

# 4590 Tank Side Monitor

Inventory Control Field device for tank sensor operation and monitoring and for integration into inventory control systems

Software Version 02.04.



**FuelsManager®**  
Compatibility



## Features and benefits

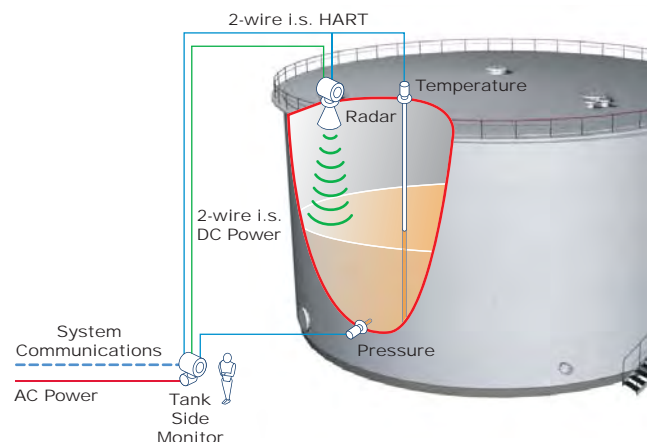
- Intrinsically safe (i.s.) power supply and communication for Varec radar tank gauges
- Connects up to 6 HART devices via i.s. 2 wire, for example temperature devices for average temperature measurement and pressure transmitters for HTMS density applications
- Backlit graphical LCD display; operation via 3 optical keys (touch control)
- User-friendly operating menu (multi-lingual)
- Interfaces to FuelsManager via 8130 Remote Terminal Unit
- Provides communication to PLC, DCS and SCADA systems
- Various industry standard communication protocols, including
  - EIA-485 Modbus, Sakura V1, Whessoematic WM 550, GPE, Mark/Space, L&J and Enraf BPM
- Approved for use in explosion hazardous areas
- Weights & Measure-approved for use in custody transfer applications

## Application

The 4590 Tank Side Monitor is a sensor integration and monitoring unit for bulk storage tank gauging applications. It can be used with Varec servo or radar tank gauges and also combined with other HART compatible devices.

The 4590 TSM offers the following functions:

- intrinsically safe (i.s.) power supply of the connected devices
- parametrization of the connected devices
- display of the measured values
- tank calculations for accurate correction of the tank distortions



## Function and system design

The 4590 Tank Side Monitor is a field device for the integration of tank sensors into tank inventory systems. It is used in tank farms, terminals and refineries. It can be used in connection with Varec radar tank gauges for inventory control and high accuracy (custody transfer) applications.

### Operating principle

The 4590 TSM is typically installed at the bottom of the tank and allows to access all connected tank sensors.

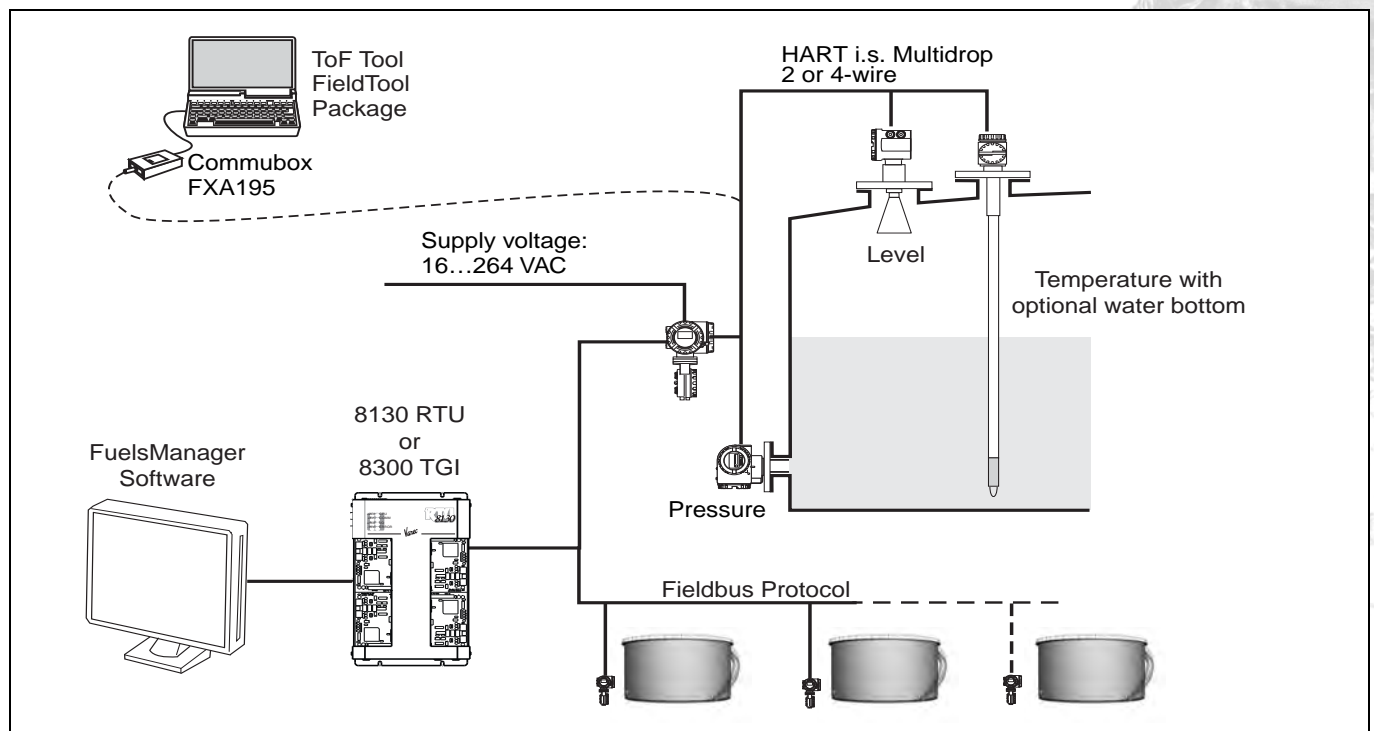
Typical process values measured by the sensors are:

- level
- temperature (point and/or average)
- water level (measured by capacitive probe)
- hydrostatic pressure (for hydrostatic tank gauging, "HTG", or hybrid tank measurements, "HTMS")
- secondary level value (for critical applications)

The 4590 TSM collects the measured values and performs several configurable tank calculations. All measured and calculated values can be displayed at the on-site display. Via a field communication protocol, the 4590 TSM can transfer the values to an inventory control system.

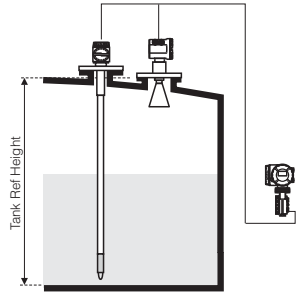
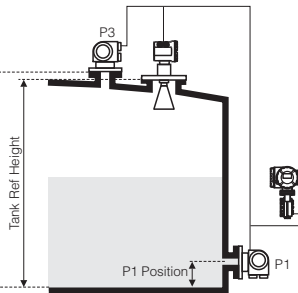
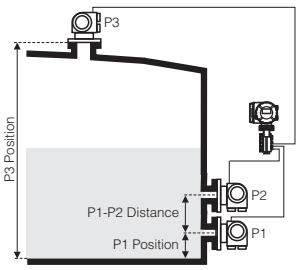
### Overfill Protection

The 4590 TSM can be configured and used as part of an overfill protection system in conjunction with the approved WHG operating mode of the Varec 7500 RTG's radar devices (as described in the TÜV test certificate for the 7500 RTG's WHG operating mode).

