





Services

# Technical Information

# Levelflex FMP53

Guided Level-Radar

Level measurement in liquids and hygienic applications



#### Application

- FMP53 premium device for the highest hygiene requirements. ASME BPE and USP Class VI compliant.
- Measuring range up to 6 m (20 ft)
- Process connections for hygiene applications (Tri-Clamp, 11864, ...)
- Temperature range: -20 to +150 °C (-4 to +302 °F)
- Pressure range: -1 to 16 bar (-14.5 to 232 psi)
- The following interfaces are available for system integration:
  - HART with 4...20 mA analog
  - PROFIBUS PA
- Used for level monitoring (MIN, MAX, range) up to SIL 2, independently assessed by TÜV as per IEC 61508

#### Your benefits

- Reliable measuring:
  - in case of moved surface and foam
  - for changing medias
  - for filling via spray head
- High availablility
- Integrated data memory
- Factory precalibrated
- Intuitive, menu-guided operating concept in national languages
- Simple integration into control or asset management systems
- Exact instrument and process diagnosis to assist fast decisions
- Approvals: ATEX, IEC Ex, FM, CSA Sanitary compatibility: 3A, EHEDG, CoC (Certificate of Compliance)



# Table of contents

Important document information	<b>3</b> 3
Function and system design         Measuring principle         Measuring system	<b>4</b> 4 6
Input . Measured variable . Measuring range . Blocking distance . Measuring frequency spectrum .	7 7 7 7
OutputOutput signal	8 8 8 8 8 8
Auxiliary energyElectrical connectionSupply voltageTerminalsCable entriesCable entriesCable specificationDevice plug connectorsPower consumptionCurrent consumptionCurrent consumptionPower supply failureLoadPotential equalizationOvervoltage protection	<b>10</b> 13 14 14 14 14 14 15 15 15 16 16
Performance characteristics         Reference operating conditions         Maximum measured error         Resolution         Resolution         Reaction time         Influence of ambient temperature         Operating conditions: Installation         Suitable mounting position         Additional mounting hints	<ol> <li>16</li> <li>16</li> <li>16</li> <li>17</li> <li>17</li> <li>18</li> <li>18</li> <li>18</li> <li>20</li> </ol>
Operating conditions: Environment	<b>24</b> 24 24 24 24 24 24 24 25 25

Operating conditions: Process       2         Process temperature range       2         Process pressure limits       2         Materials in contact with process       2         Dielectric constant       2	<b>5</b> 5 5 5
Mechanical construction2Design, dimensions2Tolerance of probe length3Weight3Material3	7 1 1 2
Human interface3Operating concept3Display elements3Operating elements3Additional functionality3On-site operation3Remote operation3System integration3	<b>4</b> 4 4 4 5 6
Certificates and approvals30CE mark3Ex approval3Functional Safety (in preparation)3Sanitary compatibility (in preparation)3Pharma (CoC)3Telecommunications3CRN approval (in preparation)3Other standards and guidelines3	<b>9</b> 999999999
Ordering information	<b>0</b> +0
Accessories4Device-specific accessories4Communication-specific accessories4Service-specific accessories4System components4	<b>3</b> 4 5
Documentation       4         Standard documentation       4         Supplementary documentation       4         Certificates       4	<b>5</b> 5 5
Registered trademarks 4	6
Patents 4	7

## Important document information

#### **Document conventions**

#### Electrical symbols

Symbol	Meaning
A0011197	<b>Direct current</b> A terminal to which DC voltage is applied or through which direct current flows.
A0011198	Alternating current A terminal to which alternating voltage (sine-wave) is applied or through which alternating current flows.
	<b>Ground connection</b> A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
A0011199	<b>Protective ground connection</b> A terminal which must be connected to ground prior to establishing any other connections.
A0011201	<b>Equipotential connection</b> A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

#### Symbols and notation for certain types of information

Symbol	Meaning
A0011182	Allowed Indicates procedures, processes or actions that are allowed.
A0011183	<b>Preferred</b> Indicates procedures, processes or actions that are preferred.
A0011184	Forbidden Indicates procedures, processes or actions that are forbidden.
A0011193	Tip Indicates additional information.
A0011194	Reference to documentation Refers to the corresponding device documentation.
A0011195	Reference to page Refers to the corresponding page number.
A0011196	<b>Reference to graphic</b> Refers to the corresponding graphic number and page number.

#### Symbols and notation in graphics

Symbol	Meaning
1,2,3	Item numbers
A, B, C,	Views
A-A, B-B, C-C,	Sections
<b>EX</b> A0011187	Hazardous area Indicates a hazardous area.
A0011188	Safe area (non-hazardous area) Indicates a non-hazardous location.

### Function and system design

#### Measuring principle

#### Level measurement

The Levelflex is a "downward-looking" measuring system that functions according to the ToF method (ToF = Time of Flight). The distance from the reference point to the product surface is measured. High-frequency pulses are injected to a probe and led along the probe. The pulses are reflected by the product surface, received by the electronic evaluation unit and converted into level information. This method is also known as TDR (Time Domain Reflectometry).



LN = probe lengt D = distace L = level R = reference point of measuremen E = empty calibration (= zero)F = full calibration (= span)

#### **Dielectric constant**

The dielectric constant (DC) of the medium has a direct impact on the degree of reflection of the highfrequency pulses. In the case of large DC values, such as for water or ammonia, there is strong pulse reflection while, with low DC values, such as for hydrocarbons, weak pulse reflection is experienced.

#### Input

The reflected pulses are transmitted from the probe to the electronics. There, a microprocessor analyzes the signals and identifies the level echo which was generated by the reflection of the high-frequency pulses at the product surface. This clear signal detection system benefits from over 30 years' experience with pulse time-offlight procedures that have been integrated into the development of the PulseMaster® software.

The distance D to the product surface is proportional to the time of flight t of the impulse:

 $\mathsf{D}=\mathsf{c}\cdot\mathsf{t}/2,$ 

where c is the speed of light.

Based on the known empty distance E, the level L is calculated:

L = E - D

Reference point for "E" see diagram above.

The Levelflex possesses functions for interference echo suppression that can be activated by the user. They guarantee that interference echoes from e.g. internals and struts are not interpreted as level echoes.

#### Output

The Levelflex is preset at the factory to the probe length ordered so that in most cases only the application parameters that automatically adapt the device to the measuring conditions need to be entered. For models with a current output, the factory adjustment for zero point E and span F is 4 mA and 20 mA, for digital outputs and the display module 0 % and 100 %. A linearization function with max. 32 points, which is based on a table entered manually or semi-automatically, can be activated on site or via remote operation. This function allows the level to be converted into units of volume or mass, for example.

#### Life cycle of the product



□ 1 Life cycle process

#### Engineering

- Universal measuring principle
- Measurement unaffected by medium properties
- Hardware and software developed according to SIL IEC 61508
- Genuine, direct interface measurement

#### Procurement

- Endress+Hauser being the world market leader in level measurement guarantees asset protection
- Worldwide support and service

#### Installation

- Special tools are not required
- Reverse polarity protection
- Modern, detachable terminals
- Main electronics protected by a separate connection compartment

#### Commissioning

- Fast, menu-guided commissioning in only 6 steps
- Plain text display in national languages reduces the risk of error or confusion
- Direct local access of all parameters
- Short instruction manual at the device

#### Operation

- Multi-echo tracking; Increased echo rate and analysis as well as automatic suppression of interfering echoes
- Diagnostics in accordance with NAMUR NE107

#### Maintenance

- HistoROM: Data backup for instrument settings and measured values
- Exact instrument and process diagnosis to assist fast decisions with clear details concerning remedies
- Intuitive, menu-guided operating concept in national languages saves costs for training, maintenance and operation
- Housing cover can be opened in hazardous areas

#### Retirement

- Order code translation for subsequent models
- RoHS-conforming (Restriction of certain Hazardous Substances), unleaded soldering of electronic components
- Environmentally sound recycling concept

Measuring system

#### Probe selection

The various types of probe in combination with the process connections are suitable for the following applications:

