TP300 Series

290 - 301 - 302 - 303

SMART TRANSMITTER FOR POSITION MEASUREMENT

TO MEASURE LINEAR OR ROTARY DISPLACEMENT OR MOVEMENT

- Available for 4 to 20 mA, HART®, FOUNDATION™ fieldbus and PROFIBUS PA communication protocols

- Position measurement without mechanical contact

- Position measurement carried out through a Hall Effect magnetic sensor

- Available for remote mounting position sensor

- Applications in high vibrations, high temperatures and hard-access locations

- Easy to assembly

- Local adjustment without need to open the transmitter housing

- For linear and Rotary applications

- Rotary display facilitates reading in any position

- Supports DD and EDDL formats for FDT/DTM applications

- Protection against reverse polarity

- Explosion-proof and intrinsically safe (ATEX (NEMKO and DEKRA EXAM), FM, CEPEL and CSA)

- Designed to comply with European regulations ATEX 94/9/EC, LVD 2006/95/EC and EMC 2004/108/EC standards

CE

CEPEL OCP-0007

CSA

Ex

EXAM
BBG Prüf- und Zertifizier GmbH

FM APPROVED

N

Fieldbus Foundation

HART COMMUNICATION PROTOCOL

PROFIBUS

FDI

EDDL ELECTRONIC DEVICE DESCRIPTION LANGUAGE

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The **TP300** is a member of the renowned family of Smar equipment available in HART® 4 to 20 mA, FOUNDATION™ fieldbus and PROFIBUS PA.

This product line presents the TP290 version, also with digital technology and a 4 - 20 mA output signal.

The **TP300** is a smart transmitter for position measurement, suitable for linear or rotary displacement or movement. Its digital technology and communication provides a friendly interface between the field and the control room, presenting features that considerably reduce installation, operation and maintenance costs.

The **TP300** uses a magnetic coupler without physical contact for position measurement. For this reason it is immune to vibration effects and provides longer operational durability. The magnetic coupler replaces the mechanical connection a significant dead band reduction and preventing inaccurate results from wearing out by use. The **TP300** may be installed in any equipment with linear or rotary motion and a variety of other devices such as skylights, dampers, rollers spacing, crushers, etc.

The **TP300** also offers other advantageous functions in comparison to other position transmitters as:

- Linear movement range from 3 mm through 100 mm: for longer courses, consult our BFY-CL Series catalog;

- Rotary movement range from 0° to 30º until 0° to 120º;

- Local or remote configuration through HART® 4 to 20 mA, FOUNDATION™ fieldbus and PROFIBUS PA protocols;

- Multifunctional, easy to use, local rotary display;

- Easy to install, fast commissioning and adjustment;

- Configuration protection by password;

- Protection against reverse polarity;

- Hall-Effect contactless position sensor that measures the device movement;

- Remote sensor version available with extension cable for applications with difficult access or involving high vibration and high temperature.
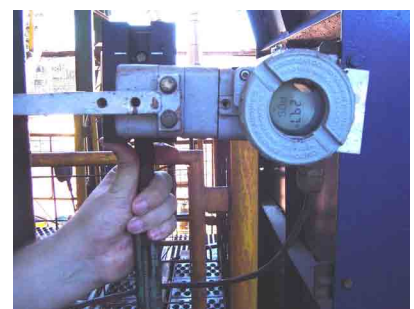
HART® - 4 to 20 mA

- Connectivity through:

  CONF 401 configuration interface;

  Palm HPC301 and HPC401 configurator;

  Remote parameterization;

  Local adjustment without need to open the equipment housing;

  FDT/DTM standard applicatives (Field Device Tool/Device Type Manager);

  Asset Management applicatives (AssetView).

- Supports DTM and EDD;

- Multidrop operation mode.

FOUNDATION™ fieldbus

- Fieldbus communication from PC or via local switch;

- Local configuration with magnetic tool, without need to open the housing or configurator HPC401;

- 12 mA consumption current;

- Dynamic block instantiation;
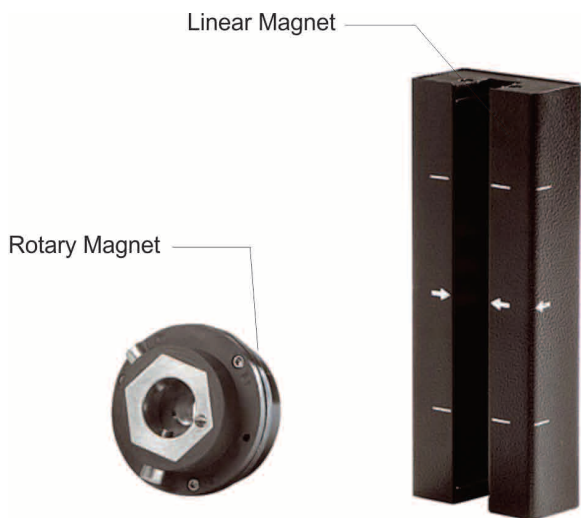
- 11 functional blocks.