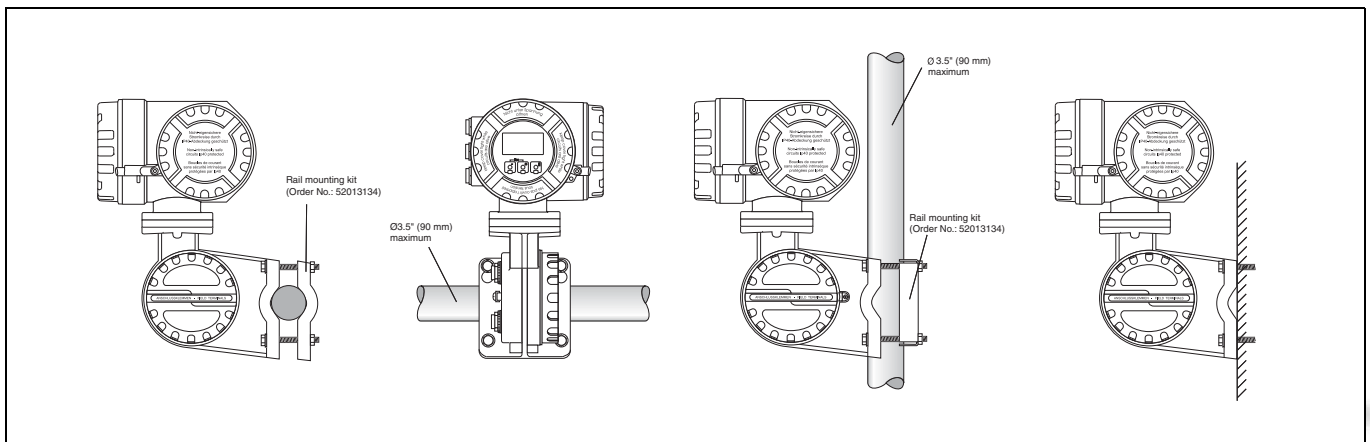


Typical 7500 RTG System

## Typical Tank calculations

Setup preset	Installation example	Sensors	measured/ calculated values	required parameters
Direct level measurement				
Level only		Level sensor	level	Tank Ref Height
Level + Temperature		Level sensor Temperature sensor (RTD or HART device; optionally with bottom water probe)	level temperature	
Hybrid Tank Measuring System (HTMS)				
HTMS + P1		Level sensor Pressure sensor (P1, bottom)	level density of the measured medium (calculated)	Tank Ref Height P1 Position Min HTMS (minimum level at which HTMS measurement is possible; should be slightly above the position of the P1 sensor) local gravity vapour density air density P3 Position (only for the "HTMS + P1,3" mode)
HTMS + P1,3 ! Note! This mode should be used in non- atmospheric tanks (e.g. pressurised tanks)		Level sensor Pressure sensor (P1, bottom) Pressure sensor (P3, top)		
Hydrostatic Tank Gauging (HTG)				
HTG P1		Pressure sensor (P1, bottom)	level (calculated)	Tank Ref Height local gravity density of the measured medium Min HTG Level (minimum level at which HTG measurement is possible; should be slightly above the position of the P1 sensor) P1 Position P3 Position (only for the "HTG P1,3" mode)
HTG P1,3 !Note! This mode should be used in non-atmospheric tanks (e.g. pressurised tanks)		Pressure sensor (P1, bottom) Pressure sensor (P3, top)		
HTG P1,2		Pressure sensor (P1, bottom) Pressure sensor (P2, middle)	level (calculated) density of the measured medium (calculated)	Tank Ref Height local gravity Min HTG Level (minimum level at which HTG measurement is possible; should be slightly above the position of the P2 sensor) P1 Position P1-P2-Distance P3 Position (only for the "HTG P1,2,3" mode)
HTG P1,2,3 Note! This mode should be used in non-atmospheric tanks (e.g. pressurised tanks)		Pressure sensor (P1, bottom) Pressure sensor (P2, middle) Pressure sensor (P3, top)		

## Installation Guidelines



Typical 4590 TSM Installation & Mounting Methods

The following information should be used as a guide only; please refer to the operation and maintenance manual for complete installation instructions.

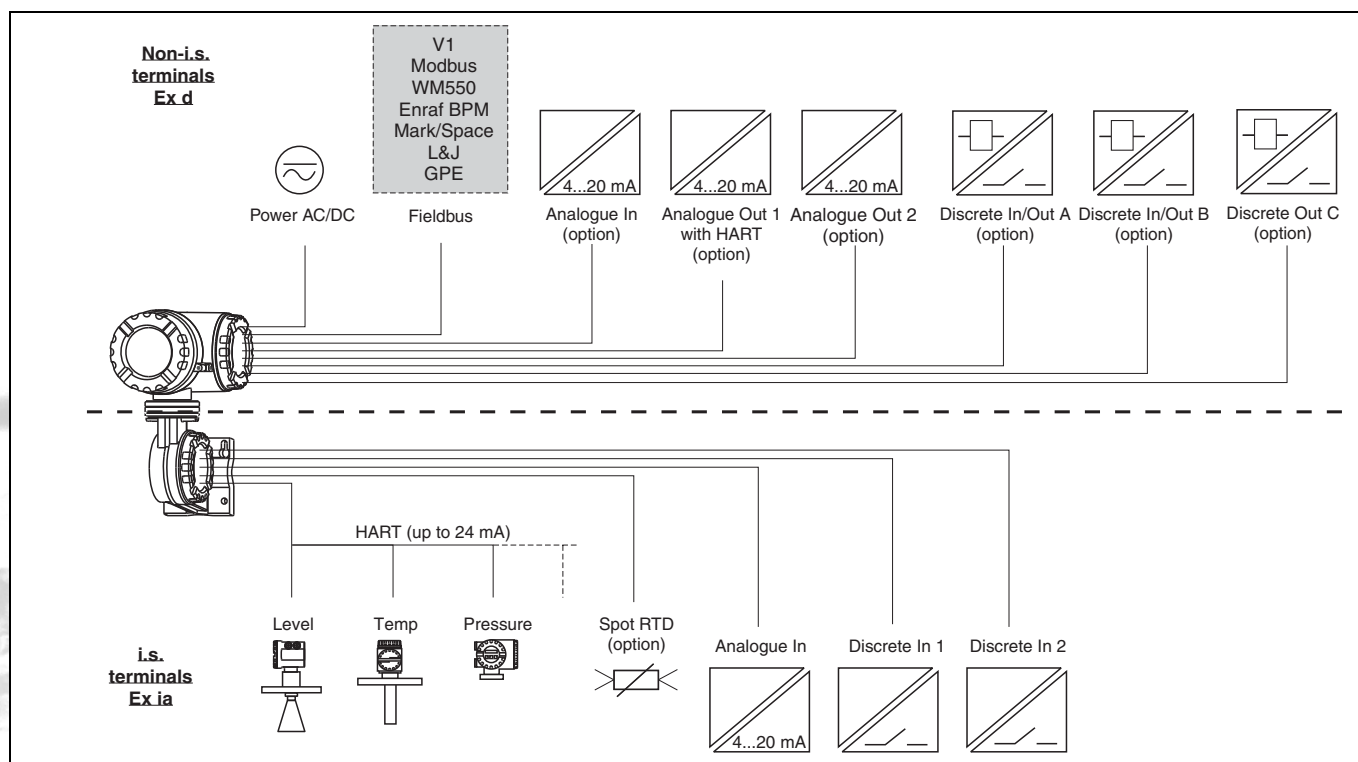
### Housing Compartments

The 4590 TSM housing has three separate compartments. The upper terminal compartment and electronics compartment are designated for non-i.s. connections and electronics and are rated EEx d. The lower terminal compartment is designated for i.s. wiring connections and wiring only.

