Baumer
Passion for Sensors

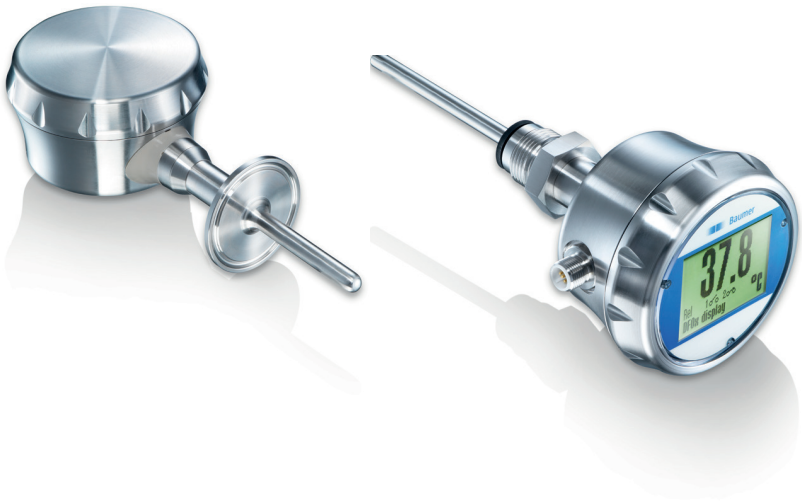
Temperature measurement

CombiTemp™ TFRH/N

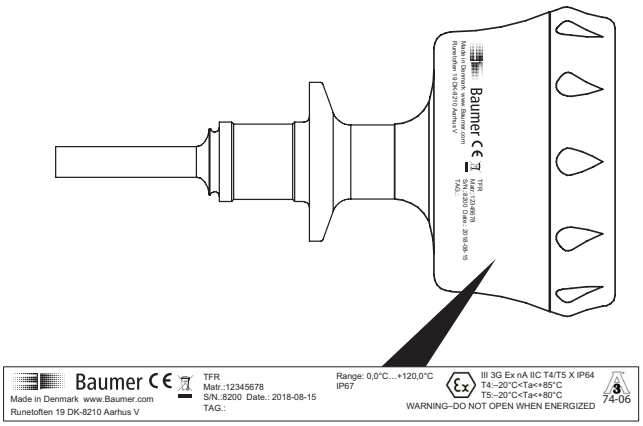
RTD temperature sensor

РусАвтоматизация®

Operating Instructions



Type plate / Typenschild / Plaque d‘identi ation



Type	▪ Type of sensor
Matr.	▪ Material number
S/N	▪ Serial number
Date	▪ Date of manufacture
Tamb	▪ Ambient temperature
Tag	▪ Tag number
Range	▪ Temperature range, costumer-specific
IP	▪ Degree of protection
Ex	▪ Explosion protection, type-specific
	▪ Do not dispose of in household waste
CE	▪ Conformity with EU directives
3	▪ Approvals, type-specific

Version	▪ Sensortyp
Matr.	▪ Materialnummer
S/N	▪ Seriennummer
Date	▪ Herstellungsdatum
Tamb	▪ Umgebungstemperatur
Tag	▪ Kennnummer, kundenspezifisch
Range	▪ Temperaturbereich, kundenspezifisch
IP	▪ Schutzklasse
Ex	▪ Explosionsschutz, typspezifisch
	▪ Nicht im Hausmüll entsorgen
CE	▪ Konformität mit EU-Richtlinien
3	▪ Zulassungen, typspezifisch

Version	▪ Type de capteur
Matr.	▪ Réf. mat.
S/N	▪ Numéro de série
Date	▪ Date de fabrication
Tamb	▪ Température ambiante
Tag	▪ Identifiant, spécifique au client
Range	▪ Plage de température, spécifique au client
IP	▪ Indice de protection
Ex	▪ Protection contre les explosions, selon le type
	▪ Ne pas jeter avec les ordures ménagères
CE	▪ Conformité avec les directives européennes
3	▪ Autorisations, selon le type

Table of contents

1. Safety

Intended use
The sensor measures temperatures of liquids and solids within the range of –50 … 400 °C.
The sensor must only be used for media against which the housing material and sensor tip are resistant.

Sta quali ation
Only use staff who are trained for the activities described. This applies in particular to assembly, installation, configuration and troubleshooting.
Make sure that the staff have read and understood these instructions.

Electrical connection and EMC
All electrical wirings must comply with local standards and connections must be made according to the connection diagrams.

Technical condition
Only use sensor in perfect technical condition.
Only use Baumer accessories.
Baumer will accept no liability for other manufacturers' accessories.

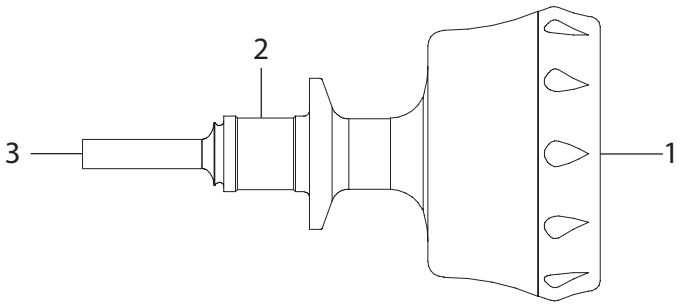
Operation
The power supply and environmental conditions must comply with the specifications of the device.
Before switching the device on and off, possible effects on other equipment and the process run must be checked.

Risk of burns from hot media
During operation the sensor housing may warm up to over 50 ºC. When working with hot media provide protection against burns.

2. Installation in accordance with UL approval

1. Device is approved for indoor usage only.
2. IP ratings are not evaluated by UL.
3. Device must be supplied from and relay contacts connected to external circuits of Class III and limited energy meeting requirements of cl. 9.4 of UL/CSA 61010-1 3rd ed. or Class 2 of UL1310.
4. UL approved CYJV/7 or PVVA/7 cables with voltage, current and temperature ratings min. 90°C suitable for the application must be used.
5. If the device is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
6. Maintenance free, no special requirements
7. Cleaning method, no special requirements: with a soft, dry cloth
8. Operating ambient: -30°C - 80°C with display, -40°C - 85°C without display

3. Construction and function



1 DFON display
2 Process connection
3 Sensor tip

The TFRH/N is a high-end programmable temperature sensor based on RTD technology. The output signal is a Pt100 signal that can be transformed to a 4 … 20 mA output signal if a temperature transmitter is built-in. Depending on the type of sensor, temperature measurements from –50 … 400 °C are possible.
Programming can be done via the touch screen display or via the FlexProgram.

