BOPP & REUTHER MESSTECHNIK

Density and Concentration Measuring Devices

DIMF1.3 TVS
DIMF2.0 TVS
DIMF2.1 TVS

for the continuous measurement of density and concentration of liquids

with HART® communication

Operating Manual

HART COMMUNICATION FOUNDATION

PACTware

FDT

Bopp & Reuther
Messtechnik GmbH
Am Neuen Rheinhafen 4
67346 Speyer
Germany

Phone: +49 6232 657-0
Fax: +49 6232 657-505
info@bopp-reuther.com
www.bopp-reuther.com

A-EN-06530-00I
02/2023

Contents

Introduction

I. Transport, Delivery, Storage

Storage and transport:

Protect devices against humidity, soiling, impacts and damages.

Inspection of the delivery:

Upon receipt, check the delivery for completeness. Compare the device data with the data on the delivery note and in the order records.

Report any in-transit damage immediately upon delivery. Damages reported at a later date shall not be recognised.

II. Warranty

Please refer to the contractual terms and conditions relating to delivery for the scope and period of warranty. Warranty claims shall be conditional to correct installation and commissioning in accordance with the operating instructions of the device.

The electronics contain electrostatically sensitive parts. Therefore, avoid electrostatic discharges when the electronics housing is open.

III. General Safety Information

Read and observe these operating instructions thoroughly and keep them available for reference.

Installation has to be carried out by qualified personnel.

Always observe the EN 60079-14 regulations, the generally acknowledged rules of technology and these operating instructions during installation and operation of the device.

We shall accept no liability for improper handling, use, installation, operation or maintenance of the device.

In the case of corrosive media, the material resistance of the oscillating pipe has to be checked.

Damaged devices must be shut down.

If zone 0 is available (also during start-up and shutdown of the system) in the pipe, ensure that solids cannot flow through the pipe, causing mechanical impact and friction sparks.

1 Technical Data

1.1 Density transducer

	DIMF 1.3	DIMF 2.0	DIMF 2.1
Density range	0 to 5000 kg/m³		
Calibration range	400 to 2000 kg/m³		
Measuring accuracy	better than ± 0.01 % (± 0.1 kg/m³)	better than ± 0.02 % (± 0.2 kg/m³)	better than ± 0.02 % (± 0.2 kg/m³)
		better than ± 0.01 % (± 0.1 kg/m³) with special calibration	
Repeatability	better than ± 0.005 % (± 0.05 kg/m³)	better than ± 0.005 % (± 0.05 kg/m³)	better than ± 0.005 % (± 0.05 kg/m³)
Medium temperature	- 40°C to + 100°C	- 40°C to + 150°C (up to 210°C on request)	- 40°C to + 150°C
Temperature compensation	via integrated Pt1000 in accordance with DIN Class A directly in the transmitter		
Pressure influence	less than 0.02 kg/m³/bar		
Operating pressure	100 bar	100 bar	40 bar
Liquid	for non-aggressive liquids or liquid mixtures, especially for hydrocarbons	pumpable liquids	pumpable liquids
Material: wetted parts	special alloy made of NiFeCr and 1.4571	stainless steel 1.4571 or Hastelloy C4 or tantalum or Inconel 600 or Monel 400 or others on request	stainless steel 1.4571, others on request
Material: Transmitter housing	stainless steel 1.4571		
Smallest inside diameter	2 x 5mm parallel	∅ approx. 10 mm	∅ approx. 25 mm
Special features	gasket-free construction, optional material certificates in accordance with DIN ISO10204-2.2	gasket-free construction, optional material certificates in accordance with DIN ISO10204-3.1B	gasket-free construction, optional material certificates in accordance with DIN ISO10204-3.1B
Weight	approx. 3 kg	approx. 4.2 kg	approx. 21 kg
Process connections	internal thread G ¼ ISO 228	Swagelok screw couplings for 12 mm outside pipe diameter DN15 or DN25 flange according to pressure stage PN 40 (or Class 150/300 RF) in accordance with DIN 2501 (or ANSI B 16.5) Other pressure stages on request, as well as various food connections	DN 25 PN 40 in accordance with DIN EN 1091 DN 50 PN 40 in accordance with DIN EN 1091 (or class 150/300 RF ANSI B16.5)

All percentages refer to a density of 1000 kg/m³.
For exact specifications of the device version, see the configuration data sheet of the supplied device.
The possibility of a special calibration depends on the application and must be clarified in advance with the sales department.

1.2 Evaluation electronics of transmitter type TR

Functions	Excites the oscillating element of the density transducer to its natural frequency. Equipped with a two-line display and four keys for displaying data and configuring the on-site transmitter. HART® communication. When the process data is changed, the user can perform a simple modification of the set parameters.
Display parameters	Density, concentration, operating temperature, etc.
Programmable parameters	Lower and upper range value of the output signal (smallest measuring span approx. 5 kg/m³) Calibration constants, constants of liquid, reference temperature etc.
HART® protocol	Operation via PC or laptop equipped with PACTware operating software in connection with the HART® interface or operation via a HART® handheld HH 275 or HC-375 from Emerson
Output signal	4-20 mA, linearised and temperature-corrected, can be assigned to any display parameter e.g. operating density, reference density, concentration, °Brix, °Plato or other parameters derived from density
Power Supply	24 V DC (min. 14 V DC / max. 30 V DC)
Connection	2-wire technology via screw terminals; cable enters via cable gland with M 20 x 1.5 or ½“ NPT thread for pipe installation (conduit system)
Cable specification	2 wires, twisted and shielded
Ambient temperature	- 10 °C to + 58 °C - 40 °C to + 70 °C on request
Storage temperature	- 40 °C to + 70 °C
Safety classes	Exi (standard version): ⟨Ex⟩ II 1/2G Ex ia IIC T4 Ga/Gb ZELM 99 ATEX 0008 X acc. EN 60079-0:2012 + A11:2013 EN 60079-11:2012 Measuring tube designed for Zone 0 EN 60079-26:2015 Exd: ⟨Ex⟩ II 2G Ex d [ib] IIC T4 BVS 04 ATEX E020 X
Degree of protection (housing)	IP67
Dimensions (housing)	ø100 (D) x 155 (L) x 120 (H) mm
Material (housing)	Cast aluminium
Weight	1.2 kg
Calibration and configuration	According to ordering data at Bopp & Reuther Messtechnik GmbH

1.3Required differential pressure

Density transducers of the DIMF series measure independent of the flow rate and also at zero flow rate. Their application is, therefore, normally problem-free. However, it has to be ensured that the operating flow rate in the transducer

- updates the sample fast enough
- equalises the temperature in the transducer
- prevents air or gas bubbles or deposits in the oscillating tube
- does not cause cavitation in the oscillating tube
- does not cause wear through abrasives

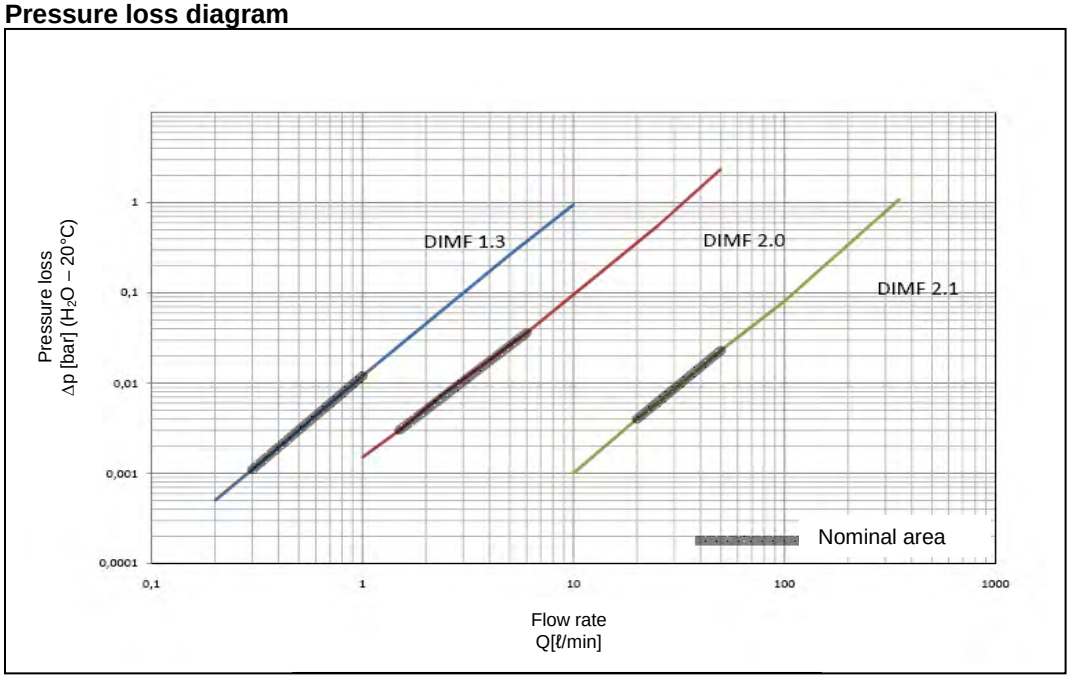
From experience, the following operating flows are recommended to ensure a sufficiently fast sample update:

DIMF 1.3	0.3 to 1 ℓ/min
DIMF 2.0	1.5 to 6 ℓ/min
DIMF 2.1	20 to 50 ℓ/min

Max. flow range:

DIMF 1.3	0 to 10 ℓ/min
DIMF 2.0	0 to 50 ℓ/min
DIMF 2.1	0 to 350 ℓ/min

Pressure loss diagram



2 Intended use

The DIMF density transducer allows the continuous measurement of the density or concentration of liquids and liquid mixtures.
The proven oscillation fork principle (DIMF 1.3) or oscillating element principle (DIMF 2.0 and 2.1) ensures a high-degree of accuracy in combination with outstanding long-term stability. The simple construction assures reliable operation even under tough process conditions.

3 Measuring principle

DIMF 1.3
The real sensor of the density transducer is a hollow oscillation fork. The liquid to be measured passes continuously through the oscillation fork. Excited electromagnetically by an exitation coil, it will oscillate at its natural frequency. Changes in the density of the liquid lead to changes in the natural frequency. This change in frequency, sensed by a pick-up coil, represents the measurement effect. An additional built-in resistance thermometer measures the process temperature, which can also be used to equalise the temperature influence in the transducer.
Each density transducer is calibrated with various liquids of different densities. The transducer constants for calculating the density from the frequency, the calibration temperature and the correction coefficients for the temperature influence can be seen in the configuration data protocol (see section 16.7 for example).

DIMF 2.0 and 2.1
The real sensor of the density transducer is an oscillating element in the form of a tube bent into a oscillation fork. The liquid to be measured passes continuously through this element. Excited electromagnetically by an exitation coil, it will oscillate at its natural frequency. Changes in the density of the liquid lead to changes in the natural frequency. This change in frequency, sensed by a pick-up coil, represents the measurement effect. An additional built-in resistance thermometer measures the process temperature, which can also be used to equalise the temperature influence in the transducer.
Each density transducer is calibrated with various liquids of different densities. The transducer constants for calculating the density from the frequency, the calibration temperature and the correction coefficients for the temperature influence can be seen in the configuration data protocol (see section 16.7 for example).

