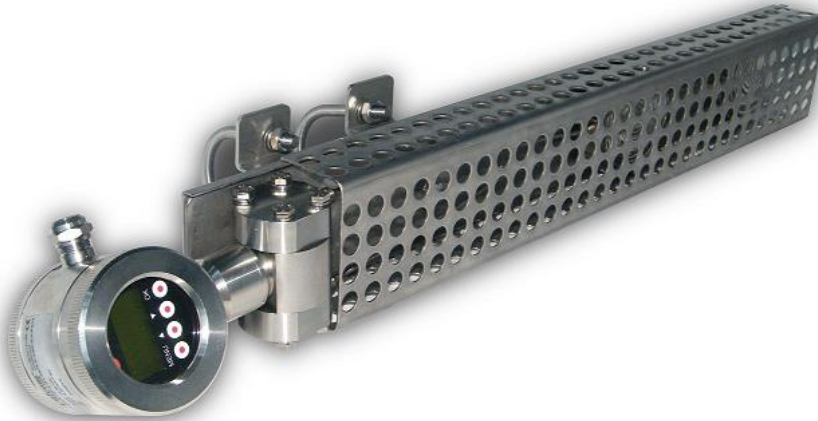


T7S SERIES

SMART ELECTRONIC DENSITY TRANSMITTER



DESCRIPTION

T7S series are Smart electronic transmitters with 4 ÷ 20 mA output and HART® digital communication protocol.

Sensors are always calibrated individually together with their own seal.

These transmitters allow the measurement of specific gravity of fluids as liquids or cement slurry.

The instrument gives the specific gravity value of the product by measuring the static differential pressure between the two seals (Δp) and applying the formula $p = \Delta p / d$ where "p" is the specific gravity, " Δp " is the differential pressure and "d" is the distance between the two seals.

Configurations and adjustments can be made locally by means of push buttons and display or remotely using HART® protocol compatible communicators.

A bracket for wall or for 2" stand pipe mounting is also supplied.

APPLICATIONS

- Suitable for Oil & Gas, Chemical, Petrochemical, Pharma, Water, Food and Marine Industries
- Measure of density in storage tanks
- Measure of density with remote digital display visualization
- Measure of density in open tanks

SPECIAL FEATURES

- Ex protection per ATEX.
- For SIL 2 applications
- Seals assembled, filled and calibrated in house
- Wetted parts in special materials (HC-276, Inconel, Titanium)
- Full construction in SS AISI 316

APPROVALS



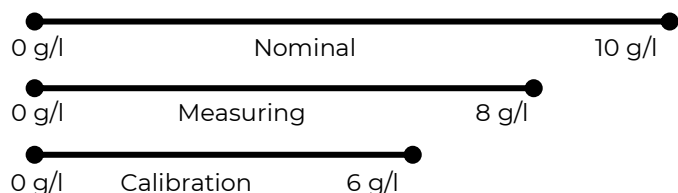


DEFINITIONS

Nominal Range: the density range, defined by a minimum value and a maximum value, for which the sensor mounted within the instrument has been designed. (Ex. 0/10 g/l)

Measuring Range: the density range, defined by a minimum value and a maximum value, within which the transmitter can be calibrated. The Measuring Range values must be within the Nominal Range values. (Ex. 0/8 g/l) Limits of the Measuring Range are fixed and cannot be configured by the User.

Calibration Range: the density range, defined by a minimum value and a maximum value, at which the instrument is actually calibrated. The Calibration Range values must be within the Measuring Range values. (Ex. 0/6 g/l). The Calibration Range can always be configured by the User within the Measuring Range values.



