TT400SIS

HART® & 4 to 20 mA

TEMPERATURE TRANSMITTER

- ± 0.02% Accuracy

- Single Unit and Several Options for Sensors and Connections

- Input Signal Isolation

- Advanced Diagnostics

- Supported by DD, EDDL and FDT/DTM

- Sensor Backup

- SIL 2 – Safety Certified to IEC 61508 by TÜV

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- 0.02% Accuracy;
- Remote configuration via Hand-Held Terminal or via PC;
- Small and lightweight;
- Output limits according to Namur NE43;
- MTBF of 665 years;
- Intrinsically safe;
- Signal simulation for loop test;
- Certified to IEC61508 for SIL 2 (non-redundant) and SIL 3 (redundant) applications;
- EMC (Electromagnetic Compatibility) according to IEC 61326-1:2005 and IEC 61326-3-2:2008;
- Write protection function;
- Universal input accepts several thermocouples, RTD's, mV and Ohm;
- Built-in thermocouples and RTD's linearization;
- Small and lightweight.

HART® - 4 to 20 mA

- 2-wire, 4-20 mA output plus direct digital communication;
- Output current with 1.5uA/bit resolution;
- Improved performance due to dedicated math coprocessor;
- Match sensor (Callendar Van Dusen equation);
- Maximum, minimum and average input sensor selection, working with two sensors simultaneously;
- Supports FDT/DTM, DDL/EDDL.

Functional Description

Safety Instrumented Systems are designed and used to prevent or mitigate hazardous events to protected people, the environment or prevent damage to process equipment. The SIS project is based on the damage that a failure can cause.

The **TT400** SIS is certified to IEC 61508 for SIL 1 and SIL 2 (non-redundant) and SIL 3 (redundant) applications, and intendeds for measurement of temperature using RTD's or thermocouples. Also, **TT400** SIS accepts up to two sensors, operating in one of the models listed below:
- Single channel with single sensor measurement;
- Single channel with two sensors (same type) in differential measurement;
- Single channel with two sensors (same type) in backup measurement;
- Single channel with two sensors (same type) with maximum, minimum or average signal selection.

The digital technology used in the **TT400** SIS enables a single device to accept several types of sensors, wide ranges, single or multiple-ended measurement and an easy interface between the field and the control room. It also includes several features which reduce considerably the installation, operation and maintenance costs.
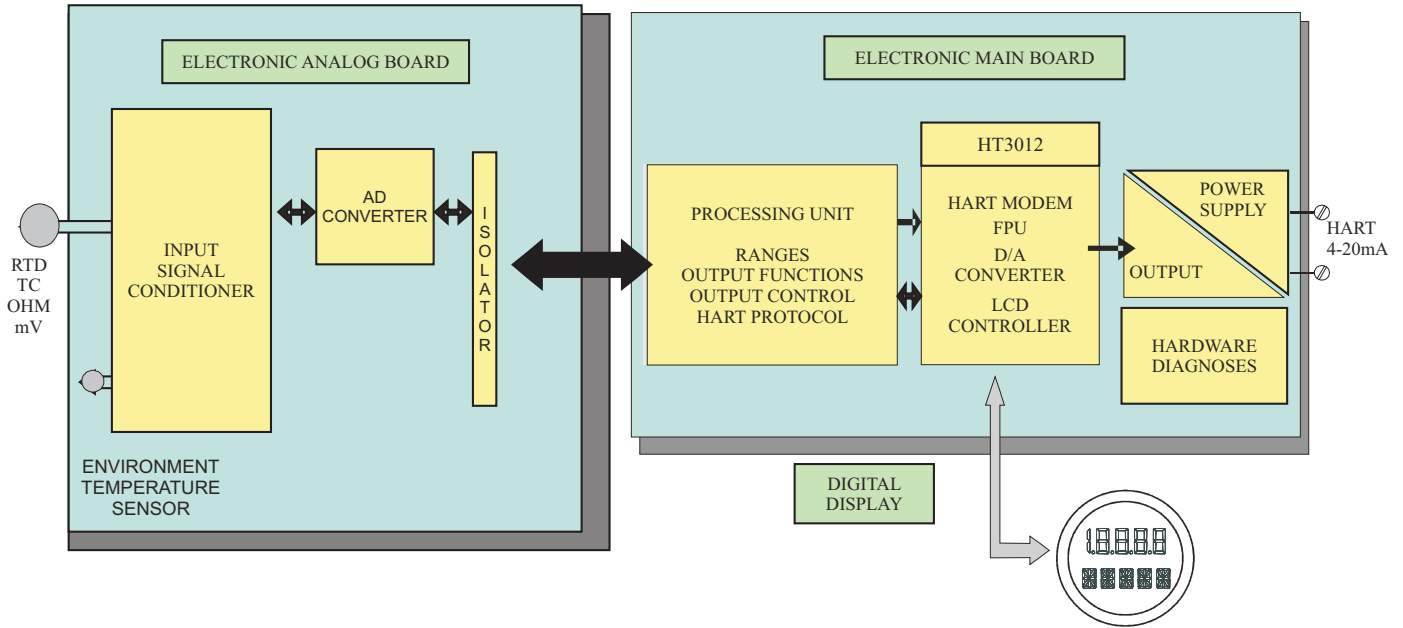
Programming and Diagnostics

