Baumer
Passion for Sensors

Temperature sensor

CombiTemp TFRN/TFRH

Operating instructions



Field of application

CombiTemp™ TFRx is a temperature sensor, based on RTD technology, which is designed and produced to meet the requirements in food & beverage and pharmaceutical industry where hygienic connections are used.

CombiTemp™ TFRx comprises a series of basic elements which can be combined in various ways to a CombiTemp TFRx temperature sensor. The product offers great flexibility in respect to modification, service and maintenance.

The sensor can be made to feature a RTD output signal or with a built in FlexTop™ temperature transmitter types 2202, 2211, 2212, 2221 AND 2222 with 4-20 mA output (for documentation of FlexTops, please see relevant data sheet or operating instructions).

Field of application

This instrument is constructed and tested according to the current EU directives and packed in technically safe condition. In order to maintain this condition and to ensure safe operation, the user must follow the instructions and warnings given in this manual.

During the installation local standards have to be observed. Ignoring the warnings may lead to severe personal injury or substantial damage to property.

The product must be operated by trained staff. Correct and safe operation of this equipment is dependent on proper transport, storage, installation and operation.

All electrical wiring must conform to local standards and the connection must be made according to the connecting diagrams.

Before switching on power supply take care that there is no unwanted interaction with other equipment. Ensure that the supply voltage and the conditions in the environment comply with the specification of the device.

Before switching off the supply voltage check the possible effects on other equipment and the processing system.

To obtain the specified protection degree, use a compliant cable for electrical installation.

⚠ WARNING

For electrical installations and commissioning of the explosion protected devices, the data given in the conformity certificate as also the local regulations for installation of electrical apparatus within explosion protected areas must be considered. The intrinsically safe versions can be mounted in the explosion hazarded area according to its specification and only connected to a certified intrinsically safe supply loop with the corresponding electrical values.

After mounting of the device - do check that the housing has a ground potential.

Note:

This product contains no replaceable parts. In case of malfunction the product must be returned to Baumer for repair.

ATEX applications

Valid for FlexTop™ 2202 / 2211 / 2221

⚠ The FlexProgrammer configuration unit must not be connected to the FlexTop within the hazardous area.

Configuration procedure:

a. Disconnect mains from the 4...20 mA loop circuit
b. Disconnect the product from the security within the hazardous area
c. Bring the product to the safe area
d. Connect the FlexProgrammer and perform the configuration
e. Reinstall the product in the hazardous area
f. Connect the power supply to the circuit

For FlexTop™ 2221/2222 only
Configuration for the FlexTop™ 2221/2222 can be made within the hazardous area by means of a handheld HART configurator, providing the precautions and guidelines described in the product's manual are observed.

The CombiTemp TFRx is ATEX approved with transmitter for Ex nA for zone 2.

The CombiTemp TFRx is ATEX approved without transmitter, i.e. with Pt100 output only, as simple apparatus as Ex ia.

Compliance and approvals

EMC	EN 61000-6-2 EN 61000-6-3
ATEX	ATEX II 1G Ex ia IIC T4/T5 ATEX II 3G Ex nA IIC T5 Ex ia Simple apparatus, gas and dust
Hygiene	Regulation 1935/2004, 2023/2006 3-A (74-07)

EN/2020-03-03 Design and specifications subject to change without notice

Mechanical specifications

Sensor tube and process connection	Stainless steel, AISI 316L (1.4404)	
Housing	Stainless steel, AISI 304 (1.4301)	
Mounting part	Stainless steel, AISI 304 (1.4301)	
Electrical connection	Plug	M12, 5-pin or 8-pin
	Material	Stainless steel AISI 304 (1.4301)
	Cable gland	M16 or M20
	Material	Plastic or Stainless steel AISI 304 (1.4301)

Environment

Process pressure	≤40 bar (60 bar)
Process temperature	-40 … 250 °C -40 … 400 °C with cooling neck
Ambient temperature	-50...160°C without transmitter / display -40...85°C with transmitter only -30...80°C with transmitter and display
Humidity	<98% RH, condensing
Protection class	IP67/IP69K
Vibrations	GL, test 2 (sensor tube <200 mm)

CombiView DFON display

Type	Graphically LCD
Front glass	Polycarbonate
Display modes	8 modes, programmable e.g. value, bar graph, analogue
Background colour	White, green, red - programmable
Measuring range	-9999...99999
Digit height	Max. 22 mm
Accuracy	0,1% @ ambient –10...70 °C 0,2% @ ambient –30 … -10 / 70 … 80 °C
Voltage drop	4V...6,5V - depending on background light
Output	2 configurable relay output, 60 Vp, 75 mA
Programming	Touch screen or FlexProgrammer 9701

Further information can be found in separate data sheet and/or operating instructions for the Baumer graphical display, CombiView DFON.

