(9)**	Z	User's specification

COD — Extension Length

COD		COD		COD		Note: Extension Material 316L SST
0	0 mm (0")	2	100 mm (4")	4	200 mm (8")	
1	50 mm (2")	3	150 mm (6")	Z	User's specification	

COD — Diaphragm Material / Extension (Level Tap)

COD		COD	
A	304L SST / 304L SST	5	Titanium / 316L SST **(8)**
1	316L SST / 316L SST	7	316L SST Gold plated **(9)**
2	Hastelloy C276 / 316L SST	L	316L SST Halar Plated
3	Monel 400 / 316L SST **(8)**		
4	Tantalum / 316L SST **(8)**		

COD — Fill Fluid

COD		COD		COD	
1	DC 200 Silicone Oil (2)	4	Krytox 1506 Oil	T	Syltherm 800 Oil
3	DC 704 Silicone Oil (2)	N	Neobee M20		
2	MO – 10 Fluorolube Oil **(6)**	H	Halocarbon 4.2		

COD — Housing Material

COD		COD	
0	Without **(10)**	3	Super Duplex (UNS 32750) **(11)**
1	316 SST	4	Duplex (UNS 31803) **(11)**
2	Hastelloy C276	M	Monel 400

COD — Gasket Material

COD		COD	
0	Without gasket	G	Grafoil (Flexible lead)
T	Teflon (PTFE)	I	316 L SST (RTJ)

COD — Continues Next Page

LD301	L2	1	I	B	U	1	0	0	1	1	2	2	1	1	1	T	*

← TYPICAL MODEL NUMBER

MOD. — FLANGED PRESSURE TRANSMITTER (CONTINUATION)

Bolts and Nuts of Flange / Adapters Material

COD	
A0	Plated CS **(16)**
A1	316 SST
A2	Carbon Steel according to NACE **(1) (1a) (16)**
A3	SST according to NACE **(1)**
A5	Hastelloy C276
A7	Super Duplex SST according to NACE **(1) (1a)**

Special Procedure

COD	
C0	Without special procedure
C1	Degrease Cleaning (oxygen or chlorine service)
C2	For vacuum service
C5	Assembly Conforming NACE

Flange

COD	
D0	SMAR Standard Thread 7/16 UNF
D1	DIN 19213 M10x1,5
D2	DIN 19213 M12x1,75

Output Signal

COD	
G0	4-20 mA
G3	NAMUR NE43 Extended 4-20 mA (Burnout 3.55 and 22.8 mA)

Housing Material

COD	
H0	Aluminum (Default) (IP/TYPE)
H1	316 SST – CF8M (ASTM – A351) IP/TYPE
H2	Aluminum for saline atmosphere (IPW/TYPEX) **(9)**
H3	316 SST for saline atmosphere (IPW/TYPEX) **(9)**
H4	Copper free Aluminum (IPW/TYPEX) **(9)**

Identification Plate

COD	
I1	FM: XP, IS, NI, DI (USA)
I3	CSA: XP, IS, NI, DI (CANADIAN)
I4	EXAM (DMT): Ex-ia, NEMKO: Ex-d (ATEX-GAS)
I5	CEPEL: Ex-d, Ex-ia (INMETRO – GAS)
I6	Without Certification
I7	EXAM: Ex-ia (ATEX – MINING)
IC	IECEX (MINING)
IE	IECEX (GAS)
IJ	NEMKO: EEx-d
IO	CEPEL: (INMETRO – DUST)
IR	GOST: Ex-d, Ex-ia (RUSSIA)

PID Configuration

COD	
M0	With PID (Default)
M1	Without PID

Painting

COD	
P0	Gray Munsell N 6.5 Polyester
P1	Safety Blue Epoxy – Immersion Condition-Petrobras N1021
P2	Safety Blue Epoxy – Atmospheric Zone - Petrobras N1021
P3	Black Polyester
P4	White Epoxy
P7	Beige Epoxy
P8	Without Painting
P9	Blue Safety Epoxy
PC	Blue Safety Polyester
PG	Orange Safety Epoxy
PH	Special Painting

Manufacturing Standard

COD	
S0	SMAR

LCD Indication

COD	
Y0	Percentage (Default)
Y1	Display1: Current – I (mA)
Y2	Display1: Pressure (Eng Unit)
Y3	Display1: Temperature (ºC)
Y4	Display2: Current – I (mA)
Y5	Display2: Pressure (Eng Unit)
Y6	Display2: Temperature (ºC)
YU	According to user – See notes **(4)**

Tag Plate

COD	
J0	With tag
J1	Blank

Special Characteristics

COD	
ZZ	See notes

Burn Out

COD	
BD	Down Scale
BU	Up Scale

Performance

COD	
OP	Standard Performance

Face

COD	
Q0	Face RF (Raised Face)
Q1	Face FF (Flat Face)
Q2	Face RTJ (Ring Joint Face)

Gasket Connection

COD	
U0	1 Con. Flush ¼" NPT (If supplied with gasket)
U1	2 Con. Flush 1/4" NPT at 180º
U3	2 Con. 1/2"-14 NPT at 180º (with cover)
U4	Without Flush connection (without gasket)
U5	1 Con. Flush1/2" NPT

LD301																	

Typical Model Number

NOTES

(1) Meets NACE MR-0175 / ISO15156 standard.
(1a) Meets NACE MR-0103
(2) Silicone Oils not recommendations for Oxygen (O_2) or Chlorine service.
(3) Not applicable for vacuum service.
(4) Drain/Vent not applicable.
(5) For remote seal, flange only in 316/cf-8m thread 7/16-20UNF
(6) Fluorolube fill fluid is not available for Monel diaphragm.
(7) Certification Ex d for FM / ATEX / IECEx / INMETRO.
(7a) Certification Ex d for INMETRO.
(8) Attention, check corrosion rate for the process, AISI 316L extension 3 to 6mm. Diaphragms of Titanium and Monel available only in 0.1 mm, and diaphragms of Tantalum only in 0.075 mm.
(9) Item by inquiry.
(10) Supplied without Gasket.
(11) Without certification for Explosion proof certification or Intrinsically safe..
(12) Limited values to 4 1/2 digits; unit limited to 5 characters.
(13) Degrease cleaning is not available for carbon steel flanges.
(14) Gasket for housing, available only in Stainless 316.
(15) Finishing of the flange faces according to specific standards.
(16) Range of application of temperature from -40 ºC to 150 ºC.
(17) Applicable only to:
- Diameter/capillary length:
2" ANSI B 16.5 DN 50 DIN, JIS 50 A, for seals up to 3 meters of capillary and level models (by inquiry).
3" ANSI B 16.5 DN 80 DIN, JIS 80 A, for seals up to 5 meters of capillary and level models.
4" ANSI B 16.5, DN 100 DIN, JIS 100 A, for seals up to 8 meters and level models.
- Faces: RF and FF;
- Temperature Range: +10 ºC to 100 ºC
+ 101 to 150 º C (by inquiry)

- Not applicable for use with gasket.

(18) Inert Fluid: Oxygen Compatibility, safe for oxygen service.
(19) Not applicable for saline atmosphere.
(20) 316L SST sensors range 0,1,2 has Hastelloy C276 diaphragm.