TT400 SIS is available in HART® technology. It can be configured with Smar software and other manufacturer configuration tools. With Smar AssetView, an user-friendly Web Tool, user can access the plant assets anywhere and anytime using an Internet browser. It is designed for management and diagnostics of field devices to ensure reactive, preventive, predictive and proactive maintenance.
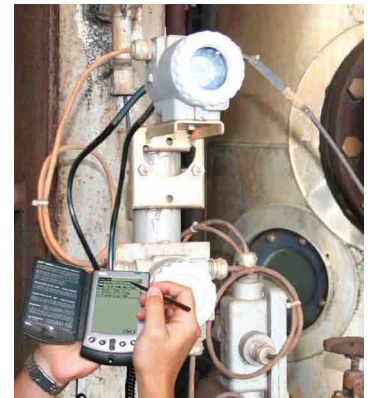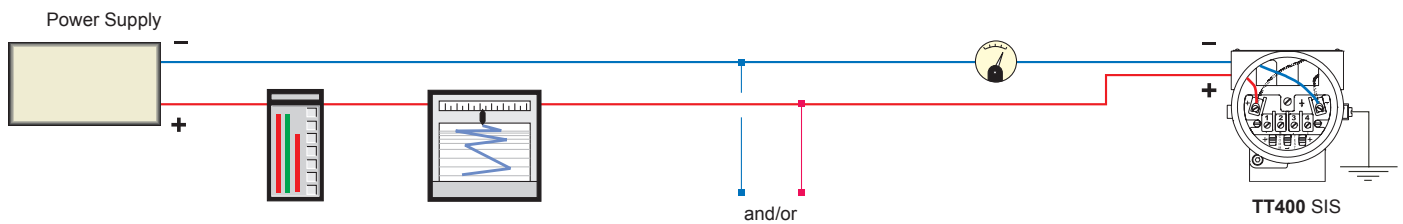
HART®

Configuration Tools:
- Smar CONF401 for Windows;
- Smar DDCON100 for Windows;
- Smar HPC401 for several models of Palms*;
- Other manufactures' configuration tools based on DDL/EDDL.

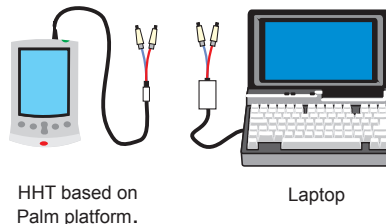For management and diagnostics, AssetView ensures continuous information monitoring.