4. Symbols

4.1 Symbols in warning signs

Symbol	Warning term	Explanation
	**DANGER**	In situations which cause death or serious injuries.
	WARNING	In situations which can cause death or serious injuries.
	CAUTION	In situations which can cause light or medium injuries.
	ATTENTION	For material damage

4.2 Approvals

The requirements of the respective 3-A Sanitary Standards will only be fulfilled in combination with appropriate mounting accessories. Those are marked with the 3-A logo.

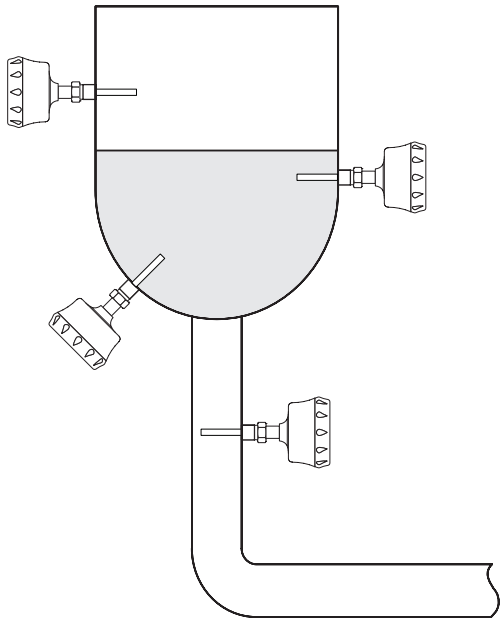
Approved for explosion hazardous areas when installed as specified.

5. Transport and storage

- Check packaging and sensor for damage.
- In the event of damage: Do not use sensor.
- Store sensor where it will be secure against shock.
  Storage temperature range: –40 ... +85 °C
  Relative humidity: < 98 %

6. Mounting

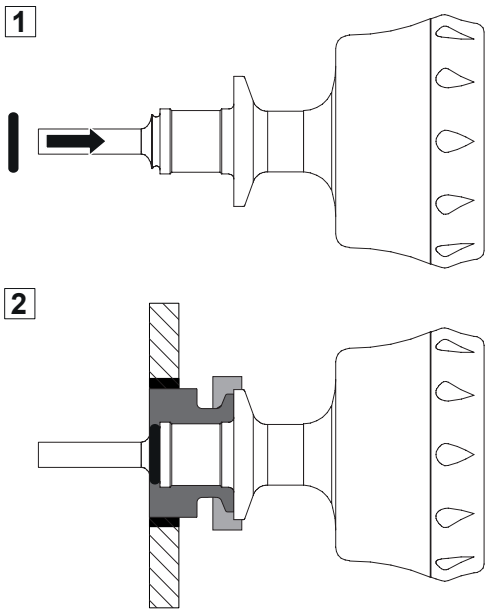
6.1 Mounting conditions



The sensor can be mounted on any point in the vessel or pipe.

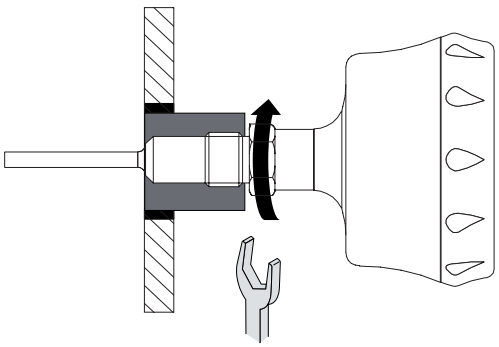
6.2 TFRH mounting

DANGER
Risk of injury from hazardous medium
- Only use weld-in sleeves or adapters from Baumer.
- Wear protective equipment for hazardous media (e.g. acids, alkaline solutions).
- Do not seal the process connections with Teflon tape (PTFE) or elastomer.
- Empty vessel and pipes before mounting.



TFRH with the following process connections:
- 3A DN 38 (BHC)
- ISO 2852 DN 38 (Tri-Clamp)
- ISO 2852 DN 51 (Tri-Clamp)
- Varivent® type N

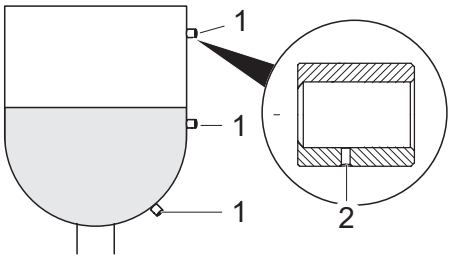
✓ Hole for mounting the sensor is easily accessible
✓ Vessel and pipe are free of media
- Mount weld-in sleeve or adapter as follows:
  - 3-A mark or arrow points upwards
  - Leakage hole points downwards
  - Hygienically and internally flush
- Grind welding to Ra ≤ 0.8 µm.
- Push sealing ring on (1).
- Mount sensor on vessel or pipe and tighten the closure clamp (2).
- Check leak-tightness.



TFRH with the following process connections:
- G 1/2 A hygienic

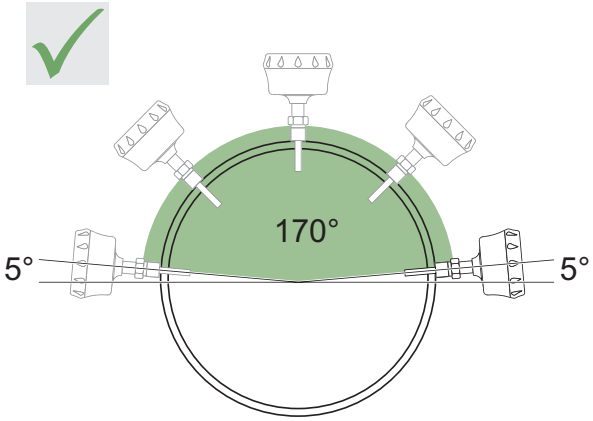
✓ Hole for mounting the sensor is easily accessible
✓ Vessel and pipe are free of media
- Mount weld-in sleeve or adapter as follows:
  - 3-A mark or arrow points upwards
  - Leakage hole points downwards
  - Hygienically and internally flush
- Grind welding to Ra ≤ 0.8 µm.
- Screw in sensor.
  Tightening torque: 20 Nm
- Check leak-tightness.