MODEL	DIFFERENTIAL PRESSURE TRANSMITER WITH SANITARY CONNECTION
LD301S	HART®

COD	Range Limits Min.	Range Limits Max.	Min. Span	Unit	Range Limits Min.	Range Limits Max.	Min. Span	Unit
2	-50	50	1,25	kPa	-200	200	5	inH2O
3	-250	250	2,08	kPa	-36	36	0.3	psi
4	-2500	2500	20,83	kPa	-360	360	3	psi
5	-25000	25000	208,3	kPa	-3625	3625	30,2	psi

Note: The range can be extended up to 0.75 LRL and 1.2 URL with small degradation of accuracy. The Upper range value must be limited by flange rating.

COD	Diaphragm Material and Fill Fluid (Low Side)
1	316L SST Silicone Oil **(2) (17)**
2	316L SST Fluorolube Inert Oil **(3) (13) (17)**
3	Hastelloy C276 Silicone Oil **(1) (2)**
4	Hastelloy C276 Fluorolube Inert Oil **(1) (3) (13)**

COD	Flange, Adapter, and Drain Vent Material (Low Side)
I	CF8M / 316 SST

COD	O-rings Material (Wetted parts – Low side)	COD	
0	Without O-ring	T	Teflon
B	Buna N	V	Viton
E	Ethylene - Propylene		

Note: O-rings are not applicable on remote seal side.

COD	Drain Vent Position (Low side)	COD	
0	Without drain/vent	D	Bottom
A	Drain/Vent (Opposite to process connection)	U	Top

Note: Drain/vent valve is recommended for better operation. Drain/vent valves are not applicable on remote seal side.

COD	Local Indicator
0	Without Indicator
1	With Digital Indicator

COD	Process Connection (Low side)	COD	
0	11/4 - 18 NPT (With Adapter)	V	Without Connection (Gage reference) **(4)**
1	1/2 - 14 NPT (With Adapter)	W	Without Connection (Assembly with Absolute Sensor) **(4)**
3	Remote Seal (With Plug) **(4) (5)**	Z	Special – See notes
9	Remote Seal (Low Volume Flange) **(3)(4)(5)**		
T	1/2 - 14 BSP (With Adapter)		

COD	Electrical Connection	COD	
0	1/2 - 14 NPT **(15)**	A	M20 X 1.5 **(15)**
1	3/4NPT x 1/2NPT (316 adapter) **(16)**	B	PG 13.5 DIN
2	3/4BSP x 1/2NPT (316 adapter)	Z	Special – See notes
3	1/2BSP x 1/2NPT (316 adapter)		

COD	Zero and Span Adjustment
1	With Adjustment

COD	Process Connection and Material (Level Tap)	COD	
1	Thread SMS – 3" **(3)**	I	Tri-Clamp – 3" – With extension
2	Thread RJT – 3" **(3)**	J	Tri-Clamp – 3" HP – With extension **(6)**
3	Thread IDF – 3" **(3)**	K	Thread IDF – 3" – With extension **(3)**
4	Thread IDF – 2" – With extension **(3)**	L	Thread RJT – 3" – With extension **(3)**
5	Thread RJT – 2" – With extension **(3)**	M	Thread SMS – 3" – With extension **(3)**
6	Tri-Clamp – 2" – With extension	N	Tri-Clamp – 2" HP – With extension
7	Thread SMS – 2" – With extension **(3)**	P	Tri-Clamp – 2" HP **(6)**
8	Thread DN25-DIN 11851 – With extension **(3)**	Q	Tri-Clamp – 1 ½" HP
9	Thread DN40-DIN 11851 – With extension **(3)**	R	Tri-Clamp – 3" HP
A	Tri-Clamp DN50 – With extension	S	Thread SMS – 1 1/2" **(3)**
B	Thread IDF – 2" **(3)**	U	Thread DN50-DIN 11851 **(3)**
C	Thread RJT – 2" **(3)**	V	Thread DN50-DIN 11851 – With extension **(3)**
D	Tri-Clamp – 2"	W	Thread DN80-DIN 11851 **(3)**
E	Thread SMS – 2" **(3)**	X	Thread DN80-DIN 11851 – With extension **(3)**
F	Tri-Clamp – 1 ½	Y	According to special Option
G	Tri-Clamp – 3"	Z	Special – See notes
H	Thread DN40-DIN 11851 **(3)**		

COD	Diaphragm Material (Level Tap)
H	Hastelloy C276
I	316L SST

COD	Fill Fluid
D	Silicone DC-704 Oil
F	Fluorolube MO-10 Oil **(3)**
N	Neobee Max. 200ºC
S	Silicone DC-200/20 Oil Max. 150ºC
T	Sytherm 800 Oil
Z	Special – See notes

COD	O-rings Material (Level Tap)
0	Without O-ring
B	Buna N
T	Teflon
V	Viton
Z	Special – See notes

COD	Tank Adapter
0	No (Supplied by Client)
1	316L SST Tank Adapter
Z	Special – See notes

COD	Tri-Clamp
0	Without Tri-Clamp
2	304 SST Tri-Clamp
Z	Special – See notes

COD	Continues next page

LD301																

LD301S — DIFFERENTIAL PRESSURE TRANSMITER WITH SANITARY CONNECTION (CONTINUATION)

Bolts, Nuts AND Adapters Material

COD	
A0	Carbon Steel **(16)**
A1	316 SST
A2	CS compatible with NACE **(1) (1a) (16)**
A3	SST compatible with NACE **(1)**
A6	Without bolts and nuts of Flange/Adapter
A7	Super Duplex SST according to NACE **(1) (1a)**

Special Procedure

COD	
C0	Without special procedure
C1	Cleaning for use in oxygen/hydrogen peroxide/chlorine
C2	For vacuum service
C5	Assembly Conforming NACE

Flange

COD	
D0	SMAR Standard Thread 7/16 UNF
D1	DIN 19213 - M10x1,5
D2	DIN 19213 - M12x1,75

Output Signal

COD	
G0	4-20 mA
G3	NAMUR NE43 Extended 4-20 mA (Burnout 3.55 and 22.8 mA)

Housing Material

COD	
H0	Aluminum (Default) (IP/TYPE)
H1	316 SST – CF8M (ASTM – A351) IP/TYPE)
H2	Aluminum for saline atmosphere (IPW/TYPEX) **(9)**
H3	316 SST for saline atmosphere (IPW/TYPEX) **(9)**
H4	Copper free Aluminum (IPW/TYPEX) **(9)**

Identification Plate

COD		COD	
I1	FM: XP, IS, NI, DI (USA)	I7	EXAM: Ex-ia (ATEX – MINING)
I3	CSA: XP, IS, NI, DI (CANADIAN)	IC	IECEX (MINING)
I4	EXAM (DMT): Ex-ia, NEMKO: Ex-d (ATEX-GAS)	IE	IECEX (GAS)
I5	CEPEL: Ex-d, Ex-ia (INMETRO – GAS)	IJ	NEMKO: EEx-d
I6	Without Certification	IO	CEPEL: (INMETRO – DUST)
		IR	GOST: Ex-d, Ex-ia (RUSSIA)