HPI311 is required

Wiring Connection

For an adequate communication, a minimun load of 250Ω is required between the configuration tool and the power supply.

HHT based on Palm platform.

Laptop

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Functional Specifications

Inputs	See table 1, 2 and 3
Output and Communication Protocol	Two-wire, 4-20 mA with superimposed digital communication (HART Protocol Version 5.1/Transmitter/ Poll-Response mode/Common 4-20 mA); HART® Protocol Version 5, with the **TT400** SIS commands set; HART® is a trademark of HART Communication Foundation.
Power Supply	**Bus powered:** 12 - 55 Vdc.
Display	Liquid crystal display, rotative, with 4½ numeric digits, 5 alphanumeric digits and icons of function and status; Display indication for both sensor failure and sensor saturation.
Failure Alarm	In case of dangerous failure detection the output goes to failure state according to NAMUR NE-43 and the detected failure is indicated in the display; The Low or High failure state is configured by the user; The failure detection by hardware results in high failure state.
Measured Type	Temperature with one sensor; Differential Temperature between two sensors; Temperature with two sensors considering the highest; Temperature with two sensors considering the lowest; Average temperature with two sensors; Backup temperature with two sensors; Temperature generated by Callendar Van Dusen equation.
Configuration	Remote configuration with the external programmer via HART protocol, using the resources of the DDL/EDDL;

Performance Specifications

Accuracy	See tables 1, 2 and 3.
Ambient Temperature Effect	**For a 10 ºC variation:** **mV (- 6 to 22 mV), TC (NBS: B, R, S,T):** ± 0.03% of the input milivoltage or 0.002 mV whichever is greater; **mV (- 10 to 100 mV), TC (NBS: E, J, K, N; DIN: L, U):** ± 0.03% of the input milivoltage or 0.01 mV whichever is greater; **mV (-50 to 500 mV):** ± 0.03% of the input milivoltage or 0.05 mV whichever is greater; **Ohms (0 to 100), RTD (GE: Cu10):** ± 0.03% of the input resistance or 0.01 Ω whichever is greater; **Ohms (0 to 400), RTD (DIN: Ni120; IEC: Pt50, Pt100; JIS: Pt50, Pt100):** ± 0.03% of the input resistance or 0.04 Ω whichever is greater; **Ohms (0 to 2000), RTD (IEC: Pt500), RTD (IEC: Pt1000):** ± 0.03% of the input resistance or 0.2 Ω whichever is greater; **TC: cold-junction compensation rejection 60:1 (Reference: 25.0 ± 0.3 °C).**
Power Supply Effect	± 0.005% of calibrated span per volt.
Update Time	230 ms.

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Output Current	Output current resolution: 15 bits; Output current accuracy: ±0.01% of the span.
Sensor Reading	A/D converter accuracy: ±0.02% of full span.
Stabilization Time after the Power up - hot start up	Less than 17 seconds.

Physical Specifications

Electrical Connections	1/2 - 14 NPT, PG 13.5 DIN, and M20 X 1.5 conduit; Electrical inlet finished in plan face to allow connection sealing by compressing the O'Ring.
Terminal Block	Two terminals for power supply connection under terminal blocks; Four terminals for sensor connection under terminal blocks.
Mounting Bracket	In carbon steel SAE 1020 with electrostatic polyester painting or 316 SST; Accessories (bolts, nuts, washers and U-clamps) in carbon steel or 316 SST.
Weight	Up to 0.93 Kg (2.067 lb) without any optional part.
Identification Plate	316 SST plate.

Transmitter Specifications

Sensor input Treatment	AD with 50 and 60 Hz input noise rejection; Input Sensor trim; Environment Temperature trim.
Primary variable Treatment	Damping of 0 to 128 seconds; Engineering unit conversion; Cold junction compensation; Input Sensor characterization (Callendar Van Dusen); Measured Type (single, differential, maximum, minimum, average).
Output Treatment	Analog current trim in two points.

