

Inventory Control

Tank Side Monitor NRF 590

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



Application

The Tank Side Monitor NRF 590 is a sensor integration and monitoring unit for bulk storage tank gauging applications. It can be used with Micropilot level radars and combined with other HART compatible devices.

The Tank Side Monitor 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 determination of the tank content

Features and benefits

- i.s. power supply and communication for Micropilot M and S level radars
- Connects up to 6 HART devices via i.s. 2 wire, for example Prothermo for average temperature measurement and Cerabar/Deltabar for HTMS density applications
- Backlit graphical LCD display; operation via 3 optical keys (touch control)
- User-friendly operating menu
- Interfaces to FuelsManager SCADA tank inventory system via RTU 8130
- Provides communication to PLC, DCS and SCADA systems
- Various industry standard communication protocols, including
 - **Sakura V1**
 - **EIA-485 Modbus**
 - **Whessoematic WM 550**
 - **Enraf BPM**
- Approved for use in explosion hazardous areas

Endress + Hauser

The Power of Know How



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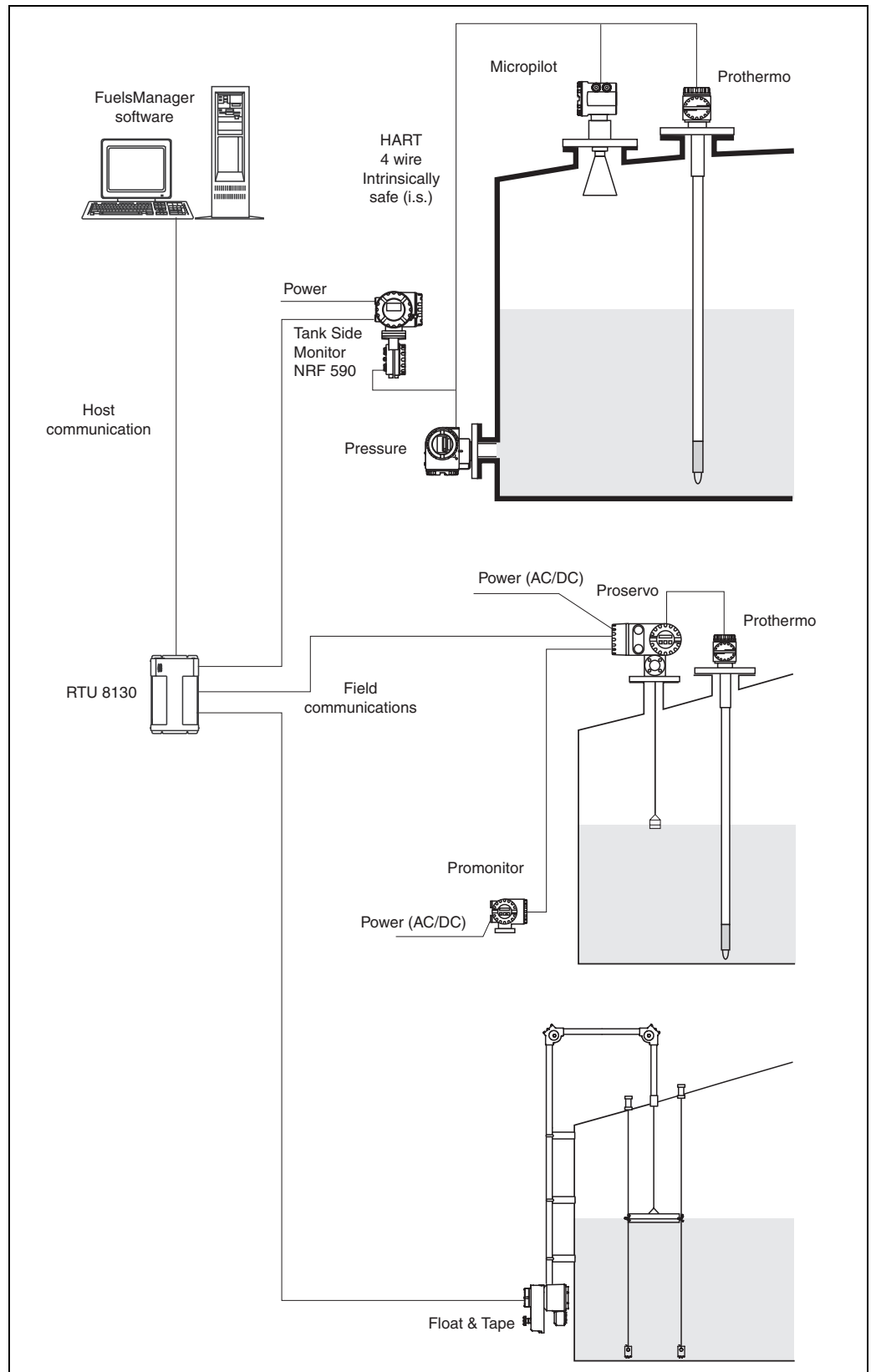
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Function and system design

Application

The Tank Side Monitor NRF 590 is a field device for the integration of tank sensors into tank inventory systems. It is used in tank farms, terminals and refineries. The Tank Side Monitor was developed primarily for interfacing with the Micropilot M-series radar for inventory control and the high-accuracy Micropilot S-series radar for custody transfer applications.

Typical measuring system

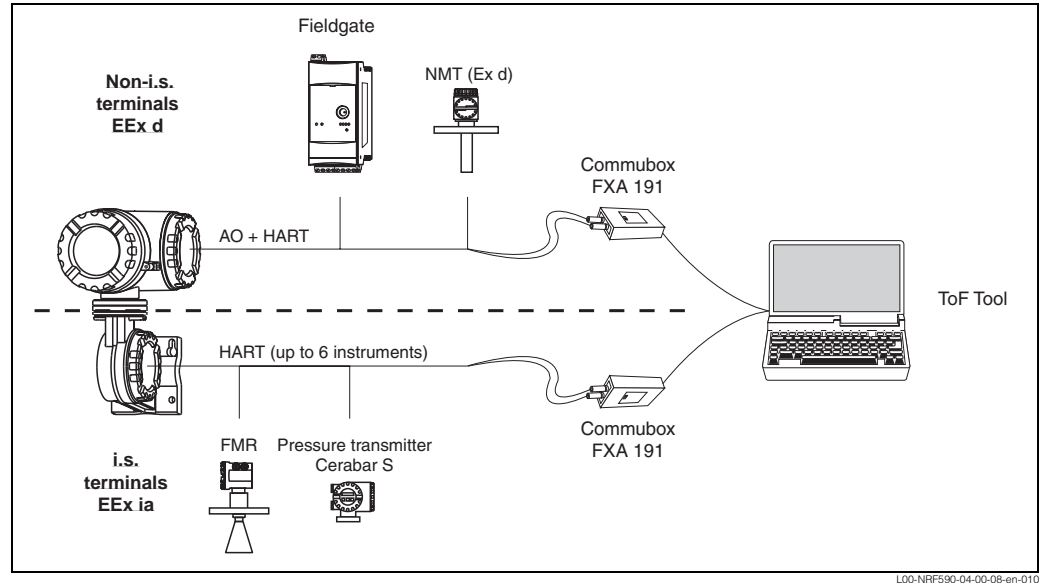


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Operating principle

The Tank Side Monitor is typically installed at the bottom of the tank and allows to access all connected tank sensors. It 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 Tank Side Monitor can transfer the values to an inventory control system.

HART sensor connection



Up to 6 sensors can be connected in multidrop mode to the intrinsically safe HART loop. Typical process variables measured by the HART sensors are:

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

Power supply

The Tank Side Monitor provides intrinsically safe power for 2-wire instruments. It also can provide intrinsically safe power for the 4-wire instrument Micropilot S.

Operation

For the following instruments, the operating menu (including the envelope curve display for Micropilot M and S) can be accessed on the display of the Tank Side Monitor:

- Micropilot M: FMR 230/231/240/244/245
- Micropilot S: FMR 530/531/532/533
- Prothermo: NMT535/536/537/538
- Prothermo: NMT539 (including Water Bottom Probe)
- Whessoe Varec 1646 Temperature Transmitter
- Cerabar S: PMC/PMP

Any other HART instrument can be operated via the universal HART commands.

Non-i.s. HART loop (only for software version 02.00)

The non-i.s. HART loop which is combined with one of the analogue outputs provides both active master and active slave functions.

In master mode, up to 6 HART sensors can be connected in multidrop mode.

In slave mode, a fixed current is provided along with communication suitable for connection of Fieldgate for reading of the Tank Side Monitors tank values and remote configuration of both the NRF590 and connected HART devices.

Optional inputs and outputs

The following inputs and outputs are available as options:

- i.s. input for 3- or 4-wire RTD spot temperature sensor
- i.s. analogue 4...20 mA input
- 2 i.s. discrete inputs
- non-i.s. analogue 4...20 mA input or output (depending on selected field protocol)
- 2 non-i.s. discrete inputs or outputs

Tank calculations

The Tank Side Monitor can perform all necessary calculations for the following modes:

- level mode (one level sensor)
- hydrostatic mode (one or two pressure sensors)
- hybrid mode (level and pressure sensor)

Also, it can automatically calculate the following corrections:

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

Overfill protection

The Tank Side Monitor provides three modes of overfill protection:

- **AL+DO (alarm + discrete out)**

The measured value of the level sensor is evaluated in the alarm block. Exceeding of the limit value is indicated at the discrete output (Ex d).