Levelflex FMP53					
Type of probe	Rod probe				
Feature 060 - Probe:	Opti	on:			
	DA	8 mm (316L), Ra<0.76μm/30μm			
	DB	DB 0.31 in (316L), Ra<0.76μm/30μm			
	EA	A 8 mm (316L), ep=electro-polished, Ra<0.38µm/15µm			
	EB 0.31 in (316L), ep=electro-polished, Ra<0.38 $\mu$ m/15 $\mu$ m				
	FA 8 mm (316L), 500 mm divisible, Ra<0.76 $\mu$ m/30 $\mu$ m				
FB 0.31 in (3		0.31 in (316L), 20 in divisible, Ra<0.76µm/30µm			
	GA 8 mm (316L), 500 mm divisible, ep=electro-polished, Ra<0				
	GB	0.31 in (316L), 20 in divisible, ep=electro-polished, Ra<0.38 $\mu m/15 \mu m$			
		HA 8 mm (316L), 1000 mm divisible, Ra<0.76μm/30μm			
		HB 0.31 in (316L), 40 in divisible, Ra<0.76μm/30μm			
	IA	8 mm (316L), 1000 mm divisible, ep=electro-polished, Ra<0.76 $\mu m/30 \mu m$			
	IB	0.31 in (316L), 40 in divisible, ep=electro-polished, Ra<0.76 $\mu m/30 \mu m$			
Max. probe length		6 m (20 ft)			
For application		level measurement in liquids			
Option	Reference probe can be connected Calibration kit FMP43 – order number: 71041382( $\rightarrow$ 🖹 44)				

### Input

-

Measured variable

The measured variable is the distance between the reference point and the product surface. Subject to the empty distance entered "E" the level is calculated. Alternatively, the level can be converted into other variables (volume, mass) by means of linearization (32 points).

Measuring range

The following table describes the media groups and the possible measuring range as a function of the media group.

Levelflex FMP53					
				T	Measuring range
Media group	DC (E <sub>r</sub> )	i ypical liquids	rod probes <sup>1)</sup>		
1	1.41.6	condensed gases, e.g. N <sub>2</sub> , CO <sub>2</sub>	on request		
2	1.61.9	<ul> <li>liquefied gas, e.g. propane</li> <li>solvent</li> <li>Freon</li> <li>palm oil</li> </ul>	4/6 m (13/20 ft)		
3	1.92.5	mineral oils, fuels	4/6 m (13/20 ft)		
4	2.54	<ul><li>benzene, styrene, toluene</li><li>furan</li><li>naphthalene</li></ul>	4/6 m (13/20 ft)		
5	47	<ul> <li>chlorobenzene, chloroform</li> <li>cellulose spray</li> <li>isocyanate, aniline</li> </ul>	4/6 m (13/20 ft)		
6	> 7	<ul><li> aqueous solutions</li><li> alcohols</li><li> acids, alkalis</li></ul>	4/6 m (13/20 ft)		

1) not divisible up to 4 m (13 ft), divisible up to 6 m (20 ft)

Reduction of the max. possible measuring range through buildup, above all of moist products.

Blocking distance

The upper blocking distance (= UB) is the minimum distance from the reference point of the measurement (mounting flange) to the maximum level.



R = reference point of measurementLN = probe length

 $UB = upper \ blocking \ distance$ 

Blocking distance (factory setting): with rod probes up to 6 m (20 ft): 200 mm (8 in)

1

The specified blocking distances are preset on delivery. Depending on the application these settings can be changed.

Within the blocking distance, a reliable measurement can not be guaranteed.

Measuring frequency spectrum

100 MHz to 1,5 GHz

### Output

Output signal	HART		
	Signal coding         FSK ±0.5 mA over currency signal		
	Data transmission rate	1200 Baud	
	Galvanic isolation	Ja	
	PROFIBUS PA		
	Signal coding	Manchester Bus Powered (MBP)	
	Data transmission rate	31,25 KBit/s, voltage mode	
	Galvanic isolation	Ja	
Signal on alarm	<ul> <li>Maintenance information can be viewed via the following interfaces:</li> <li>Local display: <ul> <li>Error symbol (in accordance with NAMUR Recommendation NE 107)</li> <li>Plain text display</li> </ul> </li> <li>Current output: failsafe mode selectable (in accordance with NAMUR Recommendation NE 43): <ul> <li>Minimum alarm: 3.6 mA</li> <li>Maximum alarm (= factory setting): 22 mA</li> </ul> </li> <li>Digital interface such as HART communication or CDI service interface (in accordance with NAMUR Recommendation NE 107)</li> </ul>		
Linearization	The linearization function of the Micropilot M allows the conversion of the measured value into any unit of length or volume. Linearization tables for calculating the volume in cylindrical tanks are pre-programmed. Other tables of up to 32 value pairs can be entered manually or semi-automatically.		
Galvanic isolation	All circuits for the outputs are galvanically isolated from each other.		
Protocol-specific data	HART		
	Manufacturer ID	17 (0x11)	
	Device type ID	0x34	
	HART specification	6.0	
	Device description files (DTM, DD)	Information and files under: • www.endress.com • www.hartcom.org	
	HART load	Min. 250 Ω	

HART device variables	The measured values can be freely assigned to the device variables.	
	Measured values for PV (primary variable) <ul> <li>Level linearized</li> <li>Distance</li> <li>Electronic temperature</li> <li>Relative echo amplitude</li> </ul>	
	<ul> <li>Measured values for SV, TV, FV (second, third and fourth variable)</li> <li>Level linearized</li> <li>Distance</li> <li>Terminal voltage</li> <li>Electronic temperature</li> <li>Absolute echo amplitude</li> <li>Relative echo amplitude</li> <li>Calculated DC</li> </ul>	
Supported functions	<ul><li>Burst mode</li><li>Additional transmitter status</li></ul>	

#### PROFIBUS PA

Manufacturer ID	17 (0x11)
Ident number	0x1558
Profile version	3.02
GSD file	Information and files under:
GSD file version	<ul> <li>www.endress.com</li> <li>www.profibus.org</li> </ul>
Output values	Analog Input: • Level linearized • Distance • Terminal voltage • Electronic temperature • Absolute echo amplitude • Relative echo amplitude • Calculated DC
	<ul> <li>Digital Input:</li> <li>Extended diagnostic blocks <sup>1)</sup></li> <li>Status output PFS Block</li> </ul>
Input values	<ul> <li>Analog Output:</li> <li>Analog value from PLC (for sensor block external pressure and temperature)</li> <li>Analog value from PLC to be indicated on the display</li> </ul>
	<ul> <li>Digital Output:</li> <li>Extended diagnostic block <sup>1</sup></li> <li>Level limiter</li> <li>Sensor block measurement on</li> <li>Sensor block save history on</li> <li>Status output</li> </ul>
Supported functions	<ul> <li>Identification &amp; Maintenance Simple device identification via control system and nameplate</li> <li>Automatic Ident Number Adoption GSD compatibility mode with respect to the previous device Levelflex M FMP4x</li> <li>Physical Layer Diagnostics Installation check of the PROFIBUS segment and the Levfelflex FMP4x via terminal voltage and telegram monitoring</li> <li>PROFIBUS Up-/Download Up to 10 times faster reading and writing of parameters via PROFIBUS Up-/ Download</li> <li>Condensed Status Simple and self-explanatory diagnostic information due to categorization of diagnostic messages</li> </ul>

1) in preparation

### Auxiliary energy

#### **Electrical connection**

#### 2-wire, 4-20mA HART (FMP5x - \*\*A...)

Without intgrated overvoltage protection



- 1 Terminal 4...20mA HART passive
- 2 Active barrier with power supply (e.g. RN221N): Observe terminal voltage ( $\rightarrow \square 13$ )
- 3 HART communication resistor ( $\geq 250 \Omega$ ): Observe maximum load ( $\rightarrow \square 15$ )
- 4 Connection for Field Communicator 375/475 or Commubox FXA195
- 5 Analog display device: Observe maximum load ( $\rightarrow \square 15$ )
- 6 Observe cable specification ( $\rightarrow \square 14$ )
- 7 Potential equalization
- 8 Cable entry