PROFIBUS PA

- Connectivity through:

  Basic configuration with magnetic tool;

  Complete configuration carried out with a remote configurator (Ex: Smar ProfibusView).

- Functional blocks for analog output and valve diagnostics;

- 12 mA current consumption;

- Supports DTM and EDDL.

Product Highlights

Rotary magnet for 30° to 120° movement and linear magnet for 3 to 100 mm stroke.
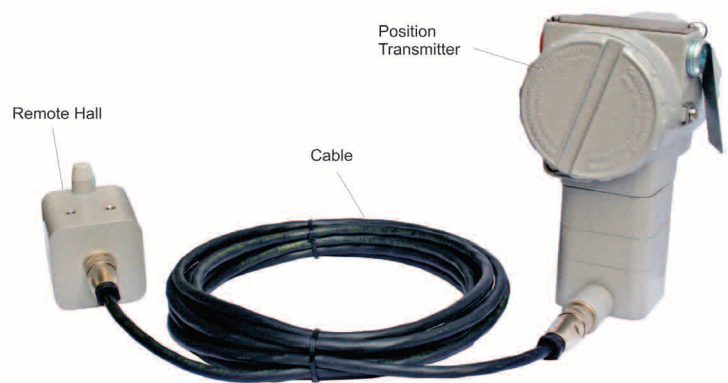
Position transmitter: local contactless Position Sensor, or remote contactless Position Sensor.

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The Remote Sensor Position is a recommended accessory for high temperatures applications (up to 105 ºC), for excessive vibration or even difficult local access. It avoids equipment excessive wear and, consequently, increases the equipment lifetime.

The cable supplied by Smar is shielded and provides excellent protection against electromagnetic interferences.
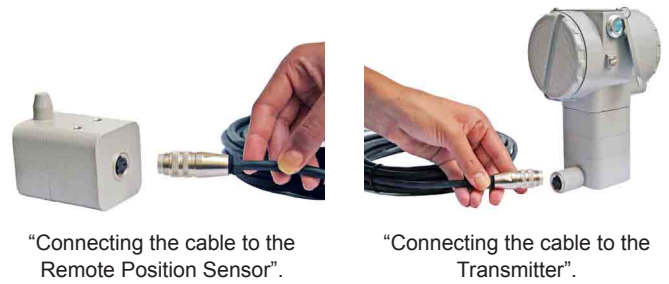
"Connecting the cable to the Remote Position Sensor".

"Connecting the cable to the Transmitter".

Remote Position Sensor

Services and Support
SMAR offers customers first-class technical support and services with a highly specialized, experienced team. We guarantee the maintenance of your system by supplying quality spare parts and services rapidly, in all stages of the project and plant maintenance.

Online Support
We provide information and technical support via the Internet at http://www.smar.com/liveperson.asp, where customers can find detailed information about SMAR products and services. Registered users may submit technical questions and visit the Most Frequent Asked Questions section. Responses are quick, usually in less than 24 hours, via chat, e-mail or telephone (except on weekends and holidays). Our support team is made up of qualified engineers and technicians who provide basic consultation and assistance for initial configurations and engineering.

Functional Description

Hall Effect Position Sensor
The magnet measure according to the motion of the device. The Hall sensor circuit detects the voltage variation and generates a small voltage proportional to the variation of the magnetic field.

The Hall sensor circuit processes the voltage variation and generates a signal to the A/D converter. The converter emits a set of signals the transmitter CPU.

Hart® Modem
Modulates and demodulates the line communication signal. The "1" represents 1200 Hz and the "0" represents 2200 Hz, as specified by the standard. The frequency signal is symmetrical and does not affect the 4-20 mA output DC current level.

Fieldbus Modem
Monitors the activity on line, modulates and demodulates the communication signals; inserts and deletes, limits the beginning and the end and verifies the integrity of the received frame.
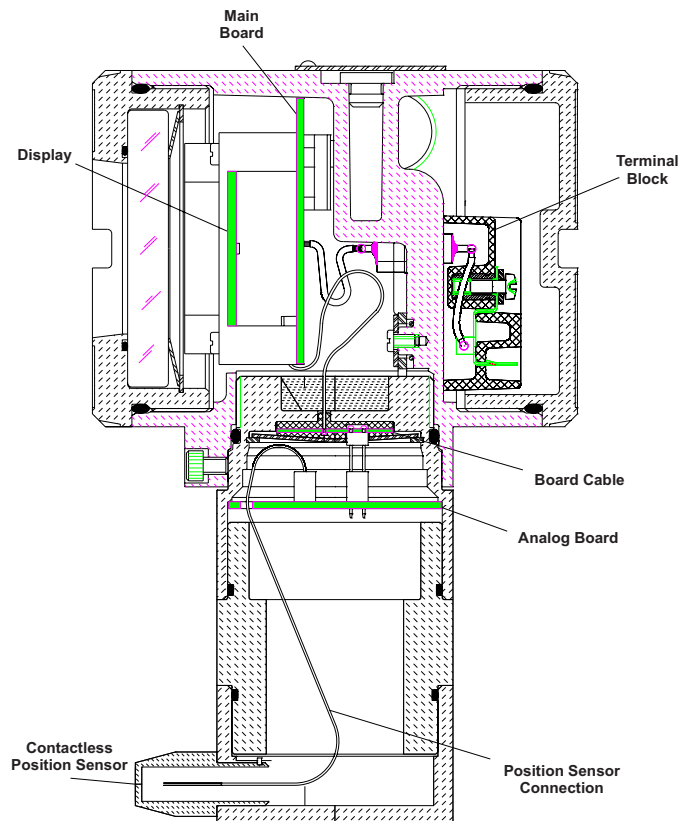
CPU, RAM, PROM and EEPROM
The CPU is the intelligent part of the position transmitter, one that is responsible for the management, operation, control and self-diagnostics. The program is stored in the PROM. For temporary storage of data the CPU has an internal RAM. The CPU has a non-volatile internal memory (EEPROM) where configuration data are stored, such as TP301 calibration and configuration.