4 Installation

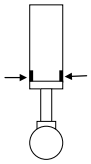
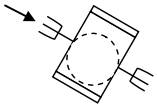
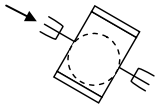
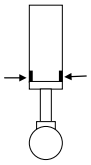
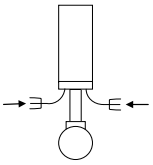
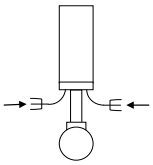
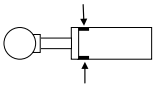
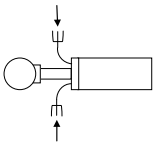
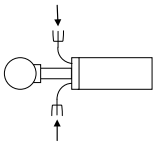
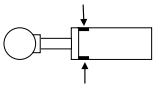
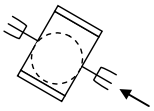
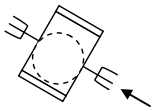
In principle, the density transducer can be installed directly in the main product line (see section 1.3 for possible flow rates). Installation in a by-pass is recommended for higher flow rates or measurements at containers.

4.1 Installation in the main product line

Installation in the main product line is possible up to a flow rate of (see details in section 1.3) (example water). Differing pressure losses have to be considered for other viscosities.

Caution!
The pressure in the product line should never fall below the vapour pressure. Keep density transducer out of direct sunlight. If necessary, heat insulation has to be provided. Only half of the supporting tube should be provided with heat insulation.

4.2Examples of installation positions

	DIMF 1.3	DIMF 2.0	DIMF 2.1
Standard installation position • Clean liquids • Also lower flow rates • Without gas admixtures	any	any	any
Self-draining installation position		 inclination angle 20°-30°	 inclination angle 20°-30°
Installation position for liquids which are subject to sedimentation			
			
Installation position for liquids in which gas bubbles can occur		 inclination angle 20°-30°	 inclination angle 20°-30°

The arrow indicates the possible direction of flow.

5 Assembly

5.1 Density transducer

- Handle with care; do not knock
- Install in the by-pass or directly in the product line
- De-aerate before commissioning
- Provide a constant flow through the density transducer
- Any flow direction is possible
- For flow rate, see details in section 1.3
  (provides current liquid sample, prevents sedimentation)
- Prevent generation of vapour bubbles
- A device installation clamp or bracket is recommended
  (installation clamps Bopp & Reuther Messtechnik accessories)
- If the installation position is self-draining a clamp
  or bracket has to be used to hold or support the device
- The pipe ends of the density transducer DIMF 2.0 and 2.1 should not be
  bent during installation

5.2 Piping

- Min. cross section of connecting pipe
  DIMF 1.3: 6 mm
  DIMF 2.0: 12 mm
  DIMF 2.1: DN 25
- Fit sampling connection laterally if the main line is horizontal
- Supply pipe should be as short as possible
- If necessary, provide heat insulation for supply pipe
- If necessary, provide flushing connections close to the density transducer

5.3 Process connections

Ensure that the transducer connection is compatible with the piping connections.
See the supplied configuration data sheet for the type of connection of your density transducer.

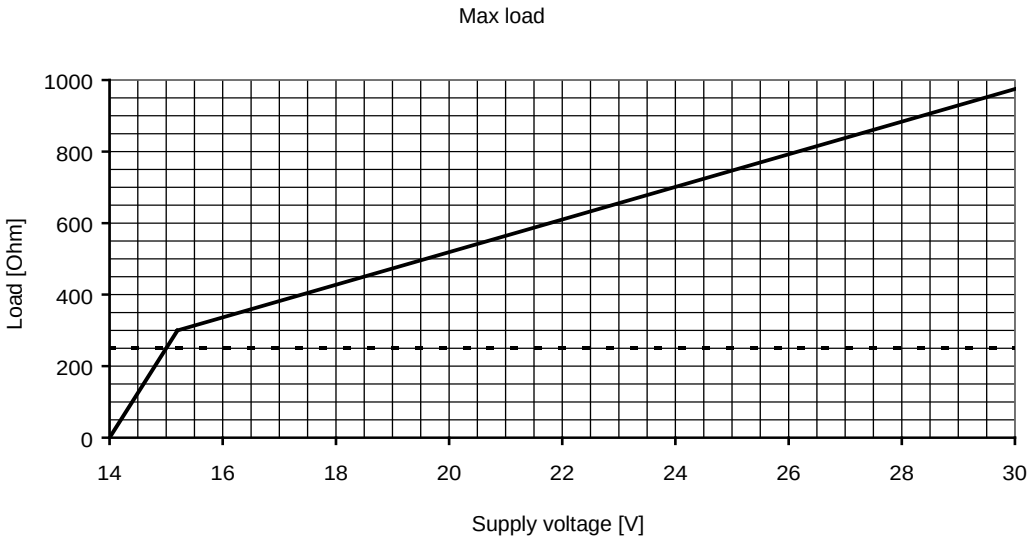
5.4 Relationship between the permissible ambient and liquid temperature

DIMF... (interconnected version)			
Class	Ambient temperature	Temperature of liquid	Type
T2 T3 T3	46 46 49	210 200 170	**H** High temperature
T3 T4 T4 T4	50 52 54 58	150 135 110 60	**S+H** Standard temperature and high temperature

6 Electrical connection

6.1 Power supply voltage

- The transmitter type TR is supplied with 24 V DC, 2-wire technology
- Terminal voltage (terminal 1 and 2) 15...30 V DC
- 2-wire cables, twisted and shielded, are recommended (cable diameter 6-12 mm)
- Cable shielding according to wiring diagram in section 0
- In order to ensure safe HART® communication, the limits for the minimum load with $R_L \geq 250\ \Omega$ must be observed
- For the maximum amount of line and load resistance, see diagram below. The maximum load depends on the supply voltage.



$$\text{For } U_B \geq 15.2V: \quad R = \frac{(U_B - 8.5V)}{0.022\ A}$$

6.2 Additional requirements in explosion hazardous area for intrinsically safe operation

- Observe installation regulations in accordance with DIN EN 60079-14 / VDE 0165 Part 1
- Connected loads power supply voltage
  U_0 = 30 V I_0 = 110 mA P_0 = 825 mW
  Ci ≤ 34 nF Li ≤ 0.6 mH
- The supply of power has to be via a certified, intrinsically safe supply unit or via safety barriers.
- In order to connect the equipotential bonding conductor safely, use the internal and external equipotential bonding connector terminals, which have been designed for a connection cross section of 1.5 mm² (inside) or 4 mm² (outside).
- If barriers are part of the supply circuit, they also have to be connected to the common equipotential bonding connector.

7 Commissioning

- Flush pipes before connecting the density transducer
- Ensure that all connections are tight
- De-aerate the density transducer
- Switch on power supply

8 Factory setting

The density transducers of the DIMF series have been parameterised according to your specifications. After switching on the power supply, the specified parameters (density, reference density, concentration, etc.) and the operating temperature are shown on the display.
If these parameters have changed since the order was placed, the setting can be modified (see section 10 “Configuration, Operation”)

9 On-site adjustment

An on-site adjustment is carried out if a deviation has been detected due to certain changes in on-site conditions, after checking the error reasons according to section 13.1. A simple adjustment can be carried out by changing the transducer constant K_0.

Example: Measured condition The temperature has to be relatively stable

Rho (measured density) = 996.6 Kg/m³
Rho (setpoint value) = 996.0 Kg/m³ (e.g. value stated in table)

difference = + 0.6 Kg/m³
current K_0 value = - 7360.708 Kg/m³

Setpoint K_0 value	**= K_0 (current) – difference**

Setpoint K_0 value = - 7360.708 Kg/m³ - 0.6 Kg/m³
= - 7361.308 Kg/m³

The value now has to be programmed into the TR transmitter.

If possible, the constants K_1 and K_2 should not be modified by the user.

10 Configuration, operation

The transmitter can be configured (operated) in two different ways

1. HART® communication
2. On-site via keys and display

10.1 Operation via HART® communication

The device can be operated using a PC or laptop and the PACTware operating software in connection with a HART® interface. PACTware and the respective driver can be downloaded from our website https://www.bopp-reuther.com/en/download/ software.

A HART® communicator (e.g. handheld HC-375 from Emerson) is another operating element which can be used. The operating functions for HC-375 are defined in a DDL (Device Description Language). Using the HC-375 it is possible to operate or configure the DIMF on-site. The connection is described in section 0.
The Device Description Language (DDL) can be downloaded from the Internet (HART Foundation).

10.1.1 Process variables

Measured value:	The current measured value is displayed. The measured value can be selected from a list with density or concentration operating modes. The units are defined in this list. The measured value is permanently assigned to the HART® primary variable and thus also the current output.
Operating density, reference density, frequency, temperature:	The uncorrected or the temperature-corrected operating density, reference density oscillation frequency and the medium temperature can also be displayed in the concentration mode and transmitted via HART® variables 2 to 4. The assignment can be freely selected.
Output range %:	Display of the current measured value in % [(I-4)/16].
Output current:	Display of the setpoint value of the present current output in mA.

10.1.2 Diagnosis

Communication status

Device address:	The device address for polling operation can be assigned a value of between 1 and 15. Address = 0 means analogue operation, address> 0 means polling operation. If the DIMF is to be installed in a multidrop application, an address of between 1 and 15 must be specified. To achieve this, the DIMF has to at first be configured with the desired address in a point-to-point connection.
Number of preambles:	The read value indicates how many preambles the master has to send to the slave in its inquiry. The written value indicates how many preambles the DIMF has to send to the master.

Device status

Data change:	If the data is changed during operation, the data change flag is set and displayed.
Reset data change flag:	The data change flag can be deleted.
Error codes:	The DIMF error codes are displayed. The last error is displayed. All previous error messages are no longer available.

Limit values

Temperatures: The DIMF measures the medium temperature and the temperature in the electronics housing. The min. and max. limit values are stored and displayed.

10.1.3 Basic settings

Device information

Model code: The model code of the device is displayed.

Device identification: The serial number of the electronics is displayed.

Type of device: The type of device is displayed.

Type of sensor: The value is always displayed as 0.

Manufacturer code: The manufacturer's name is displayed.

Distributor code: The distributor's name is displayed.

TAG: The TAG address (measuring point number) is displayed.

Date: The date of the last data change is displayed (has to be overwritten manually).

Descriptor: A short text of 16 characters can be entered or read by the user.

Message: A short text of 32 characters can be entered or read by the user.

Write protection: The DIMF does not support write protection.

Manufacturing no. sensor: The manufacturing number of the sensor can be read.

Manufacturing no. device: The manufacturing number of the device can be read. It is the same as the sensor number.

Revisions, universal, standard, software, hardware: The revision numbers are read.

Transducer data

Transducer factors: The factors K_0, K_1, K_2 as well as K_{T0}, K_{T1}, K_{T2} and T_{kal} can be read and changed.

Medium data

Medium factors: The factors K_{C0}, K_{C1}, K_{C2} as well as K_{X0}, K_{X1}, K_{X2} and T_{Bez} can be read and changed.

Process data

Damping: The damping affects the display and the output current. A value of between 0 and 5 s can be set. The increment is approx. 0.25 s.

Upper/Lower measuring range: The measuring ranges are factory-programmed in DIMF for each application.

Minimum measuring span: The measuring span can be freely defined within the measuring ranges. However, the set values should not fall below the minimum measuring span, as this can cause step changes of the output voltage.

10.1.4 Output signal

Upper measuring range value: Characteristic value for the 20 mA point.

Lower measuring range value: Characteristic value for the 4 mA point.

Selection of the measured variable: The measured variable is assigned to the HART® primary variable and thus also to the current output (operating modes) When displaying density, the user can select between either operating density or reference density. When calculating the concentration, it is possible to select between the various methods.

Current simulation: In order to check the devices connected in series, a fixed output current of 3.9 to 22 mA can be set. After the tests, the current value 0 mA has to be entered to end the simulation.