### Grounding

The 4590 TSM must be grounded to the tank potential before communication and power connections are made. The connections ( $A \geq 4\text{mm}^2$ ) from each outer ground plug of the 4590 TSM to the tank ground must be made before any other wiring connections are made. All grounding must be compliant with local and company regulations and checked before the equipment is commissioned.

## Inputs and outputs



Instrument connections for the 4590 TSM

### Non IS inputs and outputs

		V1	Modbus	WM550	BPM	Mark/Space	L&J Tankway	GPE
Analogue In	AI	–	option <sup>a</sup>	–	standard	standard	standard	–
Analogue Out 1	AO	standard + HART	option <sup>l</sup> + HART	standard + HART	standard + HART	standard + HART	standard + HART	standard + HART
Analogue Out 2	AO#2	standard	–	standard	–	–	–	standard
Discrete In/Out A	DI#A DO#A	option, s. pos. 50 of the product structure						
Discrete In/Out B	DI#B DO#B	option, s. pos. 60 of the product structure						
Discrete Out C	DO#C	standard	–	–	–	–	–	–

a. see pos. 20 option 4 of the product structure; Modbus without in- or output does **not** provide an Ex d HART bus!

### IS inputs and outputs

		V1, Modbus, WM550, BPM, Mark/Space, L&J Tankway, GPE
HART		standard
IS RTD		option, s. pos. 40 of the product structure
IS Discrete In 1	IS DI#1	standard
IS Discrete In 2	IS DI#2	standard
IS Analogue In	IS AI	standard

### Values Transmitted by the Field Protocols

The 4590 Tank Side Monitor supports all of the following industry standard communication protocols allowing it to be integrated with existing instrumentation and connect to host computer systems

without the need for additional hardware. These protocols allow for piece-by-piece replacement and upgrading of older technologies to modern radar solutions.

Tank Value	Symbol	V1 – old	V1 – new	Modbus	WM550	BPM	Mark/ Space	L&J Tankway	L&J Tankway Servo	GPE
Level	L	yes	yes	yes	yes	yes	yes	yes	yes	yes
Temperature (Product)	T <sub>p</sub>	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observed Density	D <sub>obs</sub>	–	yes	yes	yes	yes	–	–	yes	–
Water Level	L <sub>w</sub>	–	yes	yes	yes	yes	–	–	yes	–
Pressure 1 (Bottom)	P <sub>1</sub>	–	yes	yes	yes <sup>1</sup>	yes	–	–	–	–
Pressure 2 (Middle)	P <sub>2</sub>	–	yes	yes	yes <sup>a</sup>	–	–	–	–	–
Pressure 3 (Top)	P <sub>3</sub>	–	yes	yes	yes	yes	–	–	–	–
Measured Level	L <sub>m</sub>	–	–	yes	yes <sup>1</sup>	–	–	–	–	–
Level Correction	L <sub>c</sub>	–	–	yes	yes <sup>1</sup>	–	–	–	–	–
Percentage Level	L <sub>%</sub>	–	–	yes	yes	–	–	–	–	–
Vapour Temperature	T <sub>v</sub>	–	yes	yes	yes <sup>1</sup>	yes	–	–	–	–
Air Temperature	T <sub>a</sub>	–	–	yes	yes <sup>1</sup>	yes	–	–	–	–
Level Flow Rate (Rate of change of level)		–	–	yes	yes <sup>1</sup>	–	–	–	–	–
Volumetric Flow Rate		–	–	yes	yes <sup>1</sup>	–	–	–	–	–
General Purpose Value 1	GP <sub>1</sub>	–	yes	yes	yes <sup>1</sup>	–	–	–	–	–
General Purpose Value 2	GP <sub>2</sub>	–	yes	yes	yes <sup>1</sup>	–	–	–	–	–
General Purpose Value 3	GP <sub>3</sub>	–	–	yes	yes <sup>1</sup>	–	–	–	–	–
General Purpose Value 4	GP <sub>4</sub>	–	–	yes	yes <sup>1</sup>	–	–	–	–	–
Multi-Element Temperatures	T <sub>(1)</sub> to T <sub>(16)</sub>	–	yes	yes	T <sub>(1)</sub> to T <sub>(15)</sub>	–	–	–	–	–
Alarm/Discrete Values		yes <sup>b</sup>	yes <sup>2</sup>	yes	yes	yes <sup>c</sup>	yes <sup>d</sup>	yes <sup>e</sup>	yes <sup>5</sup>	–
Discrete Output Control		–	–	yes	–	–	–	–	–	1
Additional		–	4–20mA <sup>f</sup>	yes	Level %	–	–	Temp <sup>g</sup>	–	4–20mA <sup>6</sup>
Protocol Documentation		KA 246F	KA 246F	KA 245F	KA 247F	KA 248F	KA 249F	KA 250F	KA 250F	KA 251F

a.Only accessible through WM550 extended tasks (51&52); not available on older control room systems.

b.The protocol allows 2 alarm and 4 general purpose flags which can be connected to any alarm or discrete input.

c.Level L & H alarm, 4 alarms and 2 general purpose flags which can be connected to any alarm or discrete input.

d.The protocol allows 2 digital alarm values which can be connected to any alarm or discrete input.

e.The protocol allows 2 digital values which can be connected to any alarm or discrete input.

f.One additional value "4–20mA" which can be connected to any value, however range of value sent is limited (see KA 246F for details).

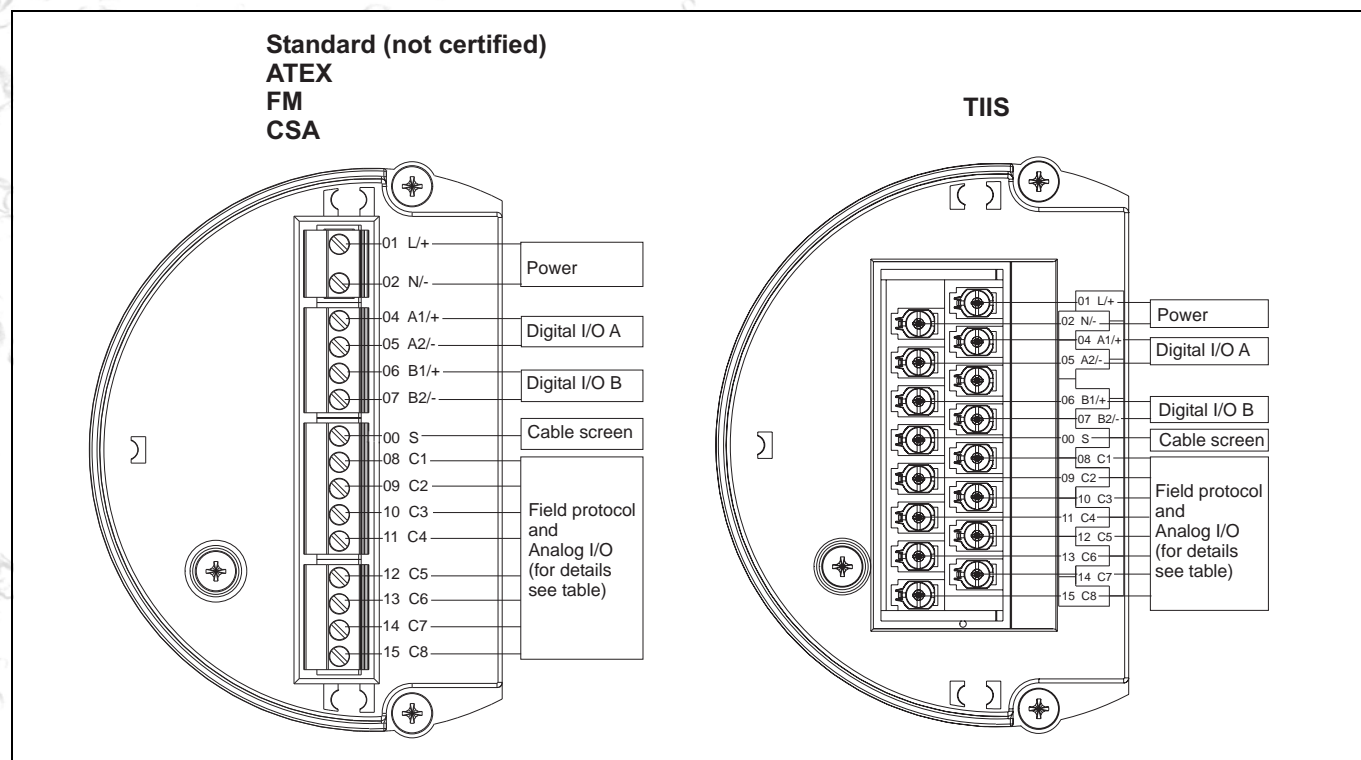
g.One additional value "Temp2" which can be connected to any value, however the range of value sent is limited (see KA 250F for details).