- **AO (analogue out)**

The measured value of the level sensor is transferred to the analogue output (Ex d) without change. It can then be used by an external overfill protection system.

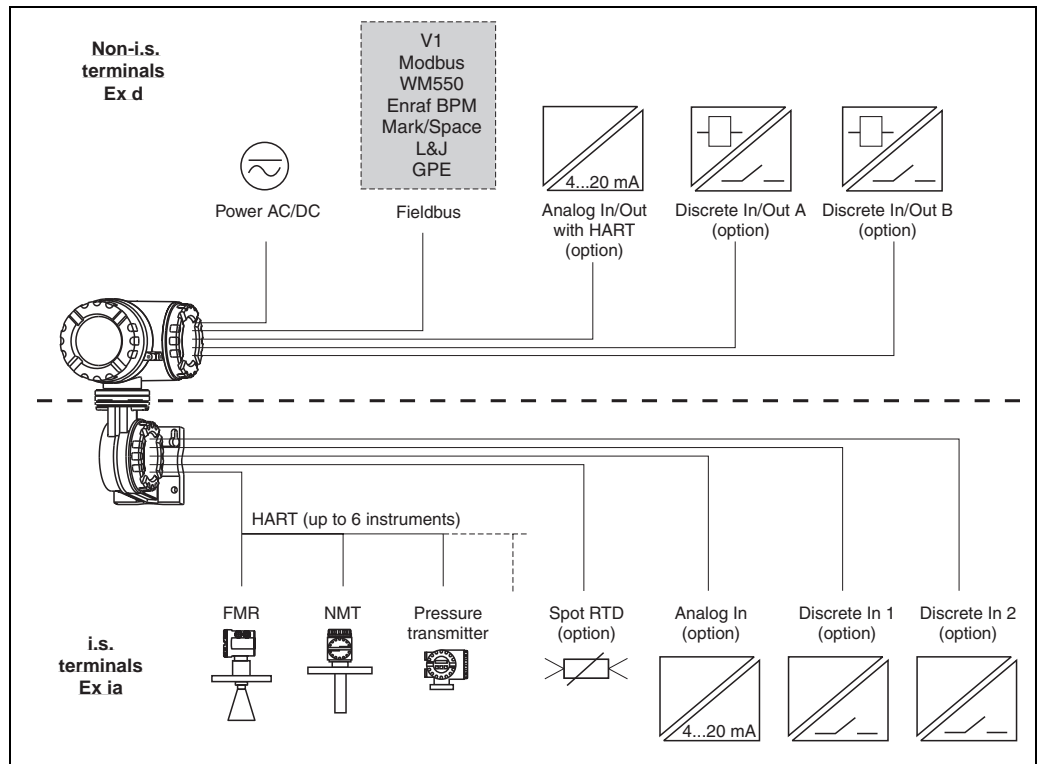
- **DI+DO (discrete in + discrete out)**

A discrete signal is transferred without change from the discrete input (Ex i) to the discrete output (Ex d).

As soon as one of these modes is activated, all parameters relevant to overfill protection are locked and in some cases are preset to specific overfill protection settings.

Input and output

Overview



Fieldbus

The Tank Side Monitor NRF 590 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.

Sakura V1

V1 protocol provides a standard form of digital communication via a two-wire system. V1 was brought to the market by Sakura Endress and meets the demands of the Japanese market. The Tank Side Monitor implementation of the V1 slave protocol supports various old and new V1 protocols:

- V1 (new V1)
- MDP (old V1)
- BBB (old V1)
- MIC+232 (old V1)

EIA-485 (RS) Modbus

In Modbus, the flow of data between two devices uses a master/slave protocol. The NRF 590 acts as a Modbus slave and runs on the EIA-485 (RS) version of the MODBUS communications board. Modbus provides Varec MFT parameter mapping for easier setup in retrofit applications. It provides direct connection to PLC and DCS systems.

Whessoematic WM550

WM550 protocol provides a standard form of digital communication via dual current loops. WM550 was developed to facilitate communications to transmitters installed on mechanical float and tape gauges. It is a two-wire system and the only protocol with a redundant loop.

Enraf BPM

Enraf BiPhaseMark (BPM) protocol provides compatibility to Enraf systems by emulating the Enraf GPU-BPM protocol. The NRF 590 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).

Varec Mark/Space

Mark/Space protocol provides a standard form of digital communication via a voltage mode bus. Mark/Space was developed to facilitate communication to transmitters installed on mechanical float and tape gauges. It supports product level, temperature and discrete inputs.

L&J Tankway

L&J Tankway protocol provides a standard form of digital communication via a voltage mode bus. Tankway supports product level, temperature and discrete inputs.

GPE

GPE protocol provides a standard form of digital communication via a current loop. It is compatible with L&J and GPE mechanical float and tape and servo instrumentation.

Transmitted values

The following values can be transmitted by the communication protocols:

	V1	Modbus	WM550	Enraf	Mark/ Space	L&J Tankway	GPE
Level	yes	yes	yes	yes	yes	yes	yes
Water Level	yes	yes	yes	yes	-	-	-
Temperature	yes	yes	yes	yes	yes	yes	yes
Vapor Temperature	yes	yes	-	yes	-	-	-
Pressure	yes	yes	only 1	yes	-	-	-
Density	yes	yes	yes	yes	yes	yes	-
Discrete IO	yes	yes	yes	yes	-	-	-
Other Values	yes	yes	yes	yes	-	-	only 1
Additional Information	KA 211F	KA 192F	KA 210F	KA 223F	KA 208F	KA 209F	KA 207F

Additional inputs and outputs

Depending on the protocol, the Tank Side Monitor uses the software version 01.xx or 02.xx and has the following additional inputs and outputs:

	V1	Modbus	WM550	Enraf	Mark/ Space	L&J Tankway	GPE
Software version	02.00 ¹	02.00 ¹	02.00 ¹	02.00	01.xx	01.xx	01.xx
Discrete In/Out A	option, s. pos. 50 of the product structure						
Discrete In/Out B	option, s. pos. 60 of the product structure						
Discrete Out C	standard	-	-	-	-	-	-
Analogue In	-	option ²	-	standard	option ²	standard	-
Analogue Out	+HART ³	+HART ^{2,3}	+HART ³	+HART	option ²	standard	standard
Analogue Out 2	standard	-	standard ³	-	-	-	-
IS Discrete In 1	standard ³	standard ³	standard ³	standard	-	-	-
IS Discrete In 2	standard ³	standard ³	standard ³	standard	-	-	-
IS Analogue In	standard ³	standard ³	standard ³	standard	-	-	-
IS RTD	option, s. pos. 40 of the product structure						

- 1) software version 02.00 is in preparation for these protocols; for the present, version 01.xx is still used
- 2) see pos. 20 of the product structure
- 3) in preparation; will be available for software version 02.00

Non-i.s. inputs and outputs Discrete inputs/outputs A and B

The Tank Side Monitor can be equipped with 1 or 2 discrete I/O modules.
Available types: see position 50 and 60 of Product Structure or chapter "Accessories".

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

Analogue 4...20 mA input (option, s. pos. 20 of the product structure)

Internal load (to ground)	100 Ω
Measuring range	0 ... 30 mA
Accuracy	$\pm 4 \mu\text{A}$ (after linearisation and calibration)
Digitising steps	6 nA (before linearisation and calibration)

Analogue 4...20 mA outputs (option, s. pos. 20 of the product structure)

Output current	3 ... 24 mA
Output voltage	max. 25 V
Output load	max. 500 Ω
Accuracy	$\pm 4 \mu\text{A}$ (after linearisation and calibration)
Digitising steps	380 nA (before linearisation and calibration)

HART input loop (for software version 02.00)

Source voltage	nominal 24 V
total I_{max}	6 x 4 mA = 24 mA (including start-up current) Exceeding I_{max} will result in the loop voltage reducing immediately to 0V due to the internal current limitation circuit.
connectable sensors	max. 6

i.s. inputs and outputs**HART input loop**

Source voltage	min. 16 V
total I_{\max}	6 x 4 mA = 24 mA (including start-up current)
connectable sensors	max. 6

Discrete inputs (option, s. pos. 70 of the product structure)

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

Analogue 4...20 mA input (option, s. pos. 70 of the product structure)

Internal load (to ground)	100 Ω
Measuring range	0 ... 30 mA
Accuracy	$\pm 4 \mu\text{A}$ (after linearisation and calibration)
Digitising steps	6 nA (before linearisation and calibration)