Display Controller
Receives data from the CPU and controls the LCD display.

Schematic Section of the TP300

Main Board

Display

Terminal Block

Board Cable

Analog Board

Contactless Position Sensor

Position Sensor Connection

Local Adjustment
Through two switches activated by the magnetic tool without opening the equipment.

The **TP300** may be mounted on any linear or rotary valve, actuator or a variety of other equipment, such as skylights, dampers, rollers spacing, crushers, etc.

The Position Transmitter mounting depends on the type of movement it is applied, be it linear or rotary.

By using the mounting bracket supplied by Smar, it is easy to install the position transmitter in a wide variety of devices.

Mounting brackets for linear or rotary courses or remote sensor applications have an "L" shaped profile for fixing on a 2" pipe.

To measure linear movement beyond 100 mm linear stroke, use the **BFY-CL** (http://www.smar.com).

TP300 Packing

Transmitter Models

Linear
Local or remote configuration, from 3 mm to 100 mm of linear stroke. To increase the measurement up to 1000 mm linear stroke, use the **BFY-CL** (http://www.smar.com).

Rotary
Local or remote configuration from 30° to 120°.

Contactless Local Position Sensor
Standard Position Sensor.

Contactless Remote Position Sensor
Best indicated for high temperature and vibration applications. Also adequate for difficult access locations. Available in 5 m to 20 m cable lengths.

Output
Reverse Output or Direct Action.

TP300 - Remote Sensor

TP300 - Integrated Sensor

Diagnostics and Parameterization

The **TP300** series is available in the **HART**®, **Foundation™ fieldbus** and **PROFIBUS PA** Technologies. These devices can be configured with the Smar software configuration tools, and those from other manufacturers. Local adjustment is available on the **TP300** series. The magnetic tool is used to locally configure the control parameters and several functions.

Additionally, Smar developed the AssetView application, a web tool with friendly interface that may be accessed at any time and place with an Internet navigator.

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HART® TP301

TP301 (HART® protocol) can be configured by:

- Smar CONF401 for Windows;
- Smar DDCON 100 for Windows;
- Smar HPC301 and HPC401 for several models of Palm™;
- Other manufacturers' configuration tools based on DD (Device Description) or FDT/DTM (Device Type Manager), such as AMS™, Simatic PDM, FieldCare™, PACTware™, HHT275 and HHT375, PRM Device Viewer.


Foundation™ fieldbus TP302

The TP302 uses the H1 communication protocol, the open technology that makes possible for any enabled H1 tool to configure this equipment.

The System Configurator Tool is a software used to configure, operate and provide maintenance for the field equipment. The Syscon offers efficient and friendly interaction with the users that operate the Windows.

Configuration tools like AMS™, FieldCare™, HHT375 e HHT475 can configure the TP302. DD (Device Description) and CF (Capability File) files may be downloaded from the Smar site or Fieldbus Foundation™ site.

The TP302 supports complex configuration strategies due to its high capacity and variety of the instantiable functional blocks.