#### 2-wire, 4-20 mA HART, 4...20mA

Without integrated overvoltage protection



- *1 Cable entry for current output 1*
- 2 Terminal for current output 1
- 3 Supply voltage for current output 1 (e.g. RN221N); Observe terminal voltage ( $\rightarrow \stackrel{\circ}{=} 14$ )
- 4 HART communication resistor ( $\geq 250 \Omega$ ): Observe maximum load ( $\rightarrow \square 15$ )
- 5 Connection for Field Communicator 375/475 or Commubox FXA195
- 6 Analog display device ; observe maximum load ( $\rightarrow \square 15$ )
- 7 Observe cable specification ( $\rightarrow 14$ )
- 8 Cable entry for current output 2
- 9 Terminal for current output 2
- 10 Supply voltage for current output 2 (e.g. RN221N); Obesrve terminal voltage ( $\rightarrow \square 14$ )
- 11 Analog display device ; observe maximum load
- 12 Terminal for the potential equalization line



#### 4-wire, 4-20 mA HART (FMP5x - \*\*K/L...)

Without integrated overvoltage protection



- 1 Terminal 4...20mA HART
- 2 Evaluation unit, e.g. PLC
- *3* HART communication resistor ( $\geq 250 \Omega$ ): Observe maximum load ( $\rightarrow \square 15$ )
- 4 Analog display device: Observe maximum load ( $\rightarrow \ge 15$ )
- 5 Observe cable specification ( $\rightarrow 14$ )
- 6 Connection Field Communicator 375/475 or Commubox FXA195
- 7 Supply voltage: Observe terminal voltage ( $\rightarrow \ge 14$ )
- 8 Terminal supply voltage
- 9 Potential equalization
- 10 Cable entry for power supply
- 11 Cable entry for signal line

In order to ensure electromagnetic compatibility (EMC): Do not ground the device via the protective earth conductor of the supply cable. Instead, ground the device via the process connection (flange or threaded connection) or the external ground terminal .

#### **PROFIBUS PA**



- 1 Terminals PROFIBUS PA
- 2 Cable screen
- 3 Cable entry
- 4 Potential equalization



- Terminals switching output 1
- 2 Cable entry

Switching output			
Function	Open collector switching output		
Switching behavior	Binary (conductive or non-conductive), switches when the programmable switch point is reached		
Failure mode	non-conductive		
Eectrical connection values	$U=10.4 \text{ to } 35 \ V_{DC}, I=0 \text{ to } 70 \ \text{mA}$		
Insulation voltage	floating, Insulation voltage 1 350 $V_{DC}$ to power supply aund 500 $V_{AC}$ to ground		
Switch point	freely programmable, separately for switch-on and switch-off point		
Switching delay	freely programmable from 0 to 100 sec. , separately for switch-on and switch-off point $% \left( {{{\left[ {{C_{1}} \right]}}} \right)$		
Number of switching cycles	corresponds to the measuring cycle		
Signal source device variables	<ul> <li>Level linearized</li> <li>Distance</li> <li>Terminal voltage</li> <li>Electronic temperature</li> <li>Relative echo amplitude</li> </ul>		
Number of switching cycles	unlimited		

Supply voltage

An external power supply is required.

Various supply units can be ordered from Endress+Hauser: see "Accessories" section (  $\rightarrow$   $\geqq$  45)

#### 2-wire, 4-20mA HART, passive

"Power Supply, Output" <sup>1)</sup>	Outputs	Terminal voltage	"Approval" <sup>2)</sup>
A: 2-wire; 4-20mA HART	1	11.5 to 35 V	Non-Ex, Ex nA, CSA GP
		11.5 to 32 V	Ex ic
		11.5 to 30 V	Ex ia / IS
		13.5 to 30 V	Ex d / XP, Ex ic(ia), Ex tD / DIP
C: 2-wire; 4-20mA HART, 4-20mA	1	13.5 to 30 V	all
	2	12 to 30 V	all

1) 2) Feature 020 of the product structure  $% \left( {{{\rm{A}}_{{\rm{B}}}} \right)$ 

Feature 010 of the product structure



#### 4-wire, 4-20mA HART, active

"Power supply; Output" <sup>1)</sup>	Terminal voltage
<b>K:</b> 4-wire 90-253VAC; 4-20mA HART	90 to 253 $V_{AC}$ (50 to 60 Hz)
L: 4-wire 10,4-48VDC; 4-20mA HART	10.4 to 48 V <sub>DC</sub>

1) Feature 020 of the product structure

#### PROFIBUS PA

	"Power supply; Output" 1)	Terminal voltage
	G: 2-wire; PROFIBUS PA, switch output	9 to 32 V <sub>DC</sub>
	1) Feature 020 der Produkstruktur	
Terminals	Plug-in spring terminals for wire cross-sections 0.5	to 2.5 mm <sup>2</sup> (20 to 14 AWG)
Cable entries	<ul> <li>Cable gland (not for Ex d): <ul> <li>Plastics M20x1,5 with cable Ø 5 to 10 mm (0.2 to 0.39 in): non-Ex, ATEX/IECEx/NEPSI Ex ia/ic/n</li> <li>Metal M20x1,5 with cable Ø 7 to 10 mm (0.28 to 0.39 in): dust-Ex, FM IS, CSA IS, CSA GP</li> </ul> </li> <li>Thread for cable entry: <ul> <li>½" NPT</li> <li>G ½"</li> <li>M20 × 1.5</li> </ul> </li> <li>Connector (only for non-Ex, Ex ic, Ex ia): M12 or 7/8"</li> </ul>	
Cable specification	<ul> <li>For ambiente temperature T<sub>U</sub>≥60 °C (140 °F): u</li> <li>A normal device cable suffices if only the analog</li> <li>A shielded cable is recommended if using the HA</li> </ul>	se cable for temperature T <sub>U</sub> +20 K. signal is used. ART protocol. Observe grounding concept of the plant.
Device plug connectors	For the versions with fieldbus plug connector opening the housing.	(M12 or 7/8"), the signal line can be connected without

Pin assignment of the M12 plug connector

	Pin	Meaning
1●≑ 3●-	1	Ground
20+ 40nc	2	Signal +
	3	Signal -
A0011175	4	not connected

Pin assignment of the 7/8" plug connector

	Pin	Meaning
1●- 3●nc	1	Signal -
2●+ 4●≠	2	Signal +
	3	not connected
A0011176	4	Ground

Power consumption

min. 60 mW, max. 900 mW

#### Current consumption

### HART

Nominal current	3.6 to 22 mA, the start-up current for multidrop mode can be parametrized (is set to 3.6 mA on delivery)
Breakdown signal (NAMUR NE43)	adjustable

#### **PROFIBUS PA**

Nominal current	max. 15 mA
Error current FDE (Fault Disconnection Electronic)	0 mA

#### Power supply failure

Load

• Configuration is retained in the HistoROM (EEPROM).

• Error messages (incl. value of operated hours counter) are stored.





	R [Ω] 500 10 12 20 23 30 U <sub>0</sub> [V] A0014078 Feature 20 "Power Supply, Output", Option C "2-wire; 4-20mA HART, 4-20mA"		
Outputs Terminal voltage Feature 010 "Approval"		Feature 010 "Approval"	
	2	12 to 30 V	all
Potential equalization	No special m If the d Instruc	easures for potential evice is designed for tions" (XA, ZD).	equalization are required. hazardous areas, observe the information in the documentation "Safety
Overvoltage protection	If the measuring device is used for level measurement in flammable liquids which requires the use of overvoltage protection according to DIN EN 60079-14, standard for test procedures 60060-1 (10 kA, pulse $8/20 \ \mu$ s), overvoltage protection has to be ensured by one of the following measures:		
	<ul> <li>Integrated Product st</li> <li>External o</li> </ul>	overvoltage protection ructure: Feature 610 vervoltage protection	on (in preparation); "Accessory mounted", option NA "Overvoltage protection". , e.g. Endress+Hauser's HAW262Z.
	Perform	nance chara	acteristics

Reference operating conditions	<ul> <li>Temperature = +24 °C (+75 °F) ±5 °C (±9 °F)</li> <li>Pressure = 960 mbar abs. (14 psia) ±100 mbar (±1.45 psi)</li> <li>Humidity = 60 % ±15 %</li> <li>Reflection factor ≥ 0,8 (metal plate for rod probe with min. 1 mm (0.04 in) diameter)</li> <li>Flange for rod probe ≥ 300 mm (12 in) diameter</li> <li>Abstand zu Hindernissen ≥ 1 m (40 in)</li> </ul>
Maximum measured error	Typical data under reference operating conditions: DIN EN 61298-2, percentage values in relation to the span.