ELECTRICAL PARAMETERS

Supply: 12.5 ÷ 30 Vdc

Output signal: 4 ÷ 20 mA + Hart®, 2 wires

Alarm values: 3.85 mA \ 21 mA

Response time (63% FS): < 256 ms (Standard Hart®)

Measured value update frequency:

4 ÷ 20 mA + Hart®: ≈ 1 s

Hart® output only: ≈ 500 ms (On request)

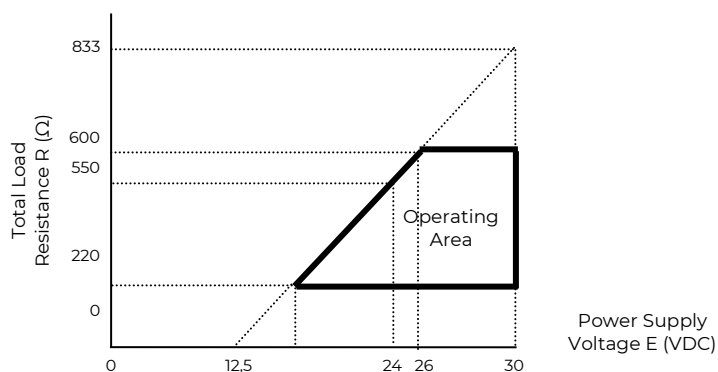
Polling time:

4 ÷ 20 mA + Hart®: ≈ 800 ms

Hart® output only: ≈ 500 ms (On request)

Load resistance: 220 Ω < RL < 600 Ω (Hart®)

The total load resistance includes both the line resistance of the connection cable and the load resistance of the reading or receiving units



MEASUREMENT PERFORMANCE

Total accuracy (*):

± 2 g/l for span of 1000 g/l

Sensitivity: ± 0.1 g/l

Long term stability: ± 0.1 % FS / year

Dead band: negligible

Power supply effect: negligible between 12.5 and 30 Vdc

Allowable de-range: Down to 30 times the Nominal Range

Damping: 0 ÷ 60 sec

(*) Including hysteresis, non-linearity and non-repeatability (IEC 60770)

Standard temperature compensation is carried out within the range 0/50°C; in case other compensation ranges are required, this shall be clearly specified.

ENVIRONMENTAL CONDITIONS

Ambient Temperature: -40 ÷ +85°C

Process fluid Temperature: -10 ÷ +130°C

Fluid density: 0.5 ÷ 5 kg / dm³

Maximum working pressure: 10 bar

Storage Temperature: -40 ÷ +90°C

Relative Humidity: 0 ÷ 99% R.H. (not condensating)

LCD Display reading: -20 ÷ +75°C

PARAMETER SETTINGS

LRV Setting of Lower Range Value (must be within the Measuring Range and lower than URV)

URV Setting of Upper Range Value (must be within the Measuring Range and higher than LRV)

PV UNIT: Setting the Process Variable measuring unit among 4 different density units, mA or % of the Measuring Range

TEMP UNIT: Setting the Temperature Variable measuring unit among 3 different temperature units

XFR FUNC: Transfer is set as linear

ALARM TYPE: according to NAMUR NE43:

- **Working Zone (WZ)** is between 3.9 < WZ < 20.5 and the display shows the value of measured current.

Status	Display Indication	Range [mA]
WZ	[current value]	3.9 < WZ < 20.5

- **Limit Zone (LZ)** between 3.85 < LZ < 3.9 mA and 20.5 < LZ < 21.0 mA. In this case the display blinks the value of measured current;

Status	Display Indication	Lower Range [mA]	Upper Range [mA]
LZ	[Blinking current value]	3.85 < LZ < 3.9	20.5 < LZ < 21.0



Alarm Zone (AZ) is between $3.85 < AZ < 21$. The transmitter failure method and relevant output current depends on the configuration type, and can be set in 4 different ways as per below table.

Status	Display Configuration	Display Indication
AZ	[NONE]	Random current value
	[21]	AZ = 21 (default configuration)
	[3.85]	AZ = 3.85
	[LAST]	Output to Last read current Value before breakdown

DAMP VALUE: damping digitally adjustable from 0 to 60 sec. (minimum response time ~ 0,1 sec.)