Protected Operation Specifications

Operation Counter	Counting of the configuration change operations;
Configuration Protection	Configurations blocked by password; Write Protection via hardware in Non-Safety Mode.
Certification (Pending)	Intrinsic safety, explosion proof, weather proof.

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Human Machine Interface Specifications

		Item	Icon	Definition
Indication of the State in the Display		1	MD	Multidrop Mode
		2	FIX	Fixed Output Current
		3	PV	Primary Variable Indication
		4	⇕	SIS Mode

SENSOR	TYPE		RANGE °C			RANGE °F			MINIMUM SPAN °C	°C DIGITAL ACCURACY*
	2, 3 or 4 wires									
RTD	Cu10	GE	-20	to	250	-4	to	482	150	± 1.0
	Ni120	DIN	-50	to	270	-58	to	518	20	± 0.1
	Pt50	IEC	-200	to	850	-328	to	1562	40	± 0.2
	Pt100	IEC	-200	to	850	-328	to	1562	40	± 0.2
	Pt500	IEC	-200	to	450	-328	to	842	40	± 0.2
	Pt1000	IEC	-200	to	300	-328	to	572	40	± 0.2
	Pt50	JIS	-200	to	600	-328	to	1112	40	± 0.25
	Pt100	JIS	-200	to	600	-328	to	1112	40	± 0.25
THERMOCOUPLE	B	NBS	100	to	1800	212	to	3272	50	± 0.5*
	E	NBS	-100	to	1000	-148	to	1832	20	± 0.2
	J	NBS	-150	to	750	-238	to	1382	30	± 0.3
	K	NBS	-200	to	1350	-328	to	2462	60	± 0.6
	N	NBS	-100	to	1300	-148	to	2372	50	± 0.5
	R	NBS	0	to	1750	32	to	3182	40	± 0.4
	S	NBS	0	to	1750	32	to	3182	40	± 0.4
	T	NBS	-200	to	400	-328	to	752	15	± 0.15
	U	DIN	-200	to	600	-328	to	1112	50	± 0.5

Table 1 – Temperature Sensor Characteristics

*Not applicable for the first 20% of the range (up to 440 °C).

SENSOR	RANGE mV	MINIMUM SPAN mV	DIGITAL ACCURACY %
mV	-6 to 22	0.40	± 0.02% or ± 2 µV
	-10 to 100	2	± 0.02% or ± 10 µV
	-50 to 500	10	± 0.02% or ± 50 µV

Table 2 - mV Sensor Characteristics

SENSOR	RANGE Ohm	MINIMUM SPAN Ohm	DIGITAL ACCURACY %
Ohm	0 to 100	3	± 0.02% or ± 0.01 Ohm
	0 to 400	12	± 0.02% or ± 0.04 Ohm
	0 to 2000	60	± 0.02% or ± 0.20 Ohm

Table 3 - Ohm Sensor Characteristics

MODEL TT400	SMART TEMPERATURE TRANSMITTER					
	COD.	**Communication Protocol**				
	H	HART and 4 to 20 mA				

		COD.	**Security Option**
		1	SIS - Safety Instrumented Systems

			COD.	**Local Indicator (1)**
			0	Without Indicator
			1	With Digital Indicator

COD. Electrical Connections

0	1/2 – 14 NPT	
1	3/4 – 14 NPT (with 316 SST adapter for 1/2 - 14 NPT) (5)	
2	3/4 – 14 BPS (with 316 SST adapter for 1/2 - 14 NPT) (2)	
3	1/2 – 14 BPS (with 316 SST adapter for 1/2 - 14 NPT) (2)	
A	M20 X 1.5 (5)	
B	PG13.5 DIN (6)	
Z	User's specification	

COD. Blanket Plug

I	316 SST	C	Carbon Steel (3) (7)