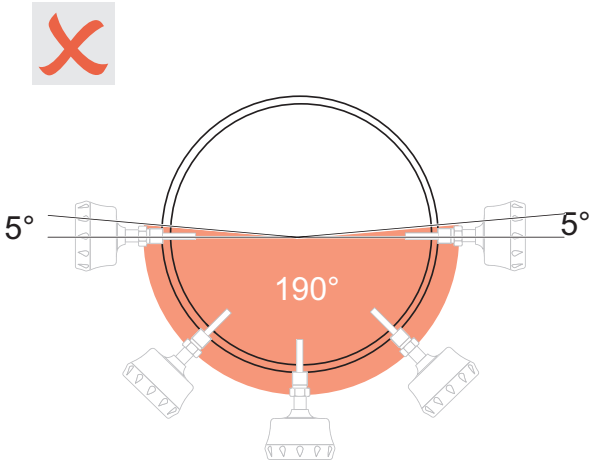
Example of mounting with weld-in sleeve ZPW3-321



1 ZPW3-321
2 Leakage hole

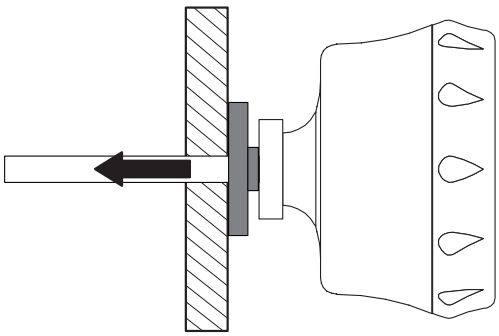
Example of mounting with weld-in sleeve ZPW2-326





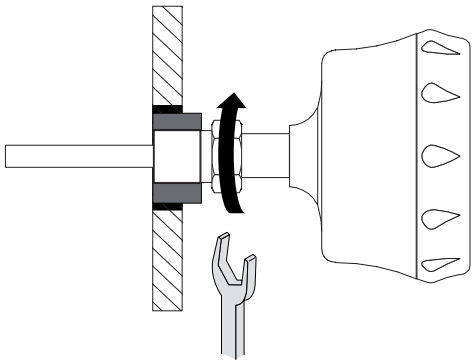
6.3 TFRN mounting

DANGER
Risk of injury from hazardous medium
- Wear protective equipment for hazardous media (e.g. acids, alkaline solutions).
- Empty vessel and pipes before mounting.



TFRN without connection
Depending on the sensor tip diameter, different options for mounting are available:
- 6 mm: Compression fitting
- 8 mm: Compression fitting or ventilation duct mounting flange

✓ Vessel and pipe are free of media
- Screw gland or flange on vessel, pipe or ventilation duct.
- Mount sensor into gland or flange.
- Ensure connection is tightened.



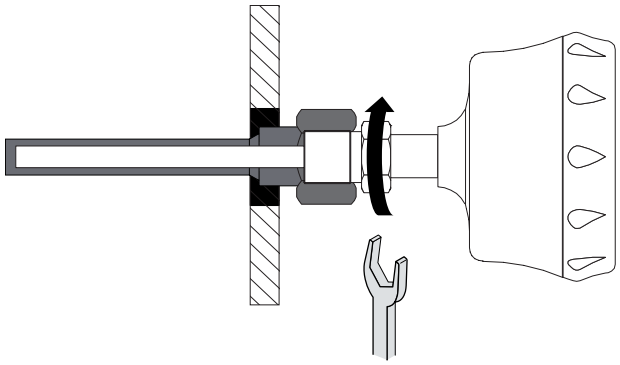
TFRN with the following process connections:

- G 1/2 A DIN 3852-E
- G 1/2 A ISO 228-1
- R 1/2 ISO 7/1
- 1/2-14 NPT

✓ Vessel and pipe are free of media
▸ Seal thread on sensor with Teflon tape (PTFE) if connection does not include sealing ring.
▸ Screw in sensor.
Tightening torque: 20 Nm
▸ Check leak-tightness.

Mounting with a thermowell

The TFRN with a G 1/2 A connection can be mounted in a thermowell of type ZPT4 from Baumer.

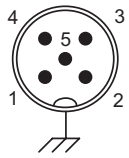
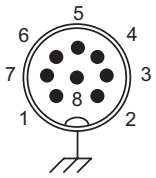


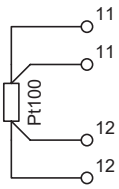
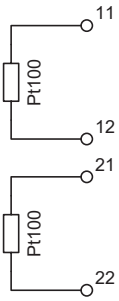
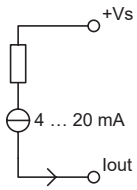
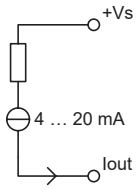
✓ Vessel and pipe are free of media
▸ Seal thread with Teflon tape (PTFE) on thermowell if no seal is attached.
▸ Screw in thermowell or tighten closure clamp.
▸ Screw sensor into thermowell.
Tightening torque: 20 Nm
▸ Ensure connection is tightened.

7. Electrical connection

7.1 External connections

✓ A power supply of 8 … 35 or 7 ... 40 V DC is provided depending on transmitter (see section 14.2 for details).
(with DFON display min. voltage is 11/12 V DC or 13.5/14.5 V DC depending on background intensity)
▸ Switch off power supply.
▸ Connect sensor in accordance with the pin assignment.