Sensor element specifications (DIN/EN/IEC 60751)

Sensor element	Pt100	
Accuracy (sensor element)	Class B	±(0,3 + 0,005×t)°C
	Class 1/3 B	±1/3 × (0,3 + 0,005×t)°C
	Class 1/6 B	±1/6 × (0,3 + 0,005×t)°C
	Class A	±(0,15 + 0,002×t)°C
Single element	1 × Pt100	
Double element	2 × Pt100	
Connection	2-wire or 4-wire	

FlexTop® 2202 temperature transmitter

Input	Pt100
Output	4...20 mA
Accuracy	input < 0,25°C, span ≤ 250 °C - < 0,1% span, span > 250 °C output < 0,1% signal span (16 mA)
Range	-200...850°C
Minimum span	25°C
Voltage supply range	8...35 V DC
Programmability	By FlexProgrammer 9701

Further information can be found in separate data sheet and/or operating instructions for FlexTop 2202

FlexTop® 2211 and 2221 temperature transmitter

Input	Pt100
Output	2211 4...20 mA 2221 4...20 mA / HART
Accuracy,	input <0,1°C output <0,1% signal span (16 mA)
Range	-200...850°C
Minimum span	25°C
Voltage supply range	2211 6,5 … 30 V DC 2221 8,0 … 35 V DC
Programmability	By FlexProgrammer 9701 or HART modem

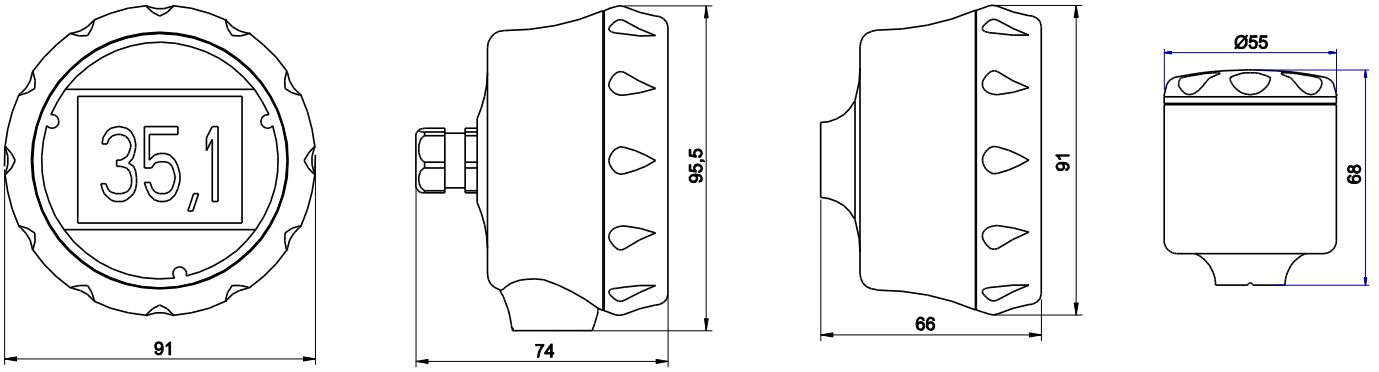
Further information can be found in separate data sheet and/or operating instructions for FlexTop 2211 or FlexTop 2221

FlexTop® 2212 and 2222 temperature transmitter

Input	Pt100
Output	2212 4...20 mA 2222 4...20 mA / HART
Accuracy,	input <0,06°C output <0,025% signal span (16 mA)
Range	-200...850°C
Minimum span	10°C
Voltage supply range	7 … 40 V DC
Programmability	Both: Touch screen or FlexProgram 2222: By HART® modem

Further information can be found in separate data sheet and/or operating instructions for FlexTop 2212 or FlexTop 2222

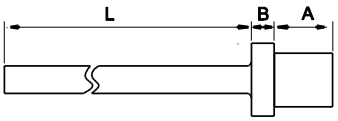
Dimensions for TFRN/TFRH housing



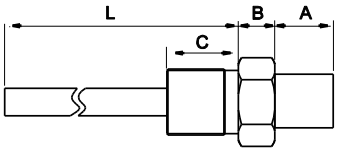
Dimensions for sensor tube and process connection (mm) for TFRN

Connection	A	B	A/F	C	L	BCID	Norm
Without	15	10	Ø18	0	20...3.000	T20	
R 1/2	15	10	22.0	17	35...3.000	R01	ISO 7/1
G 1/2 A	15	10	22.0	17	35...3.000	G40	ISO 228/1
G 1/2 DIN 3852-E	15	13	22.0	14	35...3.000	G51	DIN 3852
½-14 NPT	15	10	22.0	22	40...3.000	N02	ANSI/ASME B1.20.1