Output:	digital	analog <sup>1)</sup>
Sum of non-linearity, nonrepeatability and hysteresis	<ul> <li>Level measurement:</li> <li>Measuring range up to 15 m (49 ft): ±2 mm (0.08 in)</li> <li>Measuring range &gt;15 m (49 ft): ±10 mm (0.39 in)</li> </ul>	±0.02 %
Offset / Zero	±4 mm (0.16 in)	±0.03 %

1) Add error of the analogous value to the digital value.

If the reference conditions are not met, the offset/zero point arising from the mounting situation may be up to  $\pm 12 \text{ mm} (0.47 \text{ in})$  for rope and rod probes. This additional offset/zero point can be compensated for by entering a correction (parameter "level correction") during commissioning.



Differing from this, the following measuring error is present in the vicinity of the lower probe end:

If for rope probes the DC value is less than 7, then measurement is not possible in the area of the straining weight (0 to 250 mm from end of probe; lower blocking distance).

# Differing from this, the following measuring error is present in the vicinity of the upper probe end (rod/rope only):



#### Resolution

■ digital: 1 mm

 $\blacksquare$  analog: 1  $\mu A$ 

#### Reaction time

The reaction time can be parametrized. The fastest possible reaction time is given by the measuring rate:

Probe length	Level measurement
<10 m (33 ft)	3.6 measurements/second
up to 40 m (131 ft)	≥2.7 measurements/second

# Influence of ambient temperature

#### The measurements are carried out in accordance with EN 61298-3

- digital (HART, PROFIBUS PA, FOUNDATION Fieldbus): average  $T_K = 0.6 \text{ mm}/10 \text{ K}$
- analog (current output):
  - zero point (4 mA): average  $T_K = 0.02 \ \%/10 \ K$
  - span (20 mA): average  $T_{K}=0.05$  %/10 K

### **Operating conditions: Installation**





#### Mounting distances

- Distance (A) between wall and rod or rope probe:
  - for smooth metallic walls: > 50 mm (2")
  - for plastic walls: > 300 mm (12") mm to metallic parts outside the vessel
- Distance (B) between rod or rope probe and internal fittings (3) in the vessel: > 300 mm (12")
- Distance (C) from end of probe to bottom of the vessel: > 10 mm (0.4").

#### Additional conditions

- When mounting in the open: Use a weather protection cover (1)
- Do not mount the probe in the filling curtain (2)



#### Cleaning of the probe



#### Installation close to tank wall

By installing the probe close to the tank wall, the cleaning effect is improved in cases where a spray ball is used. The cleaning jet is deflected against the tank wall and onto the probe. This means that those parts of the probe are cleaned which would normally not be reached by the spray ball jet. If the probe is positioned in this way, only one spray ball is needed.

#### Installation in the center of the tank

If the probe is mounted in the center of the tank, it may be necessary to use a second spray ball. The spray balls should then be mounted to the left and right of the probe.

#### Wall and pipe mounting

Endress+Hauser offers a mounting bracket for installing the device on pipes or on walls.

Ordering information: Feature 600 "Probe Design", Option MB "Sensor remote, 3m/9ft cable" ( $\rightarrow a$  43). Dimensions ( $\rightarrow a$  31).

#### **Divisible probes**



If there is little mounting space (distance to the ceiling), it is advisable to use divisible rod probes ( $\emptyset$  8 mm).

- max. probe length 6 m/236 inch
- max. sideways capacity 10 Nm
- probes are separable several times with the lengths:
  - 500 mm/20 inch
- 1000 mm/ 40 inch
- torque: 4.5 Nm

#### Additional mounting hints

#### Bending strength of rod probes

Sensor	Feature 060	Probe	Bending strength [Nm]
FMP53	DA, DB, EA, EB	Rod 8mm (0.31") 316L	10
	FA, FB, GA, GB, HA, HB, IA, IB	Rod 8mm (0.31") 316L divisible	10

#### Bending load (torque)

The formula for calculating the bending torque M impacting on the probe:

 $M = c_w \cdot \rho / 2 \cdot v^2 \cdot d \cdot L \cdot (L_N - 0.5 \cdot L)$ 

#### with:

c<sub>w</sub>: Friction factor

 $\rho$  [kg/m³]: Density of the medium

v [m/s]: Velocity of the medium perpendicular to the probe rod

d $\left[m\right]$ : Diameter of the probe rod

L [m]: Level

LN [m]: Probe length

#### Calculation example

Friction factor $c_{\rm w}$	$0,9\ (\text{on the assumption of a turbulent current - high Reynolds number})$
Density $\rho~[kg/m^3]$	1000 (e.g. water)
Probe diameter d [m]	0,008
$L = L_N$	(worst case)





#### Installation in nozzles $\geq$ DN300

If installation in  $\ge$  300mm/12" nozzles is unavoidable, installation must be carried out in accordance with the sketch on the right.



- *1 Lower edge of the nozzle*
- 2 Approx. flush with the lower edge of the nozzle  $(\pm 50 \text{ mm}/2")$
- 3 Plate
- 4 Pipe Ø 150 to 180 mm (6 to 7 inch)

Nozzle diameter	Plate diameter
300 mm (12")	280 mm (11")
≥ 400 mm (16")	≥ 350 mm (14")

#### Mounting in bypasses and stilling wells



- A Mounting in a stilling well
- B Mounting in a bypass
- Pipe diameter: > 40 mm (1.6") for rod probes
- Rod probe installation can take place up to a diameter size of 100 mm. In the event of larger diameters, a coax probe is recommended.
- Side disposals, holes or slits and welded joints that protrude up to approx. 5 mm (0.2") inwards do not influence the measurement.
- The pipe may not exhibit any steps in diameter.
- The probe must be 100 mm longer than the lower disposal.
  - Within the measuring range, the probe must not get into contact with the pipe wall. If necessary, use a center washer (see feature 610 of the product structure).

#### Mounting in non-metallic vessels



- 1 Non-metallic vessel
- 2 Metal sheet or metal flange

To measure, Levelflex with a rod or rope probe needs a metallic surface at the process connection. Therefore:

- Select an instrument version with metal flange (minimum size DN50/2").
- Or: mount a metal sheet with a diameter of at least 200 mm (8") to the probe at the process connection. Its orientation must be perpendicular to the probe.

#### Mounting the probe externally at the wall of plastic or glass tanks



- 1 Plastic or glass tank
- 2 Metall sheet with threaded sleeve
- 3 No free space between tank wall and probe!

#### Requirements

- The dielectric constant of the medium must be at least DC > 7.
- The tank wall must be non-conductvie.
- Maximum wall thickness (a):
  - Plastic: < 15 mm (0.6")
  - Glass: < 10 mm (0.4")
- There may be no metallic reinforcements fixed to the tank.

#### Mounting conditions:

- The probe must be mounted directly to the tank wall (no open space)
- A plastic half pipe with a diameter of approx. 200 mm (8"), or some other protective unit, must be affixed externally to the probe to prevent any influences on the measurement.
- If the tank diameter is less than 300 mm (12"): A metallic grounding sheet must be installed at the opposite side of the tank. The sheet must be conductively connected to the process connection and cover about the half of the vessel's circumference.
- If the tank diameter exceeds 300 mm (12"):
   A metal sheet with a diameter of at least 200 mm (8") must be mounted to the probe at the process connection. Its orientation must be perpendicular to the probe (see above).