M12, 5-pin	M12, 8-pin
	

Connector type	Output	Circuit	Pin	Function
M12, 5-pin	Pt100 (single element)		1, 2	Pt100 11
			3, 4	Pt100 12
			5	n.c.
	Pt100 (double element)		1	Pt100 11
			2	Pt100 12
			3	Pt100 21
			4	Pt100 22
			5	n.c.
	4 … 20 mA (2-wire)		1	+Vs
			2	Common for relays 11, 21
			3	Iout
			4	Relay 22
			5	Relay 12
M12, 8-pin	4 … 20 mA (2-wire)		1	n.c.
			2	+Vs
			3	Relay 21
			4	Relay 22
			5	Relay 11
			6	Relay 12
			7	Iout
			8	n.c.

If no common supply is used for both relays an M12, 8-pin connector is required.

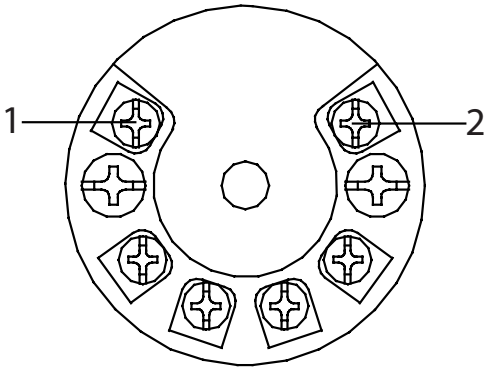
Electrical connection with cable gland

✓ Sensor is mounted
▸ Screw in cable gland.
Tighten M16 glands or M20 plastic 2...2.5 Nm
Tighten M20 steel 2.5...3 Nm

Cable gland type	Cable diameter
M16 plastic	5 … 10 mm
M16 stainless steel	5 … 9 mm
M20 plastic	8 … 13 mm
M20 stainless steel	9 … 13 mm

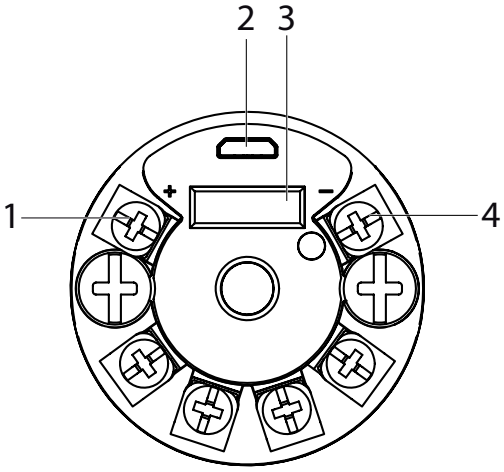
7.2 Internal connections

Connection to FlexTop™ 2202



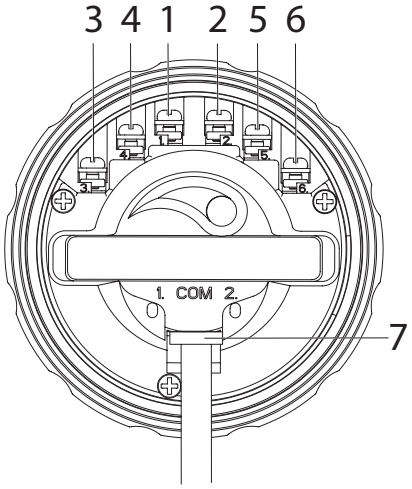
1 +Vs
2 Iout

Connection to FlexTop™ 2212/2222



1 +Vs
2 USB
3 UnitCom (ribbon cable)
4 Iout

Connection to DFON display



1 Iin (n.c. if using FlexTop 2212/2222)
2 Iout (n.c. if using FlexTop 2212/2222)
3 Relay 21
4 Relay 22
5 Relay 11
6 Relay 12
7 UnitCom (ribbon cable)

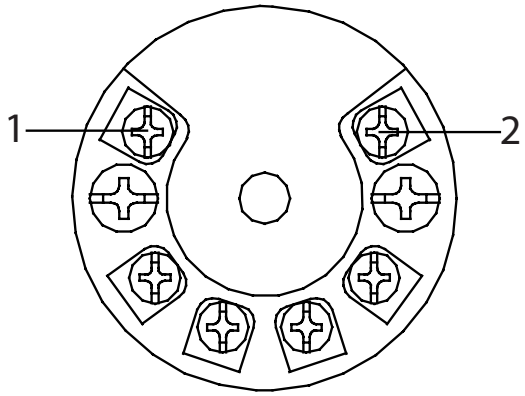
7.3 Mounting DFON display

ATTENTION
Damage of the front cover or ring
- Do not use tools to tighten the front cover or screwing ring.

- Remove the front cover.
- Remove the O-ring from the sealing groove.
- Connect the DFON display to FlexTop.
  - FlexTop 2202: According to pin assignment.
  - FlexTop 2212/2222: With internal UnitCom cable.
- Tighten the screwing ring by hand.

7.4 Connecting FlexProgrammer

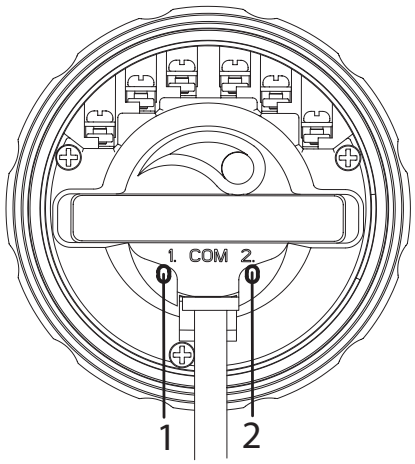
Connection to FlexTop™ 2202



1 Com 1
2 Com 2

- Open housing by unscrewing the cover.
- Connect the red clip to Com 1.
- Connect the black clip to Com 2.

Connection to DFON display



1 Com 1
2 Com 2

- Open housing by unscrewing the cover.
- Connect the red clip to Com 1.
- Connect the black clip to Com 2.