## Non I.S. Terminals

Terminal		V1	EIA-485 Modbus	Whessoe WM550	BPM	Mark/ Space	L&J Tankway	GPE
01 L/+	Power supply AC or DC							
02 N/-								
04 A1/+	Discrete I/O A +							
05 A2/-	Discrete I/O A -							
06 B1/+	Discrete I/O B +							
07 B2/-	Discrete I/O B -							
00 S	Cable screen							
08 C1		4 ... 20 mA output <sup>a</sup> #2	not used <sup>b</sup>	4 ... 20 mA output <sup>1</sup> #2	not used <sup>2</sup>	V+	Power	4 ... 20 mA output <sup>1</sup> #2
09 C2		V1A	485-B	Loop 1 -	T	Space	Encoder	Loop 1 -
10 C3		V1B	485-A	Loop 1 +		Mark	Computer	Loop 1 +
11 C4		0 V <sup>1</sup>	0 V	0 V <sup>1</sup>	0 V	0 V (V-)	Ground	0 V <sup>1</sup>
12 C5		0 V						
13 C6		4 ... 20 mA output #1 + HART						
14 C7		discrete output 1C	4 ... 20 mA input <sup>3</sup>	Loop 2-	4 ... 20 mA input <sup>3</sup>			Do not connect
15 C8		discrete output 2C	+24 V <sup>1</sup>	Loop 2+	+24 V <sup>1</sup>			

a. In case an "Ex d" rated 4-wire level gauge version is used, the power supply can be obtained from these terminals (21V  $\pm$  10%).

b. The internal voltage at this terminal is 0 V, however, shielding and signal common should be connected to terminal 11 or 12.



Non I.S. Terminals

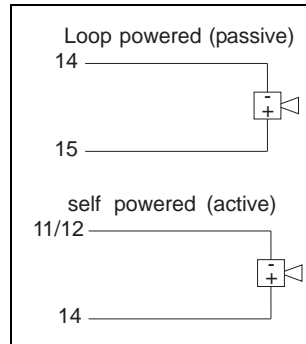


### Grounding of the fieldbus screen

The screen of the fieldbus cable should be connected to ground at both ends. If this is not possible due to signal disruption by potential equalisation currents, it is advisable to connect the screen of the fieldbus cable to terminal "00 S" at the 4590 TSM and to ground at the other end. The "00S" terminal provides a 500 V capacitor between the cable screen and tank ground potential.

### Non-i.s. 4 ... 20 mA analogue input

Depending on the selected fieldbus communication board, a non-i.s. self-powered or loop powered analogue transmitter can be connected. The analogue signal for the loop powered transmitter can be connected to the terminals 14 (-) and 15 (+24 Vdc). The maximum supply current for the analogue transmitter is limited to 24 mA. The analogue signal for a self powered transmitter should be connected to terminals 11 or 12 and 14.

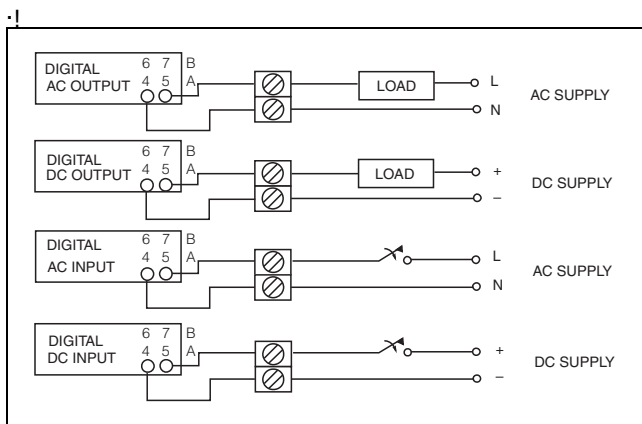


### Non-i.s. 4 ... 20 mA analogue output

For all field communication boards except the Modbus Option without analogue in/output, a non-i.s. 4...20mA output is available. Via Software settings, this analogue output can be connected to any parameter in the 4590 TSM. The analogue output is available between terminals 13 (+) and 12 (-). From SW 02.01.xx onwards, an additional HART signal is available at terminal 13.

### Discrete in and output

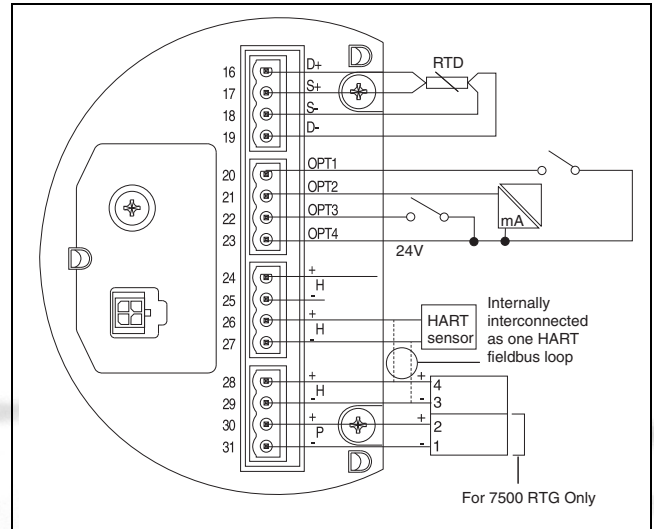
The 4590 TSM can be equipped with up to 2 discrete I/O modules. These modules can be used for interfacing to non-i.s. discrete in- or outputs. Input and output voltage and current ranges depend on the type of selected module installed in the relevant I/O slot. Terminals 4 and 5 correspond to discrete I/O slot A, terminals 6 and 7 correspond to discrete I/O slot B.



Discrete Inputs and Outputs

**Note!** 250 VAC is the maximum load that can be connected.

### I.S. Terminals



I.S. Terminals

Terminal	Designation	Meaning
16	D+	+ RTD drive <sup>a</sup>
17	S+	+ RTD sense <sup>1</sup>
18	S-	- RTD sense <sup>1,b</sup>
19	D-	- RTD drive <sup>1,2</sup>
20	OPT1	Discrete Input 1
21	OPT2	Analogue Input 1 (4 ... 20 mA)
22	OPT3	Discrete Input 2
23	OPT4	Option +24 V
24	H+	+HART comm. <sup>c</sup>
25	H-	-HART comm. <sup>d</sup>
26	H+	+HART comm. <sup>3</sup>
27	H-	-HART comm. <sup>4</sup>
28	H+	+HART comm. <sup>3</sup>
29	H-	-HART comm. <sup>4</sup>
30	P+	+ i.s. power for FMR S-series <sup>3</sup> (terminal 2 of FMR)
31	P-	- i.s. power for FMR S-series <sup>4</sup> (terminal 1 of FMR)

- a. These terminals should be left unconnected if RTD has not been selected in feature 40 of the product structure.  
b. For a 3-wire RTD, terminals 18 and 19 should be connected together.  
c. These terminals share the same HART signal.  
d. These terminals share the same i.s. 0 V signal.