PID Configuration

COD	
M0	With PID (Standard)
M1	Without PID

Painting

COD		COD	
P0	Gray Munsell N 6.5 Polyester	P8	Without Painting
P1	Safety Blue Epoxy – Immersion Condition-Petrobras N1021	P9	Blue Safety Epoxy
P2	Safety Blue Epoxy – Atmospheric Zone - Petrobras N1021	PC	Blue Safety Polyester
P3	Black Polyester	PG	Orange Safety Epoxy
P4	White Epoxy	PH	Special Painting
P7	Beige Epoxy		

Manufacturing Standard

COD	
S0	SMAR

LCD Indication

COD		COD	
Y0	Percentage (Default)	Y4	Display2: Current – I (mA)
Y1	Display1: Current – I (mA)	Y5	Display2: Pressure (Eng Unit)
Y2	Display1: Pressure (Eng Unit)	Y6	Display2: Temperature (ºC)
Y3	Display1: Temperature (ºC)	YU	According to user – See notes **(4)**

Tag Plate

COD		COD	
J0	With tag	J1	Blank

Special Characteristics

COD	
ZZ	See notes*

Burn Out*

COD		COD	
BD	Down Scale	BU	Up Scale

Performance

COD	
OP	Standard Performance

Process Connection and Material (Level Tap)

COD	
K0	Without process connection and Special Material
K1	Tri-Clamp 2" DIN 11864-3 no/ext/ AI 316L
K2	Varivent 68

LD301																

Typical Model Number

Note

(1) Meets NACE MR-0175 / ISO15156 standard.
(1a) Meets NACE MR-0103.
(2) Silicone oil not recommended for Oxygen (O2) or Chlorine Service.
(3) Not applicable for vacuum service.
(4) Drain/Vent not applicable.
(5) For remote seal is only available flange in 316 Stainless Steel - CF8M (ASTM A351) (thread 7/16).
(6) HP – High Pressure.
(7) Options not certified for hazardous locations.
(8) Not available for Tri-clamp.
(9) Without certification for explosion proof or intrinsically safe.
(10) Limited values to 4 1/2 digits; limited unit to 5 characters.
(11) Degrease cleaning is not available for Carbon Steel Flanges.
(12) Temperature application range: -40 to 140 °C.
(13) The inert fluid guarantees safety for Oxygen (O_2) service.
(14) Not applicable for saline atmosphere.
(15) Certification Ex d for FM / ATEX / IECEx / INMETRO.
(16) Certification Ex d for INMETRO.
(17) 316L SST sensors range 0,1,2 has Hastelloy C276 diaphragm.

Appendix A

CERTIFICATIONS INFORMATION

European Directive Information

Consult www.Smar.com for the EC declarations of conformity and certificates.

Authorized representative/importer located within the Community:
Smar Europe BV De Oude Wereld 116 2408 TM Alphen aan den Rijn Netherlands

ATEX Directive 2014/34//EU - "Equipment for explosive atmospheres" (applicable from 20 April 2016)
The EC-Type Examination Certificate is released by DNV GL Presafe AS (CE2460) and DEKRA EXAM GmbH (CE0158).
Designated certification body that monitors manufacturing and released QAN (Quality Assurance Notification) and QAR (Quality Assessment Report) is Nemko AS (CE0470).

LVD Directive 2014/35/EU – "Low Voltage" (applicable from 20 April 2016)
According the LVD directive Annex II, electrical equipment for use in an explosive atmosphere is outside the scope of this directive.
According to IEC standard: IEC 61010-1:2010 - Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements.

PED Directive 2014/68/EU - "Pressure Equipment" (applicable from 19 July 2016)
This product is in compliance with Article 4 paragraph 3 of the Pressure Equipment Directive 2014/68/EU and was designed and manufactured in accordance with the sound engineering practice. This equipment cannot bear the CE marking related to PED compliance. However, the product bears the CE marking to indicate compliance with other applicable European Community Directives.

ROHS Directive 2011/65/EU - "Restriction of the use of certain hazardous substances in electrical and electronic equipment"
According ROHS directive Article 2, paragraph 2, member states shall provide that EEE that was outside the scope of Directive 2002/95/EC, but which would not comply with this Directive, may nevertheless continue to be made available on the market until 22 July 2019.

EMC Directive 2014/30/EU - "Electromagnetic Compatibility" (applicable from 20 April 2016)
For products evaluation the standard IEC 61326-1:2013 were consulted and to comply with the EMC directive the installation must follow these special conditions:
Use shielded, twisted-pair cable for powering the instrument and signal wiring.
Keep the shield insulated at the instrument side, connecting the other one to the ground.

Hazardous locations general information

Ex Standards:
IEC 60079-0 General Requirements
IEC 60079-1 Flameproof Enclosures "d"
IEC 60079-7 Increased Safe "e"
IEC 60079-11 Intrinsic Safety "i"
IEC 60079-18 Encapsulation "m"
IEC 60079-26 Equipment with equipment protection level (EPL) Ga
IEC 60079-31 Equipment dust ignition protection by enclosure "t"
IEC 60529 Classification of degrees of protection provided by enclosures (IP Code)
IEC 60079-10 Classification of Hazardous Areas
IEC 60079-14 Electrical installation design, selection and erection
IEC 60079-17 Electrical Installations, Inspections and Maintenance
ISO/IEC80079-34 Application of quality systems for equipment manufacture

Warning:
Explosions could result in death or serious injury, besides financial damage.
Installation of this instrument in hazardous areas must be in accordance with the local standards and type of protection. Before proceedings with installation make sure that the certificate parameters are in accordance with the classified hazardous area.

Maintenance and Repair
The instrument modification or replaced parts supplied by any other supplier than authorized representative of Smar is prohibited and will void the Certification.

Marking Label
The instrument is marked with type of protection options. The certification is valid only when the type of protection is indicated by the user. Once a particular type of protection is installed, do not reinstall it using any other type of protection.

Instrinsic Safety / Non Incendive application
In hazardous areas with intrinsic safety or or non-incendive requirements, the circuit entity parameters and applicable installation procedures must be observed.
The instrument must be connected to a proper intrinsic safefy barrier. Check the intrinsically safe parameters involving the barrier and equipment including the cable and connections. Associated apparatus ground bus shall be insulated from panels and mounting enclosures. Shield is optional, when using shielded cable, be sure to insulate the end not grounded.
Cable capacitance and inductance plus Ci and Li must be smaller than Co and Lo of the Associated Apparatus.
It is recommended do not remove the housing covers when powered on.

Explosionproof / Flameproof application
Only use Explosionproof/Flameproof certified Plugs, Adapters and Cable glands.
The electrical connections entries must be connected using a conduit with sealed unit or closed using metal cable gland or metal blanking plug with at least IP66.
Do not remove the housing covers when powered on.

Enclosure
The electronic housing and sensor threads installed in hazardous areas must have a minimum of 6 fully engaged threads.
The covers must be tightening with at least 8 turns, to avoid the penetration of humidity or corrosive gases, and until it touches the housing. Then, tighten more 1/3 turn (120º) to guarantee the sealing.
Lock the housing and covers using the locking screw.