Alarm 21.8 mA: An alarm signal can be transmitted via the current loop. The current then rises to 21.8 mA. This alarm is generated due to malfunctioning of the DIMF. The alarm function can be switched off.
See Error Code Table 13.2.1

10.1.5 Special settings

Electronic adjustment

Calibrate current output: The characteristic of the analogue current output can be calibrated in its zero point at 4 mA and in its slope at 20 mA. Always ensure that the zero point is calibrated before the upper range value.

Reset device: Via this command, the device can be reset to a defined operating state present after the supply voltage was applied.

10.2 Key operation (configuration via the control unit)

The screw cover at the longer end of the housing has to be open in order to operate the keys. The housing protection class is not guaranteed if the cover is open.
After configuration, the cover has to be refitted and firmly hand-screwed (be careful not to damage the sealing ring).

The housing at the connection side of the Exd version should only be removed after it has been ensured that there is no explosive atmosphere.

The terminal chamber cover of the Exd version is secured against opening. Open the cover by loosening the screw and turning the locking bar to the side. Clamp the bar in this position. Secure the cover after closing it.

10.2.1 Display

The TR transmitter has a two-line display with 8 digits for each line. Each line is subdivided into two fields:

- The channel no. is displayed (1 digit) in the first field
- The respective measured values or constants are displayed (7 digits) in the second field

The activated line is marked with a triangle behind the channel number. Press the ENTER key to toggle between the lines.

10.2.2 Keys

The TR transmitter has four operating keys:

▲ and ▼
- increases or decreases the channel no. in operating mode
- increases or decreases the digits in programming mode

↵
- moves to the next input position (respective digit flashes)
- accepts the current channel contents if shifting to the right and exiting the display
- toggles between the upper and lower line (only in operating mode)

P
- changes from operating mode to programming mode
- places the comma next to the flashing input digit in programming mode.
- deletes error message at channel "]"
- press this key for a few seconds to reset the input position (flashing digit)

10.2.3 Access level

The desired access level can be activated in channel E:

- display level (operating mode)
  all configuration data and measuring values can be actuated and displayed, only channel E is writable.
- user level (programming mode)
  additionally, the upper and lower measuring range value can be configured, an on-site adjustment (K_0 and K_{X0}) carried out and values for the current simulation set
- service level (programming mode)
  all coefficients and adjustment parameters can be configured (see table 10.3)

The modification of certain parameters can result in malfunctioning.

10.2.4 Operating mode

In operating mode, measured values and constants can only be displayed. The following automatically occurs when the TR transmitter is switched on:

- a display test is carried out
- the operating mode is activated
- the current measured variable, density (kg/m³) or concentration (%) (depending on the operating mode) is displayed in the upper line
- the current temperature (°C) is displayed in the lower line
- the lower line is activated

If a different value is to be displayed in a line, press "↵" to activate the desired line. Then press "▲" or "▼" to select the respective channel no. (see table in section 10.3). After the last channel number has been reached, the display returns to the first channel. Once the first channel number has been reached, the display moves to the highest channel number.

10.2.5 Programming mode

Depending on the operating mode of the programming mode the device parameters and medium constants can be programmed or modified on-site. To achieve this, the "P" key has to be pressed briefly until the first digit starts to flash in the display field. This digit can then be changed via "▲" and "▼". Press the ↵ key to move to the next input position (respective digit flashes). Press the P key briefly at the respective position to place a comma. After exiting the last position, the channel is accepted with the current contents.

- all measured and calculated values are frozen while programming the K_0 and K_{X0} values;
  the upper display line is not activated
- if the "programming" function has been initiated but not terminated,
  it will be terminated automatically approx. 2 minutes after the last keypress;
  the old value is restored
- channel no. "]" is used to display errors;
  these can be deleted by pressing the "P" key;
  (see Error code table in section 13.2.1)

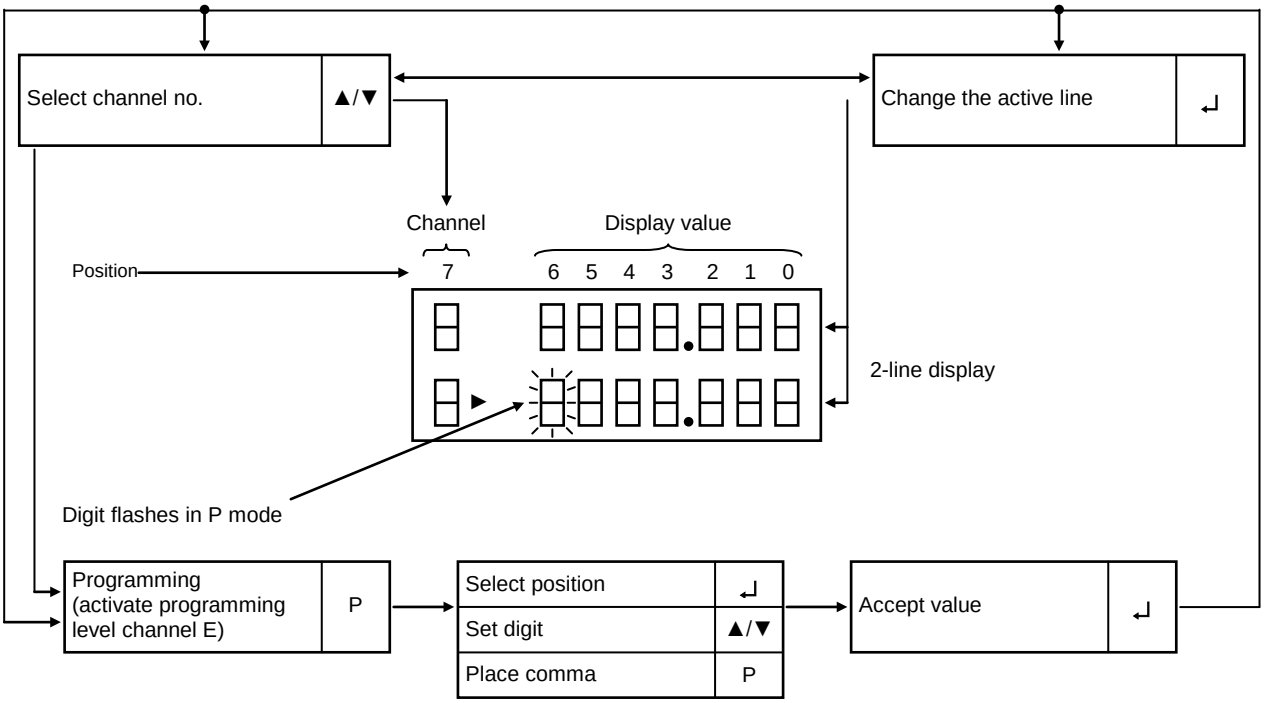
10.2.6 Operating mode

Select the operating mode (channel E) to set how to calculate the measured variable and to display the output signal.
The operating mode selection determines:

- the assignment of the primary "HART® variables" (current output signal)
- the measured value in "channel 0"
- the calculation method

The analogue output signal (4-20 mA) can be freely assigned to the desired measuring range (lower range value channel 5, upper range value channel 6) within the meter ranges.
The minimum measuring span should not fall below a density range of 5 kg/m³.

10.2.7 Brief description of the control unit



	Button			
	P	**▲**	**▼**	**↵**
Operating mode	Activate programming mode	Channel selection: Increase channel no.	Channel selection: Decrease channel no.	Change active line Prolonged pressing: Display test
Programming mode	Set decimal point Prolonged pressing: Resets input position	Set parameters: Increase digit value	Set parameters: Decrease digit value	Move to next digit or accept value Exit programming mode

10.3 Channel overview / Channel assignment

	Channel no. -	Channel no. LCD	Description	Symbol	Unit	Default value	Level
Display values	0	0	Measured value (density ρ or concentration C)	ρ or C max.	kg/m³ or #	-	-
	1	1	Output current	I	mA	-	-
	2	2	Oscillating frequency	f	Hz	-	-
	3	3	Medium temperature	t	°C	-	-
	4	4	Output range	(I-4)/16	%	-	-
Measuring range	5	5	Lower measuring range value	ρ or C min	kg/m³ bzw. #	800	1
	6	6	Upper measuring range value	ρ or C max	kg/m³ bzw. #	1200	1
Transducer constants	7	7	Constant for density polynom	K_0	kg/m³	-12000,00	1
	8	8	Constant for density polynom	K_1	kg/(m³•s)	-190,0000	2
	9	9	Constant for density polynom	K_2	kg/(m³•s²)	-275,0000	2
	10	A	Temperature-correction coefficient	K_{T0}	kg/(m³•K)	-2,60	2
	11	b	Temperature-correction coefficient	K_{T1}	10^{-6}/K	-50,00	2
	12	C	Temperature-correction coefficient	K_{T2}	kg/(m³•K²)	0	2
	13	F	Calibration temperature	t_{kal}	°C	20	2
	14	E	Operating mode switch			00-2--0	0
System constants	15	L	Current adjustment 4mA			-	2
	16	H	Current adjustment 20mA			-	2
	17	I	Pt1000 adjustment offset			-	2
	18	J	Pt1000 adjustment gradient			-	2
Liquid constants	19	n	Temperature compensation	K_{C0}	kg/(m³•K)	0,5	2
	20	o	Temperature compensation	K_{C1}	1/K	0	2
	21	P	Temperature compensation	K_{C2}	kg/(m³•K²)	0	2
	22	q	Constant for polynom approximation	K_{X0}	#		1
	23	r	Constant for polynom approximation	K_{X1}	# / kg/m³		2
	24	U	Constant for polynom approximation	K_{X2}	#•10^{-5} / (kg/m³)²		2
	25	d	Reference temperature	t_{Bez}	°C	15	1
Service measured values	26	t	Current simulation	I	mA	000	1
	27	y	Service measured value (for assignment see channel E)	ρ	kg/m³	-	-
	28	]	Status information error code			00	-
	29	=	Default concentration switch			-	2

#: Unit according to design (e.g. mass %, Brix ...)

Operating mode switch channel E

Display lower line

7	6	5	4	3	2	1	0
E▶			-		-	-	

Access level

0	Display level	(operating mode)
1	User level	(programming mode)
2	Service level	(programming mode)

Service measured value (channel y)

0	Operating density	(uncorrected)
1	Operating density	(temperature corrected)
2	Reference density	(operating mode 01)

Operating mode

0	0	Operating density in kg/m³		
0	1	Reference density in kg/m³		
0	2	Volume concentration in %		- Polynom approximation
0	3	Volume concentration in %		- Mesh point interpolation
3	0	Concentration mass/volume		- Polynom approximation
3	1	Concentration mass/volume		- Mesh point interpolation
3	2	Mass concentration in %		- Polynom approximation
3	3	Mass concentration in %		- Mesh point interpolation
0	4	Reference density in kg/m³		- Mesh point interpolation
1	0	Brix - Fischer	ρ < 1g/cm³	(lighter than water)
2	0		ρ > 1g/cm³	(heavier than water)
1	1	Baumé rationell	ρ < 1g/cm³	(lighter than water)
2	1		ρ > 1g/cm³	(heavier than water)
1	2	Baumé (American)	ρ < 1g/cm³	(lighter than water)
2	2		ρ > 1g/cm³	(heavier than water)
1	3	Balling	ρ < 1g/cm³	(lighter than water)
2	3		ρ > 1g/cm³	(heavier than water)
2	4	Twaddle	ρ > 1g/cm³	(heavier than water)
6	5	API (linear)		
6	6	S. G. (specific gravity 60/60)		

11 Calculation methods

11.1 Determination of the hydrometer degrees

For the determination of the hydrometer degrees, calculation of the reference density occurs via equation 3. The reference temperature for this is specified.
The equations for converting the hydrometer scales as well as the respective reference temperature are compiled in the following table:

Hydrometer degree	Reference temperature t in °C	Liquids heavier than water	Liquids lighter than water
Brix - Fischer	15.625 (12.3°R)	$400 - \frac{400}{d}$	$\frac{400}{d} - 400$
Baumé rationell	15	$144.30 - \frac{144.30}{d}$	$\frac{144.30}{d} - 144.30$
Baumé (American)	15.56 (60°F)	$145 - \frac{145}{d}$	$\frac{140}{d} - 130$
Balling	17.5	$200 - \frac{200}{d}$	$\frac{200}{d} - 200$
Twaddle	15.56 (60°F)	$200(d-1)$	-
API (linear)	15.56 (60°F)	-	$\frac{141.5}{d} - 131.5$
S.G. (specific gravity 60/60)	15.56 (60°F)	$\frac{\rho_{60°F}}{\rho_{Water,60°F}}$	

d: density ratio $d_{t/t} = \frac{\rho_t}{\rho_{Water,t}}$

The calculation method is determined by the choice of operating mode (see table “Operating mode switch” in section 10.3).

