

# MANUAL

INSTALLATION | OPERATION | MAINTENANCE

## SMART PRESSURE TRANSMITTER LD400



**HART**  
COMMUNICATION PROTOCOL



MAR/24 - VERSION 2

**smar**  
Technology Company

# LD400

Smart Pressure Transmitter



Consult our  
subsidiary



Rua Dr. Antônio Furlan Junior, 1028 - Sertãozinho, SP - CEP: 14170-480  
insales@smar.com.br | +55 (16) 3946-3599 | [www.smar.com](http://www.smar.com)

© Copyright 2022, Nova Smar S/A. All rights reserved. March 2022.  
Specifications and information are subject to change.  
Updated addresses are available on our website.

**smar**  
Technology Company

# INTRODUCTION

LD400 HART® is a Smart Pressure Transmitter for differential, absolute, gauge, level, and flow measurements.

✓ **Differential Transmitter – LD400D and LD400H**

This model measures the differential pressure applied in the sensor. Normally, both sides of the sensor are connected to the process and if the selected output function is linear, the measurement is the differential pressure.

✓ **Flow Transmitter – LD400D and LD400H**

The differential pressure is generated by a flow primary element and the square root function provides the measurement flow.

✓ **Gauge Pressure Transmitter – LD400M**

This model has the Lower Side Input connected to a blind flange and open to atmosphere. Therefore, this model measures the pressure relative to atmosphere and the output function can be linear or linearized by the linearization table.

✓ **Absolut Pressure Transmitter - LD400A**

The pressure is measured on the high side of the sensor and on the low side there is a vacuum chamber, which is the absolute zero reference for the capacitive cell.

✓ **Level Transmitter – LD400L**

This model is available as a flange mounted unit with a flush diaphragm for direct installation on vessels. Extended diaphragms are also available.

✓ **Level Transmitter with Insertion Probe – LD400I**

The LD400I model is a gauge pressure transmitter with an extended probe for measurement in non-pressurized tanks. A probe, in several lengths, with a sensor in its ends, is immersed in the process fluid, providing the level of the liquid in the tank.

✓ **Sanitary Transmitter – LD400S**

The sanitary transmitter was specially developed to work in the food industry and in applications that require sanitary connections. Its use allows for quick and easy maintenance and cleaning.

✓ **In-line Gauge Pressure Transmitter – LD400G**

This model uses the Low-Cost Differential Capacitive Sensor with the Lower Side Input opened to atmosphere. Therefore, this model measures the pressure relative to atmosphere and the output function can be linear or linearized by the linearization table.

The LD400 series use HART® technology. These instruments can be configured through Smar configuration software or other suppliers. The local adjustment is enabled for all the LD400 series. With magnetic tools is possible to configure the zero and the span, to alter the measurement range, to alter the unit of measured pressure, to select the square root function, to operate the totaled value or to enable the control loop.

With the AssetView from Smar it is possible to do the diagnoses management field's instrument to aid in the reactive, preventive, predictive and proactive maintenance.

## **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.

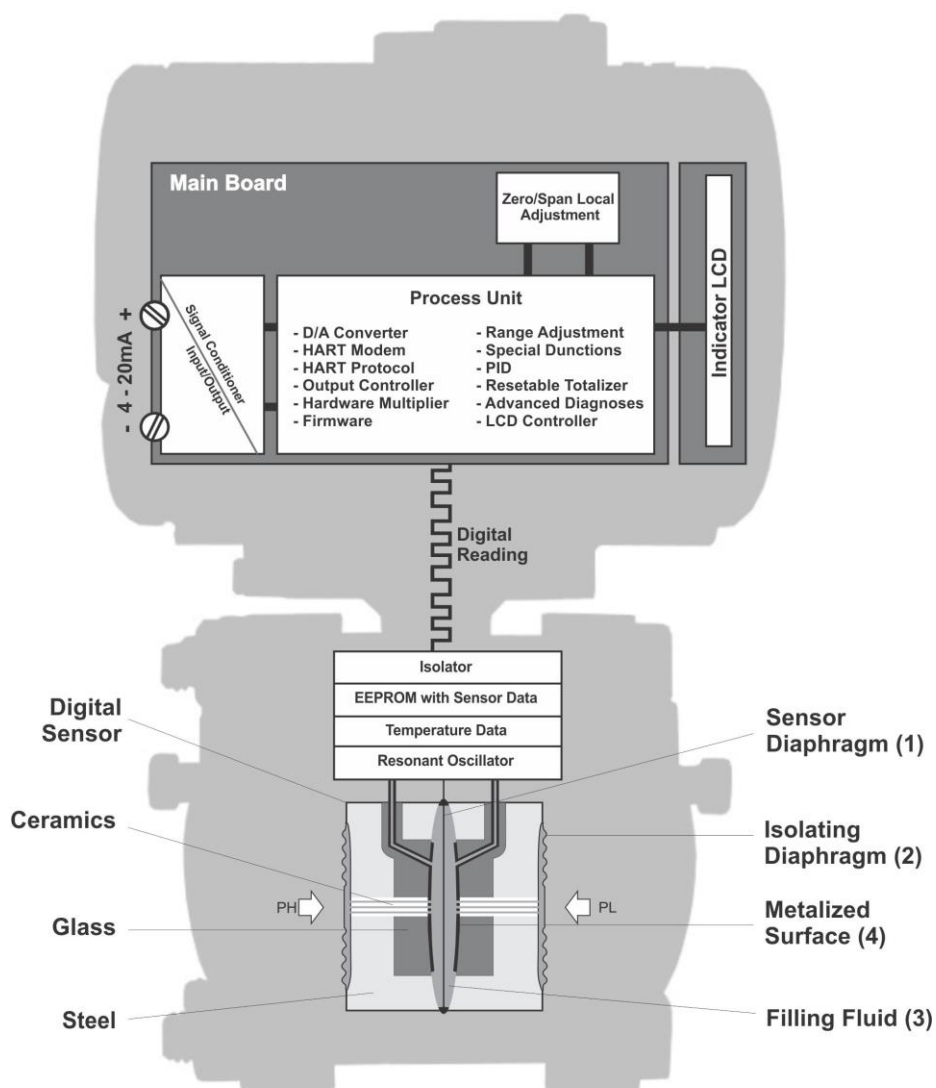
The field equipment referred to in this manual, when acquired for classified or hazardous areas, has its certification void when having its parts replaced or interchanged without functional and approval tests by Smar or any of Smar authorized dealers, which are the competent companies for certifying 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.



# TRANSMITTER GENERAL VIEW

The LD400 HART® uses a highly proven technique for pressure measuring by capacitance reading. The block diagram of the LD400 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 process and supply 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 stable electrodes. A deflection on the sensor diaphragm is read by the capacitance variation between both stable and mobile electrodes.

The resonance oscillator reads the capacitance variations between the mobile and the stable 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, any errors or deviations are eliminated during the process. Temperature compensation is done by a sensor, which combined with a precision sensor, results in a high accuracy and small range measurement.

The process variable, as well as the diagnostic monitoring and information, are supplied by the digital communication protocol. The LD400 is available with the HART® communication protocol.

Read carefully these instructions for better use of the LD400 HART®. Smar pressure transmitters are protected by American patents n. 6,433,791 and 6,621,443.

## Acronyms and Abbreviations

Acronym / Abbreviation	Designation	Description
HFT	Hardware Fault Tolerance	The hardware fault tolerance of the device.  This is the capability of a functional unit to continue the execution of the demanded function in case of faults or deviations.
MTBF	Mean Time Between Failures	This is the mean time period between two failures.
MTTR	Mean Time To Repair	This is the mean time period between the occurrence of a failure in a device or system and its repair.
PFD	Probability of Failure on Demand	This is the likelihood of dangerous safety function failures occurring on demand.
PFDavg	Average Probability of Failure	This is the average likelihood of dangerous safety function failures occurring on demand.
SIL	Safety Integrity Level	The International Standard IEC 61508 specifies four discrete safety integrity levels (SIL 1 to SIL 4). Each level corresponds to a specific probability range regarding the failure of a safety function. The higher the safety integrity level of the safety-related systems, the lower the likelihood of non-execution of the demanded safety functions.
SFF	Safe Failure Fraction	The fraction of non-hazardous failures, e.g. the fraction of failures without the potential to set the safety-related system to a dangerous undetected state.
Low Demand Mode	Low Demand Mode of Operation	Measuring mode with low demand rate, in which the demand rate for the safety-related system is not more than once a year and is not greater than double the frequency of the periodic test.
DTM	Device Type Manager	The DTM is a software module which provides functions for accessing device parameters, configuring, and operating the devices and diagnosing problems. By itself, a DTM is not executable software.
LRV	Device Configuration	Lower Range Value of the measurement range.
URV	Device Configuration	Upper Range Value of the measurement range.
Multidrop	Multidrop Mode	In multidrop mode, up to 15 field devices are connected in parallel to a single wire pair. The analog current signal serves just to energize the two-wire devices providing a fixed current of 4 mA.

# TABLE OF CONTENTS

## SECTION 1 - INSTALLATION

GENERAL .....	1.1
MOUNTING .....	1.1
ELECTRONIC HOUSING .....	1.10
WIRING .....	1.11
TYPICAL INSTALLATION FOR HART® PROTOCOL .....	1.12
INSTALLATION IN HAZARDOUS LOCATIONS .....	1.15
EXPLOSION/FLAME PROOF .....	1.15
INTRINSICALLY SAFE .....	1.15

## SECTION 2 - FUNCTIONAL DESCRIPTION

FUNCTIONAL DESCRIPTION – HARDWARE .....	2.2
FUNCTIONAL DESCRIPTION – LD400 HART® SOFTWARE .....	2.4
FUNCTIONAL DESCRIPTION - DISPLAY (LCD) .....	2.7

## SECTION 3 - TECHNICAL CHARACTERISTICS

ORDERING CODE .....	3.9
---------------------	-----

## SECTION 4 - CONFIGURATION

GENERAL .....	4.1
CONFIGURATION FEATURES .....	4.2
MANUFACTURING DATA AND IDENTIFICATION .....	4.2
PRIMARY VARIABLE TRIM – PRESSURE .....	4.3
PRIMARY VARIABLE CURRENT TRIM .....	4.4
TEMPERATURE TRIM .....	4.4
TRANSMITTER ADJUSTMENT TO THE WORKING RANGE .....	4.5
ENGINEERING UNIT SELECTION .....	4.5
TRANSFER FUNCTION FOR FLOW MEASUREMENT .....	4.7
TABLE POINTS .....	4.8
TOTALIZATION CONFIGURATION .....	4.8
PID CONTROLLER CONFIGURATION .....	4.10
EQUIPMENT CONFIGURATION .....	4.11
EQUIPMENT MAINTENANCE .....	4.12

## SECTION 5 - PROGRAMMING USING LOCAL ADJUSTMENT

THE MAGNETIC TOOL .....	5.1
LOCAL ADJUSTMENT .....	5.3
SIMPLE LOCAL ADJUSTMENT .....	5.3
COMPLETE LOCAL ADJUSTMENT .....	5.4
SIMULATION [SIMUL] .....	5.5
RANGE [RANGE] .....	5.6
PRESSURE TRIM [TRIM] .....	5.11
CONFIGURATION [CONF] .....	5.13
OPERATION [OPER] .....	5.20
EQUIPMENT CONFIGURED TO TRANSMITTER OR SIS MODE .....	5.20
EQUIPMENT CONFIGURED TO CONTROLLER MODE .....	5.21
QUIT [QUIT] .....	5.23

## SECTION 6 - MAINTENANCE

DIAGNOSTIC USING CONFIGURATION TOOL .....	6.1
ERROR MESSAGES .....	6.1
DIAGNOSTIC VIA TRANSMITTER .....	6.2
DISASSEMBLY PROCEDURE .....	6.5
SENSOR .....	6.5
ELECTRONIC CIRCUIT .....	6.9
REASSEMBLY PROCEDURE .....	6.9
SENSOR .....	6.9
ELECTRONIC CIRCUIT .....	6.10
INTERCHANGEABILITY .....	6.10
RETURNING MATERIALS .....	6.11
LIFETIME TRANSMITTER .....	6.11

SPARE PARTS LIST.....	6.11
DETAILED SPARE PARTS ORDERING CODE .....	6.12
SENSOR ORDERING CODE .....	6.14
HART® SPECIAL UNITS.....	6.20

**SECTION 7 - SAFETY INSTRUMENTED SYSTEMS**

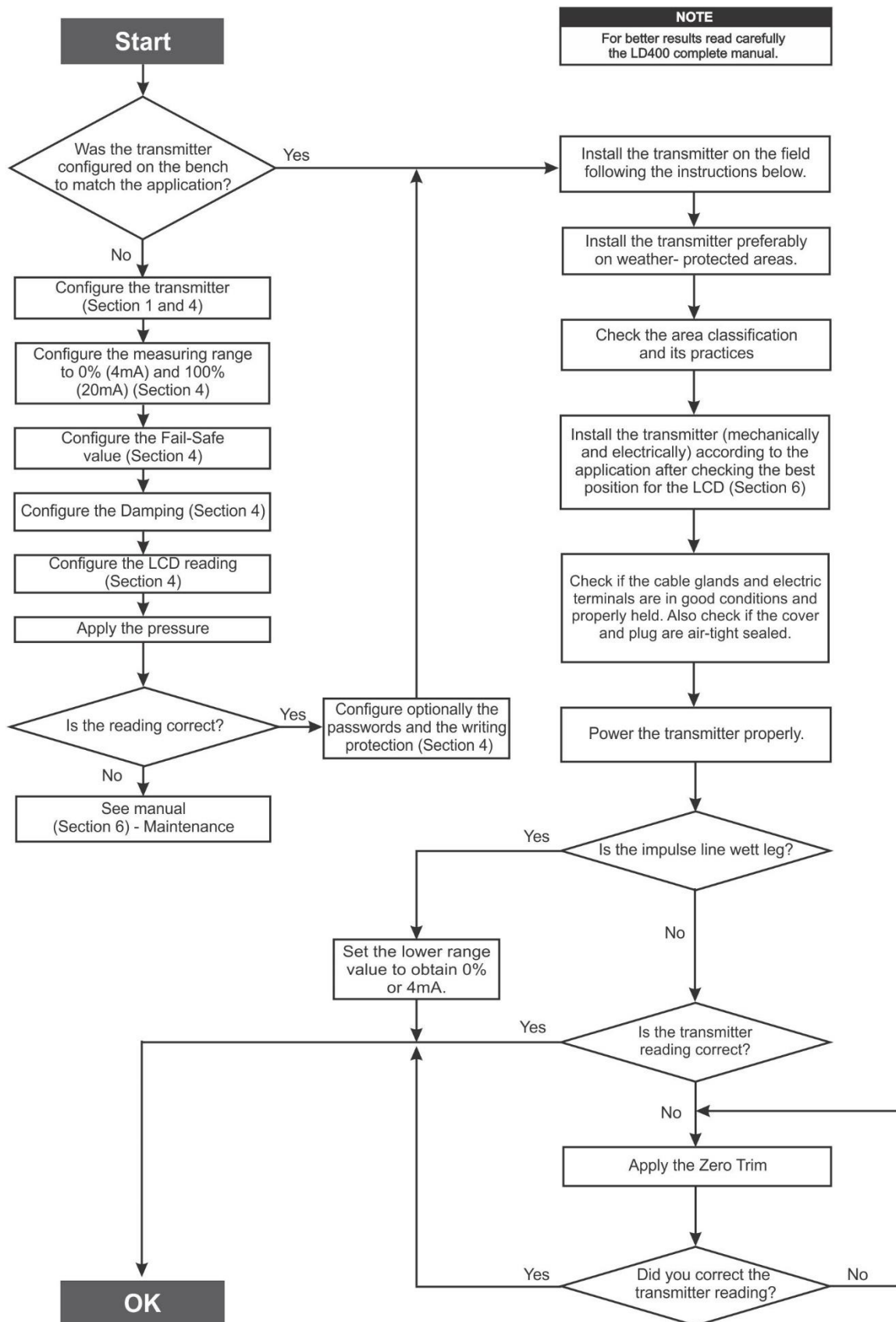
INTRODUCTION.....	7.1
SAFETY STANDARD.....	7.1
APPLICATION STANDARDS .....	7.2
SAFETY FUNCTION.....	7.2
FUNCTIONAL SAFETY PROPERTIES .....	7.3
ENVIRONMENTAL PROPERTIES .....	7.3
INSTALLATION.....	7.3
MODES OF OPERATION .....	7.3
CONFIGURATION MODE ENABLING PROCEDURE.....	7.4
LD400 HART® SIS TECHNICAL CHARACTERISTICS .....	7.4
MAINTENANCE .....	7.6

**APPENDIX A - CERTIFICATIONS INFORMATION**

EUROPEAN DIRECTIVE INFORMATION.....	A.1
HAZARDOUS LOCATION GENERAL INFORMATION .....	A.1
SAFETY APPROVAL .....	A.3
HAZARDOUS LOCATIONS APPROVALS .....	A.3
IDENTIFICATION PLATE .....	A.7

**APPENDIX B – SRF – SERVICE REQUEST FORM**

# Installation Flowchart







# INSTALLATION

## General

### NOTE

The installation carried out in hazardous areas should follow the recommendations of the IEC60079-14 standard.

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 **LD400 HART®** uses a capacitive sensor that is submitted to a temperature cycle, and the characteristics under different temperatures are recorded into sensor memory at the factory. At the field, this feature minimizes the temperature variation effect. The built-in temperature sensor available in the sensor board is only for temperature diagnoses.

Installing the transmitter in areas protected from extreme environmental changes can minimize temperature fluctuation effects. 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. In outdoor environments, the transmitter should be installed to avoid, as much as possible, direct exposure to the sun. Use of sunshades or heat shields to protect the transmitter from external heat sources should be considered, if necessary.

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 tightened 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.

Although the transmitter is very resistant to vibration, installation close to pumps, turbines or other vibrating equipment should be avoided, due to induced resonance at the filling fluid of the capacitive sensors. If entirely inevitable, install the transmitter on a solid basis and use flexible vibration-proof hoses.

Proper winterization should be employed to prevent freezing within the measuring chamber (freeze protection), since this will result in an inoperative transmitter and could even damage the cell.

### NOTE

When installing or storing the level transmitter, the diaphragm must be protected to avoid scratching denting or perforation of its surface.

### NOTE

For a better performance, the installation should not present degradation problems of the sign 4 to 20 mA. For detection of this problem, the operator should always certify that the current emitted by the transmitter it is the same read by PLC.

## Mounting

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 and 1.2. Existing standards for the manifolds have also been considered, and standard designs fits perfectly to the transmitter flanges

When the measured fluid contains solids in suspension, install valves at regular intervals to clean the pipeline (discharge).

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).

Shut the Drain/Vent valves tightly after each drain or discharge operation.

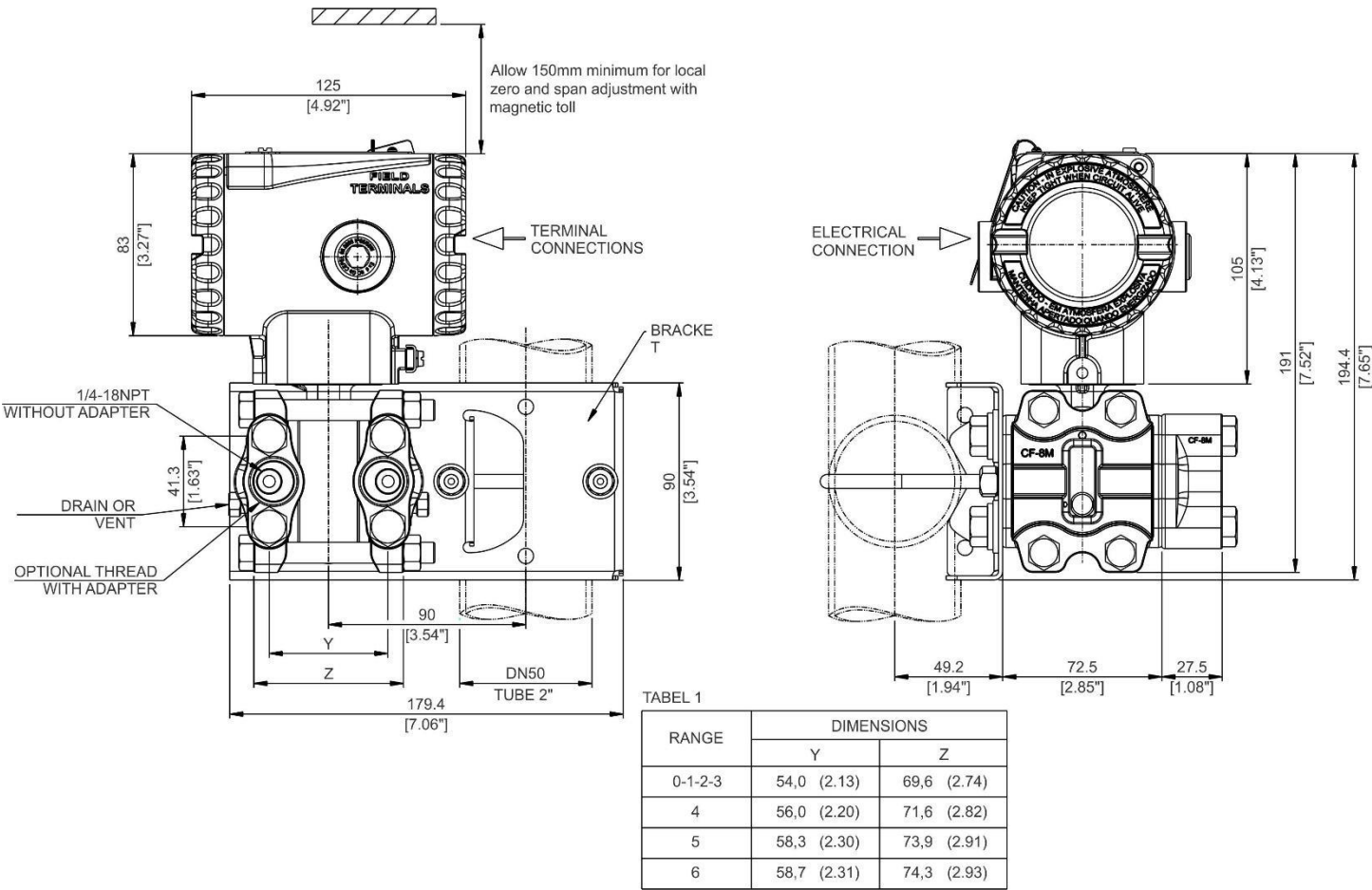
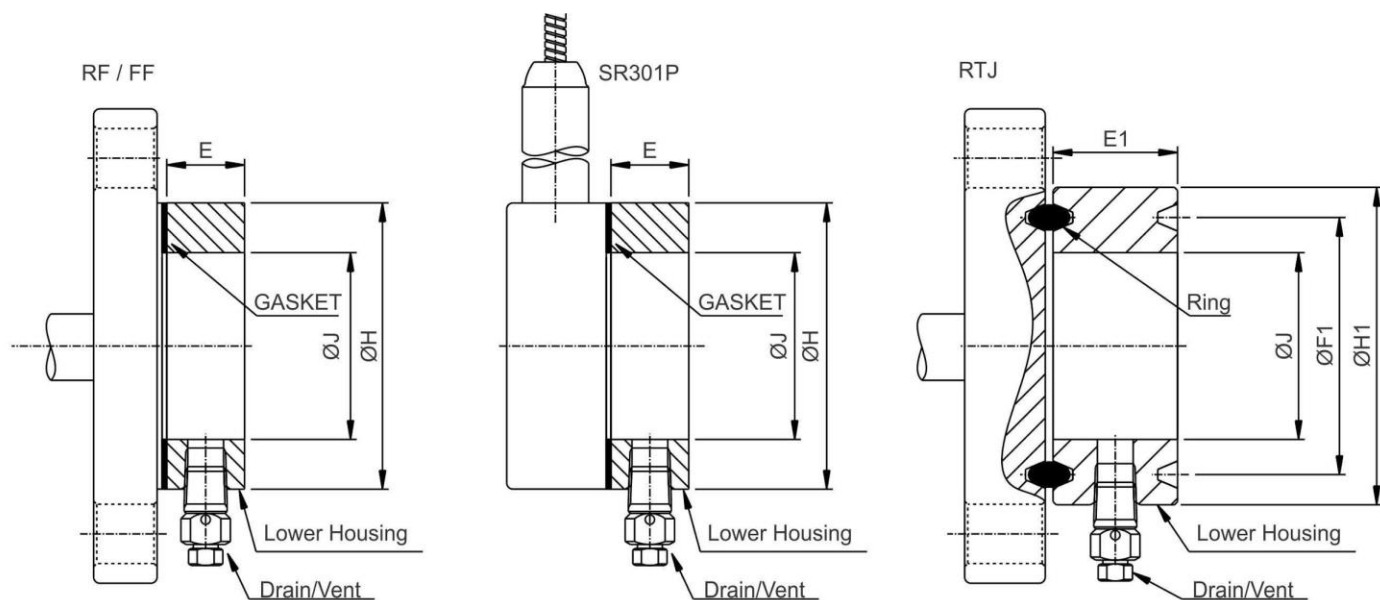


Figure 1.1 (a) – Dimensional Drawing and Mounting Position for the LD400 HART® – Differential Pressure, Flow, Gage, Absolute and High Static Pressure Transmitter with Mounting Bracket





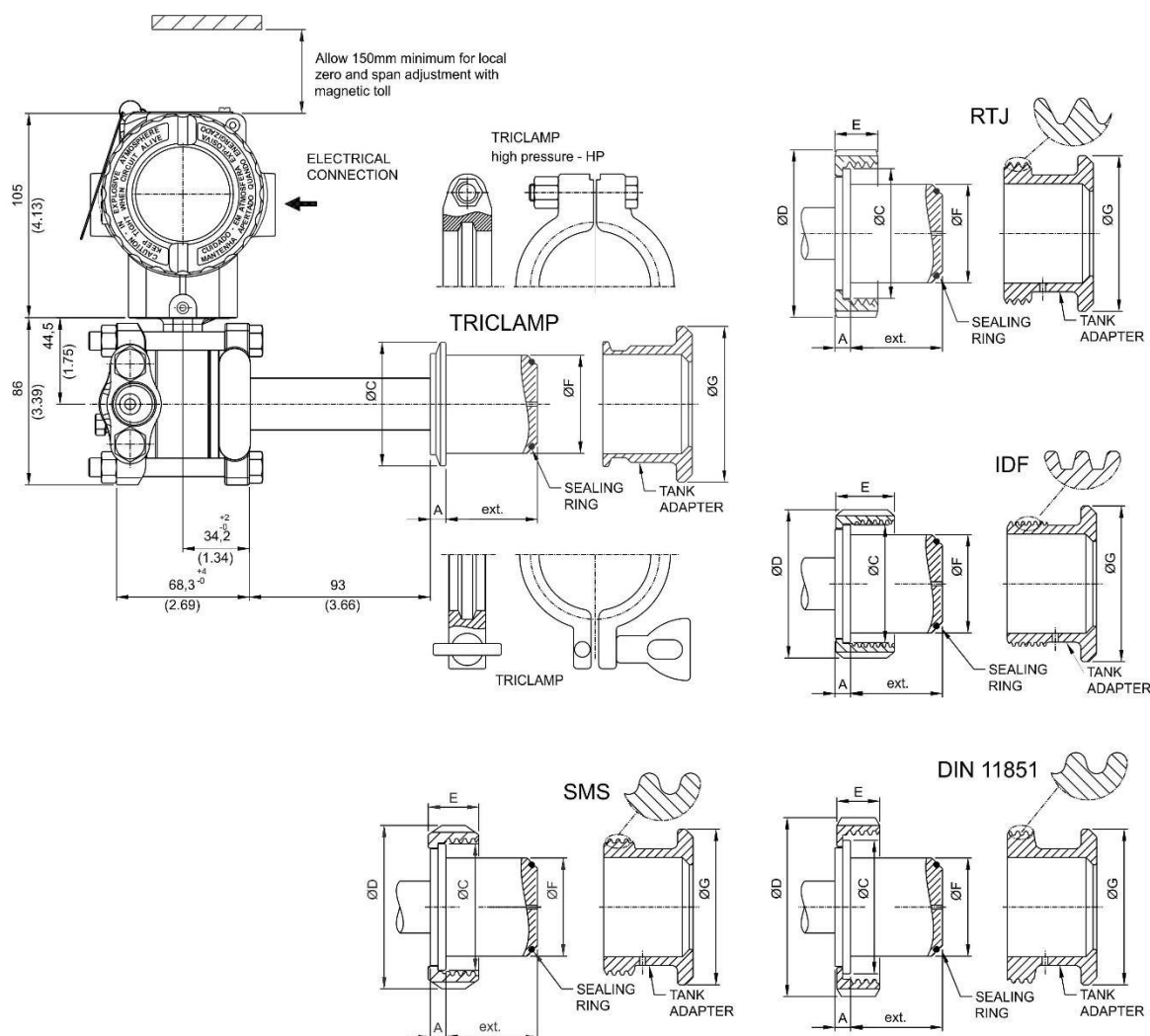
DIMENSIONS - RF / FF - mm (inch)						
STANDARD	DN	CLASS	H	J	E	
					1/4"NPT	1/2"NPT
ASME B16.5	1"	ALL	50,8 (2,00)	35 (1,38)	25	35
	1.1/2"		73,2 (2,88)	48 (1,89)	25	35
	2"		91,9 (3,62)	60 (2,36)	25	35
	3"		127 (5,00)	89 (3,50)	25	35
	4"		158 (6,22)	115 (4,53)	25	35
DIN EN 1092-1	25	ALL	68 (2,68)	35 (1,38)	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
	50A	40K	105 (4,13)	60 (1,36)	25	35
	80A	10K	126 (4,96)	89 (3,50)	25	35
	80A	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

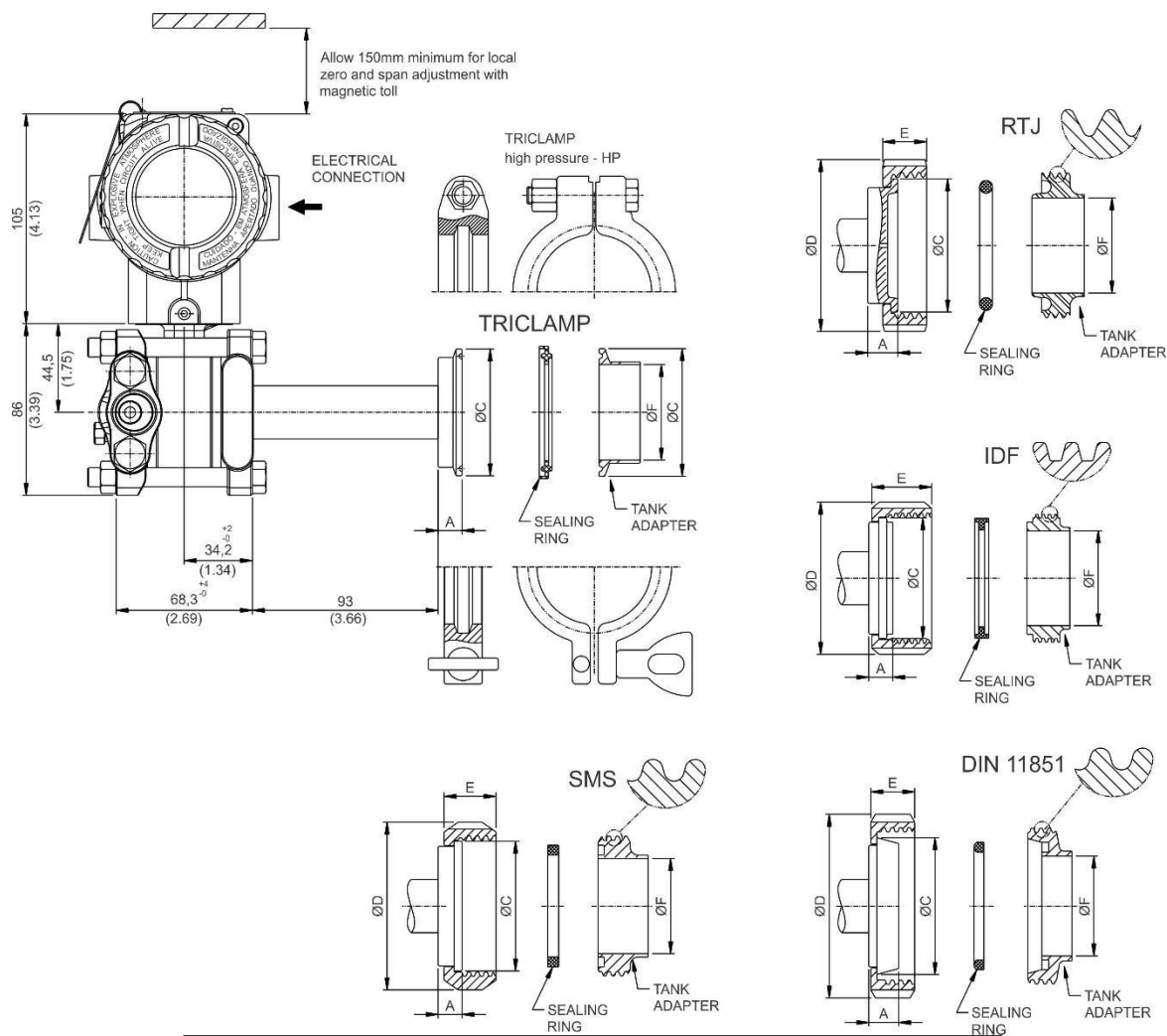
Figure 1.1 (c) – Dimensional Drawing LD400 HART with Lower Housing





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 (d) – Dimensional Drawing and Mounting Position for the LD400 HART® – Sanitary Transmitter with Extension



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 (e) – Dimensional Drawing and Mounting Position for the LD400 HART® – Sanitary Transmitter without Extension**

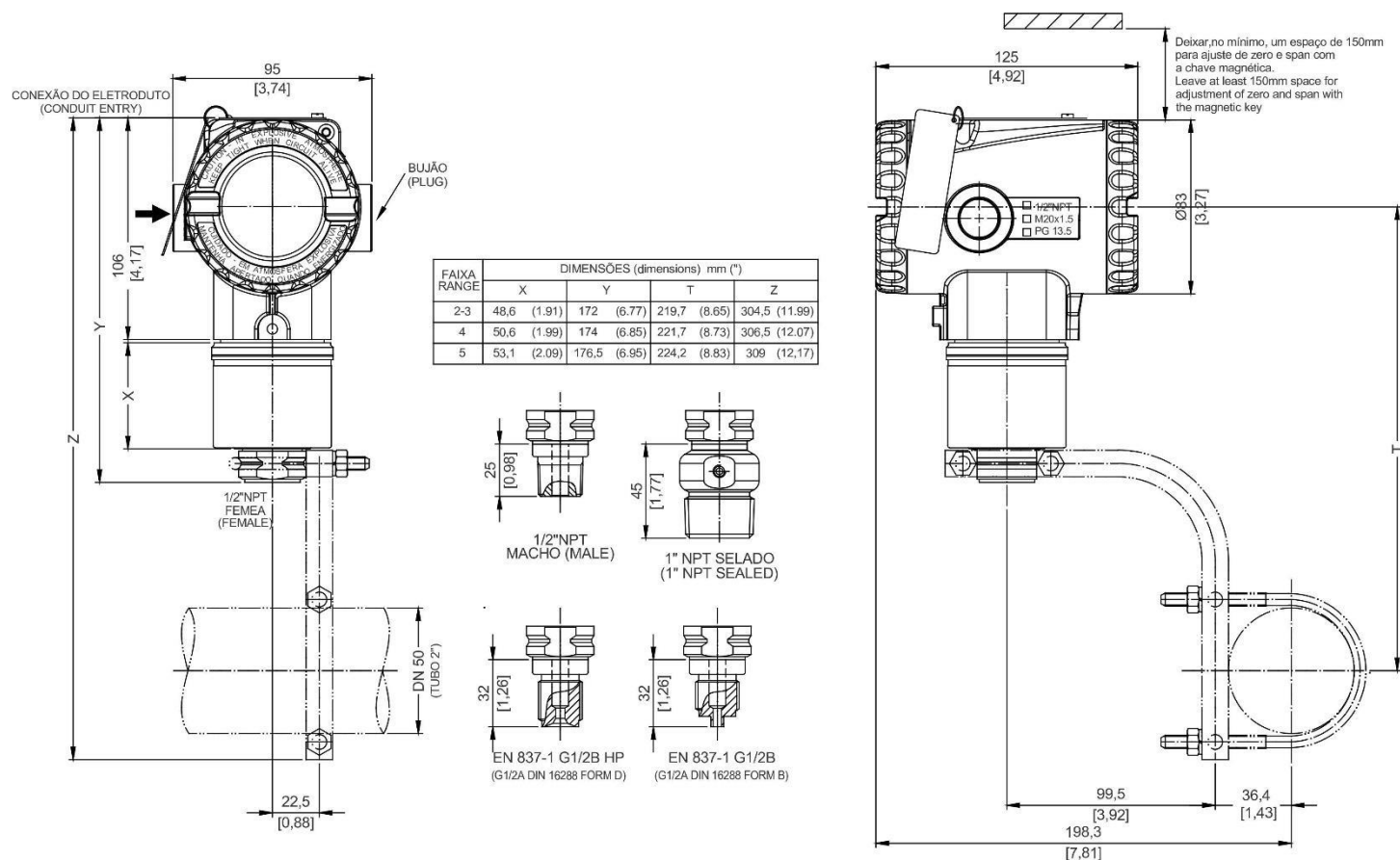


Figure 1.1 (f) – Dimensional Drawing and Mounting Position for the LD400 HART G - Gage IN LINE

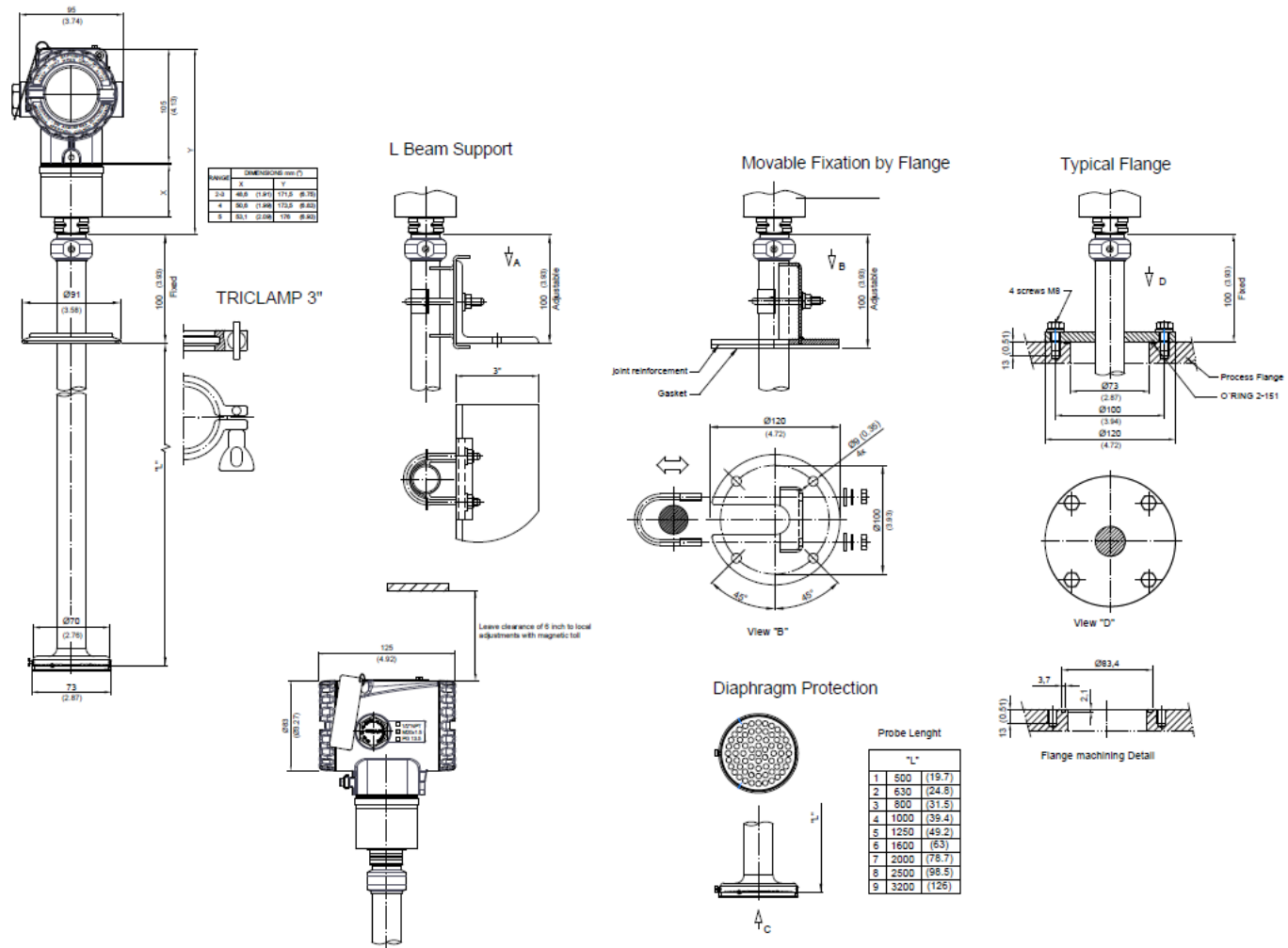
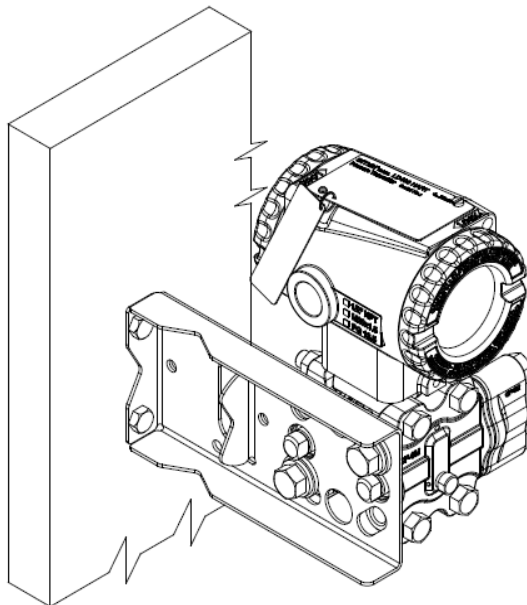


Figure 1.1 (g) – Dimensional Drawing and Mounting Position for the LD400 HART – Pressure Transmitter with Insertion Probe



MOUNTING ON THE PANEL OR WALL  
(See Section 6 –spare parts for mounting brackets available)

Figure 1.2 – Drawing of LD400 HART® Mounted on the Panel or Wall

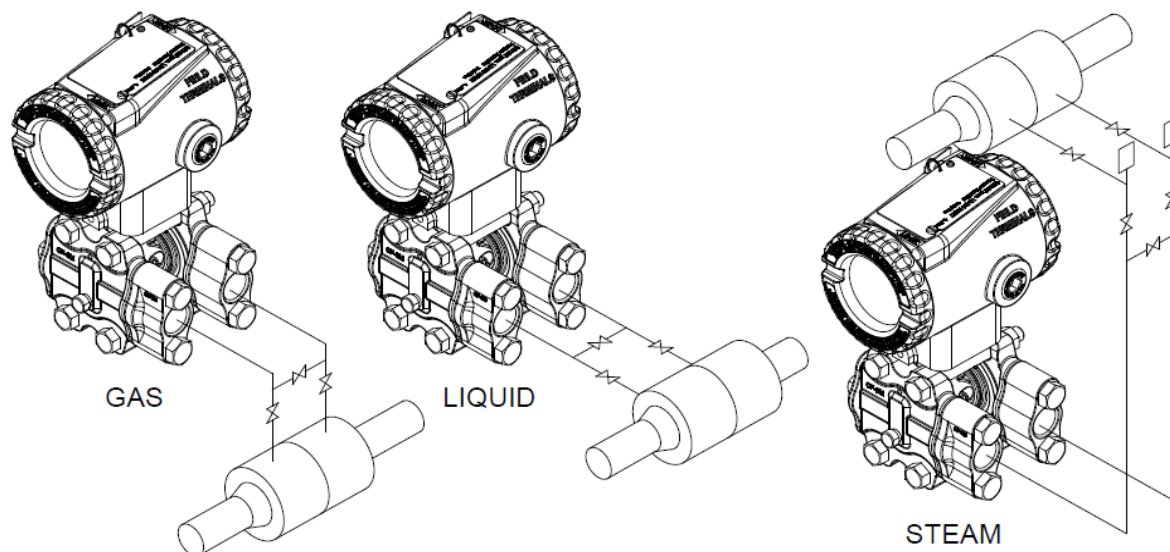
Some examples of installation, illustrating the transmitter position in relation to the taps, are shown in Figure 1.3. The pressure taps location, and the relative positions of the transmitter are indicated in Table 1.1.