8. Electrical connection in explosion hazardous areas

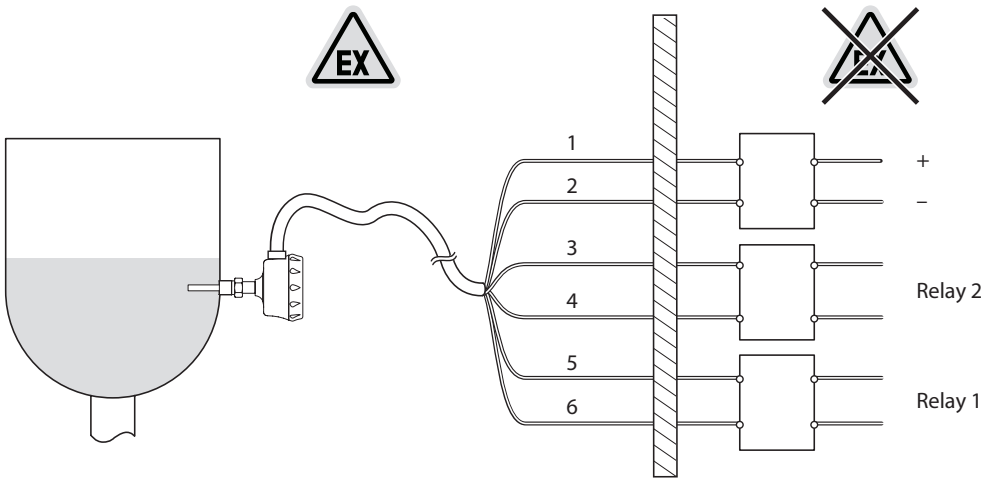
DANGER
Risk of fatal accident due to a wrongly connected sensor
Correct gas and dust protection can only be achieved by meeting their installation requirements.
- Make sure that all requirements are met and that sensor and installation have a valid approval for their specific explosive atmosphere.
- Allow only persons trained in explosion protection to perform the installation.
- Never use FlexProgrammer in explosion hazardous areas.

8.1 Explosive gas atmospheres zone 0, 1 and 2

The TFRH/N can be used with built in FlexTop™ 22xx transmitter in explosion hazardous areas of zone 0, 1 or 2. Sensors must be installed with Zener barriers. If electrostatic dissipative film on display cover becomes damaged, discontinue use in zone 0.
Approval for TFRH/N-xxxx.x1xx.xxxx.xxxx.xxxx: ATEX II 1G/IECEx Ex ia IIC T6...T4

All TFRH/N with intrinsic safety protection ia
- Use Zener barriers.
- If enabled, protect each relay by a separate Zener barrier or use a barrier with multiple channels.
- Depending on the transmitter type, comply with the following temperatures and connection values.

Ex ia IIC T5 Ga			
	With DFON display	Without display	
FlexTop™ 2202	Ci: 25 nF Li: 20 µH T5: –20 ≤ Tamb ≤ +60 °C T4: –20 ≤ Tamb ≤ +65 °C	Ci: 25 nF Li: 20 µH T5: –20 ≤ Tamb ≤ +60 °C T4: –20 ≤ Tamb ≤ +65 °C	Ui: 28 V DC Ii: 100 mA Pi: 700 mW
FlexTop™ 2212, 2222	Ci: 26 nF Li: 34 µH T5: –20 ≤ Tamb ≤ +60 °C T4: –20 ≤ Tamb ≤ +65 °C	Ci: 11 nF Li: 24 µH T5: –20 ≤ Tamb ≤ +60 °C T4: –20 ≤ Tamb ≤ +65 °C	Ui: 30 V DC Ii: 95 mA Pi: 750 mW
Relay outputs	Ci: 10 nF Li: 10 µH T5: –20 ≤ Tamb ≤ +60 °C T4: –20 ≤ Tamb ≤ +65 °C	N/A	Ui: 30 V DC Ii: 75 mA Pi: 750 mW



Function	Pin
+Vs	1
Iout	2
Relay 21	3
Relay 22	4
Relay 11	5
Relay 12	6

8.2 Explosive gas atmospheres zone 2

The TFRH/N can be used in explosion hazardous areas of zone 2 without using Zener barriers.

Approval for TFRH/N-xxxx.x3xx.xxxx.xxxx.xxxx: ATEX II 3 G Ex ec IIC T5...T4

All TFRH/N with protection class ec

- Comply with the following temperatures and connection values.

Ex ec II T4/T5	
Supply range	Un: 30 V DC max. In: 20 mA
Temperature class	■ With display: T4: -20 <Tamb <70°C T5: -20 <Tamb <60°C ■ Without display: T5: -40 <Tamb <80°C

8.3 Simple apparatus (no display, no transmitter)

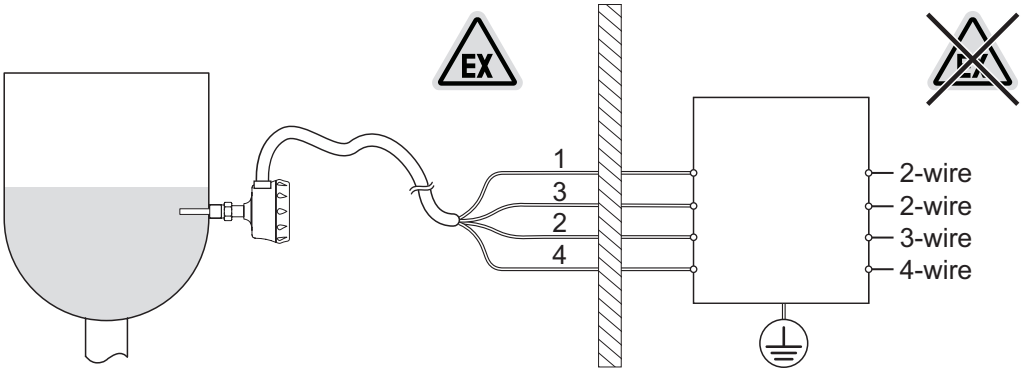
The TFRH/N without transmitter (Pt100 output) and without display can be used in explosion hazardous in all zones. Zener barrier must be used for all zones.

Approval for TFRH/N-xxxx.x9xx.xxxx.xxxx.xxxx: Ex ia simple apparatus Da / Ga

All TFRH/N in all zones

- Use Zener barrier.
- Comply with the following temperatures, connection values and circuit diagram.