11.2 Mesh point interpolation

With this calculation method the reference density or the concentration is determined by a table interpolation from the measured operating density.
To achieve this, the connection, e.g. between concentration, density and temperature c=f(ρ,t), is specified in tabular form. The table can contain max. 400 mesh points, with max 80 lines or columns.
The material values have to be present as an Excel table in the following form:

e.g. concentration table

ρ \ t	Temperature
Density	Concentration c (max. 400 points*)

* e.g. 80 density values for 5 temperatures

The calculation of the concentration occurs via linear interpolation. The unit results from the specified table values.
The creation of the mesh point table from available material values and the transfer of the table values to the transducer occurs via the PACTware configuration software.

11.3 Default concentration

Default concentrations are stored in the transmitter from software version 4 and higher. The respective medium constants can be changed via the keys.

The following 11 mediums are programmed:

Display	Medium	C_{min}	C_{max}	T_{ref}
AEtHA-1	Ethanol	5	20	20
AEtHA-2	Ethanol	90	100	20
nAtron	Sodium hydroxide	20	50	20
SALPE-1	Nitric acid	2	40	20
SALPE-2	Nitric acid	40	70	20
SALZ	Hydrochloric acid	10	30	20
SULPHUr	Sulphuric acid	10	60	20
SUGAr-1	Sugar solution	0	20	20
SUGAr-2	Sugar solution	20	50	20
SUGAr-3	Sugar solution	50	80	20
SUGAr-4	Sugar solution	50	80	20

- Press the "↵" key to select the lower display line. The activated line is indicated by a small arrow (►) next to the channel number.
- Use the arrow keys "▲" and "▼" to select channel "E".
- Press the "P" key. The right hand position of channel "E" flashes.
- Use the arrow keys to change the value to "2" and press the "↵" key to confirm it (authorisation to change the settings is thus provided).
- Use the arrow key "▲" to move to the "=" level. The currently set data set, e.g. AEtHA-1 or AEtHA-2 or nAtron, etc. is displayed there.
- Press the "P" key. The current data set, e.g. AEtHA-1, flashes.
- Use the arrow keys "▲" and "▼" to select the fluid data:

  e.g. AEtHA-1 or AEtHA-2 or nAtron, etc.
- Press the "↵" key to confirm the selection.
- Use the arrow keys "▲" and "▼" to select level "3" for displaying the temperature.

The selected fluid data is now used to calculate the concentration. The current concentration is displayed in channel "0" if the operating mode 02, 30 or 32 has been set. If this is not the case, the first two digits must be set accordingly in channel "E" (see Operating mode switch channel E, page 24).
If the fluid data changes, check channels 5 and 6 to ensure that the lower range and upper range values of the concentration measuring range are correct. If this is not the case, both these values must be changed.
The fluid data stored in the device is only valid in a range between C_{min} and C_{max}.

11.4 Customer-specific concentration settings

Besides the permanently programmed default concentrations, the customer can store 5 further concentrations in the transmitter. These can be retrieved at the "=" level from the storage locations 25 to 29. Use "↵" to save the liquid parameters in channels n, o, p, q, r and u.

The parameters stored at locations 25 to 29 can be changed via the keypad. Customers can save their liquid parameters at one of the storage locations and then place their parameters in the corresponding channel n – U by selecting level "=" and reselecting a storage location.

Procedure for programming a parameter set at a storage location in level "="

- Activate the service level in channel "E".
- Select channel "=".
- Select the respective storage level, e.g. [25].
- Enter the parameter set in the channels n, o, P, q, r and U (polynominal coefficients according to the configuration data sheet).
- Select channel "=".
- Use the "▲" or "▼" key to select the next storage level to be programmed.

Please note that data is only saved when exiting a level or selecting another level!

12 Maintenance

Maintenance work involves cleaning and zero point adjustment.

Cleaning

The density transducer should be cleaned according to the sedimentation tendencies of the measured liquid. The simplest cleaning method is to increase the flow velocity through the density transducer to the maximum permissible value for a few minutes in order to flush away any sediment and solids. If this measure is not successful, the density transducer should be cleaned with special detergent if flushing connections are provided according to section 4.2. Always observe the corrosion resistance of the density transducer material.

Zero point adjustment

Abrasion, sedimentation or corrosion can cause the zero point of the density transducer to shift: The zero point shift can be established via a comparison measurement and rectified by an on-site adjustment (see sections 9 and 13.1).

13 Error detection / Troubleshooting

Periodical inspections of the density transducer facilitate error detection and can provide information about possible error sources.
The inspection can usually be limited to a comparison between the value measured by the density transducer and a reference measurement (e.g. sampling with laboratory measurement or a comparison density meter connected in series).
It is essential that the reference measurement is sufficiently reliable and accurate (if necessary, calibratable) to ensure correct results. During this comparison, ensure that the reference conditions are comparable to actual operating conditions (if necessary, take the temperature coefficient of the used liquid into consideration).
If the value measured by the density transducer does not match the result of the reference measurement, carry out the following measures:

- Inspect the evaluation electronics (transmitter)
  (electronic connection and power supply as well as cabling to the density transducer).
- Ensure that the data of the configuration log or the
  service list and the programmed parameters of the evaluation electronics are identical.
- Inspect the density transducer for damages
  (temper colours on the housing due to high temperature as well as obvious mechanical defects, e.g. damaged electronic housing, gasket, terminal clamp, etc.).
- Look for process-related malfunctioning (e.g. empty product line, gas bubbles).

A seriously damaged density transducer should be disassembled and returned to Bopp & Reuther Messtechnik (see section 15).

Otherwise, troubleshooting should be carried out as described below. There are three general sources of error:

- Errors caused by the liquid
- Errors caused by the transmitter
- Errors caused by the transducer

13.1 Errors caused by the liquid

Error	Possible reason	Remedy
Negative measuring error unstable display	Air locks or gas bubbles in the liquid or inside the transducer	Increase pressure in the product line
		De-aerate the product line
		Increase the flow velocity in the transducer
Positive measuring error long-term drift	Sedimentation in the transducer	Increase the flow velocity in the transducer (recommended value, e.g. 5 m/s)
		Remove any sediments in the transducer with appropriate solvent (observe the corrosion resistance of the transducer)
		Clean the transducer pipe more than once using a scraper with the appropriate pressure (only for DIMF 2.0 and DIMF 2.1. Not for DIMF 1.3!)
Negative measuring error long-term drift	Corrosion	Inspect the material resistance of the transducer
	Abrasion	Reduce the flow velocity in the transducer (recommended value, e.g. 1 m/s)
The display does not change or is too slow Temperature display is too low	Flow in the transducer is too low or zero	Open all shut-off valves
		Increase the flow velocity in the transducer

Errors caused by sedimentation, corrosion and abrasion can often be detected once the density transducer has been disassembled.
If necessary, the density transducer should be returned to Bopp & Reuther Messtechnik (see section 15) for recalibration, or carry out an on-site adjustment (see section 9) using the offset value K_0.

13.2 Errors caused by the transmitter

Error	Possible reason	Remedy
Current ouput does not react or reacts incorrectly	Power supply voltage too low	Inspect power supply voltage (> 15 V DC, < 30 V DC)
	Cable resistance too high	Select larger cable cross section
	Transmitter defective	Inspect current output (see self-monitoring function section 14) If necessary, replace transmitter
	Upper range value has been reached	Extend measuring range (channel 5 and 6)
Current output is unsteady	Either the shield is not earthed or the equipotential bonding is not connected	Earth the cable shield or connect the equipotential conductor in the cable gland
Display flashes constantly	Power supply voltage too low	Supply voltage has to be > 15 V DC at the terminal
Empty display	Power supply voltage too low	Inspect supply voltage
	Transmitter defective	Replace transmitter
Error no. at the display on channel]	(See Error code table in section 13.2.1)	
Incorrect density or concentration is displayed or the temperature is not compensated	Incorrect parameterisation	Inspect the programmed log data as well as its signs
	Specified measuring range has been exceeded	New fluid data required
No frequency signal or excessive frequency	Air locks in the liquid	See section 13.1, "Errors caused by the liquid"
	Transmitter is incorrectly connected to the transducer	Inspect the sensor connections
	Transducer defective	If necessary, inspect transducer coil (see section 13.3)
	Transmitter defective	Replace transmitter
Displayed temperature is incorrect	Transmitter is incorrectly connected to the transducer	Inspect Pt1000 connections
	Transducer defective	Inspect temperature sensor (see section 13.3)

13.2.1 Error code table

No.	Description	Remedy
0	No error occurred	none
1	Watchdog reset or interruption of the power supply	Inspect supply voltage
2	Pt1000 line short-circuited	Clear short circuit, if necessary, return the complete device to Bopp & Reuther Messtechnik
3	Pt1000 line interrupted	Re-establish connection, if necessary, return the complete device to Bopp & Reuther Messtechnik
33	Internal error: Impermissible transmitter variable code	Contact Bopp & ReutherMesstechnik GmbH
42	Data error in the A/D converter	Contact Bopp & ReutherMesstechnik GmbH
50	Primary measured value falls below the lower measuring range	Inspect process status
51	Primary measured value exceeds the upper measuring range	Inspect process status
60	Primary measured value falls below the lower measuring range (channel 5)	Extend measuring range or inspect process status
61	Primary measured value exceeds the upper measuring range (channel 6)	Extend measuring range or inspect process status
71	Liquid temperature falls below minimum limiting value or	Modify temperature range or inspect process status
	Liquid temperature falls below minimum index of the interpolation table	Load suitable concentration table or inspect process status
72	Liquid temperature exceeds maximum limiting value or	Modify temperature range or inspect process status
	Liquid temperature exceeds maximum index of the interpolation table	Load suitable concentration table or inspect process status
73	Operating density falls below minimum index of the interpolation table	Load suitable concentration table or inspect process status
74	Operating density exceeds maximum index of the interpolation table	Load suitable concentration table or inspect process status
75	Device temperature falls below quartz calibration interval	Check device environment
76	Device temperature exceeds quartz calibration interval	Check device environment

The marked error statuses result in an alarm situation. Via PACTware (current alarm) it is possible to set whether an existing alarm situation should be signalled on the current loop.

All error messages can be deleted by pressing the P key when the programming line is activated in channel "]". If the error number reappears on the display, the error source has not been cleared.

13.3 Errors caused by the transducer

Firstly, disconnect the supply voltage and then open the screw cover, unscrew the two fastening screws for the electronics and carefully remove the electronics. For the version with the control unit, the digital display has to be unscrewed first. Disconnect all coil and temperature sensor cables from the transducer in order to measure the resistances according to the following data.