Process Fluid	Location of Taps	Location of LD400 HART® 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**

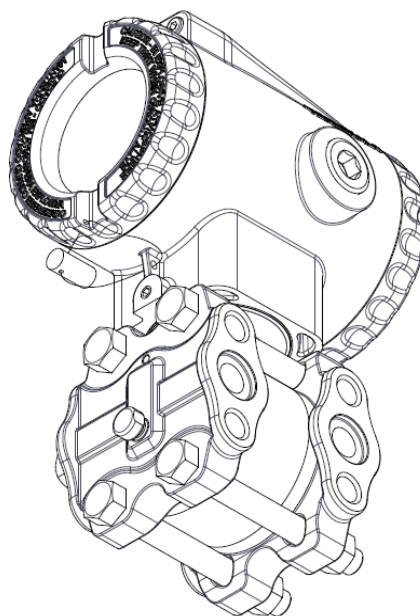
**NOTE**

For liquids, condensates, wet vapors, and gases the impulse lines must be bent on the ratio 1:10 to prevent bubbles from accumulating.



**Figure 1.3 – Position of the Transmitter and Taps**

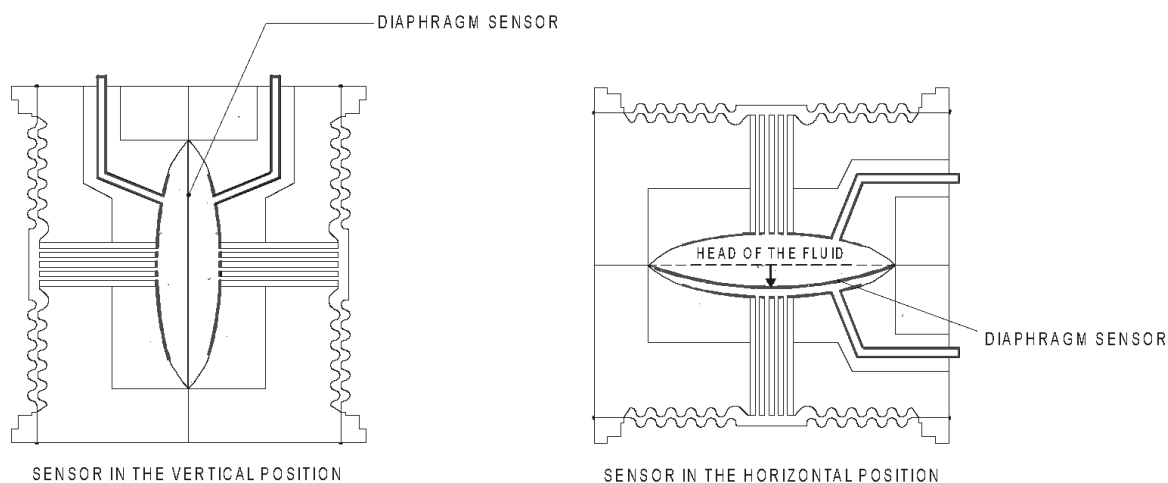
For fiscal measuring and custody transference, use a safety seal on the front cover of the **LD400 HART®**, as shown below, Figure 1.4.



**Figure 1.4 – Safety Seal and Custody Transference**



When the sensor is in the horizontal position, the fluid weight pushes the diaphragm down and then the lower pressure trim must be applied. See Figure 1.5.



**Figure 1.5 – Position of Sensor**

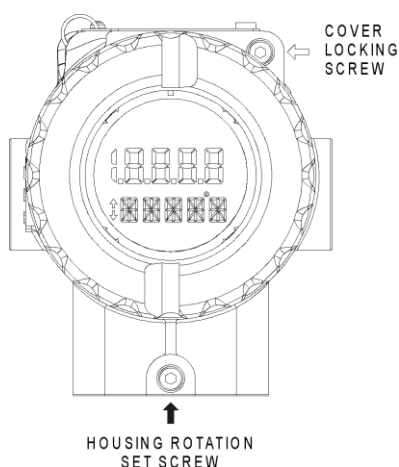
**NOTE**

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, since the absolute zero is the unattainable reference for these transmitters, so there is no need for a zero value for the Lower trim.

## Electronic Housing

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 1.6.



**Figure 1.6 – Cover Locking and Housing Rotating Set Screw**

**NOTE**

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. Transmitters have a stopper that restricts housing rotation to one turn. See Section 6, Figure 6.2.

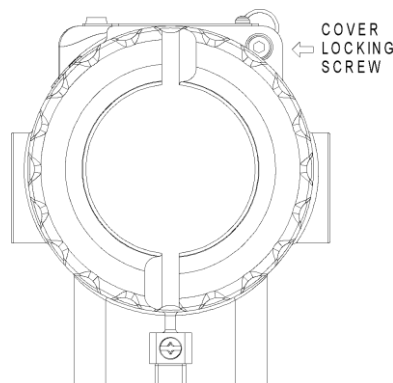
The display can also be rotated from 90° to 90°, for a better visualization. For more details on the several display positions, see Section 6 – Figure 6.4.

**NOTE**

The process flange on the level transmitter may be rotated  $\pm 45^\circ$ . Just loosen the two screws and rotate the flange. Do not remove the screw, according to a tag in the transmitter. See at Figure 1.1 (b), the Position Adjustment screws.

## Wiring

To access the wiring block, loosen the rear cover locking screw to release the cover. See Figure 1.7.



**Figure 1.7 – Terminal Connection Side**

The terminal block has screws that fit fork or eye type terminals. See Figure 1.8.

**NOTE**

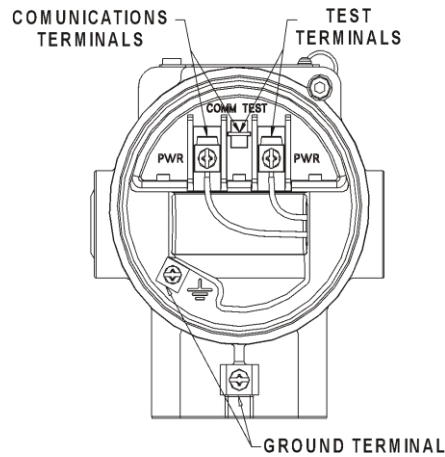
To avoid the penetration of humidity or corrosive gases the cover must be tightened **until you feel the O-rings being compressed**. Then, tighten more 1/3 turn (120°) to guarantee the sealing. Lock the covers using the locking screw.

The signal cables passage to the terminal block may be done through one of the housing openings and may be connected to a conduit or cable gland.

The unused cable entries should be plugged and sealed accordingly to avoid humidity entering, which can cause the loss of the product's warranty. If the area is hazardous, use the required plug. This manual has an order code for this type of plug. See Maintenance section.

Test and Communication terminals allow, respectively, to measure the current in the 4 - 20 mA loop, without opening the circuit, and 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 or ring-type terminals can be fastened. See Figure 1.8.

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



**Figure 1.8 – LD400 HART® Terminal Block**

**NOTE**

The external ground was designed to accept wiring up to 10 mm<sup>2</sup> section (S=12 mm<sup>2</sup>). Use a heavy-duty conductor, at least Ø 1,6mm<sup>2</sup>/15 AWG.

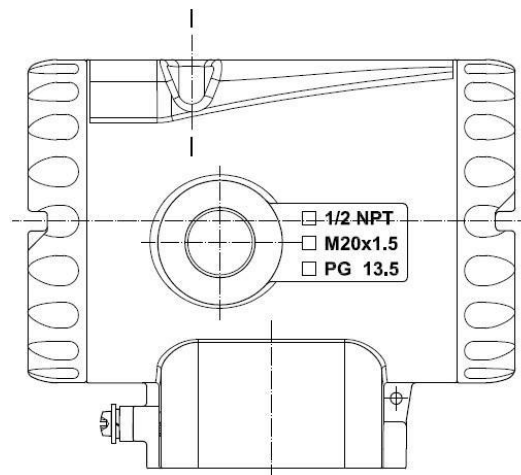
The **LD400 HART®** terminal block was developed to allow signal connections regardless their polarity.

Use of twisted pair (at least 22 AWG) cables are recommended. For sites with high electromagnetic levels (EMI above 10 V/m) shield conductors are recommended.

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

The duct threads must be sealed according to the hazardous area standards (see Installation in Hazardous Locations page 1.15).

The unused passage opening must be sealed with stopper and seal as per the area requirements to avoid humidity penetration. See Figure 1.9.



**Figure 1.9 – Electric Conduit Thread Seal**

## Typical Installation for HART® Protocol

Figures 1.10 and 1.11 show **LD400 HART®** wiring diagrams to work as transmitter and controller, respectively.

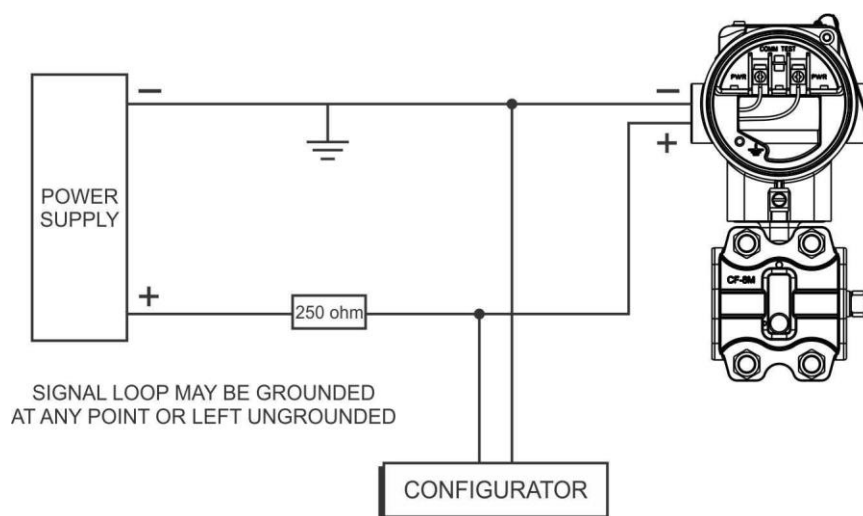
Figure 1.12 shows the **LD400 HART®** wiring diagrams to work in the multidrop network. Note that a maximum of 15 transmitters can be connected on the same line and that they should be connected in parallel. Take care to the power supply as well, when many transmitters are connected on the same line.

The current through the 250  $\Omega$  resistor will be high causing a high voltage drop. Therefore make sure that the power supply voltage is sufficient.

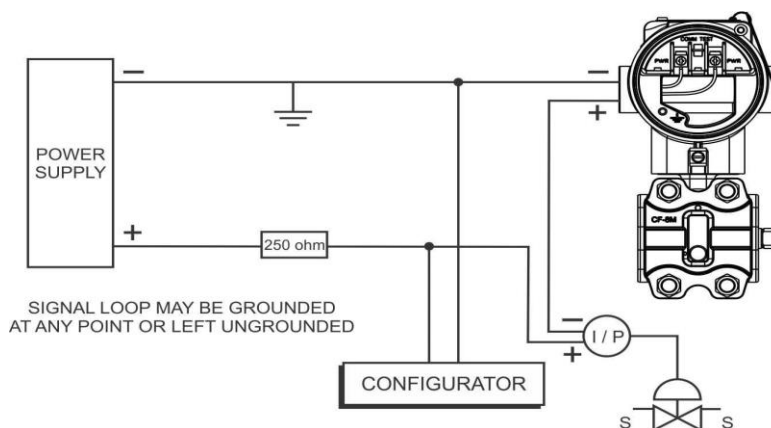
**NOTE**

For HART® transmitters to operate in multidrop 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 the same.

The Handheld 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 multidrop connections, the circuit loop integrity must be assured, with special care to prevent short-circuit between the circuit loop and the housing.



**Figure 1.10 – Wiring Diagram for the LD400 HART® Working as Transmitter**



**Figure 1.11 – Wiring Diagram for the LD400 HART® Working as Controller**

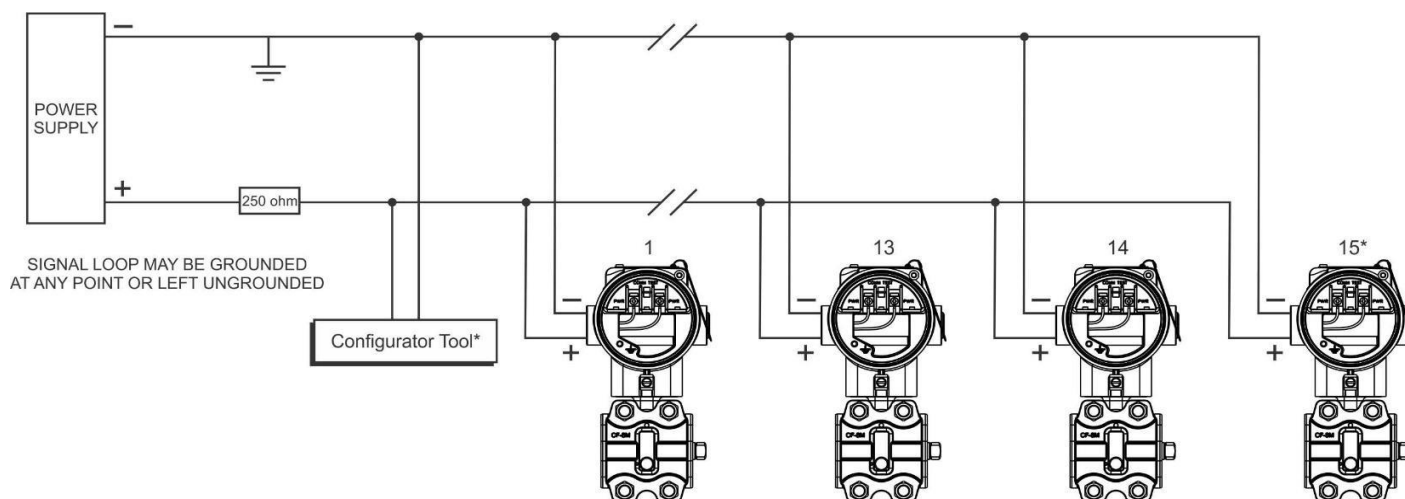


Figure 1.12 – Wiring Diagram for the LD400 HART® in Multidrop Configuration

**NOTE**

Make sure that the transmitter is operating within the operating area as shown on the load curve (Figure 1.13). Communication requires a minimum load of 250 Ohm.

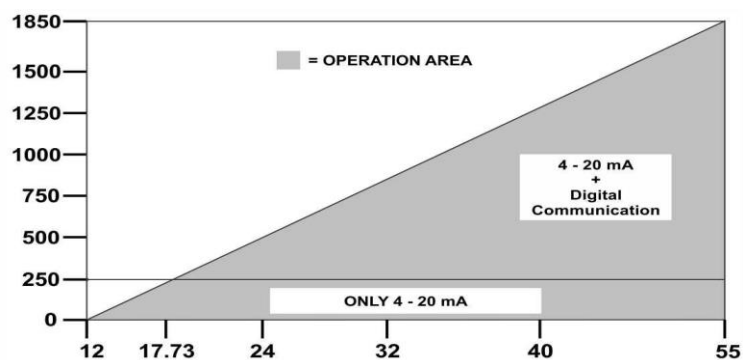


Figure 1.13 – Load Curve



## Installation in Hazardous Locations

### WARNING

Explosions could result in death or serious injury, besides financial damage. Installation of this transmitter in explosive areas must be carried out in accordance with the local standards and the protection type adopted. Before continuing the installation make sure the certificate parameters are in accordance with the classified area where the equipment will be installed.

The instrument modification or parts replacement supplied by other than authorized representative of Smar is prohibited and will void the certification.

The transmitters are marked with options of the protection type. The certification is valid only when the protection type is indicated by the user. Once a particular type of protection is selected, any other type of protection cannot be used.

The electronic housing and the sensor installed in hazardous areas must have a minimum of 6 fully engaged threads. Lock the housing using the locking screw (Figure 1.6).

The cover must be tightened with at least 8 turns to avoid the penetration of humidity or corrosive gases. The cover must be tightened until it touches the housing. Then, tighten more 1/3 turn (120°) to guarantee the sealing. Lock the covers using the locking screw (Figure 1.7).

Consult the Appendix A for further information about certification.

## Explosion/Flame Proof

### WARNING

Only use Explosion Proof/Flameproof certified Plugs, Adapters and Cable glands.

In Explosion-Proof installations the cable entries must be connected or closed using metal cable gland and metal blanking plug, both with at least IP66 and Ex-d certification.

The standard plugs provided by Smar are certified according to CEPEL certificate. If the plug needs to be replaced, a certified plug must be used.

The electrical connection with NPT thread must use waterproofing sealant. A non-hardening silicone sealant is recommended.

For NEMKO ATEX certificate please to follow the installation guidelines in hazardous locations below:

Group II Category 2G, Ex d, Group IIC, Temperature Class T6, EPL Gb

U = 28VDC

Ambient Temperature: -20 to 60°C for T6

Environmental Protection: IP65/67 or IP65W/67W

The electrical connection available are ½ - 14NPT and M20x1,5.

Cable entries must be connected or closed using metal cable gland and metal blanking plug, both with at least IP66 and Ex-d certification or any appropriate ATEX approved metal cable gland and metal blanking plug.

Do not remove the transmitter covers when power is ON.

## Intrinsically Safe

### WARNING

In hazardous zones with intrinsically safe or non-incendive requirements, the circuit entity parameters and applicable installation procedures must be observed.

To protect the application, the transmitter must be connected to a barrier. Match the parameters between barrier and the equipment (Consider the cable parameters). Associated apparatus ground bus shall be insulated from panels and mounting enclosures. Shield is optional. If used, be sure to insulate the end not grounded. Cable capacitance and inductance plus  $C_i$  and  $L_i$  must be smaller than  $C_o$  and  $L_o$  of the associated Apparatus.

For free access to the HART bus in the explosive environment, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices. Use only Ex HART communicator approved according to the type of protection Ex-i (IS) or Ex-n (NI).

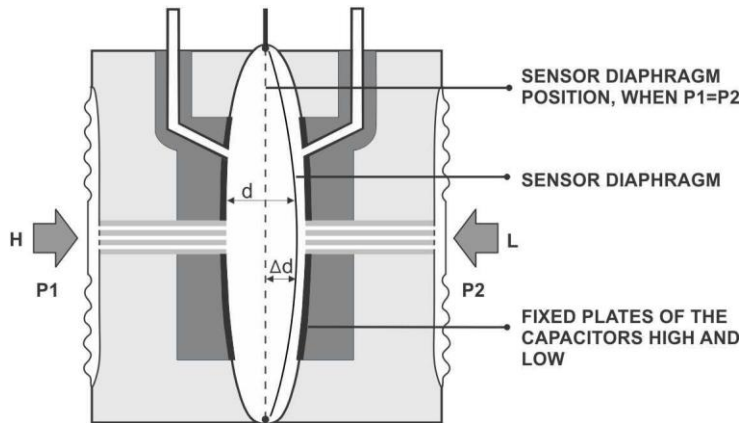
It is not recommended to remove the transmitter cover when the power is ON.



# FUNCTIONAL DESCRIPTION

## Functional Description – Sensor

The **LD400 HART®** Smart Pressure Transmitters use capacitive sensor (capacitive cells) as pressure sensing elements, as shown in Figure 2.1



**Figure 2.1 – Capacitive Cell**

Where:

**P<sub>1</sub>** and **P<sub>2</sub>** are the pressures in chambers H and L.

**CH** = capacitance between the fixed plate on P<sub>1</sub> side and the sensing diaphragm.

**CL** = capacitance between the fixed plate on P<sub>2</sub> side and the sensing diaphragm.

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

**Δd** = sensing diaphragm's deflection due to the differential pressure **ΔP = P<sub>1</sub> - P<sub>2</sub>**.

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. See equation 1:

$$C = \frac{\varepsilon A}{d} \quad (1)$$

Where:

**ε** = dielectric constant of the fluid between the capacitor's plates.

Should **CH** and **CL** be considered as capacitances of flat and parallel plates with identical areas, when **P<sub>1</sub> > P<sub>2</sub>** then:

$$CH = \frac{\varepsilon \cdot A}{(d/2) + \Delta d} \quad (2)$$

and

$$CL = \frac{\varepsilon \cdot A}{(d/2) - \Delta d} \quad (3)$$

However, should the differential pressure ( $\Delta P$ ) applied to the capacitive cell not deflect the sensing diaphragm beyond  $d/4$ , it is possible to assume  $\Delta P$  proportional to  $\Delta d$ :

By developing the expression:

$$\frac{CL - CH}{CL + CH} \quad (4)$$

It follows that:

$$\Delta P = \frac{CL - CH}{CL + CH} = \frac{2\Delta d}{d} \quad (5)$$

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  $\Delta d$  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.

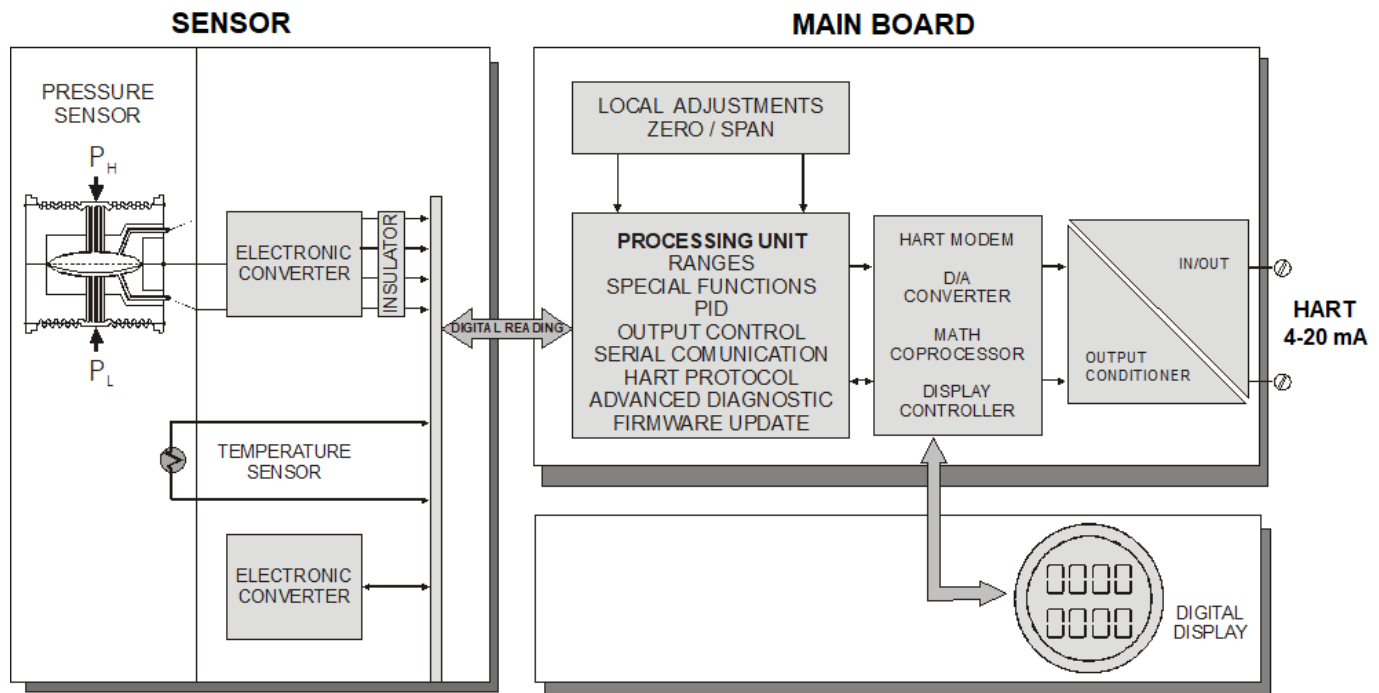


Figure 2.2 – LD400 HART® Hardware Block Diagram

### Electronic Converter

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.

### EEPROM

An EEPROM memory 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.

**Temperature Sensor**

Sensor used to measure temperature of the sensor.

**Processing Unit**

The Processing Unit is the intelligent portion of the transmitter, being responsible for the management and operation of all other blocks, linearization, and communication. This unit consists of a Microcontroller (MCU) with many peripherals like Timers, Serial Communication Channels, A/D converter, Persistent Memory, like Flash, to store the Firmware and Volatile Memory RAM to store temporary data used by the MCU. For quick floating-point arithmetic processing an internal 32x32-bit Hardware Multiplier is used.

**D/A Converter**

It converts the digital data from the CPU to an analog signal with 16-bit resolution.

**Output Controller**

It controls the current in the supply line of the transmitter (2-wire transmitter). It acts as a variable resistive load whose value depends on the voltage from the D/A converter.

**HART Modem**

This peripheral provides the data exchanged with the serve-master digital communicators. This unit demodulates information from the power supply line, and after treating it adequately, modulates, over the line, the response to be sent. A "1" is represented by 1200 Hz and "0" by 2200 Hz. This analog signal is symmetrical and does not affect the DC-level of the 4-20 mA signals (analog signal without DC component).

**Display Controller**

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

**External Persistent Memory**

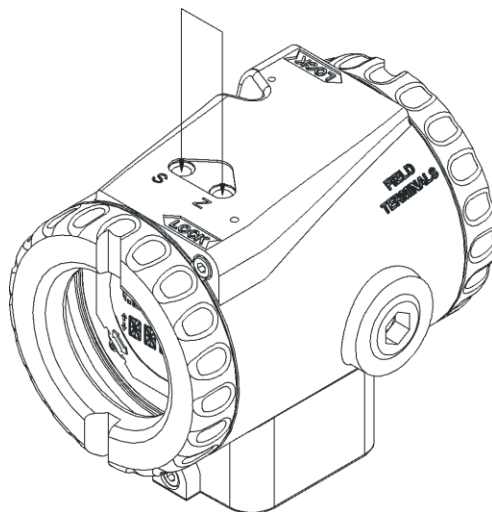
The specific transmitter data such as calibration, configuration and identification data should be maintained intact when the power supply is switched off. An external persistent serial memory is used for this purpose.

**Power Supply**

Power must be supplied to the transmitter circuit using the signal line (2-wire system). The transmitter quiescent consumption is 3.55 mA; during operation, consumption may be as high as 21 mA, depending on the measurement and sensor status. The **LD400 HART®** in the transmitter mode shows failure indication at 3.6 mA when configured for low signal failure; at 21 mA, when 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 to 100% of the working range.

**Local Adjustment**

Two switches on the main board are magnetically activated by inserting the magnetic screwdriver. See Figure 2.3. This kind of actuation access the local adjust method externally, without any contact to electronic board, maintaining totally sealed the electronic chamber.



**Figure 2.3 – Local Adjustment**

## Functional Description – LD400 HART® Software

The functional block diagram of the LD400 HART software is represented in the Figure 2.4. The function of each block is described below.

### Factory Characterization

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

### Pressure Trim

The values obtained by Lower Pressure TRIM and Upper Pressure TRIM may correct the transmitter for long term drift or zero deviation or upper pressure reading due to installation or overpressure.

### User Linearization

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

### 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 to reach 63.2% of the submitted input step value.

This value (in seconds) may be freely configured by the user, from 0 to 128 seconds, zero value means no damping.

### Engineering

The pressure normalized value is converted to the engineering unit, configured by the user.

### Calibration

The pressure value is calculated in percentage taking in consideration the work range provided by the Lower Range Value (LRV) and the Upper Range Value (URV).

### 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).

### Block PID

The PID Block executes a control loop having the Setpoint (SP) and the Process Variable (PV) as input and the Manipulated Value (MV) as output.

#### Block PID: SP - Setpoint

It is the desired value in the process variable when the controller mode is activated.

#### Block PID: PID Algorithm

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) icon.

#### Block PID: Auto/Manual

With the PID in Manual, the MV output can be bypassed by the user in the LOW LIMIT to HIGH LIMIT range. The POWER-ON option is used to determine in which mode the controller should be upon powering it on.

#### Block PID: 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. The Change Rate parameter limits the output signal variation to this selected percentage per second value.

#### Block PID: Bumpless A/M

On the Manual mode, the PID algorithm uses the output values as a compensation to its proportional action so that the Manual to Automatic transition do not occur abruptly. Therefore, even if the transition occurs in the presence of a percent ERROR, the proportional action is nullified, and the output is



adjusted softly according to the integral action.

**Block PID: Points Table PID**

This block receives the Manipulated Variable output as the input of a look-up table of 2 to 16 points. The output of this block 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 ( $Y_i$ ). Normally, this table is used for adaptative control.

**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.

**Current Trim**

The 4 mA TRIM and 20 mA TRIM adjustment is used to make the transmitter current comply with a current standard, when a deviation occurs.

**User Unit**

It converts 0 and 100% of the process variable to the desired engineering unit readout 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 this 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.

**Display**

Until 3 variables can be configured to be showed alternately in the display.

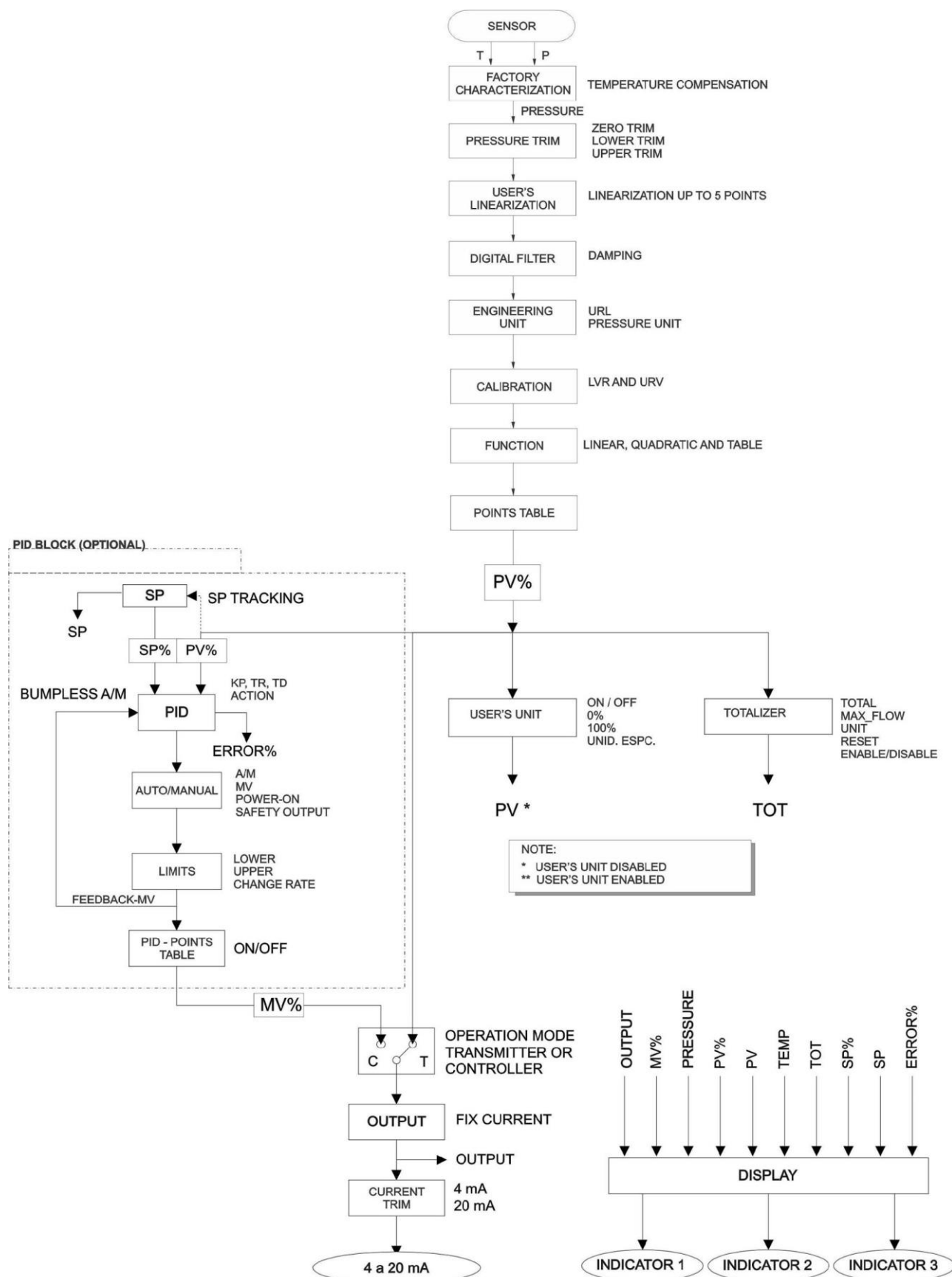


Figure 2.4 – LD400 HART® – Software Block Diagram

## Functional Description - Display (LCD)

The local indicator is able to display three variables, which are user-selectable. When multiples 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 2.5.

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

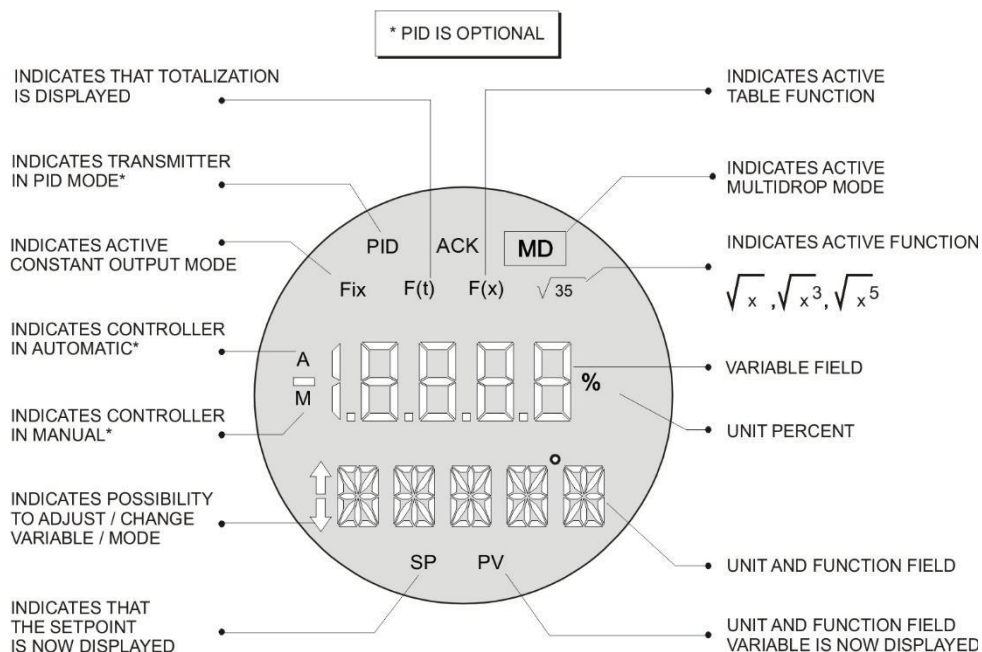


Figure 2.5 – Display for LD400 HART®

### Monitoring

During normal operation, the **LD400 HART®** is in the monitoring mode. In this mode, indication alternates between the three variables (LCD\_1, LCD\_2, LCD\_3) as configured by the user. See Figure 2.6.

The display indicates engineering units, values, and parameters simultaneously with most status indicators.



Figure 2.6 – Typical Monitoring Mode Display Showing PV, in this case 25.00 mmH<sub>2</sub>O

The monitoring mode is interrupted when the user applies the simple or complete local adjustment, going to the interactive actions defined to each selected local adjustment mode.

The **LD400 HART®** display may also exhibit messages and errors. A few examples of these messages are listed on Table 2.1. For a complete list, see Section 6 – Maintenance.

INDICATOR		DESCRIPTION
Numeric	Alphanumeric	
Version	LD400 HART and Version	The <b>LD400 HART®</b> is initialized after feeding.
Variable Value	SAT / Unit	Output current saturated on 3.8 or 20.5 mA. (see section 6 – Maintenance)
CH / CL alternating with current value	SAT / Unit	Failure on one sensor side or on both. The SAT is showed when the variable on the display is in percent value.
F-XX	YY-YY	Safety failure information in hexadecimal format. See Diagnostic via Transmitter, page 6.4, for more details.
FLSH	HH-HH	Flash CRC error: HH-HH = expected CRC value in hexadecimal format.
Icon Fix		This icon is showed when the output current is not more controlled according to the measurement. The output current is on the freeze state on user or safe state demands (safety current).