SET LRV: Fixes the current value to 4 mA (without changing the displayed value)

SET URV: Fixes the current value to 20 mA (without changing the displayed value)

LOOP TEST: Simulates the current output at a selectable fixed value

CAL 4-20mA: Calibration of the Analog output 4-20mA

ADDRESS: setting of the HART polling address

INFO: scrolling of general transmitters' info (Polling, LSL, USL e Firmware Revision)

PASSWORD: setting of a protection password

SET S.URV: Fixes the current value to 20 mA and the variable value to URV

SPAN URV: Allows the manual entering of linear correction for URV value

OFFSET: Allows Zero Re-setting

ZERO ELEVATION: allow the manual entering of zero correction

GAP C.(m): shows the distance between top and bottom diaphragm

RESTORE: Factory settings restore

PHYSICAL SPECIFICATIONS

Housing:

- Die cast aluminum alloy EN AB-44100 finished with epoxy resin (RAL 5014). It is dust and sand tight and protected against sea wave effects as defined by IEC IP66. Suitable for tropical climate operation as defined by DIN 50015.
- SS AISI 316 defined by IEC IP67.

Covers O-ring: EPDM.

Filling fluid:

- Standard silicone oil
- Inert oil

Helium Test: All welded & filled diaphragm are 100% Helium tested in house in accordance with ASME V, Article 10, Mandatory Appendix V "Helium Mass Spectrometer Test"

Nameplate: Stainless Steel, firmly fixed or engraved on housing.

Calibration:

- **Standard:** at nominal range, direct action, linear.
- **Optional:** at the conditions specified within the purchase order.

Electrical connections: two cable entries on electronic housing: M20 x 1.5 and cable gland PG 13.5 for 7 to 12 mm diameter cable as a standard.

Terminal board: 2 terminals for signal wiring up to 1.5 mm² (14 AWG). Connection for ground and cable shield.

Mounting position: any position.

Net weight: 4 kg approx.

PROCESS WETTED PARTS

Different combinations between diaphragm and wetted parts can be achieved, to reach the best compliance with the process application:

- **Wetted parts** in AISI 316 / 316L and **Diaphragm material** in SS AISI 316/316L, Hastelloy C 276 or Tantalum;
- **Wetted parts** and **Diaphragm material** in Hastelloy C276;
- **Wetted parts** and **Diaphragm material** in Titanium;

Other wetted parts (SS AISI 321, Duplex, Super Duplex, Monel, Inconel 625...) can be provided on request, depending on the Diaphragm seal.

OPTIONS

- Bracket for 2 inch pipe mounting;
- Others on request

EXTRA CERTIFICATES

- Material Test Certificates as per UNI EN 10204, 3.1;
- Material Test Certificates as per UNI EN 10204, 3.2 by ISO 17025 Third Party Laboratory;
- Wetted parts in compliance with NACE MR0175 / ISO 15156 and MR0103 / ISO 17945;
- Wetted parts testes with ASTM A262 Pr. E or ASTM G28 (Intergranular Corrosion Test);
- Special materials (Nickel based alloys and SDSS) tested with ASTM G48 (Pitting);
- HIC Test as per NACE TM0284;
- SSC Test as per NACE TM0177;
- PMI Standard;
- PMI with Carbon content examination (For SS AISI 316 / 316L only);



APPROVALS

Directive 2014/34/EU (ATEX)

- II 1G Ex ia IIC T6, T5 Ga
- II 1/2G Ex ia IIC T6, T5 Ga/Gb

Power supply parameters:

If $T_a < 60^\circ\text{C}$

$U_i = 30\text{V}$, $I_i = 100\text{mA}$; $P_i = 0.75\text{W}$; $C_i = 10\text{nF}$; $L_i \approx 0\text{ mH}$

If $60 < T_a < 75^\circ\text{C}$

$U_i = 25.2\text{V}$, $I_i = 100\text{mA}$; $P_i = 0.62\text{W}$; $C_i = 10\text{nF}$; $L_i \approx 0\text{ mH}$

The transmitter must be supplied with associated apparatus certified according to EN 60079-0 and EN 60679-11 with the electrical characteristics described

Directive 2014/68/EU (PED)

Up to Category II, for fluids in Group 1

Directive 2014/30/EU (EMC)

Adequate level of electromagnetic compatibility

Directive EN 50581 (RoHS)