## Connection of HART instruments

### Tank sensors

The 4590 TSM can interface to a maximum of 6 i.s. HART sensors. All HART sensors are connected to one HART multi-drop communication loop. In order to keep wiring simple, 3 interconnected terminal pairs are available. The terminal pairs are marked respectively H+ and H-.

### Power supply

The 4590 TSM provides intrinsically safe power for 2-wire tank sensors. It also can provide intrinsically safe power for the 4-wire instrument Varec radar tank gauges. For supplying extra i.s. power to the 7500 RTG's, additional power terminals are available, marked as P+ and P-. Although it is possible to use only 3 wires between the 7500 RTG's and the NRF590, by combining the P- and H- wires, it is recommended to use a double pair of screened and twisted cable.

### Grounding of the cable screen (for Varec radar tank gauges S)

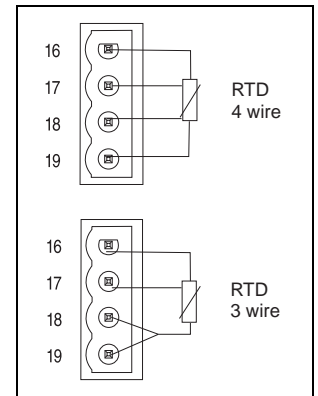
The screen of the cable connecting the Varec radar tank gauges to the 4590 TSM should be grounded at the 4590 TSM, **not** at the Varec radar tank gauges.

### Scan time

The data of connected HART sensors is constantly scanned and updated in the internal data base. The scanning sequence is based on the priorities of the measurements (level – prio 1, temperature – prio 2, pressure – prio 3,...). Typically, a value change on the HART multidrop loop is displayed after a 2 seconds delay (for priority 1 values).

### Spot RTD

A spot RTD can be connected to the 4590 TSM if the option is installed. For 4-wire connection, the RTD must be connected to the 4 available terminals marked D+, S+, S- and D-. For 3-wire connection, the RTD should be connected to the same 4 terminals. The terminals D- and S- should be connected together directly at the 4590 TSM terminals.



RTD resistance is measured and recalculated at least every second.

## Human interface

### Display and operating elements

#### Optical keys

The optical keys allow the 4590 TSM to be operated without the housing being opened.

From Software Version 02.xx.xx onwards they function as softkeys, i.e. their meaning varies depending on the current position within the operating menu. The meaning is indicated by softkey symbols in the bottom line of the display.

#### Liquid crystal display (LCD)

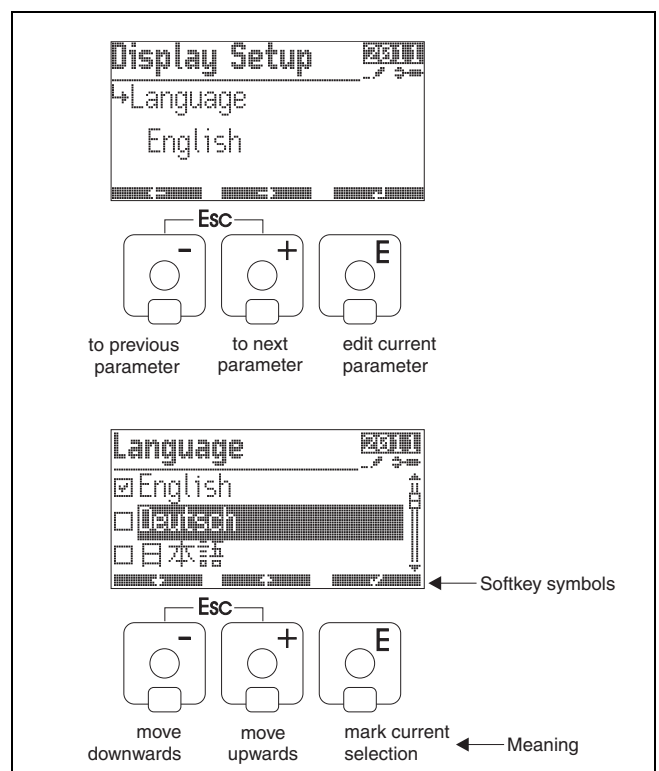
Four lines with 20 characters each. Display contrast adjustable through key combination. The backlight of the display is activated during operation for user defined time (30 sec ... continuous backlight).

The following display languages can be selected by the user:

- English
- German
- Japanese
- Simplified Chinese
- Dutch
- Spanish
- French
- Italian

**Note!** Chinese font: GB18030, CITS Committee approved

**Note!** Japanese font: JIS X 208-1997 including Hiragana, Katakana and Kanji



LCD and Optical Keys

## Operation of HART instruments

For the following instruments, the operating menu can be accessed on the display of the 4590 TSM :

- 7200 series Radar Tank Gauges
- 7500 series Radar Tank Gauges
- 453x ATC's average temperature devices
- Whessoe Varec 1646 Temperature Transmitter
- Cerabar M: PMC/PMP4x
- Cerabar S: PMC/PMP7x
- Cerabar: PCM/PMC73x/63x
- Deltabar: PMD/FMD23x/63x
- Deltabar S: PMD/FMD7x

Any other HART instrument can be operated via the Generic HART menu (allowing all 4 universal HART values to be accessed).

## Operation with "ToF Tool Field Tool Package"

The 4590 TSM can also be operated via the "ToF Tool – Field Tool Package". This program supports commissioning, securing of data, signal analysis and

documentation of the instruments. It is compatible with the following operating systems: WinNT4.0, Win2000 and Win XP.

The "ToF Tool – Field Tool Package" supports the following functions:

- Online configuration of transmitters
- Loading and saving of instrument data (Upload/Download)
- Documentation of measuring point

## Corrections

The 4590 TSM can automatically calculate the following corrections:

- Correction for the Hydrostatic Tank Deformation (HyTD)
- Temperature Correction for Thermal Expansion of the Tank Shell (CTSh)

## Flow calculation

The 4590 TSM can calculate the approximate flow based on the rate of level change and a linear conversion, to volumetric flow.