	DIMF 1.3	DIMF 2.0	DIMF 2.1
Resistance of the transducer coil (at 20°C) between blue (BU) and yellow (YE)	60 Ω	60 Ω	408 Ω
Resistance of the excitation coil (at 20°C) between black (BK) and white (WH)	60 Ω	125 Ω	408 Ω
Resistance to earth	≥ 100MΩ		

The wires of the temperature transducer are marked with a black shrinkdown sleeve.

Resistance values Pt 1000 between blue (BU) and yellow (YE)

Temperature (°C)	-20	0	20	40	60	80	100	120	140
Resistance (Ω)	922	1000	1078	1155	1232	1309	1385	1460	1536

Error	Possible reason	Remedy
Coil resistance is zero or infinite	Coil defective	Return transducer with additional electronics to Bopp & Reuther Messtechnik
Temperature sensor resistance is zero or infinite	Temperature sensor defective	Return transducer with additional electronics to Bopp & Reuther Messtechnik
Short circuit between a cable and the housing	Earth contact	Return transducer with additional electronics to Bopp & Reuther Messtechnik

14 Self-monitoring functions

14.1 LCD test

A display test is triggered if the ↵ key is pressed for longer than 3 seconds. This allows all the LCD segments to be inspected.

14.2 Monitoring the supply voltage

After a power failure a power ON reset is carried out and the error code 1 is displayed in channel "]" or the error is reported via HART®.

14.3 Simulation of the current output

This function affects the running process!

Activate user level

To achieve this, select channel E, switch position 0 to 1 Set and accept the desired current value in channel t.
The output signal displays the set value. If the set value is 000, the output current follows the measured value.

14.4 Error message

An error code is displayed at channel "]". The last reported error is displayed.
For the respective error description, see Error code table in section 13.2.1.

15 Service

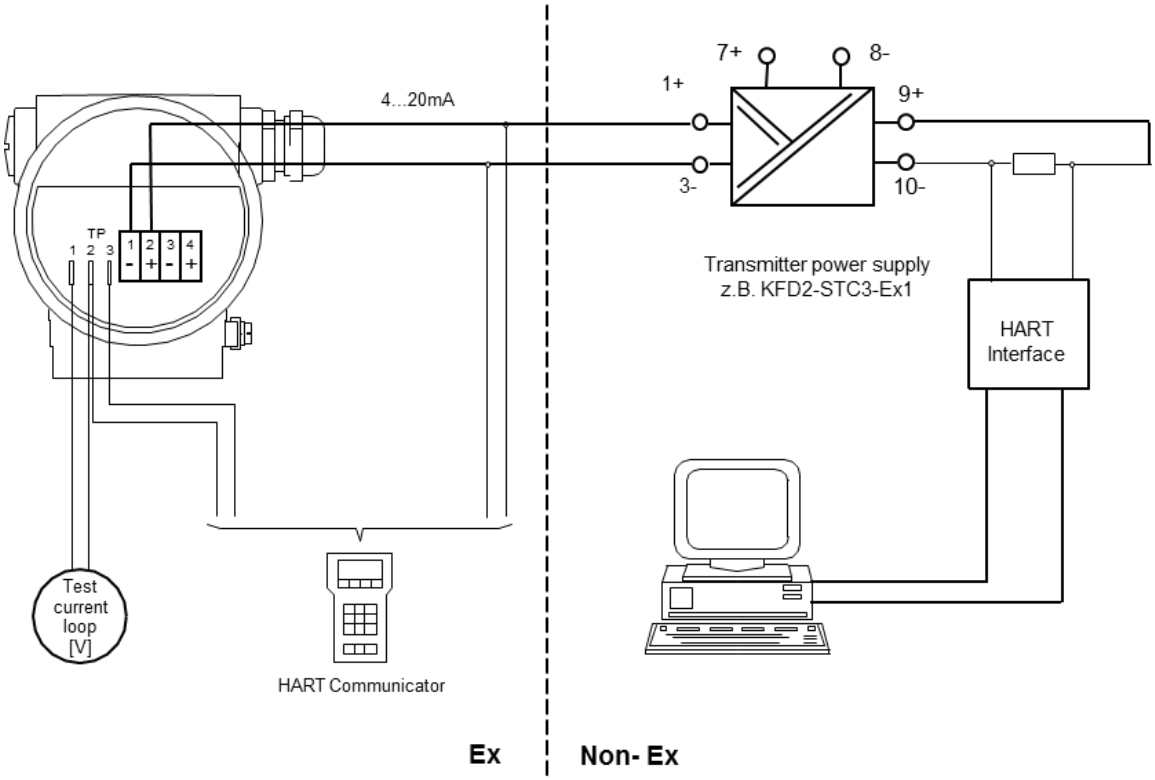
Please contact our Service Department with regard to density and concentration measuring device faults:

Bopp & Reuther
Messtechnik GmbH
Service
Am Neuen Rheinhafen 4
67346 Speyer, Germany
Phone: +49 6232 / 657-420
Fax: +49 6232 / 657 561
E-Mail: service@bopp-reuther.com
Internet: https://www.bopp-reuther.com

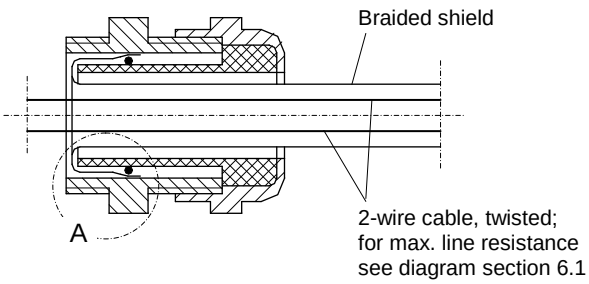
Appendix

A.1 Wiring diagram

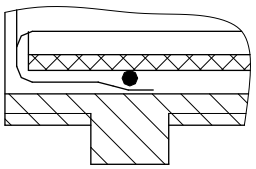
A.1.1 Wiring diagram for the Ex i and non Ex connection



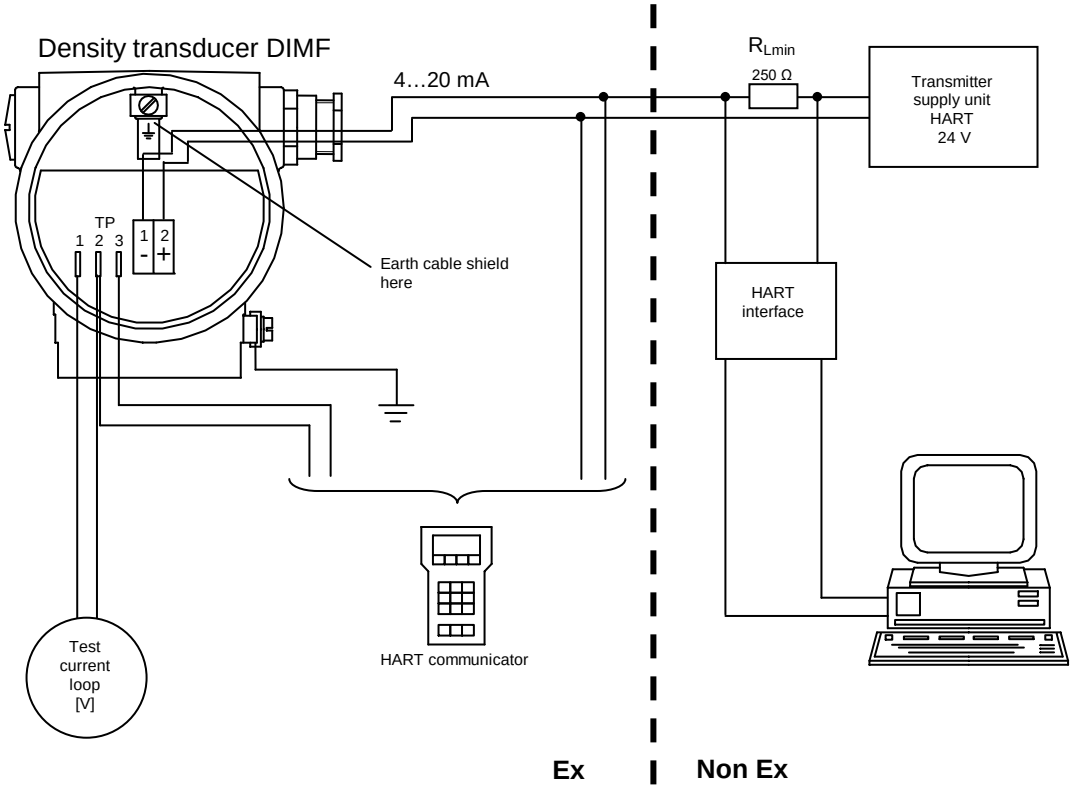
Earthing of the cable shield



Detail A

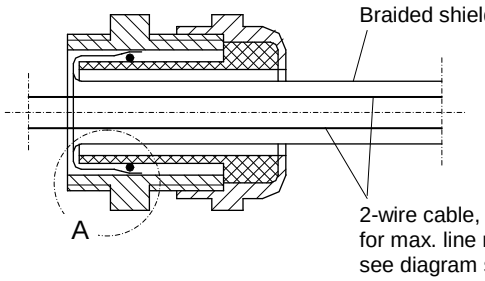


A.1.2 Wiring diagram for Ex d connection

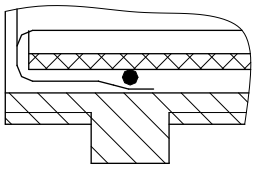


The cover of the housing at the connection side of the Exd version should only be removed after it has been ensured that there is no explosive atmosphere.

Earthing of the cable shield



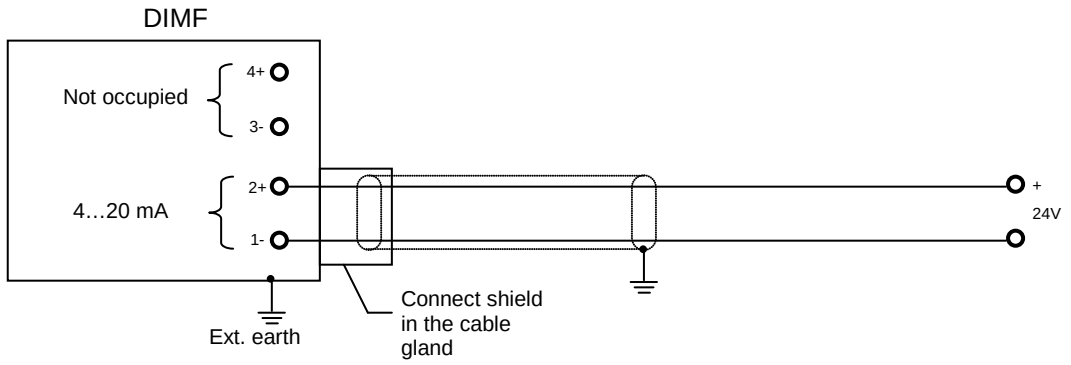
Detail A



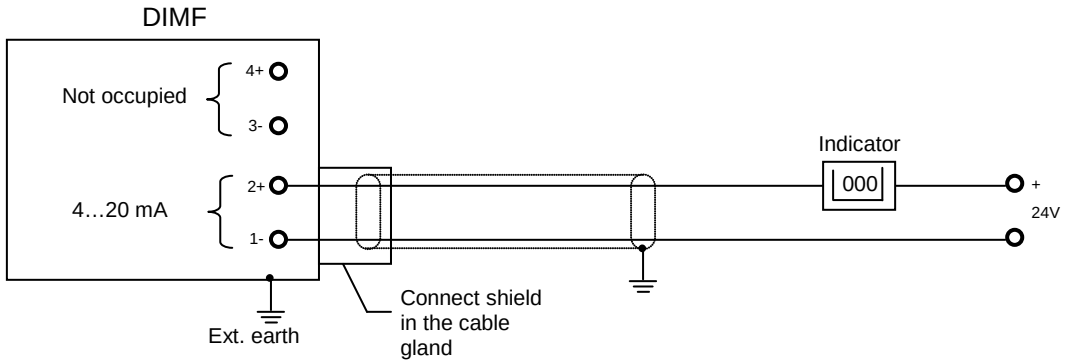
Caution!
For Ex safety reasons, the negative pole of the terminal is earthed to the housing for this type of connection circuit. This can lead to interference with several 4-20 mA current loops. In this case, a passive isolator, e.g. IsoTrans 36 from Knick, should be applied.