Ex ia simple apparatus (IEC 60079-11)	
Limit values	Ui: 15 V DC Ii: 50 mA Pi: 25 mW Li: 0 µH Ci: 0 nF
Temperature class	■ T1 … T5: –40 ≤ Tamb ≤ 85 °C ■ T6: –40 ≤ Tamb ≤ 55 °C ■ T135 °C: –40 ≤ Tamb ≤ 85 °C



Function	Pin
Pt100 11	1, 2
Pt100 12	3, 4

9. Con guration

9.1 Con uring DFON touch screen

- Tap on the display screen and hold until the menu button appears.
- Press menu to start the configuration.

Example

- Configure screen layout.

Further possible settings:

- Relays
- Warning and error indication
- Screen layout
- Color
- Language

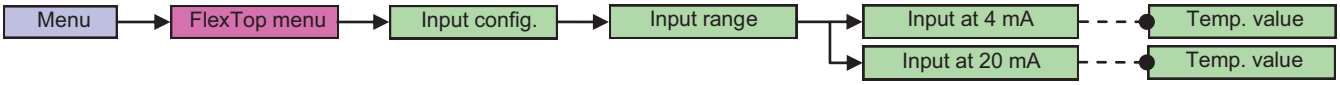
9.2 Con uring transmitter via DFON touch screen

For TFRH/N with mounted FlexTop™ 2212 and FlexTop™ 2222 transmitters further configurations can be programmed via DFON touch screen.

- Tap on the display screen and hold until the menu button appears.
- Press menu to start the configuration.

Example

- Configure input range.



- Configure damping range.

Further possible settings:

- Sensor type
- Temperature unit
- Output limit
- Sensor offset

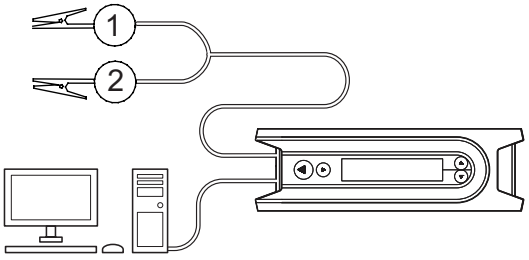
9.3 Con uring transmitter via FlexProgram

DANGER
FlexProgrammer is not ATEX approved for use in explosive atmospheres

- Do not use FlexProgrammer in explosive atmospheres.

Con guring with FlexProgrammer and PC

- Remove front cover/DFON display from TFRH/N.
- Connect FlexProgrammer to FlexTop 2202.
- Connect FlexProgrammer to PC and set parameters (see FlexProgrammer instructions).



Con guring with USB cable and PC

- ▸ Remove front cover/DFON display from TFRH/N.
- ▸ Connect PC directly to FlexTop 22x2 with a Micro-B USB cable and set parameters.

Con uration in explosive atmospheres

- ✓ Power supply off
- ▸ Disconnect TFRH/N from circuit.
- ▸ Remove TFRH/N and take it to a safe area (outside of the explosive atmosphere).
- ▸ Start configuration.

Options with FlexProgram

- ■ Sensor type
- ■ Temperature unit
- ■ Temperature range
- ■ Output limit
- ■ Damping
- ■ Data Logging
- ■ Sensor offset
- ■ Automatic cable compensation

10. Troubleshooting

Fault	Cause	Action
Display is off and no signal from transmitter	Sensor not correctly connected	▸ Check plug and power supply.
	Device error	▸ Dismount and send sensor to Baumer.
Display is on but no signal from transmitter	Short circuit	▸ Remedy short circuit.
Display is off but there is a signal from transmitter	Wrong cabling	▸ Connect the display and the transmitter with the UnitCom cable.
Display does not show the correct data	Incorrect temperature range	▸ Check programmed range limits.

11. Cleaning, maintenance and repair

Cleaning

- ▸ Clean, disinfect or sterilize sensor as needed (CIP/SIP).

Maintenance

Regular maintenance is not required.

Repair

Do not repair the sensor yourself.

- ▸ Send damaged sensor to Baumer.

12. Disposal

- ▸ Do not dispose of in household waste.
- ▸ Separate materials and dispose of in compliance with nationally applicable regulations.

13. Accessories

For mounting aids and other accessories see www.baumer.com.

14. Technical data

14.1 Sensor

Environmental conditions	
Process pressure	See „Process conditions“
Ambient temperature range	▪ –40 … 160 °C ▪ –40 … 85 °C (with transmitter) ▪ –30 … 80 °C (with display)
Humidity	< 98 %, condensing
Degree of protection	▪ IP67 ▪ IP69K (with appropriate cable)
Vibration (sinusoidal) (IEC 60068-2-6)	▪ 1.6 mm p-p (2 … 25 Hz), 4 g (25 … 100 Hz), 1 octave/min.
Process temperature	See „Process conditions“
Mass aprox.	0.8 kg, depending on product configuration

Sensor element, Pt100 DIN EN 60751	
1/1 DIN Class B	± (0.3 + 0.005 x t) °C
1/3 DIN Class B	± 1/3 x (0.3 + 0.005 x t) °C
1/6 DIN Class B	± 1/6 x (0.3 + 0.005 x t) °C
1/1 DIN Class A	± (0.15 + 0.002 x t) °C

Response time T50

Sensor diameter	Liquid 0.4 m/s	Air 3 m/s
6 mm	< 6.1 s	< 27.2 s
6/4 mm	< 1.5 s	< 21.4 s
8 mm	< 7.6 s	< 47.7 s
8/4 mm	< 1.5 s	< 33.6 s