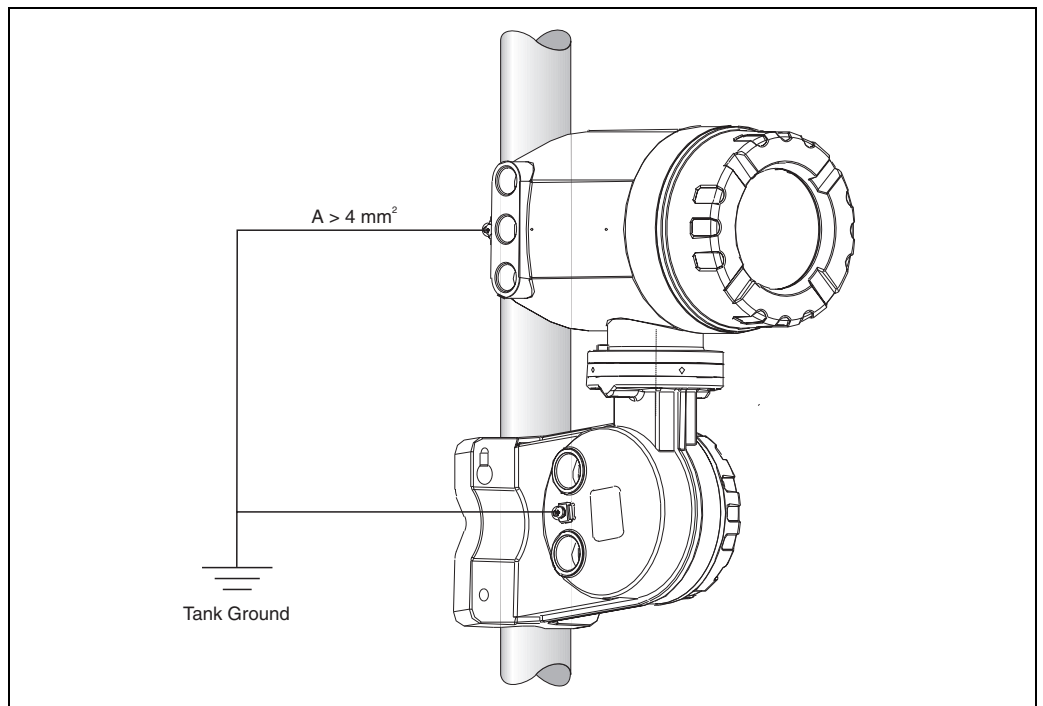
Spot RTD input (option, s. pos. 40 of the product structure)

Measuring range	0 ... 400 Ω
Excitation current	typ. 400 μA , max. 2000 μA
Excitation voltage	1,25 V
Digitising steps	18 $\mu\Omega$ (before linearisation and calibration)

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

Auxiliary energy

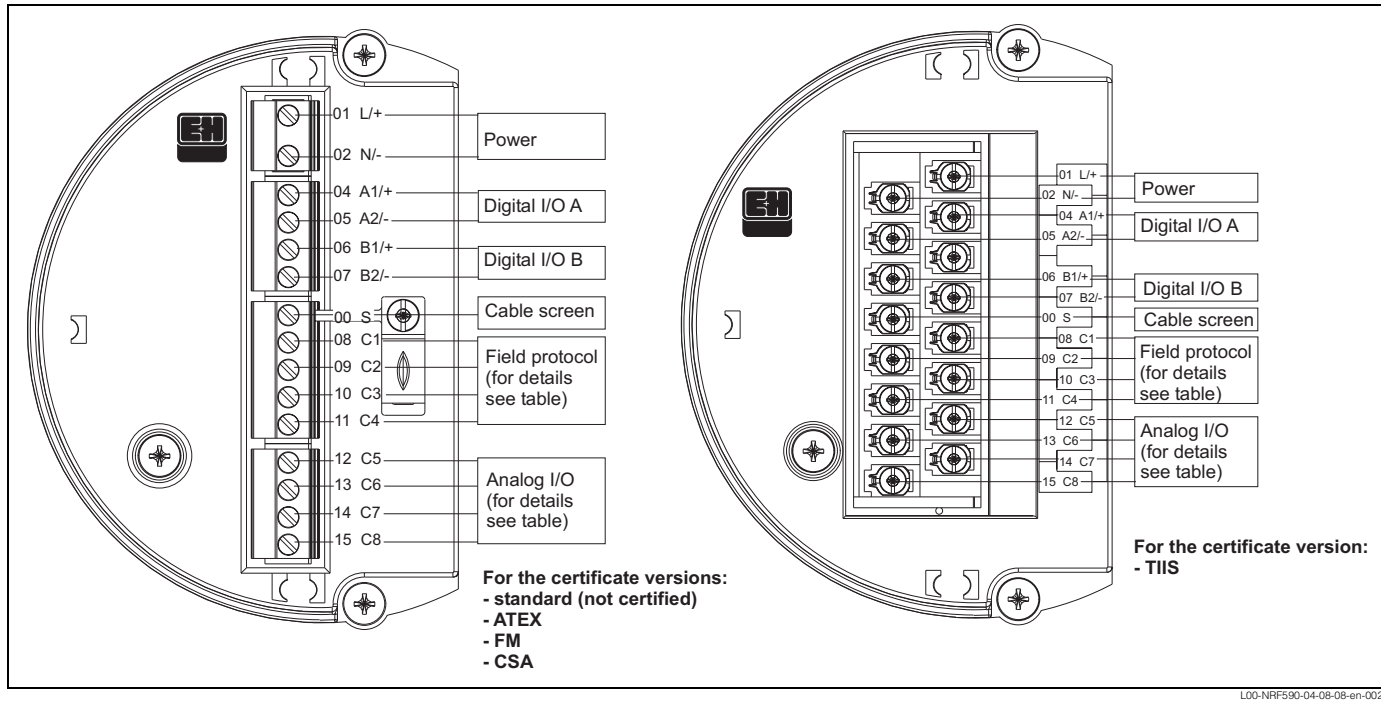
AC supply	55 ... 264 VAC
DC supply	18 ... 50 VDC
Power consumption	<ul style="list-style-type: none"> • 370 mA @ 24 VDC • 200 mA @ 48 VDC • 75 mA @ 125VAC • 45 mA @ 220 VAC
Fuse	Internal (on primary power)
Grounding	<p>The NRF 590 must be grounded to the tank potential before communication and power connections are made. The connections ($A \geq 4 \text{ mm}^2$) from each outer ground lug of the NRF 590 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.</p>



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Electrical connection - non-i.s. terminals

Terminal assignment



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Terminal	01 L/+	02 N/-	04 A1/+	05 A2/-	06 B1/+	07 B2/-	00 S
	Power supply		Discrete I/O - 1A	Discrete I/O - 2A	Discrete I/O - 1B	Discrete I/O - 2B	Cable screen

	08 C1	09 C2	10 C3	11 C4	12 C5	13 C6	14 C7	15 C8
V1	4 ... 20 mA output ² #2	V1A	V1B	0 V	0 V	4 ... 20 mA output ² #1 + HART ³	discrete output ² 1C	discrete output ² 2C
EIA-485 Modbus	0 V	485-B	485-A	0 V	0 V	4 ... 20 mA output ¹ + HART ³	4 ... 20 mA input ¹	+24 V
Whessoe WM550	0 V	Loop 1-	Loop 1+	0 V	0 V	4 ... 20 mA output ² + HART ³	Loop 2-	Loop 2+
Enraf BPM	0 V	A	B	0 V	0 V	4 ... 20 mA output ² + HART	4 ... 20 mA input ¹	+24 V
Varec Mark/Space	V+	Space	Mark	0 V (V-)	0 V	4 ... 20 mA output ¹	4 ... 20 mA input ¹	+24 V
L&J Tankway	Power	Encoder	Computer	Ground	0 V	4 ... 20 mA output ¹	4 ... 20 mA input ¹	+24 V
GPE	0 V	Loop 1-	Loop 1+	0 V	0 V	4 ... 20 mA output ²	do not connect	do not connect

¹ These signals are not connected to main boards without 4 ... 20 mA option.

² Standard

³ From software version 02.00 onwards

Connection of the field protocols

Sakura V1

The V1 protocol provides 2 wire communication. V1 connects to terminals 9-10.

EIA-485 Modbus

The NRF 590 protocol uses a shielded 3-wire EIA-485 hardware interface to communicate with the modbus master. EIA-485 is a high speed, differential communications network that allows up to 32 devices to operate on one network.

- Using one shielded twisted pair of 18 AWG wire, connect the EIA-485 at terminal 9 and 10.
- Terminate the EIA-485 bus at the NRF 590 most distant from the host computer by placing a 120 Ohm 1/2 watt resistor between terminals 9 and 10.
- Wire the EIA-485 ground to terminal 8.
- Max distance: 4000 ft (1300 M)

Whessoematic WM550

The WM550 protocol provides 2 wire, current loop communication and allows up to 32 devices per loop (16 with lightning protection). For redundancy (safety function) two wire pairs are used. They always transmit the same values. The WM550-loops connect to terminals 9 - 10 and 14 - 15.

Enraf BPM

The Enraf BPM protocol provides 2 wire communication. Enraf BPM connects to terminals 9-10.

Varec Mark/Space

For a NRF 590 using the Mark/Space field communications option, the following additional wiring connections must be made:

- Run 2 twisted pairs of 18 AWG wire (Mark/Space wires) into the upper terminal compartment through one of the conduit entries along with the 48 Vdc power wiring.
- Connect the Mark line to terminal 10 and the Space line to terminal 9.
- Connect to power supply at terminals 8 and 11.

L&J Tankway

Including power and ground, L&J is a 4-wire system, allowing 50+ devices to be connected on the communication bus. L&J connects to terminals 8 through 11.

GPE

The GPE protocol provides 2 wire current loop communication. GPE connects to terminal 9-10.