COD. Mounting Bracket

0	Without Bracket	2	316 SST Bracket
1	Carbon Steel Bracket	7	Carbon Steel Bracket with 316 SST Fasteners

COD. Housing Material

A	Aluminium (default)	J	316 SST - saline atmospheres (IPW/TYPEX) (4)	H	Aluminium Copper Free (IPW/TYPEX)
I	316 SST - CF8M (ASTM - A351)	B	Aluminum - saline atmospheres (IPW/TYPEX) (4)		

COD. Painting

0	Gray Munsell N 6.5 Polyester (Default)
8	Without Painting (8)
9	Safety Blue Epoxy - Electrostatic Painting
C	Safety Blue Polyester - Electrostatic Painting
Z	Special Painting

COD. Certification Type (10)

N	Without Certification	F	Non-incendive + Intrinsic Safety
I	Intrinsic Safety	K	Intrinsic Safety + Explosion Proof + Non-incendive
D	Explosion Proof	J	Non-incendive + Intrinsic Safety + Dust

COD. Organ Certifier (10)

0	Without Organ Certified	5	CEPEL
3	CSA (pending)	8	SIRA (pending)

COD. Tag Plate (11)

0	With TAG, when specified	1	Blanket	2	User's specification

COD. Sensor Type

1	RTD Cu10 – GE	F	Thermocouple type S - NBS
2	RTD Ni120 – DIN	G	Thermocouple type T - NBS
3	RTD Pt50 – IEC	K	Thermocouple type L - DIN
4	RTD Pt100 – IEC	P	Thermocouple type U - DIN
5	RTD Pt500 – IEC	M	22 mV
6	RTD Pt1000 – IEC	N	100 mV
7	RTD Pt50 – JIS	O	500 mV
8	RTD Pt100 – JIS	R	100 Ohm
9	Thermocouple type B - NBS	S	400 Ohm
A	Thermocouple type E - NBS	U	2K Ohm
B	Thermocouple type J - NBS	Z	Other
C	Thermocouple type K - NBS		
D	Thermocouple type N - NBS		
E	Thermocouple type R - NBS		

COD. Sensor Connection

2	2-wire
3	3-wire
4	4-wire
F	2-wire (two sensors) (9)

TT400	-	H	1	1	0	C	1	-	A	0	N	0	0	-	4	3

◄ TYPIC MODEL NUMBER

NOTES

(1) Values limited to 4 ½ digits; units limited to 5 characters.

(2) Explosion proof approvals do not apply to these adapters, only to transmitters.

(3) Only available for electrical connections 1/2".

(4) IP66/68W tested for 200h to according with standard NBR 8094 / ASTM B 117.

(5) Certificate for use in Explosion Proof (CEPEL and FM) (Pending).

(6) Certificate for use in Explosion Proof (CEPEL) (Pending).

(7) Not applicable for saline atmosphere.

(8) Not available for aluminum housing.

(9) For the choice of the sensor, consult HART table, Measurement Mode item in the page 6.

(10) For hazardous locations.

(11) Rectangular plate in 316 SST.

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HART OPTIONAL CONFIGURATION (1)