***Table 2.1 – Messages Displayed***

## TECHNICAL CHARACTERISTICS

Functional Specifications	
Process Fluid	Liquid, gas, or steam.
Output and Communication Protocol	Two-wire, 4 - 20 mA controlled according to NAMUR NE43 specification, with superimposed digital communication (HART® Protocol).
Power Supply	12 - 55 Vdc. Input without polarization, with protection for transient suppressor and complemented by a surge arrester. Insulation of housing larger than 10 GΩ.  <b>Transient Suppressor</b> V <sub>max</sub> = 65 Vp; Differential mode - bi-directional; Low current leak and capacitance; meets the standards: IEEE61000-4-4 and IEEE61000-4-5; Less than 5 ns response time.  <b>Surge Arrester</b> V = 1000 Vdc; Discharge current peak = 10 kA; Nominal current = 10 A/s; Common mode - low leak current and capacitance.
Indicator	4 1/2 -digit numerical and 5-character alphanumeric LCD indicator (optional). Function and status icon.
Hazardous Area Certifications	See Appendix A.
Zero and Span Adjustments	No interactive, via digital communication and local adjustment. Local adjustment jumper with three positions: simple, disable, and complete.
Load Limitation	
Failure Alarm (Diagnostics)	Detailed diagnostics via HART® communicator. Sensor failure and overpressure indication. 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 configuration and NAMUR NE43 specification.
Temperature Limits	Ambient: -40 to 85 °C (-40 to 185 °F) Process: -40 to 100 °C (-40 to 212 °F) (Silicon Oil) -40 to 85 °C (-40 to 185 °F) (Halocarbon Inert Oil) 0 to 85 °C (32 to 185 °F) (Fluorolube Inert Oil) -20 to 85 °C (-4 to 185 °F) (Krytox Inert Oil and Fomblim Oil) -25 to 100 °C (-13 to 212 °F) (Viton O'Ring) -40 to 150 °C (-40 to 302 °F) (Level Model) Storage: -40 to 100 °C (-40 to 212 °F) Digital Display: -20 to 80 °C (-4 to 176 °F) -40 to 85 °C (-40 to 185 °F) (Without damage)
Turn-on Time	Performs within specifications in less than 3 seconds after power is applied to the transmitter.
Configuration	Through digital communication, using DevComDroid configuration software (Android DDL Interpreter), used with HART interfaces, such as HI331 Bluetooth interface. However, the old Palm with HPC301 or CONF401, which are obsolete, are still operable with the latest versions of HART transmitters. It can also be configured using DD and FDT/DTM tools and can be partially configured through local adjustment.  To keep the equipment configuration safe, the LD400 HART® has two kinds of write protection. One is via software and the other is a hardware mechanism selected by a jumper, with priority over the software.
Volumetric Displacement	Less than 0.15 cm³ (0.01 in³).

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 H2 to H5 models Except for LD400A, LD400M, LD400G, and LD400I  <i>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.</i>																																																																																							
	From 3.45 kPa abs. (0.5 psia) to: 0.5 MPa (72.52 psi) for range 0 8 MPa (1150 psi) for range 1 16 MPa (2300 psi) for ranges 2, 3 and 4 32 MPa (4600 psi) for models H and A5 40 MPa (5800 psi) for model M5 52 MPa (7500 psi) for models M6 and A6  Flange Test Pressure: 68.95 MPa (10000 psi) <i>Flange test is the maximum pressure applied to the transmitter without damage to the measuring set.</i>  Overpressures above will not damage the transmitter, but a new calibration may be necessary. <i>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.</i>																																																																																							
Pressure Limits Flanges	<div><div>WARNING</div><div>It is described here only the maximum pressures of the materials referenced in each rule, it cannot be manufactured on request.  Temperatures above 150 °C are not available in level models.</div></div>																																																																																							
	PRESSURES TABLE FOR SEAL AND LEVEL FLANGES DIN EN 1092-1 2008 STANDARD																																																																																							
	<table><tr><th rowspan="3">Material Group</th><th rowspan="3">Pressure Class</th><th colspan="7">Maximum Temperature Allowed</th></tr><tr><th>RT*</th><th>100</th><th>150</th><th>200</th><th>250</th><th>300</th><th>350</th></tr><tr><th colspan="7">Maximum Pressure Allowed (bar)</th></tr><tr><td rowspan="6">10E0 AISI 304/304L</td><td>PN 16</td><td>16</td><td>13.7</td><td>12.3</td><td>11.2</td><td>10.4</td><td>9.6</td><td>9.2</td></tr><tr><td>PN 25</td><td>25</td><td>21.5</td><td>19.2</td><td>17.5</td><td>16.3</td><td>15.1</td><td>14.4</td></tr><tr><td>PN 40</td><td>40</td><td>34.4</td><td>30.8</td><td>28</td><td>26</td><td>24.1</td><td>23</td></tr><tr><td>PN 63</td><td>63</td><td>54.3</td><td>48.6</td><td>44.1</td><td>41.1</td><td>38.1</td><td>36.3</td></tr><tr><td>PN 100</td><td>100</td><td>86.1</td><td>77.1</td><td>70</td><td>65.2</td><td>60.4</td><td>57.6</td></tr><tr><td>PN 160</td><td>160</td><td>137.9</td><td>123.4</td><td>112</td><td>104.3</td><td>96.7</td><td>92.1</td></tr><tr><td>PN 250</td><td>250</td><td>215.4</td><td>192.8</td><td>175</td><td>163</td><td>151.1</td><td>144</td></tr></table>								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)																																																																																								
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																																																																																	
<table><tr><th rowspan="3">Material Group</th><th rowspan="3">Pressure Class</th><th colspan="7">Maximum Temperature Allowed</th></tr><tr><th>RT*</th><th>100</th><th>150</th><th>200</th><th>250</th><th>300</th><th>350</th></tr><tr><th colspan="7">Maximum Pressure Allowed (bar)</th></tr><tr><td rowspan="6">14E0 AISI 316/316L</td><td>PN 16</td><td>16</td><td>16</td><td>14.5</td><td>13.4</td><td>12.7</td><td>11.8</td><td>11.4</td></tr><tr><td>PN 25</td><td>25</td><td>25</td><td>22.7</td><td>21</td><td>19.8</td><td>18.5</td><td>17.8</td></tr><tr><td>PN 40</td><td>40</td><td>40</td><td>36.3</td><td>33.7</td><td>31.8</td><td>29.7</td><td>28.5</td></tr><tr><td>PN 63</td><td>63</td><td>63</td><td>57.3</td><td>53.1</td><td>50.1</td><td>46.8</td><td>45</td></tr><tr><td>PN 100</td><td>100</td><td>100</td><td>90.9</td><td>84.2</td><td>79.5</td><td>74.2</td><td>71.4</td></tr><tr><td>PN 160</td><td>160</td><td>160</td><td>145.5</td><td>134.8</td><td>127.2</td><td>118.8</td><td>114.2</td></tr><tr><td>PN 250</td><td>250</td><td>250</td><td>227.3</td><td>210.7</td><td>198.8</td><td>185.7</td><td>178.5</td></tr></table>								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)																																																																																						
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																																																																																	
<table><tr><th rowspan="3">Material Group</th><th rowspan="3">Pressure Class</th><th colspan="7">Maximum Temperature Allowed</th></tr><tr><th>RT*</th><th>100</th><th>150</th><th>200</th><th>250</th><th>300</th><th>350</th></tr><tr><th colspan="7">Maximum Pressure Allowed (bar)</th></tr><tr><td rowspan="6">16E0 1.4410 Super Duplex 1.4462 Duplex</td><td>PN 16</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td><td>-</td><td>-</td></tr><tr><td>PN 25</td><td>25</td><td>25</td><td>25</td><td>25</td><td>25</td><td>-</td><td>-</td></tr><tr><td>PN 40</td><td>40</td><td>40</td><td>40</td><td>40</td><td>40</td><td>-</td><td>-</td></tr><tr><td>PN 63</td><td>63</td><td>63</td><td>63</td><td>63</td><td>63</td><td>-</td><td>-</td></tr><tr><td>PN 100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>-</td><td>-</td></tr><tr><td>PN 160</td><td>160</td><td>160</td><td>160</td><td>160</td><td>160</td><td>-</td><td>-</td></tr><tr><td>PN 250</td><td>250</td><td>250</td><td>250</td><td>250</td><td>250</td><td>250</td><td>-</td><td>-</td></tr></table>								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	250	-	-
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	250	-	-																																																																																
* RT = Reference Temperature (-10 to 50 °C)																																																																																								



# Functional Specifications

## 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
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
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
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
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
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 120°	220°	300°	350°
AISI316L	10k	14	12	10	--
	20k	34	31	29	26
	40k	68	62	57	52

Pressure Limits Flanges  
(continuation)

Functional Specifications				
Pressure Limits for Sanitary Connections	<b>PRESSURES TABLE FOR TRICLAMP CONNECTIONS BS4825 P3</b>			
	DN	PN normal		HP (High pressure)
		20°C (68°F)	120°C (248°F)	20°C (68°F)
		Maximum Temperature Allowed (bar)		
	1.1/2"	34	20	100
	2" – DN50	28	17	70
	3"	22	13	70
	<b>PRESSURES TABLE FOR THREADED CONNECTIONS</b>			
	Sanitary Threads – Temperature Limits			
	DN	RJT	IDF	SMS
		120°C (248°F)	120°C (248°F)	120°C (248°F)
		BS4825 P5	BS4825 P4	SMS1145
	DN25	Maximum Temperature Allowed (bar)		
		--	--	--
		10	16	40
		10	16	25
		10	16	25
Humidity Limits	0 to 100% UR (Relative Humid).			
Damping Adjustment	User configurable from 0 to 128 seconds (via digital communication or local adjustment).			

Performance Specifications	
Reference Conditions	Span starting at zero, temperature of 25°C (77°F), atmospheric pressure, power supply of 24 Vcc, silicone or halocarbon oil fill fluid, isolating diaphragms in 316L SST and digital trim equal to lower and upper range values.
Accuracy	<p><b>Standard Class:</b></p> <p><b>For range 0 and gage or differential model:</b>  <math>\pm (0.1) \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.0545 + 0.00728 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.05 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL}</math></p> <p><b>For range 1 and differential or gage model:</b>  <math>\pm (0.06) \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.0364 + 0.003776 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.025 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL}</math></p> <p><b>For range 2, 3 or 4 and differential, high static pressure or gage models:</b>  <math>\pm (0.06) \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.0364 + 0.003776 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.025 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL};</math>  <math>\pm (0.00024 + 0.00468 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.005 \text{ URL} \leq \text{span} \leq 0.025 \text{ URL}</math></p> <p><b>For range 5 and gage or high static pressure or any sanitary model:</b>  <math>\pm (0.065) \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL}</math>  <math>\pm (0.0326 + 0.005184 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.025 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL};</math>  <math>\pm (0.00636 + 0.00584 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.00833 \text{ URL} \leq \text{span} \leq 0.025 \text{ URL}</math></p> <p><b>For range 6 and gage model:</b>  <math>\pm (0.08) \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL}</math>  <math>\pm (0.0504 + 0.004736 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.025 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL};</math>  <math>\pm (0.00304 + 0.00592 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.00833 \text{ URL} \leq \text{span} \leq 0.025 \text{ URL}</math></p> <p><b>For range 1 and absolute model:</b>  <math>\pm [0.0667 + 0.0333 \text{ URL}/\text{span}] \% \text{ span}</math></p> <p><b>For range 2 and absolute model:</b>  <math>\pm (0.08) \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.0482 + 0.005088 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.05 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL}</math></p> <p><b>For range 3 or 4 and absolute model:</b>  <math>\pm (0.065) \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.0326 + 0.005184 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.025 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL};</math>  <math>\pm (0.00636 + 0.00584 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.00833 \text{ URL} \leq \text{span} \leq 0.025 \text{ URL}</math></p> <p><b>For range 5 and absolute model:</b>  <math>\pm (0.075) \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.0443 + 0.004912 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.025 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL}</math>  <math>\pm (0.00406 + 0.005918 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.00833 \text{ URL} \leq \text{span} \leq 0.025 \text{ URL}</math></p> <p><b>For range 6 and absolute model or for range 2, 3, 4 or 5 and level model:</b>  <math>\pm (0.08) \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.0504 + 0.004736 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.025 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL};</math>  <math>\pm (0.00616 + 0.005842 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.00833 \text{ URL} \leq \text{span} \leq 0.025 \text{ URL}</math></p> <p><b>For ranges 2, 3 or 4 Inline model (G):</b>  <math>\pm 0.06\% \text{ of the span for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm [0.0364 + 0.0038 \text{ URL}/\text{span}] \% \text{ of the span for } 0.025 \text{ URL} \leq \text{span} &lt; 0.16 \text{ URL}</math>  <math>\pm [0.0015 + 0.0047 \text{ URL}/\text{span}] \% \text{ of the span for } 0.005 \text{ URL} \leq \text{span} &lt; 0.025 \text{ URL};</math></p> <p><b>For range 5 Inline model (G):</b>  <math>\pm 0.065 \% \text{ of the span for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL}</math>  <math>\pm [0.0326 + 0.0052 \text{ URL}/\text{span}] \% \text{ of the span for } 0.025 \text{ URL} \leq \text{span} &lt; 0.16 \text{ URL}</math>  <math>\pm [0.01 + 0.0058 \text{ URL}/\text{span}] \% \text{ of the span for } 0.0083 \text{ URL} \leq \text{span} &lt; 0.025 \text{ URL}</math></p> <p><b>For Insertion model:</b>  <math>\pm 0.2\% \text{ of span}</math></p> <p><b>Performance High Class:</b></p> <p><b>For range 0 and gage or differential model:</b>  <math>\pm (0.06) \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.0145 + 0.00728 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.05 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL}</math></p> <p><b>For range 1 and differential or gage model:</b>  <math>\pm 0.05 \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.0264 + 0.003776 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.025 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL}</math></p> <p><b>For range 2, 3 or 4 and differential, high static pressure or gage models:</b>  <math>\pm 0.045 \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.021 + 0.00384 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.025 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL};</math>  <math>\pm (0.0002 + 0.00436 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.005 \text{ URL} \leq \text{span} \leq 0.025 \text{ URL}</math></p>

Performance Specifications	
Accuracy (Continuation)	<p><b>For range 5 and gage or high static pressure:</b>  <math>\pm (0.055) \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL}</math>  <math>\pm (0.0257 + 0.004688 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.025 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL};</math>  <math>\pm (0.00466 + 0.005214 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.00833 \text{ URL} \leq \text{span} \leq 0.025 \text{ URL}</math></p> <p><b>For range 6 and gage model:</b>  <math>\pm (0.075) \% \text{ of the span, for } 0.16 \text{ URL} \leq \text{span} \leq \text{URL}</math>  <math>\pm (0.0454 + 0.004736 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.025 \text{ URL} \leq \text{span} \leq 0.16 \text{ URL};</math>  <math>\pm (0.00316 + 0.005792 * \text{URL}/\text{span}) \% \text{ of the span, for } 0.00833 \text{ URL} \leq \text{span} \leq 0.025 \text{ URL}</math></p>
Stability	<p><b>For ranges 2, 3, 4, 5 or 6:</b>  <b>Performance High Class:</b> <math>\pm 0.2\%</math> of URL per 12 years  <b>Standard Class:</b> <math>\pm 0.15\%</math> URL per 7 years  At 20 °C temperature change and up to 7 MPa (1000 psi) of static pressure.</p> <p><b>For range 1:</b>  <b>Performance High Class:</b> <math>\pm 0.3\%</math> do URL per 12 years  <b>Standard Class:</b> <math>\pm 0.3\%</math> of URL per 7 years  At 20 °C temperature change and up to 3.5 MPa (500 psi) of static pressure.</p> <p><b>For range 0:</b>  <b>Performance High Class:</b> <math>\pm 0.4\%</math> do URL per 12 years  <b>Standard Class:</b> <math>\pm 0.4\%</math> of URL per 7 years  At 20 °C temperature change and up to 100 kPa (14.5 psi) of static pressure.</p> <p><b>For ranges 2, 3, 4 or 5 of Inline model (G):</b>  <math>\pm 0.15\%</math> of URL per 7 years, at <math>\pm 20</math> °C temperature change, 0 -100% de relative humidity</p> <p><b>Note:</b> Installation complying with the best process practices and adequacy may be generated (hydrogen migration).</p>
Temperature Effect	<p><b>For any model range 2, 3, 4, 5 or 6, except level or sanitary models:</b>  <math>\pm (0.0795 + 0.0205 * \text{URL}/\text{span}) \% \text{ of the span, per } 20 \text{ }^{\circ}\text{C for } 0.1 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.0345 + 0.025 * \text{URL}/\text{span}) \% \text{ of the span, per } 20 \text{ }^{\circ}\text{C for } \text{span} \leq 0.1 \text{ URL}</math></p> <p><b>For any model range 1:</b>  <math>\pm (0.08 + 0.05 * \text{URL}/\text{span}) \% \text{ of the span, per } 20 \text{ }^{\circ}\text{C for } 0.1 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.06 + 0.052 * \text{URL}/\text{span}) \% \text{ of the span, per } 20 \text{ }^{\circ}\text{C for } \text{span} \leq 0.1 \text{ URL}</math></p> <p><b>For any model range 0:</b>  <math>\pm (0.1 + 0.1 * \text{URL}/\text{span}) \% \text{ of the span, per } 20 \text{ }^{\circ}\text{C for } 0.1 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.05 + 0.105 * \text{URL}/\text{span}) \% \text{ of the span, per } 20 \text{ }^{\circ}\text{C for } \text{span} \leq 0.1 \text{ URL}</math></p> <p><b>For any level or sanitary model:</b>  6 mmH<sub>2</sub>O per 20 °C for flange 4" and DN100  17 mmH<sub>2</sub>O per 20 °C for flange 3" and DN80  Consult for other flange dimensions and fill fluid.</p> <p><b>For ranges 2, 3, 4 or 5 of Inline model:</b>  <math>\pm [0.0205\% \text{ URL} + 0.0795\% \text{ span}], \text{ per } 20 \text{ }^{\circ}\text{C for } 0.1 \text{ URL} \leq \text{span} \leq \text{URL}</math>  <math>\pm [0.021\% \text{ URL} + 0.075\% \text{ span}] \text{ per } 20 \text{ }^{\circ}\text{C for } \text{span} &lt; 0.1 \text{ URL}</math></p> <p><b>Insertion Model</b>  It depends on the insertion probe size to determine the variation by temperature. Contact Smar.</p>
Static Pressure Effect**	<p><b>Zero Error:</b>  <b>For ranges 5*:</b> <math>\pm 0.05\%</math> URL (<math>\pm 0.1\%</math> for Tantalum diaphragm) per 7 MPa (1000 psi)  <b>For ranges 2, 3 or 4*:</b> <math>\pm 0.025\%</math> URL (<math>\pm 0.1\%</math> for Tantalum diaphragm) per 7 MPa (1000 psi)  <b>For range 1:</b> <math>\pm 0.05\%</math> URL per 1.7 MPa (250 psi)  <b>For range 0:</b> <math>\pm 0.1\%</math> URL por 0.5 MPa (73 psi)  <b>For any level or sanitary models:</b> <math>\pm 0.1\%</math> 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.</p> <p><b>Span Error:</b>  <b>For ranges 2,3,4 or 5*:</b> correctable to <math>\pm 0.1\%</math> of reading per 7MPa (1000 psi)  <b>For range 1:</b> correctable to <math>\pm 0.1\%</math> of reading per 1.7 MPa (250 psi)  <b>For range 0:</b> correctable to <math>\pm 0.2\%</math> of reading per 0.5 MPa (72 psi)  <b>For level or sanitary models:</b> correctable to <math>\pm 0.1\%</math> of reading per 3.5 MPa (500 psi)</p> <p>* Except level or sanitary model.  ** Except for LD400A, LD400M, LD400G, and LD400I. Not applicable</p>
Power Supply Effect	$\pm 0.005\%$ of calibrated span per volt.
Mounting Position Effect	Zero shift of up to 250 Pa (1 inH <sub>2</sub> O) which can be eliminating by calibration. No span effect.
Electromagnetic Interference Effect	Approved according to IEC61326-1:2006, IEC61326-2-3:2006, IEC61000-6-4:2006, IEC61000-6-2:2005.

Performance Specifications	
Vibration Effect	All models: URL $\pm 0.1\%$ in plants with high vibration levels or piping with too much vibration, according to the following specification by IEC 60770-1: 10-60 Hz, 0.21 mm peak displacement standard / 60-2000 Hz, 29.4 m/s <sup>2</sup> acceleration.

URL = Upper Range Limit

LRL = Low Range Limit

Physical Specifications	
Electrical Connection	<div> <div> 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) </div> <div> 1/2 - 14 BSP (with 316 SST adapter for 1/2 - 14 NPT)  M20 X 1.5  PG 13.5 DIN </div> </div>
Process Connection	1/4 - 18 NPT or 1/2 - 14 NPT (with adapter). For level models or more information, see Ordering Code.
Wetted Parts	<p><b>Sensor Isolating Diaphragms:</b> 316L SST, Hastelloy C276, Monel 400 or Tantalum</p> <p><b>Drain/Vent Valves and Plugs 1/4NPT:</b> 316 SST, Hastelloy C276 or Monel 400</p> <p><b>Drain / Vent Valves and 1/4 NPT Plug:</b> 316L SST, Hastelloy C276, Monel 400</p> <p><b>Transmitter's Flanges (1/4 NPT) and 1/2 NPT Adapter:</b> Plated Carbon Steel, 316 SST (ASTM - A351-CF8M), Hastelloy C276 (ASTM - A494 CW-12MW) or Monel 400</p> <p><b>Wetted O-Rings (For Flanges and Adapters):</b> Nitrile, Viton™, PTFE or Ethylene-Propylene.</p> <p><b>Level Flanges (LD400L – ASME / DIN / JIS)</b> 316L SST; 304L SST; Hastelloy C276; Duplex UNS S31803 / S32205; Super Duplex UNS S32750 / S32760</p> <p><b>Flanges Isolating Diaphragms</b> 316L SST; 304L SST; Hastelloy C276; Super Duplex UNS S32750 / S32760; 316L SST with Halar coating; 316L SST gold plated; Monel gold plated.</p> <p><b>Flange's Gaskets</b> PTFE; Grafoil</p> <p><b>Sanitary connections</b> 316L SST (without extension) 316L SST; Hastelloy C276 (extension end of connection)</p> <p><b>Sanitary Diaphragms</b> 316L SST; Hastelloy C276</p> <p><b>Sanitary connections - Sealing rings</b> Nitrile; PTFE; Viton</p> <p><b>Insertion probe:</b> 316L SST/ 304L SST</p> <p><b>Insertion Model Diaphragm</b> 316L SST</p> <p>The <b>LD400</b> is available in NACE MR-0175/ISO 15156 compliant materials.</p>
Nonwetted Parts	<p><b>Electronic Housing:</b> 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*.  <i>*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.</i></p> <p><b>Absolute/Gage Flange; reduced volume flange and Plug Flange</b> 316 SST - CF8M (ASTM - A351)</p> <p><b>Fill Fluid:</b> Silicone, Fluorolube, Krytox, Halocarbon 4.2 or Fomblim oils</p> <p><b>O-Rings (cover/housing and sensor/housing)</b> Buna-N</p> <p><b>Mounting Bracket:</b> Plated carbon steel or 316 SST Accessories (bolts, nuts, washers and U-clamps) in plated carbon steel or 316 SST</p>

Physical Specifications	
<b>Nonwetted Parts (continuation)</b>	<p><b>Transmitter Flange Bolts and Nuts:</b> 316 SST For NACE applications: carbon steel B7M; Hastelloy; Super duplex</p> <p><b>Identification Plate:</b> 316 SST</p> <p>The <b>LD400</b> is available in NACE MR-01-75/ISO 15156 compliant materials.</p>
<b>Mounting</b>	<p>a) Flange mounting or sanitary connection for LD400L or LD400S. 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 or LD400G.</p>
<b>Approximate Weights</b>	<p>3.15 kg (7 lb): all models with aluminum housing, 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.</p>
<b>Control Functions Characteristics (Optional)</b>	<p>Control Block (PID) and Totalization (TOT).</p> <p>NOTE: The PID block is not available for <b>LD400SIS</b> Model.</p>



## Ordering Code

MODEL DIFFERENTIAL PRESSURE, FLOW, GAGE, ABSOLUTE AND HIGH STATIC PRESSURE TRANSMITTER											
LD400 Smart Pressure Transmitter											
COD	Type	RANGE LIMITS						Turn Down			
		Min.	Max.	Unit	Min.	Max.	Unit	Max.			
D0	Differential (23)	-1	1	kPa	-10	10	mbar	20			
D1	Differential and Flow	-5	5	kPa	-50	50	mbar	40			
D2	Differential and Flow	-50	50	kPa	-500	500	mbar	200			
D3	Differential and Flow	-250	250	kPa	-2500	2500	mbar	200			
D4	Differential and Flow	-2500	2500	kPa	-25	25	bar	200			
M0	Gage	-1	1	kPa	-10	10	mbar	20			
M1	Gage	-5	5	kPa	-50	50	mbar	40			
M2	Gage	-50	50	kPa	-500	500	mbar	200			
M3	Gage	-100	250	kPa	-1000	2500	mbar	200			
M4	Gage	-100	2500	kPa	-1	25	bar	200			
M5	Gage	-0,1	25	MPa	-1	250	bar	120			
M6	Gage	-0,1	40	MPa	-1	400	bar	120			
A0	Absolute	0	1	kPa	0	7.5	mmHga	20			
A1	Absolute	0	5	kPa	0	37	mmHga	4			
A2	Absolute	0	50	kPa	0	500	mbar	20			
A3	Absolute	0	250	kPa	0	2500	mbar	120			
A4	Absolute	0	2500	kPa	0	25	bar	120			
A5	Absolute	0	25	MPa	0	250	bar	120			
A6	Absolute	0	40	MPa	0	400	bar	120			
H2	Differential – High Static Pressure	-50	50	kPa	-500	500	mbar	120			
H3	Differential – High Static Pressure	-250	250	kPa	-2500	2500	mbar	120			
H4	Differential – High Static Pressure	-2500	2500	kPa	-25	25	bar	120			
H5	Differential – High Static Pressure	-25	25	MPa	-250	-250	bar	120			
<b>COD Diaphragm Material and Fill Fluid</b>											
1	316L SST	Silicone Oil (9)(29)	M	Monel 400 Gold Plated	Silicone Oil (1) (3) (9)						
2	316L SST	Inert (Fluorolube Oil) (2) (19) (29)	P	Monel 400 Gold Plated	Inert (Krytox Oil) (1) (3) (19)						
3	Hastelloy C276	Silicone Oil (1) (9)	Q	316 L SST	Inert (Halocarbon 4.2 Oil) (19) (29)						
4	Hastelloy C276	Inert (Fluorolube Oil) (1) (2) (19)	R	Hastelloy C276	Inert (Halocarbon 4.2 Oil) (19)						
5	Monel 400	Silicone Oil (1)(3)(9)	S	Tantalum	Inert (Halocarbon 4.2 Oil) (3) (19)						
7	Tantalum	Silicone Oil (3) (9)	I	316L SST, L.I. Gold Plated	Silicone Oil (3) (9) (18)						
8	Tantalum	Inert (Fluorolube Oil) (2) (3) (19)	J	316L SST, L.I. Gold Plated	Inert (Fluorolube Oil) (3) (4) (18) (19)						
9	316L SST	Fomblim Oil (12) (29)	L	316L SST, L.I. Gold Plated	Inert (Krytox Oil) (3) (18) (19)						
A	Monel 400	Fomblim Oil (1) (3)	T	316L SST, L.I. Gold Plated	Inert (Halocarbon 4.2 Oil) (3) (18) (19)						
D	316 L SST	Inert (Krytox Oil) (12) (19) (29)	U	316L SST, L.I.	Silicone Oil (3) (9)						
E	Hastelloy C276	Inert (Krytox Oil) (1) (12) (19)	V	316L SST, L.I.	Inert (Fluorolube Oil) (3) (4) (19)						
G	Tantalum	Inert (Krytox Oil) (3) (19)	W	316L SST, L.I.	Inert (Krytox Oil) (3)(19)						
K	Monel 400	Inert (Krytox Oil) (1) (3) (19)	X	316L SST, L.I.	Inert (Halocarbon 4.2 Oil) (3)(19)						
<b>Note: L.I. = Integral steel</b>											
<b>COD Performance Class</b>											
0	Default	1	High Performance (14)								
<b>COD Communication Protocol</b>											
H	HART® and 4 to 20 mA										
<b>COD Security Option</b>											
0	Default- For use in measurement and control	1	SIS - Safety Instrumented Systems (24)								
<b>COD Flange(s), Adapter(s) and Drain/Vent Valves Material</b>											
0	Without Flanges, Adapters and Drain/Vent Valves										
P	Carbon Steel with superficial treatment (Stainless Steel Purge) (20)										
H	Hastelloy C276 (CW-12MW, ASTM - A494) (1)										
I	316 SST - CF8M (ASTM A351)										
F	Monel 400 - Laminated bar (for HF application) (1)										
1	316 SST - CF8M (ASTM A351) (Drain/Vent in Hastelloy C276) (1)										
2	316 SST - CF8M (ASTM A351) Flange with PVDF (Kynar) Insert (5) (7) (11)										
3	316 SST - CF8M (Drain/Vent and Plug in Monel) NACE Standard										
<b>COD O'Ring Material</b>											
0	Without O'Ring	B	Buna-N	T	Teflon	<b>Note: O'Rings are not available on the side with Remote Seals.</b>					
E	Etileno-Propileno	K	Kalrez (3)	V	Viton						
<b>COD Drain/Vent Position</b>											
0	Without Drain/Vent										
A	Drain/Vent (Opposite to Process Connection)	<b>Note: For better drain/vent operation, vent valves are strongly recommended. Drain/Vent valve are not available on the sides with remote seals.</b>									
D	Bottom										
U	Top										
<b>COD Process Connections</b>											
0	1/4 - 18 NPT (Without Adapter)										
1	1/2 - 14 NPT (With Adapter)										
2	CF 16 (Without Adapter) (28)										
3	Remote Seal (With Plug) (3) (8)										
5	1/2 - 14 NPT Axial (with PVDF Insert PVDF) (5) (7) (16)										
6	Flange for third party remote seal - 1/4 NPT										
8	Flange for third party remote seal - Weld										
9	Remote Seal (Low Volume Flange) (3) (4) (8)										
A	High Side: 1/4 NPT and Remote Seal (with plug)(3)										
B	High Side: 1/2 - 14 NPT Low Side: Remote Seal (With Plug) (3) (10)										
D	High Side: Remote Seal (With Plug) and Low Side: 1/2 14 NPT (3) (10)										
E	High Side: Remote Seal (with plug) and Low Side: 1/4 NPT (3)(10)(12)										
F	High Side: 1/2 - 14 NPT and Low Side: Low volume flange for remote seal (3) (10)										
G	High Side: 1/4 NPT and Low Side: Remote Seal (Low Volume Flange) (3)(4)(10)(12)										
H	High Side: Low volume flange for remote seal and Low Side: 1/2 - 14 NPT (3) (10)										
I	High Side: Remote Seal (Low Volume Flange) and Low Side: 1/4 NPT (3) (4) (10) (12)										
Q	8mm hole without thread. According to DIN 19213 (13)										
T	1/2 - 14 BSP (With Adapter)										
V	Manifold Valve Integrated to the Transmitter										
Z	User's specification										
<b>COD Special Applications</b>											
0	Without special cleaning										
1	Degrease Cleaning (Oxygen or Chlorine Service) (15)										

CONTINUE IN THE NEXT PAGE

LD400-D210-H0-IBD11 DIFFERENTIAL PRESSURE, FLOW, GAGE, ABSOLUTE AND HIGH STATIC PRESSURE TRANSMITTER (CONTINUATION)												
	COD		Flanges Bolts and Nuts Material									
	I C H A		316 SST									
			Carbon Steel (ASTM A193 B7M) (1) (20)									
			Hastelloy C276 (1a)									
			Super Duplex Stainless Steel NACE MR0175 / MR0103 Compliant (1a)									
	COD		Flange thread for fixing accessories (adapters, manifolds, mounting brackets, etc)									
			0 7/16 UNF									
			1 M10 X 1.5									
			2 M12 X 1.75									
	COD		Local Indication									
			0 Without Indicator									
			1 With Digital Indicator									
	COD		Electrical Connections									
			0 1/2 - 14 NPT (27)									
			1 3/4 - 14 NPT (with 316 SST adapter for 1/2 - 14 NPT) (22)									
			2 3/4 - 14 BSP (with 316 SST adapter for 1/2 - 14 NPT) (6)									
			3 1/2 - 14 BSP (with 316 SST adapter for 1/2 - 14 NPT) (6)									
			A M20 X 1.5 (27)									
			B PG 13.5 DIN (6)									
			Z User's specification									
	COD		Blanket Plug									
			I 316 SST									
	COD		Mounting Bracket for 2" Pipe or Surface Mounting									
			0 Without Bracket									
			1 Carbon steel bracket and accessories (20)									
			2 316 SST bracket and accessories									
			5 L type, carbon steel bracket and accessories (20)									
			6 L type, 316 SST bracket and accessories									
			7 Carbon steel bracket. Accessories: 316 SST (20)									
			9 L Type, carbon steel bracket. Accessories: 316 SST (20)									
			A Flat, 304 SST bracket and 316 SST accessories									
			Z User's specification									
	COD		Housing Material (25) (26)									
			A Aluminum (Default)									
			I 316 SST – CF8M (ASTM – A351)									
			J 316 SST - saline atmospheres (21)									
			B Aluminum - saline atmospheres (21)									
	COD		Painting									
			0 Gray Munsell N 6.5 Polyester									
			8 Without Painting (17)									
			9 Safety Blue Epoxy – Electrostatic Painting									
			C Safety Blue Polyesters – Electrostatic Painting									
			Z Special Painting									
	COD		Certification Type for Hazardous Locations									
			N No Certification									
			I Intrinsic Safety									
			E Increased Safety									
			D Explosion Proof									
			F Non-incendive + Intrinsic Safety									
			G Explosion Proof + Increased Safety									
			H Intrinsic Safety + Explosion Proof + Increased Safety									
			J Non-incendive + Intrinsic Safety + Dust									
	COD		Certifying Body for Hazardous Locations									
			0 Without Certification									
			2 ATEX									
			5 INMETRO (CEPEL)									
			8 INMETRO (UL BR)									
			9 IECEX									
	COD		Tag Plate									
			0 With tag, when specified (Default)									
			1 Blank									
			2 User's specification									
	COD		HART® Configuration									
			**									

LD400-D210-H0-IBD11- I 0- 1 0 I- 1 A 0 N 0 0 / \*\* TYPICAL MODEL NUMBER

\*\* Fill out with HART® Optional Configuration (see page 3.17)

#### Notes:

- (1) Meets NACE MR-0175 / ISO15156 standard.  
 (1a) Meets NACE MR-0103  
 (2) Not available for absolute models nor vacuum applications.  
 (3) Not applicable for ranges 0 and 1.  
 (4) Not applicable for vacuum service.  
 (5) Pressure maximum: 24 bar.  
 (6) Options not certified for use in hazardous locations.  
 (7) Drain/Vent not applicable.  
 (8) For Remote Seal only 316 SST CF8M (ASTM A351) flange is available (thread 7/16UNF and M10x1.5).  
 (9) Silicone Oil is not recommended for Oxygen (O2) or Chlorine service.  
 (10) Only available for differential pressure transmitter.  
 (11) O' Ring material must be of Viton or Kalrez.  
 (12) Not applicable for ranges 0.  
 (13) Only available for pressure transmitters D4 or H4 and 7/16 UNF or M10 x 1.5 flange thread for fixing accessories.  
 (14) Only available for **LD400D** and **LD400M**.  
 (15) Degrease cleaning not available for carbon steel flanges.  
 (16) Only available for Flange with PVDF (Kynar) Insert.  
 (17) Not available for aluminum housing.  
 (18) Effective for hydrogen migration processes.  
 (19) Inert Fluid: Oxygen Compatibility, safe for oxygen service.  
 (20) Not applicable for saline atmosphere.  
 (21) IPW/TYPEx was performed in a saturated solution of NaCl 5% w/w at 35°C for a time of 200 h.  
 (22) Certification Ex-d for INMETRO.  
 (23) The D0 range should not be used for flow measurement.  
 (24) SIL 1 and SIL 2 (non-redundant) and SIL 3 (redundant) applications.  
 (25) IPX8 tested in 10 meters of water column for 24 hours.  
 (26) Ingress Protection:
- | Product | CEPEL    | NEMKO / EXAM | FM        |
|---------|----------|--------------|-----------|
| LD400   | IP66/68W | IP65/67W     | Type4X/6P |
- (27) Certification Ex-d for FM / ATEX / IECEx / INMETRO  
 (28) LD400A exclusive connection.  
 (29) Sensors in 316L stainless steel ranges 0, 1, and 2 are mounted with Hastelloy C276 diaphragm.