Auxiliary energy

The Tank Side Monitor can be AC or DC supplied, depending on the installed power supply board. The AC supply needs to be connected to the terminals marked L/+ (Line) and N/- (Neutral), corresponding with the phase/line and neutral wire. DC supply can be connected to the same terminals, for which it is suggested to connect the positive (+) to the terminal marked (L/+), and the negative to the terminal marked (N/-). However, since the supply board is bipolar, no damage will occur when the wires are swapped and the Tank Side Monitor will operate correctly.

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

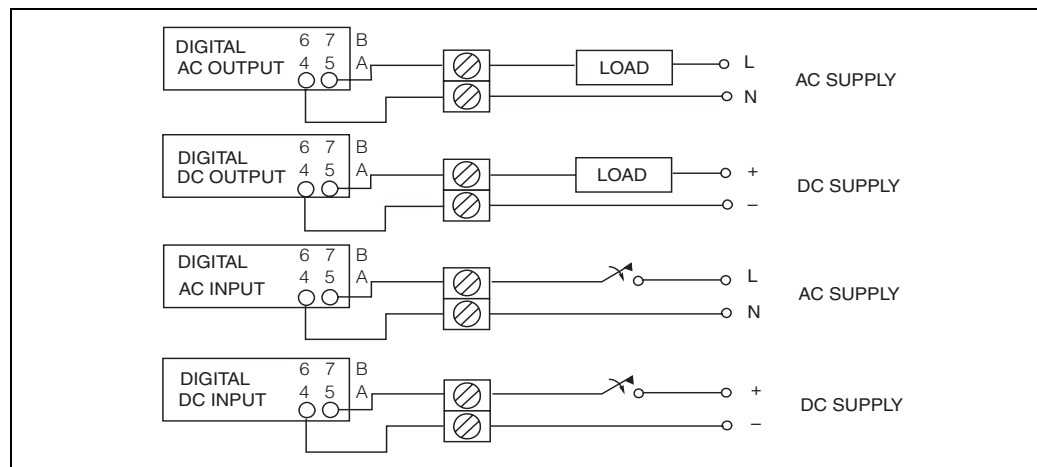
Depending on the selected fieldbus communication board, a non-i.s. self-powered or loop powered analogue transmitter can be connected. The analogue signal for the loop powered transmitter can be connected to the terminals 14 (-) and 15 (+24 Vdc). The maximum supply current for the analogue transmitter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

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

Depending on the selected fieldbus communication board, a non-i.s. analogue 4...20 mA output can be available. Via software settings, this analogue output can be connected to any parameter in the Tank Side Monitor. The analogue output is available between terminals 13 (+) and 12(0 V) and terminals 8 (+) and 11 (0V).
From software version 02.00 onwards, an additional HART signal is available at terminal 13.

Discrete I/O

The Tank Side Monitor can be equipped with 1 or 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. For details on available I/O modules, see Page 28.



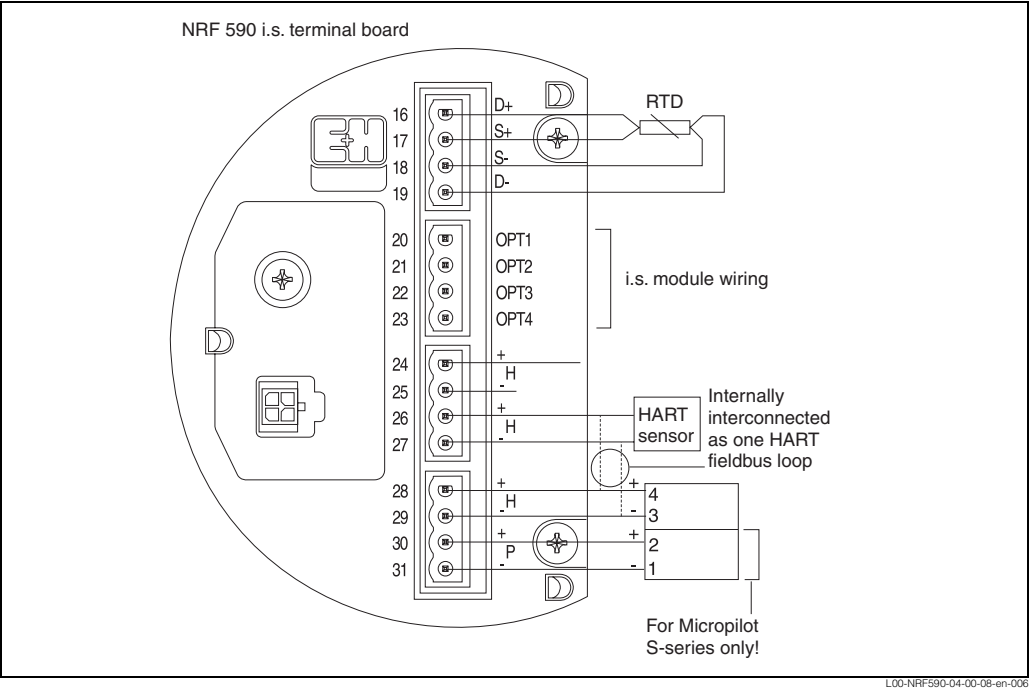
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Note!
250 VAC is the maximum load that can be connected.

Electrical connection - i.s. terminals

Terminal assignment



L00-NRF590-04-00-08-en-006

Terminal	Designation	Meaning
16	D+	+ RTD drive ¹
17	S+	+ RTD sense ¹
18	S-	- RTD sense ¹²
19	D-	- RTD drive ²³
20	OPT1	depending on option 70 of the product structure; connection diagram: see below
21	OPT2	
22	OPT3	
23	OPT4	
24	H+	+HART comm. ⁴
25	H-	-HART comm. ³
26	H+	+HART comm. ⁴
27	H-	-HART comm. ³
28	H+	+HART comm. ⁴
29	H-	-HART comm. ³
30	P+	+ i.s. power for FMR S-series (terminal 2)
31	P-	- i.s. power for FMR S-series (terminal 1) ³

¹ These signals are not connected on i.s. boards without RTD option.

² For a 3-wire RTD, terminals 18 and 19 should be connected together.

³ All these terminals share the same i.s. 0 V signal.

⁴ These three terminals share the same H+ signal.

HART connection

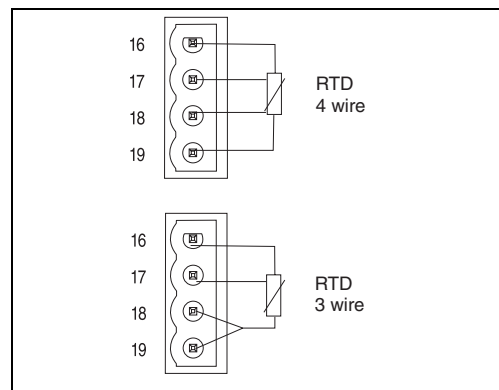
Tank sensors

The Tank Side Monitor 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 keep wiring simple, 3 interconnected terminal pairs are available. The terminal pairs are marked respectively H+ and H-.

FMR S-series

For supplying extra i.s. power to the FMR S-series radar, additional power terminals are available, marked as P+ and P-. Although it is possible to use only 3 wires between the S-series radar and the NRF 590, by combining the P- and H- wires, it is recommended to use a double pair of screened and twisted cable.

Spot RTD



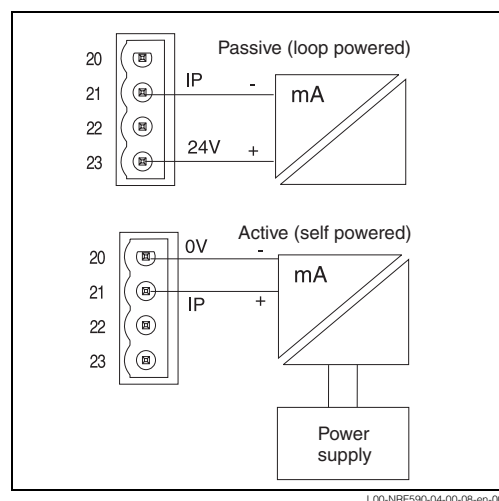
A spot RTD can be connected to the NRF 590 if the option is installed. For 4-wire connection, the RTD must be connected to the 4 available terminals marked D+, S+, S- and D-. For 3-wire connection, the RTD should be connected to the same 4 terminals. The terminals D- and S- should be connected together.

Additional intrinsically safe 4 ... 20 mA analogue input

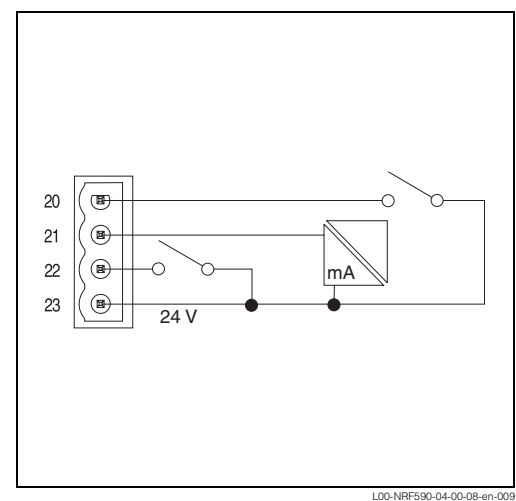
If the appropriate option has been selected (s. option 70 of the product structure), the following is available:

- an intrinsically safe analogue input (opt. 70 = 1)
- an intrinsically safe analogue input and two additional discrete inputs (opt. 70 = 2)

Opt. 70 = 1



Opt. 70 = 2



Performance characteristics

Accuracy

HART sensors

Accuracy of all data from connected HART sensors depends on the type and installation of instruments. The use of the digital HART protocol prevents accuracy data degradation, as would be the case with analogue (4...20 mA) sensors.