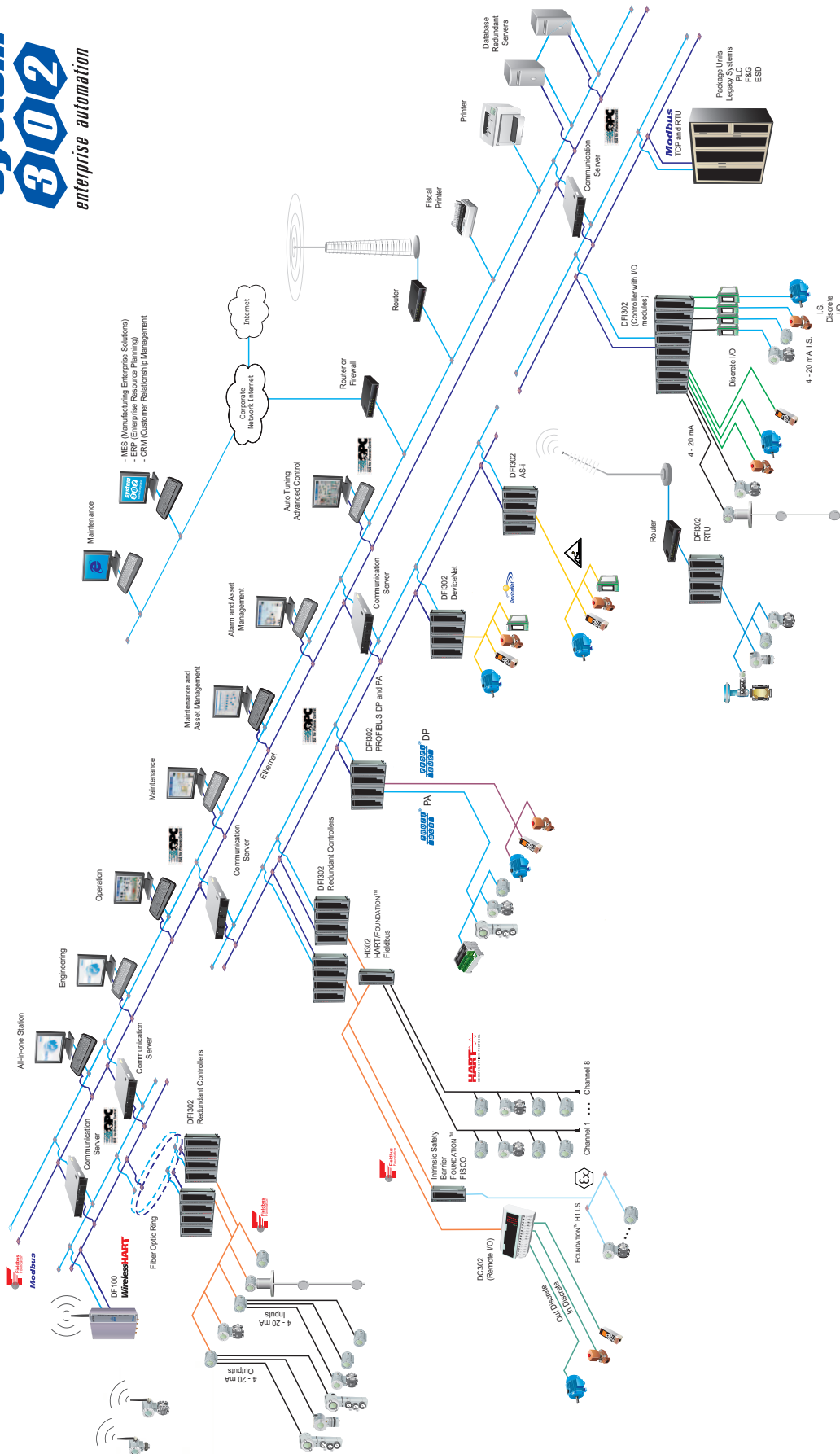| TT400	MAIN CODE OF HART TRANSMITTER (CONTINUATION)						
COD.	**Burn-out**						
BD **BU**	Start Scale (According NAMUR NE43 specifications) (Default) End Scale (According NAMUR NE43 specifications)						
	COD.	**LCD1 Indication**					
	Y0 **Y1** **Y2**	LCD1: Percentage (Default) LCD1: Current - I (mA) LCD1: Temperature (Engineering Unit)					
		COD.	**LCD2 Indication**				
		Y0 **Y1** **Y2**	LCD2: Perentage (Default) LCD2: Current (mA) LCD2: Temperature (Engineering Unit)				
			COD.	**PID Avaliability**			
			P0	PID not available			
				COD.	**Special Measurement Type (2)**		
				F3	Callendar Van Dusen		
					COD.	**Measurement Mode (3)**	
					T0 **T1** **T2** **T3** **T4** **T5**	Differential Backup Average Maximum Minimum Not Applicable	
						COD.	**Special Features**
						ZZ	User´s specifications
TT400-H11-0C1-A0N00-43 -	**BD**	**Y2**	**Y1**	**P0**	**F3**	**T0**	*****	← TYPICAL MODEL NUMBER

*Leave blank for no optional items.