MODEL		FLANGED PRESSURE TRANSMITTER									
LD400		Smart Pressure Transmitter									
COD	TYPE	RANGE LIMIT						Turn Down			
		Min	Max	Unit	Min	Max	Unit	Max			
L2	Level	-50	50	kPa	-500	500	mbar	120	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.		
L3	Level	-250	250	kPa	-2500	2500	mbar	120			
L4	Level	-2500	2500	kPa	-25	25	bar	120			
L5	Level	-25	25	MPa	-250	250	bar	120			
COD.	Diaphragm material and Fill Fluid (Low Side)										
1	316L SST						Silicone Oil (2) (25)				
2	316L SST						Inert (Fluorolube Oil) (3) (16) (25)				
3	Hastelloy C276						Silicone Oil (1) (2)				
4	Hastelloy C276						Inert (Fluorolube Oil) (1) (3) (16)				
5	Monel 400						Silicone Oil (1) (2)				
7	Tantalum						Silicone Oil (2)				
8	Tantalum						Inert (Fluorolube Oil) (3) (16)				
9	316L SST						Fomblin Oil (25)				
A	Monel 400						Fomblin Oil (1)				
D	316 L SST						Inert (Krytox Oil) (16) (25)				
E	Hastelloy C276						Inert (Krytox Oil) (1) (16)				
G	Tantalum						Inert (Krytox Oil) (16)				
K	Monel 400						Inert (Krytox Oil) (1) (16)				
M	Monel 400 Gold Plated						Silicone Oil (1) (2)				
P	Monel 400 Gold Plated						Inert (Krytox Oil) (1) (16)				
Q	316L SST						Inert (Halocarbon 4.2 Oil) (16) (25)				
R	Hastelloy C276						Inert (Halocarbon 4.2 Oil) (1) (16)				
S	Tantalum						Inert (Halocarbon 4.2 Oil) (16)				
I	316L SST, L.I. Gold Plated						Silicone Oil (2) (15)				
J	316L SST, L.I. Gold Plated						Inert (Fluorolube Oil) (3) (15) (16)				
L	316L SST, L.I. Gold Plated						Inert (Krytox Oil) (15) (16)				
T	316L SST, L.I. Gold Plated						Inert (Halocarbon 4.2 Oil) (15) (16)				
COD.	Performance Class										
0	Default										
COD.	Communication Protocol										
H	HART® and 4 to 20 mA										
COD.	Security Option										
0	Default- For use in measurement and control										
1	SIS - Safety Instrumented Systems (23)										
COD.	Flange, Adapter and Drain/Vent Valves material										
A	304L SST										
P	Plated CS (Drain/Vent in Stainless Steel) (17)										
H	Hastelloy C276 (CW-12MW, ASTM - A494) (1)										
I	316 SST - CF8M (ASTM A351)										
F	Monel 400 - Laminated bar (Application in HF)										
1	316 SST - CF8M (ASTM A351) (Drain/Vent in Hastelloy C276) (1)										
2	316 - CF8M (ASTM A351) Flange with PVDF (Kynar) Insert (3) (4) (5)(6)										
COD.	O'Ring Material										
O	Without O'Ring										
B	Buna-N										
E	Ethylene - Propylene										
K	Kalrez										
T	Teflon										
V	Viton										
COD.	Drain/Vent Position (Low Side)										
0	Without Drain/Vent										
A	Drain/Vent (Opposite to Process connection)										
D	Bottom										
U	Top										
COD.	Process Connection (Low Side)										
0	1/4 - 18 NPT (Without adapter)										
1	1/2- 14 NPT (With adapter)										
3	Remote Seal (With Plug) (7)										
5	1/2- 14 NPT Axial with PVDF Insert (3) (4) (6)										
9	Remote Seal (Low Volume Flange) (3) (7)										
T	1/2 - 14 BSP (With adapter)										
U	Flange for Level with Welded Plug (4)										
Z	User's specifications										
COD.	Special Applications										
0	Without Special Applications										
1	Degrease Cleaning (Oxygen or Chlorine Service) (10)										
2	For vacuum applications										
COD.	Flanges Bolts and Nuts Material										
I	316 SST										
C	Carbon Steel (ASTM A193 B7M) (1) (17)										
H	Hastelloy C276										
A	Super Duplex Stainless Steel NACE MR0175 / MR0103 Compliant (1a)										
COD.	Flange thread for fixing accessories (adapters, manifolds, mounting brackets, etc)										
0	7/16UNF										
1	M10 x 1.5										

LD400

L2

1

0

H

0

P

B

D

0

0

I

0

CONTINUE IN THE NEXT PAGE

CONTINUE IN THE NEXT PAGE

LD400-L210-H0-PBD00-I0		FLANGED PRESSURE TRANSMITTER (CONTINUATION)	
<b>COD.</b>	<b>Process Connection (High Side)</b>		
U	1" 150 # (ASME B16.5)		
V	1" 300 # (ASME B16.5)		
W	1" 600 # (ASME B16.5)		
O	1 1/2" 150 # (ASME B16.5)		
P	1 1/2" 300 # (ASME B16.5)		
Q	1 1/2" 600 # (ASME B16.5)		
A	2" 150 # (ASME B16.5)		
B	2" 300 # (ASME B16.5)		
1	2" 600 # (ASME B16.5)		
2	3" 150 # (ASME B16.5)		
C	3" 300 # (ASME B16.5)		
3	3" 600 # (ASME B16.5)		
4	4" 150 # (ASME B16.5)		
D	4" 300 # (ASME B16.5)		
5	4" 600 # (ASME B16.5)		
E	DN 25 PN10/40 (DIN EN 1092-1)		
6	DN 40 PN10/40 (DIN EN 1092-1)		
7	DN 50 PN 10/40 (DIN EN 1092-1)		
8	DN 80 PN 10/40 (DIN EN 1092-1)		
H	DN 100 PN 10/16 (DIN EN 1092-1)		
F	DN 100 PN 25/40 (DIN EN 1092-1)		
G	10K 100A (JIS B2220)		
M	10K 50A (JIS B2220)		
S	10K 80A (JIS B2220)		
K	20K 100A (JIS B2220)		
L	20K 40A (JIS B2220)		
Z	20K 50A (JIS B2220)		
	20K 80A (JIS B2220)		
	User's specifications		
<b>COD.</b>	<b>Type and Flange Material (High Side)</b>	<b>Z</b>	User's specification
I	316L SST (Integral Flange)		
H	Hastelloy C276 (Integral Flange)		
<b>COD.</b>	<b>Flange Facing Finish</b>		
0	Raised Face – RF (Default)		
1	Flat Face – FF (12)		
2	Ring Joint Face – RTJ (Only available for ASME standard flange) (11)		
<b>COD.</b>	<b>Extension Length</b>		
0	0 mm (0")	Note: Extension Material 316L SST	
1	50 mm (2")		
2	100 mm (4")		
3	150 mm (6")		
4	200 mm (8")		
Z	User's specifications		
<b>COD.</b>	<b>Diaphragm Material (Tap Level)</b>		
A	304L SST / 304L SST		
L	316 L SST / 316 SST		
H	Hastelloy C276 / 316 SST		
M	Monel 400 / 316 SST (9)		
T	Tantalum / 316 SST (9)		
X	Titanium / 316 SST (9)		
1	316L SST with Teflon Lining (For 2" and 3")		
2	316L SST Gold plated		
3	Tantalum with Teflon Lining		
<b>COD.</b>	<b>Fill Fluid (Tap Level)</b>		
1	Silicone DC-200/20 Oil		
2	Inert (Fluorolube MO-10 Oil) (7) (16)		
3	Silicone DC704 Oil		
4	Inert (Krytox Oil) (16)		
N	Neobee M20 Propylene Glycol Oil		
T	Syltherm 800 Oil		
Z	User's specifications		
<b>COD.</b>	<b>Local Indicator</b>		
0	Without indicator		
1	With digital indicator		
<b>COD.</b>	<b>Electrical Connection</b>		
0	1/2 - 14 NPT (20)		
1	3/4 - 14 NPT (with 316 SST adapter for 1/2 - 14 NPT) (19)		
2	3/4 - 14 BSP (with 316 SST adapter for 1/2 - 14 NPT) (8)		
3	1/2 - 14 BSP (with 316 SST adapter for 1/2 - 14 NPT) (8)		
A	M20 X 1.5 (20)		
B	PG 13.5 DIN (8)		
Z	User's specifications		
<b>COD.</b>	<b>Plug</b>		
I	316 SST		

LD400-L210-H0-PBD00-I0 1 - I 0 1 - L 1 1 0 I

CONTINUE IN THE NEXT PAGE

LD400-L210-H0-PBD00-I01-I01-L110I										FLANGED PRESSURE TRANSMITTER (CONTINUATION)									
										COD. Housing Material (21) (22)									
										A I Aluminum 316 SST – CF8M (ASTM – A351) J 316 SST - saline atmosphere (18) B Aluminum - saline atmosphere (18)									
										COD Painting									
										0 Gray Munsell N6,5 Polyester									
										8 Without painting (14)									
										9 Safety Blue Epoxy – Electrostatic Painting									
										C Safety Blue Polyester – Electrostatic Painting									
										Z Special Painting									
										COD Certification Type for Hazardous Locations									
										N Without certification F Non-incendive + Intrinsic Safety									
										I Intrinsic Safety G Explosion Proof + Increased Safety									
										E Increased Safety H Intrinsic Safety + Explosion Proof + Increased Safety									
										D Explosion Proof J Non-incendive + Intrinsic Safety + Dust									
										COD Identification Plate for Hazardous Locations									
										0 Without certification 8 INMETRO (UL BR)									
										2 ATEX 9 IECEx									
										5 INMETRO (CEPEL)									
										COD Tag Plate									
										0 With TAG, when specified									
										1 Blanket									
										2 According to user's notes									
										COD Lower Housing Material									
										0 Without Lower Housing (24) 3 Super Duplex (UNS 32750) (13)									
										1 Stainless Steel 316 4 Duplex (UNS 31803) (13)									
										2 Hastelloy C276 5 Stainless Steel 304L (13)									
										COD Gasket Material									
										0 Without gasket									
										T Teflon (PTFE)									
										G Grafoil (Flexible lead)									
										I Stainless 316L									
										COD HART® Configuration									

TYPICAL MODEL NUMBER

\*\* Fill out with HART® Optional Configuration (see page 3.17)

## Notes:

- (1) Meets NACE MR – 01 – 75/ISO 15156 recommendations.  
 (1a) MR103  
 (2) Silicone Oil is not recommended for Oxygen (O<sub>2</sub>) or Chlorine service.  
 (3) Not applicable for vacuum service.  
 (4) Drain/Vent not applicable.  
 (5) O'Ring should be Viton or Kalrez.  
 (6) Maximum pressure 24 bar.  
 (7) Inert fill fluid (Fluorolube) is not available for Monel diaphragm.  
 (8) Options not certified for use in hazardous locations.  
 (9) Attention, check corrosion rate for the process, tantalum plate 0.1 mm, AISI 316L extension 3 to 6 mm.  
 (10) Degrease cleaning not available for carbon steel flanges.  
 (11) Only available for ASME B16.5 flange.  
 (12) Do not available for JIS B 2220.  
 (13) For this option consult Smar.  
 (14) Do not available for aluminum housing.  
 (15) Effective for hydrogen migration processes.  
 (16) Inert Fluid: Oxygen Compatibility, safe for oxygen service.  
 (17) Not applicable for saline atmosphere.  
 (18) IPW/TYPEx was performed in a saturated solution of NaCl 5% w/w at 35°C for a time of 200 hours.  
 (19) Certification Ex-d for INMETRO.  
 (20) Certification Ex-d for FM / ATEX / IECEx / INMETRO  
 (21) IPX8 tested in 10 meters of water column for 24 hours.  
 (22) Ingress Protection:

Product	CEPEL	NEMKO / EXAM	FM
LD400	IP66/68W	IP66/68W	Type4X/6P

- (23) SIL 1 and SIL 2 (non-redundant) and SIL 3 (redundant) applications.  
 (24) Supplied without Gasket.  
 (25) Sensors in 316L stainless steel, range 2, are mounted with Hastelloy C276 diaphragm.

MODEL	SANITARY PRESSURE TRANSMITTER																				
LD400	Smart Pressure Transmitter																				
COD	TYPE	RANGE LIMIT						Turn Down													
		Min	Max	Unit	Min	Max	Unit	Max													
S2	Sanitary	-50	50	kPa	-500	500	mbar	200	<b>Note:</b> 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.												
S3	Sanitary	-250	250	kPa	-2500	2500	mbar	200													
S4	Sanitary	-2500	2500	kPa	-25	25	bar	200													
S5	Sanitary	-25	25	MPa	-250	250	bar	120													
<b>COD.</b> Diaphragm material and Fill Fluid (Low Side)																					
1	316L SST	Silicone Oil (2) (18)																			
2	316L SST	Inert (Fluorolube Oil) (3) (9) (18)																			
3	Hastelloy C276	Silicone Oil (1) (2)																			
4	Hastelloy C276	Inert (Fluorolube Oil) (1) (3) (9)																			
<b>COD.</b> Performance Class																					
0	Default																				
<b>COD.</b>		Communication Protocol																			
H	HART® and 4 to 20 mA																				
<b>COD.</b>		Security Option																			
0	Default – For use in measurement and control																				
1	SIS - Safety Instrumented Systems (15)																				
<b>COD.</b>		Flange, Adapter and Drain/Vent Valves material (Low Side)																			
I	316 SST																				
<b>COD.</b>		O'Ring Material																			
O	Without O'Ring																				
B	Buna-N																				
E	Ethylene – Propylene																				
T	Teflon																				
V	Viton																				
<b>COD.</b>		Drain/Vent Position (Low Side)																			
0	Without drain/vent																				
A	Drain/Vent (Opposite to Process Connection)																				
D	Bottom																				
U	Top																				
<b>COD.</b>		Process Connection (Low Side)																			
0	1/4 - 18 NPT (Without adapter)																				
1	1/2 - 14 NPT (With adapter)																				
3	Remote Seal (With Plug) (4)																				
9	Remote Seal (Low Volume Flange) (3) (4)																				
T	1/2 – 14 BSP (With adapter)																				
Z	User's specifications																				
<b>COD.</b>		Special Applications																			
0	Without special cleaning																				
1	Degrease Cleaning (Oxygen or Chlorine Service) (6)																				
2	For application in vacuum																				
<b>COD.</b>		Flanges Bolts and Nuts Material																			
I	316 SST																				
C	Carbon Steel (ASTM A193 B7M) (1) (10)																				
H	Hastelloy C276																				
A	Super Duplex Stainless Steel NACE MR0175 / MR0103 Compliant (1a)																				
<b>COD.</b>		Flange thread for fixing accessories (adapters, manifolds, mounting brackets, etc)																			
0	7/16UNF																				
1	M10 x 1.5																				
LD400	-	S2	-	1	-	0	-	H	-	0	-	H	B	D	U	-	0	-	I	-	0

CONTINUE IN THE NEXT PAGE

CONTINUE IN THE NEXT PAGE



LD400-S210-H0-HBDU0-I0		SANITARY PRESSURE TRANSMITTER (CONTINUATION)										
		COD.	Process Connection (High Side) (17)									
		8	THREAD DN25 DIN 11851 – WITH EXTENSION/316L SST									
		9	THREAD DN40 DIN 11851 - WITH EXTENSION									
		H	THREAD DN40 DIN 11851 – 316L SST									
		V	THREAD DN50 DIN 11851 - WITH EXTENSION									
		U	THREAD DN50 DIN 11851 – 316L SST									
		X	THREAD DN80 DIN 11851 - WITH EXTENSION									
		W	THREAD DN80 DIN 11851 – 316L SST									
		4	THREAD IDF 2" - WITH EXTENSION									
		B	THREAD IDF 2" – 316L SST									
		K	THREAD IDF 3" - WITH EXTENSION									
		3	THREAD IDF 3" - WITHOUT EXTENSION/316L SST									
		5	THREAD RJT 2" - - WITH EXTENSION									
		C	THREAD RJT 2" – 316L SST									
		L	THREAD RJT 3" - WITH EXTENSION									
		2	THREAD RJT 3" - WITHOUT EXTENSION/316L SST									
		S	THREAD SMS 1 1/2" – 316L SST									
		7	THREAD SMS 2" - - WITH EXTENSION									
		E	THREAD SMS 2" – 316L SST									
		M	THREAD SMS 3" - - WITH EXTENSION									
		1	THREAD SMS 3" - - WITHOUT EXTENSION/316L SST									
		F	TRI CLAMP 1 1/2" – 316L SST									
		Q	TRI CLAMP 1 1/2" HP (High Pressure) – 316L SST									
		6	TRI CLAMP 2" - - WITH EXTENSION									
		D	TRI CLAMP 2" – 316L SST									
		N	TRI CLAMP 2" HP (High Pressure) - WITH EXTENSION									
		P	TRI CLAMP 2" HP (High Pressure) – 316L SST									
		I	TRI CLAMP 3" - - WITH EXTENSION									
		G	TRI CLAMP 3" – 316L SST									
		J	TRI CLAMP 3" HP (High Pressure) - WITH EXTENSION									
		R	TRI CLAMP 3" HP (High Pressure) – 316L SST									
		A	TRI CLAMP DN50 - - WITH EXTENSION									
		O	TRI CLAMP DN50 HP (High Pressure) - WITH EXTENSION									
		Z	User's specifications									
		COD.	O' Ring Material (High Side)									
		0	Without O' Ring ((Client supplied)									
		B	Buna-N									
		T	Teflon									
		V	Viton									
		Z	User's specifications									
		COD.	Tank Adapter									
		0	Without adapter (Client supplied)									
		1	With tank, 316 SST adapter									
		Z	User's specifications									
		COD.	Clamp TRI-CLAMP									
		0	Without TRI-CLAMP clamp (Client supplied)									
		2	With 304 SST TRI-CLAMP clamp (7)									
		Z	User's specifications									
		COD.	Diaphragm material (High Side)									
		I	316 L SST									
		H	Hastelloy C276									
		COD.	Fill Fluid (High Side)									
		1	DC – 200/20 Silicone Oil									
		2	Inert (Fluorolube MO-10 Oil) (3)									
		3	Silicone Oil DC704									
		N	Neobee M20 Propylene Glycol Oil									
		Z	User's specifications									
		COD.	Local Indicator									
		0	Without indicator									
		1	With digital indicator									
		COD.	Electrical Connection									
		0	1/2 - 14 NPT (16)									
		1	3/4 – 14 NPT (with 316 SST adapter for ½ - 14 NPT) (12)									
		2	3/4 – 14 BSP ((with 316 SST adapter for ½ - 14 NPT) (5)									
		3	1/2 – 14 BSP ((with 316 SST adapter for ½ - 14 NPT) (5)									
		A	M20 X 1.5 (16)									
		B	PG 13.5 DIN (5)									
		Z	User's specifications									
		COD.	Blanket Plug									
		I	316 SST									

LD400-S210-H0-HBDU0-I0	4	-	B	1	0	-	I	1	1	0	I
------------------------	---	---	---	---	---	---	---	---	---	---	---

CONTINUE IN THE NEXT PAGE

LD400-S210-H0-HBDU0-I04-B10-I110I		SANITARY PRESSURE TRANSMITTER (CONTINUATION)													
		COD		Housing Material (13) (14)											
		A		Aluminum (IP/TYPE)					J		316 SST - saline atmospheres (IPW/TYPEX) (11)				
		I		316 SST – CF8M (ASTM – A351) (IP/TYPE)					B		Aluminum - saline atmospheres (IPW/TYPEX) (11)				
				COD		Painting									
				0		Gray Munsell N6,5 Polyester									
				8		Without painting (8)									
				9		Blue Safety Epoxy – Electrostatic Painting									
				C		Blue Safety Polyester - Electrostatic Painting									
				Z		Special Painting									
				COD		Certification Type for Hazardous Locations									
				N		Without Certification			F		Non-incendive + Intrinsic Safety				
				I		Intrinsic Safety			G		Explosion Proof + Increased Safety				
				E		Increased Safety			H		Intrinsic Safety + Explosion Proof + Increased Safety				
				D		Explosion Proof			J		Non-incendive + Intrinsic Safety + Dust				
				COD		Identification Plate for Hazardous Locations									
				0		Without certification			8		INMETRO (UL BR)				
				2		ATEX			9		IECEX				
				5		INMETRO (CEPEL)									
				COD		TAG Plate									
				0		With TAG, when specified.									
				1		Blank									
				2		According to user notes									
				COD		HART Configuration									
				**											
LD400-S210-H0-HBDU0-I04-B10-I110I		-	A	0	N	0	0	0	/	**	TYPICAL MODEL NUMBER				

LD400-S210-H0-HBDU0-I04-B10-I110I - A 0 N 0 0 / \*\*

TYPICAL MODEL NUMBER

\*\* Fill out with HART® Optional Configuration (see page 3.17)

## Notes:

- (1) Meets NACE MR – 01 – 75/ISO 15156 recommendations.  
 (1a) MR103  
 (2) Silicone Oil is not recommended for Oxygen (O<sub>2</sub>) or Chlorine service.  
 (3) Not applicable for vacuum service.  
 (4) Drain/Vent not applicable.  
 (5) Options not certified for use in hazardous locations.  
 (6) Degreaser's cleaning is not available for carbon steel flanges.  
 (7) Only available for TRI-CLAMP connections.  
 (8) Do not available for aluminum housing.  
 (9) Inert Fluid: Oxygen Compatibility, safe for oxygen service.  
 (10) Not applicable for saline atmosphere.  
 (11) IPW/TYPEX was performed in a saturated solution of NaCl 5% at 35°C for 200 hours.

- (12) Certification Ex-d for INMETRO.  
 (13) IPX8 tested in 10 meters of water column for 24 hours.  
 (14) Ingress Protection:

Product	CEPEL	NEMKO / EXAM	FM
LD400	IP66/68W	IP66/68W	Type4X/6P

- (15) SIL 1 and SIL 2 (non-redundant) and SIL 3 (redundant) applications.  
 (16) Certification Ex-d for FM / ATEX / IECEx / INMETRO  
 (17) LD400S without extension always 316L SST/316L SST or Hastelloy C276; connections with extension, the wet tip follows 316L SST or Hastelloy C276 diaphragm material.  
 (18) Sensors in 316L stainless steel, range 2, are mounted with Hastelloy C276 diaphragm.

**\*\*HART OPTIONAL CONFIGURATION (1)**

LD400-D210-H0-IBD11-I01-011-A060 LD400-L210-H0-PBD00-I01-I01-L110I-A060 LD400-S210-H0-HBDU0-I04-B10-I110I-A060 / MAIN CODE OF HART TRANSMITTER (CONTINUATION)									
		COD.	Burn-out						
		BD	Start Scale (According NAMUR NE43 specifications) (Default)						
		BU	End Scale (According NAMUR NE43 specifications)						
		COD.	LCD1 Indication						
		Y0	LCD1: Percentage (Default)						
		Y1	LCD1: Current - I (mA)						
		Y2	LCD1: Pressure (Engineering Unit)						
		Y3	LCD1: Temperature (Engineering Unit)						
		YU	LCD1: User's specifications (2)						
		COD.	LCD2 Indication						
		Y0	LCD2: Percentage (Default)						
		Y1	LCD2: Current - I (mA)						
		Y2	LCD2: Pressure (Engineering Unit)						
		Y3	LCD2: Temperature (Engineering Unit)						
		YU	LCD2: User's specifications (2)						
		COD.	LCD 3 Indication						
		Y0	LCD3: Percentage (Default)						
		Y1	LCD3: Current - I (mA)						
		Y2	LCD3: Pressure (Engineering Unit)						
		Y3	LCD3: Temperature (Engineering Unit)						
		YU	LCD3: User's specifications (2)						
		COD.	PID availability						
		P0	PID do not available						
		P1	Available and disable (Default)						
		P2	Available and enable						
		COD.	Transfer Function for Flow Measurement						
		F0	Linear (Default)						
		F1	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 or Venturi tube etc. (3)						
		F2	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. (3)						
		F3	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. (3)						
		F4	TABLE - The output is a curve formed by 16 points. These points may be edited directly on the XY Table of LD400. 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. (3)						
		F5	SQRT & TABLE - Square root and Table. Same application as square roots, but also allows additional compensation of, e.g., varying Reynolds number. (3)						
		F6	SQRT**3 & TABLE - Square Root of the Third Power AND TABLE. (3)						
		F7	SQRT**5 & TABLE - Square Root of the Fifth Power AND TABLE. (3)						
		F8	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. (3)						
		COD.	Special Characteristics						
		M0	Without special characteristics (Default)						
		M4	Calibration with reading on the top and bottom (Hysteresis)						
		M5	Calibration with 10 points						
		M6	Special method of Acquisition disabled						
		COD.	Insulator Kit						
		K0	Without insulator Kit						
		K1	With insulator kit (4)						
		COD.	Special Characteristics						
		ZZ	User's specifications						

LD400-D210-H0-IBD11-I01-011-A060	/	BU	Y2	Y3		P2	F1			
LD400-L210-H0-PBD00-I01-I01-L110I-A060	/	BD	Y2	Y3		P2				
LD400-S210-H0-HBDU0-I04-B10-I110I-A060	/	BD	Y2	Y3		P2				

TYPICAL MODEL NUMBER

**Notes:**

- (1) Fill out with optional codes only if different from default.
- (2) Limited values to 4 ½ digits; limited units to 5 characters.
- (3) Only available for differential, gage, absolute and high static pressure differential models.
- (4) Only available for level models.

MODEL	INLINE PRESSURE TRANSMITTER															
LD400G	Smart Pressure Transmitter															
COD	TYPE	RANGE LIMIT						Turn Down								
		Min.	Max.	Unit	Min.	Max.	Unit									
2	Inline	-50	50	kPa		-500	500	mbar	200	<b>Note:</b> 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.						
3	Inline	-100	250	kPa		-1000	2500	mbar	200							
4	Inline	-100	2500	kPa		-1	25	bar	200							
5	Inline	-0,1	25	MPa		-1	250	bar	200							
COD	Diaphragm material and Fill Fluid (Low Side)															
1	316L SST	Silicone Oil (3) (14)														
2	316L SST	Fluorolube Inert Oil (2) (4) (14)														
3	Hastelloy C276	Silicone Oil (1) (3)														
4	Hastelloy C276	Fluorolube Inert Oil (1) (2) (4)														
D	316L SST	Krytox Inert Oil (2) (14)														
E	Hastelloy C276	Krytox Inert Oil (1) (2)														
Q	316L SST	Halocarbon 4.2 Inert Oil (2) (14)														
R	Hastelloy C276	Halocarbon 4.2 Inert Oil (1) (2)														
COD.	Performance Class															
0	Standard															
1	High Performance															
COD	Communication Protocol															
H	HART® and 4 to 20 mA															
COD	Security Option															
0	Default – For use in measurement and control															
1	SIS - Safety Instrumented Systems (5)															
COD	Process Connection															
1	1/2 - 14 NPT - Female															
A	M20X1,5 - Male															
G	DIN EN 837-1 G1/2B Male (6)															
H	DIN EN 837-1 G1/2B HP Male (6)															
M	1/2 - 14 NPT - Male															
R	Remote Seal – See notes															
U	1/2 BSP - Male															
V	Manifold Valve Integrated to the Transmitter															
X	1" NPT Sealed (Diaphragm 316L SST/ Fill fluid Silicone DC200/20)															
Y	1 ½ NPT Sealed (Diaphragm 316L SST/ Fill fluid Silicone DC200/20)															
Z	Special – See notes															
COD.	Process Connection Material															
H	Hastelloy C276 (1)															
I	316L SST/ 316L SST															
Z	Special – See notes															
COD	Special Applications															
0	Without special cleaning															
1	Degrease Cleaning															
COD	Local Indicator															
0	Without indicator															
1	With digital indicator															
COD	Electrical Connection															
0	1/2 - 14 NPT (7)															
1	3/4 - 14 NPT (with 316 SST adapter for ½ - 14 NPT) (8)															
2	3/4 - 14 BSP (with 316 SST adapter for ½ - 14 NPT) (9)															
3	1/2 - 14 BSP (with 316 SST adapter for ½ - 14 NPT) (9)															
A	M20X1,5 (7)															
B	PG 13.5 DIN (9)															
Z	Special – See notes															
COD	Blanket Plug															
I	316 SST															
COD	Mounting Bracket															
0	Without Bracket															
1	Carbon steel bracket and accessories															
2	316 SST bracket and accessories															
7	Carbon steel bracket. Accessories: 316 SST															
LD400G	-	2	1	0	-	H	0	-	1	I	0	1	0	-	I	1
CONTINUE IN THE NEXT PAGE																

CONTINUE IN THE NEXT PAGE

LD400G-210-H0-1I010-I1		INLINE PRESSURE TRANSMITTER (CONTINUATION)			
COD		Housing Material (12)			
A		Aluminum (IP/TYPE)		J	316 SST - saline atmospheres (IPW/TYPEX) (10)
I		316 SST – CF8M (ASTM – A351) (IP/TYPE)		B	Aluminum - saline atmospheres (IPW/TYPEX) (10)
COD		Painting			
0		Gray Munsell N6,5 Polyester			
1		Blue Safety N4845 (1374 STANDARD – PETROBRAS)			
2		Blue Safety N4845 (1735 STANDARD – PETROBRAS)			
8		Without painting (11)			
9		Blue Safety Epoxy – Electrostatic Painting			
C		Blue Safety Polyester - Electrostatic Painting			
G		Orange Safety Epoxy – Electrostatic Painting			
Z		Special Painting			
COD		Certification Type for Hazardous Locations			
N		Without certification		G	Explosion Proof + Increased Safety
I		Intrinsic Safety		H	Intrinsic Safety + Explosion Proof + Increased Safety
E		Increased Safety		J	Non-incendive + Intrinsic Safety + Dust
D		Explosion Proof			
F		Non-incendive + Intrinsic Safety			
COD		Certification Body for Hazardous Locations			
0		Without certification			
2		ATEX			
5		INMETRO (CEPEL)			
8		INMETRO (UL BR)			
9		IECEX			
COD		TAG Plate			
0		With TAG, when specified.			
1		Blanket			
2		According to user notes			

LD400G-210-H0-1I010-I1	-	A	0	N	0	0	**
------------------------	---	---	---	---	---	---	----

TYPICAL MODEL NUMBER

SPECIAL OPTIONS		MAIN CODE OF HART TRANSMITTER (CONTINUATION)		
		COD.	Burn-out	
			B0	Without Burn-out indication
			BD	Start Scale (According NAMUR NE43 specifications)
			BU	End Scale (According NAMUR NE43 specifications)
		COD.	LCD Indication	
			Y0	Percentage (Default)
			Y1	Current (mA)
			Y2	Pressure (Engineering Unit)
			Y3	Temperature (Engineering Unit)
			YU	User's specification (13)
		COD.	PID availability	
			P0	PID do not available
		P1	Available and disable (Default)	
			P2	Available and enable
		COD.	Special Characteristics	
			M0	Without special characteristics (Default)
		M4	Calibration with reading on the top and bottom (Hysteresis)	
			M5	Calibration with 10 points
M6	Special method of Acquisition disabled			
	COD.	Special Procedure		
C5		Mounting according to NACE		
COD.	Certification for Telecommunications			
	W0	Without certification		
W1	ANATEL			
	COD.	Mounting Position		
D1		Vertical		
D2	Horizontal			
	COD.	Manufacturing Standard		
S0		SMAR		
SJ	316 SST Sensor			

LD400G-210-H0-1I010-I1 – A0N00	BU	Y2	P0	M0	*	W0	D1	S0
--------------------------------	----	----	----	----	---	----	----	----

TYPICAL MODEL NUMBER

## NOTES

- (1) Meets NACE MR – 01 – 75 recommendations.
- (2) Inert Fluid: Oxygen Compatibility, safe for oxygen service.
- (3) Silicone Oil is not recommended for Oxygen (O2) or Chlorine service.
- (4) Not applicable for vacuum service.
- (5) SIL 1 and SIL 2 (non-redundant) and SIL 3 (redundant) applications.
- (6) The DIN16288 standard was replaced by DIN EN 837-1 standard.
- (7) Certification Ex-d for FM / ATEX / IECEx / INMETRO.
- (8) Certification Ex-d for INMETRO.
- (9) Options not certified for use in hazardous locations.
- (10) IPW/TYPEX was performed in a saturated solution of NaCl 5% at 35°C for 200 hours.
- (11) Do not available for aluminum housing.

## (12) Ingress Protection:

Product	CEPEL	NEMKO / EXAM	FM
LD400	IP66/68W	IP66/68W	Type4X/6P

- (13) Limited values to 4 ½ digits; limited units to 5 characters.
- (14) Sensors in 316L stainless steel, range 2, are mounted with Hastelloy C276 diaphragm.

MODEL	PRESSURE TRANSMITTER WITH EXTENDED PROBE														
LD400	Pressure Transmitter with Extended Probe														
COD	TYPE	RANGE LIMITS			Turn Down										
		Min.	Max.	Unit	Max.										
I2	Level	12,5	500	mbar	120										
COD	Diaphragm material and Fill Fluid (Low Side)														
1	316L SST	Silicon Oil (9)													
COD	Performance Class														
0	Default														
COD	Communication Protocol														
H	HART														
COD	Security Option														
0	Default- For use in measurement and control														
COD	Probe Material /Diaphragm														
A	304L SST / 316L SST														
H	304L SST / Hastelloy C276														
I	316L SST / 316L SST														
U	316L SST / Hastelloy C276														
Z	User's Specification														
COD	Probe Length														
1	500 mm				5	1250 mm				8	2500 mm				
2	630 mm				6	1600 mm				9	3200 mm				
3	800 mm				7	2000 mm				Z	User's Specification				
4	1000 mm														
COD	Probe Fill Fluid														
N	Propilen Glicol Oil (Neobee M20)														
COD	Fixing Transmitter														
1	Support in L				4	Fixed Flanged Support									
2	Adjustable Flanged Support				Z	User's Specification									
3	Triclamp diameter 3"														
COD	Special Applications														
0	Without Special Applications														
COD	Local Indicator														
0	Without Local Indicator														
1	With Local Indicator														
COD	Electrical Connection														
0	1/2 - 14 NPT (4)														
1	1/2 - 14 NPTx3/4 NPT (316 SST) – with adapter (5)														
2	1/2 - 14 NPTx3/4 BSP (316 SST) - with adapter (6)														
3	1/2 - 14 NPTx1/2 BSP (316 SST) - with adapter (6)														
A	M20x1.5 (4)														
B	PG 13.5 DIN (6)														
Z	User's Specification														
COD	Plug														
I	316 SST														
COD	Housing Material (3)														
A	Aluminum														
I	316 SST – CF8M (ASTM – A351)														
J	316 SST - saline atmosphere (1)														
B	Aluminum - saline atmosphere (1)														
COD	Painting														
0	Gray Munsell N 6.5 Polyester														
1	Safety Blue Epoxy – Immersion Condition-Petrobras N1021														
2	Safety Blue Epoxy – Atmospheric Zone - Petrobras N1021														
8	Without Painting (2)														
9	Safety Blue Epoxy														
C	Safety Blue Polyester														
G	Orange Safety Epoxy														
Z	Special Painting														
COD	Certification Type for Hazardous Locations														
N	Without certification														
I	Intrinsic Safety														
COD	Certification Body for Hazardous Locations														
0	Without Certified				8	INMETRO (UL BR)									
2	ATEX				9	IECEX									
5	INMETRO (CEPEL)														
COD	Tag Plate														
0	With tag, when specified														
1	Blanket														
2	User's Specification														

LD400

I2

1

0

H

0

I

9

N

2

0

I

0

1

A

0

N

0

0

CONTINUE IN THE NEXT PAGE

CONTINUE IN THE NEXT PAGE

## Notes:

- (1) IPW/TYPEx tested for 200h according to NBR 8094 / ASTM B 117 standard.  
 (2) Not available for aluminum housing.  
 (3) Ingress Protection:

Product	CEPEL	NEMKO / EXAM	FM
LD400	IP66/68W	IP66/68W	Type4X/6P

- (4) Certification Ex-d for FM / ATEX / IECEX / INMETRO  
 (5) Certification Ex-d for INMETRO.  
 (6) Options not certified for use in hazardous locations.  
 (7) Limited values to 4 ½ digits; limited units to 5 characters.

SPECIAL OPTIONS		CONTINUATION OF TRANSMITTER MAIN CODE					
		COD.	Burn-out				
		B0	Without Burn-out indication				
		BD	Start Scale (According NAMUR NE43 specifications)				
		BU	End Scale (According NAMUR NE43 specifications)				
		COD.	LCD Indication				
		Y0	Percentage (Default)				
		Y1	Current - I (mA)				
		Y2	Pressure (Engineering Unit)				
		Y3	Temperature (Engineering Unit)				
		YU	User's specifications (7)				
		COD.	PID Availability				
		P0	PID do not available				
		P1	Available and disabled (Default)				
		P2	Available and enabled				
		COD.	Special Characteristics				
		M0	Without special characteristics (Default)				
		M4	Calibration with reading on the top and bottom (Hysteresis)				
		M5	Calibration with 10 points				
		M6	Special method of Acquisition disabled				
		COD.	Special Procedure				
		C5	Mounting according to NACE				
		COD.	Certification for Telecommunications				
		W1	ANATEL				
		COD.	Special				
		ZZ	See notes				

LD400I-210-H0-I9N20-I01-A0N00	BU	Y2	P0	M0	C5		ZZ
-------------------------------	----	----	----	----	----	--	----

TYPICAL MODEL





# CONFIGURATION

### General

The **LD400 HART®** 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 type of 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 with "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 **LD400 HART®**, 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 **LD400 HART®** to control its output current and addresses "1" through "15" place the **LD400 HART®** in the multidrop mode, according to the text above.

**CONTROLLER MODE** - The **LD400 HART®** always controls the output current, in accordance with the value calculated for the Controlled Variable, regardless of its network address.

#### WARNING

The controller mode is not available for use in SIS mode.

#### NOTE

In the case of multidrop network configuration for classified areas, the entity parameters allowed for the area shall be strictly observed. Therefore, the following shall be checked:

$$\begin{aligned} Ca &\geq \sum Ci_j + Cc & La &\geq \sum Li_j + Lc \\ Voc &\leq \min[V \max_j] & Isc &\leq \min[I \max_j] \end{aligned}$$

Where:

**Ca, La** - Allowable capacitance and inductance on the bus;

**Ci<sub>j</sub>, Li<sub>j</sub>** - Non protected internal Capacitance/Inductance of transmitter *j* (*j* = up to 15);

**Cc, Lc** - Cable capacitance and Inductance;

**Voc** - Barrier open circuit voltage;

**Isc** - Barrier short circuit current;

**Vmax<sub>j</sub>** - Maximum allowable voltage to be applied to the transmitter *j*;

**Imax<sub>j</sub>** - Maximum allowable current to be applied to the transmitter *j*.

The **LD400 HART®** 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 – LD400 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).

## **Configuration Features**

By means of the HART configuration tool, the **LD400 HART®** firmware allows the following configuration features to be accessed:

- Transmitter Identification and Manufacturing Data;
- Primary Variable Trim – Pressure;
- Primary Variable Trim – Current;
- Temperature Trim;
- Transmitter Adjustment to the Working Range;
- Engineering Unit Selection;
- Transference Function for Flow rates 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 signal, up to 2 km away from the transmitter.

## **Manufacturing Data and Identification**

The following information about the **LD400 HART®** manufacturing and identification data is available:

- **TAG** – 8-byte ASCII character for transmitter identification, coded in 6-byte HART Packed ASCII format;
- **DESCRIPTOR** - 16-byte ASCII character for additional transmitter identification, coded in 12-byte HART Packed ASCII format. 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- byte ASCII character for any other information, coded in 24-byte HART Packed ASCII format, 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, Coplanar, Remote Seal, Level 3 in # 150, Level 4 in # 150, Level 3 in # 300, Level 4 in # 300, Level DN80 PN10/16, Level DN80 PN25/40, Level DN100 PN10/16, Level DN100 PN25/40, Level 2 in # 150, Level 2 in # 300, Level DN50 PN10/16, Level DN50 PN25/40, None, Unknown and Special.
- **FLANGE MATERIAL** - Carbon Steel, 316 SST, Hastelloy C, Monel, Unknown and Special.
- **O-RING MATERIAL** - PTFE, Viton, Buna-N, Ethyl-prop, None, Unknown and Special.
- **LOCAL INDICATOR** - Installed, None and Unknown.
- **DRAIN/VENT MATERIAL** - Carbon Steel, 316 SST, Hastelloy C, Monel, None, Unknown and Special.
- **REMOTE SEAL TYPE** - Chemical Tee, Flanged Extended, Pancake, Flanged, Threaded,

Sanitary, Sanitary Tank Spud, None, Unknown and Special.

- **REMOTE SEAL FLUID** - Silicone, Syltherm 800, Inert, Glycerin/H2O, Prop gly/H2O, Neobee-M20, None, Unknown and Special.
- **REMOTE SEAL DIAPHRAGM** - 316L SST, Hastelloy C, Monel, Tantalum, Titanium, None, Unknown and Special.
- **REMOTE SEAL QUANTITY** - One, Two, None, Unknown 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.

\*These marked items cannot be changed. They come directly from the sensor memory.

## Primary Variable Trim – Pressure

Pressure, defined as a Primary Variable, is determined from the sensor readout 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 long-term drift.

### 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.

### NOTE

For Absolute Pressure Transmitter is recommended to do Lower Trim, writing the value of pressure, instead of doing the Zero Trim.

- **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. 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 LD400 HART® 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 are working with a pressure standard with 0.03% accuracy or better, otherwise the transmitter accuracy will be seriously affected.

## Primary Variable Current Trim

When the microprocessor generates a 0% signal, the Digital to Analog converter and associated electronics are supposed to deliver 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 readout 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 readout to the transmitter, it is recommended that data input consider values up to tenths of microamperes.

## Temperature Trim

The LD400 HART® transmitter monitors the temperature to be measured with the capacitive sensor located near the process tap. Normally, this temperature is adjusted to the ambient temperature, during manufacturing. Is any deviation on the measuring is recorded; the Temperature Trim is done to correct it. Through a single calibration method, the LD400 HART® may adjust temperature Zero as well as Span. Whenever the Temperature Trim is applied at temperature over 20 °C in relation to the last measuring; the LD400 HART® adjusts these two parameters simultaneously.

## 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 **LD400 HART®** 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, shall be greater than the minimum span, defined by [Transmitter Range / (120) for models: D, M, H, A4, A5, and Transmitter Range / (2.5), (25), or (50) for A1, A2, and A3, respectively]. Values up to 0.75 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 readout in engineering units with zero suppression be required, it is recommended to use the User Unit feature for such conversion.

## Engineering Unit Selection

Transmitter **LD400 HART®** includes a selection of engineering units to be used in measurement indication.

For pressure measurements, the **LD400 HART®** includes an option list with the most common units.

The internal reference unit is inH<sub>2</sub>O @ 20 °C; should the desired unit be other than this one, it will be automatically converted using conversion factors included in Table 4.1.

As the **LD400 HART®** uses a 4 ½ digit display, the largest indication will be 19999. Therefore, when selecting a unit, make sure that it will not require readouts greater than this limit. For User reference, Table 4.1 presents a list of recommended sensor ranges for each available unit.

CONVERSION FACTOR	ENGINEERING UNITS	RECOMMEND RANGE
1.00000	inH <sub>2</sub> O @ 20 °C	1, 2, 3 and 4
0.0734241	inHg @ 0 °C	all
0.0833333	ftH <sub>2</sub> O @ 20 °C	all
25.4000	mmH <sub>2</sub> O @ 20 °C	1 and 2
1.86497	mmHg @ 0 °C	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 <sup>2</sup>	1, 2, 3 and 4
0.00253545	kg/cm <sup>2</sup>	3, 4, 5 and 6
248.642	Pa	1
0.248642	kPa	1, 2, 3 and 4
1.86947	Torr @ 0 °C	1, 2, 3 and 4
0.00245391	atm	3, 4, 5 and 6
0.000248642	MPa	4, 5 and 6
0.998205	inH <sub>2</sub> O @ 4 °C	1, 2, 3 and 4
25.3545	mmH <sub>2</sub> O @ 4 °C	1 and 2
0.0254	mH <sub>2</sub> O @ 20 °C	1, 2, 3 and 4
0.0253545	mH <sub>2</sub> O @ 4 °C	1, 2, 3 and 4

**Table 4.1 – Available Pressure Units**

In applications where the **LD400 HART®** 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 **LD400 HART®**. Table 4.2 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 **LD400 HART®** does not verify if the values corresponding to the 0% and 100% inserted by the user are compatible with the selected unit.