Degree of Protection of enclosure (IP)
IPx8: Second numeral meaning continuous immersion in water under special condition defined as 10m for a period of 24 hours (Ref: IEC60529).
IPW/ TypeX: Supplementary letter W or X meaning special condition defined as saline environment tested in saturated solution of NaCl 5% w/w at 35ºC for a period of 200 hours (Ref: NEMA 250/ IEC60529).
For enclosure with IP/IPW/TypeX applications, all NPT threads must apply a proper water-proof sealant (a non-hardening silicone group sealant is recommended).

Hazardous Locations Approvals

CSA (Canadian Standards Association)

Class 2258 02 – Process Control Equipment – For Hazardous Locations (CSA1111005)
Class I, Division 1, Groups B, C and D
Class II, Division 1, Groups E, F and G
Class III, Division 1
Class I, Division 2, Groups A, B, C and D
Class II, Division 2, Groups E, F and G
Class III

Class 2258 03 – Process Control Equipment – Intrinsically Safe and Non-Incendive Systems – For Hazardous Locations (CSA 1111005)
Class I, Division 1, Groups A, B, C and D
Class II, Division 1, Groups E, F and G
Class III, Division 1
Model LD301 Series Pressure Transmitters, supply 12 – 42Vdc, 4-20mA; Maximum pressure 5800 psi; Enclosure Type 4/4X; intrinsically safe when connected through CSA Certified Diode Safety Barrier, 28V max, 300 ohms min, per Smar Installation Drawing 102A0435; Dual Seal.

Class 2258 04 – Process Control Equipment – Intrinsically Safe Entity – For Hazardous Locations (CSA 1111005)
Class I, Division 1, Groups A, B, C and D
Class II, Division 1, Groups E, F and G
Class III, Division 1

Model LD290 Series Pressure Transmitters, supply 12 – 42Vdc, 4-20mA; Maximum pressure 3600 psi; Enclosure Type 4/4X; intrinsically safe with Entity parameters:
Vmax = 28 V, Imax = 110 mA, Ci = 5 nF, Li = 0 uH,
when connected through CSA Certified Safety Barriers as per Smar Installation Drawing 102A0435; Dual Seal.
Note: Only models with stainless steel external fittings are Certified as Type 4X.
Maximum Working Pressure: 5800psi
Ambient Temperature: 40ºC (-20 to 40 ºC)
Dual Seal (Process)

Drawing
102A-0435, 102A-1316, 102A-1443

FM Approvals (Factory Mutual)

FM 3V1A6.AX / FM 0X3A8.AE
XP Class I Division 1, Groups A, B, C, D
DIP Class II, Class III Division 1, Groups E, F, G
IS Class I, II, III Division 1, Groups A, B, C, D, E, F G
NI Class I, Division 2, Groups A, B, C, D; NIFW
T4; Ta = -25°C < Ta < 60°C; Type 4, 4X, 6

Electrical parameters: 30Vdc
Entity Parameters/Nonincendive Field Wiring Parameters:
Supply terminals: Vmax = 30 V dc, Imax = 110 mA, Ci = 5nf, Li = 0

Special conditions for safe use:
The enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be taken during installation and use to prevent impact or friction.

Overpressure Limits: 5800 psi (report 3024465)
The range H2 to H5 are similar to D2 to D5, the H ranges are differential type with high static pressure feature.
The ranges H, A5, A6, M5 and M6 need parback for correct and safe operation.

Drawing
38A-2075, 102A-1216, 102A-1339, 102A-1638, 102A-1639, 102A-2125, 102A-2126

ATEX DNV GL Presafe A/S

Explosion Proof (PRESAFE 18 ATEX 12410X)
II 2 G Ex db IIC T6 Gb
Ta -20 ºC to +60 ºC
Options: IP66/68W or IP66/68

Special Conditions for Safe Use
Repairs of the flameproof joints must be made in compliance with the structural specifications provided by the manufacturer. Repairs must not be made on the basis of values specified in tables 1 and 2 of EN/IEC 60079-1.

The Essential Health and Safety Requirements are assured by compliance with:
EN 60079-0:2012/A11:2013 General Requirements
EN 60079-1:2014 Flameproof Enclosures “d”

Drawing
102A-1313, 102A-1491

IECEx DNV GL Presafe A/S

Explosion Proof (IECEx PRE 18.0031X)
Ex db IIC T6 Gb
Ta -20 ºC to +60 ºC
Options: IP66/68W or IP66/68

Special Conditions for Safe Use
Repairs of the flameproof joints must be made in compliance with the structural specifications provided by the manufacturer. Repairs must not be made on the basis of values specified in tables 1 and 2 of EN/IEC 60079-1.

The Essential Health and Safety Requirements are assured by compliance with:
IEC 60079-0:2011 General Requirements
IEC 60079-1:2014-06 Equipment protection by flameproof enclosures “d”

Drawing
102A-2107, 102A-2108

ATEX EXAM (BBG Prüf - und Zertifizier GmbH)

Intrinsic Safety (DMT 00 ATEX E 009)
I M1 Ex ia I Ma
II 1/2 G Ex ia IIC T4/T5/T6 Ga/Gb

Supply and signal circuit intended for the connection to an intrinsically safe 4-20mA current loop:
Ui = 28 Vdc, Ii = 93 mA, Ci ≤ 5 nF, Li = Neg

Maximum Permissible power:

Max. Ambient temperature Ta	Temperature Class	Power Pi
85ºC	T4	700 mW
75ºC	T4	760 mW
44ºC	T5	760 mW
50ºC	T5	700 mW
55ºC	T5	650 mW
60ºC	T5	575 mW
65ºC	T5	500 mW
70ºC	T5	425 mW
40ºC	T6	575 mW

Ambient Temperature: -40ºC ≤ Ta ≤ + 85ºC

The Essential Health and Safety Requirements are assured by compliance with:
EN 60079-0:2018 General Requirements
EN 60079-11:2012 Intrinsic Safety “i”
EN 60079-26:2015 Equipment with equipment protection level (EPL) Ga

Drawing
102A-1313, 102A-1491, 102A-1465, 102A-1521

IECEx EXAM (BBG Prüf - und Zertifizier GmbH)

Intrinsic Safety (IECEx BVS 19.0015)
Ex ia I Ma
Ex ia IIC T4/T5/T6 Ga/Gb
Supply and signal circuit intended for the connection to an intrinsically safe 4-20 mA current loop
Ui = 28 Vdc, Ii = 93 mA, Ci ≤ 5 nF, Li = Neg

Maximum Permissible power:

Max. Ambient temperature Ta	Temperature Class	Power Pi
85ºC	T4	700 mW
50ºC	T5	700 mW
55ºC	T5	650 mW
60ºC	T5	575 mW
65ºC	T5	500 mW
70ºC	T5	425 mW
40ºC	T6	575 mW

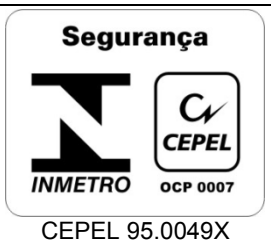
Ambient Temperature: -40ºC ≤ Ta ≤ + 85ºC