Eleven functional block types are available. The fieldbus technology enables the AssetView application to access status and diagnostics information. Therefore, the maintenance
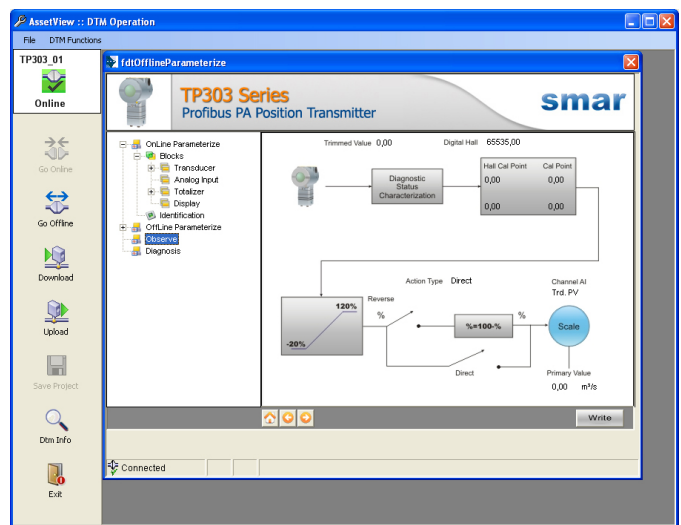procedures become more efficient, providing more safety and plant availability.
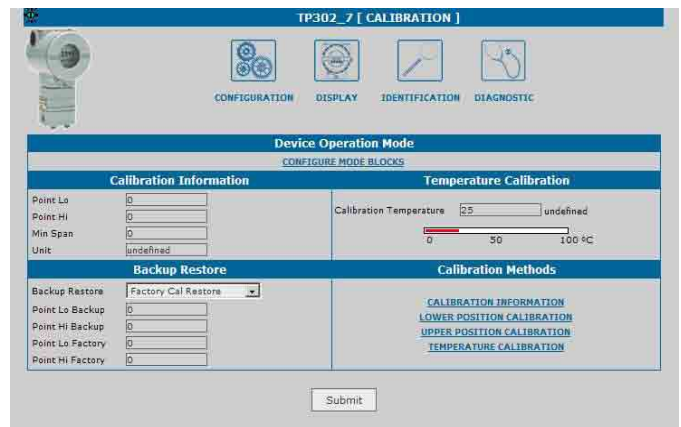
PROFIBUS PA TP303

These devices can be configured by the Smar ProfibusView or the Siemens Simatic PDM.

TheTP303 was designed to use the PROFIBUS PA protocol and it is configured using the Simatic PDM or the FDT (Field Device Tool) and DTM (Device Type Manager) tools concept , such as FieldCare™ e PACTware™. It can also be configured by any PROFIBUS system that uses de GSD files.

The PROFIBUS PA also provides information on quality and diagnostics to improve the plant management and maintenance.

The EDDL (Electronica Device Description Language) and DTM files are available on the Smar site at the Internet.

HART® - TP301

Power Supply

250 Ω

Interface HI

system 302
automação empresarial

DCS, computer with CONF401 or DDCON100

Field Control Panel

4-20 mA

4-20 mA

4-20 mA

4-20 mA

TP301

TP301

TP301

FOUNDATION™ fieldbus - TP302

BT302
Bus Terminator

LD302
PT

TP302

LD302
FT

Power Supply
+ Bus Impedance

DF52 DF53

LD302
LT

system 302
automação empresarial

DF50 DF62

HSE
Link Device

BT302
Bus Terminator

PROFIBUS PA - TP303

BT302
Bus Terminator

LD303
PT

TP303

LD303
FT

Power Supply

DF52

BT302
Bus Terminator

LD303
LT

PA
DP

system 302
automação empresarial

DF50 DF73

Profibus
DP Master

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Functional Specifications

Travel	Linear Motion: 3 - 100 mm. (For measurement beyond 100 mm consult the BFY-CL catalog at www.smar.com). Rotary Motion: 30° - 120° Rotation Angle.
Output and Communication Protocol	**HART®** Two-wire 4-20 mA (TP290) with digital overlaid communication (HART® Protocol) compliant with NAMUR NE-43 (TP301). **FOUNDATION™ fieldbus and PROFIBUS PA** Only digital, compliant with IEC 61158-2 (H1) 31,25 Kbit/s with power supply through the bus.
Zero and Span Adjustment	Non-interactive adjustment, via digital communication or local adjustment.
Indicator	Rotary CLD with 4½ - numerical digits and 5 alphanumerical characters. Function and Status Indication (optional).
Hazardous Area Certifications	Explosion-proof and intrinsically safe (ATEX (NEMKO and DEKRA EXAM), FM, CEPEL and CSA). Designed to comply with European regulations ATEX 94/9/EC, LVD 2006/95/EC and EMC 2004/108/EC standards.
Temperature Limits	Ambient: -40 to 85 °C (-40 to 185 °F). Storage: -40 to 90 °C (-40 to 194 °F). Digital Display: -10 to 75 °C (14 to 167 °F) in operation; -40 to 85 °C (-40 to 185 °F) without damages. Remote Sensor: -40 to 105 °C (-40 to 221 °F).
Configuration	**4 to 20 mA** Local adjustment and configuration with the use of the magnetic tool and digital display. **HART®** By digital communication (HART® protocol) using the configuration software CONF401, DDCON (for windows), HPC301 or HPC401 (for Palm™). It can also be configured using DD and FDT/DTM tools, and can be partially configured through local adjustment. **FOUNDATION™ fieldbus and PROFIBUS PA** Basic configuration may be done using the local adjustment magnetic tool if device is fitted with display. Complete configuration is possible using configuration tools.
Humidity Limits	0 to 100% RH (Non-condensable Relative Humidity).
Failure Alarms	In case of sensor or circuit failures the self-diagnostics directs the output on 3.8 or 21.0 mA, at the user's choice.
Protection Against Reverse Polarity	12 to 45 Vdc.
Update Time	Around 150 ms.
Operation Start Time	The performance within specifications is smaller than 5 seconds after power supply is applied to the transmitter.
Output	Direct or reverse.
Position Sensor	Non-contact Hall effect sensor.