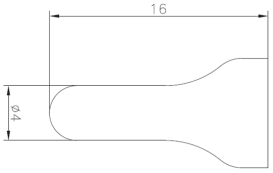
Tube without connection



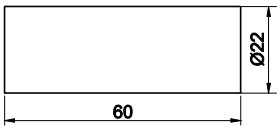
Tube with threaded connection



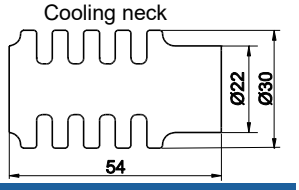
Fast response tip



Distance piece

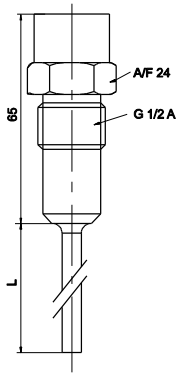


Cooling neck

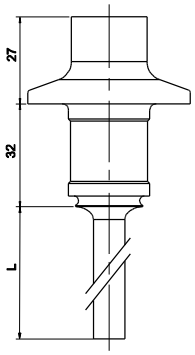


Dimensions for sensor tube and process connection (mm) for TFRH

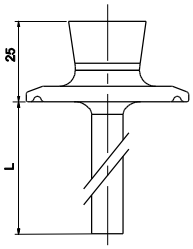
G 1/2 A
Hygienic
(A03)



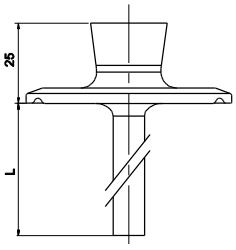
BHC 3A
DN 38
(B01)



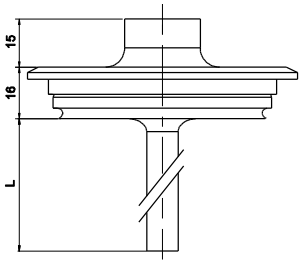
ISO 2852
DN 38
(C04)



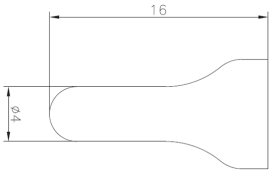
ISO 2852
DN 51
(C05)



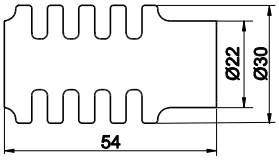
Varivent®
Type N
(V02)