The Essential Health and Safety Requirements are assured by compliance with:
IEC 60079-0:2017 General Requirements
IEC 60079-11:2011 Intrinsic Safety “i”
IEC 60079-26:2014 Equipment with equipment protection level (EPL) Ga

Drawing
102A-2107, 102A-2108, 102A-2138, 102A-2139

CEPEL (Centro de Pesquisa de Energia Elétrica)

Segurança Intrinseca (CEPEL 95.0049X)

<table>
<tr><td colspan="5"> 

CEPEL 95.0049X
Ex ia IIC T5 Ga
Ex ia IIIC T100 ºC Da</td></tr>
<tr><td colspan="3">IP66W/IP68W</td><td colspan="2">IP66/IP68</td></tr>
<tr><td colspan="3">(aço inox e aluminio Copper Free)</td><td colspan="2">(aluminio)</td></tr>
<tr><td>Ui = 30 V</td><td>Ii = 100 mA</td><td>Pi = 0,7 W</td><td>Ci = 6,4 nF</td><td>Li = desp</td></tr>
<tr><td colspan="5">T_{amb}: -20 °C a +50 °C</td></tr>
</table>

Prova de Explosão (CEPEL 96.0039)

<table>
<tr><td colspan="3"> 

CEPEL 96.0039
Ex d IIC T6 Gb
Ex tb IIIC T85 ºC Db</td></tr>
<tr><td>IP66W/IP68W</td><td>IP66/IP68</td></tr>
<tr><td>(aço inox e aluminio Copper Free)</td><td>(aluminio)</td></tr>
<tr><td colspan="2">T_{amb}: -20 °C a +40 °C</td></tr>
</table>

Observações:
- O número do certificado é finalizado pela letra “X” para indicar que para a versão do Transmissor de pressão, intrinsecamente seguro, modelo LD301 equipado com invólucro fabricado em liga de alumínio, somente pode ser instalado em “Zona 0”, se durante a instalação for excluído o risco de ocorrer impacto ou fricção entre o invólucro e peças de ferro/aço.
- O produto adicionalmente marcado com a letra suplementar "W" indica que o equipamento foi ensaiado em uma solução saturada a 5% de NaCl p/p, à 35 °C, pelo tempo de 200 h e foi aprovado para uso em atmosferas salinas, condicionado à utilização de acessórios de instalação no mesmo material do equipamento e de bujões de aço inoxidável ASTM-A240, para fechamento das entradas roscadas não utilizadas. Os materiais de fabricação dos equipamentos aprovados para letra "W" são: aço inoxidável AISI 316 e alumínio Copper Free SAE 336 pintados (Procedimento P-CQ-FAB764-09) com tinta Resina Poliéster ou Resina Epoxy com espessura da camada de tinta de 70 a 150 µm e 120 a 200 µm, respectivamente, ou pintados com o plano de pintura P1 e P2 (Procedimento P-CQ-FAB-765-05) com tinta Resina Epoxy ou Poliuretano Acrílico Alifático com espessura de camada de tinta de 290 µm a 405 µm e 185 µm a 258 µm, respectivamente.
- Os planos de pintura P1 e P2 são permitidos apenas para equipamento fornecido com plaqueta de identificaçao com marcação para grupo de gases IIB.
- O grau de proteção IP68 só é garantido se nas entradas roscadas de ½” NPT for utilizado vedante não endurecível à base de silicone conforme Procedimento P-DM-FAB277-06.
- O segundo numeral oito indica que o equipamento foi ensaiado para uma condição de submersão de dez metros por vinte e quatro horas. O acessório deve ser instalado em equipamentos com grau de proteção equivalente.
- Equipamentos com tipo de proteção Ex d aprovados para categoria Gb, não podem ter o sensor de pressao instalados em processos industriais classificadas como "Zona 0".
- As atividades de instalação, inspeção, manutenção, reparo, revisão e recuperação dos equipamentos são de responsabilidade dos usuários e devem ser executadas de acordo com os requisitos das normas técnicas

vigentes e com as recomendações do fabricante.

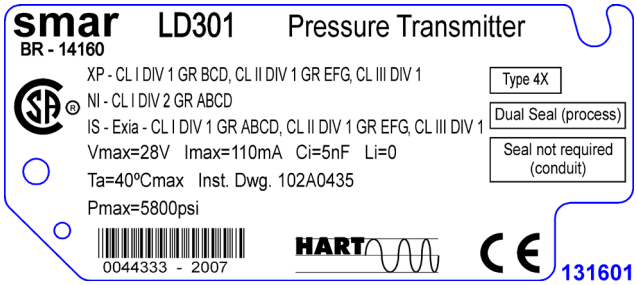
Normas Aplicáveis:
ABNT NBR IEC 60079-0:2013 Atmosferas explosivas - Parte 0: Equipamentos – Requisitos gerais
ABNT NBR IEC 60079-1:2016 Atmosferas explosivas - Parte 1: Proteção de equipamento por invólucro à prova de explosão “d”
ABNT NBR IEC 60079-11:2013 Atmosferas explosivas - Parte 11: Proteção de equipamento por segurança intrínseca "i"
ABNT NBR IEC 60079-26:2016 Equipamentos elétricos para atmosferas explosivas - Parte 26: Equipamentos com nível de proteção de equipamento (EPL) Ga
ABNT NBR IEC 60079-31:2014 Atmosferas explosivas - Parte 31: Proteção de equipamentos contra ignição de poeira por invólucros “t”
ABNT NBR IEC 60529:2017 Graus de proteção para invólucros de equipamentos elétricos (Código IP)

Desenhos

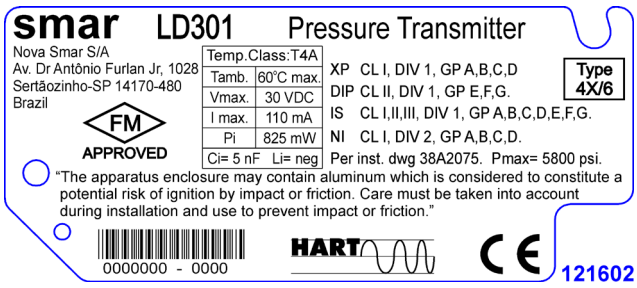
102A1374	LD301 Plaqueta de Identificação CEPEL IP66/68
102A1254	LD301 Plaqueta de Identificação CEPEL IP66W/68w
102A2032	LD301 Plaqueta de Identificação CEPEL IP66/68 IIB P1/P2
102A2031	LD301 Plaqueta de Identificação CEPEL IP66W/68W IIB P1/P2
102A2088	LD301 Plaqueta de Identificação CEPEL IP66 POEIRA

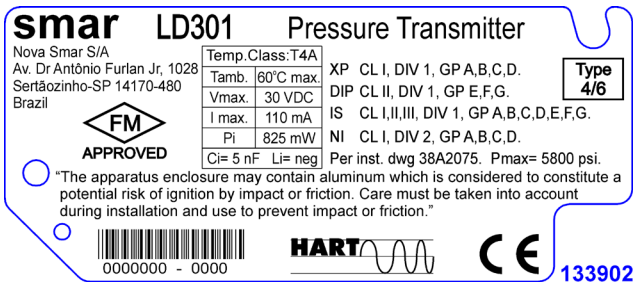
Identification Plates and Control Drawings