#### Installation at an angle



- For mechanical reasons, the probe should be installed as vertically as possible.With inclined installations the probe length has to be adjusted in dependence to the installation angle. - Up to LN = 1 m (3.3 ft):  $\alpha = 30^{\circ}$ 
  - Up to LN = 2 m (6.6 ft):  $\alpha = 10^{\circ}$
  - Up to LN = 4 m (13.1 ft):  $\alpha = 5^{\circ}$

#### Ambient temperature range Measuring device -40 to +80 °C (-40 to +176 °F) Local display -20 to +70 °C (-4 to +158 °F), the readability of the display may be impaired at temperatures outside the temperature range. When operating the device in the open with strong sunlight: Mount the device in a shady position. • Avoid direct sunlight, especially in warmer regions. Use a weather protection cover (see accessories). Ambient temperature limits With a temperature $(T_{\rm p})$ at the process connection the admissible ambient temperature $(T_{\rm a})$ is reduced according to the following diagram (temperature derating): Temperature derating for FMP53 [°C] ([°F]) T<sub>a</sub> +80 (+176)-GT20: +68 (+154) GT19: +53 (+127) A: G → 4-20 mA HART -20 (-4) **'p** [°C] +150 +82 -20 (+302) ([°F]) (-4) (+180) [°C] ([°F]) **T**a +79 (+174)GT20: +79 (+174)-GT19: +74 (+165) GT20: +64 (+147) C: G → 4-20 mA HART G + 4–20 mA GT19: +53 (+127) Ð 90-253 VAC Ð 10.4-48 VDC -20 (-4) **P** اC +74 +150 -20 (-4) (+165) (+302) ([°F]) A0013635 A = 1 current output GT19 = plastic housing $T_a = ambient \ temperature$ GT20 = aluminum housing C = 2 current outputs $T_p$ = temperature at the process connection K, L = 4-wire Storage temperature -40 to +80 °C (-40 to +176 °F) Climate class DIN EN 60068-2-38 (test Z/AD) Degree of protection With closed housing tested according to: - IP68, NEMA6P (24 h at 1.83 m under water surface) – IP66, NEMA4X • With open housing: IP20, NEMA1 (also ingress protection of the display) Degree of protection IP68 NEMA6P applies for M12 PROFIBUS PA plugs only when the PROFIBUS cable is plugged in and is also rated IP68 NEMA6P.

### **Operating conditions: Environment**

Vibration resistance

DIN EN 60068-2-64 / IEC 68-2-64: 20 to 2000 Hz, 1 (m/s<sup>2</sup>)<sup>2</sup>/Hz

Cleaning the probe	Depending on the application, contamination or buildup can accumulate on the probe. A thin, even layer only influences measurement slightly. Thick layers can dampen the signal and then reduce the measuring range. Severe, uneven buildup, adhesion e.g. through crystallization, can lead to incorrect measurement. In this case, we recommend that you use a non-contact measuring principle, or check the probe regularly for soiling.
Electromagnetic compatibility (EMC)	Electromagnetic compatibility to EN 61326 and NAMUR Recommendation EMC (NE21). Details are provided in the Declaration of Conformity. A standard installation cable is sufficient if only the analog signal is used.
	Use a shielded cable when working with a superimposed communications signal (HART).
	Maximum measured error: $< 0.5$ % of the span.
	<ul> <li>When installing the probes in metal and concrete tanks and when using a coax probe:</li> <li>Interference emission to EN 61326 - x series, electrical equipment Class B.</li> <li>Interference immunity to EN 61326 - x series, requirements for industrial areas and NAMUR Recommendation NE 21 (EMC)</li> </ul>
	<ul> <li>The measured value can be affected by strong electromagnetic fields when installing rod and rope probes without a shielding/metallic wall, e.g. in plastic and wooden silos.</li> <li>Interference emission to EN 61326 - x series, electrical equipment Class A.</li> </ul>

#### • Interference Immunity: the measured value can be affected by strong electromagnetic fields.

### **Operating conditions: Process**

	Device	O-ring material		Process temperature	Approval
	FMP53	EPDM	Freudenberg 70 EPDM 291	-20 to +130 °C (-4 to +266 °F)	FDA, 3A,
		FFKM DuPont Kalrez 62		221 -20 to +150 °C (-4 to +302 °F)	
			1		
Process pressure limits	Device	Device Process pressure			
	FMP53		-1 to 16 bar (-14.5 to 232 psi)		



This range may be reduced by the selected process connection. The pressure rating (PN) specified on the flanges refers to a reference temperature of 20 °C. Pay attention to pressure-temperature dependencies.

Materials in contact with	
process	

i	Further material specifications ( $\rightarrow$ $\supseteq$ 32)	

Levelflex FMP53					
Process c	onnection	No.	Material	Approval	
		1	304 (1.4301)	_	
	2	304 (1.4301)	_		
	3	316L (1.4435)	_		
		4	Ketron PEEK LSG	FDA, 3A, USP C1. VI	
	A0013903	5	304L (1.4307)		

Levelflex FMP53					
Rod probe		No.	Material		
Ø 8 mm (1/3")	$\emptyset$ 8 mm (1/3") divisible				
ļ.		1	<ul> <li>316L (1.4435)</li> <li>0.76 μm (30 μin) mechanically polished</li> <li>0.38 μm (15 μin) electro-polished</li> </ul>		
1	│	2	O-ring (see sensor)		
A0013872					
	A0013873				

#### Dielectric constant

Rod probe: DC  $(\epsilon_r) \ge 1.6$ 

### Mechanical construction

#### Design, dimensions

#### Dimensions of the electronics housing



☑ 2 Housing GT19 (Plastics PBT); Dimensions in mm (in)



□ 3 Housing GT20 (Alu coated); Dimensions in mm (in)

#### FMP53: Dimensions of process connection

Version	Dimensions [mm (inch)]
MAJ DIN11864-1 A DN25 tube DIN11866-A, 316L	M24x1.5 (9) (9) (9) (9) (9) (9) (9) (9)
MDJ DIN11864-1 A DN50 tube DIN11866-A, 316L	W24x1.5 (60) (60
MOJ DIN11851 DN50 PN40 cap-nut, 316L	M24x1.5 L 0 0 0 0 0 0 0 0 0 0 0 0 0
MQJ DIN11851 DN40 PN40 cap-nut, 316L	M24x1.5
S1J NEUMO BioControl D25 PN16, 316L	050 (Ø1.97) M24x1.5 (b) 0 0 0 0 0 0 0 0 0 0 0 0 0
S4J NEUMO BioControl D50 PN16, 316L (Not available with Probe Design "Sensor compact", feature 600, option MA)	0 0 0 0 0 0 0 0 0 0 0 0 0 0

Version	Dimensions [mm (inch)]
S6J NEUMO BioControl D80 PN16, 316L (Not available with Probe Design "Sensor compact", feature 600, option MA)	Ø115 (Ø4.53) M24x1.5 (0
TDJ Tri-Clamp ISO2852 DN40-51 (2"), 316L	M24x1.5 L 0 Ø63.9 (Ø2.52) A0012770
TFJ Tri-Clamp ISO2852 DN70-76.1 (3"), 316L	M24x1.5 K 0 0 0 0 0 0 0 0 0 0 0 0 0
TOJ Tri-Clamp ISO2852 DN25-38 (11-1/2"), 316L	M24x1.5 (190) Ø50.4 (Ø1.98) A0012772
TSJ Varivent N 50/40 PN16, 316L	M24x1.5 (1970)
TXJ SMS 2" PN25, 316L	M24x1.5

Version	Dimensions [mm (inch)]
T7J SMS 1-1/2" PN25, 316L	M24x1.5 M24x1.5
U1J Thread M24, 316L for installation in weld-in adapter (to be ordered as an accessory)	A0012775

#### FMP53: Dimensions of probe



A Mounting bracket for probe design "Sensor remote" (Feature 600)

B Sensor compact (No option selected in feature 600)

C Sensor compact, detachable (Feature 600)

D Rod probe 8mm or 1/3" (Feature 060)

*E* Rod probe 8mm or 1/3", 20in or 40in divisible (Feature 060)

LN Length of probe

*R Reference point of the measurement* 

#### Tolerance of probe length

th	Rod probes			
	Rod length	<1 (<3,3)	1<4 (3,3<13)	
	Admissible tolerance [mm (in)]	+0 / -3 (-0,12)	+0 / -5 (-0,2)	

#### Weight

#### Housing

Part	Weight
Housing GT19 - plastic	approx. 1.2 kg
Housing GT20 – aluminium	approx. 1.9 kg

#### FMP53

Part	Weight	Part	Weight
Sensor	approx. 1.2 kg	Rod probe 8 mm	approx. 0.4 kg/m probe length

#### Material



	Housing GT19 - plastic		
No.	Part: material	No.	Part: material
1	Housing: PBT	5	Cable entry
2.1	Compartment for the display module Cover: PBT / PA Cover seal: EPDM		<ul> <li>Sealing: EMPB</li> <li>Cable gland: polyamide (PA), nickel-plated brass (CuZn)</li> <li>Adapter: 316L (1.4435)</li> </ul>
2.2 Terminal compartment		6	Dummy plug: PBT
<ul><li>Cover: PBT</li><li>Cover seal: EPDM</li></ul>	<ul> <li>Cover: PBT</li> <li>Cover seal: EPDM</li> </ul>	7	Pressure relief stopper: PBT
4	Turn housing Screw: A4-70 Clamp: 316L (1.4404)	8	Ground terminal Screw: A2 Spring washer: A4 Clamp: 304 (1.4301) Holder: 304 (1.4301)
		9	Identification Nameplate: sticker

