Conductivity measurement/CombiLyz

AFI4 (2 x 4...20 mA, HART)

AFI4-###0.#0#4.1###

Overview

- All-in-One conductivity sensor
- All wetted parts in PEEK
- Compact, food-safe, hygienic design
- 3-A sanitary standards and FDA-compliant, EHEDG-certified
- HART® communication protocol

Technical data

Performance characteristics conductivity	
Conductivity	14 selectable ranges
Min. measurable conductivity	50 µS/cm
Measuring ranges (selectable)	0 … 500 µS/cm 0 … 1 mS/cm 0 … 2 mS/cm 0 … 3 mS/cm 0 … 5 mS/cm 0 … 10 mS/cm 0 … 20 mS/cm 0 … 30 mS/cm 0 … 50 mS/cm 0 … 100 mS/cm 0 … 200 mS/cm 0 … 300 mS/cm 0 … 500 mS/cm 0 … 1000 mS/cm
Max. measuring span	1000 mS/cm
Min. measuring span	500 µS/cm
Max. measuring error	± 1.0 % FSR , 0 … 1 mS/cm to 0 … 500 mS/cm ± 1.5 % FSR , 0 … 1000 mS/cm ± 1.5 % FSR , 0 … 500 µS/cm
Reference conditions for max. measuring error	Sensor incl. transmitter @ 25°C ambient temperature
Reference temperature	25 °C , adjustable
Repeatability	< 0.5 % FSR , > 1 mS/cm
Compensated temperature range	-20 … 150 °C
Temperature compensation	0.0 … 5.0 % FSR/K , adjustable
Step response time, T90	≤ 2.0 s
Sample time	≤ 0.4 s

Performance characteristics conductivity	
Temperature drift (Factor of change in process temperature from 25°C)	≤ 0.1 % FSR/K
Temperature drift (Factor of change in process temperature from 25°C) (0 ... 500 µS / cm)	≤ 0.3 % FSR/K
Performance characteristics concentration	
Concentration	Programmable with FlexProgram
Factory set media (available from FlexProgram)	0 … 25 % by weight , HNO3 (nitric acid) 36 … 82 % by weight , HNO3 (nitric acid) 0 … 12 % by weight , NaOH (caustic soda) 25 … 50 % by weight , NaOH (caustic soda)
Customer defined media	Customer defined (30 point lookup table)
Performance characteristics temperature	
Temperature	Free programmable range
Measuring range	-20 … 150 °C
Thermal response time, T90	≤ 15 s
Max. measuring error	± 1.5 K 0.3 K , 20 … 50 °C
Reference conditions for max. measuring error	Sensor incl. transmitter @ 25°C ambient temperature
Temperature coefficient (Factor of change in process temperature from 25°C)	≤ 0.05 % FSR/K

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2023-01-06

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Technical data

Process conditions	
Process temperature	-20 … 140 °C , permanent 140 … 150 °C , max. t < 1 h
Process pressure	≤ 25 bar
SIP/CIP compatibility	< 60 min, @ medium temperature up to 150 °C
Process connection	
Connection variants	G 1 A hygienic
Immersion length	Refer to section "Dimensional drawings"
Wetted parts material	PEEK Natura
Surface roughness wetted parts	Ra ≤ 0.8 µm
Ambient conditions	
Operating temperature range	-30 … 80 °C , with DFON touch screen -40 … 85 °C , without DFON touch screen
Degree of protection (EN 60529)	IP67 IP69K , with appropriate cable
Humidity	< 98 % RH , condensing
Insulation voltage	500 V AC
Vibration (sinusoidal) (EN 60068-2-6)	1.0 mm p-p (2 … 13.2 Hz), 0.7 g (13.2 … 100 Hz), 1 octave / min.
Output signal	
Conductivity/Concentration	4 … 20 mA 4 … 20 mA , + HART®
Temperature	4 … 20 mA
Relays	2 relays included in the display
Current rating	100 mA , max.
Interface	IO-Link 1.1 With HART® modem With FlexProgrammer 9701
HART® interface	
Properties	Universal commands Common-practice commands Conductivity device family commands Device Specific Commands For more information please see ‚HART Field Device Specification‘
Protocol	HCF standard, Rev.7
IO-Link interface	
IO-Link version	1.1
Device profile	Smart Sensor Profile
IO-Link port type	Class A
Baud rate	38,4 kbaud (COM2)
Cycle time	≥ 8.4 ms
Process data length	128 bit
SIO-mode	Yes
Process data (cyclic)	Switch state Signal analog output 1 Signal analog output 2 Temperature Unit temperature Conductivity Concentration Actual measuring range