VARIABLE	UNIT
Pressure	inH <sub>2</sub> O, inHg, ftH <sub>2</sub> O, mmH <sub>2</sub> O, mmHg, psi, bar, mbar, gf/cm <sup>2</sup> , kgf/cm <sup>2</sup> , Pascal, Torricelli, atm, Mpa, inH <sub>2</sub> O @ 4 °C, mmH <sub>2</sub> O @ 4 °C, mH <sub>2</sub> O @ 4 °C, mH <sub>2</sub> O @ 20 °C.
Volumetric Flow	ft <sup>3</sup> /min, gal/min, Gal/min, m <sup>3</sup> /h, gal/s, l/s, Ml/d, ft <sup>3</sup> /d, m <sup>3</sup> /s, m/d, Ga/h, Ga/d, ft <sup>3</sup> /h, m <sup>3</sup> /min, bbl/s, bbl/min, bbl/d, gal/s, l/h, gal/d.
Velocity	ft/s, m/s, m/h.
Volume	gal, litro, Gal, m <sup>3</sup> , bbl, bush, Yd <sup>3</sup> , Pé <sup>3</sup> , In <sup>3</sup> , hl.
Level	ft, m, in, cm, mm.
Mass	grama, 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 <sup>3</sup> , kg/m <sup>3</sup> , g/ml, kg/l, Twad, Brix, Baum L, API, % Solw, % Solv, Ball.
Others	CSO, cPo, mA, %.
Special	12 characters. (See section 6)

**Table 4.2 – Available User Units**



Should a special unit other than those presented on Table 4.2 be required, the **LD400 HART®** allows the user to create a new unit by entering up to 5 alphanumeric digits. The **LD400 HART®** includes an internal feature to enable and disable the User Unit.

**Example:** transmitter **LD400 HART®** 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:  $[(\pi \cdot d^2)/4] \cdot l = [(\pi \cdot 2.2^2)/4] \pi \cdot 6 = 18.85 \text{ m}^3$ . 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 = 250mmH<sub>2</sub>O

Superior = 2250 mmH<sub>2</sub>O

Pressure unit = mmH<sub>2</sub>O

**In User Unit:**

User Unit 0% = 0

User Unit 100% = 18.85 m<sup>3</sup>

User Unit = m<sup>3</sup>

When activating the User's Unit, **LD400 HART®** it will start to indicate the new measurement.

## Transfer Function for Flow Measurement

The function can be used to convert the measured pressure for others measure unit as flow or volume. The following functions are available:

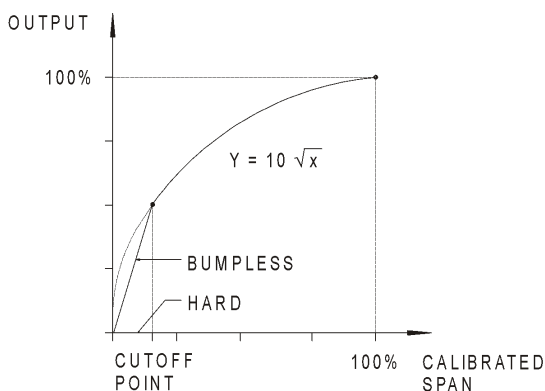
**NOTE**

- 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 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 4.4. 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 **LD400 HART®** configurable parameters are: cutoff point defined at a certain pressure expressed as % and the cutoff mode, hard or bumpless.



**Figure 4.1 – Square Root curve with Cutoff point**

**NOTE**

In bumpless cutoff mode the gain below the cutoff point is given by the equation:

$$G = \frac{10}{\sqrt{\text{Cutoff}}}$$

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.

**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 **LD400 HART®**. For example, it may be used as a camber table for tanks in applications here 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).

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 maneuvering there are several pipes where the direction of the fluid may vary. In this case, **LD400 HART®** 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.

## 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, he must transform the pressure measurement "X" into volume (or mass) "Y" using the tank strapping table, as the example shown in Table 4.3.

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

**Table 4.3 – 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 **LD400 HART®** includes an internal feature to enable and disable the Linearization Table.

## Totalization Configuration

When the **LD400 HART®** 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 PV% over time:

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

$$TOT = \int \frac{\text{Maximum\_Flowrate}}{\text{Totalization\_Increment}} \times PV\% dt$$

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

To configure any these parameters, the totalizer should be disable.

The largest totalized value is 9.999.999 totalizing units, in integer format, without decimal digits. 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 4.5 shows a typical display indication.

#### NOTE

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



**Figure 4.2 – Typical Monitoring Mode Display Showing the Total, in this case 9.670.823**

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

The total value is not lost with power drop.

Example: A differential pressure of 0 - 20 inH<sub>2</sub>O represents a flow of 0 - 6800 dm<sup>3</sup>/minute. In CONF set Lower = 0 inH<sub>2</sub>O and Upper = 20 inH<sub>2</sub>O.

In order to adjust the MAX\_FLOW, the maximum flow must be converted to cubic decimeters per second: 6800 / 60 = 113.3 dm<sup>3</sup> / 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 time required for the totalization to reach 99.999.999.

In the example, if U\_TOTAL = 1, the totalization increment is 1 dm<sup>3</sup>. The time required for the overrun with maximum flow 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<sup>3</sup>. Considering the maximum flow rate (113.3 dm<sup>3</sup>/s), the totalizer will reach its maximum value and return to zero in 10 days, 5 hours, 10 minutes e 12.5 seconds.

## PID Controller Configuration

The LD400 HART® may be factory -configured to work as Transmitter only or as Transmitter / Controller. In case the LD400 HART® is configured as a Transmitter / Controller, the end user may change its operation mode at any time simply by configuring an internal status variable.

The LD400 HART SIS does not support PID Controller configuration.

As a PID Controller, the LD400 HART® 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:

$$MV = K_p \left( e + 1/Tr \int e dt + T_d dPV / dt \right)$$

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 that of 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 **LD400 HART®** 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 **LD400 HART®** has an internal variable to enable and disable the characterization table of the MV output of the PID.

## Equipment Configuration

The **LD400 HART®** enables the configuration not only of its operational services, but of the instrument itself. This group includes services related to: Input Filter, Burnout, Addressing, Display Indication and Passwords.

- **INPUT FILTER** - The Input Filter, also referenced to as damping, is a first order digital filter implemented by the firmware. User configurable from any value higher than zero seconds in addition to intrinsic sensor response time (0.2 s) (via digital communication). The transmitter mechanical damping is 0.2 seconds.
- **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 **LD400 HART®** includes a variable to define the equipment address in a HART network. Addresses may go from value "0" to "15"; addresses from "1" to "15" are specific addresses for multidrop connections. This means that, in a multidrop configuration, the **LD400 HART®** will display the MD icon for addresses "1" to "15".

### NOTE

The output current will be fixed to 4 mA as the **LD400 HART®** address, in the Transmitter mode, is altered to another value than "0" (this does not happen when the **LD400 HART®** is configured in the Controller mode).

The **LD400 HART®** is factory-configured with address "0".

- **DISPLAY INDICATION** - the **LD400 HART®** digital display is comprised of 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-digit alphanumeric field for units and status information.

The **LD400 HART®** may work with up to three display configurations to be alternately displayed at 2 second intervals. Parameters that may be selected for visualization are those listed on Table 4.4, below.

PARAMETER	DESCRIPTION
CURRENT	Current in milliamperes.
OUT% = (MV% (*))	Output in percentage.
PV	Process Variable in engineering units.
PV%	Process Variable in percentage.
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 or third indication.

**Table 4.4– 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.

- **PASSWORDS** - this service enables the user to modify the operation passwords used in the LD400 HART®. Each password defines the access for a priority level (1 to 3); such configuration is stored in the LD400 HART® EEPROM. Password Level 3 is hierarchically superior to password level 2, which is superior to level 1.

## 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 LD400 HART® to define this code and the last one is a bar that must be placed at the end of the main code; the sequential characters are optional \*. The optional items may select or not, according to user needs. Example:

LD400 - D2 1 0 - H 1 - I B U 0 0 - P 0 1 - 0 I 1 - A 0 N 0 0 / BU Y2 Y5 P2 F1

Nº	OPTION	DESCRIPTION
1	LD400	Differential, Flow, and Level Transmitter
2	D2	Differential, Range: -50 a 50 kPa.
3	1	Stainless Steel 316L Diaphragm and Fill Fluid with Silicone Oil
4	0	Class of Standard performance
5	H	HART® Transmitter 4-20 mA
6	1	SIS: Safety Instrumented System
7	I	Flanges, Adapters, and 316 Stainless steel Drain/Vent valves
8	B	Buna-N O-Rings
9	U	Drain in up position
10	0	Process Connection: 1/4 - 18 NPT (Without Adapter)
11	0	Without Special Cleaning
12	P	Flanges, nuts, and bolts Material: Plated Carbon Steel
13	0	Flange Threaded for accessories fixing (adapters, manifolds, etc): 7/16" UNF.
14	1	With Digital Indicator
15	0	Electrical connection 1/2 NPT
16	I	316 Blank conduit Plug
17	1	316 Stainless Steel Blank Conduit Plug. Mounting Bracket for 2" Pipe or surface mounting: Bracket and Accessories in Carbon Steel
18	A	Electronic Housing: Aluminum
19	0	Painting: N6, 5 Munsell Gray Polyester
20	N	Without identification
21	0	None
22	0	TAG plate: with tag, when specified
23	BU	Burn-out: full Scale
24	Y2	LCD1 Indication: Pressure (Engineering Units)
25	Y5	LCD2 Indication: Temperature (Engineering Units)
26	P2	Available and enable PID
27	F1	Transfer Function for flow measure: Square Root

**Table 4.5– 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 LD400 HART® 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 4.6. 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, const, 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.
Characterization	When any change is made in any point of the pressure characterization table in trim mode.
Temperature Trim	When the temperature is done.
TRM/PID	When any change is made in the operation mode, i.e., from PID to TRM or vice versa.
Totalization	When any change is made in the totalization, configuration or in the reset.
Table	When the contents on the transference function table is altered.
Multidrop	When any change is made in the communication mode, for example, multidrop or single transmitter.
Password	When any change is made in the password

**Table 4.6 – Functions Monitored by the Operation Counter**

- **BACKUP** - This option allows copying the data saved in the main board to the sensor memory.
- **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*

With the Magnetic Tool it is possible to configure locally the **LD400 HART®** and eliminate the need for additional configurators in many basic applications.

There are two ways to adjust the **LD400 HART®** locally according to the jumper configuration (see Table 5.1):

- ✓ Simple Local Adjustment
- ✓ Complete Local Adjustment

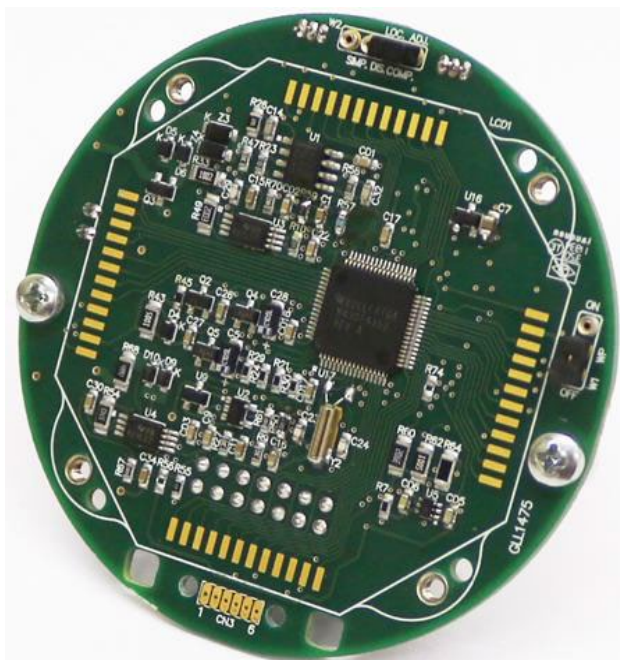
For the configuration with the magnetic tool to be possible:

- ✓ The display must be connected;
- ✓ The writing protection jumper must be disabled;
- ✓ The local adjustment jumper must be enabled on simple mode or complete mode.

See on Figure 5.1 the jumper positions for Local Adjustment and Writing Protection on the main board. If the option chosen is Complete Adjustment, with a disabled writing protection and without the display connected, the transmitter will redirect automatically the local adjustment for Simple mode. This happens because the Complete Local Adjustment needs an interaction with the display, and Simple Local Adjustment does not.

The Simple Local Adjustment is used for Zero and Span Calibration.

On the other hand, the Complete Local Adjustment makes possible to use the transmitter for several operations, both for control and for configuration.



**Figure 5.1 – Main Electronic Board**

To configure the Local Adjustment, set the main board jumpers as shown on Table 5.1.






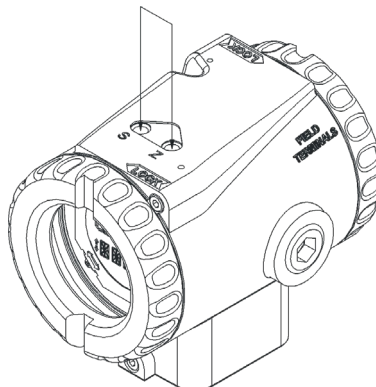
Local Adjustment	
	Simple Mode Enabled
	Disabled
	Complete Mode Enabled
Writing Protection	
	Writing Enabled
	Writing Disabled

Table 5.1– Local Adjustment Selection

- Notes:**
- 1 - If the writing protection (WP ON) is selected, the writing in EEPROM will be protected.
  - 2 - The standard configuration for the jumpers is the local adjustment selected for simple, and the writing protection is disabled.

## Local Adjustment

Under the identification plate, the transmitter has two holes where the magnetic tool is inserted to set the Local Adjustment. See Figure 5.2.



**Figure 5.2 – Zero and Span Local Adjustment**

The holes are marked with **Z** (Zero) and **S** (Span) and from now on will be simply described as **(Z)** and **(S)**, respectively. Table 5.2 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:

- ✓ 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 group of functions displayed depends on the mode selected for the **LD400 HART®**, either Transmitter or Controller.
- ✓ 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 5.3 – 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.
- ✓ 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	
	TRANSMITTER MODE	CONTROLLER MODE	TRANSMITTER MODE	CONTROLLER MODE
<b>Z</b>	Selects the Lower Range Value		Moves among the Complete Local Adjustment options	Moves among all the options
<b>S</b>	Selects the Upper Range Value		Activates the selected Functions	Activates the selected Functions

**Table 5.2- Local Adjustment Description**

## Simple Local Adjustment

The Simple Local Adjustment executes the following functions:

- ✓ **Zero Calibration:** when inserting the magnetic tool in the **(Z)** hole, the measured pressure will be equivalent to the 4 mA current pressure;
- ✓ **Span Calibration:** when inserting the magnetic tool in the **(S)** hole, the measured pressure will be equivalent to the 20 mA current pressure.

NOTE

For adequate calibration, notice the minimum span for each measuring range and types as defined on 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 5.2);
- Wait 2 seconds with the magnetic tool into the hole and the transmitter should be generating 4 mA. During this time the display will show CALIB and ZERO in sequence;
- 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 SPAN adjustment hole (S);
- Wait 2 seconds with the magnetic tool into the hole and the transmitter should be generating 20 mA. During this time the display will show CALIB and SPAN in sequence
- Remove the tool.

Zero adjustment causes a new upper value (URV), 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 adjusted.

Complete Local Adjustment

The following functions are available for local adjustment: Simulation, Range, Trim, Configuration, Operation and Quit.

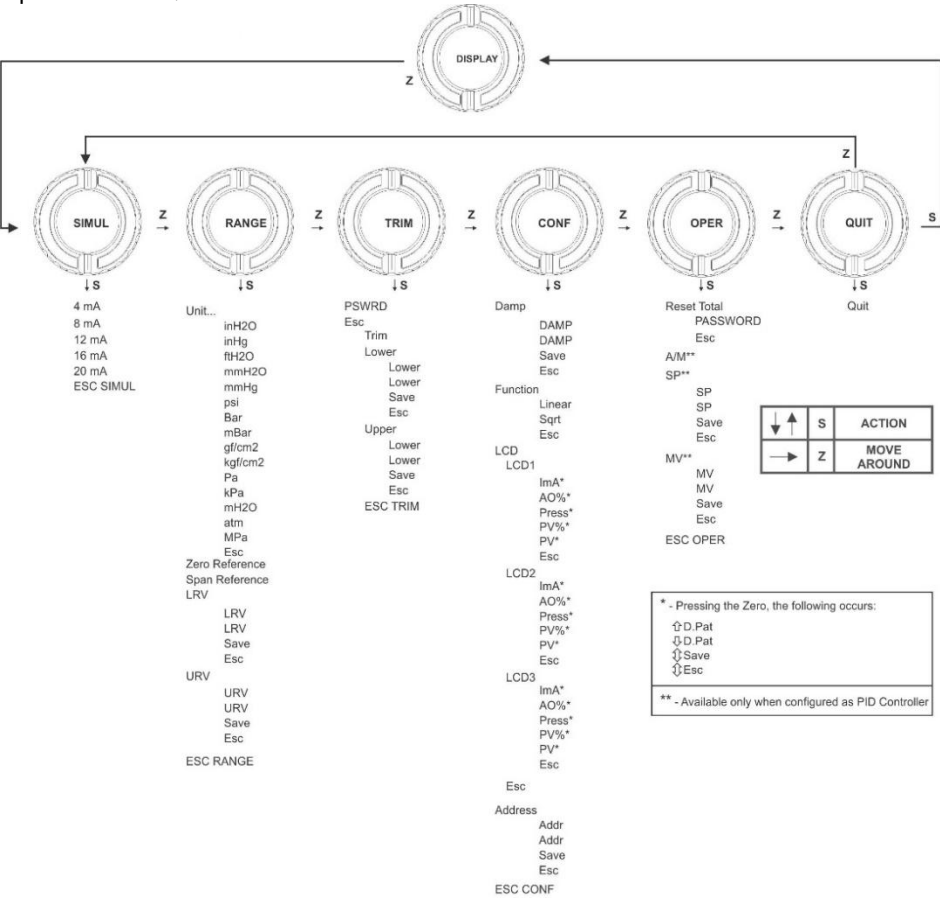


Figure 5.3 – Complete Local Adjustment Programming Tree – Main Menu

### WARNING

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

The Main branch starts at the "SIMUL" option.

**SIMULATION (SIMUL)** – Simulation loop test current. Options: 4 mA, 8 mA, 12 mA, 16 mA or 20 mA.

**RANGE (RANGE)** – This option allows change the measurement unit and the operation range like as zero, span, lower and upper range values calibrations.

**TRIM (TRIM)** – It is the option used to trim the transmitter with the following options: Zero, Lower and Upper Trim.

**CONFIGURATION (CONF)** – Is the option where the output and display related parameters are configured: damping, function, display and address.

**OPERATION (OPER)** – Is the option where the operation related parameters of the transmitter or controller: Reset Totalization, Auto/Manual, Setpoint and Manual output.

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

## Simulation [SIMUL]

This operation simulates the output current for the Loop test. Optional values to be simulated are 4 mA, 8 mA, 12 mA, 16 mA or 20 mA.

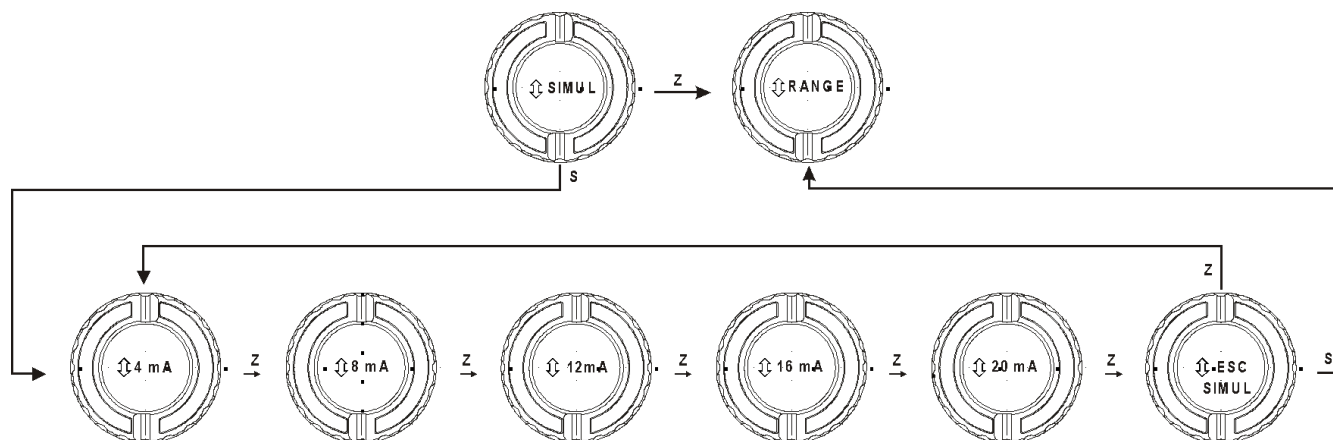
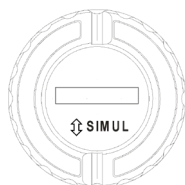


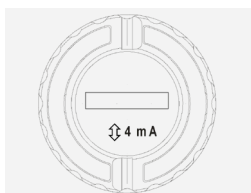
Figure 5.4 – Simulation branch of the Complete Local Adjustment Tree

### SIMULATION BRANCH (SIMUL)



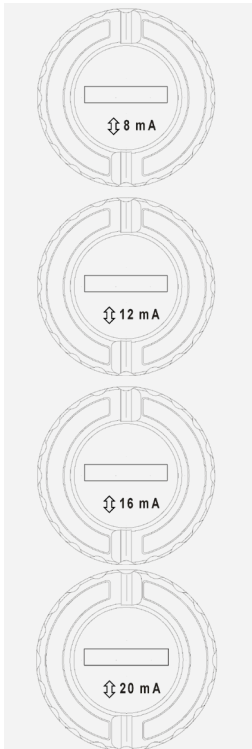
Z: Moves between the Main branch options of the Complete Local Adjustment tree.

S: Enters in the Simulation branch.



Z: Moves between the Simulation branch options.

S: Selects 4 mA value for simulation.



Z: Moves between the Simulation branch options.

S: Selects 8 mA value for simulation.

Z: Moves between the Simulation branch options.

S: Selects 12 mA value for simulation.

Z: Moves between the Simulation branch options.

S: Selects 16 mA value for simulation.

Z: Moves between the Simulation branch options.

S: Selects 20 mA value for simulation.



Z: Moves between the Main branch options of the Complete Local Adjustment tree.

S: Escapes from the Simulation branch and returns to the Main branch.

NOTE

After entering a simulation current value, the **LD400 HART®** automatically quits the simulation mode in around 2 minutes if the ESC option is not selected. Other configuration branches are also abandoned in fairly less time, around 8 seconds.

Range [RANGE]

This option makes zero and span calibration, also called calibration with reference, or define lower and upper operation range values, while performing calibration without reference. The unit associated to pressure measuring may also be modified in this branch.



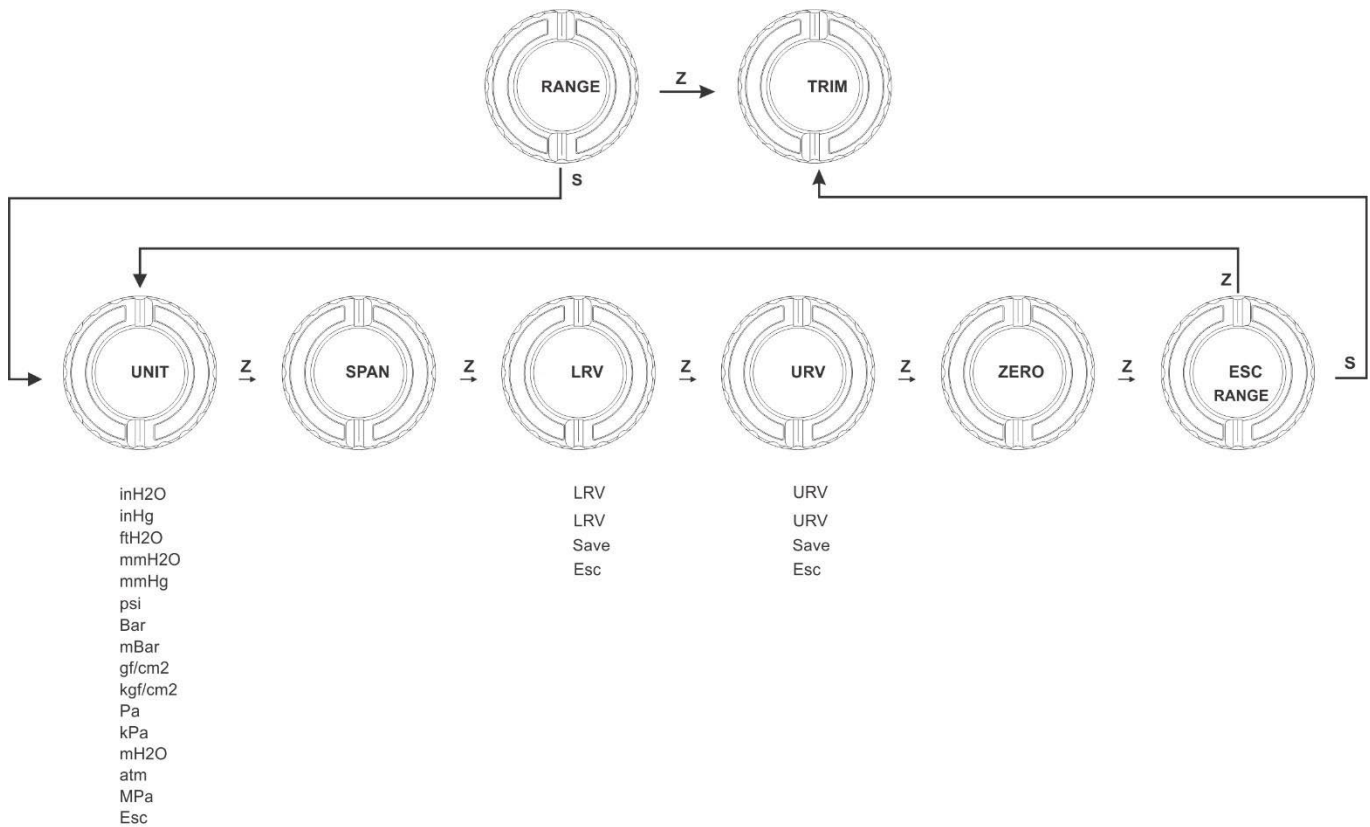
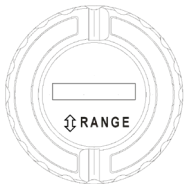


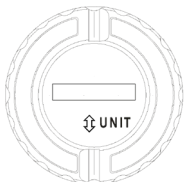
Figure 5.5 – Range branch of the Complete Local Adjustment Tree

#### RANGE BRANCH [RANGE]



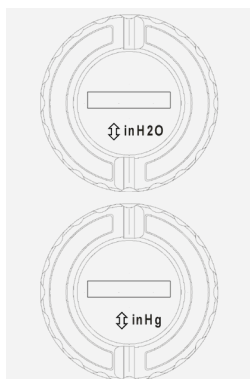
Z: Moves between the Main branch options of the Complete Local Adjustment tree.

S: Enters in the RANGE branch.



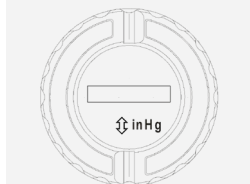
Z: Moves between the Range branch options.

S: Enters in the Engineering Units branch.



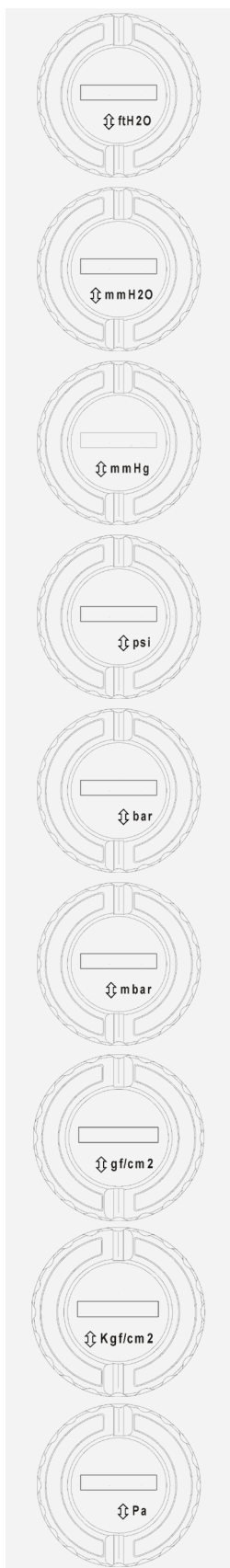
Z: Moves between the Engineering Units branch options.

S: Selects **inH<sub>2</sub>O** and returns to the Engineering Units branch to circulate in the RANGE branch options.



Z: Moves between the Engineering Units branch options.

S: Selects **inHg** and returns to the Engineering Units branch to circulate in the RANGE branch options.



Z: Moves between the Engineering Units branch options.

S: Selects **ftH<sub>2</sub>O** and returns to the Engineering Units branch to circulate in the RANGE branch options.

Z: Moves between the Engineering Units branch options.

S: Selects **mmH<sub>2</sub>O** and returns to the Engineering Units branch to circulate in the RANGE branch options.

Z: Moves between the Engineering Units branch options.

S: Selects **mmHg** and returns to the Engineering Units branch to circulate in the RANGE branch options.

Z: Moves between the Engineering Units branch options.

S: Selects **psi** and returns to the Engineering Units branch to circulate in the RANGE branch options.

Z: Moves between the Engineering Units branch options.

S: Selects **bar** and returns to the Engineering Units branch to circulate in the RANGE branch options.

Z: Moves between the Engineering Units branch options.

S: Selects **mbar** and returns to the Engineering Units branch to circulate in the RANGE branch options.

Z: Moves between the Engineering Units branch options.

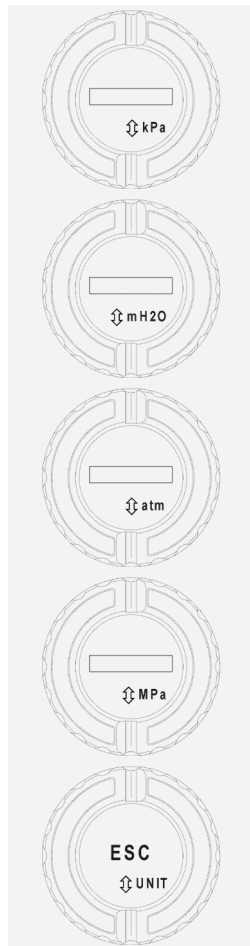
S: Selects **gf/cm<sup>2</sup>** and returns to the Engineering Units branch to circulate in the RANGE branch options.

Z: Moves between the Engineering Units branch options.

S: Selects **kgf/cm<sup>2</sup>** and returns to the Engineering Units branch to circulate in the RANGE branch options.

Z: Moves between the Engineering Units branch options.

S: Selects **Pa** and returns to the Engineering Units branch to circulate in the RANGE branch options.



Z: Moves between the Engineering Units branch options.

S: Selects **kPa** and returns to the Engineering Units branch to circulate in the RANGE branch options.

Z: Moves between the Engineering Units branch options.

S: Selects **mH<sub>2</sub>O** and returns to the Engineering Units branch to circulate in the RANGE branch options.

Z: Moves between the Engineering Units branch options.

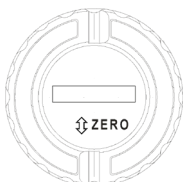
S: Selects **atm** and returns to the Engineering Units branch to circulate in the RANGE branch options.

Z: Moves between the Engineering Units branch options.

S: Selects **MPa** and returns to the Engineering Units branch to circulate in the RANGE branch options.

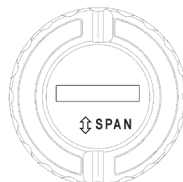
Z: Moves between the Engineering Units branch options.

S: Escapes from the Engineering Unit branch and returns to the Range branch options.



Z: Moves between the Range branch options.

S: Performs Zero Calibration.



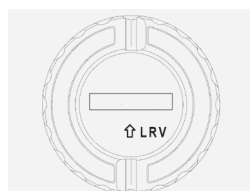
Z: Moves between the Range branch options.

S: Performs Span Calibration.



Z: Moves between the Range branch options.

S: Enters in the Lower Range Value branch.



Z: Moves between the Lower Range Value branch options.

S: Increases the Lower Range Value until the magnetic tool is removed or the maximum Lower Range Value is reached.



Z: Moves between the Lower Range Value branch options.

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

Z: Moves between the Lower Range Value branch options.

S: Saves the Lower Range Value.

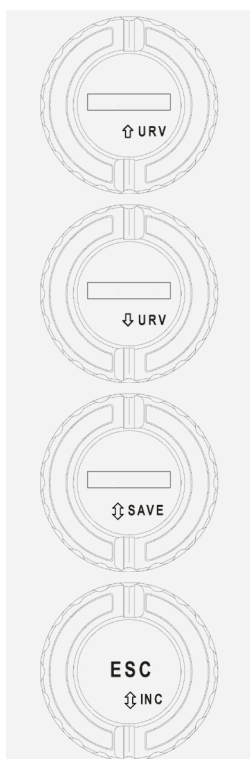
Z: Moves between the Lower Range Value branch options.

S: Escapes from the Lower Range Value branch and returns to the Range branch.



Z: Moves between the Range branch options.

S: Enters in the Upper Range Value branch.



Z: Moves between the Upper Range Value branch options.

S: Increases Upper Range Value.

Z: Moves between the Upper Range Value branch options.

S: Decreases Upper Range Value.

Z: Moves between the Upper Range Value branch options.

S: Saves the Upper Range Value.

Z: Moves between the Upper Range Value branch options.

S: Escapes from the Upper Range Value branch and returns to the Range branch.



Z: Moves between the Range branch options.

S: Escapes from the Range branch and returns to the Main branch of the Complete Local Adjustment tree.

## 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 4-20 mA.

Figure 5.6 shows the options available to run the pressure TRIM.

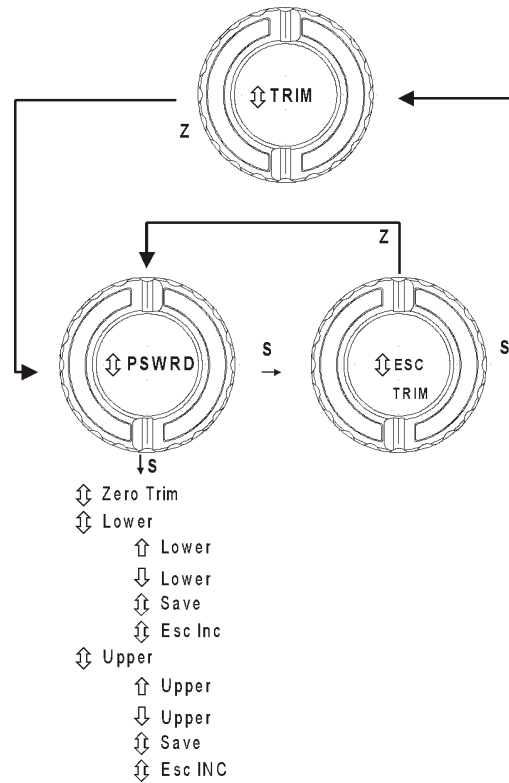
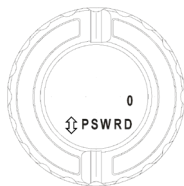


Figure 5.6 – Trim branch of the Complete Local Adjustment Tree

## PRESSURE TRIM BRANCH [TRIM]



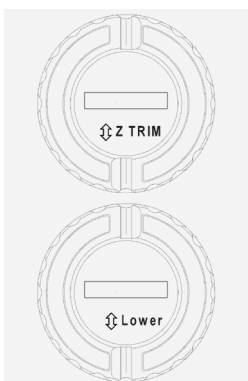
Z: Moves between 0 PSWRD and ESC PSWRD options.

S: This function is protected by a "password," when prompted 0 PSWD, enter the password. The password code is entered by inserting and removing the magnetic tool twice in (S). The password value is changed from 0 to 1. After entering the "password," you can move around the Trim branch options using (Z). To select the desired option, uses (S).



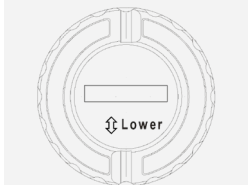
Z: Moves between 0 PSWRD and ESC PSWRD options.

S: Escapes from the PSWRD branch and returns to the Main branch of the Complete Local Adjustment tree.



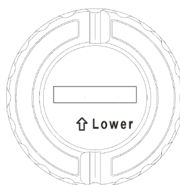
Z: Moves between the TRIM branch options.

S: Zero Trim: Trims the transmitter internal reference to read 0 at the applied pressure.



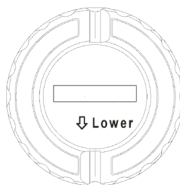
Z: Moves between the TRIM branch options.

S: Enters in the Lower Trim branch.



Z: Moves between the Lower Trim branch options.

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



Z: Moves between the Lower Trim branch options.

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



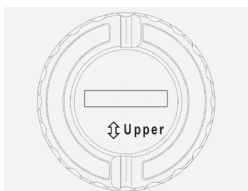
Z: Moves between the Lower Trim branch options.

S: Save the Lower Pressure Trim adjustment.



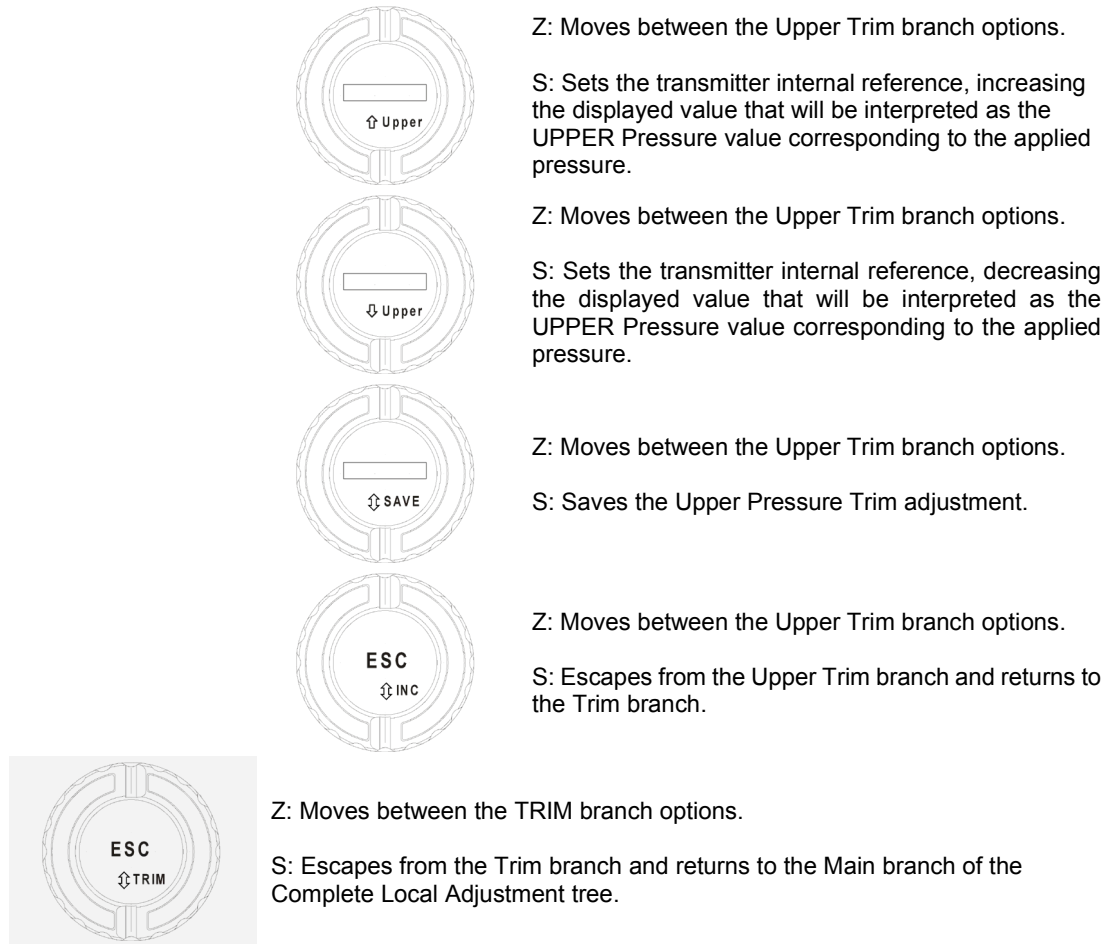
Z: Moves between the Lower Trim branch options.