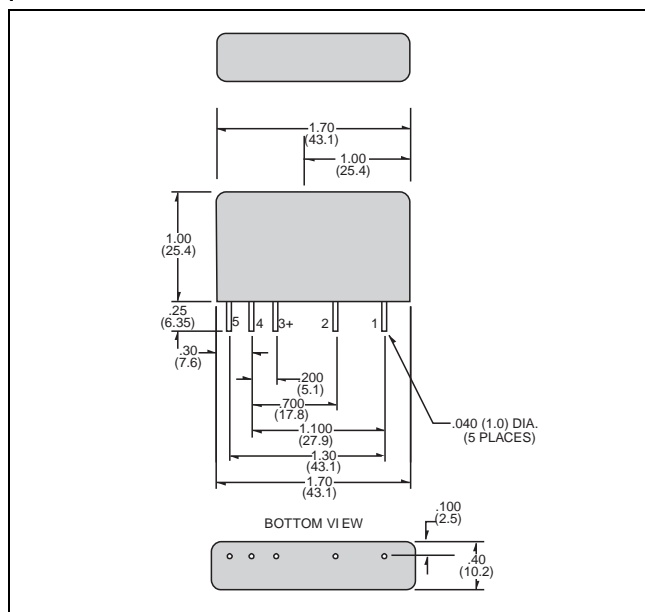
## Accessories

## Rail mounting kit

For rail mounting the 4590 TSM to vertical or horizontal pipe. **(Order-Number: 52013134)**

## Discrete I/O modules

The 4590 TSM can be equipped with 1 or 2 discrete I/O modules. (see position 50 and 60 of the order codes)



### Standard Mechanical Diagram for all I/O Modules

<b>Output modules</b>	<b>AC voltage</b>		<b>DC voltage</b>	
Order code entry				
<sup>a</sup> Module A or B	J	G	H	K

Output modules	AC voltage		DC voltage	
Order Code <sup>b</sup>	52012959	52012960	52012961	52012962
Colour	black	black	red	red
Load voltage	24 ... 140 V AC	24 ... 250 V AC	3 ... 60 V DC	4 ... 200 V DC
Load current	30 ... 500 mA eff. <sup>c</sup>		20 ... 500 mA eff. <sup>1</sup>	
Typ. power dissipation	1 W/A		1 ... 1.5 W/A	
Transient protection	Meets IEEE472		Meets IEEE472	
Type of contact	SPST normally open Zero crossing turn-on		SPST normally open	
Optical isolation	yes		yes	
Isolation voltage	4000 V eff.		4000 V eff.	
Approvals	UL, CSA, CE, TÜV		UL, CSA, CE, TÜV	

a. This order code is valid if the module is pre installed in the 4590 TSM as module A or module B

b. This order code is valid if the module is ordered as an accessory.

c. This upper limit of the load current is determined by the 4590 TSM

Input modules	AC voltage		DC voltage	
Order code entry				
<sup>a</sup> Module A or B	B	D	C	E
Order code <sup>b</sup>	52012955	52012956	52012957	52012958
Colour of housing	yellow	yellow	white	white
Input voltage	90 ... 140 V AC	180 ... 264 V AC <sup>c</sup>	3 ... 32 V DC	35 ... 60 V DC
Nominal input resistance	22 kΩ	60 kΩ	22 kΩ	60 kΩ
Max. pick-up voltage	90 V AC	180 V AC	3 V DC	35 V DC
Min. drop-out voltage	25 V AC	50 VAC	1 V DC	9 V DC
Input current @ max. voltage	8 mA rms		8 mA rms	
Typ. power dissipation	1 ... 1.5 W/A		1 ... 1.5 W/A	
Transient protection	Meets IEEE472		Meets IEEE472	
Optical isolation	yes		yes	
Isolation voltage	4000 V rms		4000 V rms	
Approvals	UL, CSA, CE, TÜV		UL, CSA, CE, TÜV	

a. This order code is valid if the module is pre installed in the 4590 TSM as module A or module B.

b. This order code is valid if the module is ordered as an accessory.

c. This upper limit of the input voltage is determined by the 4590 TSM.

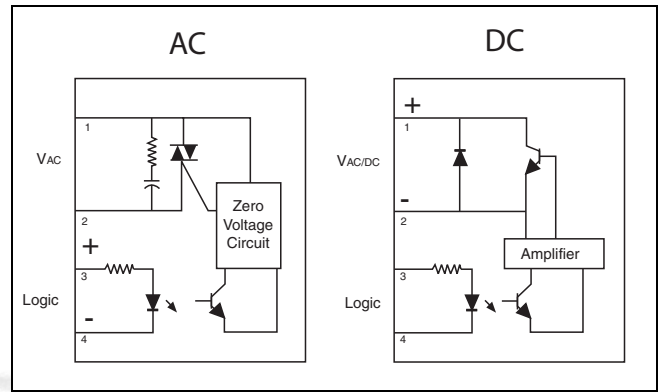
Relay output module	
Order code Entry <sup>a</sup> Module A or B	R
Order code <sup>b</sup>	52026945
Colour of housing	red
Load voltage	0 ... 100 VDC / 0 ... 120 VAC
Load current	0 ... 500 mA <sup>c</sup>
Max. contact resistance	250 mΩ
Max. turn on/off time <sup>d</sup>	1 ms
Min. life expectancy	500000 cycles
Type of contact	SPST normally open; mechanical relay
Isolation voltage	1500 V <sub>eff</sub>
Approvals	UL, CSA, CE, TÜV

a. This order code is valid if the module is pre installed in the 4590 TSM as module A or module B.

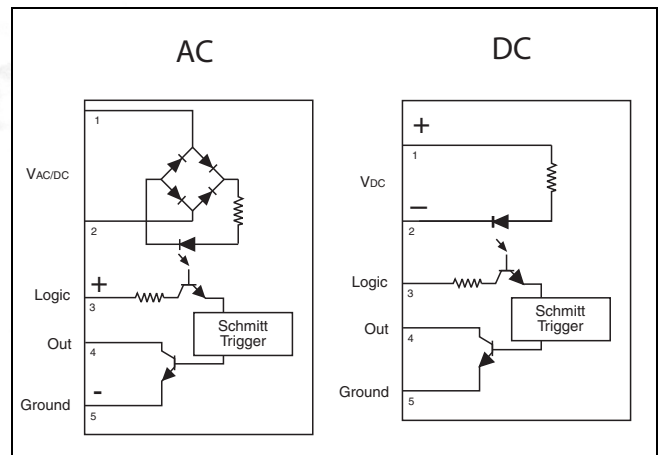
b. This order code is valid if the module is ordered as an accessory.

c. For inductive loads, use diode suppression or RC network to improve contact life.

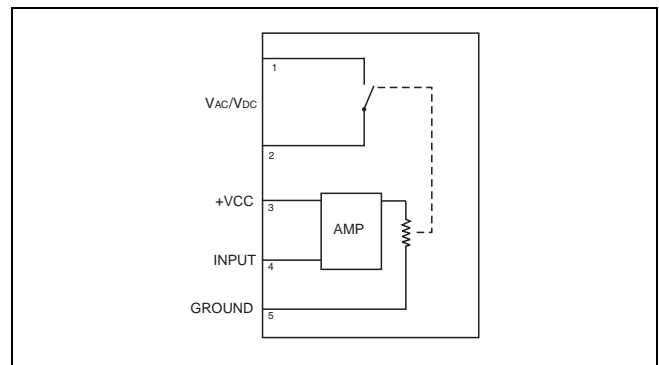
d. including debounce



Output Module AC and DC Voltage



Input Module AC and DC Voltage



Relay Output Module

## Technical Specifications

The following specifications apply to the model 4000 ATT over the normal (ambient) operating temperature range.

### Physical

<b>Net weight</b>	17.6 lbs (8 kg)
<b>Shipping weight</b>	
<b>Enclosure</b>	Explosion proof die-cast epoxy coated aluminium Rated IP65 (NEMA 4)
<b>Conduit entries</b>	3 Non i.s. entries – M20x1.5. 2 i.s. entries – M25x1.5. internal diameter of the cable entry is 16 mm. Optional Adaptors EEx d M20x1.5 G½ ½" NPT ¾" NPT (max. 2 cable entries)

### Power

<b>Power supply</b>	55 ... 264 VAC; insensitive to polarity / CSA approved: 55 ... 250 VAC  18 ... 55 VAC/DC
<b>Power consumption</b>	370 mA @ 24 VDC 200 mA @ 48 VDC 75 mA @ 125VAC 45 mA @ 220 VAC
<b>Fuse</b>	Internal (on primary power)

### Environmental

<b>Ambient temperature</b>	–40 °C ... +60 °C (–40 °F ... +140 °F)
<b>Storage temperature</b>	–55 °C ... 85 °C (–67 °F...185 °F)
<b>EMC</b>	Interference emission to EN 61326, Equipment class A Interference immunity to EN 61326 Use shielded signal lines for installation.
<b>Overvoltage Protection</b>	Internal 600 Vrms surge arresters which have been tested against 10 kA transient discharges.