14.2 Transmitter

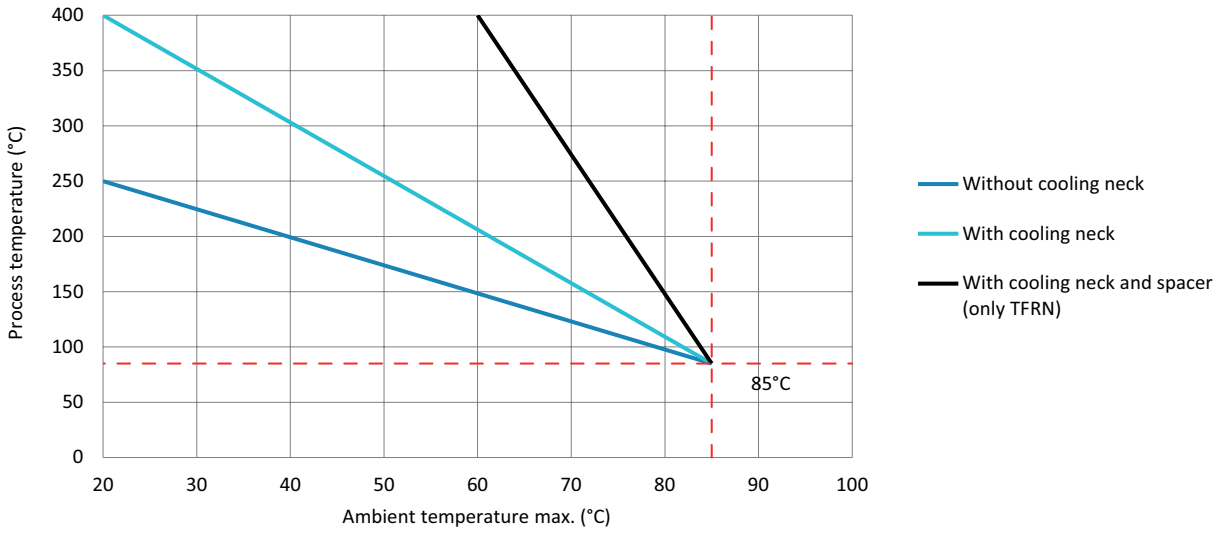
FlexTop® 2202 – Standard	
Input	Pt100
Output	4 … 20 mA
Accuracy	Input: < ±0.25 °C Output: < ±0.1 % of output span
Measuring range	–200 … 850 °C (programmable) Minimum span: 25 °C
Programmability	FlexProgrammer 9701
Voltage supply range	8 … 35 V DC without DFON display 14.5 ... 35 V DC with DFON display
Factory settings:	
▪ Output range	0 … 120 °C
▪ Connection	2-wire
▪ Damping	0 s
▪ Output at sensor fault	Upscale 23 mA

FlexTop® 2212 and 2222	
Input	Pt100
Output	▪ 2212: 4 … 20 mA ▪ 2222: 4 … 20 mA/HART
Accuracy	Input: < ±0.06 °C Output: < ±0.025 % of output span
Measuring range	–200 … 850 °C (programmable) Minimum span: 10 °C
Voltage supply range	7 … 40 V DC without DFON display 13.5 ... 40 V DC with DFON display
Programmability:	
▪ FlexTop® 2212	PC with FlexProgram
▪ FlexTop® 2222	PC with FlexProgram / HART terminal
Factory settings:	
▪ Output range	0 … 100 °C
▪ Connection	2-wire
▪ Damping	0 s
▪ Output at sensor fault	Upscale 23 mA

15. Process conditions

Process connection	BCID	Ordering key	Process pressure [bar]	Process temperature, standard [°C] Tamb = 20 °C	Process temperature, with cooling neck [°C] Tamb = 20 °C	Process temperature, with cooling neck and spacer Tamb = 60 °C
TFRN						
Sleeve Ø6	T65	10	-1 … 40	-50 … 250	-50 … 400	-50 … 400
G 1/2 A DIN 3852-E	G51	11	-1 … 100	-50 … 250	-50 … 400	-50 … 400
G 1/2 A ISO 228-1	G06	12	-1 … 100	-50 … 250	-50 … 400	-50 … 400
R 1/2 ISO 7/1	R01	13	-1 … 100	-50 … 250	-50 … 400	-50 … 400
1/2-14 NPT	N02	30	-1 … 100	-50 … 250	-50 … 400	-50 … 400
TFRH						
G 1/2 A hygienic	A03	51	-1 … 100	-50 … 250	-50 … 400	N/A
BHC 3A DN 38	B01	60	-1 … 40	-50 … 250	-50 … 400	N/A
ISO 2852 DN38 (Tri-Clamp)	C04	65	-1 … 40	-50 … 250	-50 … 400	N/A
ISO 2852 DN51 (Tri-Clamp)	C05	66	-1 … 40	-50 … 250	-50 … 400	N/A
Varivent® Type N	V02	70	-1 … 16	-50 … 250	-50 … 400	N/A