S: Escapes from the Lower Trim adjustment branch and returns to the Trim branch.



Z: Moves between the TRIM branch options.

S: Enters in the Upper Pressure Trim branch.



## Configuration [CONF]

Configuration functions affect directly the 4-20 mA output current and the display indication. The configuration options implemented in this branch are the following:

- Digital filter damping time configuration of the readout signal input;
- Selection of the transfer function to be applied to the measured variable;
- Selection of the variable to be shown on Display 1, Display 2 and Display 3;

Figure 5.7 shows the CONF branch with the available options.

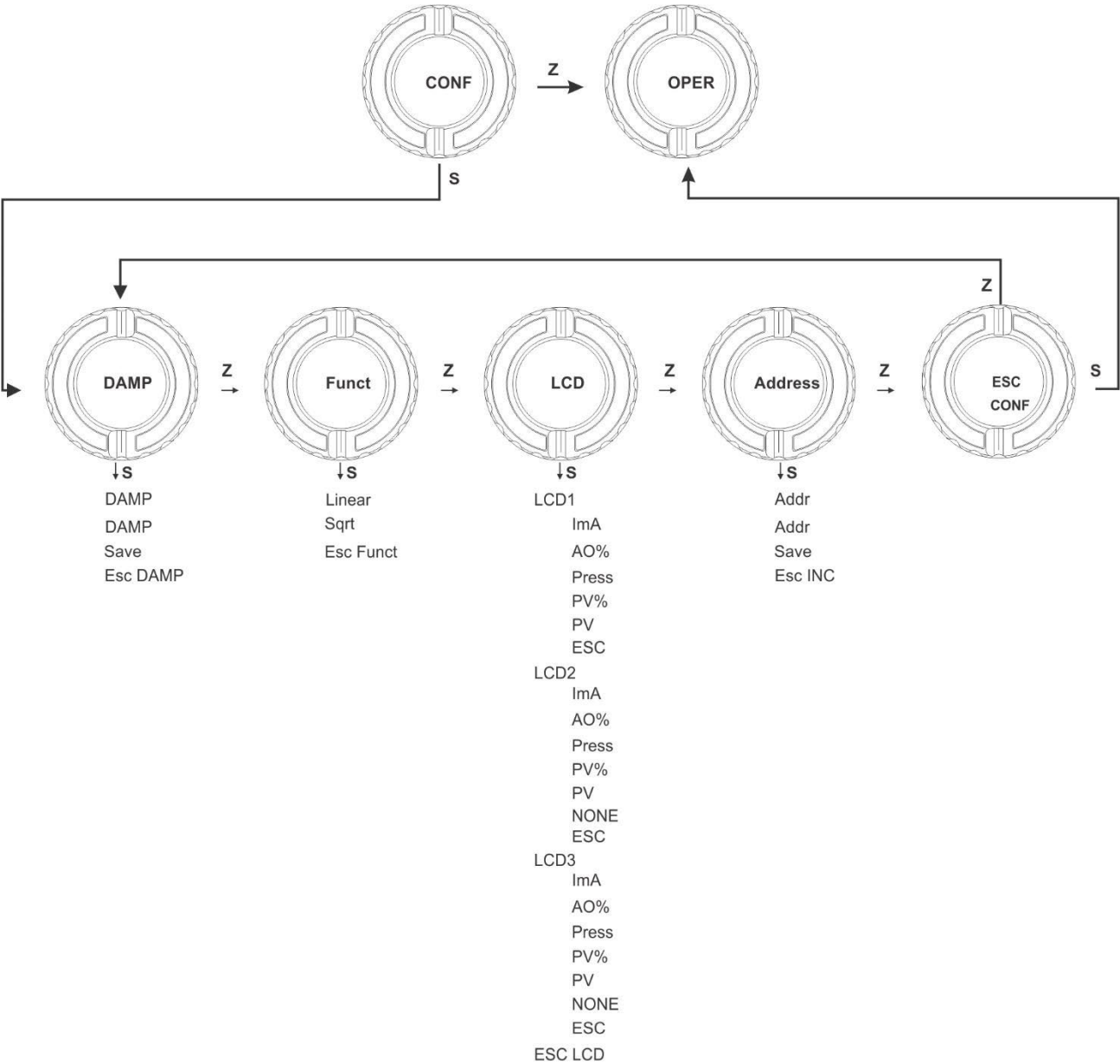
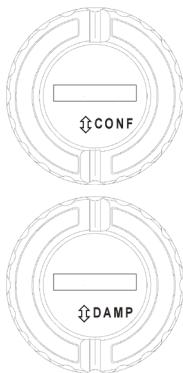


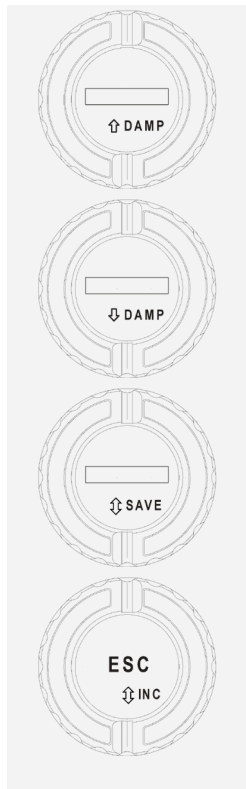
Figure 5.7 – Configuration branch of the Complete Local Adjustment Tree

CONFIGURATION BRANCH [CONF]



- Z: Moves between the Main branch options of the Complete Local Adjustment tree.
- S: Enters in the CONFIGURATION branch.
- Z: Moves between the Configuration branch options.
- S: Enters in the Damping Time branch.





Z: Moves enter Damping Time branch options.

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

Z: Moves between Damping Time branch options.

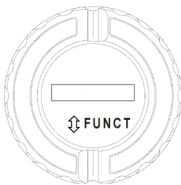
S: Decreases the Damping Time constant until the magnetic tool is removed or 0 seconds is reached.

Z: Moves between the Damping Time branch options.

S: Save the Damp Time value.

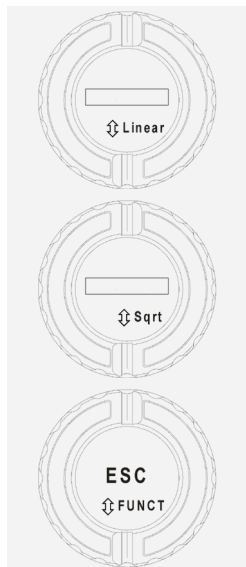
Z: Moves between the Damping Time branch options.

S: Escapes from the Damping Time branch and returns to the Configuration branch.



Z: Moves between the Configuration branch options.

S: Enters the Transfer Function branch.



Z: Moves between the Transfer Function options.

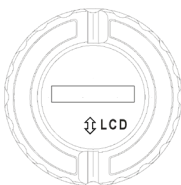
S: Selected of input function and returns to the Configuration branch.

Z: Moves between the Transfer Function options.

S: Selected of Square Root function and returns to the Configuration branch.

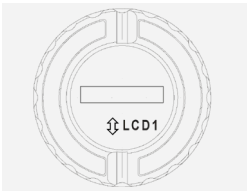
Z: Moves between the Transfer Function options.

S: Escapes from the Transfer Function branch and returns to the Configuration branch.



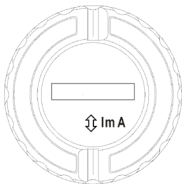
Z: Moves between the Configuration branch options.

S: Enters in the Display branch.



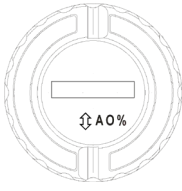
Z: Moves between the LCD1, LCD2, LCD3 and ESC LCD options.

S: Enters in the Display 1 branch.



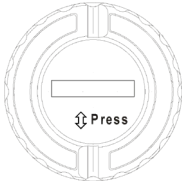
Z: Moves between the variables to be indicated as primary display.

S: Selects current in mA and enter in the Decimal Point branch showed at the end of Configuration branch.



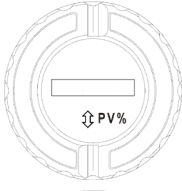
Z: Moves between the variables to be indicated as primary display.

S: Selects the analog output in percentage and enter in the Decimal Point branch showed at the end of Configuration branch.



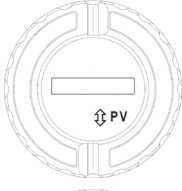
Z: Moves between the variables to be indicated as primary display.

S: Selects the Pressure (Engineering Unit) and enter in the Decimal Point branch showed at the end of Configuration branch.



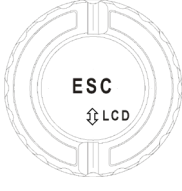
Z: Moves between the variables to be indicated as primary display.

S: Selects Process Variable in Percentage and enter in the Decimal Point branch showed at the end of Configuration branch.



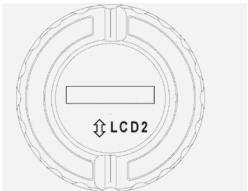
Z: Moves between the variables to be indicated as primary display.

S: Selects Process Variable and enter in the Decimal Point branch showed at the end of Configuration branch.



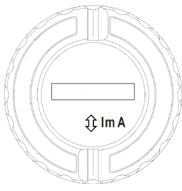
Z: Moves between the variables to be indicated as primary display.

S: Escapes from the Display 1 branch.



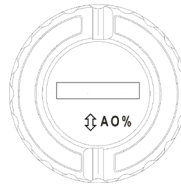
Z: Moves between the LCD1, LCD2, LCD3 and ESC LCD options.

S: Enters in the Display 2 branch.



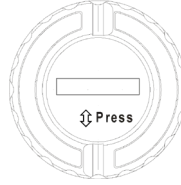
Z: Moves between the variables to be indicated on the Display 2.

S: Selects the current in mA and enter in the Decimal Point branch showed at the end of Configuration branch.



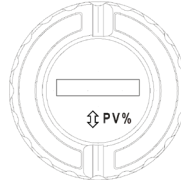
Z: Moves between the variables to be indicated on the Display 2.

S: Selects the analog output in percentage and enter in the Decimal Point branch showed at the end of Configuration branch.



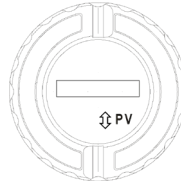
Z: Moves between the variables to be indicated on the Display 2.

S: Selects the Pressure (Engineering Unit) and enter in the Decimal Point branch showed at the end of Configuration branch.



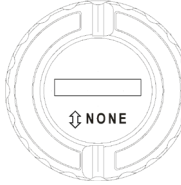
Z: Moves between the variables to be indicated on the Display 2.

S: Selects the Process Variable in Percentage and enter in the Decimal Point branch showed at the end of Configuration branch.



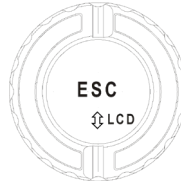
Z: Moves between the variables to be indicated on the Display 2.

S: Selects the Process Variable and enter in the Decimal Point branch showed at the end of Configuration branch.



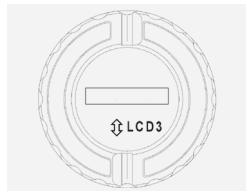
Z: Moves between the variables to be indicated on the Display 2.

S: Selects the option for not showing the readout on Display 2.



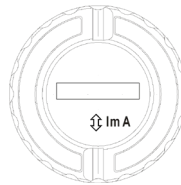
Z: Moves between the variables to be indicated on the Display 2.

S: Escapes from the choose Display 2 variable branch.



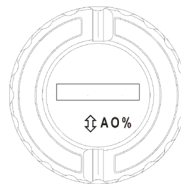
Z: Moves between the LCD1, LCD2, LCD3 and ESC LCD options.

S: Enters in the Display 3 branch.



Z: Moves between the variable to be indicated in the Display 3.

S: Selects the output in mA and enter in the Decimal Point branch showed at the end of Configuration branch.



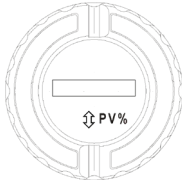
Z: Moves between the variable to be indicated in the Display 3.

S: Selects analog output in percentage and enter in the Decimal Point branch showed at the end of Configuration branch.



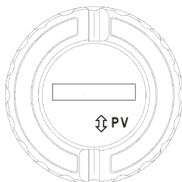
Z: Moves between the variable to be indicated in the Display 3.

S: Selects the Pressure (Engineering Unit) and enter in the Decimal Point branch showed at the end of Configuration branch.



Z: Moves between the variable to be indicated in the Display 3.

S: Selects the Process Variable in Percentage and enter in the Decimal Point branch showed at the end of Configuration branch.



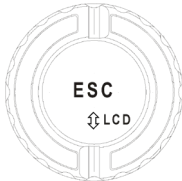
Z: Moves between the variable to be indicated in the Display 3.

S: Selects Process Variable and enter in the Decimal Point branch showed at the end of Configuration branch.



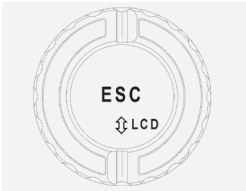
Z: Moves between the variable to be indicated in the Display 3.

S: Selects the option for not showing the indication on Display 3.



Z: Moves between the variable to be indicated in the Display 3.

S: Escapes from the Display 3 branch.



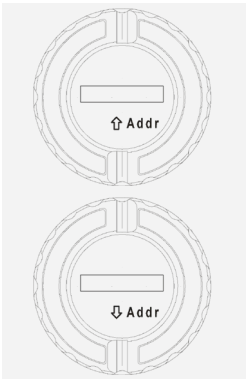
Z: Moves between the LCD1, LCD2, LCD3 and ESC LCD options.

S: Escapes from LCD branch and returns to Configuration branch.



Z: Moves between the Configuration branch options.

S: Enters in the Address branch.



Z: Moves between the available options to address adjustment.

S: Increases the value on the address shown on the display.

Z: Moves between the available options to address adjustment.

S: Decreases the value on the address shown on the display.



Z: Moves between the available options to address adjustment.

S: Saves the address adjusted.

Z: Moves between the available options to address adjustment.

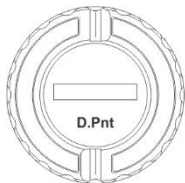
S: Escapes from the equipment address adjustment branch.



Z: Moves between the Configuration branch options.

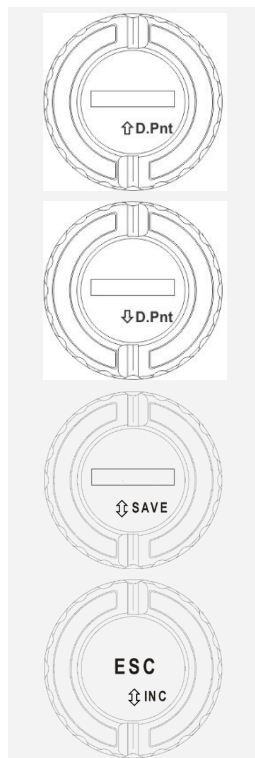
S: Escapes from the Configuration branch and returns to the Main branch of the Complete Local Adjustment tree.

### DECIMAL POINT BRANCH [D.Pnt]



Z: Moves between the LCDi branch options.

S: Enters in the DPoint branch.



Z: Moves between the available options to DPoint adjustment.

S: Increases the value of decimal points shown on the display.

Z: Moves between the available options to DPoint adjustment.

S: Decreases the value of decimal points shown on the display.

Z: Moves between the available options to address adjustment.

S: Saves the decimal points adjusted.

Z: Moves between the available options to DPoint adjustment.

S: Escapes from the DPoint branch.

Operation [OPER]

This adjustment option is applicable to the LD400 HART® configured to Transmitter, SIS or Controller mode. It allows to Reset the Totalization Value to Zero and the control state to be changed from Automatic to Manual and vice versa, and also to adjust the Setpoint and Manipulated Variable values. Figure 5.8 shows branch OPER with the available options.

If the equipment is configured to Transmitter or SIS mode, only the total Reset will be available.

Equipment Configured to Transmitter or SIS Mode

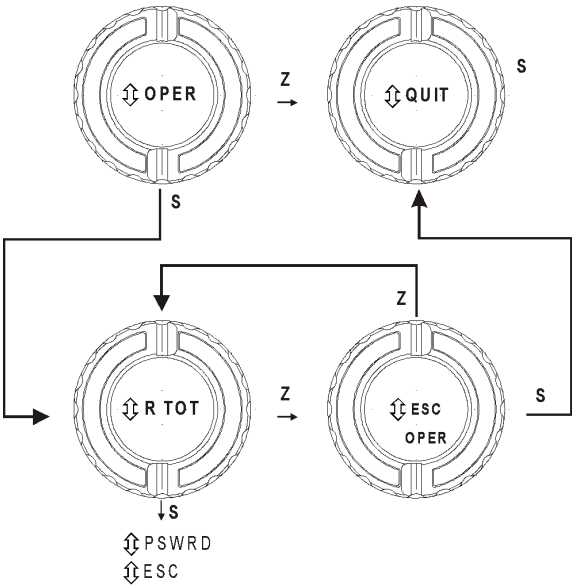
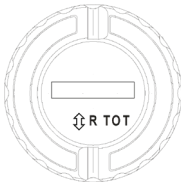


Figure 5.8 - Operation branch of the Complete Local Adjustment Tree - Transmitter and SIS Mode

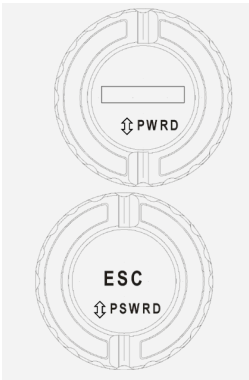
OPERATION BRANCH (OPER) – TRANSMITTER and SIS MODE



- Z: Moves between the Main branch options of the Complete Local Adjustment tree.
- S: Enters in the OPERATION branch.



- Z: Moves between the Operation branch options.
- S: Asks for password.



- Z: Moves between the 0 PSWRD and ESC PSWRD options.
- S: This function is protected by a "password," when prompted 0 PSWD, enter the password. The password code is entered by inserting and removing the magnetic tool twice in (S). The password value is changed from 0 to 1. After entering the "password," the Totalization value is zeroed.
- Z: Moves between the 0 PSWRD and ESC PSWRD options.
- S: Escapes from the PSWRD branch and returns to the Operation branch.



Z: Moves between the Operation branch options.

S: Escapes from Operation branch.

### Equipment Configured to Controller Mode

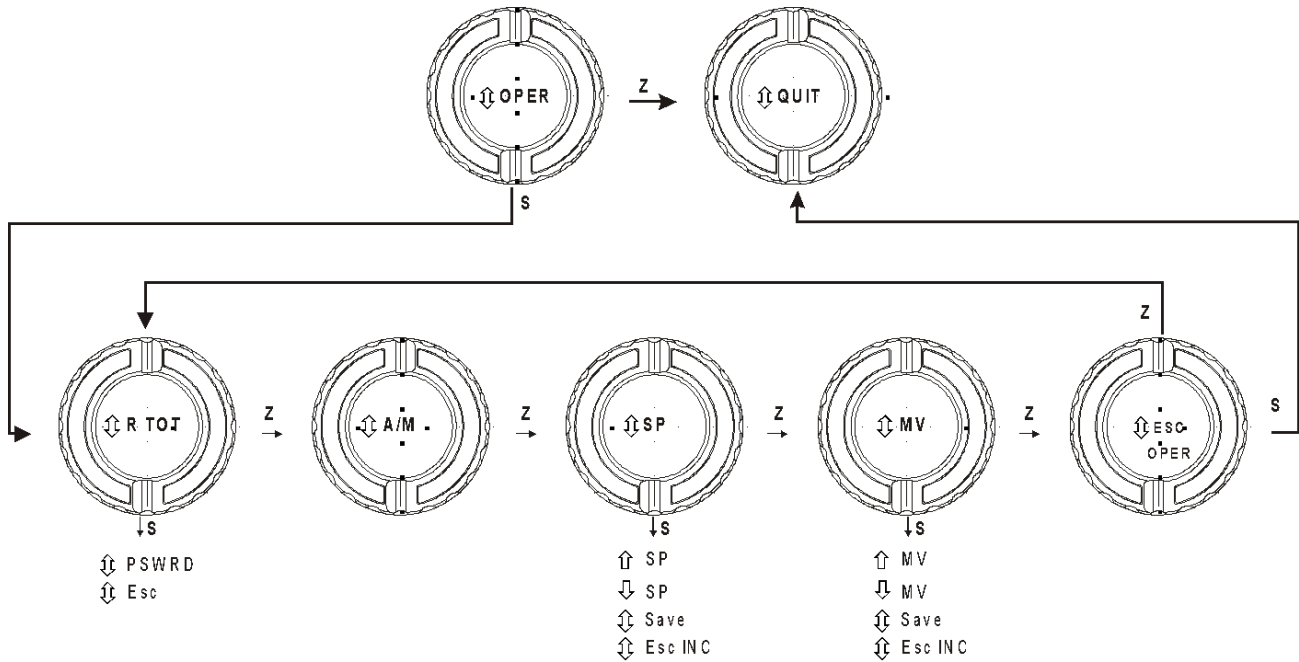


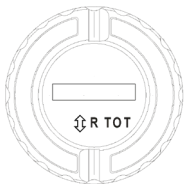
Figure 5.9 - Operation branch of the Complete Local Adjustment Tree – Controller Mode

### OPERATION BRANCH (OPER) – CONTROLLER MODE



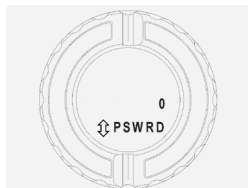
Z: Moves between the main branch options of complete local adjustment tree.

S: Enters in the Operation branch.



Z: Moves between the Operation branch options.

S: Asks for password.



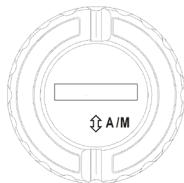
Z: Moves between the 0 PSWRD and ESC PSWRD.

S: This function is protected by a "password," when prompted 0 PSWD, enter the password. The password code is entered by inserting and removing the magnetic tool twice in (S). The password value is changed from 0 to 1. After entering the "password," the Totalization Value is zeroed.



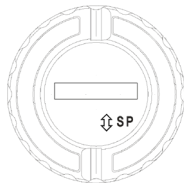
Z: Moves between the 0 PSWRD and ESC PSWRD.

S: Escapes from PSWRD branch and returns to the Operation branch.



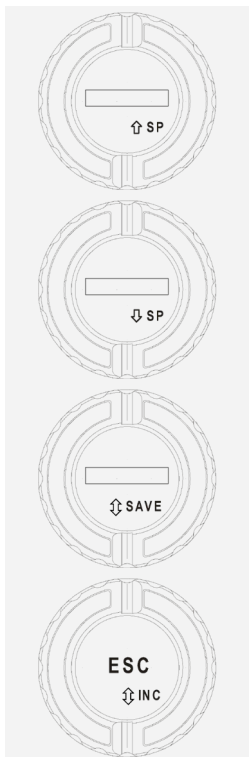
Z: Moves between the Operation branch options.

S: Toggles controller status, Automatic to Manual or Manual to Automatic. A and M indicate status.



Z: Moves between the Operation branch options.

S: Enters in the Setpoint adjustment branch.



Z: Moves between the increase or decrease Setpoint value, save or escape.

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

Z: Moves between the increase or decrease Setpoint value, save or escape.

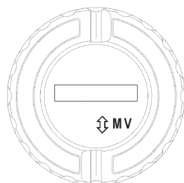
S: Decreases the Setpoint until the magnetic tool is removed or 0% is reached.

Z: Moves between the increase or decrease Setpoint value, save or escape.

S: Save adjusted Setpoint Value.

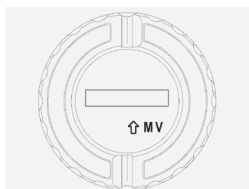
Z: Moves between the increase or decrease Setpoint value, save or escape.

S: Escapes from Setpoint Adjustment branch.



Z: Moves between the Operation branch options.

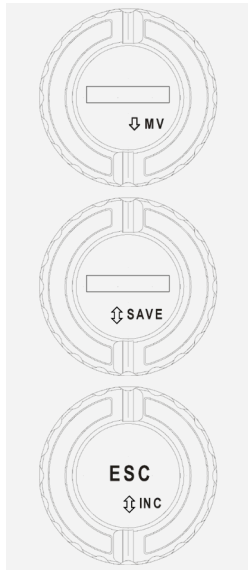
S: Enters in the Manipulated Variable adjustment branch.



Z: Moves between the increase or decrease Setpoint value, save or escape.

S: Increases the control output until the magnetic tool is removed or the upper output limit is reached.





Z: Moves between the increase or decrease Setpoint value, save or escape.

S: Decreases the control output until the magnetic tool is removed or the lower output limit is reached.

Z: Moves between the increase or decrease Setpoint value, save or escape.

S: Saves the Set Point and Manipulated Variable.

Z: Moves between the increase or decrease Setpoint value, save or escape.

S: Escapes from Manipulated Variable adjustment branch.



Z: Moves between the Operation branch options.

S: Escapes from Operation branch.

## Quit [QUIT]

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

### QUIT BRANCH [QUIT]



Z: Moves between the main branch options of complete local adjustment tree.

S: Escapes from the Complete Local Adjustment tree and returns to the monitoring mode.



# MAINTENANCE

## General

### NOTE

Equipment installed in hazardous atmospheres must be inspected in compliance with the IEC60079-17 standard.

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 changed 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 6.1).

The configurator should be connected to the transmitter according to the wiring diagram shown on Section 1.

## Error Messages

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

Table 6.1 presents a list of error messages with details for corrective actions that may be necessary.

ERROR MESSAGES	POTENTIAL SOURCE OF PROBLEM
UART RECEIVER FAILURE: <ul style="list-style-type: none"><li>• PARITY ERROR</li><li>• OVERRUN ERROR</li><li>• ERROR CHECK SUM</li><li>• FRAMING ERROR</li></ul>	<ul style="list-style-type: none"><li>• The line resistance is not according to load curve;</li><li>• Excessive noise or ripple in the line;</li><li>• Low level signal;</li><li>• Interface damaged;</li><li>• Power supply with inadequate voltage.</li></ul>
CONFIGURATOR RECEIVES NO ANSWER FROM TRANSMITTER	<ul style="list-style-type: none"><li>• Transmitter line resistance is not according to load curve.</li><li>• Transmitter not powered.</li><li>• Interface not connected or damaged</li><li>• Repeated bus address.</li><li>• Power supply with inadequate voltage.</li></ul>
CMD NOT IMPLEMENTED	<ul style="list-style-type: none"><li>• Software version not compatible between configurator and transmitter.</li><li>• Configurator is trying to carry out a <b>LD400 HART®</b> specific command in a transmitter with different Specific revision or, from another manufacturer.</li></ul>
TRANSMITTER BUSY	<ul style="list-style-type: none"><li>• Transmitter carrying out an important task, e.g., local adjustment.</li></ul>
XMTR MALFUNCTION	<ul style="list-style-type: none"><li>• Sensor disconnected;</li><li>• Sensor failure.</li></ul>
COLD START	<ul style="list-style-type: none"><li>• Start-up or Reset due to power supplies failure.</li></ul>
OUTPUT FIXED	<ul style="list-style-type: none"><li>• Output in Constant Mode;</li><li>• Transmitter in Multidrop mode;</li><li>• Transmitter in safe current mode.</li></ul>

OUTPUT SATURATED	<ul style="list-style-type: none"> <li>• Pressure out of calibrated Span or in fail-safe state (Output current in 3.8 or 20.5 mA).</li> </ul>
SV OUT OF LIMITS	<ul style="list-style-type: none"> <li>• Temperature out of operating limits.</li> <li>• Temperature sensor damaged.</li> </ul>
PV OUT OF LIMITS	<ul style="list-style-type: none"> <li>• Pressure out of operation limits;</li> <li>• Sensor damaged or sensor module not connected;</li> <li>• Transmitter with false configuration.</li> </ul>
LOWER RANGE VALUE TOO HIGH	<ul style="list-style-type: none"> <li>• Lower value exceeds 24% of the Upper Range Limit.</li> </ul>
LOWER RANGE VALUE TOO LOW	<ul style="list-style-type: none"> <li>• Lower value exceeds 24% of the Lower Range Limit.</li> </ul>
UPPER RANGE VALUE TOO HIGH	<ul style="list-style-type: none"> <li>• Upper value exceeds 24% of the Upper Range Limit.</li> </ul>
UPPER RANGE VALUE TOO LOW	<ul style="list-style-type: none"> <li>• Upper value exceeds 24% of the Lower Range Limit.</li> </ul>
UPPER & LOWER RANGE VALUES OUT OF LIMITS	<ul style="list-style-type: none"> <li>• Lower and Upper Values are out of the sensor range limits.</li> </ul>
SPAN TOO SMALL	<ul style="list-style-type: none"> <li>• The difference, between the Lower and Upper values is less than the 0.75 x (minimum span).</li> </ul>
APPLIED PRESSURE TOO HIGH	<ul style="list-style-type: none"> <li>• The pressure applied was above the 24% upper range limit.</li> </ul>
APPLIED PRESSURE TOO LOW	<ul style="list-style-type: none"> <li>• The pressure applied was below the 24% lower range limit.</li> </ul>
EXCESS CORRECTION	<ul style="list-style-type: none"> <li>• The trim value entered exceeded the factory-characterized value by more than 10%.</li> </ul>
PASSED PARAMETER TOO LARGE	<ul style="list-style-type: none"> <li>• Parameter above operating limits.</li> </ul>
PASSED PARAMETER TOO SMALL	<ul style="list-style-type: none"> <li>• Parameter below operating limits.</li> </ul>

Table 6.1 – Error Messages and Potential Source

## Diagnostic via Transmitter

### Symptom: NO LINE CURRENT

#### Probable Source of Trouble:

##### ✓ Transmitter Connections

- Check wiring polarity and continuity.
- Check for shorts 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 50 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 compatible with HART® Protocol

- Transmitter connections.
- Check if connections are according to wiring diagram.
- Check if there is resistance in the 250  $\Omega$  line.

✓ **Power Supply**

- Check output of power supply. The voltage at the **LD400 HART®** terminals must be between 12 and 50 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 OF 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 specific gravity of process fluid.
- Check process flanges for sediments.
- 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.

✓ **Noise Measurement Fluid**

- 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 “F-XX YY-ZZ”**

When the diagnoses of the LD400 HART Transmitter detect any kind of the failure that result in safe state current, the display shows the failure in hexadecimal format, where each bit set corresponds to the failure listed below. The XX represents the first diagnosis byte, the YY, the second and ZZ, the third.

**Probable Source of Trouble:****XX- First diagnosis byte contents:**

BIT #	DESCRIPTION	TRANSMITTER DETECTION
7	Memory Leak	Stack violation detected
6	FRAM memory failure	FRAM failure detected during writing operation
5	Sensor EEPROM memory failure	EEPROM failure detected during writing operation
4	ROM check failure	Invalid ROM CRC
3	RAM memory check failure	Invalid RAM Mirror CRC
2	Floating Point Unit Failure	FPU failure detected
1	No temperature update	Acquisition process stops the execution
0	No pressure update	Acquisition process stops the execution

**YY- Second diagnosis byte contents:**

BIT #	DESCRIPTION	TRANSMITTER DETECTION
7	Microprocessor Unit Failure	CPU register Failure is detected
6	Sensor module not initialized	Invalid sensor serial number detected on device power-on
5	Sensor Module not connected	No sensor connected during power-on
4	Incompatible sensor connected	Invalid Smar Sensor Type
3	Sensor Chamber High shorted	Without sensor capacitance signal
2	Sensor Chamber High opened	Invalid capacitance signal: stray capacitance
1	Sensor Chamber Low shorted	Without sensor capacitance signal
0	Sensor Chamber Low opened	Invalid capacitance signal: stray capacitance

**ZZ- Third diagnosis byte contents:**

BIT #	DESCRIPTION	TRANSMITTER DETECTION
7	Sensor Degraded	Excessive Zero Drift
6	System Clock Failure	Excessive System Clock drift
5	Lost Output Control	Excessive difference between Output Current and Feedback Current
4	Sequence Failure	Execution sequencing failure
3	RAM Static Failure	Failure on RAM cells - Galpat method
2	Program Code Failure	Failure on Flash Memory cells
1	Capacitance Switching failure	Failure on sensor board
0	Incompatible Output Current value	Output current and feedback does not match

**Symptom: DISPLAY INDICATES “FLSH XX-XX”****Probable Source of Trouble:**✓ **Wrong Sensor Connected**

- Check if the sensor is proper to the LD400 HART transmitter: Smar Sensor Type = 7, 8, 9 or 10 type. These sensor types are manufactured with validation CRC code and if the sensor CRC does not match, this message shows what valid CRC is expected for this connected sensor.

## Information about Hazardous Locations

### WARNING

Only use Explosion Proof/Flameproof certified Plugs, Adapters and Cable glands.

In Explosion-Proof installations the cable entries must be connected or closed using metal cable gland and metal blanking plug, both with at least IP66 and Ex-d certification.

The standard plugs provided by Smar are certified according to CEPEL certificate. If the plug needs to be replaced, a certified plug must be used.

The electrical connection with NPT thread must use waterproofing sealant. A non-hardening silicone sealant is recommended.

For NEMKO ATEX certificate please to follow the installation guidelines in hazardous locations below:

Group II Category 2G, Ex d, Group IIC, Temperature Class T6, EPL Gb

U = 28VDC

Ambient Temperature: -20 to 60°C for T6

Environmental Protection: IP65/67 or IP65W/67W

The electrical connection available are ½ - 14NPT and M20x1,5.

Cable entries must be connected or closed using metal cable gland and metal blanking plug, both with at least IP66 and Ex-d certification or any appropriate ATEX approved metal cable gland and metal blanking plug.

Do not remove the transmitter covers when power is ON.

## Disassembly Procedure

### WARNING

Do not disassemble with power on.

Figure 6.1 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 counterclockwise, one at a time. After removing bolts and flanges, the isolating diaphragms will be easily accessible for cleaning.

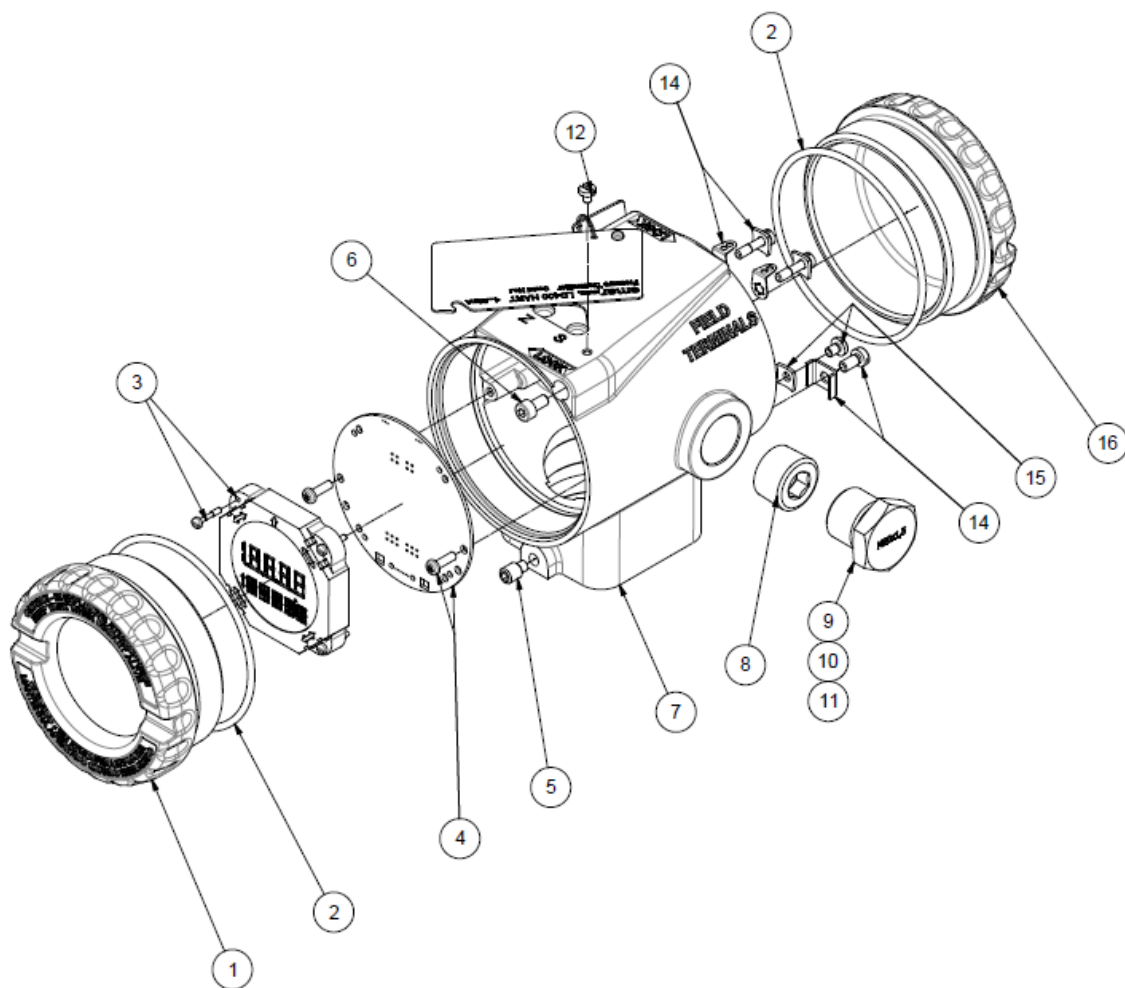
Cleaning should be done carefully in order to avoid damaging the delicate isolating diaphragms. Use of a soft cloth and a nonacid solution is recommended.

The oscillator circuit is part of the sensor. If the former is replaced, the latter should also be replaced. The oscillating circuit is a part of the sensor and the replacement of one implies replacing the other. 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.

### WARNING

To avoid damage do not rotate the electronic housing more than 270° without disconnecting the electronic circuit from the sensor and from the power supply. See Figure 6.2.