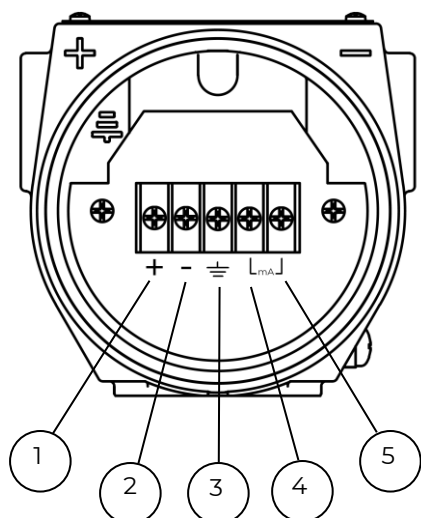
In compliance

Functional Safety (IEC 61508:2010)

λ_{DD}	λ_{DU}	λ_S	λ_{TOT}	SFF
1,7053E-07	5,2470E-08	3,1482E-07	5,3782E-07	94,83%

- Level SIL 2 capable for single transmitter use
- Level SIL 3 capable for dual transmitter use.

TERMINAL CONFIGURATION

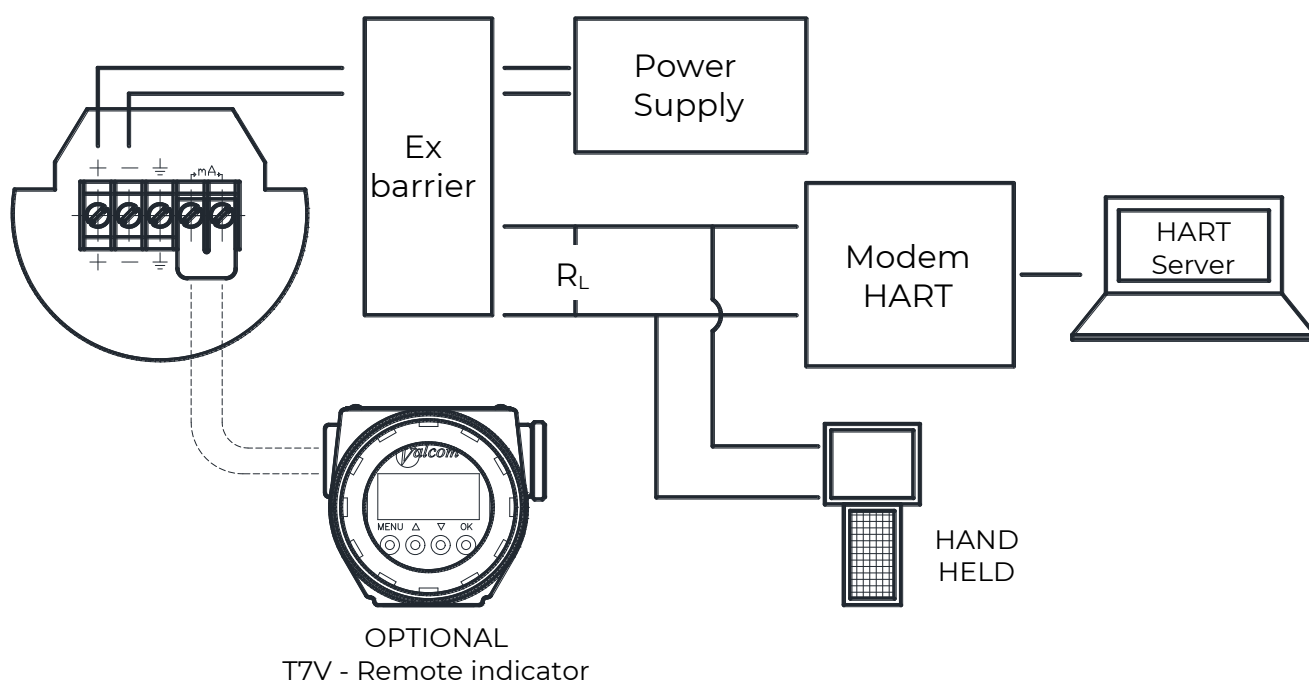


TERMINAL WIRING

	TERMINALS	SCOPE
SUPPLY & OUTPUT	1 (+) 2 (-)	Power supply and 4-20mA + HART Output Signal
GROUNDING	3	Ground Terminal
OPTIONAL REMOTE INDICATOR	4 5	Remote Indicator Loop Connection (no polarity)