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Performance Specifications

Accuracy	≤ 0.2% F. S. the effects of linearity, hysteresis and repeatability are included. (NOTE: Valid value only when used with the table of points. Refer to the Configuration Section on the Instructions Manual).
Resolution	≤ 0.1% F. S.
Repeatability	≤ 0.5% F. S.
Hysteresis of Full Scale	≤ 0.2% F. S.
Stability	± 0.1% F. S.
Temperature Effect	± 0.8% / 20°C F. S.
Power Supply Effect	± 0.005% F. S. Calibration.
Electromagnetic Interference Effect	Designed to comply with European Directive EMC 2004/108/EC.

Physical Specifications

Electrical Connection **See Note (*)**	½ - 14 NPT. M20 X 1.5. PG 13.5 DIN.	¾ - 14 NPT (with 316 SST adapter for ½ - 14 NPT). ¾ - 14 BSP (with 316 SST adapter for ½ - 14 NPT). ½ - 14 BSP (with 316 SST adapter for ½ - 14 NPT).
Material of Construction	Injected low copper aluminum with polyester painting or 316 Stainless Steel housing, with Buna N O-Rings on cover. Identification Plate: 316 SST.	
Mounting Brackets	Bichromatized Carbon Steel with polyester paint of Stainless Steel 316.	
Approximate Weight	**TP** 1.5 kg in Aluminum (without mounting bracket); 3.3 kg in Stainless Steel (without mounting bracket). **Remote sensor:** 0.58 kg in Aluminum; 1.5 kg in Stainless Steel. **Cable and remote sensor connectors:** Cable 0.045 kg/m; 0.05 kg for each connector.	