NOTES
(1) Fill out with optional codes only if different from default.
(2) Callendar Van Dusen defines user-specific linearization of resistance temperature sensor.
(3) When working with two sensors connected to the terminal block.

Dimensions

NOTES
- DIMENSIONS ARE mm (in)

195
(7.67)

94
(3.70)

125
(4.92)

CONDUIT PLUG

1/2 NPT

Ø83
(Ø3.27)

62,5
(2.46)

119
(4.68)

TERMINAL CONNECTION

MOUNTING BRACKET

DIN 50
(TUBE Ø 2")

CONDUIT PLUG

ELECTRIC CONNECTION

83
(3.27)

97
(3.81)

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Pressure

4-20 mA LD290

LD291
LD292
LD293

LD1.0

Pressure Transmitter

Gauge Economic Capacitive Pressure Transmitter
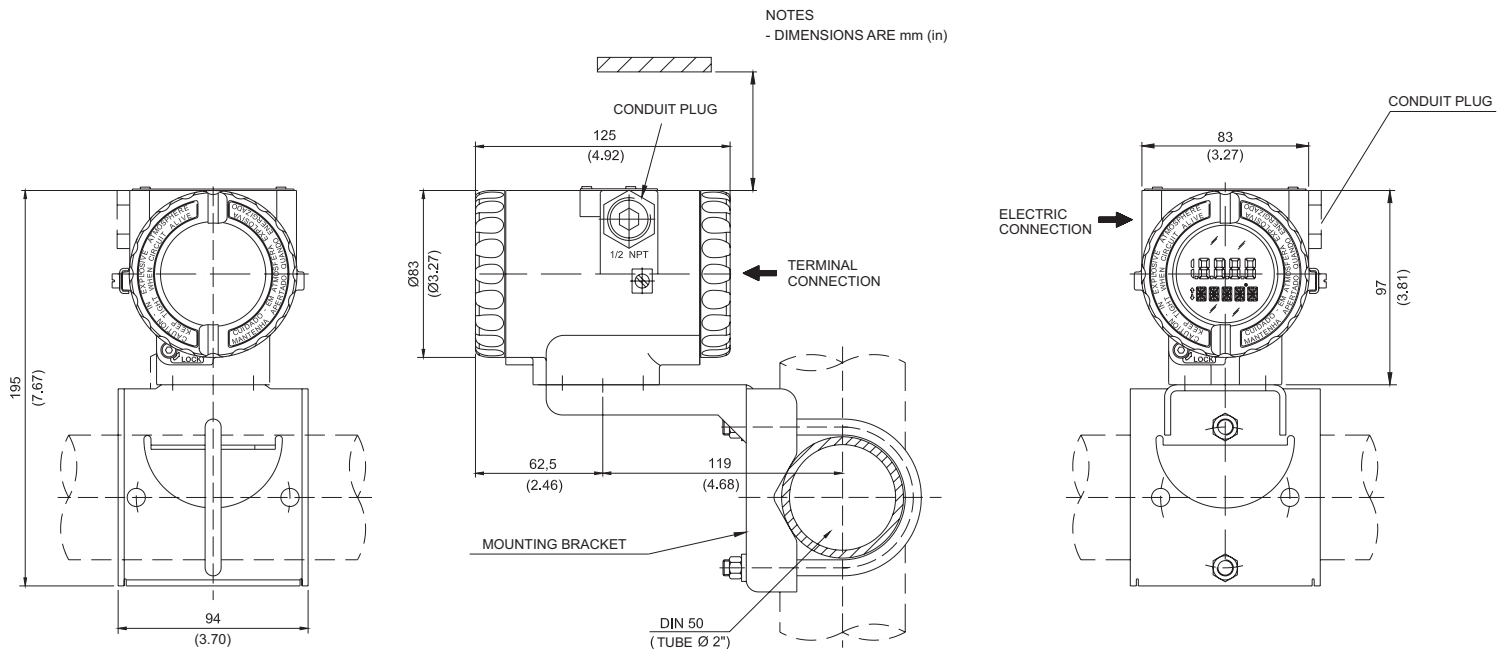
Pressure, Level and Flow