### Certifications & Approvals

<b>CE mark</b> The measuring system meets the legal requirements of the EC-guidelines. Varec confirms the instrument passing the required tests by attaching the CE-mark.
<b>FM</b> FM XP – Class I, Div 1 Groups A-D; Note the Installation Drawings ZD 084F and ZD 085F (IS 4–20 mA Option Module)
<b>CSA</b> FM XP – Class I, Div 1 Groups A-D; Note the Installation Drawings ZD 103F and ZD 104F (IS 4–20 mA Option Module)

#### ATEX

ATEX II 2 (1) EEx d (ia) IIC T6;  
Note the Safety Instructions XA 160F and XA 169F (IS 4–20 mA Option Module)

#### Custody transfer approvals

NMI type approval  
NMI initial verification, type approval  
PTB initial verification, type approval

### External Standards and Guidelines

EN 60529 – Protection class of housing (IP-code)  
EN 61010 – Safety regulations for electrical devices for measurement, control, regulation and laboratory use.  
EN 61326 – Emissions (equipment class B), compatibility (appendix A – industrial use)  
API MPMS Ch. 3.1A – Standard Practice for Manual Gauging of Petroleum and Petroleum Products in Stationary Tanks.  
API MPMS Ch. 3.1B – Standard Practice for Level Measurement of Liquid Hydrocarbons in Stationary Tanks by Automatic Tank Gauging  
API MPMS Ch. 3.3 – Standard Practice for Level Measurement of liquid Hydrocarbons in Stationary Pressurized Storage Tanks by Automatic Tank Gauging  
API MPMS Ch. 3.6 – Measurement of Liquid Hydrocarbons by Hybrid Tank Measurement Systems  
API MPMS Ch. 7.4 – Static Temperature Determination Using Fixed Automatic Tank Thermometers  
ISO 4266 / Part 1 – Petroleum and liquid petroleum products – Measurement of level and temperature in storage tanks by automatic methods – Part 1: Measurement of level in atmospheric tanks  
ISO 4266 / Part 3 – Petroleum and liquid petroleum products – Measurement of level and temperature in storage tanks by automatic methods – Part 3: Measurement of level in pressurized storage tanks (non refrigerated)  
ISO 4266 / Part 4 – Petroleum and liquid petroleum products – Measurement of level and temperature in storage tanks by automatic methods – Part 4: Measurement of temperature in atmospheric tanks  
ISO 4266 / Part 6 – Petroleum and liquid petroleum products – Measurement of level and temperature in storage tanks by automatic methods – Part 6: Measurement of temperature in pressurized tanks  
ISO 15169 – Petroleum and liquid petroleum products – Determination of volume, density and mass of the contents of vertical cylindrical tanks by Hybrid Tank Measurement Systems  
OIML – R85 – Organisation Internationale de Métrologie Légale – Automatic level gauges for measuring the level of liquid in fixed storage tanks.

## Non-IS inputs and outputs

## Analogue 4...20 mA input

Internal load (to ground)	110 $\Omega$
Measuring range	0 ... 26 mA
Accuracy	$\pm 15 \mu\text{A}$ (after linearisation and calibration)

## Analogue 4...20 mA outputs

Output current	3 ... 24 mA
Output voltage	$U = 24 \text{ V} - I_{\text{LOAD}} 400 \Omega$
Output load	max. 500 $\Omega$
Accuracy	$\pm 15 \mu\text{A}$ (after linearisation and calibration)
HART options <sup>a</sup>	Slave, address # 0: 4 ... 20 mA active Slave, address #1 – #15: fixed current (user selectable) Master: max. current ( $\leq 24 \text{ mA}$ ) selectable by user; typically 6 HART instruments (each 4 mA) can be connected <sup>b</sup>

a. The second analogue output (available for V1, WM550 and GPE) has no HART option.

b. Start-up current of the HART instruments has to be taken into account

## Discrete output C (for V1 protocol)

Load voltage	3 ... 100 V
Load current	max. 500 mA
Type of contact	Mechanical latching relay
Isolation voltage	1500 V
Approvals	UL, CSA

## Technical Data of the IS inputs and outputs

## HART input loop

Source voltage	$U = 25 \text{ V} - I_{\text{Load}} \times 333 \Omega$ (typically)
total $I_{\text{max}}$	Start-up currents of all connected HART devices may not exceed a total of 27 mA
connectable sensors	depending on current consumption (including start-up current)

## Spot RTD input (option, s. pos. 40 of the product structure)

Measuring range	10 ... 600 $\Omega$
Excitation current	typ. 400 $\mu\text{A}$ , max. 2000 $\mu\text{A}$

Type of Sensor	Nominal value	Temp <sub>min</sub>
Pt100 (385) IEC751 Pt100 (389) Pt100 (392) IPTS-68	100 $\Omega$ @ 0 °C ( $\approx 32$ °F)	-200 °C ( $\approx -330$ °F)
Cu90 (4274)	100 $\Omega$ @ 25 °C ( $\approx 77$ °F) [90 $\Omega$ @ 0 °C ( $\approx 32$ °F)]	-100 °C ( $\approx -150$ °F)
Ni120 (672)	120 $\Omega$ @ 0 °C ( $\approx 32$ °F)	-60 °C ( $\approx -75$ °F)
Ni100 (618) DIN 43760	100 $\Omega$ @ 0 °C ( $\approx 32$ °F)	-60 °C ( $\approx -75$ °F)
Type of Sensor	Temp <sub>max</sub>	Accuracy <sup>a</sup>
Pt100 (385) IEC751 Pt100 (389) Pt100 (392) IPTS-68	+600 °C ( $\approx +1110$ °F)	$\pm 0.1$ °C ( $\approx \pm 0.2$ °F)
Cu90 (4274)	+250 °C ( $\approx +480$ °F)	$\pm 0.1$ °C ( $\approx \pm 0.2$ °F)
Ni120 (672)	+180 °C ( $\approx +350$ °F)	$\pm 0.1$ °C ( $\approx \pm 0.2$ °F)
Ni100 (618) DIN 43760	+180 °C ( $\approx +350$ °F)	$\pm 0.1$ °C ( $\approx \pm 0.2$ °F)

a. Accuracy of converter, may be influenced by element accuracy

## IS Analogue 4...20 mA input

Source voltage	$U = 25 \text{ V} - I_{\text{Load}} \times 333 \Omega$ (typically)
Internal load (to ground)	100 $\Omega$
Measuring range	0 ... 26 mA
Accuracy	$\pm 15 \mu\text{A}$ (after linearisation and calibration)
Usage	Source for Discrete Inputs / Source for 4 ... 20 mA loop device

## Discrete inputs

Active voltage ("closed circuit")	min. 9 V (default)
In-active voltage ("open circuit")	max. 7 V (default)
Active high current	4 mA
Switching hysteresis	2 V

## Field Communications

**EIA-485 MODBUS**

No. of units	Maximum 32 instruments per loop
Baud rate	600 / 1,200 / 2,400 / 4,800 / 9,600 / 19,200 bits selectable
Parity	Odd, Even, None, selectable
Cable	3-wire twisted cable with screening (DGND is connected to the ground cable)
Topology	Serial bus, electrically isolated, tree structure
Functionality	Slave Only Modbus provides Varec MFT parameter mapping for easier setup in retrofit applications. It provides direct connection to PLC and DCS systems.
Distance	Maximum 3,600 ft (1,200 m) including limbs or branches (negligible with branches under 3 m)
Isolation	Bus inputs are electrically isolated from the other electronics