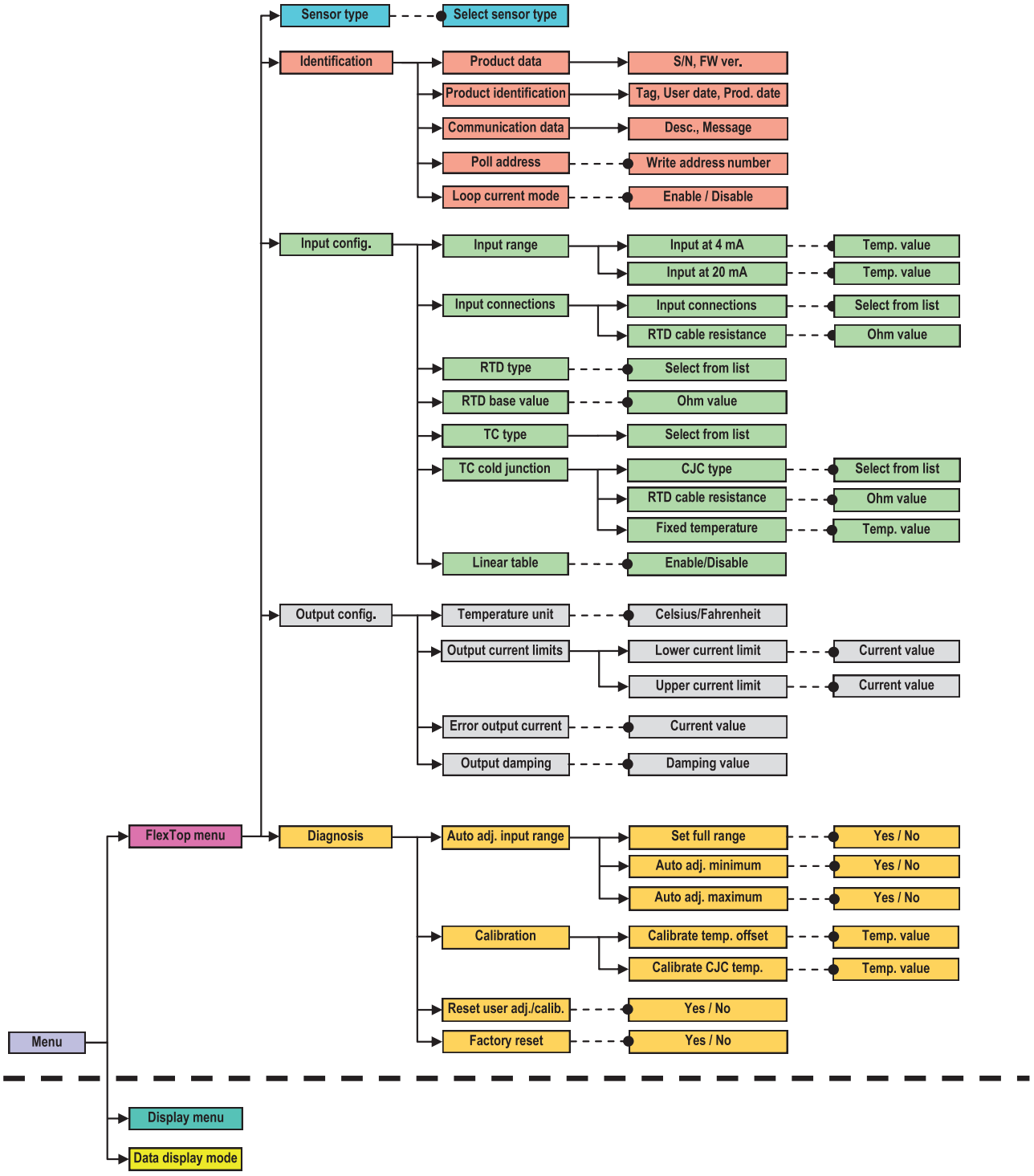
Process temperature

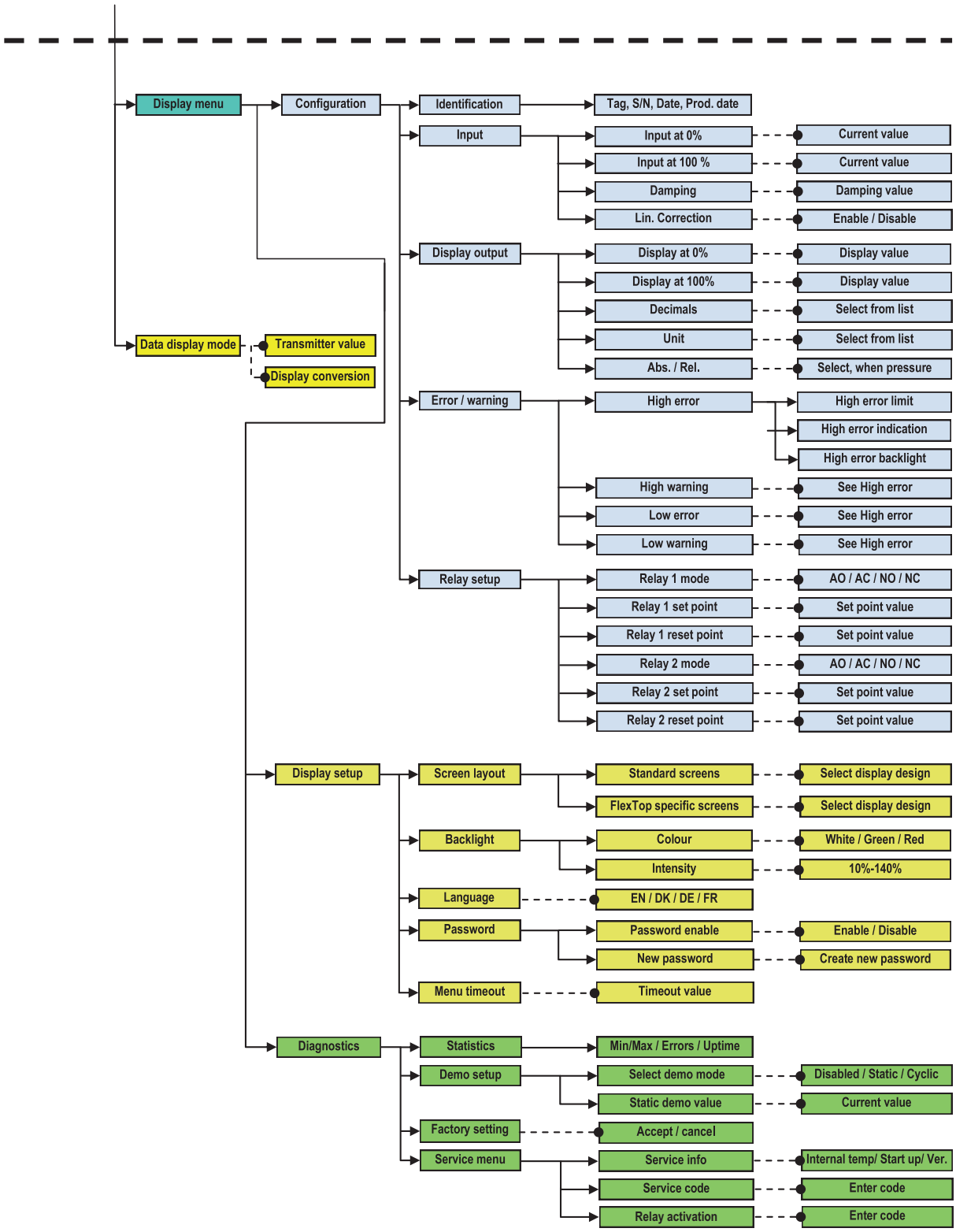


16. Con uration overview

DFON menu structure

The FlexTop menu point is only available with FlexTop 2212/2222.





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