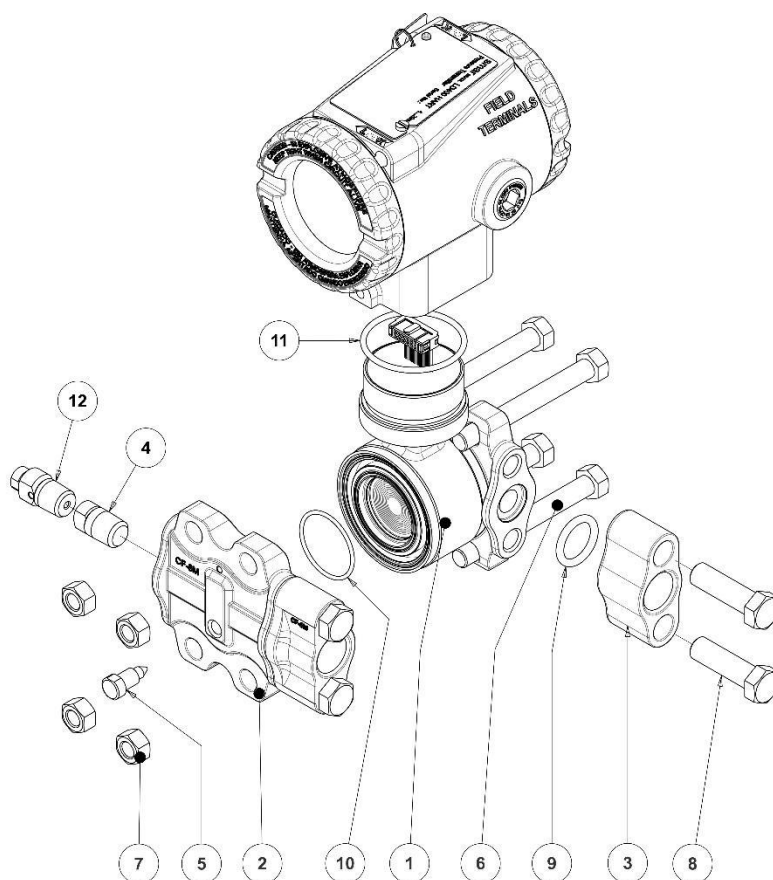
16	1	Cover	400-1257
15	1	Internal Ground washer and screw	400-0833
14	1	External Ground washer and screw	400-0904
13	1	Serrated terminal with screw and lock washer	400-0827
12	1	Identification plate screw	204-0116
11	1	3/4NPT AISI316 adapter Exd	400-0812
10	1	Plug PG13.5 316	400-0811
9	1	Plug M20 316 Exd	400-0810
8	1	Plug 1/2NPT 316 Exd	400-1484
7	1	Electronic Housing 400	400-1368-xxxxx
6	2	Cover lock screw	204-0120
5	1	Sensor lock screw	400-1121
4	1	Main board screw	400-0832
4	1	Main Board GLL1475 (with display / assembly kit) LD400 HART	400-1461 *
4	1	Main Board GLL1475 (with display / assembly kit) LD400 HART SIS	400-1459 **
3	1	Display LD400 (include assembly kit)	400-1467 ***
2	1	Cover oring	204-0122
1	1	Cover with window	400-0822-xx
ITEM	QTY	DESCRIPTION	PART NUMBER

\* Previous main board 400-0829 and 400-0831 have been discontinued, if revision is needed it should be replaced by the current one (GLL1475)

\*\* When a revision is needed in the SIS transmitter, the sensor and board must be replaced by a new one (GLL1475)

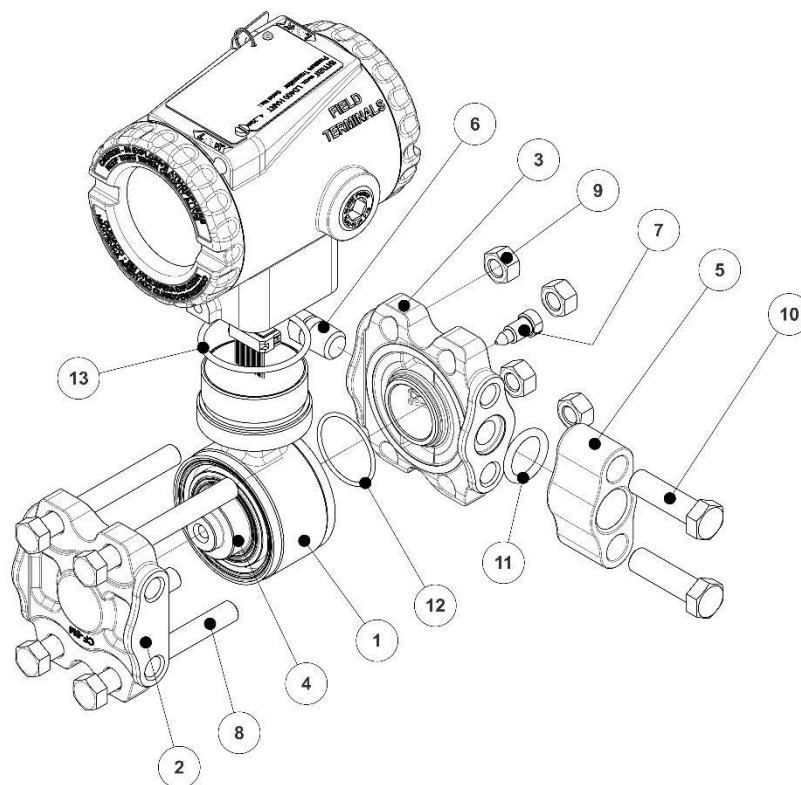
\*\*\* New display 400-1467 does not work with previous boards (GLL1306 and GLL1353), if a new display is needed, the board must also be replaced (GLL1475)





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



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

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
4	1	Absolute Campanula	
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
ITEM	QTD	DESCRIÇÃO	CÓDIGO

Figure 6.1 – LD400 Exploded View



**Figure 6.2– Sensor Rotation Stopper**

## Electronic Circuit

To remove the circuit board, loosen the two screws.

### WARNING

The board has CMOS components, which may be damaged by electrostatic discharges. Make sure that these components will be handled by trained people that know the right handling procedures. The operator and the bench must be grounded during the entire process. Also, the circuit boards should be stored in electric-charge proof packages.

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

## Reassembly Procedure

### WARNING

Do not assemble with power on.

## Sensor

When mounting the sensor, make use of a new set of gaskets 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 gaskets and Backup (only for high pressure) in the flange according to figure 6.1. Set the four bolts and tighten the nuts initially by hand while keeping the flanges parallel through the whole mounting and finalize with an adequate tool.

### O-RINGS AND BACKUP RINGS FOR HIGH PRESSURE

Except for special cases, the new standard flanges no longer use parbak. For specials that still use it, proceed as follows:

Do not bend the parback ring and check that it has no biting, etc. 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 nut diagonally across with a torque of 2.5 to 3 Kgfm;
- ✓ 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 gaskets and to connect the adapters to the process flanges before coupling them to the sensor. Optimum torque is 2.5 to 3 Kgfm.

The fitting of the sensor must be done with the main electronic board out of the housing. Mount the

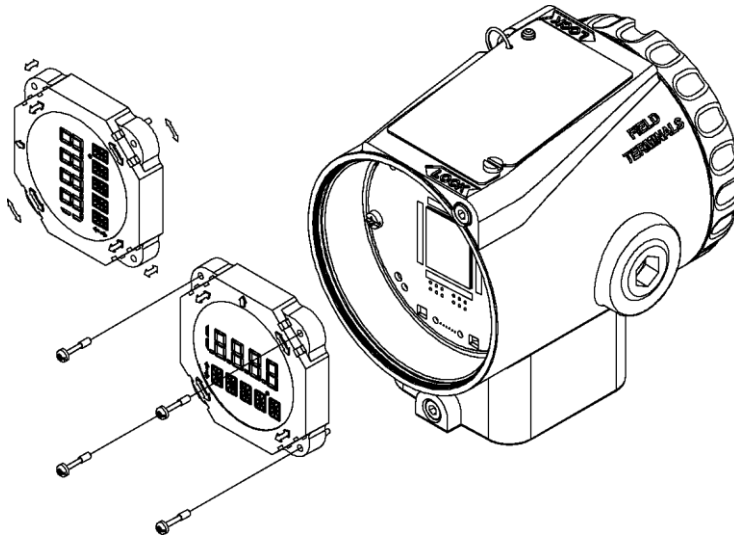
sensor to the housing turning it clockwise until it stops. Then turn it counterclockwise until the cover is parallel to the process flange. Tighten the screw to lock the housing to the sensor.

### **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. The display can be installed in any of the 4 possible positions (See Figure 6.3). The '▲' mark indicates up position.

Pass the screws through the main board holes and the spacers as shown on Figure 6.3 and tighten them to the body.

After tightening the protective cover, 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 6.3 - Four Possible Positions of the Display**

## **Interchangeability**

To obtain an accurate and better temperature compensated response, each sensor is submitted to a characterization process and the specific data is stored in an EEPROM located in the sensor body.

The main board, 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 probe the memory of the new sensor for the following information:

- ✓ Temperature compensation coefficients.
- ✓ Sensor trim data, including 5-point 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 MAINT/BACKUP/READ FROM SENSOR.

## 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.

If it becomes necessary to return the transmitter and/or configurator to Smar, simply contact our office, informing the defective instrument's serial number, and return it to our factory. 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 warranty term should be accompanied by a purchase order or a quote request.

## Lifetime Transmitter

The **LD400 HART®** Smart Pressure Transmitter has a life span of 50 years. The reliability data listed in the FMEDA report are only valid for this period. After this time the transmitter may present failures.

## Spare Parts List

SPARE PARTS LIST FOR TRANSMITTER				
DESCRIPTION OF PARTS		POSITION	CODE	CATEGORY (NOTE 1)
MOUNTING BRACKET FOR 2" PIPE MOUNTING (NOTE 3)	. Carbon Steel		203 0801	
	. 316 SST		203 0802	
	. Carbon Steel with accessories in 316 SST		203 0803	
MOUNTING BRACKET IN L FOR LD400G (NOTE 3)	CS		209-0801	
	316 SST		209-0802	
	Carbon Steel with accessories in 316 SST		209-0803	
SENSOR		29	(NOTE 2)	B
DRAIN/VENT VALVE	. 316 SST	30	400-0792	

### NOTES

- (1) For category **A**, it is recommended to keep, in stock, 25 parts installed for each set, and **20** for category **B**.
- (2) To specify sensors, use the following tables.
- (3) Including U-Clamp, nuts, bolts and washers.

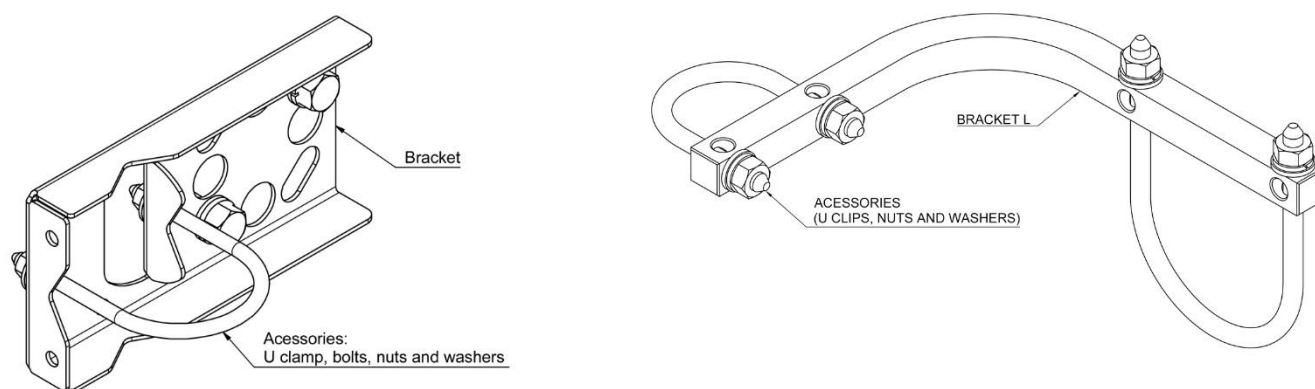


Figure 6.4 – Mounting Brackets

## Detailed Spare Parts Ordering Code

CODE	DESCRIPTION			
400-1368	400 HOUSING			
	Option	Product		
	1	LD400		
		Option	Communication Protocol	
		H	HART & 4-20 mA	
			Option	Electrical Connection
			0	½ NPT
			A	M20 X 1,5
			B	PG 13.5
400-1368	1	H	*	*

TYPICAL MODEL

Special Options	
COD.	Material
H0	Aluminum (IP/Type)
H1	SST (IP/Type)
H2	Aluminum - saline atmospheres (IPW/Type X)
COD.	Painting
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
P7	Beige Epoxy
P8	Without painting
P9	Safety Blue Epoxy
PD	Bright Plain Blue RAL5010 – Epoxy
PG	Safety Orange Epoxy

CODE	DESCRIPTION
400-0822	Cover with window

Special Options	
COD.	Material
H0	Aluminum (IP/Type)
H1	SST (IP/Type)
COD.	Painting
P0	Gray Munsell N 6.5 - Polyester
PJ	Textured White - Polyester

CODE	DESCRIPTION
400-1257	Cover without window

Special Options	
COD.	Material
H0	Aluminum (IP/Type)
H1	SST (IP/Type)
COD.	Painting
P0	Gray Munsell N 6.5 – Polyester
P8	Without painting
PJ	Textured White - Polyester

CODE	DESCRIPTION		
400-1330	STANDARD DIFFERENTIAL FLANGE 1/4 NPT CONNECTION;		
	Option	Drain/Vent	
	0	Without drain/vent	
	1	With drain/vent	
	Option	Flange thread for fixing	
	0	7/16 - 20 UNF	
	1	M10 X 1.5	
	2	M12 X 1.75	
	Option	Flange Material	
	A	304L SST / CF-3	
	H	Hastelloy C276 / CW-12MW	
	I	316 SST / CF-8M	
400-1330	1	0	I



## Sensor Ordering Code

MODEL	DIFFERENTIAL, FLOW, GAGE, ABSOLUTE AND HIGH STATIC PRESSURE SENSOR										
400-0837	Sensor Module										
COD	Type	Range LIMITS						Turn Down			
		Min	Max	Unit	Min	Max	Unit3	Max			
D0	Differential (10)	-1	1	kPa	-10	10	mbar	20	NOTE: The range can be extended up to 0.75 LRL* and 1.2 URL* with small degradation of accuracy.  *LRL = Lower Range Limit. *URL = Upper Range Limit.		
D1	Differential and Flow	-5	5	kPa	-50	50	mbar	40			
D2	Differential and Flow	-50	50	kPa	-500	500	mbar	200			
D3	Differential and Flow	-250	250	kPa	-2500	2500	mbar	200			
D4	Differential and Flow	-2500	2500	kPa	-25	25	bar	200			
M0	Gage	-1	1	kPa	-10	10	mbar	20			
M1	Gage	-5	5	kPa	-50	50	mbar	40	Due to differences in mechanical project, A1 range has turn-down lower than A0 range.		
M2	Gage	-50	50	kPa	-500	500	mbar	200			
M3	Gage	-100	250	kPa	-1000	2500	mbar	200			
M4	Gage	-100	2500	kPa	-1	25	bar	200			
M5	Gage	-0.1	25	MPa	-1	250	bar	120			
M6	Gage	-0.1	40	MPa	-1	400	bar	120			
A0	Absolute	0	1	kPa	0	7.5	mmHg	20			
A1	Absolute	0	5	kPa	0	37	mmHg	4			
A2	Absolute	0	50	kPa	0	500	mbar	20			
A3	Absolute	0	250	kPa	0	2500	mbar	120			
A4	Absolute	0	2500	kPa	0	25	bar	120			
A5	Absolute	0	25	MPa	0	250	bar	120			
A6	Absolute	0	40	MPa	0	400	bar	120			
H2	Differential – High Static Pressure	-50	50	kPa	-500	500	mbar	120			
H3	Differential – High Static Pressure	-250	250	kPa	-2500	2500	mbar	120			
H4	Differential – High Static Pressure	-2500	2500	kPa	-25	25	bar	120			
H5	Differential – High Static Pressure	-25	25	MPa	-250	-250	bar	120			
COD Diaphragm Material and Fill Fluid											
1	316L SST	Silicone Oil (5) (12)		M	Monel 400 Gold Plated		Silicone Oil (1) (3) (5)				
2	316L SST	Inert (Fluorolube Oil) (2) (9) (12)		P	Monel 400 Gold Plated		Inert (Krytox Oil) (1) (3) (9)				
3	Hastelloy C276	Silicone Oil (1) (5)		Q	316 L SST		Inert (Halocarbon 4.2 Oil) (9) (12)				
4	Hastelloy C276	Inert (Fluorolube Oil) (1) (2) (9)		R	Hastelloy C276		Inert (Halocarbon 4.2 Oil) (1) (9)				
5	Monel 400	Silicone Oil (1)(3)(5)		S	Tantalum		Inert (Halocarbon 4.2 Oil) (3) (9)				
7	Tantalum	Silicone Oil (3) (5)		I	316L SST, L.I. Gold Plated		Silicone Oil (3) (5) (8)				
8	Tantalum	Inert (Fluorolube Oil) (2) (3) (9)		J	316L SST, L.I. Gold Plated		Inert (Fluorolube Oil) (2) (3) (4) (8) (9)				
9	316L SST	Fomblin Oil (6) (12)		L	316L SST, L.I. Gold Plated		Inert (Krytox Oil) (3) (8)(9)				
A	Monel 400	Fomblin Oil (1) (3)		T	316L SST, L.I. Gold Plated		Inert (Halocarbon 4.2 Oil) (3) (8) (9)				
D	316 L SST	Inert (Krytox Oil) (6) (9) (12)		U	316L SST, L.I.		Silicone Oil (3) (5)				
E	Hastelloy C276	Inert (Krytox Oil) (1) (6) (9)		V	316L SST, L.I.		Inert (Fluorolube Oil) (3) (4) (9)				
G	Tantalum	Inert (Krytox Oil) (3) (9)		W	316L SST, L.I.		Inert (Krytox Oil) (3) (9)				
K	Monel 400	Inert (Krytox Oil) (1) (3) (9)		X	316L SST, L.I.		Inert (Halocarbon 4.2 Oil) (3) (9)				
Note: L.I. = Integral Steel											
COD Performance Class											
0	Default		1	High Performance (7)							
COD Safety Instrumented											
0	Default – For use in measurement and control		1	SIS - Safety Instrumented Systems (11)							
400-0837	D2	1	1	0							

400-0837	D2	1	1	0
----------	----	---	---	---

### NOTES

- |  |  |
|--|--|
| <p>(1) Meets NACE MR – 01 – 75/ISO 15156 recommendations.</p> <p>(2) Not available for absolute models nor for vacuum applications.</p> <p>(3) Not available for ranges 0 and 1.</p> <p>(4) Not recommended for vacuum applications.</p> <p>(5) Silicone Oil is not recommended for oxygen (O2) or Chlorine service.</p> <p>(6) Not available for range 0.</p> | <p>(7) Only available for differential pressure and gage transmitters.</p> <p>(8) Effective for hydrogen migration processes.</p> <p>(9) Inert Fluid: Oxygen Compatibility, safe for oxygen service.</p> <p>(10) The D0 range should not be used for flow measurement.</p> <p>(11) SIL 1 and SIL 2 (non-redundant) and SIL 3 (redundant) applications.</p> <p>(12) Sensors in 316L stainless steel ranges 0, 1, and 2 are mounted with Hastelloy C276 diaphragm.</p> |
|--|--|



MODEL	LEVEL SENSOR														
400-0837	Smart Pressure Transmitter														
COD	TYPE	RANGE LIMITS						Turn Down							
		Min	Max	Unit	Min	Max	Unit	Max							
L2	Level	-50	50	kPa	-500	500	mbar	120	<b>Note:</b> 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.						
L3	Level	-250	250	kPa	-2500	2500	mbar	120							
L4	Level	-2500	2500	kPa	-25	25	bar	120							
L5	Level	-25	25	MPa	-250	250	bar	120							
COD	Diaphragm material and Fill Fluid														
1	316L SST	Silicone Oil (2)(18)					M	Monel 400 Gold Plated	Silicone Oil (1) (2)						
2	316L SST	Inert (Fluorolube Oil) (3) (14)(18)					P	Monel 400 Gold Plated	Inert (Krytox Oil) (1) (14)						
3	Hastelloy C276	Silicone Oil (1) (2)					Q	316 L SST	Inert (Halocarbon 4.2 Oil) (14) (18)						
4	Hastelloy C276	Inert (Fluorolube Oil) (1) (3) (14)					R	Hastelloy C276	Inert (Halocarbon 4.2 Oil) (1) (14)						
5	Monel 400	Silicone Oil (1) (2)					S	Tantalum	Inert (Halocarbon 4.2 Oil) (14)						
7	Tantalum	Silicone Oil (2)					I	316L SST, L.I. Gold Plated	Silicone Oil (2) (13)						
8	Tantalum	Inert (Fluorolube Oil) (3) (14)					J	316L SST, L.I. Gold Plated	Inert (Fluorolube Oil) (3) (13) (14)						
9	316L SST	Fomblim Oil (18)					L	316L SST, L.I. Gold Plated	Inert (Krytox Oil) (13) (14)						
A	Monel 400	Fomblim Oil (1)					T	316L SST, L.I. Gold Plated	Inert (Halocarbon 4.2 Oil) (13) (14)						
D	316 L SST	Inert (Krytox Oil) (14) (18)					<b>Note:</b> L.I. = Integral Steel								
E	Hastelloy C276	Inert (Krytox Oil) (1) (14)													
G	Tantalum	Inert (Krytox Oil) (14)													
K	Monel 400	Inert (Krytox Oil) (1) (14)													
COD.	Performance Class														
0	Default														
COD.	Safety Instrumented														
0	Default – For use in measurement and control														
1	SIS - Safety Instrumented Systems (16)														
COD.	Flange, Adapter and Drain/Vent Valves Material														
A	304L SST														
P	Plated CS (Drain/Vent in Stainless Steel) (15)														
H	Hastelloy C276 (CW-12MW, ASTM - A494) (1)														
I	316 SST - CF8M (ASTM A351)														
F	Monel 400 - Laminated bar (HF applications)														
1	316 SST - CF8M (ASTM A351) (Drain/vent in Hastelloy C276) (1)														
2	316 SST - CF8M (ASTM A351) Flange with PVDF (Kynar) insert (3) (4) (5)(6)														
COD.	O'Ring Material														
0	Without O-ring														
B	Buna-N														
E	Ethylene – Propylene														
K	Kalrez														
T	Teflon														
V	Viton														
<b>Note:</b> O-rings are not available on the sides with remote seals.															
COD.	Drain/Vent Position (Low Side)														
0	Without drain/vent														
A	Drain/Vent (Opposite to Process Connection)														
D	Bottom														
U	Top														
<b>Note:</b> For better Drain/Vent operation, vent valves are strongly recommended. Drain/Vent valve not available on the sides with remote seals.															
COD.	Process Connection (Low Side)														
0	1/4 - 18 NPT (Without adapter)														
1	1/2- 14 NPT (With adapter) (8)														
3	Remote Seal (With Plug) (4)														
5	1/2- 14 NPT Axial with PVDF Insert (3) (4) (5) (6)														
9	Remote Seal (Low Volume Flange) (3) (4)														
T	1/2 - 14 BSP (With adapter) (8)														
U	Reduced Volume Level Flange, Welded														
Z	User's specifications														
COD.	Special Applications														
0	Without special cleaning														
1	Degrease Cleaning (Oxygen or Chlorine Service) (10)														
2	Applicable for vacuum service														
COD.	Flanges Bolts and Nuts Material														
I	316 SST														
C	Carbon Steel (ASTM A193 B7M) (1) (15)														
H	Hastelloy C276														
A	SST Super Duplex according to NACE MR0175 / MR0103 (1a)														
COD.	Flange thread for fixing accessories (Adapters)														
0	7/16" UNF (Default)														
1	M10 x 1.5														
COD.	Process Connection (High Side)														
O	1 1/2" 150 # (ASME B16.5)										R	DN 40 PN10/40 (DIN EN 1092-1)			
P	1 1/2" 300 # (ASME B16.5)										E	DN 50 PN 10/40 (DIN EN 1092-1)			
Q	1 1/2" 600 # (ASME B16.5)										6	DN 80 PN 10/40 (DIN EN 1092-1)			
9	2" 150 # (ASME B16.5)										7	DN 100 PN 10/16 (DIN EN 1092-1)			
A	2" 300 # (ASME B16.5)										8	DN 100 PN 25/40 (DIN EN 1092-1)			
B	2" 600 # (ASME B16.5)										H	10K 100A (JIS B 2220)			
1	3" 150 # (ASME B16.5)										F	10K 50A (JIS B 2220)			
2	3" 300 # (ASME B16.5)										G	20K 100A (JIS B 2220)			
C	3" 600 # (ASME B16.5)										S	20K 50A (JIS B 2220)			
3	4" 150 # (ASME B16.5)										L	20K 80A (JIS B 2220)			
4	4" 300 # (ASME B16.5)										T	40K 50A (JIS B 2220)			
D	4" 600 # (ASME B16.5)										Z	User's specifications			

400-0837	L2	1	0	0	I	B	A	0	1	I	0	1	Continued from Sensor Main Code									
													<b>COD</b>	<b>Type and Flange Material (High Side)</b>								
													I	316L SST (Integral Flange)								
													H	Hastelloy C276 (Integral Flange)								
													<b>COD</b>	<b>Flange Facing Finish</b>								
													0	Raised Face – RF (Default)								
													1	Flat Face – FF (17)								
													2	Ring Joint Face – RTJ (Only available for ANSI standard flange) (11)								
													<b>COD</b>	<b>Extension Length</b>								
													0	0 mm (0")								
													1	50 mm (2")								
													2	100 mm (4")								
													3	150 mm (6")								
													4	200 mm (8")								
													Z	User's specifications								
													<b>COD</b>	<b>Diaphragm Material</b>								
													A	304 L SST								
													L	316 L SST								
													H	Hastelloy C276								
													M	Monel 400 (9)								
													T	Tantalum (9)								
													X	Titanium (9)								
													1	316L SST with Teflon Lining (For 2" and 3")								
													2	316L SST Gold plated								
													3	Tantalum with Teflon Lining								
													<b>COD</b>	<b>Fill Fluid</b>								
													1	Silicone DC-200/20 Oil								
													2	Fluorolube MO-10 Oil (7)(14)								
													3	Silicone DC704 Oil								
													4	Krytox Oil (14)								
													N	Neobee M20 Propylene Glycol Oil								
													T	Syltherm 800 Oil								
													Z	User's specifications								
400-0837	L2	1	0	0	I	B	A	0	1	I	0	1	I	0	1	L	1	TYPICAL MODEL NUMBER				

**Notes:**

- (1) Meets NACE MR – 01 – 75/ISO 15156 recommendations.  
 (1a) MR103  
 (2) Silicone Oil is not recommended for Oxygen (O<sub>2</sub>) or Chlorine service.  
 (3) Not applicable for vacuum service.  
 (4) Drain/Vent not applicable.  
 (5) O'Ring should be Viton or Kalrez.  
 (6) Maximum pressure 24 bar.  
 (7) Inert fill fluid Fluorolube is not available for Monel diaphragm.  
 (8) Explosion proof approvals do not apply to adapter, only to transmitter.  
 (9) Attention, check corrosion rate for the process, tantalum plate 0.1 mm, AISI 316L extension 3 to 6mm.

- (10) Degrease cleaning not available for carbon steel flanges.  
 (11) Only enable for flange ASME B16.5.  
 (12) For this option consult Smar.  
 (13) Effective for hydrogen migration processes  
 (14) Inert Fluid: Oxygen Compatibility, safe for oxygen service.  
 (15) Not applicable for saline atmosphere.  
 (16) SIL 1 and SIL 2 (non-redundant) and SIL 3 (redundant) applications.  
 (17) Not available for JIS B2220 flange.  
 (18) Sensors in 316L stainless steel, range 2, are mounted with Hastelloy C276 diaphragm.

MODEL		SENSOR FOR SANITARY PRESSURE TRANSMITTER									
400-0837		Sensor Module									
COD.	TYPE	Range Limits						Turn Down			
		Min	Max	Unit	Min	Max	Unit	Max			
S2	Sanitary	-50	50	kPa	-500	500	mbar	120	<b>Note:</b> 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.		
S3	Sanitary	-250	250	kPa	-2500	2500	mbar	120			
S4	Sanitary	-2500	2500	kPa	-25	25	bar	120			
S5	Sanitary	-25	25	MPa	-250	250	bar	120			
COD. Diaphragm material and Fill Fluid (Low Side)											
1	316L SST	Silicone Oil (2) (10)					3	Hastelloy C276	Silicone Oil (1) (2)		
2	316L SST	Inert Fluorolube Oil (3) (7) (10)					4	Hastelloy C276	Inert Fluorolube Oil (1) (3) (7)		
COD. Performance Class3											
U	Default										
COD. Safety Instrumented											
0	Default – For use in measurement and control										
1	SIS - Safety Instrumented Systems (9)										
COD. Flange, Adapter and Drain/Vent Valves material											
H	Hastelloy C276 (CW-12MW, ASTM - A494)										
COD. O'Ring Material											
O	Without O-ring										
B	Buna-N										
E	Ethylene – Propylene										
T	Teflon										
V	Viton										
COD. Drain/Vent Position											
0	Without drain/vent										
A	Drain/Vent (Opposite to Process Connection)										
D	Bottoms										
U	Top										
COD. Process Connection (Low Side)											
0	1/4 - 18 NPT (Without Adapter)										
1	1/2 - 14 NPT (Without Adapter) (5)										
3	Remote Seal (With Plug) (4)										
9	Remote Seal (Low Volume Flange) (3) (4)										
T	1/2 - 14 BSP (With adapter) (5)										
Z	User's specifications										
COD. Specials Applications											
0	Without special cleaning										
1	Degrease Cleaning (Oxygen or Chlorine Service) (6)										
2	Applicable for vacuum service.										
COD. Flanges Bolts and Nuts Material											
I	316 SST										
C	Carbon Steel (ASTM A193 B7M) (1) (8)										
H	Hastelloy C276										
A	SST Super Duplex according to NACE MR0175 / MR0103 (1a)										
COD. Flange thread for fixing accessories (adapters, manifolds, mounting brackets, etc)											
0	7/16" UNF										
1	M10 x 1.5										

400-0837	S2	1	0	0	H	B	D	0	0	I	0
----------	----	---	---	---	---	---	---	---	---	---	---

CONTINUE IN THE NEXT PAGE

400-0837	S2	1	0-	0	H	B	D	0	0	I	0	Continued from sanitary sensor main code										
												COD.	Process Connections (11)									
												8	DN25 DIN 11851 – WITH EXTENSION/316 SST									
												9	DN40 DIN 11851 - WITH EXTENSION/316 SST									
												H	DN40 DIN 11851 – 316 SST									
												V	THREAD DN50 DIN 11851 - WITH EXTENSION/316 SST									
												U	THREAD DN50 DIN 11851 - WITHOUT EXTENSION/316 SST									
												X	THREAD DN80 DIN 11851 - WITH EXTENSION/316 SST									
												W	THREAD DN80 DIN 11851 - WITHOUT EXTENSION/316 SST									
												4	THREAD IDF 2" - WITH EXTENSION/316 SST									
												B	THREAD IDF 2" - 316 SST									
												K	THREAD IDF 3" - WITH EXTENSION/316 SST									
												3	THREAD IDF 3" - WITHOUT EXTENSION/316 SST									
												5	THREAD RJT 2" - - WITH EXTENSION/316 SST									
												C	THREAD RJT 2" - 316 SST									
												L	THREAD RJT 3" - WITH EXTENSION/316 SST									
												2	THREAD RJT 3" - WITHOUT EXTENSION/316 SST									
												S	THREAD SMS 1 1/2" - 316 SST									
												7	THREAD SMS 2" - - WITH EXTENSION/316 SST									
												E	THREAD SMS 2" - 316 SST									
												M	THREAD SMS 3" - - WITH EXTENSION/316 SST									
												1	THREAD SMS 3" - - WITHOUT EXTENSION/316 SST									
												F	TRI CLAMP 1 1/2" - 316 SST									
												Q	TRI CLAMP 1 1/2" HP (High Pressure) - 316 SST									
												6	TRI CLAMP 2" - - WITH EXTENSION/316 SST									
												D	TRI CLAMP 2" - 316 SST									
												N	TRI CLAMP 2" HP (High Pressure) - - WITH EXTENSION/316 SST									
												P	TRI CLAMP 2" HP (High Pressure) - 316 SST									
												I	TRI CLAMP 3" - - WITH EXTENSION/316 SST									
												G	TRI CLAMP 3" - 316 SST									
												J	TRI CLAMP 3" HP (High Pressure) - - WITH EXTENSION/316 SST									
												R	TRI CLAMP 3" HP (High Pressure) - 316 SST									
												A	TRI CLAMP DN50 - - WITH EXTENSION/316 SST									
												O	TRI CLAMP DN50 HP (High Pressure) - - WITH EXTENSION/316 SST									
												Z	User's specifications									
												COD.	O-Rings Materials (High Side)									
												0	Without O-ring (Supplied by Client)									
												B	Buna N									
												T	Teflon									
												V	Viton									
												Z	User's specifications									
												COD.	Diaphragm Material (High Side)									
												L	316L SST									
												H	Hastelloy C276									
												COD.	Fill Fluid (High Side)									
												1	Silicone DC-200/20 Oil									
												2	Fluorolube MO-10 Oil (3)									
												3	Silicone Oil DC704									
												N	Neobee M20 Propylene Glycol Oil									
												Z	User's specifications									
400-0837	S2	1	0	0	H	B	D	0	0	I	0	4	B	L	1	TYPICAL MODEL NUMBER						

## Notes:

- |   |  |
|---|--|
| <p>(1) Meets NACE MR – 01 – 75/ISO 15156 recommendations.</p> <p>(2) Silicone Oil is not recommended for Oxygen or Chlorine service.</p> <p>(3) Not applicable for vacuum service.</p> <p>(4) Drain/Vent not applicable.</p> <p>(5) Explosion proof approvals do not apply to adapter, only to transmitter.</p> | <p>(6) Degrease cleaning not available for carbon steel flanges.</p> <p>(7) Inert Fluid: safe for oxygen service.</p> <p>(8) Not applicable for saline atmosphere.</p> <p>(9) SIL 1 and SIL 2 (non-redundant) and SIL 3 (redundant) applications.</p> <p>(10) Sensors in 316L stainless steel, range 2, are mounted with Hastelloy C276 diaphragm.</p> <p>(11) LD400S without extension always 316L SST/316L SST or Hastelloy C276; connections with extension, the wet tip follows 316L SST or Hastelloy C276 diaphragm material.</p> |
|---|--|

MODEL		SENSOR FOR INLINE PRESSURE TRANSMITTER									
400-0837		Sensor Module LD400-G									
COD	TYPE	RANGE LIMITS							Turn Down		
		Min.	Max.	Unit		Min.	Max.	Unit			Max.
G2	Inline	-50	50	kPa		-500	500	mbar	200	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.	
G3	Inline	-100	250	kPa		-1000	2500	mbar	200		
G4	Inline	-100	2500	kPa		-1	25	bar	200		
G5	Inline	-0,1	25	MPa		-1	250	bar	200		
COD	Diaphragm material and Fill Fluid (Low Side)										
1	316L SST Silicone Oil (3) (7)										
2	316L SST Fluorolube Inert Oil (2) (4) (7)										
3	Hastelloy C276 Silicone Oil (1) (3)										
4	Hastelloy C276 Fluorolube Inert Oil (1) (2) (4)										
D	316L SST Krytox Inert Oil (2) (7)										
E	Hastelloy C276 Krytox Inert Oil (1) (2)										
Q	316L SST Halocarbon 4.2 Inert Oil (2) (7)										
R	Hastelloy C276 Halocarbon 4.2 Inert Oil (1) (2)										
COD.	Performance Class										
0	Standard										
1	High Performance										
COD	Communication Protocol										
H	HART® & 4 - 20 mA										
COD	Safety Instrumented										
0	Default – For use in measurement and control										
1	SIS - Safety Instrumented Systems (5)										
COD	Process Connections										
1	1/2 - 14 NPT - Female										
A	M20X1.5 - Male										
G	DIN EN 837-1 G1/2B Male (6)										
H	DIN EN 837-1 G1/2B HP Male (6)										
M	1/2 - 14 NPT - Male										
R	Remote Seal – See notes										
U	1/2 BSP - Male										
V	Manifold valve integrated to the transmitter										
X	1" NPT Sealed (Diaphragm 316L SST/ Fill fluid Silicone DC200/20)										
Y	1 ½ NPT Sealed (Diaphragm 316L SST/ Fill fluid Silicone DC200/20)										
Z	Special – See notes										
COD.	Process Connections Material										
H	Hastelloy C276 (1)										
I	316L SST/ 316L SST										
Z	Special – See notes										
400-0837	-	G2	1	0	-	H	0	-	1	I	TYPICAL MODEL

## NOTES

- (1) Meets NACE MR – 01 – 75 recommendations.
- (2) Inert Fluid: safe for oxygen service.
- (3) Silicone Oil is not recommended for Oxygen or Chlorine service.
- (4) Not applicable for vacuum service.
- (5) SIL 1 and SIL 2 (non-redundant) and SIL 3 (redundant) applications.
- (6) The DIN16288 standard was replaced by DIN EN 837-1 standard.
- (7) Sensors in 316L stainless steel, range 2, are mounted with Hastelloy C276 diaphragm.

**HART® Special Units**

VARIABLE	CODE	UNIT	DESCRIPTION
Pressure	1	inH <sub>2</sub> O (68°F)	inches of water at 68 degrees F
	2	inHg (0°C)	inches of mercury at 0 degrees C
	3	ftH <sub>2</sub> O (68°F)	feet of water at 68 degrees F
	4	mmH <sub>2</sub> O (68°F)	millimeters of water at 68 degrees F
	5	mmHg (0°C)	millimeters of mercury at 0 degrees C
	6	lb/in <sup>2</sup>	pounds per square inch
	7	bar	bars
	8	mbar	millibars
	9	gf/cm <sup>2</sup>	Gram force per square centimeter
	10	kgf/cm <sup>2</sup>	Kilogram force per square centimeter
	11	Pa	pascals
	12	kPa	kilopascals
	13	torr	torr
	14	atm	atmospheres
	145	inH <sub>2</sub> O (60°F)	inches of water at 60 degrees F
	237	MPa	megapascals
	238	inH <sub>2</sub> O (4°C)	inches of water at 4 degrees C
	239	mmH <sub>2</sub> O (4°C)	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 <sup>3</sup> /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 <sup>3</sup> /s	cubic feet per second
	27	ft <sup>3</sup> /d	cubic feet per day
	28	m <sup>3</sup> /s	cubic meters per second
	29	m <sup>3</sup> /d	cubic meters per day
	30	ImpGal/h	imperial gallons per hour
	31	ImpGal/d	imperial gallons per day
	121	Nm <sup>3</sup> /h	normal cubic meters per hour
	122	Nl/h	normal liters per hour
	123	ft <sup>3</sup> /min	standard cubic feet per minute
	130	CFH	cubic feet per hour
	131	m <sup>3</sup> /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	°C	degrees Celsius
	33	°F	degrees Fahrenheit
	34	°R	degrees Rankine
	35	K	degrees Kelvin
ELECTROMAGNETIC 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 <sup>3</sup>	cubic meters
	46	bbl	barrels
	110	bushel	bushels
	111	yd <sup>3</sup>	cubic yards
	112	ft <sup>3</sup>	cubic feet
	113	in <sup>3</sup>	cubic inches
	124	bbl(liq)	liquid barrels
	166	Nm <sup>3</sup>	normal cubic meter
	167	NI	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 <sup>16</sup>	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	Lton/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/cm <sup>3</sup>	grams per cubic centimeter
	92	kg/m <sup>3</sup>	kilograms per cubic meter
	93	lb/gal	pounds per gallon
	94	lb/ft <sup>3</sup>	pounds per cubic foot
	95	g/ml	grams per milliliter
	96	kg/l	kilograms per liter
	97	g/l	grams per liter
	98	lb/in <sup>3</sup>	pounds per cubic inch
	99	ton/yd <sup>3</sup>	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/m <sup>3</sup>	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	degbrx	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



# SAFETY INSTRUMENTED SYSTEMS

## Introduction

### WARNING

**LD400 HART® SIS** has the housing cover in red to distinguish them from the standard model.

**LD400 HART® SIS** is an intelligent pressure transmitter used for differential, absolute, gauge, level and flow measurements in safety applications. **LD400 HART® SIS** outputs a 4 to 20 mA DC signal corresponding to the pressure applied. This information is transmitted to a safety PLC and can be shown on the LCD display or remotely monitored via HART communication. **LD400 HART® SIS** is certified by TÜV for safety applications.

### WARNING

The SIS project must be carried by a professional duly qualified for this type of work.

## Safety Standard

**LD400 HART® SIS** satisfies the requirements of the standards shown in the Table 7.1.

Standard	Description
<b>IEC 61508: 2010</b>	Functional safety of E/E/PE safety-related systems.
<b>IEC 61326-1:2012</b>	Electrical equipment for measurement, control and laboratory use - EMC requirements – Part 1 General Requirements.
<b>IEC 61000-6-7:2014</b>	Electromagnetic compatibility (EMC) – Part 6-7: Generic standards – Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations.
<b>IEC 61298:2008</b>	Process measurement and control devices - General Methods and procedures for evaluating performance.
<b>IEC 60770:2010</b>	Transmitters for use in industrial-process control systems - Methods for performance evaluation and for inspection and routine testing.
<b>IEC 61010:2017</b>	Safety requirements for electrical equipment for measurement, control and laboratory use.
<b>ANSI/NEMA-250:2018</b>	Enclosures for Electrical Equipment and IEC 60529:2013 Degrees of protection provided by enclosures (IP Code).