**Bidirectional serial pulse (V1 protocol)**

No. of units	Maximum 10 instruments per loop
Baud rate	3,300 BPS
Cable	Two wire (twisted pair) unscreened cable
Transmission distance	Maximum 18,000 ft (6,000 m)
Versions	V1 (new V1) MDP (old V1) BBB (old V1) MIC+232 (old V1) (in preparation)
Topology	Serial bus, tree structure
Isolation	Serial communication circuit isolated from other circuits

**GPE**

No. of units	16
Baud rate	2,400 or 4,800
Cable	Four (4) wire
Topology	Current loop

**Whessmatic 550**

No. of units	16 instruments per loop
Baud rate	1,200 / 2,400 bit/s
Cable	4-wire, twisted pairs with screening
Transmission distance	Depending on specifications Max. distance: 7000 m
Topology	20 mA dual (Redundant) current loop
Instrument address	Setting by DIP switches on communication board
Isolation	Current loop circuit isolated from other circuits

**Mark/Space**

No. of units	50+ (Depending on specifications; consult a Varec Engineer)
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Baud rate	1,200 / 2,400 / 4,800 / 9,600 / 19,200 bits
Cable	Four (4) wire, twisted pairs
Transmission distance	Depending on specifications
Topology	Serial bus, tree structure
Isolation	Serial communication isolated from other circuits
Functions	Tankway supports product level, temperature and discrete inputs.

**Enraf Bi-Phase Mark (GPU-BPM)**

No. of units	Maximum 10 instruments per loop
Baud rate	1,200 / 2,400 bits, selectable
Cable	Two wire, twisted cable with screening
Transmission distance	Maximum 10 km
Topology	Serial bus, electrically isolated, tree structure
Isolation	Serial communication circuit isolated from other circuits
Compatibility	The 4590 TSM is fully compatible to ENRAF (802, 812), 811, 854 and 954 series servo gauges, 813 MGT (mechanical gauge transmitter), 872, 873 and 973 series Radar gauges, 874 AIM (Analogue Input Module) and the 875 VCU (Valve Command Unit).

**L&J Tankway**

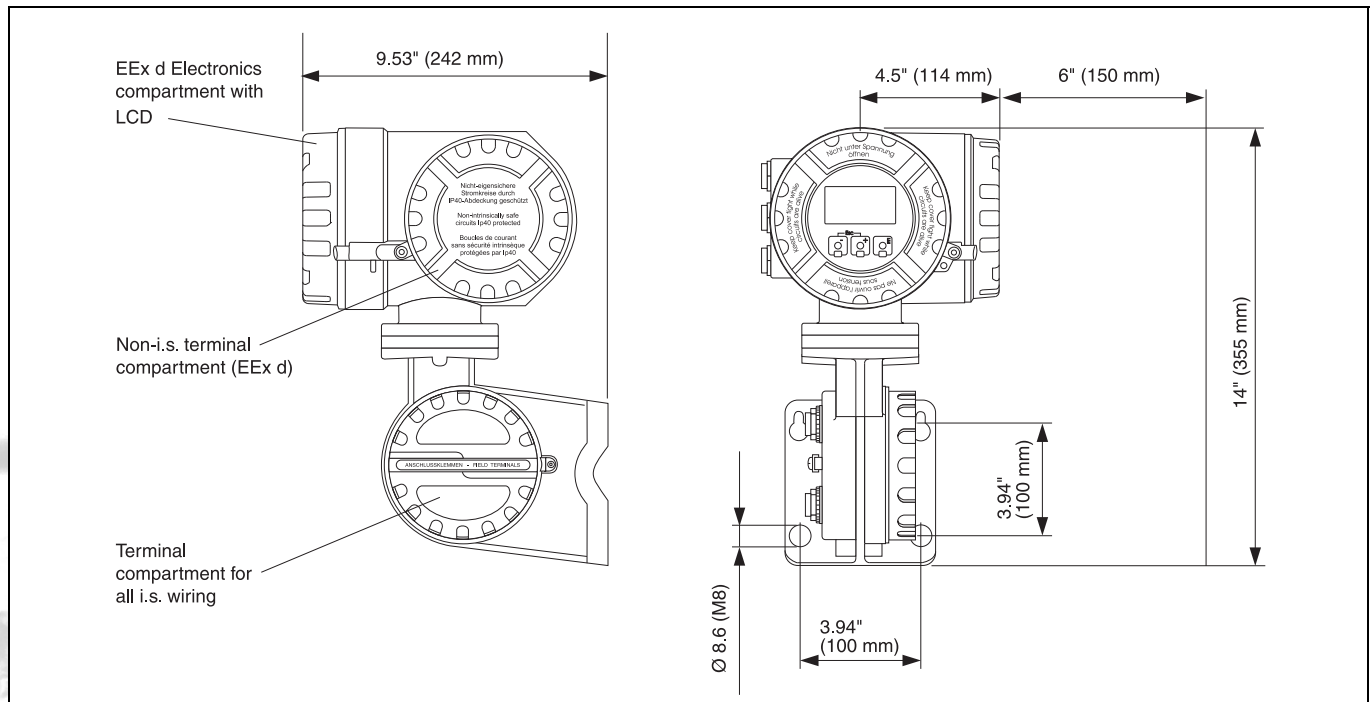
No. of units	50+
Baud rate	1200
Cable	Four (4) wire, twisted pairs
Functions	Tankway supports product level, temperature and discrete inputs.

**HART interface**

IS (intrinsically safe)	HART Master for measuring device connection
Non-IS (if selected by order code)	user settable: HART Master HART Slave (active 4–20 mA when address is "0")



## Product Dimensions



## Order Codes

10	<b>Certificates</b>	
	A	For non-hazardous areas
	6	ATEX II 2 (1) EEx d (ia) IIC T6
	U	CSA XP Cl. I, Div 1, Gr. A-D
	S	FM XP Cl. I, Div 1, Gr. A-D
	Y	Special version, to be specified
20	<b>Field communication protocol</b>	
	E	ENRAF BPM, non-I.S. 4-20mA input, non-I.S. 4-20mA HART Master output
	G	GPE, non-I.S. 4-20mA HART Master output
	1	WM550, non-I.S. 4-20mA output, Whessoe protocol with dual communication
	3	Varec Mark/Space, non-I.S. 4-20mA input, non-I.S. 4-20mA HART Master output
	5	Modbus, non-I.S. 4-20mA input, non I.S. 4-20mA HART Master output, EIA 485
	7	L&J, non-I.S. 4-20mA input, non-I.S. 4-20mA HART Master output
	8	V1, non-I.S. 4-20mA output, non-I.S. 4-20mA HART Master output, relay output
	9	Special version, to be specified
30	<b>Power supply</b>	
	A	Power supply 18...55 VAC/DC
	B	Power supply 55...264V AC
	Y	Special version, to be specified
40	<b>Spot RTD option</b>	
	0	Without RTD temperature input
	1	With spot RTD temperature input, I.S.
	9	Special version, to be specified
50	<b>Discrete I/O Module A</b>	
	A	Without discrete input/output module A
	B	Discrete input module A, 90...140V AC
	C	Discrete input module A, 3...32V DC
	D	Discrete input module A, 180...280V AC
	E	Discrete input module A, 35...60V AC/DC
	G	Discrete output module A, 24...280V AC
	H	Discrete output module A, 3...60V DC
	J	Discrete output module A, 24...140V AC
	K	Discrete output module A, 4...200V DC
	R	Relay output A, 0-100 VDC, 0-120VAC
	Y	Special version, to be specified