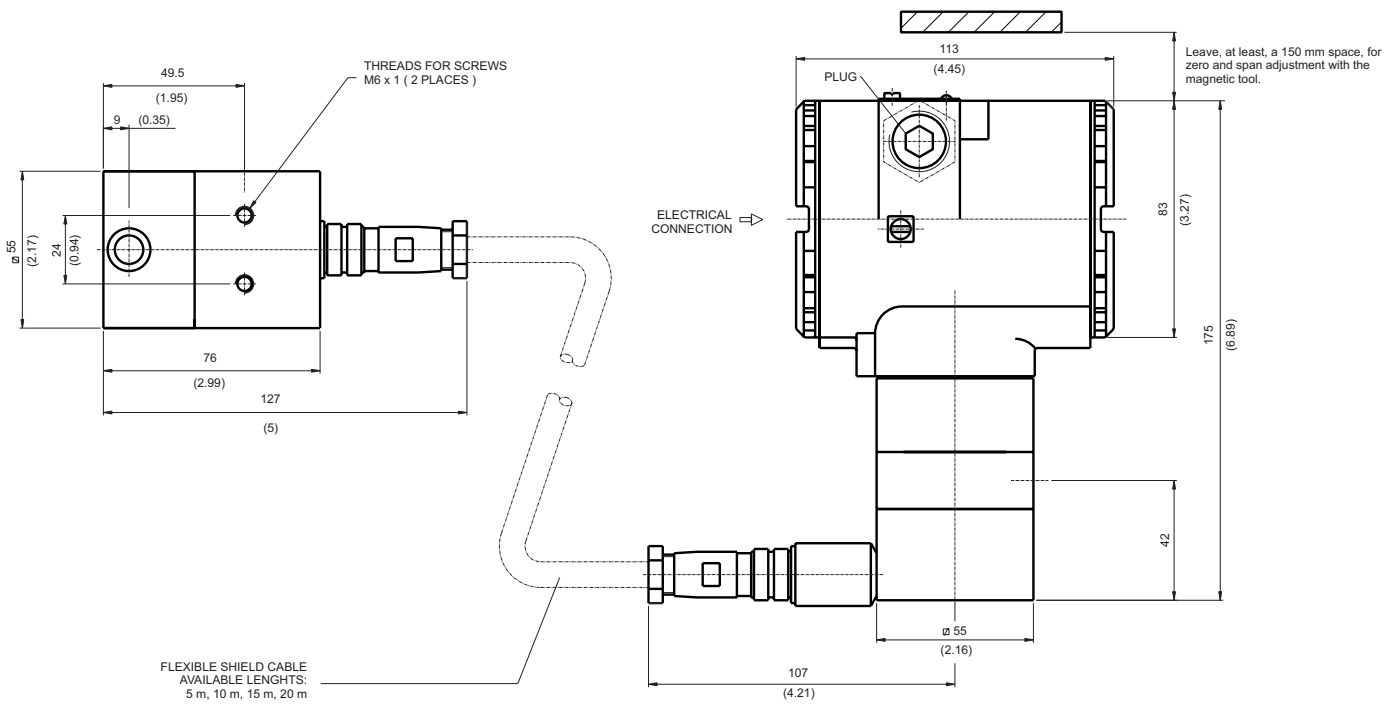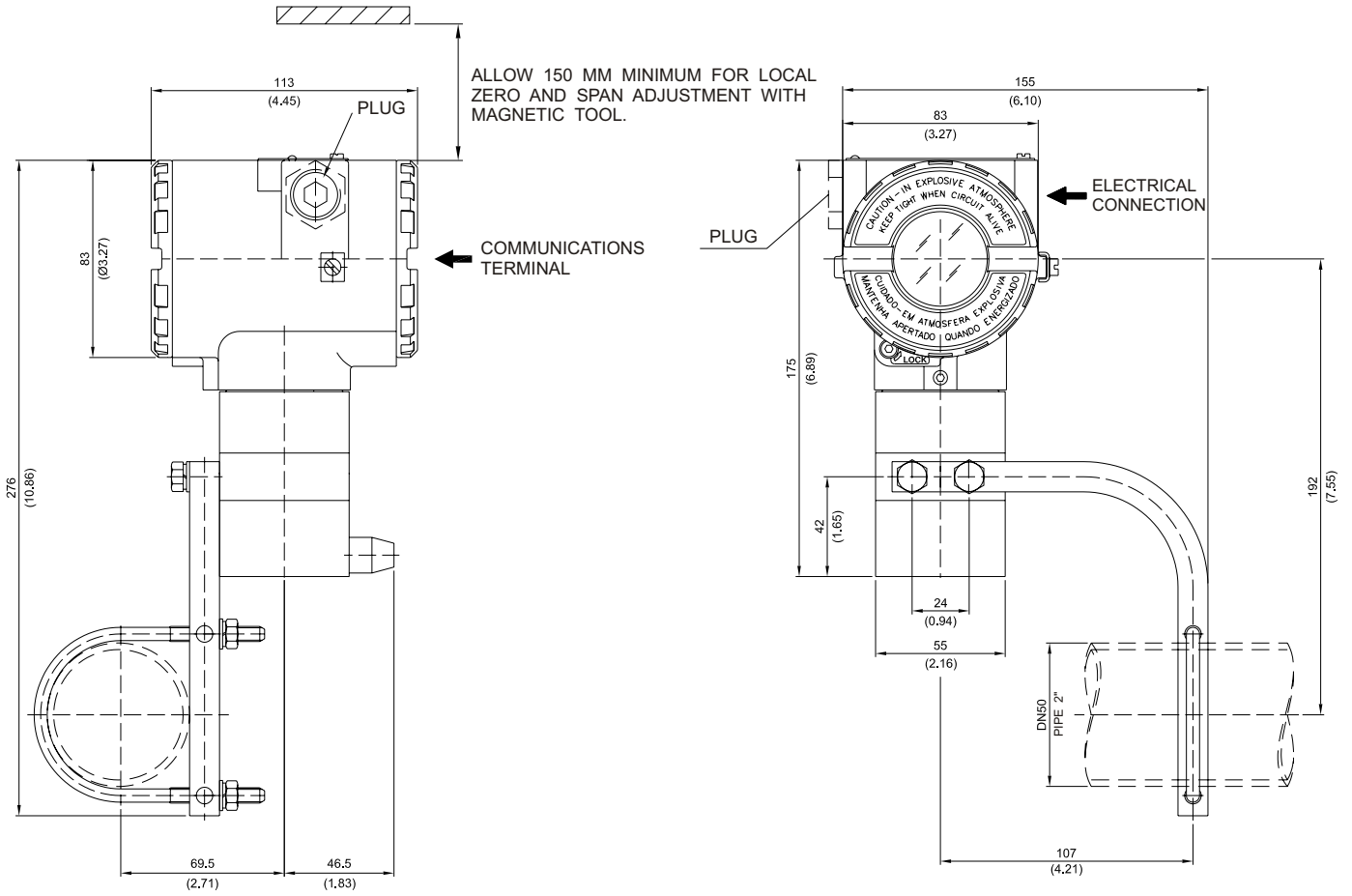HART® is a trademark of HART® Communication Foundation.
FOUNDATION™ Fieldbus
PROFIBUS PA

(*) Consult Smar for applications in classified areas.

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MODEL	POSITION TRANSMITTER
TP290 **TP301** **TP302** **TP303**	4 to 20 mA HART® & 4 to 20 mA FOUNDATION™ fieldbus PROFIBUS PA

	COD.	Local Display
	0	Without Local Display
	1	With Local Display

		COD.	Mounting Bracket
		0	Without Bracket
		1	Carbon Steel, "L" + clamp "U" pipe 2". **(3)**
		2	Stainless Steel, "L" + clamp "U" pipe 2". **(3)**
		3	Carbon Steel, rotary - VDI / VDE NAMUR
		4	Stainless Steel, rotary - VDI / VDE NAMUR
		7	Carbon Steel, "L" + clamp "U" pipe 2" - (316 SST) accessories. **(3)**

COD.	Electrical Connection			
0	1/2" - 14 NPT	**3**	1/2" - 14 NPT X 1/2 BSP (316 SST) - with adapter
1	1/2" - 14 NPT X 3/4 NPT (316 SST) - with adapter	**A**	M20 X 1.5
2	1/2" - 14 NPT X 3/4 BSP (316 SST) - with adapter	**B**	PG 13.5 DIN