A.2 Wiring examples DIMF 1.3 and DIMF 2.0 for a non-explosive area

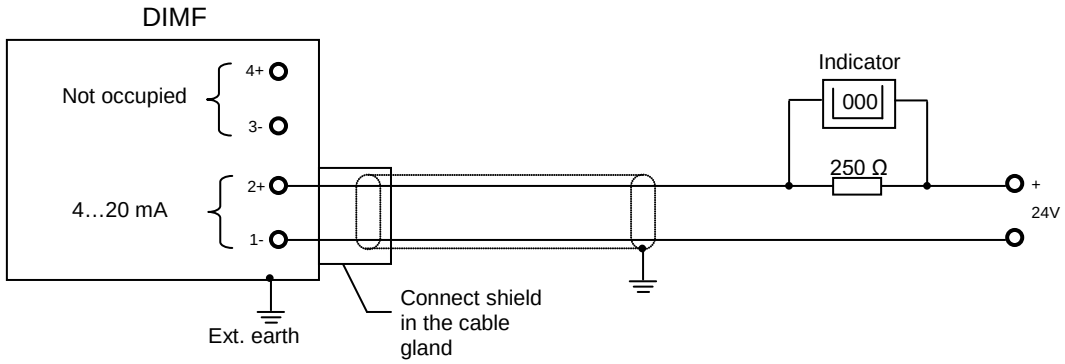
Local display without signal transfer



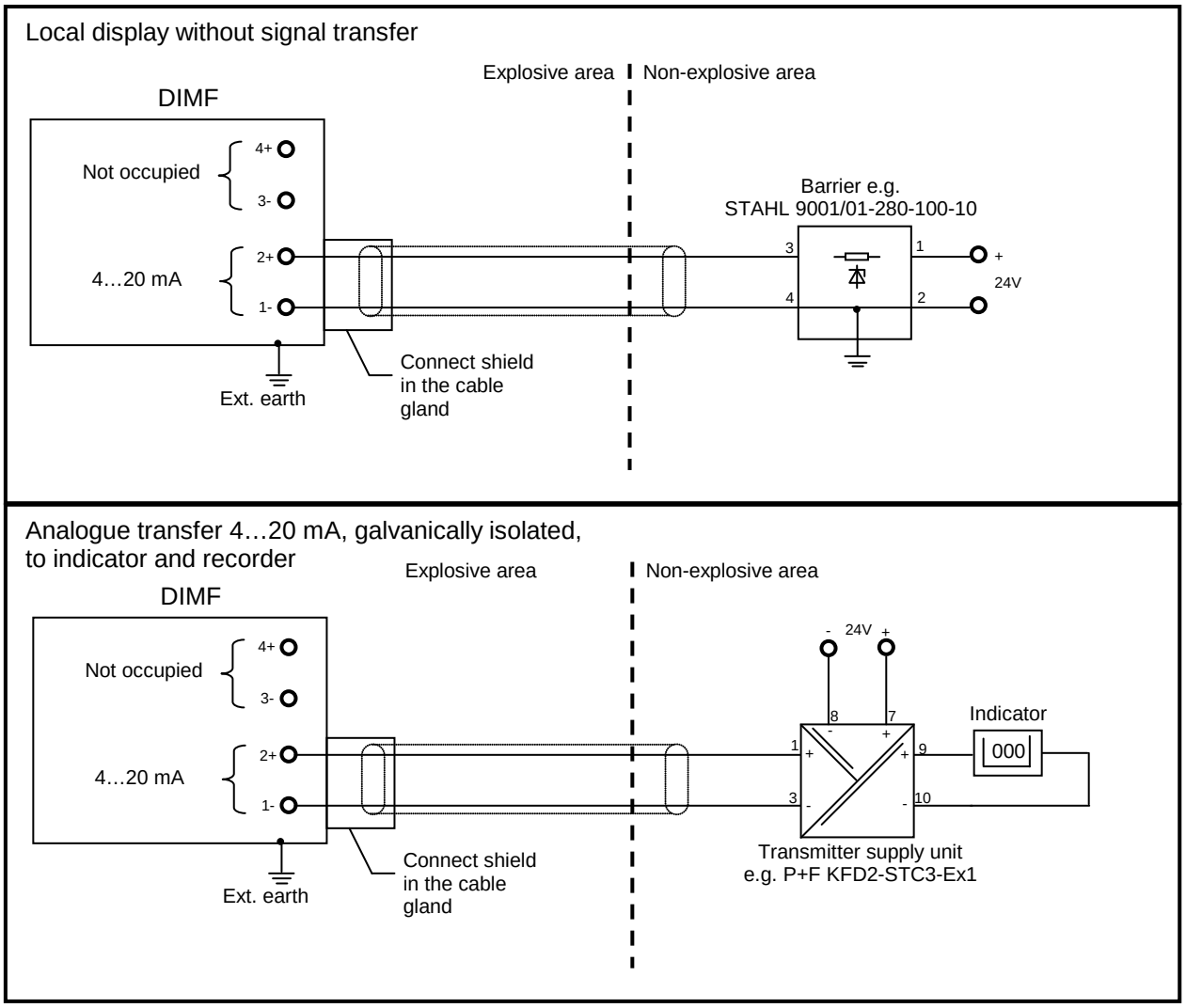
Analogue transfer 4…20 mA to indicator or recorder

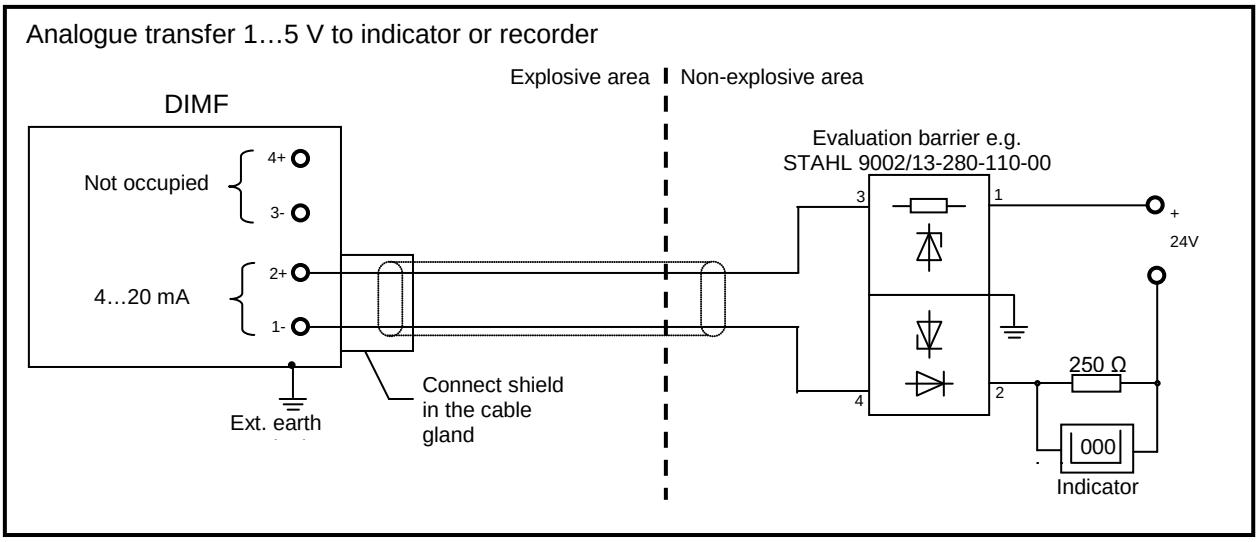


Analogue transfer 1…5 V to indicator or recorder



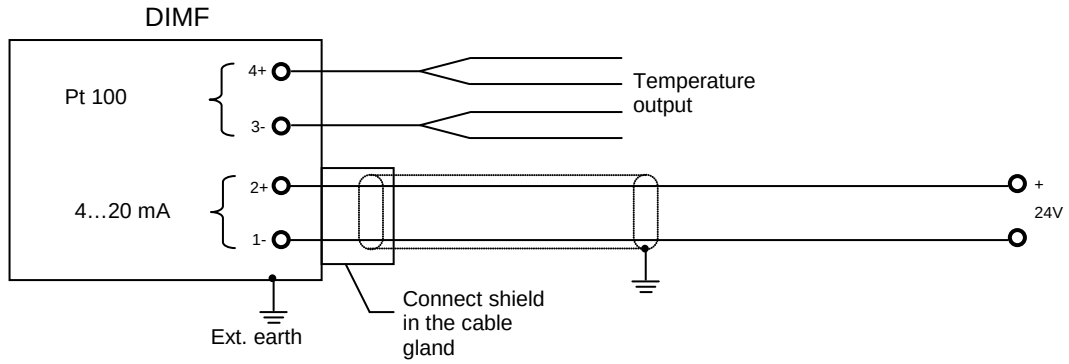
A.3 Wiring examples DIMF 1.3 and DIMF 2.0 for explosive area (Ex i version)