IO-Link interface	
Adjustable data (acyclic)	Measuring mode Sensor calibration Media calibration Reference temperature Temperature compensation Switch parameters
Dual Channel	Conductivity/Concentration
Dual Channel 2	Temperature
Dual Channel 3	Relay 1
Dual Channel 4	Relay 2
Housing	
Style	FlexHousing, Ø80 mm Bottom process connection Rear process connection
Overall size	Refer to section "Dimensional drawings"
Material	AISI 304 (1.4301)
Electrical connection	
Connector (available for left side)	M12-A, 5-pin, stainless steel M16x1.5, plastic M16x1.5, stainless steel M20x1.5, plastic M20x1.5, stainless steel
Connector (available for right side)	M16x1.5, plastic M16x1.5, stainless steel M20x1.5, plastic M20x1.5, stainless steel M12-A, 4-pin, stainless steel, 4 … 20 mA output M12-A, 8-pin, stainless steel, 4 … 20 mA + relay output
Power supply	
Voltage supply range	15 … 35 V DC 18 … 30 V DC , with IO-Link
Current consumption (no load)	150 mA , max.
Power-up time	≤ 10 s , without DFON touch screen ≤ 16 s , with DFON touch screen
Factory settings	
HART®	Activated
IO-Link	Disabled
Output mode	Conductivity
Conductivity Range 1	0 … 200 mS/cm
Conductivity Range 2	0 … 20 mS/cm
Conductivity Range 3	0 … 2 mS/cm
Conductivity Range 4	0 … 500 µS/cm
Temperature output	0 … 150 °C
Output damping	0.00 s
Temperature compensation Range 1-4	2.00 % FSR/K
Output lower limit	3.70 mA
Output upper limit	21.00 mA
Compliance and approvals	
EMC	EN 61326-1

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Technical data

Compliance and approvals

Hygiene	3-A (74-07) EHEDG EL Class I FDA (21 CFR 177.2415)

Compliance and approvals

Safety	cULus listed, E491206

Operating conditions

Measuring range	Max. measuring error	
0 … 500 µS/cm	1,5 % FSR	7,5 µS/cm
0 … 1 mS/cm	1,0 % FSR	10 µS/cm
0 … 2 mS/cm	1,0 % FSR	20 µS/cm
0 … 3 mS/cm	1,0 % FSR	30 µS/cm
0 … 5 mS/cm	1,0 % FSR	50 µS/cm
0 … 10 mS/cm	1,0 % FSR	100 µS/cm
0 … 20 mS/cm	1,0 % FSR	200 µS/cm
0 … 30 mS/cm	1,0 % FSR	300 µS/cm
0 … 50 mS/cm	1,0 % FSR	500 µS/cm
0 … 100 mS/cm	1,0 % FSR	1 mS/cm
0 … 200 mS/cm	1,0 % FSR	2 mS/cm
0 … 300 mS/cm	1,0 % FSR	3 mS/cm
0 … 500 mS/cm	1,0 % FSR	5 mS/cm
0 … 1000 mS/cm	1,5 % FSR	15 mS/cm

Conductivity		Media group	Media
55 nS/cm		Water	Ultra-pure water
1 µS/cm			Pure water
10 µS/cm			Process water
600 µS/cm	AFIx range	Food & Beverage	Drinking water
			Beer
1 mS/cm			Milk
			Orange juice
			Apple juice
10 mS/cm		Process	Phosphoric acid
100 mS/cm			Hydrochloric acid
1000 mS/cm			Sodium hydroxide