LD301
LD302
LD303

LD400

Pressure Transmitter

Pressure Transmitter with high performance

Level

RD400

Level Transmitter

Density/Concentration

DT301
DT302
DT303

Intelligent Density / Concentration Transmitter

Position

FY301
FY302
FY303

Valve Positioner

FY400

Valve Positioner with auto tuning

FY301
FY302
FY303

Valve Positioner with remote sensor
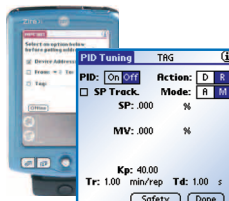
TP301
TP302
TP303

Position Transmitter
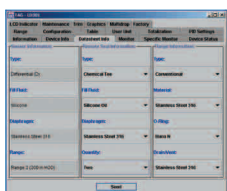
Temperature

TT301
TT302
TT303

Temperature Transmitter

TT411

Panel Mounting Temperature Transmitter

TT421

Head Mouting Temperature Transmitter

Junction Box

4-20 mA

3 Ways Junction Box JM1

4-20 mA

4 Ways Junction Box JM400

Configurators

HART® Configurator Interface CONF401

HART® Configurator Interface DDCON 100

HART® Configurator for Palm HPC301

Interfaces

HART-RS232 Interface HI311

HART-USB Interface HI321

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Converters

FP302
FP303

Fieldbus to Pneumatic Signal Converter

IF302
IF303

Current to Fieldbus Converter

FI302
FI303

Fieldbus to Current Converter

HART® / Fieldbus Interface HI302

HART® / Current Converter HCC301
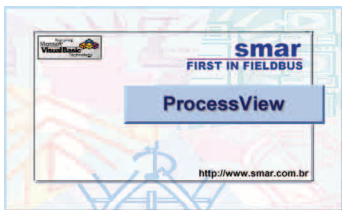
Controllers

Programmable Logical Controller LC700

Digital Controller CD600Plus

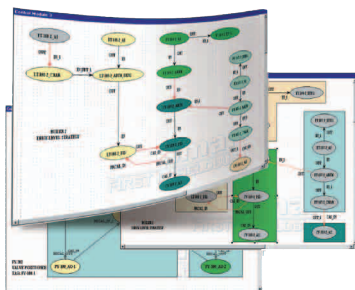**Interface Universal Fieldbus DFI302**

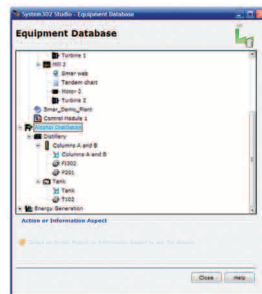## Systems

ProcessView Process Visualization Tool

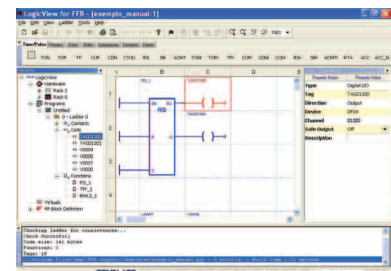**Studio302 System302 Management Tool**

AssetView On Line Plant Asset Management Tool

Syscon System Configurator

Equipment Database Plant Information Management

LogicView 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

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