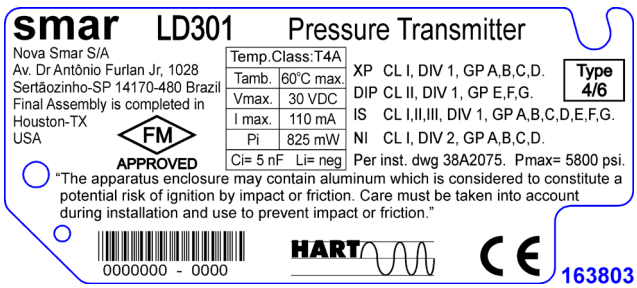
CSA (Canadian Standards Association)

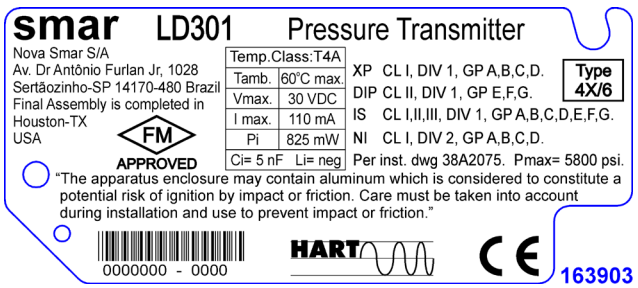


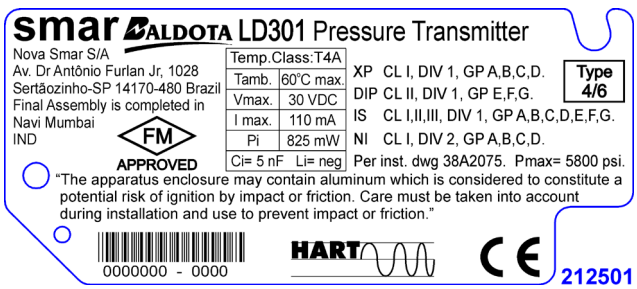
FM Approvals (Factory Mutual)

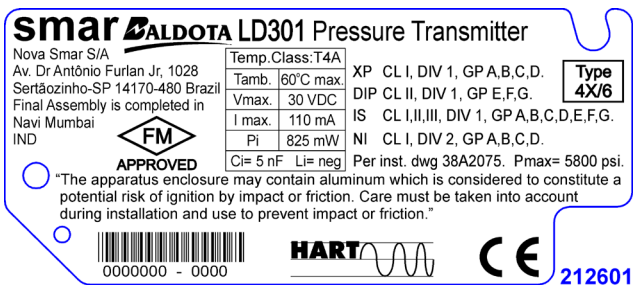




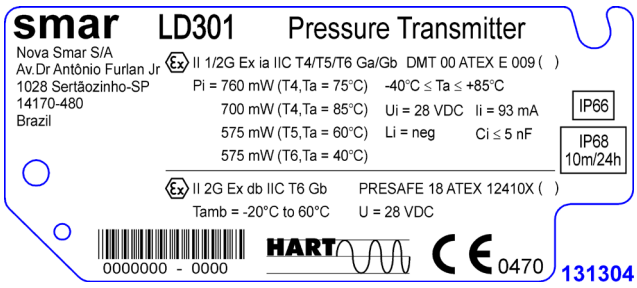


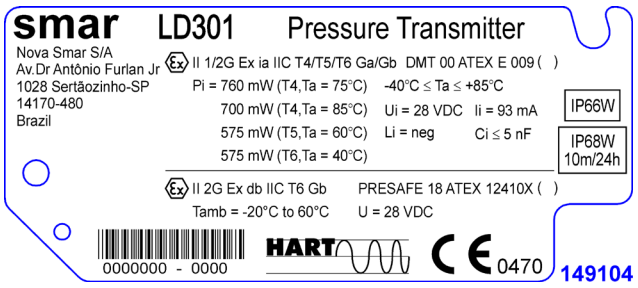


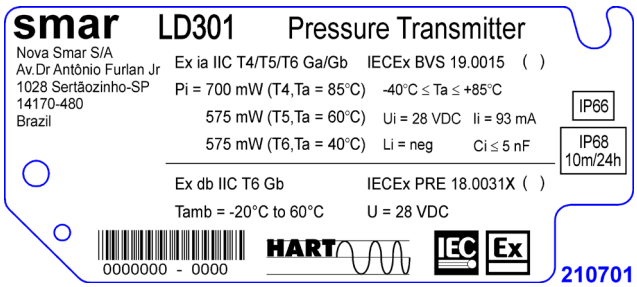


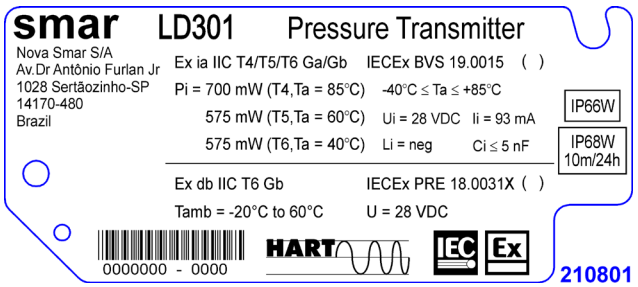


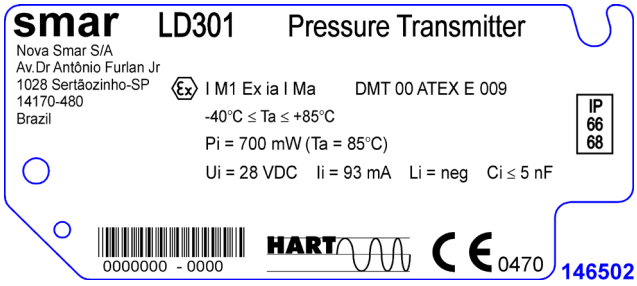
DNV GL Presafe A/S / EXAM (BBG Prüf - und Zertifizier GmbH)