	Housing GT20 - die-cast aluminum, powder-coated, seawater-resistant		
No.	Part: material	No.	Part: material
1	Housing: AlSi10Mg(<0.1% Cu)	5	Cable entry
2.1	Compartment for the display module • Cover: AlSi10Mg(<0.1% Cu) • Window: glass • Cover seal: EPDM		<ul> <li>Sealing: EMPB</li> <li>Cable gland: polyamide (PA), nickel-plated brass (CuZn)</li> <li>Adapter: 316L (1.4435)</li> </ul>
2.2	Terminal compartment	6	Dummy plug: nickel-plated brass (CuZn)
<ul> <li>Cover: AlSi10Mg(&lt;0.1% Cu)</li> <li>Cover seal: EPDM</li> </ul>		7	Pressure relief stopper: nickel-plated brass (CuZn)
3	Cover lock • Screw: A4 • Clamp: 316L (1.4404)	8	Ground terminal Screw: A2 Spring washer: A2 Clamp: 304 (1.4301) Holder: 304 (1.4301)
4	Turn housing Screw: A4-70 Clamp: 316L (1.4404)	9	Identification Nameplate: sticker



- Further material specifications
  Materials in contact with process (→ ≧ 25)
  Ordering information (→ ≧ 40)
  Accessories materials (→ ≧ 43)

Operating concept	Operator-oriented menu structure for user-specific tasks <ul> <li>Commissioning</li> <li>Operation</li> <li>Diagnostics</li> <li>Expert level</li> </ul>
	<ul> <li>Quick and safe commissioning</li> <li>Guided menus ("Make-it-run" wizards) for applications</li> <li>Menu guidance with brief explanations of the individual parameter functions</li> </ul>
	<ul> <li>Reliable operation</li> <li>Local operation in several languages possible (→ Product structure → Feature 500 → Additional Operation Language)</li> <li>Standardized operation at the device and in the operating tools</li> </ul>
	<ul> <li>Efficient diagnostics increase measurement reliability</li> <li>Remedy information is integrated in plain text</li> <li>Diverse simulation options and line recorder functions</li> </ul>
Display elements	<ul> <li>4-line display</li> <li>Format for displaying measured values and status variables can be individually configured</li> <li>Permitted ambient temperature for the display: -20 to +70 °C (-4 to +158 °F) The readability of the display may be impaired at temperatures outside the temperature range.</li> </ul>
Operating elements	<ul> <li>Local operation with 3 push buttons (, , ), ), )</li> <li>Operating elements also accessible in various hazardous areas</li> </ul>
Additional functionality	<ul> <li>The display module offers:</li> <li>Data backup function <ul> <li>The device configuration can be saved in the display module.</li> </ul> </li> <li>Data comparison function <ul> <li>The device configuration saved in the display module can be compared to the current device configuration.</li> </ul> </li> <li>Data transfer function</li> </ul>

### Human interface

The transmitter configuration can be transmitted to another device using the display module.

On-site operation



**2**• 4 On-site operation options

- 1
- Display module SD02, push buttons; cover must be open for operation Operating options via CDI interface (= Endress+Hauser Common Data Interface) 2
- 2.1 Computer with operating tool (FieldCare)
  2.2 Commubox FXA291, connected to the CDI interface of the device

#### Remote operation

#### Operation via:

- HART protocol
- Operating tools
  - FieldCare ( $\rightarrow$  1 45)
  - AMS Device ManagerSIMATIC PDM



**⊡** 5 Options for remote operation via HART protocol

- 1 PLC (programmable logic controller)
- 2 Transmitter power supply unit, e.g. RN221N (with communication resistor)
- Connection for Commubox FXA195 and Field Communicator 375, 475 3
- 4 Field Communicator 375, 475
- 5 Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)
- 6 Commubox FXA195 (USB)
- 7 Field Xpert SFX100
- VIATOR Bluetooth modem with connecting cable 8
- 9 Transmitter

#### System integration

#### System integration via PROFIBUS PA

A maximum of 32 devices (8 if mounted in an explosion hazardous location EEx ia IIC according to FISCOmodel) can be connected to the bus. The segment coupler provides the operating voltage to the bus. Both onsite as well as remote operation are possible.



□ 6 The complete measuring system consists of devices and:

- 1 Segment coupler
- 2 Computer with Profiboard/Proficard and operating tool (FieldCare)
- *3 PLC (programmable logic controller)*
- 4 More functions (valves etc.)
- 5 Computer with operating tool (FieldCare)
- 6 Commubox FXA291 (CDI interface)

#### Integrated in tank gauging system

The Endress+Hauser Tank Side Monitor NRF590 provides integrated communications for sites with multiple tanks, each with one or more sensors on the tank, such as radar, spot or average temperature, capacitive probe for water detection and/or pressure sensors. Multiple protocols out of the Tank Side Monitor guarantee connectivity to nearly any of the existing industry standard tank gauging protocols. Optional connectivity of analog 4...20 mA sensors, digital I/O and analog output simplify full tank sensor integration. Use of the proven concept of the intrinsically safe HART bus for all on-tank sensors yields extremely low wiring costs, while at the same time providing maximum safety, reliability and data availability.



- The complete measuring system consists of:
- 1 Computer with Fuels Manager Software
- 2 Commubox FXA195 (USB) optional
- 3 Computer with operating tool (ControlCare) optional
- 4 Level measuring device
- 5 Temperature measuring device
- 6 Tank Side Monitor NRF590
- 7 Pressure measuring device
- 8 Remote Terminal Unit RTU8130

#### System integration via Fieldgate

#### Vendor Managed Inventory

By using Fieldgates to interrogate tank or silo levels remotely, suppliers of raw materials can provide their regular customers with information about the current supplies at any time and, for example, account for them in their own production planning. For their part, the Fieldgates monitor the configured level limits and, if required, automatically activate the next supply. The spectrum of options here ranges from a simple purchasing requisition via e-mail through to fully automatic order administration by coupling XML data into the planning systems on both sides.

#### Remote maintenance of measuring equipment

Fieldgates not only transfer the current measured values, they also alert the responsible standby personnel, if required, via e-mail or SMS. In the event of an alarm or also when performing routine checks, service technicians can diagnose and configure connected HART devices remotely. All that is required for this is the corresponding HART operating tool (e.g. FieldCare, ...) for the connected device. Fieldgate passes on the information transparently, so that all options for the respective operating software are available remotely. Some on-site service operations can be avoided by using remote diagnosis and remote configuration and all others can at least be better planned and prepared.



Image: Second Second

- 1 Fieldgate FXA520
- 2 Multidrop Connector FXN520

The number of instruments which can be connected in mutidrop mode can be calculated by the "FieldNetCalc" program. A description of this program can be found in Technical Information TI 400F (Multidrop Connector FXN520). The program is available form your Endress+Hauser sales organisation or in the internet at: www.de.endress.com/Download (text search = "Fieldnetcalc").