Display

General information

Panel type	FSTN Graphical LCD
Display range	-9999 … 99999
Max. digit height	22 mm
Material	Polycarbonate

Ambient conditions

Operating temperature range	-30 … 80 °C
Optimal readability temperature range	-10 … 70 °C
Degree of protection (EN 60529)	IP 67 IP 69 K

Input signal

Input signal from transmitter	Digital, 2-way for communication between transmitter and display
Update time	≤ 1 s , max. 0.3 s , typ.

User configurable data

Error- / Warning-indication	Individually configurable display and backlight indication in white, green or red colour, steady or flashing light. Configurable limits over the range
Media description	Customer programmable e.g. "MILK", "Water", "NaOH"
Measuring unit	µS/cm mS/cm % °C °F
User defined measuring unit	8 × 20 pixel matrix

Relays

Contacts	2 x solid state relays
Max. load current	75 mA
Max. switching voltage	60 V

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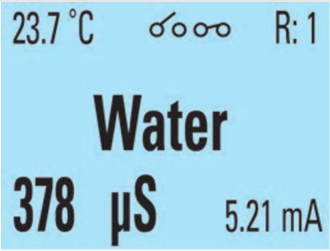
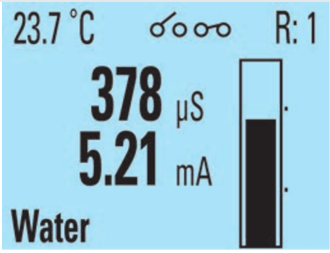
Display

Selectable display views

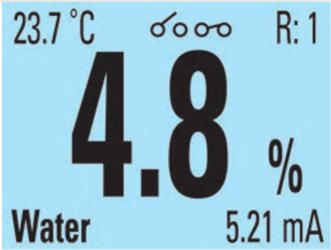
Conductivity value with medium and additional values



Medium with additional values

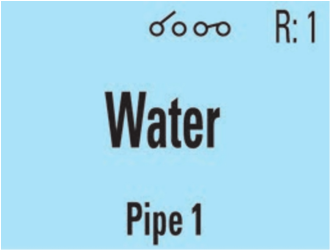


Bar chart with additional values and medium

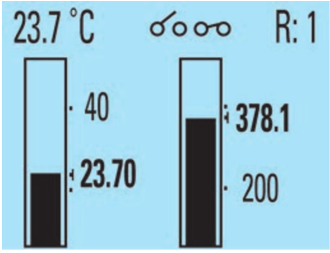


Concentration with additional values and medium

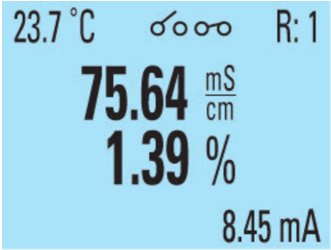
Conductivity value with measuring point (TAG)



Medium with measuring point (TAG)



Bar chart including temperature

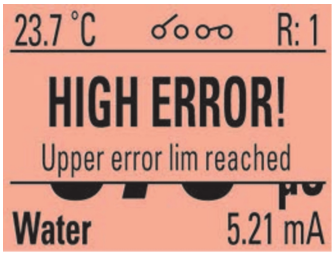


Conductivity and concentration value

White background

Green background

Red background

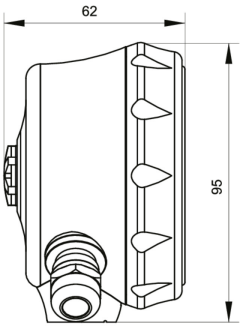


Exemplary error message

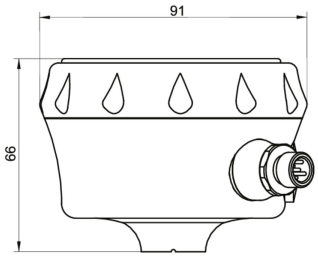
Dimensional drawings (mm)