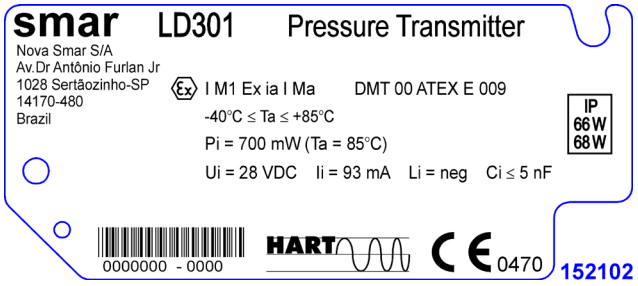


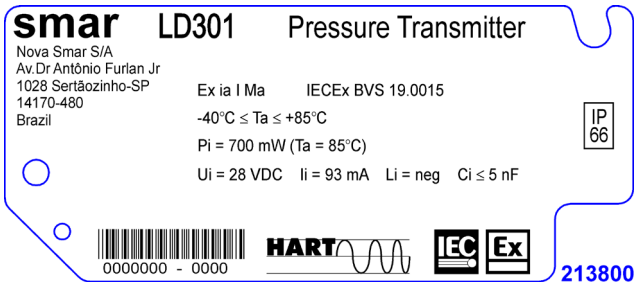


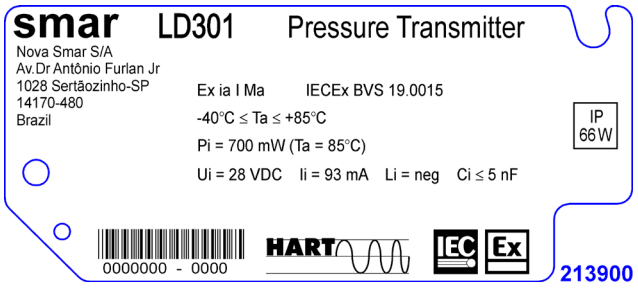




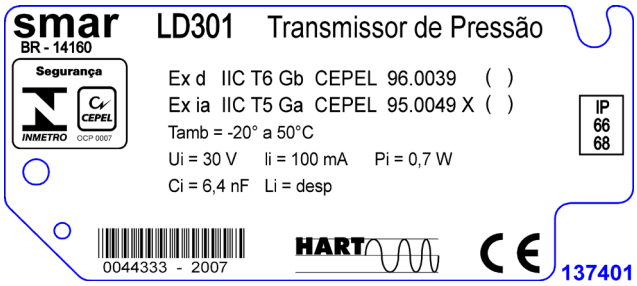


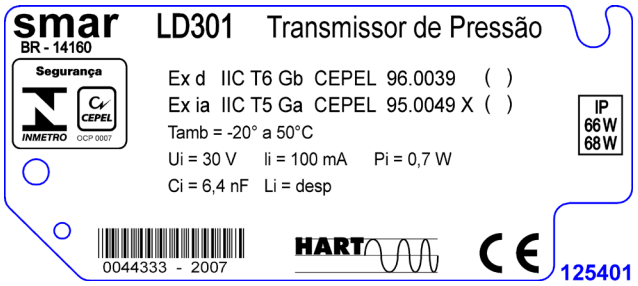


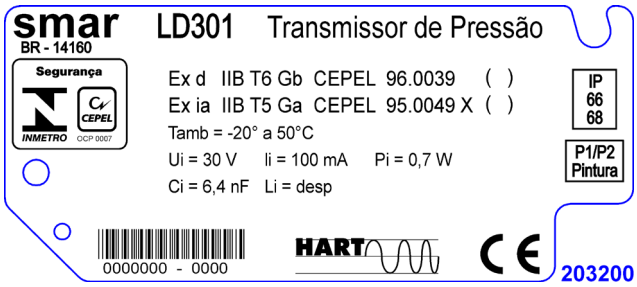


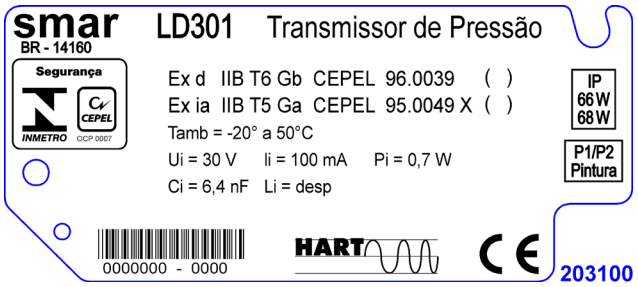


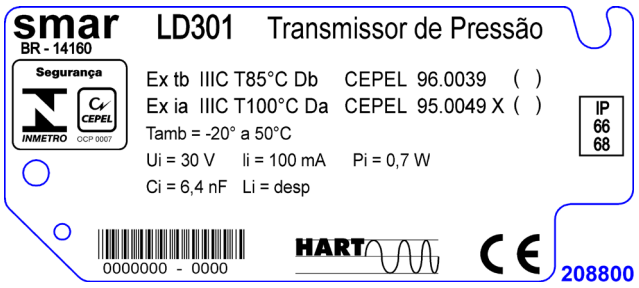
CEPEL (Centro de Pesquisa de Energia Elétrica)