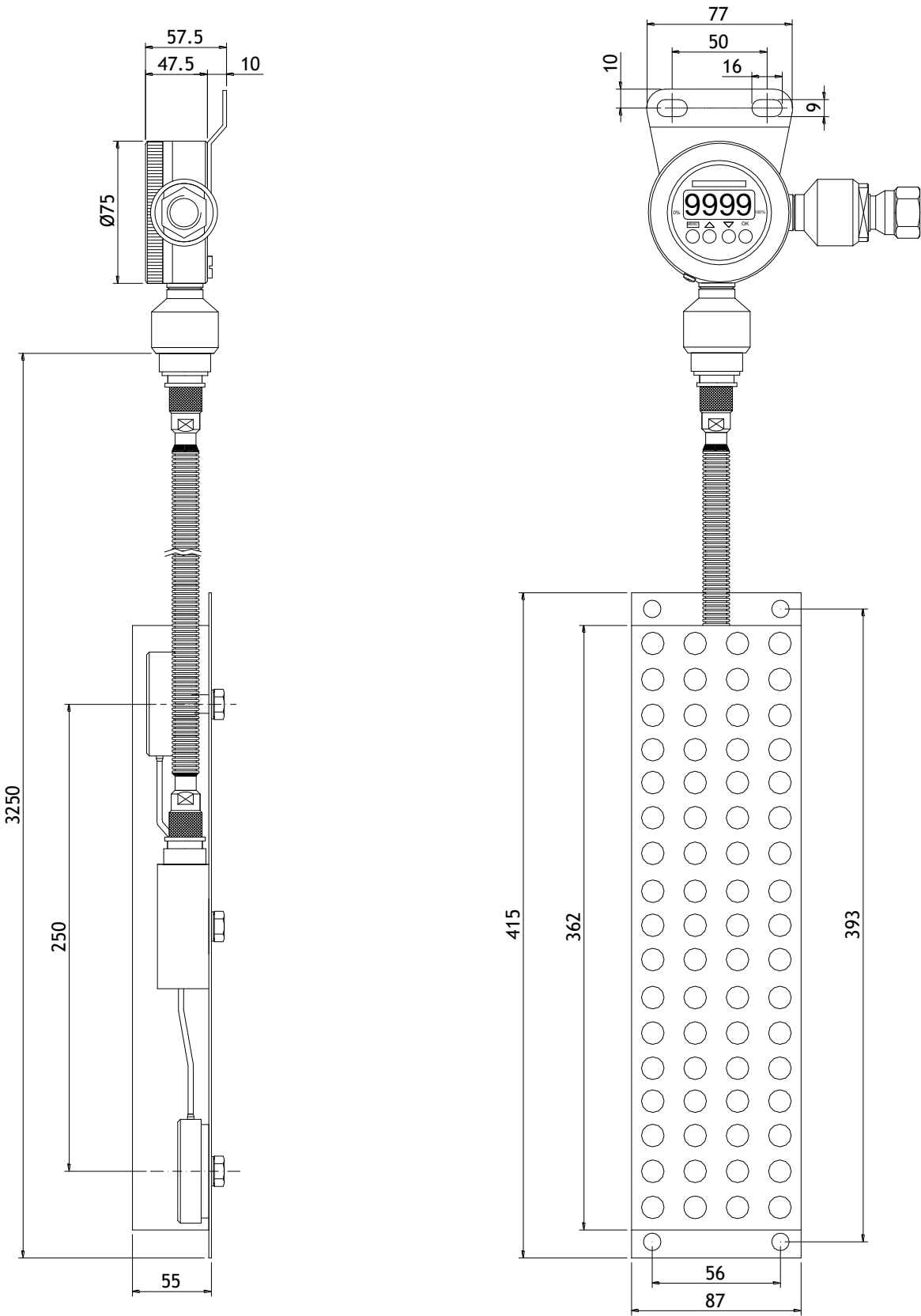
- When Remote Indicator is not connected to the instrument, Terminals 4 and 5 **must be short-circuited** (default configuration)
- When connecting Remote Indicator or check meter to Terminals 4 and 5, the internal resistance must be $10\ \Omega$ or less.