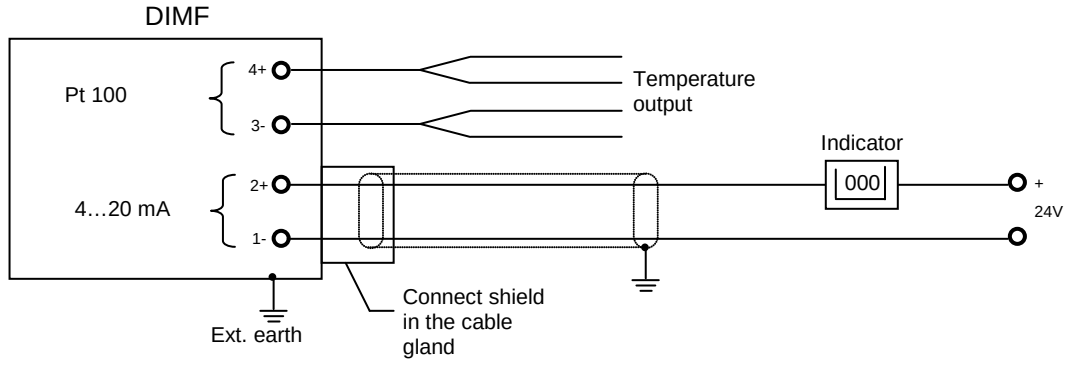


A.4 Wiring examples DIMF 2.1 for non explosive area

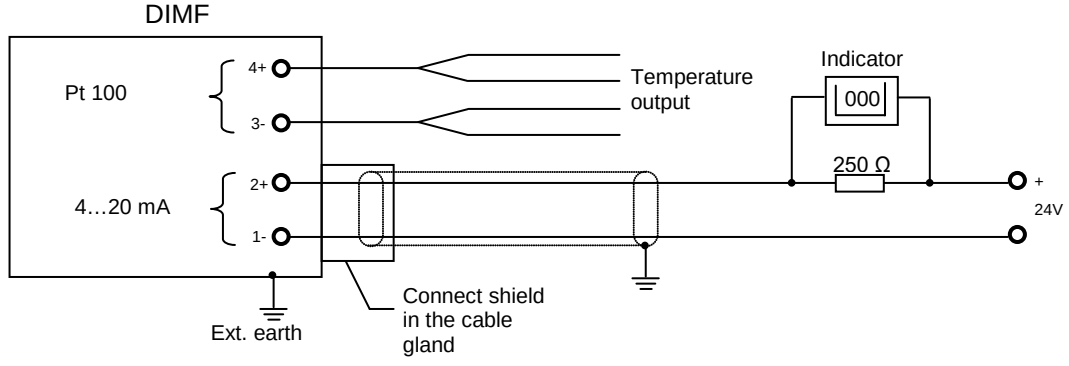
Local display without signal transfer



Analogue transfer 4…20 mA to indicator or recorder

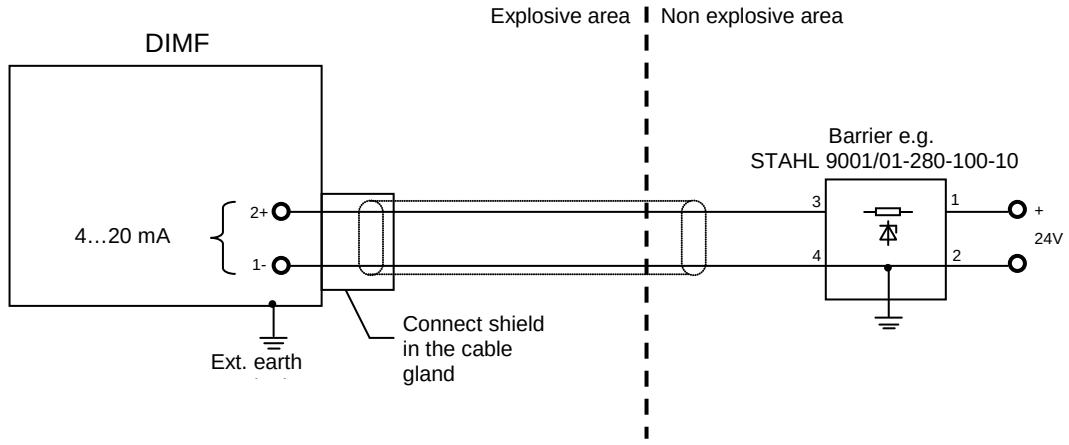


Analogue transfer 1…5 V to indicator or recorder

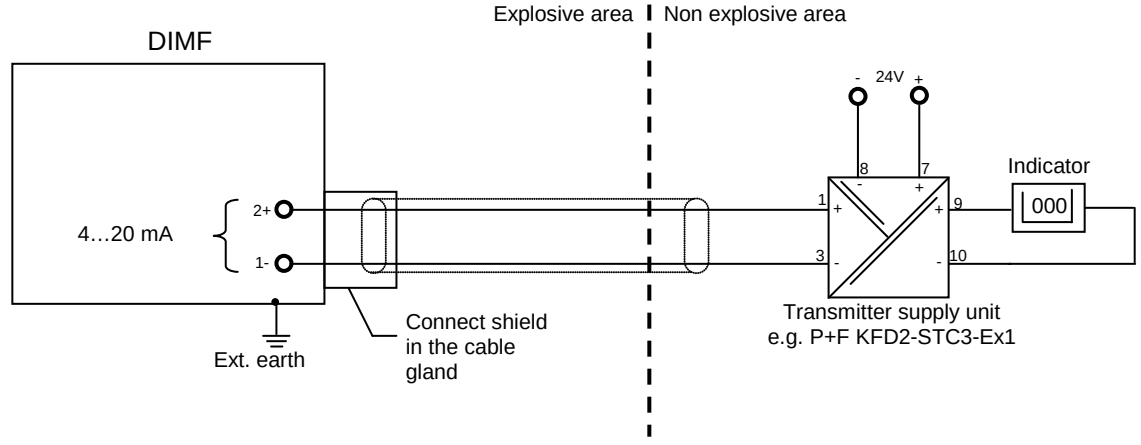


A.5 Wiring examples DIMF 2.1 for explosive area (Exi version)

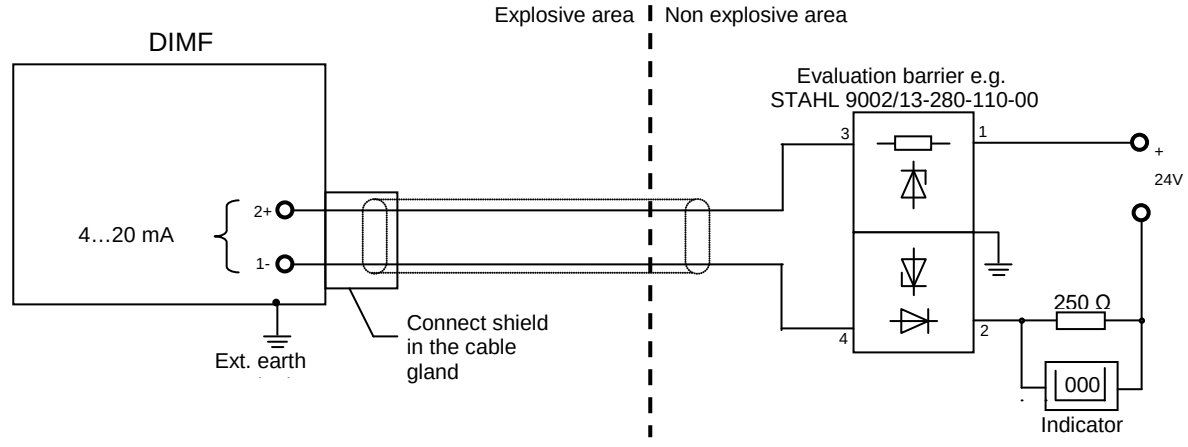
Local display without signal transfer



Analogue transfer 4…20 mA, galvanically isolated,
to indicator or recorder

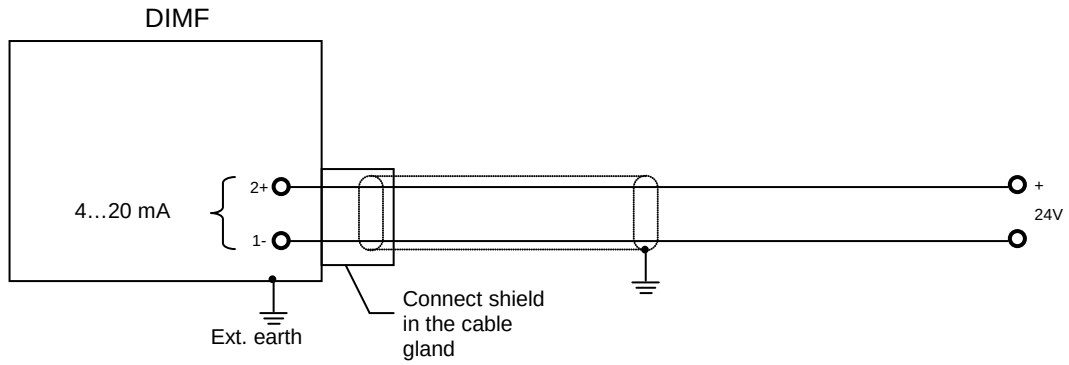


Analogue transfer 1…5 V to indicator or recorder

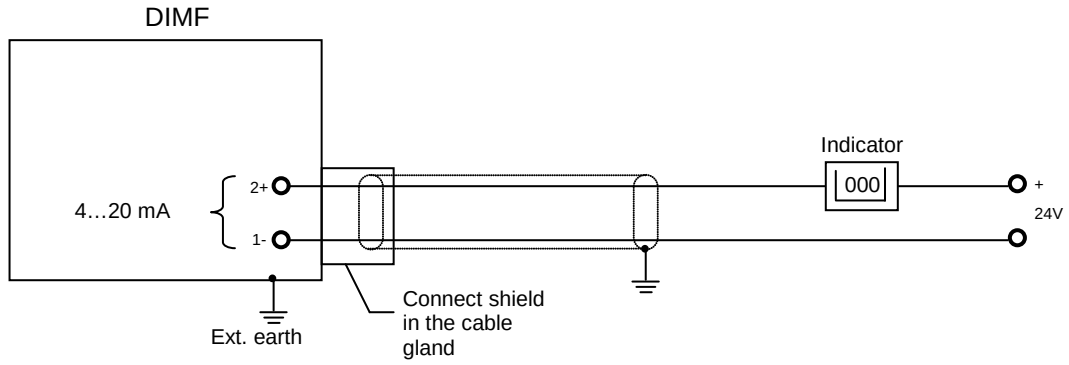


A.6 Wiring examples DIMF 1.3, DIMF 2.0 and DIMF 2.1 for explosive area (Exd version)

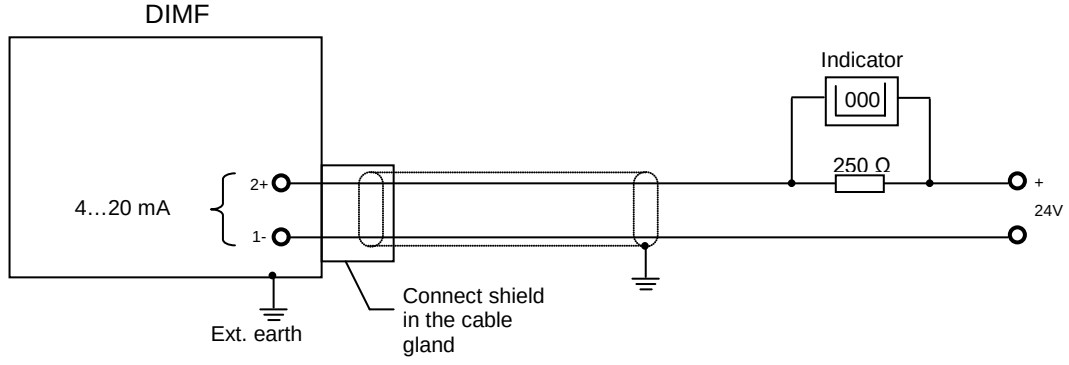
Local display without signal transfer



Analogue transfer 4…20 mA to indicator or recorder



Analogue transfer 1…5 V to indicator or recorder



The cover of the housing at the connection side of the Exd version should only be removed after it has been ensured that there is no explosive atmosphere.

Caution!
For Ex safety reasons, the negative pole of the terminal is earthed to the housing for this type of connection circuit. This can lead to interference with several 4-20mA current loops. In this case, a passive isolator, e.g. IsoTrans 36 from Knick, should be applied.