Spot RTD input, analogue inputs, analogue outputs

see tables P. 10

Resolution

Resolution of all measured data depends on sensor and communication settings. The following settings are recommended for inventory and custody transfer applications:

Data type	Units	Inventory control	Custody transfer
Level	millimeters	1 mm	1 or 0,1 mm
	meters	10 mm	1 or 0,1 mm
	feet	0.01 ft	0.01 ft
	inches	1" or 0,1"	0.01" or 0.001"
	ft-in-16	1/16"	1/32"
Temperature	°C	0,1 °C	0,1 °C
	°F	0.1 °F	0,1 °F

For purpose of consistency all internal calculations are in SI units.

Scan time

HART sensors

Data is scanned at 1200 baud and data status is updated at least every 300 milliseconds.

Spot RTD input

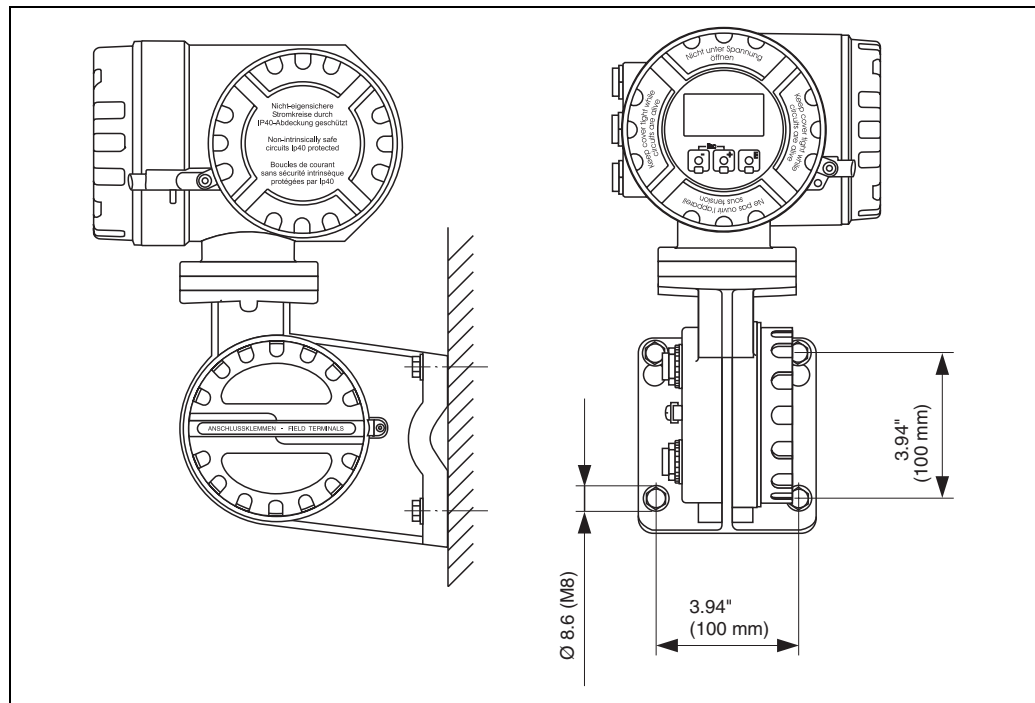
RTD resistance is measured and recalculated at least every second.

Reaction time

All discrete in- and outputs and the analogue output are corrected/adjusted at least every 500 milliseconds.

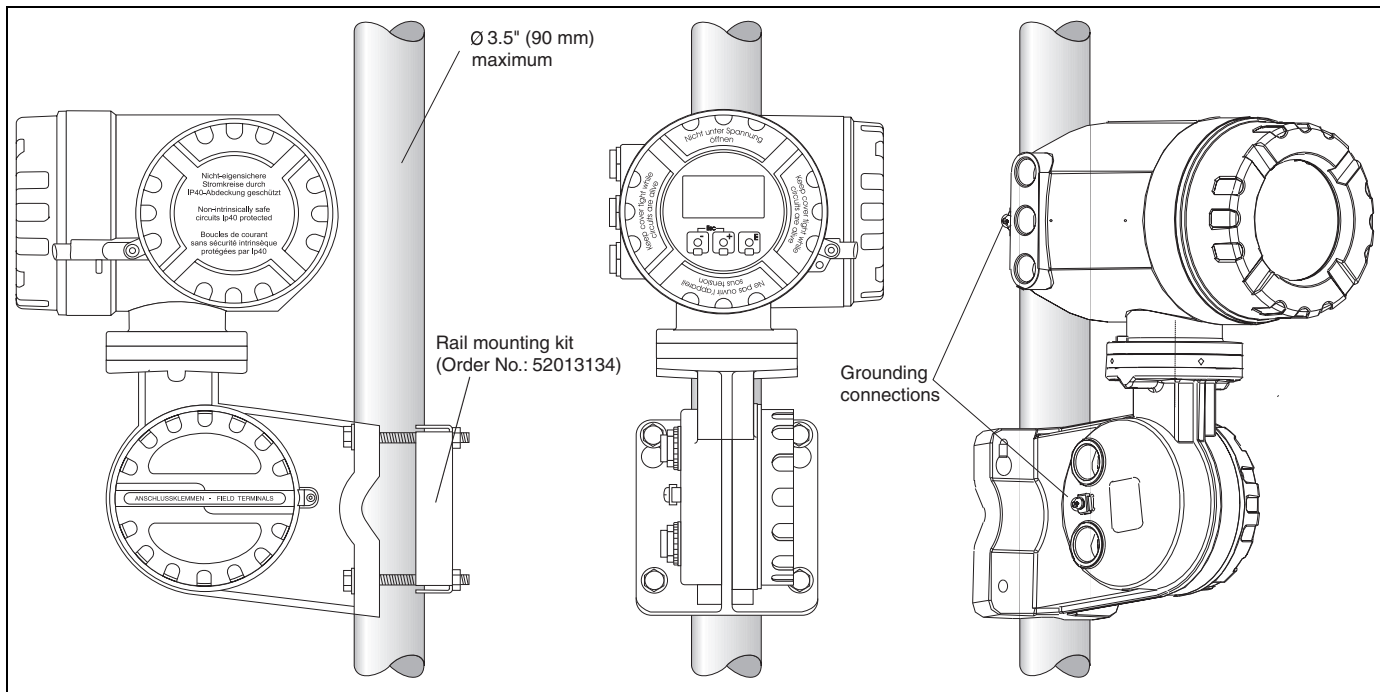
Installation conditions

Wall mounting



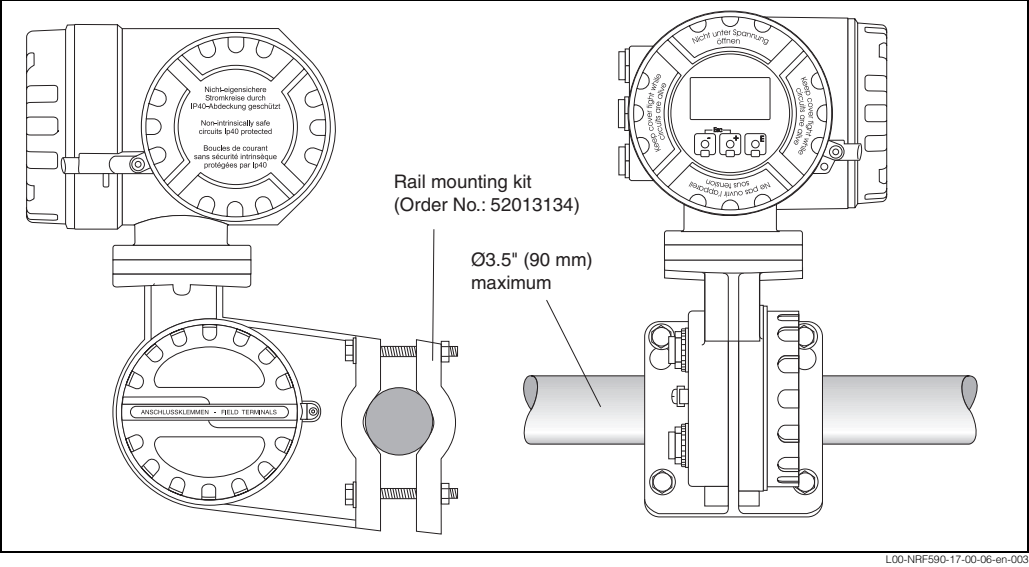
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Mounting on vertical rail