Housing

FlexHousing, available with or without DFON tochscreen



FlexHousing with bottom process connection



FlexHousing with rear process connection

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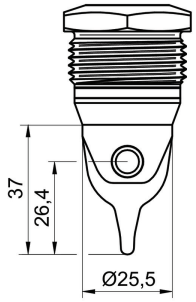
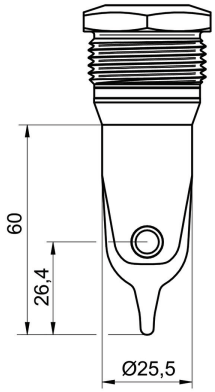
Dimensional drawings (mm)

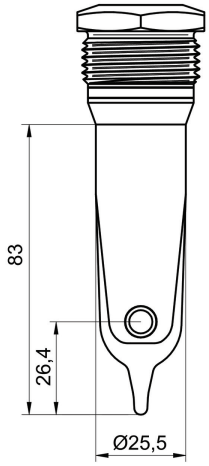
Process connection



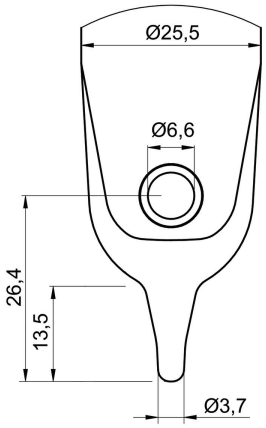
G 1 A hygienic (BCID: A04), PEEK, 37 mm



G 1 A hygienic (BCID: A04), PEEK, 60 mm



G 1 A hygienic (BCID: A04), PEEK, 83 mm



Sensor tip with integrated Pt100 sensor element

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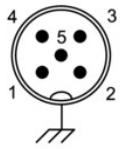
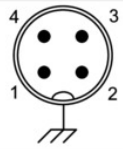
Electrical connection

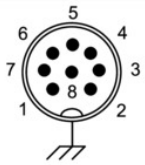
M12-A, 5-pin



M12-A, 4-pin



M12-A, 8-pin



Left side connection (front view): M12-A, 5-pin

Function			Pin assignment
+Vs	Power supply +	15 … 35 V DC	1
GND (0 V)	Power supply -	15 … 35 V DC	3
Iout1+	Conductivity +	4 … 20 mA	4
Iout-	Conductivity -	4 … 20 mA	2
IO-Link	IO-Link / SW		5

Iout- is internally connected as common for both Conductivity/Concentration and Temperature output.

Left side connection (front view): Cable gland

Function			Recommended wiring
+Vs	Power supply +	15 … 35 V DC	BN
GND (0 V)	Power supply -	15 … 35 V DC	BU
Iout1+	Conductivity +	4 … 20 mA	BK
Iout-	Conductivity -	4 … 20 mA	WH
IO-Link	IO-Link / SW		GY

Iout- is internally connected as common for both Conductivity/Concentration and Temperature output.

Right side connection (front view): M12-A, 4-pin

Function			Pin assignment
Iout2+	Temperature +	4 … 20 mA	4
Iout-	Temperature -	4 … 20 mA	2
S1	External input	n.c. / 24 V DC	1
S2	External input	n.c. / 24 V DC	3

Iout- is internally connected as common for both Conductivity/Concentration and Temperature output.

Right side connection (front view): M12-A, 8-pin

Function			Pin assignment
Iout2+	Temperature +	4 … 20 mA	2
Iout-	Temperature -	4 … 20 mA	7
S1	External input	n.c. / 24 V DC	1
S2	External input	n.c. / 24 V DC	8
R11	Relay 1		5
R12	Relay 1		6
R21	Relay 2		3
R22	Relay 2		4

Iout- is internally connected as common for both Conductivity/Concentration and Temperature output.