WIRING EXAMPLE





DIMENSIONAL DRAWINGS





CODIFICATION

00 SERIES

T7S	Electronic Smart specific gravity transmitter
-----	---

01 TYPE OF MEASURE

G	Density
---	---------

02 SENSOR TYPE

PR	Piezoresistive Remote
----	-----------------------

03 MEASURING RANGE

C01	0...250 gr/lt
C02	0...600 gr/lt
C03	0...1600 gr/lt
C04	0...3000 gr/lt
Z99	Special

04 FILLING OIL

8	Standard siliconic Oil -40/+200°C
9	Oil for food use -10/+220°C
Z	Special

05 PROCESS TEMPERATURE LIMITS

B	Standard -40 ÷ 85°C
Z	Special

06 HOUSING MATERIAL AND TYPE

A16	SS AISI 316
D04	Aluminum housing

07 PROCESS CONNECTION

F52	Flange DN 100 PN 16
F61	Flange DN 150 PN 6 / 10
Z31	Cage with holes L = 1200 mm w fixing bracket
Z32	Cage with holes L = 2420 mm w fixing bracket
Z33	Cage with holes L = 415 mm w fixing bracket Ø 8.5
Z99	Speciale / Special

08 EXTENSION LENGHT

XA1	Sonda-flex DN 16 5/8" AISI 316 OVP 25 < 1 m
XA2	Sonda-flex DN 16 5/8" AISI 316 OVP 25 < 2 m
XA3	Sonda-flex DN 16 5/8" AISI 316 OVP 25 < 3 m
XA4	Sonda-flex DN 16 5/8" AISI 316 OVP 25 < 4 m
XA5	Sonda-flex DN 16 5/8" AISI 316 OVP 25 < 5 m
N00	No extension

09 DIAPHRAGM MATERIAL

A	SS AISI 316L
K	Hastelloy C
Z	Special



10 PROCESS GASKET MATERIAL

T	All welded
---	------------

11 OTHER WETTED PARTS MATERIAL

A	SS AISI 316
N	Hastelloy C
Z	Special



12 ELECTRICAL CONNECTION

19	AISI 316 Cable Gland PG9 IP67 cable \varnothing 5 ÷ 7 mm
20	AISI 316 Cable Gland PG13 IP67 for cable \varnothing 8 ÷ 12 mm
36	Nipple AISI 316 1/2" G-F
37	Nipple AISI 316 1/2" NPT-F
39	Nipple AISI 316 M20 x 1.5 F
81	Screwed M20 x 1.5

13 ELECTRICAL OUTPUT

R	4 ÷ 20 mA + HART With LCD and blind cover
S	4 ÷ 20 mA + HART With LCD and transparent cover

14 EX TYPE APPROVAL

A2	ATEX  II 1G Ex ia IIC T6, T5 Ga
A5	ATEX  II 1/2G Ex ia IIC T6, T5 Ga/Gb
NN	None

15 OPTIONS AND ACCESSORIES

01	Test and material report according to EN 10204
10	Calibration report on 5 points
21	SIL Certificate
22	PED Certificate
S5	2" Pipe Mounting bracket
NN	No options

TERRANOVA®

WE DO PROCESS INSTRUMENTATION PRECISELY



SPRIANO®



Valcom®



MEC-RELA®

HQ: Via Rosso Medardo, 16 - 20159 Milano IT

Factory: Via A. Gramsci, 1 - 26827 Terranova dei Passerini (LO) - IT

ph: +39 0377 911066

fax: +39 0377 919156

www.terranova-instruments.com