# Certificates and approvals

CE mark	The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied.
	Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
Ex approval	The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.
	The separate documentation "Safety Instructions" (XA) containing all the relevant explosion protection data is available from your Endress+Hauser Sales Center. Correlation of documentations to the device $(\rightarrow \triangleq 46)$ .
Functional Safety (in preparation)	Used for level monitoring (MIN, MAX, range) up to SIL 2, independently assessed by TÜV Rhineland as per IEC 61508. Other information see documentation "Functional Safety Manual".
Sanitary compatibility (in	Overview of permitted process connections ( $\rightarrow \textcircled{1}{28}$ )
preparation)	The gap-free connections can be cleaned without residue using the usual cleaning methods.
	Many versions of the Levelflex M meet the requirements of 3A-Sanitary Standard No. 74.
	Endress+Hauser confirms this by attaching the 3A symbol.
Pharma (CoC)	<ul> <li>Certificate of Compliance (CoC)</li> <li>Ordering information ,feature 590 "Additional Approval:", option "LW"</li> <li>Materials in contact with process made of 316L with Δ ferrite &lt; 3 %</li> <li>Surface roughness R<sub>a</sub> &lt; 0.38 µm (15 µin)</li> <li>Information on ASME BPE Conformity</li> </ul>
Telecommunications	Complies with part 15 of the FCC rules for an unintentional radiator. All probes meet the requirements for a Class A digital device.
	In addition, all probes in metallic tanks as well as the coax probe meet the requirements for a Class B digital device.
CRN approval (in preparation)	Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection has to be ordered with a CSA approval.
Other standards and guidelines	<ul> <li>EN 60529 Degrees of protection by housing (IP code)</li> <li>EN 61010-1 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.</li> <li>IEC/EN 61326 "Emission in accordance with Class A requirements". Electromagnetic compatibility (EMC requirements)</li> <li>NAMUR NE 21 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.</li> <li>NAMUR NE 43 Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.</li> <li>NAMUR NE 53 Software of field devices and signal-processing devices with digital electronics</li> <li>NAMUR NE 107 Status classification as per NE107</li> <li>NAMUR NE 131 Requirements for field devices for standard applications</li> </ul>

# Ordering information

Compact device Levelflex	
	O Design of the Levelflex
	2 Process connection
	3 Rod probe
Product structure FMP53	This overview does not mark options which are mutually exclusive.
	Option with $* =$ in preparation
	010 Approval:
	AA Non-hazardous area
	BA ATEX II 1G Ex ia IIC Tó
	BB ATEX II 1/2G Ex ia IIC T6
	BC ATEX II 1/2G Ex d(ia) IIC T6
	BD ATEX II 1/3G Ex ic(ia) IIC T6
	BG ATEX II 3G Ex nA IIC T6
	BH ATEX II 3G Ex ic IIC T6
	B2 ATEX II 1/2G Ex ia IIC T6, 1/2D Ex tD IIIC IP6x
	B3 ATEX II 1/2G Ex d(ia) IIC T6, 1/2D Ex tD IIIC IP6x
	B4 ATEX II 1/2G Ex ia IIC T6, Ex d(ia) IIC T6
	CA CSA General Purpose
	C2 CSA C/US IS Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex ia
	C3 CSA C/US XP Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex d
	*FB FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia, NI Cl.1 Div.2
	*FD FM XP Cl.I,II,III Div.1 Gr.A-G, AEx d, NI Cl.1 Div.2
	IA IEC Ex Zone 0 Ex ia IIC Tó Ga
	IB IEC Ex Zone 0/1 Ex ia IIC T6 Ga/Gb
	IC IEC Ex Zone 0/1 Ex d(ia) IIC T6 Ga/Gb
	ID IEC Ex Zone 0/2 Ex ic(ia) IIC T6 Ga/Gc
	IG IEC Ex Zone 2 Ex nA IIC T6 Gc
	IH   IEC Ex Zone 2 Ex ic IIC Tó Gc

010	Approval:
I2	IEC Ex Zone 0/1 Ex ia IIC Tó Ga/Gb, Zone 20/21 Ex tD IIIC A20/21 IPóx Da/Db
I3	IEC Ex Zone 0/1 Ex d(ia) IIC T6 Ga/Gb, Zone 20/21 Ex tD IIIC A20/21 IP6x Da/Db
*8A	FM/CSA IS+XP Cl.I,II,III Div.1 Gr.A-G
99	Special version, TSP-no. to be sepc.
020	Power Supply, Output
A	2-wire; 4-20mA HART
С	2-wire; 4-20mA HART, 4-20mA
*G	2-wire; PROFIBUS PA, switch output
K	4-wire 90-253VAC; 4-20mA HART
L	4-wire 10,4-48VDC; 4-20mA HART
Y	Special version, TSP-no. to be sepc.
030	Display, Operation:
A	W/o, via communication
С	SD02 4-line, push buttons + data backup function
Y	Special version, TSP-no. to be sepc.
040	Housing:
A	GT19 dual compartment, Plastics PBT
C	GT20 dual compartment, Alu coated
Y	Special version, TSP-no. to be sepc.
050	Electrical connection:
A	Gland M20, IP66/68 NEMA4X/6P
В	Thread M20, IP66/68 NEMA4X/6P
С	Thread G1/2, IP66/68 NEMA4X/6P
D	Thread NPT1/2, IP66/68 NEMA4X/6P
Ι	Plug M12, IP66/68 NEMA4X/6P
M	Plug 7/8", IP66/68 NEMA4X/6P
Y	Special version, TSP-no. to be sepc.
060	Probe:
DA	mm, rod 8mm 316L, Ra<0.76µm/30µin
DB	in, rod 0.31in 316L, Ra<0.76µm/30µin
EA	mm, rod 8mm 316L, ep=electro-polished, Ra<0.38µm/15µin
EB	in, rod 0.31in 316L, ep=electro-polished,Ra<0.38µm/15µin
FA	mm, rod 8mm 316L, Ra, 500mm divisible Ra<0.76µm/30µin
FB	in, rod 0.31in 316L, Ra, 20in divisible Ra<0.76µm/30µin
GA	mm, rod 8mm 316L, ep, Ra, 500mm divisible, ep=electro-polished, Ra<0.38µm/15µin
GB	in, rod 0.31in 316L, ep, Ra, 20in divisible, ep=electro-polished,Ra<0.38µm/15µin
HA	mm, rod 8mm 316L, Ra, 1000mm divisible Ra<0.76µm/30µin
HB	in, rod 0.31in 316L, Ra, 40in divisible Ra<0.76µm/30µin
IA	mm, rod 8mm 316L, ep, Ra, 1000mm divisible, ep=electro-polished Ra<0.38µm/15µin
IB	in, rod 0.31in 316L, ep, Ra, 40in divisible, ep=electro-polished,Ra<0.38µm/15µin
YY	Special version, TSP-no. to be sepc.

090	Seal:
B5	EPDM, FDA, USP Cl.VI, -20130°C
C4	Kalrez, FDA, USP Cl.VI, -20150°C
Y9	Special version, TSP-no. to be sepc.
100	Process connection:
MAJ	DIN11864-1 A DN25 tube DIN11866-A, 316L
MDJ	DIN11864-1 A DN50 tube DIN11866-A, 316L
MOJ	DIN11851 DN50 PN40 cap-nut, 316L
MQJ	DIN11851 DN40 PN40 cap-nut, 316L
S1J	NEUMO BioControl D25 PN16, 316L
S4J	NEUMO BioControl D50 PN16, 316L
S6J	NEUMO BioControl D80 PN16, 316L
TDJ	Tri-Clamp ISO2852 DN40-51 (2"), 316L
TFJ	Tri-Clamp ISO2852 DN70-76.1 (3"), 316L
TOJ	Tri-Clamp ISO2852 DN25-38 (11-1/2"), 316L
TSJ	Varivent N 50/40 PN16, 316L
TXJ	SMS 2" PN25, 316L
T7J	SMS 1-1/2" PN25, 316L
U1J	Thread M24, 316L, install > accessory weld-in adapter
YYY	Special version, TSP-no. to be sepc.
500	Additional Operation Language:
AA	English
AB	German
AC	French
AD	Spanish
AE	Italian
AF	Dutch
AL	Japanese
550	Calibration:
*F4	5-point linearity protocol
F9	Special version, TSP-no. to be sepc.
570	Service: (Multiple options can be selected)
IJ	Customized parametrization HART
IK	Customized parametrization PA
IW	W/o Tooling DVD (FieldCare setup)
I9	Special version, TSP-no. to be sepc.
580	Test, Certificate: (Multiple options can be selected)
JA	EN10204-3.1 material wetted parts 316/ 316L, inspection certificate
*KB	EN10204-3.1 material wetted parts + Ra, 316/316L, Ra= surface roughness, measuring method, inspection certificate
KE	EN10204-3.1 pressure test, inspection certificate
*KF	EN10204-3.1 Delta Ferrit Content test, inspection certificate
К9	Special version, TSP-no. to be sepc.