Right side connection (front view): Cable gland

Function			Recommended wiring
Iout2+	Temperature +	4 … 20 mA	BN
Iout-	Temperature -	4 … 20 mA	BU
S1	External input	n.c. / 24 V DC	WH
S2	External input	n.c. / 24 V DC	RD
R11	Relay 1		GY
R12	Relay 1		PK
R21	Relay 2		GN
R22	Relay 2		YE

Iout- is internally connected as common for both Conductivity/Concentration and Temperature output.

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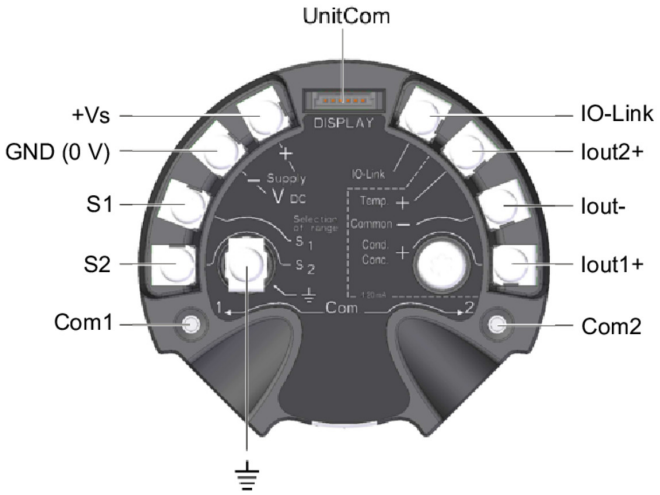
Electrical connection

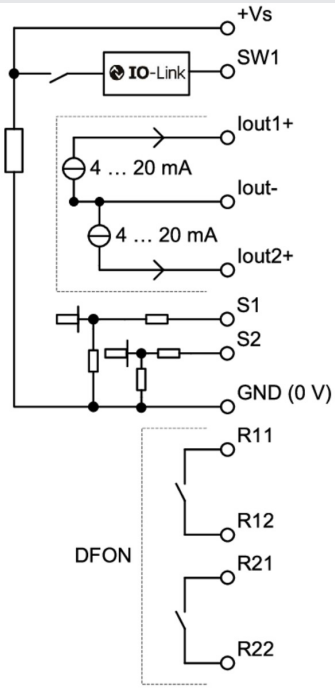
Terminal assignment transmitter



Terminal assignment DFON display

The ground connection is to be connected with the cable shield if using cable gland and shielded cable.

Equivalent circuit diagram



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Ordering information

Ordering key - Configuration possibilities see website

	AFI	4	-	#	#	#	0	.	#	0	#	4	.	1	#	#	#
Product																	
	AFI																
Type																	
Compact version		4															
Housing																	
Bottom process connection				5													
Rear process connection				6													
Electrical connection																	
2 x M16x1.5 cable gland					8												
1 x M16x1.5 + 1 x M20x1.5 cable gland					A												
2 x M20x1.5 cable gland					B												
1 x M12-A, 5-pin + 1 x M12-A, 4-pin					C												
1 x M12-A, 5-pin + 1 x M12-A, 8-pin					D												
Material of el. connection																	
Plastic						1											
Stainless steel, AISI 304 (1.4301)						3											
Cable length (cm)																	
No cable, compact version							0										
Display																	
Without display									1								
With display, with activated relays									4								
Safety																	
Standard										0							
Configuration																	
No configuration											0						
Configuration of range											1						
Configuration of range + display incl. 2 relays											3						
Output																	
2 x 4...20 mA, HART												4					
Version																	
IO-Link														1			
Process connection																	
G 1 A hygienic, PEEK, length: 37 mm. (A04)															1		
G 1 A hygienic, PEEK, length: 83 mm. (A04)															2		
G 1 A hygienic, PEEK, length: 60 mm. (A04)															3		
Approvals																	
Standard approvals																0	
3-A / EHEDG																1	
Calibration certificate																	
No																	0
Calibration certificate, conductivity (5 points)																	1
Calibration certificate, temperature. (3 points)																	2
Calibration certificate, conductivity (5 points) and temperature (3 points)																	3

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