**Table 7.1 – Safety Standards**

## Application Standards

Standard	Description
<b>IEC 61511:2018</b>	Functional safety - Safety instrumented systems for the process industry sector.
<b>ANSI/ISA 61511:2018</b>	Functional safety - Safety instrumented systems for the process industry sector.
<b>IEC 60079-0:2017</b>	Explosive atmospheres – Part 0: Equipment – General requirements
<b>IEC 60079-1:2017</b>	Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures “d”
<b>IEC 60079-7:2017</b>	Explosive atmospheres – Part 7: Equipment protection by increased safety “e”
<b>IEC 60079-11:2017</b>	Explosive atmospheres – Part 11: Equipment protection by intrinsic safety “i”
<b>FMRC-3600:2018</b>	Electrical Equipment for use in Hazardous (Classified) Locations - General Requirements.
<b>FMRC-3610:2018</b>	Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, II and III, Division 1 Hazardous Location.
<b>FMRC-3611:2018</b>	Electrical Equipment for use in Class I, Division 2; Class II, Division 2; and Class III, Division 1 and 2 Hazardous Location.
<b>FMRC-3615:2018</b>	Explosionproof Electrical Equipment General Requirements.
<b>FMRC-3810:2018</b>	Electrical Equipment for Measuring, Control and Laboratory Use.

**Table 7.2 – Application Standards**

## Safety Function

The **LD400 HART® SIS** transmitter measures the pressure within the safety accuracy and converts it in a 4-20 mA analog output using the selected output transfer function and the output current is treated according to NAMUR NE-43 specification. In case of sensor or circuit failure, the implemented self-diagnoses (software or hardware) drive the output to below 3.6 or above 21 mA that are the device safe states defined to this equipment.

In the normal circumstance it takes about 280 milliseconds to read the pressure within the specified resolution (response time) and about 80 milliseconds for pressure with high change rates.

To judge the failure behavior of the **LD400 HART® SIS**, the following definitions for the product were considered:

Failure	Description
Safe State	It is considered the state when the output current is out of the valid range, therefore lower than 3.8 mA or higher than 20.5 mA;
Safe Failure	Failure that leads the system to a safe state, without a process demand;
Dangerous Failure	Failure that leads the system to a dangerous condition, in other words, the transmitter will output a current out of the safety specification;
Undetected Failure	Failure that cannot be detected by the online diagnostics;
Detected Failure	Failure that can be detected by the online diagnostics.

Table 7.3 – Failure Modes

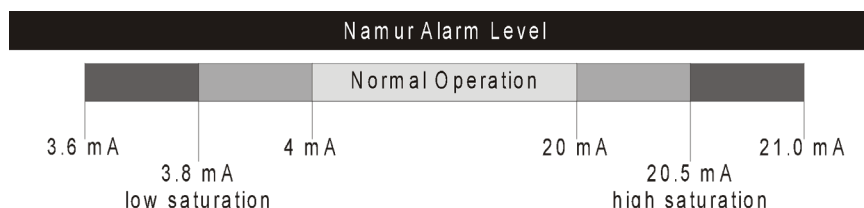


Figure 7.1 – Alarm Levels

## Functional Safety Properties

The Table 7.4 shows the Functional Safety Values obtained for **LD400 HART® SIS**.

OPERATION MODE	LOW DEMAND
TYPE	B
SFF	96.51%
LAMBDA SD (FITS)	19.63
LAMBDA SU (FITS)	269.21
LAMBDA DD (FITS)	233.85
LAMBDA DU (FITS)	18.90
PFD AVG FOR 20 YEARS PROOF TEST INTERVAL	1.7 E-03
TRANSMITTER LIFETIME	20 YEARS
SAFETY INTEGRITY LEVEL (SIL)	SIL 2 (HFT=0) SIL 3 (HFT=1)

Table 7.4 – Functional Safety Values

## Environmental Properties

Refer to the Section 3 Technical Characteristics for the proper environmental instructions.

## Installation

Refer to the Section 1 Installation for the proper installation instructions.

## Modes of Operation

The **LD400 HART® SIS** Transmitter has two modes of operation:

- **Configuration Mode**

This is the mode used for the configuration of the transmitter. In this mode the transmitter will accept HART write commands and local adjust. To enter in this mode, the user must follow the Configuration Mode Enabling Procedure that is explained in this SAFETY MANUAL.

### WARNING

It is highly recommended that the user does not use the transmitter for SIS applications while it is in the Configuration Mode.

- **SIS Mode**

In the SIS Mode the **LD400 HART® SIS** is enabled to work only as measurement equipment. In this mode no changes on configuration are allowed. Not even the hardware jumpers can be able to change

transmitter parameters and only the Hart read commands are permitted in SIS Mode the following applies:

- HART Protocol: only the READ commands are available;
- Multidrop Mode: is available, but will not stay with fixed current;
- PID: not available for the LD400 HART® SIS Transmitter;
- Hardware Jumpers: no action in SIS mode;
- DAMPING: User-selected damping will affect the transmitters' ability to respond to changes in the applied process. The damping value + response time should not exceed the loop requirements.

**WARNING**

The SIS mode is recognized either by reading the transmitter settings or by looking the icon on the display (↔). In the configuration mode this icon will be blinking and in safety mode this icon will be stopped.

**WARNING**

The Safety Function of the transmitter does not depend on the value in the display. This value is for information purposes only.

## **Configuration Mode Enabling Procedure**

To change the transmitter to the configuration mode:

- Set the Write Protection jumper in the OFF position;
- Choose the appropriate Local Adjustment Mode (COMPLETE or SIMPLE);
- Reset the transmitter if it is turned on or turn it on if it is not powered.

To return the transmitter to the SIS Mode:

- Set the Write Protection jumper in the ON position;
- Choose the appropriate Local Adjustment Mode in OFF
- Reset the transmitter if it is turned on or turn it on if it is not powered.

Refer to the Table 5.1 - Section 5 Programming Using Local Adjustment for the proper main board jumpers' instructions.

## **LD400 HART® SIS Technical Characteristics**

The **LD400 HART® SIS** must be operated according to functional and performance specifications described in this manual - Section 3, with the following exceptions:

## Functional Specifications

### Turn Down Limits

MODEL	TURN DOWN	MODEL	TURN DOWN
D0	10:1	G3	20:1
D1	10:1	G4	20:1
D2	20:1	G5	20:1
D3	20:1	A1	4:1
D4	20:1	A2	10:1
H2	20:1	A3	20:1
H3	20:1	A4	20:1
H4	20:1	A5	20:1
H5	20:1	L2	10:1
M0	10:1	L3	20:1
M1	10:1	L4	20:1
M2	20:1	L5	20:1
M3	20:1	S2	20:1
M4	20:1	S3	20:1
M5	20:1	S4	20:1
M6	20:1	S5	20:1
G2	20:1		

## Performance Specifications

### Reference Accuracy

- Notes:
- Reference accuracy includes the linearity effects, hysteresis and repeatability of the hardware and sensor;
  - Reference Conditions: Span starting at 0 of pressure, with digital trim at the lower and upper range values of measure; temperature of 25 °C; atmospheric pressure; power supply voltage of 24 Vdc; and silicone oil fill fluid and isolating diaphragms in 316 L SST.
- Accuracy for ranges D2, D3, D4, M2, M3 or M4 (10:1):  
 $\pm [0.06] \%$  of the span, for  $0.2 \text{ URL} \leq \text{span} \leq \text{URL}$   
 $\pm [0.04 + 0.004 \text{ URL/span}] \%$  of the span, for  $0.1 \text{ URL} \leq \text{span} \leq 0.2 \text{ URL}$
  - Accuracy for ranges D1 or M1 (5:1):  $\pm [0.065] \%$  of the span
  - Accuracy for range M5 (10:1):  
 $\pm [0.065] \%$  of the span, for  $0.2 \text{ URL} \leq \text{span} \leq \text{URL}$   
 $\pm [0.044 + 0.0042 \text{ URL/span}] \%$  of the span, for  $0.1 \text{ URL} \leq \text{span} \leq 0.2 \text{ URL}$
  - Accuracy for range M6 (10:1):  
 $\pm [0.075] \%$  of the span, for  $0.2 \text{ URL} \leq \text{span} \leq \text{URL}$   
 $\pm [0.054 + 0.0042 \text{ URL/span}] \%$  of the span, for  $0.1 \text{ URL} \leq \text{span} \leq 0.2 \text{ URL}$
  - Accuracy for range A1 (5:1):  $\pm [0.075 + 0.0015 \text{ URL/span}] \%$  of the span
  - Accuracy for range A2 (10:1):  
 $\pm [0.08] \%$  of the span, for  $0.2 \text{ URL} \leq \text{span} \leq \text{URL}$   
 $\pm [0.056 + 0.0048 \text{ URL/span}] \%$  of the span, for  $0.1 \text{ URL} \leq \text{span} \leq 0.2 \text{ URL}$
  - Accuracy for ranges A3 or A4 (10:1):  
 $\pm [0.075] \%$  of the span, for  $0.2 \text{ URL} \leq \text{span} \leq \text{URL}$   
 $\pm [0.052 + 0.0046 \text{ URL/span}] \%$  of the span, for  $0.1 \text{ URL} \leq \text{span} \leq 0.2 \text{ URL}$
  - Accuracy for range A5 (10:1):  
 $\pm [0.08] \%$  of the span, for  $0.2 \text{ URL} \leq \text{span} \leq \text{URL}$   
 $\pm [0.057 + 0.0046 \text{ URL/span}] \%$  of the span, for  $0.1 \text{ URL} \leq \text{span} \leq 0.2 \text{ URL}$
  - Accuracy for range A6 (10:1):  
 $\pm [0.08] \%$  of the span, for  $0.2 \text{ URL} \leq \text{span} \leq \text{URL}$   
 $\pm [0.0565 + 0.0047 \text{ URL/span}] \%$  of the span, for  $0.1 \text{ URL} \leq \text{span} \leq 0.2 \text{ URL}$

	<ul style="list-style-type: none"> <li>Accuracy for ranges H2, H3 or H4 (10:1):  <math>\pm [0.07] \% \text{ of the span, for } 0.2 \text{ URL} \leq \text{span} \leq \text{URL}</math>  <math>\pm [0.047 + 0.0046 \text{ URL/span}] \% \text{ of the span, for } 0.1 \text{ URL} \leq \text{span} \leq 0.2 \text{ URL}</math> </li> <li>Accuracy for range H5 (10:1):  <math>\pm [0.075] \% \text{ of the span, for } 0.2 \text{ URL} \leq \text{span} \leq \text{URL}</math>  <math>\pm [0.0515 + 0.0047 \text{ URL/span}] \% \text{ of the span, for } 0.1 \text{ URL} \leq \text{span} \leq 0.2 \text{ URL}</math> </li> <li>Accuracy for ranges L2, L3, L4 or L5 (10:1):  <math>\pm [0.08] \% \text{ of the span, for } 0.2 \text{ URL} \leq \text{span} \leq \text{URL}</math>  <math>\pm [0.0565 + 0.0047 \text{ URL/span}] \% \text{ of the span, for } 0.1 \text{ URL} \leq \text{span} \leq 0.2 \text{ URL}</math> </li> <li>The accuracy for special assembling of the transmitter, different of the above stated condition, must be specified in detail in the product manual.</li> </ul>
Reference Temperature Effect	<p><b>For standard flange models:</b></p> <p>Notes.: Reference Condition: Span starting at 0 of pressure, with digital trim at the lower and upper range values of measure done at temperature of 20 °C; atmospheric pressure; power supply voltage of 24 Vdc; silicone oil fill fluid and isolating diaphragms in 316 L SST.</p> <p>For the calculation of the deviation in temperature, never consider step lower than 20 °C. The temperature cycle recommended is: 20 °C (reference); 40 °C; 60 °C; 20 °C; 0 °C; -20 °C; e 20 °C.</p> <ul style="list-style-type: none"> <li>Temperature effect for ranges 2, 3, 4, 5 or 6, except level or sanitary models:  <math>\pm (0.0795 + 0.0205 * \text{URL/span}) \% \text{ of the span, for } 20 \text{ °C for } 0.1 \text{ URL} \leq \text{span} \leq \text{URL};</math>  <math>\pm (0.0345 + 0.025 * \text{URL/span}) \% \text{ of the span, for } 20 \text{ °C for } 0.05 \text{ URL} \leq \text{span} \leq 0.1 \text{ URL}</math> </li> <li>Temperature effect for range 1:  <math>\pm (0.08 + 0.05 * \text{URL/span}) \% \text{ of the span, for } 20 \text{ °C}</math> </li> <li>Temperature effect for range 0:  <math>\pm (0.1 + 0.1 * \text{URL/span}) \% \text{ of the span, for } 20 \text{ °C}</math> </li> <li>The temperature effect for special assembling of the transmitter, different of the above stated condition, must be specified in detail in the product manual.</li> </ul> <p><b>For In-Line gauge models:</b></p> <ul style="list-style-type: none"> <li>Temperature effect for ranges 2, 3, 4 and 5:  <math>\pm (0.0795 + 0.0205 * \text{URL/span}) \% \text{ of the span, for } 20 \text{ °C for } 0.1 \text{ URL} \leq \text{span} \leq \text{URL};</math> </li> <li><math>\pm (0.0345 + 0.025 * \text{URL/span}) \% \text{ of the span, for } 20 \text{ °C for } 0.05 \text{ URL} \leq \text{span} \leq 0.1 \text{ URL}</math> </li> </ul> <p><b>For flush diaphragm models:</b></p> <ul style="list-style-type: none"> <li>With flange of 4" and DN100: 6 mmH<sub>2</sub>O for 20 °C</li> <li>With flange of 3" and DN80: 17 mmH<sub>2</sub>O for 20 °C</li> </ul>
Stabilization time after the power up	<ul style="list-style-type: none"> <li>Less than 5 seconds for hot start up.</li> <li>Less than 30 seconds for cold start up;</li> </ul>

## Maintenance

The maintenance of **LD400 HART® SIS** must be done according to the specifications described in the Section 6.

All maintenance services must be done by qualified personnel. Parts replacements must be supplied by Smar.

### WARNING

The firmware download should not be done in the field.



## CERTIFICATIONS INFORMATION

### *European Directive Information*

Consult [www.Smar.com](http://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"**

The EC-Type Examination Certificate is released by DNV Product Assurance AS (NB 2460) and DEKRA Testing and Certification GmbH (NB 0158).

Designated certification body that monitors manufacturing and released QAN (Quality Assurance Notification) is Nemko AS (NB 0470) and UL International Demko AS (NB 0539).

**LVD Directive 2014/35/EU – "Low Voltage"**

According to 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 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements.

**PED Directive 2014/68/EU - "Pressure Equipment"**

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"**

For the evaluation of the products the following standards were consulted: EN IEC 63000.

**EMC Directive 2014/30/EU - "Electromagnetic Compatibility"**

For products evaluation, the standard IEC 61326-1 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 Separation Elements or combined Levels of Protection

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

IEC 60079-19 Equipment repair, overhaul and reclamation

ISO/IEC 80079-34 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.

**Intrinsic Safety / Non Incendive application**

Only connect the equipment with the "Intrinsic safety" protection type to a circuit intrinsically safe. If the equipment has already been used in circuits not intrinsically safe or if the electrical specifications have not been respected, the safety of the equipment is no longer guaranteed for "Intrinsic Safety" installations.

In hazardous areas with intrinsic safety or non-incendive requirements, the circuit entity parameters and applicable installation procedures must be observed.

The instrument must be connected to a proper intrinsic safety 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  $C_i$  and  $L_i$  must be smaller than  $C_o$  and  $L_o$  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 (120°) to guarantee the sealing.

Lock the housing and covers using the locking screw.

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.

**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 35°C 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).

## Safety Approval

### TUV SUD

LD400 HART SIS

Safety components

Smart Pressure transmitters

Certificate No. Z10 070430 0003

Parameters:	Pressure range:	Up to 40 MPa
	Mode of operation:	Low demand
	Output:	4-20mA
	Hardware Fault Tolerance	0 - SIL 2
	Hardware Fault Tolerance	1 - SIL 3

Tested According to: IEC 61508 part 1 to 7; IEC 61511; IEC 61010-1; IEC 61326-1; IEC 61326-3-2

Test report no.: SS82601T

## Hazardous Locations Approvals

### ATEX DNV

Explosion Proof (DNV 22 ATEX 34311X)



II - / 2G Ex db IIC T6 Gb

Voltage = 28 VDC, Current = 157 mA

T amb -20 °C to 60 °C

Special Condition for Safe Use "X":

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 3 of EN/IEC 60079-1.

For cover and sensor thread form and quality of fit, contact the manufacturer for proper details.

Type Designation for the following variants

- a) Differential, Gage, Absolute Pressure and Differential Pressure for High Static Pressure.
- b) Level Measurement.
- c) Level with Extended Probe Measurement.
- d) Sanitary Measurements.
- e) Gage Inline Measurement.

LD400-\*\*\*-X1\*-\*\*\*\*\*-\*\*\*-X2\*\*-X3X4D2\*/\*

X1 - Communication Protocol (H - HART® & 4 to 20 mA)

X2 - Electrical connection (0 = ½ - 14NPT; A = M20x1,5)

X3 - Housing material (A and B = Aluminum, I and J = 316 SST)

X4 - Painting (0 = Gray Munsell N 6,5 Polyester, 8 = Without Painting, 9 = Safety Blue Epoxy - Electrostatic Painting, C = Safety Blue Polyester – Electrostatic)

The Essential Health and Safety Requirements are assured by compliance with:


EN IEC 60079-0:2018 General Requirements

EN 60079-1:2014 Flameproof Enclosures "d"

Drawings 102A-1916, 102A-1917, 102A-1918, 102A-1919, 102A-1920, 102A-1921, 102A-1922, 102A-1923, 102A-1924, 102A-1925

**ATEX UL DEMKO**

Intrinsic Safety (UL 22 ATEX 2648X)

 II 1 G Ex ia IIC T6...T4 Ga  
Ui = 30V li = 110 mA Pi = 0.825 W Ci = 21,6 nF Li = 4uH  
T4 = -40 °C ≤ Ta ≤ +80 °C  
T5 = -40 °C ≤ Ta ≤ +60 °C  
T6 = -40 °C ≤ Ta ≤ +40 °C

Special Condition for Safe Use "X":

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.

The Essential Health and Safety Requirements are assured by compliance with:

EN IEC 60079-0:2018 General Requirements

EN 60079-11:2012 Intrinsic Safety "i"

Drawings 102A2211, 102A2212, 102A2213, 102A2214

**IECEX UL do Brasil**

Intrinsic Safety (IECEX UL 22.0003X)

Ex ia IIC T6...T4 Ga  
Ui = 30V li = 110 mA Pi = 0.825 W Ci = 21,6 nF Li = 4uH  
T4 = -40 °C ≤ Ta ≤ +80 °C  
T5 = -40 °C ≤ Ta ≤ +60 °C  
T6 = -40 °C ≤ Ta ≤ +40 °C

Special Condition for Safe Use "X":

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.

The Essential Health and Safety Requirements are assured by compliance with:

IEC 60079-0:2017 General Requirements

IEC 60079-11:2011 Intrinsic Safety "i"

Drawings 102A2207, 102A2208, 102A2209, 102A2210

**INMETRO UL do Brasil**

Segurança Intrínseca (UL-BR 22.4328X)

Ex ia IIC T6...T4 Ga  
Ui = 30V li = 110 mA Pi = 0.825 W Ci = 21,6 nF Li = 4uH  
T4 = -40 °C ≤ Ta ≤ +80 °C  
T5 = -40 °C ≤ Ta ≤ +60 °C  
T6 = -40 °C ≤ Ta ≤ +40 °C

Observações:

O número do certificado é finalizado pela letra "X" para indicar que o invólucro contém alumínio e é considerado um risco potencial de ignição por impacto ou fricção. Deve-se tomar cuidado durante a instalação e uso para evitar impacto ou fricção.

Normas Aplicáveis:



ABNT NBR IEC 60079-0:2020 Atmosferas explosivas - Parte 0: Equipamentos – Requisitos gerais

ABNT NBR IEC 60079-11:2013 Atmosferas explosivas - Parte 11: Proteção de equipamento por segurança intrínseca "i"

Desenhos 102A2203, 102A2204, 102A2205, 10A2206

## INMETRO CEPEL

## Prova de Explosão (CEPEL 06.1214X)

 <p>CEPEL 06.1214X</p> <p>Ex db IIC T* Ga/Gb</p> <p>Ex db eb mb IIC T* Ga/Gb</p> <p>IP66W/IP68W</p> <p>T<sub>amb</sub>: -20 °C a +85 °C para T5</p> <p>T<sub>amb</sub>: -20 °C a +70 °C para T6</p>	 <p>CEPEL 06.1214X</p> <p>Ex tb IIIC T* Da/Db</p> <p>IP66W/IP68W</p> <p>T<sub>amb</sub>: -20 °C a +85 °C para T100°C</p> <p>T<sub>amb</sub>: -20 °C a +70 °C para T85°C</p>
--	---

## Observações:

- 1) A validade deste Certificado de Conformidade está atrelada à realização das avaliações de manutenção e tratamento de possíveis não conformidades, de acordo com as orientações do Cepel, previstas no Regulamento de Avaliação da Conformidade. Para verificação da condição atualizada de regularidade deste Certificado de Conformidade deve ser consultado o banco de dados de produtos e serviços certificados do Inmetro.
- 2) O número do certificado é finalizado pela letra "X":
  - Indicar que durante a instalação do equipamento, é de responsabilidade do usuário, utilizar cabo e prensa-cabo adequado quando o equipamento for instalado em ambiente com temperatura maior do que 80°C.
- 3) A tampa do invólucro possui uma plaqueta de advertência com a seguinte inscrição: "ATENÇÃO - NÃO ABRA ENQUANTO ENERGIZADO", ou similar tecnicamente equivalente.
- 4) 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-FAB764-11) com tinta Resina Poliéster ou Resina Epóxi 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-765-07) com tinta Resina Epóxi ou Poliuretano Acrílico Alifático com espessura de camada de tinta de 290 µm a 405 µm e 90 µm a 200 µm, respectivamente.
- 5) Os planos de pintura P1 são permitidos apenas para equipamento fornecido com plaqueta de identificação com marcação para grupo de gás IIB.
- 6) 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-FAB277-08.
- 7) 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.
- 8) Este certificado é válido apenas para os produtos dos modelos avaliados. Qualquer modificação nos projetos, bem como a utilização de componentes ou materiais diferentes daqueles definidos pela documentação descritiva dos produtos, sem a prévia autorização do Cepel, invalidará este certificado.
- 9) É responsabilidade do fabricante assegurar que os produtos fornecidos ao mercado nacional estejam de acordo com as especificações e documentação descritiva avaliada, relacionadas neste certificado.
- 10) 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.
- 11) A marcação é executada conforme a Norma ABNT NBR IEC 60079-0:2020 e o Requisito de Avaliação da Conformidade de Equipamentos Elétricos para Atmosferas Explosivas nas Condições de Gases e Vapores Inflamáveis (RAC), e é fixada na superfície externa do equipamento, em local visível. Esta marcação é legível e durável, levando-se em conta possível corrosão química.

## Normas Aplicáveis:

ABNT NBR IEC 60079-0:2020 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 60079-7:2018 Atmosferas explosivas - Parte 7: Proteção de equipamentos por segurança aumentada "e"

ABNT NBR IEC 60079-18:2020 Atmosferas explosivas – Parte 18: Proteção de equipamento por encapsulamento "m"

ABNT NBR IEC 60079-26:2022 Atmosferas explosivas - Parte 26: Equipamentos com elementos de separação ou níveis de proteção combinados

ABNT NBR IEC 60079-31:2022 Atmosferas explosivas - Parte 31: Proteção de equipamentos contra ignição de poeira por invólucros "t"

ABNT NBR IEC 60529:2017 Graus de proteção providos por invólucros (Código IP)

Desenhos 102A1308, 102A1319, 102A1613, 102A1616, 102A2037, 102A2038, 102A2043, 102A2044

# Identification Plate

DNV

**smar** LD400 HART  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Pressure Transmitter**  
for Differential, Absolute, Gage and  
Differential for High Static Pressure Measurement

Ex II -/2G Ex db IIC T6 Gb DNV 22 ATEX 34311X IP  
Tamb= -20° to 60°C  
Ui= 28 VDC

LD400 - \*\*\* - X1\* - \*\*\*\*\* - \*\*\* - X2\*\* - X3X4D2\*/\*

0000000 - 0000 HART 0470

191601

**smar** LD400 HART SIS  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Pressure Transmitter**  
for Differential, Absolute, Gage and  
Differential for High Static Pressure Measurement

Ex II -/2G Ex db IIC T6 Gb DNV 22 ATEX 34311X IP  
Tamb= -20° to 60°C  
Ui= 28 VDC

LD400 - \*\*\* - X1\* - \*\*\*\*\* - \*\*\* - X2\*\* - X3X4D2\*/\*

0000000 - 0000 HART 0470

191701

**smar** LD400 HART  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Pressure Transmitter**  
for Level Measurement

Ex II -/2G Ex db IIC T6 Gb DNV 22 ATEX 34311X IP  
Tamb= -20° to 60°C  
Ui= 28 VDC

LD400 - \*\*\* - X1\* - \*\*\*\*\* - \*\*\* - X2\*\* - X3X4D2\*\*/\*

0000000 - 0000 HART 0470

191801

**smar** LD400 HART SIS  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Pressure Transmitter**  
for Level Measurement

Ex II -/2G Ex db IIC T6 Gb DNV 22 ATEX 34311X IP  
Tamb= -20° to 60°C  
Ui= 28 VDC

LD400 - \*\*\* - X1\* - \*\*\*\*\* - \*\*\* - X2\*\* - X3X4D2\*\*/\*

0000000 - 0000 HART 0470

191901

**smar** LD400 HART  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Pressure Transmitter**  
for Level with  
Extended Probe Measurement

Ex II -/2G Ex db IIC T6 Gb DNV 22 ATEX 34311X IP  
Tamb= -20° to 60°C  
Ui= 28 VDC

LD400 - \*\*\* - X1\* - \*\*\*\*\* - X2\* - X3X4D2\*

0000000 - 0000 HART 0470

192001

**smar** LD400 HART SIS  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Pressure Transmitter**  
for Level with  
Extended Probe Measurement

Ex II -/2G Ex db IIC T6 Gb DNV 22 ATEX 34311X IP  
Tamb= -20° to 60°C  
Ui= 28 VDC

LD400 - \*\*\* - X1\* - \*\*\*\*\* - X2\* - X3X4D2\*

0000000 - 0000 HART 0470

192101

**smar** LD400 HART  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Pressure Transmitter**  
for Sanitary Measurement

Ex II -/2G Ex db IIC T6 Gb DNV 22 ATEX 34311X IP  
Tamb= -20° to 60°C  
Ui= 28 VDC

LD400 - \*\*\*X1\* - \*\*\*\*\* - \*\* - \*\*\*\*\* - X2\* - X3X4D2/\*

0000000 - 0000 HART 0470

192201

**smar** LD400 HART SIS  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Pressure Transmitter**  
for Sanitary Measurement

Ex II -/2G Ex db IIC T6 Gb DNV 22 ATEX 34311X IP  
Tamb= -20° to 60°C  
Ui= 28 VDC

LD400 - \*\*\*X1\* - \*\*\*\*\* - \*\* - \*\*\*\*\* - X2\* - X3X4D2/\*

0000000 - 0000 HART 0470

192302

**smar**  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**LD400 HART**  
**Pressure Transmitter**  
for Gage Inline Measurement

Ex II -/2G Ex db IIC T6 Gb DNV 22 ATEX 34311X  
Tamb= -20° to 60°C  
Ui= 28 VDC

LD400 - \*\*\* - X1\* - \*\*\*\* - X2\*\* - X3X4D2\*

0000000 - 0000

**HART**

**CE** 0470

192401

**smar**  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**LD400 HART SIS**  
**Pressure Transmitter**  
for Gage Inline Measurement

Ex II -/2G Ex db IIC T6 Gb DNV 22 ATEX 34311X  
Tamb= -20° to 60°C  
Ui= 28 VDC

LD400 - \*\*\* - X1\* - \*\*\*\* - X2\*\* - X3X4D2\*

0000000 - 0000

**HART**

**CE** 0470

192501

## CEPEL

**smar**  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**LD400 HART**  
**Transmissor de Pressão**

Segurança Ex db IIC T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Ex db e mb IIC T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Tamb= -20°C a 85°C(T5) 70°C(T6)

IP66  
IP68  
10m/24h

0000000 - 0000

**HART**

**CE**

131904

**smar**  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**LD400 HART**  
**Transmissor de Pressão**

Segurança Ex db IIC T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Ex db e mb IIC T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Tamb= -20°C a 85°C(T5) 70°C(T6)

IP66W  
IP68W  
10m/24h

0000000 - 0000

**HART**

**CE**

130804

**smar**  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**LD400 HART**  
**Transmissor de Pressão**

Segurança Ex db IIB T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Ex db e mb IIB T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Tamb= -20°C a 85°C(T5) 70°C(T6)

IP66  
P1/P2  
Pintura  
IP68  
10m/24h

0000000 - 0000

**HART**

**CE**

203802

**smar**  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**LD400 HART**  
**Transmissor de Pressão**

Segurança Ex db IIB T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Ex db e mb IIB T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Tamb= -20°C a 85°C(T5) 70°C(T6)

IP66W  
P1/P2  
Pintura  
IP68W  
10m/24h

0000000 - 0000

**HART**

**CE**

203701

**smar**  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**LD400 HART SIS**  
**Transmissor de Pressão**

Segurança Ex db IIC T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Ex db e mb IIC T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Tamb= -20°C a 85°C(T5) 70°C(T6)

IP66  
IP68  
10m/24h

0000000 - 0000

**HART**

**CE**

161603

**smar**  
Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**LD400 HART SIS**  
**Transmissor de Pressão**

Segurança Ex db IIC T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Ex db e mb IIC T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Tamb= -20°C a 85°C(T5) 70°C(T6)

IP66W  
IP68W  
10m/24h

0000000 - 0000

**HART**

**CE**

161303



**smar** LD400 HART SIS  
Transmissor de Pressão

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Segurança**  
Ex db IIB T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Ex db e mb IIB T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Tamb= -20°C a 85°C(T5) 70°C(T6) IP66W P1/P2 Pintura  
IP68W 10m/24h

**Segurança**  
UL 0029 INMETRO

**TUV**  
SUD

0000000 - 0000

**HART**

**CE**

204302

**smar** LD400 HART SIS  
Transmissor de Pressão

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Segurança**  
Ex db IIB T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Ex db e mb IIB T5/T6 Ga/Gb CEPEL 06.1214 X ( )  
Tamb= -20°C a 85°C(T5) 70°C(T6) IP66 P1/P2 Pintura  
IP68 10m/24h

**Segurança**  
UL 0029 INMETRO

**TUV**  
SUD

0000000 - 0000

**HART**

**CE**

204402

## UL do Brasil / UL DEMKO

**smar** LD400 HART  
Transmissor de Pressão

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Segurança**  
II 1 G Ex ia IIC T6...T4 Ga UL-BR 22.4328X  
Ui= 30V li= 110mA Pi= 0.825W  
Ci= 21.6nF Li= 4uH  
T4= -40°C <= Ta <= +80°C  
T5= -40°C <= Ta <= +60°C  
T6= -40°C <= Ta <= +40°C

**Segurança**  
UL 0029 INMETRO

**TUV**  
SUD

0000000 - 0000

**HART**

**CE**

220300

**smar** LD400 HART  
Transmissor de Pressão

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Segurança**  
II 1 G Ex ia IIC T6...T4 Ga UL-BR 22.4328X  
Ui= 30V li= 110mA Pi= 0.825W  
Ci= 21.6nF Li= 4uH  
T4= -40°C <= Ta <= +80°C  
T5= -40°C <= Ta <= +60°C  
T6= -40°C <= Ta <= +40°C

**Segurança**  
UL 0029 INMETRO

**TUV**  
SUD

0000000 - 0000

**HART**

**CE**

220400

**smar** LD400 HART SIS  
Transmissor de Pressão

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Segurança**  
II 1 G Ex ia IIC T6...T4 Ga UL-BR 22.4328X  
Ui= 30V li= 110mA Pi= 0.825W  
Ci= 21.6nF Li= 4uH  
T4= -40°C <= Ta <= +80°C  
T5= -40°C <= Ta <= +60°C  
T6= -40°C <= Ta <= +40°C

**Segurança**  
UL 0029 INMETRO

**TUV**  
SUD

0000000 - 0000

**HART**

**CE**

220500

**smar** LD400 HART SIS  
Transmissor de Pressão

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Segurança**  
II 1 G Ex ia IIC T6...T4 Ga UL-BR 22.4328X  
Ui= 30V li= 110mA Pi= 0.825W  
Ci= 21.6nF Li= 4uH  
T4= -40°C <= Ta <= +80°C  
T5= -40°C <= Ta <= +60°C  
T6= -40°C <= Ta <= +40°C

**Segurança**  
UL 0029 INMETRO

**TUV**  
SUD

0000000 - 0000

**HART**

**CE**

220600

**smar** LD400 HART  
Pressure Transmitter

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Segurança**  
Ex ia IIC T6...T4 Ga IECEx ULBR 22.0003X  
Ui= 30V li= 110mA Pi= 0.825W  
Ci= 21.6nF Li= 4uH  
T4= -40°C <= Ta <= +80°C  
T5= -40°C <= Ta <= +60°C  
T6= -40°C <= Ta <= +40°C

**Segurança**  
UL 0029 INMETRO

**TUV**  
SUD

0000000 - 0000

**HART**

**CE**

220700

**smar** LD400 HART  
Pressure Transmitter

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr.  
1028 Sertãozinho-SP  
14170-480 Brazil

**Segurança**  
Ex ia IIC T6...T4 Ga IECEx ULBR 22.0003X  
Ui= 30V li= 110mA Pi= 0.825W  
Ci= 21.6nF Li= 4uH  
T4= -40°C <= Ta <= +80°C  
T5= -40°C <= Ta <= +60°C  
T6= -40°C <= Ta <= +40°C

**Segurança**  
UL 0029 INMETRO

**TUV**  
SUD

0000000 - 0000

**HART**

**CE**

220800

**smar** LD400 HART SIS Pressure Transmitter

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr  
1028 Sertãozinho-SP  
14170-480 Brazil

Ex ia IIC T6...T4 Ga IECEx ULBR 22.0003X  
Ui= 30V li= 110mA Pi= 0.825W  
Ci= 21.6nF Li= 4uH  
T4= -40°C ≤ Ta ≤ +80°C  
T5= -40°C ≤ Ta ≤ +60°C  
T6= -40°C ≤ Ta ≤ +40°C

IP 66 68

**WARNING:**  
DURING INSTALLATION TAKE ACTIONS TO PREVENT THE EQUIPMENT FROM MECHANICAL IMPACT OR FRICTION

0000000 - 0000

**HART**

**CE**

220900

**smar** LD400 HART SIS Pressure Transmitter

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr  
1028 Sertãozinho-SP  
14170-480 Brazil

Ex ia IIC T6...T4 Ga IECEx ULBR 22.0003X  
Ui= 30V li= 110mA Pi= 0.825W  
Ci= 21.6nF Li= 4uH  
T4= -40°C ≤ Ta ≤ +80°C  
T5= -40°C ≤ Ta ≤ +60°C  
T6= -40°C ≤ Ta ≤ +40°C

IP 66W 68W

**WARNING:**  
DURING INSTALLATION TAKE ACTIONS TO PREVENT THE EQUIPMENT FROM MECHANICAL IMPACT OR FRICTION

0000000 - 0000

**HART**

**CE**

221000

**smar** LD400 HART Pressure Transmitter

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr  
1028 Sertãozinho-SP  
14170-480 Brazil

CE 0539 Ex II 1 G Ex ia IIC T6...T4 Ga UL 22 ATEX 2648X  
Ui= 30V li= 110mA Pi= 0.825W  
Ci= 21.6nF Li= 4uH  
T4= -40°C ≤ Ta ≤ +80°C  
T5= -40°C ≤ Ta ≤ +60°C  
T6= -40°C ≤ Ta ≤ +40°C

IP 66 68

**WARNING:**  
DURING INSTALLATION TAKE ACTIONS TO PREVENT THE EQUIPMENT FROM MECHANICAL IMPACT OR FRICTION

0000000 - 0000

**HART**

221100

**smar** LD400 HART Pressure Transmitter

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr  
1028 Sertãozinho-SP  
14170-480 Brazil

CE 0539 Ex II 1 G Ex ia IIC T6...T4 Ga UL 22 ATEX 2648X  
Ui= 30V li= 110mA Pi= 0.825W  
Ci= 21.6nF Li= 4uH  
T4= -40°C ≤ Ta ≤ +80°C  
T5= -40°C ≤ Ta ≤ +60°C  
T6= -40°C ≤ Ta ≤ +40°C

IP 66W 68W

**WARNING:**  
DURING INSTALLATION TAKE ACTIONS TO PREVENT THE EQUIPMENT FROM MECHANICAL IMPACT OR FRICTION

0000000 - 0000

**HART**

221200

**smar** LD400 HART SIS Pressure Transmitter

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr  
1028 Sertãozinho-SP  
14170-480 Brazil

CE 0539 Ex II 1 G Ex ia IIC T6...T4 Ga UL 22 ATEX 2648X  
Ui= 30V li= 110mA Pi= 0.825W  
Ci= 21.6nF Li= 4uH  
T4= -40°C ≤ Ta ≤ +80°C  
T5= -40°C ≤ Ta ≤ +60°C  
T6= -40°C ≤ Ta ≤ +40°C

IP 66 68

**WARNING:**  
DURING INSTALLATION TAKE ACTIONS TO PREVENT THE EQUIPMENT FROM MECHANICAL IMPACT OR FRICTION

0000000 - 0000

**HART**

221300

**smar** LD400 HART SIS Pressure Transmitter

Nova Smar S/A  
Av. Dr. Antônio Furlan Jr  
1028 Sertãozinho-SP  
14170-480 Brazil

CE 0539 Ex II 1 G Ex ia IIC T6...T4 Ga UL 22 ATEX 2648X  
Ui= 30V li= 110mA Pi= 0.825W  
Ci= 21.6nF Li= 4uH  
T4= -40°C ≤ Ta ≤ +80°C  
T5= -40°C ≤ Ta ≤ +60°C  
T6= -40°C ≤ Ta ≤ +40°C

IP 66W 68W


**WARNING:**  
DURING INSTALLATION TAKE ACTIONS TO PREVENT THE EQUIPMENT FROM MECHANICAL IMPACT OR FRICTION

0000000 - 0000

**HART**

221400

# Appendix B

		<b>SRF – Service Request Form Pressure Transmitters</b>				<b>Proposal No.:</b>	
<b>Company:</b>				<b>Unit:</b>		<b>Invoice:</b>	
<b>COMMERCIAL CONTACT</b>				<b>TECHNICAL CONTACT</b>			
<b>Full Name:</b>				<b>Full Name:</b>			
<b>Function:</b>				<b>Function:</b>			
<b>Phone:</b>		<b>Extension:</b>		<b>Phone:</b>		<b>Extension:</b>	
<b>Fax:</b>				<b>Fax:</b>			
<b>Email:</b>				<b>Email:</b>			
<b>EQUIPMENT DATA</b>							
<b>Model:</b>				<b>Serial Number:</b>		<b>Sensor Number:</b>	
<b>Technology: ( ) HART® ( ) FOUNDATION fieldbus™ ( ) PROFIBUS PA</b>						<b>Firmware Version</b>	
<b>PROCESS DATA</b>							
<b>Process Fluid:</b>							
<b>Calibration Range</b>		<b>Ambient Temperature ( °F )</b>		<b>Process Temperature ( °F )</b>		<b>Process Pressure</b>	
<b>Min.:</b>	<b>Max.:</b>	<b>Min.:</b>	<b>Max.:</b>	<b>Min.:</b>	<b>Max.:</b>	<b>Min.:</b>	<b>Max.:</b>
<b>Static Pressure</b>		<b>Vacuum</b>					
<b>Min.:</b>	<b>Max.:</b>	<b>Min.:</b>	<b>Max.:</b>				
<b>Normal Operation Time:</b>				<b>Failure Date:</b>			
<b>FAILURE DESCRIPTION</b>							
Please, describe the failure. Can the error be reproduced? Is it repetitive?							
<b>OBSERVATIONS</b>							
<b>USER INFORMATION</b>							
<b>Company:</b> <b>Contact:</b> <span style="float: right;"><b>Title:</b> <span style="float: right;"><b>Section:</b></span></span> <b>Phone:</b> <span style="float: right;"><b>Extension:</b> <span style="float: right;"><b>E-mail:</b></span></span> <b>Date:</b> <span style="float: right;"><b>Signature:</b></span>							
<b>For warranty or non-warranty repair, please contact your representative.</b> <b>Further information about address and contacts can be found on <a href="https://www.smar.com/en/contact-us">https://www.smar.com/en/contact-us</a>.</b>							