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Mounting on horizontal rail



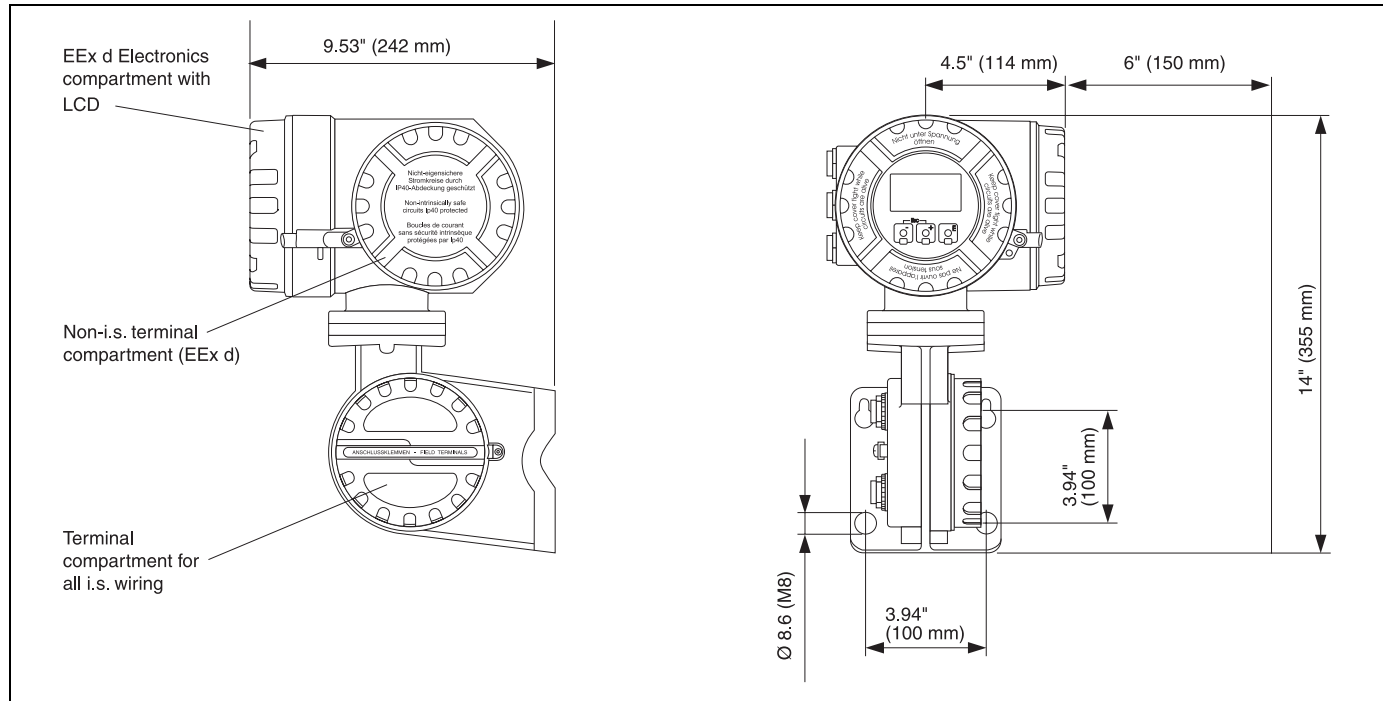
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Ambient conditions

Ambient temperature	-40 °C ... +60 °C (-40 °F ... +140 °F)
Storage temperature	-55 °C ... 85 °C (-67 °F...185 °F)
Ingress protection	IP65, Nema 4X
Electromagnetic compatibility (EMC)	<ul style="list-style-type: none">• Interference emission to EN 61326, Equipment class A• Interference immunity to EN 61326 Use shielded signal lines for installation.

Mechanical construction

Design, dimensions



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Construction

The NRF 590 housing has three separate compartments, one containing all electronics and two for electrical connections. The enclosure is die-cast aluminum with an epoxy coating and IP65 (NEMA 4) rating. 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.

Weight

approx. 8 kg

Cable entries

The non-i.s. terminal compartment has 3 cable entries. The threading in this terminal compartment enclosure is M20x1.5. All intrinsically designated wiring has to be terminated in the i.s. terminal compartment. For the i.s. wiring, two M25x1.5 cable entries are available.

For accommodating various types of cable glands or cable conduit (rigid or flexible), the following sizes of cable gland adapters are optionally available:

- M20x1.5
- G1½
- ½" NPT
- ¾" NPT (max. 2 cable entries)

All adapters are rated EEx d and can be used for either cable connection. When installing, properly seal all ports to prevent moisture or other contamination from entering the wiring compartments.

Human interface

Display and operating elements

Liquid crystal display (LCD)

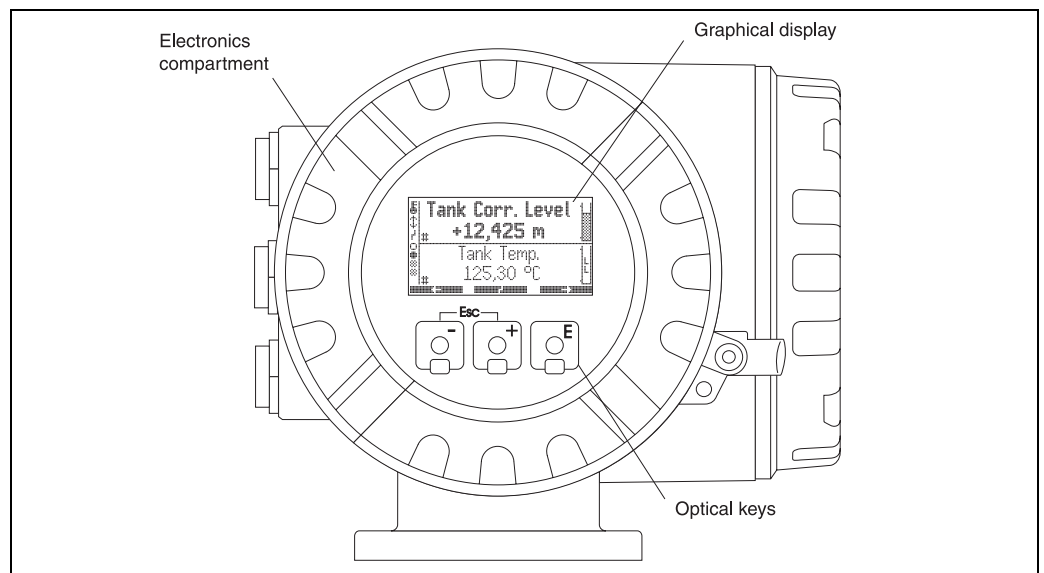
Four lines with 20 characters each. Display contrast adjustable through key combination. The following display languages can be selected by the user:

- English
- German¹
- French¹
- Italian¹
- Spanish¹
- Dutch¹
- Japanese^{1,2}
- Simplified Chinese^{1,3}

¹ for software version 02.00

² Japanese font: JIS X 208-1997 including Hiragana, Katakana and Kanji

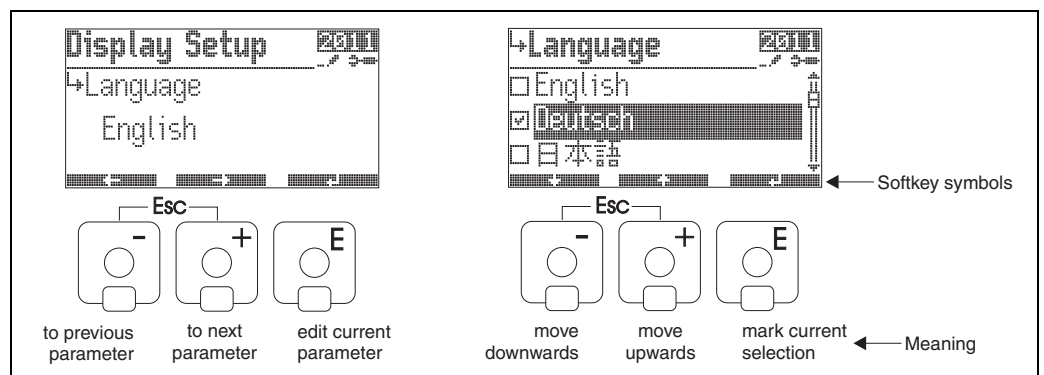
³ Chinese font: GB18030, CITS Committee approved



L00-NRF590-07-00-00-en-001

Optical keys

The optical keys allow to operate the Tank Side Monitor without the housing being opened. From Software Version 2.0 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:

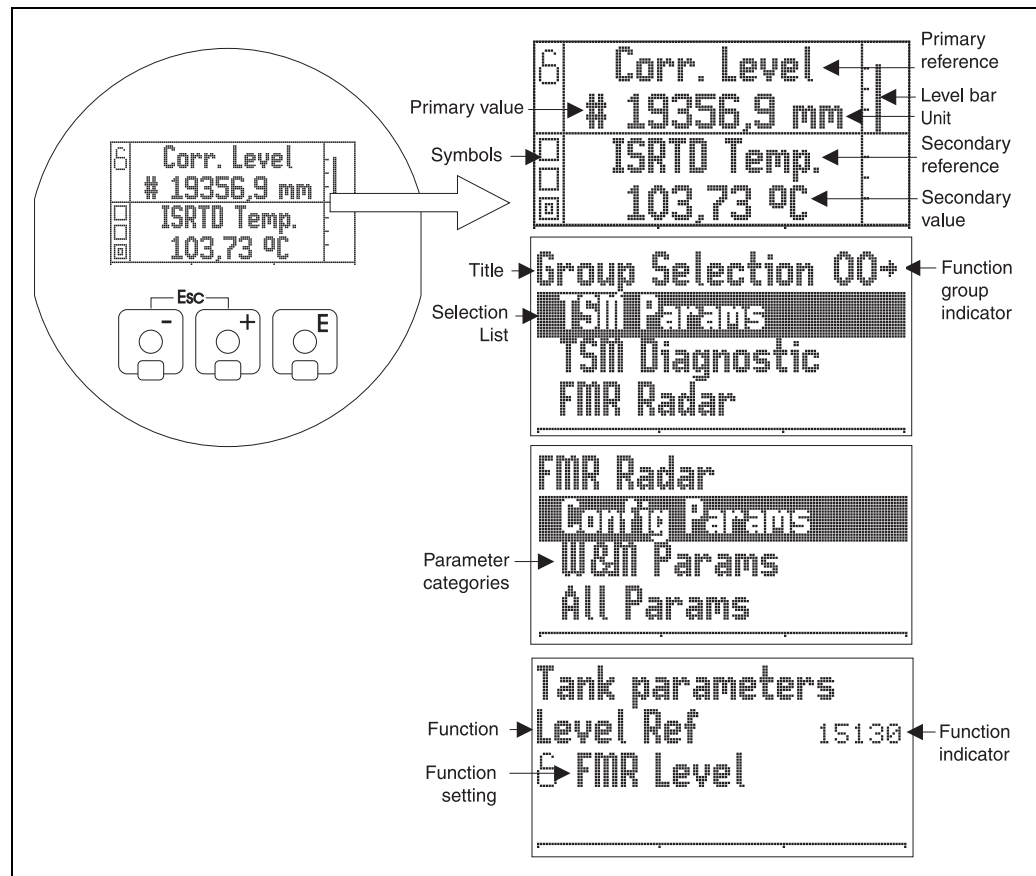


L00-NRF590-07-00-00-en-003

Operating concept for
software version SW 01.xx

Operating Menu

The Tank Side Monitor is operated via a four-layer menu. The appearance of the LCD changes according to the current position within the menu.



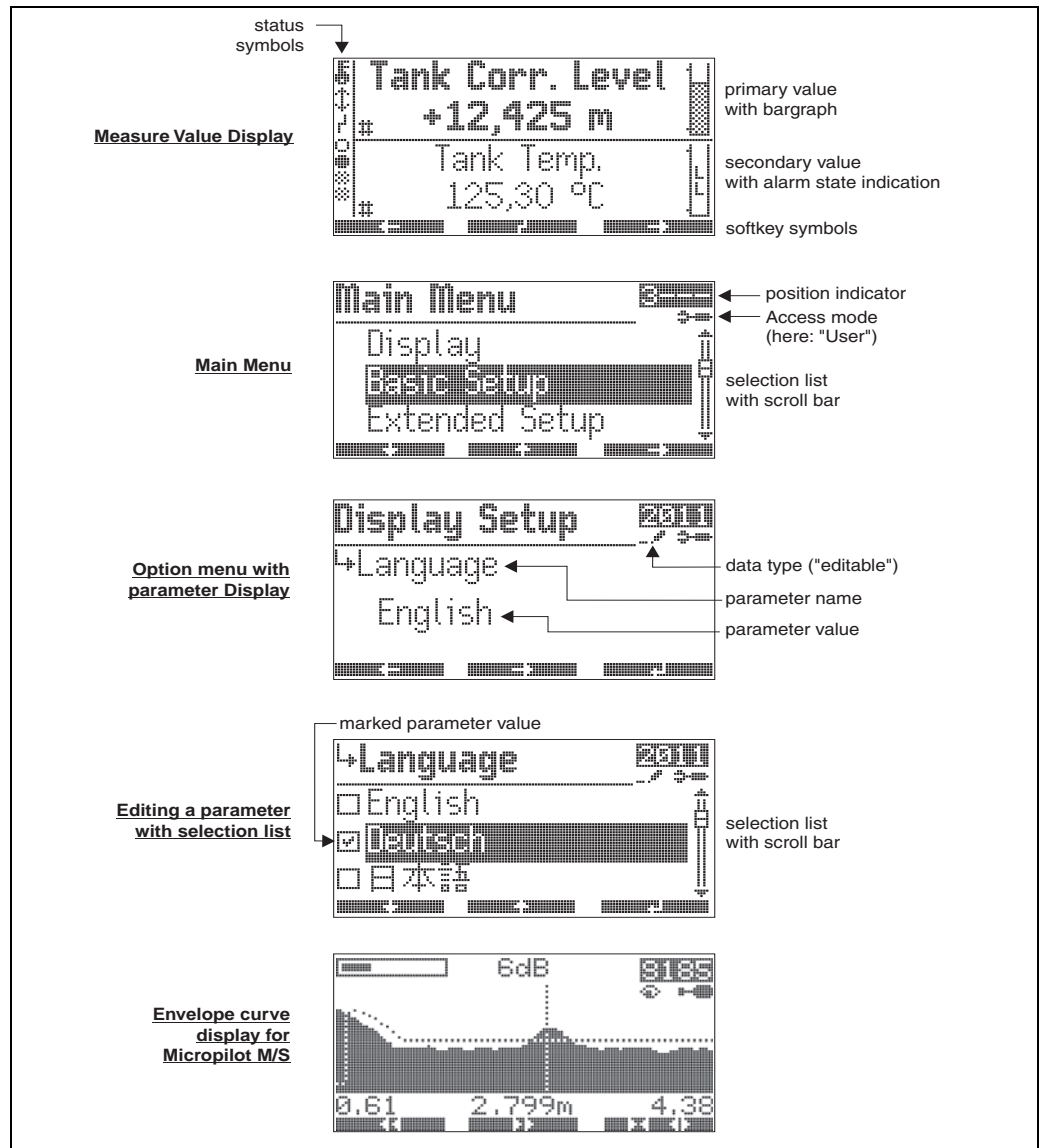
L00-NRP590-07-00-00-en-002

Operating concept for software version 02.xx

Operating Menu

The Tank Side Monitor is operated via a four-layer menu. The structure of the menu accounts for typical measuring tasks as well as for the individual instrument configuration and installation. In particular, the menu contains dynamic function groups which are only indicated if the respective option is installed or the respective instrument is connected. This structure ensures clarity and simple operation without restricting the scope of functions.

The appearance and meaning of the LCD change according to the current position within the menu.

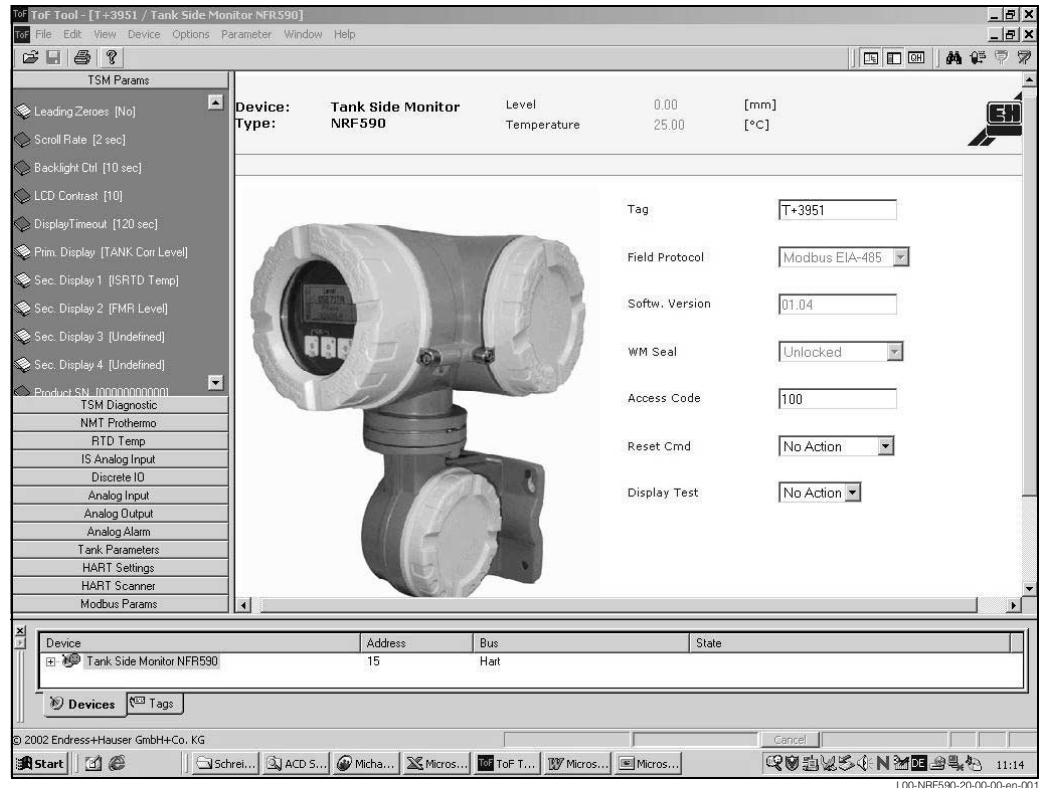


L00-NRF590-07-00-00-en-004

Setup-Wizard

From SW 02.00 onwards the Tank Side Monitor has got a Setup-Wizard, which leads the user through the complete commissioning procedure. It allows quick and easy configuration of the various tank gauging modes.

Operation with "ToF Tool Field Tool Package"



The Tank Side Monitor 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: Win95, Win98, 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

Certificates and Approvals

CE approval

The NRF 590 meets the legal requirements of the EC-guidelines. Endress+Hauser confirms the instruments passing the required tests by attaching the CE-mark.