A.7 Example of configuration data log

Page 1/1 4.11.99 9:21:04	**Density/Conc. Transmitter DIMF** (Bopp & Reuther Messtechnik) Configuration File:	BOPP & REUTHER MESSTECHNIK

Measuring point

Denominator	***TEST***	Date	***23.06.2016***
Tag no.	***TEST***		
Production no.	***33105***		
User message	***WITH TRANSDUCER COIL CONNECTION***		

Manufacturer data

Type name	***DIMF***	Universal command	***5***
Manufacturer	***Bopp & Reuther Messtechnik GmbH***	Device spec. command rev.	***7***
Type of device	***Type 238***	Software revision	***4***
Device identification	***14***	Hardware revision	***2.1***

Measuring range

Upper range value	***10000.00***	%	Production no.	***33105***
Lower range value	***0.00***	%		
Minimum measuring span:	***0.00***	%		

Measuring output (PV)

Upper range value	***1.20***
Lower range value	***700.00***
Dimension of the data	*%*
Transfer function	***Linear***
Damping in seconds	*3.00*

Model code:

DIMF2.1-TVS-I-71-S12-M-1-H

Operation

Alarm code	*off*
Operating mode	***1:concentration f(t)***

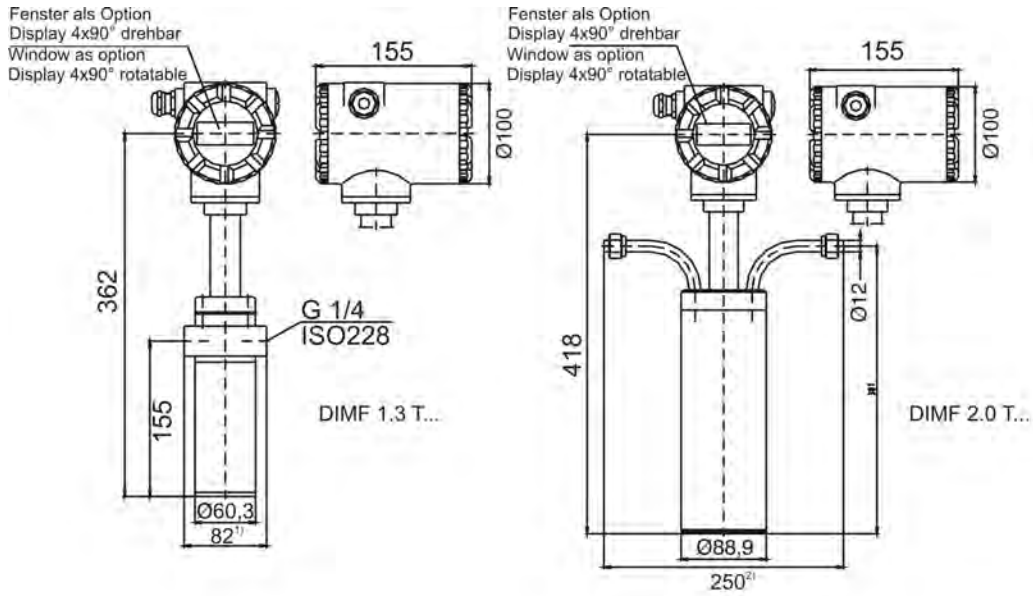
Transducer constants

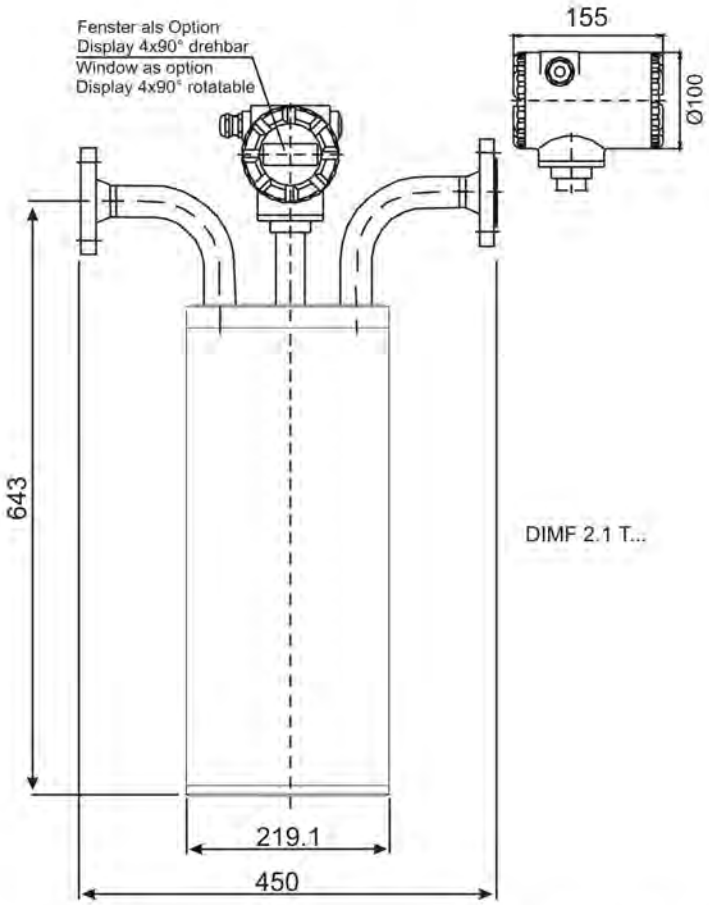
K_0	***-5806.77002***	(-100000...100000)
K_1	***16.19601***	(-100000...100000)
K_2	***41.28275***	(-100000...100000)
K_{T0}	***-2.65598***	(-10...10)
K_{T1}	***-5806.77002***	(-100...0)
K_{T2}	***-5806.77002***	(-10...10)

Liquid constants

K_{C0}	***0.00000***	(-100000...100000)
K_{C1}	***0.00000***	(-100000...100000)
K_{C2}	***0.00000***	(-100000...100000)
K_{X0}	***0.00000***	(-100000...100000)
K_{X1}	***0.00000***	(-100000...100000)
K_{X2}	***0.00000***	(-100000...100000)
K_{X3}	***0.00000***	(-100000...100000)
alpha	***0.00000***	(0.0...10)
Tref	***20.00***	(-50...210)
Tkal	***20.10***	(-50...210)

A.8 Dimensions





1) Overall length of DIMF 1.3 in flange version 200 mm
2) Overall length of DIMF 2.0 in flange version 250 mm

B. Declaration on decontamination

Bopp & Reuther Messtechnik GmbH
Am Neuen Rheinhafen 4
67346 Speyer
Germany

BOPP & REUTHER MESSTECHNIK

Telephone: +49 (0) 6232 / 657 420
Fax: +49 (0) 6232 / 657 561
Mail: service@bopp-reuther.com
Web: www.bopp-reuther.com

ERA number:

DECLARATION ON DECONTAMINATION OF METERS AND COMPONENTS

Please complete this form and return in advance by email or by Fax to +49(0)6232 / 657 561 in order to receive an Equipment Return Authorisation (ERA) number (not necessarily required). No action to repair or examine the meter will be done, until a valid declaration of decontamination has been received.

Contact information

Company Name:
Company Address:
Contact Person:
Name:
Phone:
Email:

Meter information

Type:
Id. no.:
Serial no.:

Reason for return (e.g. calibration, repair). Please describe in detail.

Contamination information

The meter was contaminated with:

- ☐ poisonous 
- ☐ corrosive, irritant 
- ☐ flammable 
- ☐ hazardous 
- ☐ oxidizing 
- ☐ cancer-causing, harmful 
- ☐ explosive 
- ☐ environmental hazardous 
- ☐ other:

The meter was cleaned with:

Packaging and shipping instructions

- Remove all cables, connectors, separate filters and mounting materials
- Please pack each item in two suitable sealed protective foil bags
- Transport in suitable shipping package (e.g. original Bopp & Reuther Messtechnik shipping package)
- Include a copy of this declaration form along with the shipping documents on the outside

By signing this form, you are accepting the full responsibility for its contents and confirming that appropriate decontamination has taken place in accordance with legal regulations.

Print name: Date:

Legally valid signature:

C. Certificates

C.1 Explosions protection certificates

C.1.1 EC-Type-Examination Certificate ZELM 99 ATEX 0008 X

see Homepage: https://www.bopp-reuther.com/en/download// EC Type Examination Approvals Bopp & Reuther Messtechnik

C.1.2 EC-Type-Examination Certificate BVS 04 ATEX E 020 X

see Homepage: https://www.bopp-reuther.com/en/download/ EC Type Examination Approvals Bopp & Reuther Messtechnik

C.1.3 IECEx Certificate of Conformity Density Meter DIMF

see Homepage: https://www.bopp-reuther.com/en/download/ EC Type Examination Approvals Bopp & Reuther Messtechnik

C.2. EU – Declaration of Conformity

BOPP & REUTHER MESSTECHNIK

EU - Konformitätserklärung
EU - Declaration of conformity
UE - Déclaration de conformité

Hiermit erklärt der Hersteller in alleiniger Verantwortung, dass die nachfolgend bezeichnete Baueinheit den Anforderungen der zutreffenden EU-Richtlinien entspricht. Bei nicht mit uns abgestimmten Änderungen verliert diese Erklärung ihre Gültigkeit.

The manufacturer herewith declares under sole responsibility that the unit mentioned below complies with the requirements of the relevant EU directives. This declaration is no longer valid if the unit is modified without our agreement.

Par la présente, le fabricant déclare sous sa seule responsabilité que les appareils décrits ci-dessous, correspondent aux exigences de la réglementation UE qui les concerne. Toute modification des appareils sans notre accord entraine la perte de validité de cette déclaration de conformité.

Hersteller *Manufacturer* Fabricant	Bopp & Reuther Messtechnik GmbH Am Neuen Rheinhafen 4 67346 Speyer / Germany
Bezeichnung *Description* Description	Dichtemesser *Density meter* Capteur de masse volumique
Typ, Modell *Type, model* Type, modèle	DIMF1.3 / DIMF2.0 / DIMF2.1 mit *with* avec TR, PV24

Richtlinie *Directive* Directive	2014/30/EU /UE L 96/79 Elektromagnetische Verträglichkeit *Electromagnetic interference* Compatibilité électromagnétique
Normen und normative Dokumente *Standards and normative documents* Normes et documents normatifs	EN IEC 61000-6-2:2019 EN IEC 61000-6-3:2021

Richtlinie *Directive* Directive	2014/34/EU /UE L 96/309 Explosionsschutz *Explosion protection* Protection contre les explosions	
Baumusterprüfbescheinigung *Type examination certificate* Certificat d'approbation de type	ZELM 99 ATEX 0008 X	DIMF-I
	BVS 04 ATEX E 020 X	DIMF-X
	DMT 00 ATEX E 092 X	DIMF*.* (PV24)
	DMT 00 ATEX E 092 X N1	DIMF*.* (PV24-X)
Notifizierte Stelle *Notified Body* *Organisme Notifié*	ZELM	0820
	BVS, DMT (DEKRA EXAM)	0158
Normen und normative Dokumente *Standards and normative documents* Normes et documents normatifs	EN IEC 60079-0:2018	DIMF-I, DIMF-X, PV24, PV24-X
	EN 60079-1:2014	DIMF-X, PV24-X
	EN 60079-11:2012	DIMF-I, DIMF-X, PV24, PV24-X
	EN 60079-26:2015	DIMF-I

Bopp & Reuther Messtechnik GmbH, Am Neuen Rheinhafen 4, 67346 Speyer / Germany
Telefon: +49(0)6232 657-0, **Telefax**: +49(0)6232 657-505, **Email**: info@bopp-reuther.com, **Internet**: www.bopp-reuther.com

Z-ML-KE DIMF-V11 2023-013-23

BOPP & REUTHER
MESSTECHNIK

Richtlinie *Directive* Directive	2011/65/EU /UE L 174/88 Beschränkung gefährlicher Stoffe *Restriction of hazardous substances* Limitation de substances dangereuses
Delegierte Richtlinie *Delegated Directive* Directive Déléguée	(EU /UE) 2015/863 L 137/10 Änderung Anhang II der Richtlinie 2011/65/EU *Amending Annex II to Directive 2011/65/EU* Modifiant l'annexe II de la directive 2011/65/UE
Normen und normative Dokumente *Standards and normative documents* Normes et documents normatifs	EN IEC 63000:2018

Ort, Datum / *Place, Date* / Lieu, Date: **Speyer, 2023-01-23**

Dr. J. Ph. Herzog
Geschäftsführer
Managing director / Gérant

i . V. J. Riedl
stv. QM Beauftragter
Deputy *QM Officer* / Adjoint chargé de la qualité

Bopp & Reuther Messtechnik GmbH, Am Neuen Rheinhafen 4, 67346 Speyer / Germany
Telefon: +49(0)6232 657-0, **Telefax**: +49(0)6232 657-505, **Email**: info@bopp-reuther.com, **Internet**: www.bopp-reuther.com

Z-ML-KE DIMF-V11 2023-013-23