590	Additional Approval: (Multiple options can be selected)
*LA	SIL
LW	CoC Certificate of Compliance
L9	Special version, TSP-no. to be sepc.
600	Probe Design: (Multiple options can be selected)
MA	Sensor compact, detachable
MB	Sensor remote, 3m/9ft cable, detachable+mounting bracket
MC	Sensor remote, 6m/18ft cable, detachable+mounting bracket
M9	Special version, TSP-no. to be sepc.
610	Accessory mounted: (Multiple options can be selected)
NA	Overvoltage protection
ND	Cover, housing GF26, window Glass
09	Special version, TSP-no. to be sepc.
850	Firmware Version:
77	01.00.zz, PROFIBUS PA, DevRev01
78	01.00.zz, HART, DevRev01
895	Tagging: (Multiple options can be selected)       Image: (Multiple options can be selected)
Z1	Tagging (TAG), see additional spec.
Z2	Bus address, see additional spec.

### Accessories

Device-specific accessories	Accessory	Description
	Weld-in adpater M24 D65	With M24x1.5 thread for flush-mounted sensors. Material: 1.4435 (AISI 316L) Weight: 0.22 kg (0.48 lbs) Order No. • Standard version: 71041381 • with 3.1 material certificate: 71041383
		For details see Operating instructions BA301F.

Accessory	Description	
Protective cover		A0013589
	With the protective cover the probe can be locked with dismantled electronics. Order no.: 71041379 For details refer to Operating Instructions BA362F.	

Accessory	Description
Calibration kit	The calibration kit is used to regularly test the accuracy and reproducibility of the Levelflex FMP53 level measurement device. Order No.: 71041382 For details refer to Operating Instructions BA360F.

# Communication-specific accessories

Accessory	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface.
	For details refer to Technical Information TI404F/00

Accessory	Description
Commubox FXA291	Connects Endress+Hauser field devices with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a computer.
	For details refer to Technical Information TI405C/07

Accessory	Description
HART Loop Converter HMX50	Evaluates the dynamic HART variables and converts them to analog current signals or limit values.
	For details refer to Technical Information " TI429F/00 and Operating Instructions BA371F/00

Accessory	Description
WirelessHART Adapter SWA70	Connects field devices to a WirelessHART network. The WirelessHART adapter can be mounted directly at a HART device and is easly integrated into an existing HART network. It ensures safe data transmission and can be operated in parallel with other wireless networks.
	For details refer to Operating Instructions BA061S/04

Accessory	Description		
Fieldgate FXA320	Gateway for remote monitoring of connected 4-20mA measuring devices via web browser. For details refer to Technical Information TI025S/04 and Operating Instructions BA053S/04		

Accessory	Description		
Fieldgate FXA520	Gateway for remote diagnosis and parametrization of connected HART measuring devices via web browser.		
	For details refer to Technical Information TI025S/04/xx and Operating Instructions BA051S/04		

Accessory	Description
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote parametrization and measured value inspection via the HART current output (4-20mA).

Service-specific accessories	Accessory	Description
	FieldCare	Endress+Hauser's FDT-based Plant Asset Management tool. Helps to configure and maintain all field devices of your plant. By supplying status information it also supports the diagnosis of the devices. For details refer to Operating Instructions BA027S/04 and BA059AS/04

System components	Accessory	Description
	Graphic Data Manager Memograph M	The graphic data manager Memograph M provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on an SD card or USB stick.
		For details refer to Technical Information TI133R/09 and Operating Instructions BA247R/09
	RN221N	Active barrier with power supply for safe separation of 4 to 20 mA current circuits. Provides bi-directional HART transmission.
		For details refer to Technical Information TI073R/09 and Operating Instructions $\ensuremath{BA202R/09}$
	RNS221	Transmitter supply for 2-wire sensors or transmitters exclusively for non-Ex areas. Provides bi-directional communication using the HART communication sockets.
		For details refer to Technical Information TI081R/09 and Operating Instructions KA110R/09

### **Documentation**

Standard documentation

The following document types are available: • On the CD supplied with the device

 $\blacksquare$  In the Download Area of the Endress+Hauser Internet site: www.endress.com  $\rightarrow$  Download

#### Levelflex FMP53

Correlation of documentations to the device:

Device	Power supply, output	Communication	Document type	Document code
FMP53	A, B, C, K, L	HART	Operating Instructions	BA01002F/00/DE
			Brief Operating Instructions	KA01078F/00/DE
			Description of Device Parameters	GP01000F/00/DE
	G	PROFIBUS PA	Operating Instructions	BA01007F/00/DE
			Brief Operating Instructions	KA01080F/00/DE
			Description of Device Parameters	GP01001F/00/DE

#### Supplementary documentation

Devrice	Decument time	Decument code
Device	Document type	Document code
Fieldgate FXA520	Technical Information	TI369F/00/EN
Tank Side Monitor NRF590	Technical Information	TI402F/00/EN
	Operating Instructions	BA256F/00/EN
	Description of Device Parameters	BA257F/00/EN

Description	Document type	Document code
<b>Time of Flight Liquid Level Measurement</b> Selection and engineering for the process industry	Special Documentation	SD157F/00/EN
<b>Radar Tank Gauging brochure</b> For inventory control and custody transfer applications in tank farms and terminals	Special Documentation	SD001V/00/EN
Engineering hints PROFIBUS PA Guidelines for planning and commissioning	Operating Instructions	BA198F/00/EN

#### Certificates

#### Safety Instructions (XA) for Levelflex FMP53

Depending on the approval, the following Safety Instructions (XA) are supplied with the instrument. They are an integral part of the Operating Instructions.

Feature 010	Approval	Safety Instructions
BA	ATEX II 1 G Ex ia IIC T6 Ga	XA496F-A
BB	ATEX II 1/2 G Ex ia IIC T6 Ga/Gb	XA496F-A
BC	ATEX II 1/2 G Ex d[ia] IIC T6 Ga/Gb	XA499F-A
BD	ATEX II 1/3 G Ex ic[a] IIC T6 Ga/Gc	XA497F-A
BG	ATEX II 3 G Ex nA IIC T6 Gc	XA498F-A
BH	ATEX II 3 G Ex ic IIC T6 Gc	XA498F-A
B2	ATEX II 1/2 G Ex ia IIC T6 Ga/Gb, II 1/2 D Ex t[ia] IIIC Txx°C Da/Db IP6x	XA502F-A
B3	ATEX II 1/2 G Ex d[ia] IIC Tó Ga/Gb, II 1/2 D Ex t[ia] IIIC Txx°C Da/Db IPóx	XA503F-A
B4	ATEX II 1/2 G Ex ia IIC T6 Ga/Gb, Ex d[ia] IIC T6 Ga/Gb	XA500F-A
IA	IECEx Zone 0 Ex ia IIC T6 Ga	XA496F-A
IB	IECEx Zone 0/1 Ex ia IIC T6 Ga/Gb	XA496F-A
IC	IECEx Zone 0/1 Ex d[ia] IIC T6 Ga/Gb	XA499F-A
ID	IECEx Zone 0/2 Ex ic[ia] IIC T6 Ga/Gc	XA497F-A
IG	IECEx Zone 2 Ex nA IIC T6 Gc	XA498F-A
IH	IECEx Zone 2 Ex ic IIC T6 Gc	XA498F-A
I2	IECEx Zone 0/1 Ex ia IIC To Ga/Gb, Zone 20/21 Ex t[ia] IIIC Txx°C Da/Db IP6x	XA502F-A
I3	IECEx Zone 0/1 Ex d[ia] IIC T6 Ga/Gb, Zone 20/21 Ex t[ia] IIIC Txx°C Da/Db IP6x	XA503F-A

For certified devices the relevant Safety Instructions (XA) are indicated on the nameplate.

### **Registered trademarks**

#### HART®

Registered trademark of the HART Communication Foundation, Austin, USA

#### **PROFIBUS®**

Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

#### FOUNDATION<sup>TM</sup> Fieldbus

Registered trademark of the Fieldbus Foundation, Austin, Texas, USA

#### KALREZ®, VITON ®

Registered trademark of DuPont Performance Elastomers L.L.C., Wilmington, USA

#### TEFLON ®

Registered trademark of E.I. DuPont de Nemours & Co., Wilmington, USA

#### TRI CLAMP ®

Registered trademark of Alfa Laval Inc., Kenosha, USA

### Patents

This product may be protected by at least one of the following patents. Further patents are pending.

US Patents	EP Patents
5.827.985	
5.884.231	
5.973.637	_
6.087.978	955 527
6.140.940	
6.481.276	
6.512.358	1 301 914
6.559.657	1 020 735
6.640.628	—
6.691.570	_
6.847.214	
7.441.454	_
7.477.059	
	1 389 337

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