Ex approvals

FM

FM XP - Class I, Div 1 Groups A-D;
Note the Installation Drawings ZD 084F and ZD 085F (IS 4-20 mA Option Module)

CSA

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) G EEx d (ia) IIC T4;
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.

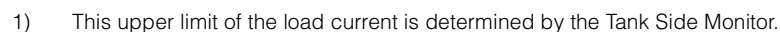
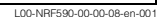
Ordering information

Product structure

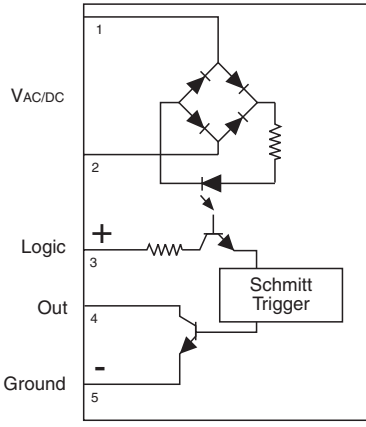
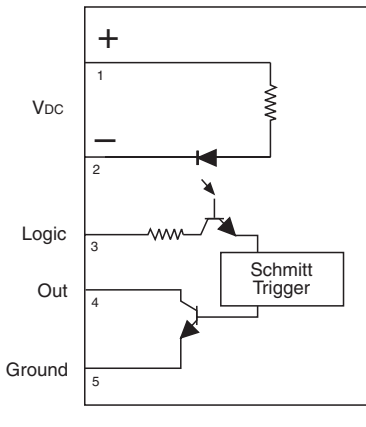
10	Certificates			
	A	For non-hazardous areas		
	6	ATEX II 2 (1) EEx d (ia) IIC T4		
	U	CSA XP Cl. I, Div 1, Gr. A-D		
	S	FM XP Cl. I, Div 1, Gr. A-D		
	K	TIIS EEx d (ia) IIC T4 (in preparation)		
	Y	Special version		
20	Field communication protocol			
	E	ENRAF BPM, non-IS 4...20mA input, non IS 4...20mA HART Master output		
	G	GPE, non-IS 4...20mA output		
	1	WM550, non-IS 4...20mA output, Whessoe protocol with dual communication		
	2	M/S without 4...20mA in- or output, Varec Mark/Space protocol		
	3	M/S, non-IS 4...20mA in- and output, Varec Mark/Space protocol		
	4	Modbus without 4...20mA in- or output, EIA 485		
	5	Modbus, non-IS 4...20mA in- and output, EIA 485		
	7	L&J, non-IS 4...20mA in- and output		
	8	V1, non-IS 4...20mA output, non-IS 4...20mA HART output, relay output		
	9	Special version		
30	Power supply			
	A	Power supply 18...50V DC		
	B	Power supply 55...264V AC		
	Y	Special version		
40	Spot RTD option			
	0	Without RTD temperature input		
	1	With spot RTD temperature input, IS		
	9	Special version		
50	Discrete I/O Module A			
	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...250V AC		
	E	Discrete input module A, 35...60V AC/DC		
	G	Discrete output module A, 24...250V 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		
	Y	Special version		
60	Discrete I/O Module B			
	A	Without discrete input/output module B		
	B	Discrete input module B, 90...140V AC		
	C	Discrete input module B, 3...32V DC		
	D	Discrete input module B, 180...250V AC		
	E	Discrete input module B, 35...60V AC/DC		
	G	Discrete output module B, 24...250V AC		
	H	Discrete output module B, 3...60V DC		
	J	Discrete output module B, 24...140V AC		
	K	Discrete output module B, 4...200V DC		
	Y	Special version		
70	Additional intrinsically safe module			
	0	Additional IS module not selected		
	1	Additional IS 4...20mA analogue input		
	2	Integrated 4...20mA input, two discrete inputs		
	9	Special version		
				Product designation (part 1)

Endress + Hauser 27

Standard mechanical diagram for all I/O modules



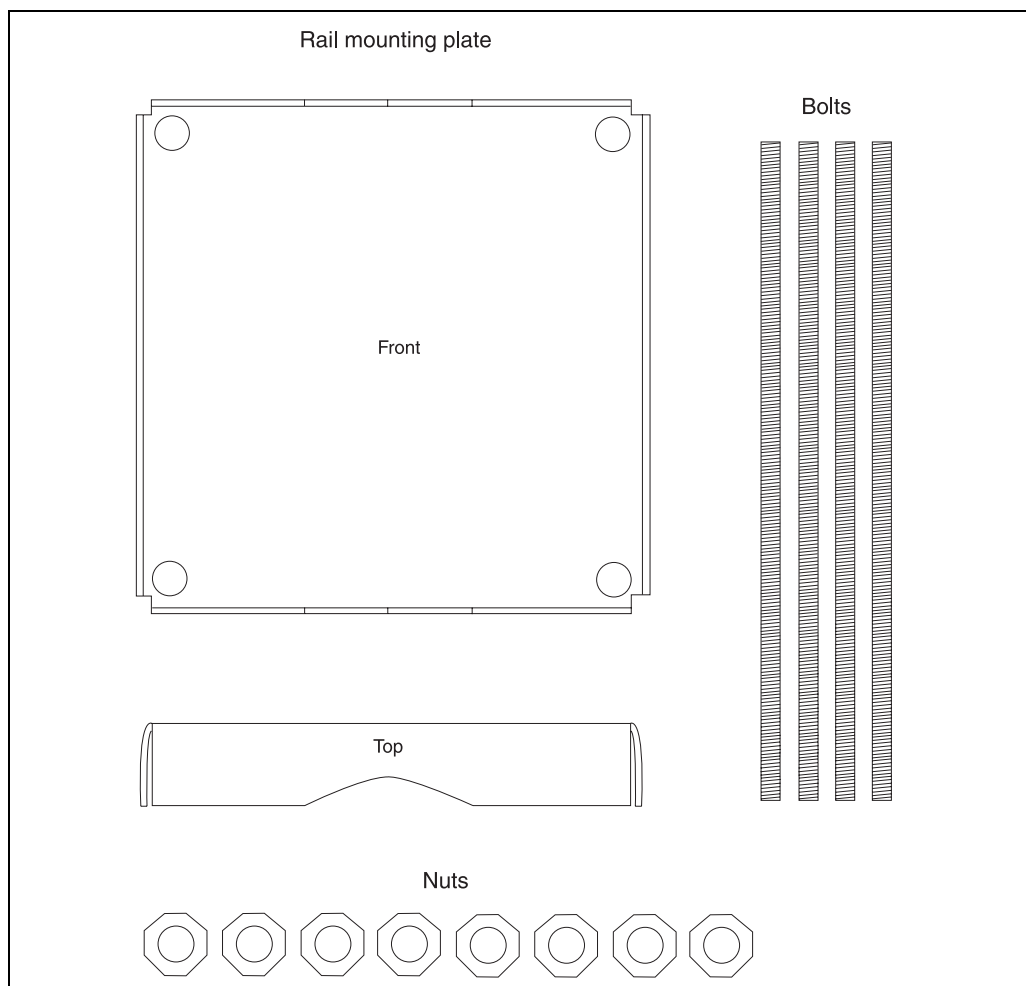
Input modules

	AC voltage		DC voltage	
				
Order code	52012955	52012956	52012957	52012958
Colour of housing	yellow	yellow	white	white
Input voltage	90 ... 140 V AC	180 ... 264 V AC ¹	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	

1) This upper limit of the input voltage is determined by the Tank Side Monitor.

Rail mounting kit

For rail mounting the Tank Side Monitor to vertical or horizontal pipe.
Order-Number: 52013134



L00-NRFS90-00-00-06-en-001

Supplementary Documentation

Special Documentation	SD 001V Special Documentation - Radar Tank Gauging
Technical Information	TI 006G Technical Information Fuels Manager TI 007G Technical Information RTU 8130 TI 042N Technical Information Prothermo NMT 539 TI 216P Technical Information Cerabar S PMC 731 / PMP 731 TI 217P Technical Information Cerabar S PMC 631 / PMP 635 TI 344F Technical Information Micropilot S FMR 530/531/532/533 TI 345F Technical Information Micropilot M FMR 230/231/240/244/245
Operating Instructions	BA 256F Operating Instructions Tank Side Monitor NRF 590 This document describes installation and commissioning of the Tank Side Monitor. Only those functions of the operating menu are included, which are relevant for a usual application. BA 257F Tank Side Monitor - Description of Instrument Functions This document contains a detailed description of all the functions of the Tank Side Monitor.
Safety Instructions	XA 160F Tank Side Monitor NRF 590 - ATEX II 2 (1) G XA 169F i.s. 4-20mA analogue input module for NRF 590 - ATEX II 2 (1) G
Control Drawings	ZD 084F Tank Side Monitor NRF 590 - FM XP - Class I, Div. 1, Groups A-D ZD 085F i.s. 4-20mA analogue input module for NRF 590 - FM XP - Class I, Div. 1, Groups A-D ZD 103F Tank Side Monitor NRF 590 - CSA XP - Class I, Div. 1, Groups A-D ZD 104F i.s. 4-20mA analogue input module for NRF 590 - CSA XP - Class I, Div. 1, Groups A-D

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