COD.	Type of Actuator
1	Rotary
5	Linear Stroke up to 50 mm
7	Linear Stroke up to 100 mm
A	Linear Stroke up to 30 mm

SPECIAL OPTIONS (1)

CODE	Housing					
H0	Aluminum (IP/TYPE)	**H2**	Aluminum for saline atmosphere (IPW/TYPE X)	**H4**	Copper Free Aluminium (IPW/TYPE X)
H1	316 Stainless Steel (IP/TYPE)	**H3**	316 Stainless Steel for saline atmosphere (IPW/TYPE X)		

CODE	Identification Plate		
I1	FM: XP, IS, NI, DI	**I5**	CEPEL: EX-D, EX-IA, IP
I2	NEMKO: EX-D, EX-IA, IP (FOUNDATION™ fieldbus)	**I6**	Without certification
I3	CSA: XP, IS, NI, DI (FOUNDATION™ fieldbus and PROFIBUS PA)	**IJ**	NEMKO - EX-D
I4	EXAM (DMT): EX-IA, IP		

CODE	Painting
P0	Gray Munsell N 6.5 Polyester
P8	Without Painting
P9	Blue Safety Epoxy – Electrostatic Painting
PD	Blue smooth diamond RAL5010 - Epoxy

CODE	TAG Plate
J0	With TAG
J1	Blank
J2	According to user's notes

CODE	Sensor Mounting (2)
R0	Full Mounting
R1	Remote sensor - 5 m cable
R2	Remote sensor - 10 m cable
R3	Remote sensor - 15 m cable
R4	Remote sensor - 20 m cable

CODE	Special
ZZ	See notes

| TP290 | – | 1 | 0 | – | 0 | 1 | * | • | * | / | * | / | * | / | * | / | * |

TYPICAL MODEL NUMBER

TP301	–	1	0	–	0	1	*	•	*	/	*	/	*	/	*	/	*
TP302	–	1	0	–	0	1	*	•	*	/	*	/	*	/	*	/	*
TP303	–	1	0	–	0	1	*	•	*	/	*	/	*	/	*	/	*

(1) Leave it blank when there are not optional items. TP290 standard model is supplied with local display.
(2) Consult us for classified areas applications.
(3) Magnet mounting bracket not supplied with the TP.

ALLOW 150 MM MINIMUM FOR LOCAL ZERO AND SPAN ADJUSTMENT WITH MAGNETIC TOOL.

113 (4.45)

PLUG

83 (Ø3.27)

276 (10.86)

COMMUNICATIONS TERMINAL

69.5 (2.71)

46.5 (1.83)

155 (6.10)

83 (3.27)

PLUG

ELECTRICAL CONNECTION

CAUTION – IN EXPLOSIVE ATMOSPHERE KEEP TIGHT WHEN CIRCUIT ALIVE

CUIDADO – EM ATMOSFERA EXPLOSIVA MANTENHA APERTADO QUANDO ENERGIZADO

LOCK

175 (6.89)

192 (7.55)

42 (1.65)

24 (0.94)

55 (2.16)

DN50 PIPE 2"

107 (4.21)

49.5 (1.95)

9 (0.35)

THREADS FOR SCREWS M6 x 1 (2 PLACES)

Ø 55 (2.17)

24 (0.94)

76 (2.99)

127 (5)

FLEXIBLE SHIELD CABLE AVAILABLE LENGHTS: 5 m, 10 m, 15 m, 20 m

113 (4.45)

PLUG

Leave, at least, a 150 mm space, for zero and span adjustment with the magnetic tool.

ELECTRICAL CONNECTION

83 (3.27)

175 (6.89)

42

Ø 55 (2.16)

107 (4.21)

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Special Mounting Bracket - Rotary VDI / VDE NAMUR

52,5

POSITION TRANSMITTER

ROTARY MAGNET

MAGNET BRACKET

20

MOUNTING BRACKET

PNEUMATIC ACTUATOR
NAMUR VDI/VDER STANDARD

80 X 30

52,5

POSITION TRANSMITTER

ROTARY MAGNET

MAGNET BRACKET

30

MOUNTING BRACKET

PNEUMATIC ACTUATOR
NAMUR VDI/VDER STANDARD

130 X 30

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Pressure

4-20 mA LD290
HART LD291
LD292
PROFIBUS LD293

HART LD1.0

Pressure Transmitter "In Line"