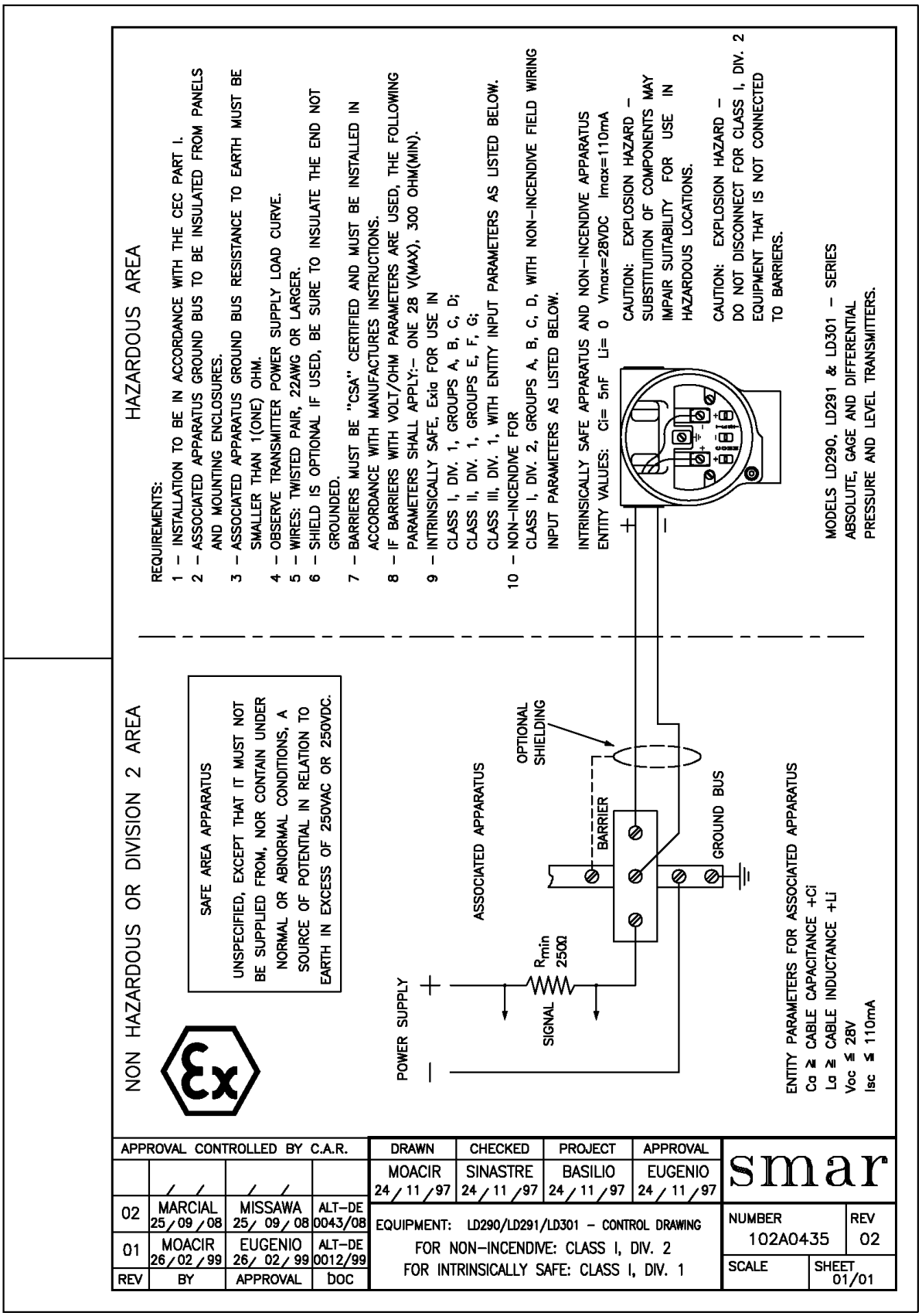




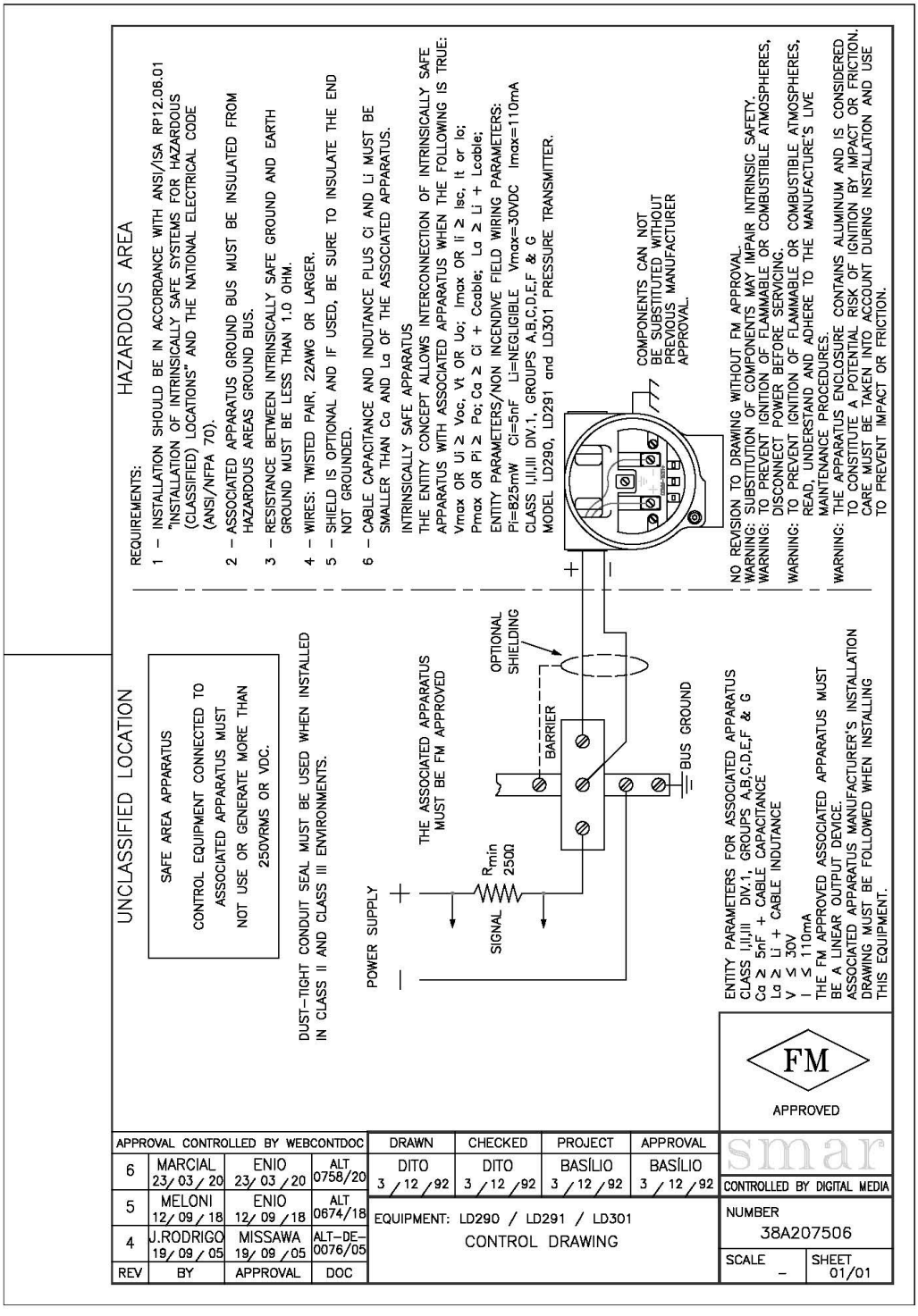



smar
BR - 14160
LD301 Transmissor de Pressão
Segurança
INMETRO
CEPEL
CCP 0007
Ex tb IIIC T85°C Db CEPEL 96.0039 ( )
Ex ia IIIC T100°C Da CEPEL 95.0049 X ( )
Tamb = -20° a 50°C
Ui = 30 V Ii = 100 mA Pi = 0,7 W
Ci = 6,4 nF Li = desp
IP
66
68
0000000 - 0000
HART
208800

Canadian Standards Association (CSA)



FM Approvals (Factory Mutual)



Appendix B

smar	SRF – Service Request Form Pressure Transmitters	Proposal No.: (1)

Company:	Unit:	Invoice:

COMMERCIAL CONTACT		CUSTUMER CONTACT	
Full Name:		Full Name:	
Function:		Function:	
Phone:	Extension:	Phone:	Extension:
Fax:		Fax:	
Email:		Email:	

EQUIPMENT DATA

Model:	Serial Number:	Sensor Number:

Technology: ( ) 4-20 mA ( ) HART® ( ) HART® SIS ( ) WIRELESSHART® ( ) ISP ( ) FOUNDATION™ fieldbus ( ) PROFIBUS PA	Firmware Version:

PROCESS DATA

Process Fluid:

Calibration Range (4)		Ambient Temperature (ºF)		Process Temperature (ºF)	
Min.:	Max.:	Min.:	Max.:	Min.:	Max.:

Process Pressure (4)		Static Pressure (4)		Vacuum (4)		Application (3)
Min.:	Max.:	Min.:	Max.:	Min.:	Max.:	( ) Transmitter ( ) Repeater

Normal Operation Time:	Failure Date:

FAILURE DESCRIPTION

(Please, describe the failure. Can the error be reproduced? Is it repetitive?

Did device detect the fail? (2) ( ) Yes ( ) No	What is the final value of the current? (2) _____ mA	What is the message in the display? (2)

MAINTENANCE INFORMATION

Did you allow the firmware upgrade? ( ) Yes ( ) No	Certification plate: Will certification be maintained? ( ) Yes ( ) No

Main board configuration:
( ) Original factory configuration ( ) Default configuration
( ) Special configuration (should be informed by the client. Please, use the space below)

OBSERVATIONS

SUBMITTER INFORMATION

Company:

Submitted by: Title: Section:

Phone: Extension: E-mail:

Date: Signature:

For warranty or non-warranty repair, please contact your representative.
Further information about address and contacts can be found on www.smar.com/contactus.asp.

NOTE

(1) This field should be filled out by the Smar. **(2)** Required for SIS devices.	**(3)** Required for WirelessHART® devices. **(4)** Required to specify the pressure unit.