Gauge Economic Capacitive Pressure Transmitter

Pressure and Level

4-20 mA LD290
HART LD291
LD292
PROFIBUS LD293

4-20 mA LD290
HART LD291
LD292
PROFIBUS LD293

Flanged Transmitter

Pressure Transmitter with Extended Probe

Pressure, Level and Flow

HART LD400

WirelessHART LD400

HART LD301
LD302
PROFIBUS LD303

Pressure Transmitter

Pressure Transmitter with High Performance

WirelessHART Pressure Transmitter

Level

RD400
HART
PROFIBUS

Guided Wave Level Transmitter

Density/Concentration

HART DT301
DT302
PROFIBUS DT303

Intelligent Density / Concentration Transmitter

Position

HART FY301
FY302
PROFIBUS FY303

HART FY400

Valve Positioner

Valve Positioner with Auto Tuning

Position

HART FY400
HART FY301
FY302
PROFIBUS FY303

Valve Positioner with Remote Sensor

HART ACP400
HART ACP301
ACP302
PROFIBUS ACP303

Pneumatic Linear Cylindric Actuador

HART ACP400
HART ACP301
ACP302
PROFIBUS ACP303

Pneumatic Rotary Cylindric Actuador

4-20 mA TP290
HART TP301
TP302
PROFIBUS TP303

Position Transmitter

Temperature

HART TT301
TT302
PROFIBUS TT303

PROFIBUS TT383

TT400 HART® SIS

WirelessHART TT400

HART TT411

HART TT421

Temperature Transmitter

Eight Input Temperature Transmitter

Smart Temperature Transmitter

WirelessHART Temperature Transmitter

Panel Mounting Temperature Transmitter

Head Mouting Temperature Transmitter

Junction Box
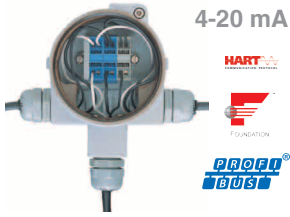
JM1
4-20 mA

3 Ways Junction Box

JM400
4-20 mA

4 Ways Junction Box

Didactic Products

PD3

Didactic Plant

Didactical Kits

Configurators

CONF401

HART® Configurator Interface
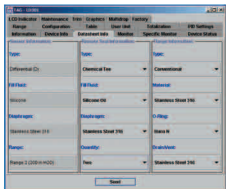
DDCON 100

HART® Configurator Interface

HART® Configurator

Interfaces

HI311/HI321

HART-USB Interface for PC

PBI-PLUS

Advanced PROFIBUS PA Interface

Converters

FP302
FP303
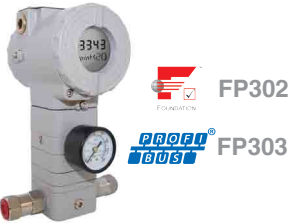
FOUNDATION™ / PROFIBUS PA to Pneumatic Signal Converter

IF302
IF303

Triple Channel Current to FOUNDATION™ / PROFIBUS PA Converters

FI302
FI303

Triple Channel FOUNDATION™ / PROFIBUS PA to Current Converters

FRI302
FRI303

FOUNDATION™ / PROFIBUS PA Relay and Digital Input

HI302

HART® / Fieldbus Interface

HCC301

HART® / Current Converter

Controllers

DFI302

Interface Universal Fieldbus

LC700

Programmable Logical Controller

CD600Plus

Digital Controller

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Controllers - Remote Input and Output

WirelessHART DF100

DC303

DC302

**HSE Controller and
WirelessHART Gateway**

**FOUNDATION™ fieldbus / PROFIBUS PA
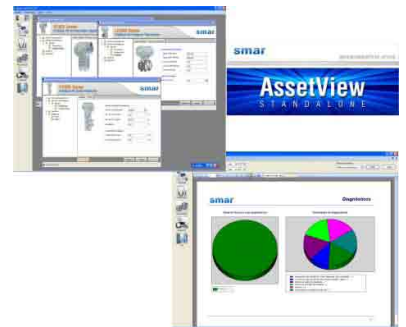Remote Input and Output**
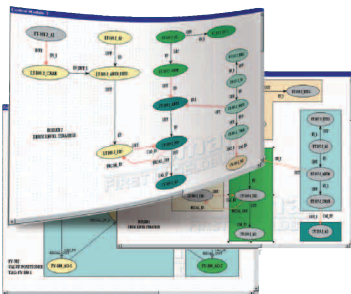
SYSTEM302

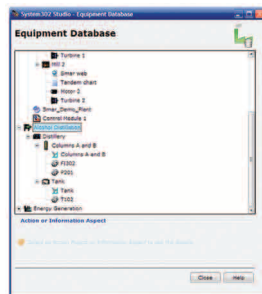**ProcessView
Supervision / Operation System**

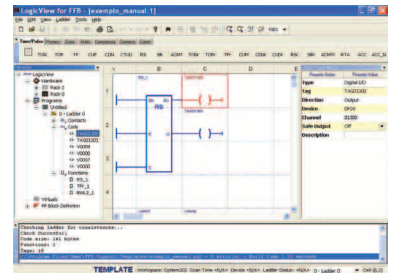**SimulationView
Control Strategy Simulator**

**AssetView STANDALONE
Asset Management System**

**Syscon
Control Strategy and
Industrial Network Configurator**

**Process Equipment Database
Plant Information Management**

**LogicView for FFB
IEC61131 Programming Tool**

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www.smar.com

Specifications and information are subject to change without notice.
Up-to-date address information is available on our website.

web: www.smar.com/contactus.asp

TP300CE