Fast response tip

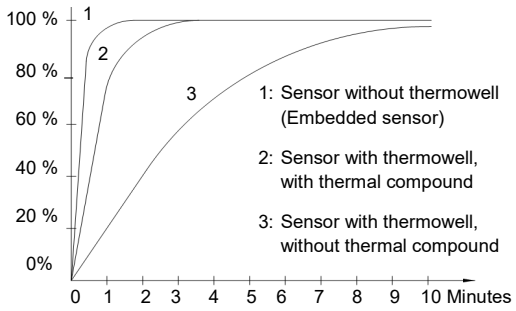


Cooling neck



Response time, (time constant) T50

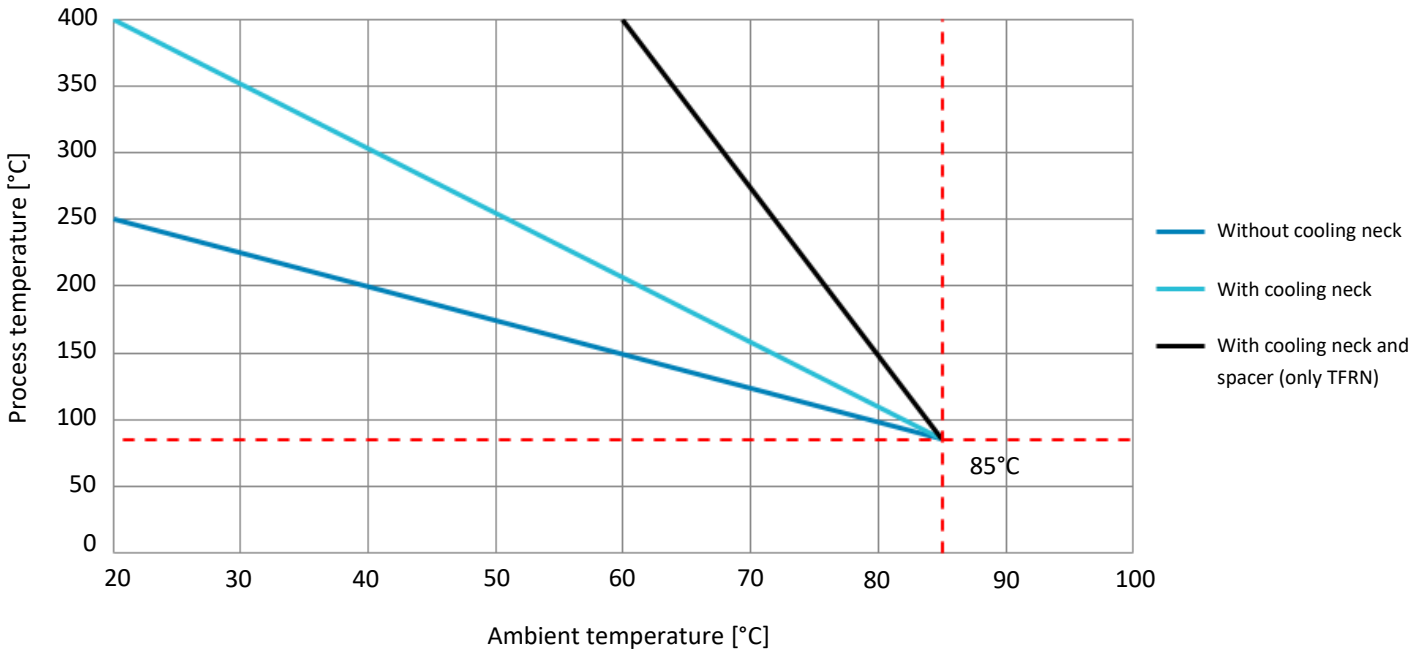
Sensor diameter	Sensor tip	Liquid 0,4 m/sec	Air 3 m/sec	Air 0 m/sec
Ø6 mm	Fast	<1,5 sec	<21,4 sec	<135,6 sec
	Standard	<6,1 sec	<27,2 sec	<137,8 sec
8 mm	Fast	<1,5 sec	<33,6 sec	<181,0 sec
	Standard	<7,6 sec	<47,7 sec	<200,9 sec



Note:
When a thermowell is used, the time delay increases. The delay is the time duration for the sensor to reflect the correct temperature after a temperature change in the media.

Process conditions

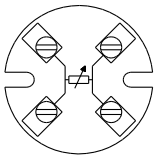
Process connection	BCID	Ordering key	Process pressure [bar]	Process temperature, standard (Tamb = 20 °C) [°C]	Process temperature, with cooling neck (Tamb = 20 °C) [°C]	Process temperature, with cooling neck and spacer (Tamb = 60 °C) [°C]
TFRN						
Sleeve Ø 6	T65	10	-1 … 40	-50 … 250	-50 … 400	-50 … 400
G 1/2 A DIN 3852-E	G51	11	-1 … 100	-50 … 250	-50 … 400	-50 … 400
G 1/2 A DIN 3852-A	G44	12	-1 … 100	-50 … 250	-50 … 400	-50 … 400
R 1/2 ISO 7/1	R06	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



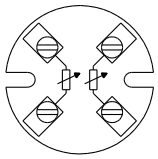
Electrical connection Pt100

To connect with Pt100 output with ceramic terminal block

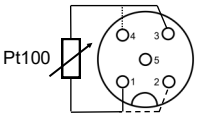
1 × Pt100



2 × Pt100

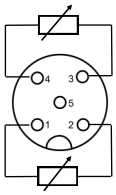


To connect Pt100 output with M12 connector



1 × Pt100	
1	2-wire Pt100
2	3-wire Pt100
3	2-wire Pt100
4	4-wire Pt100
5	N.C

2 × Pt100	
1	Pt100 (1)
2	Pt100 (1)
3	Pt100 (2)
4	Pt100 (2)
5	N.C

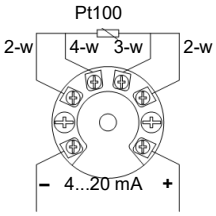


Electrical connection 4 … 20 mA

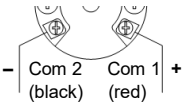
FlexTop® 22xx



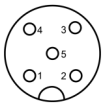
To connect the FlexTop® 22xx



To connect the FlexProgrammer 9701



To connect with M12 connector



5-pin 4-20 mA	
1	+ supply, 4-20 mA
2	Common for relays
3	– supply, 4-20 mA
4	Relay 2
5	Relay 1

8-pin 4-20 mA	
1	N.C.
2	+ supply, 4-20 mA
3	Relay 2
4	Relay 2
5	Relay 1
6	Relay 1
7	– supply, 4-20 mA
8	N.C.

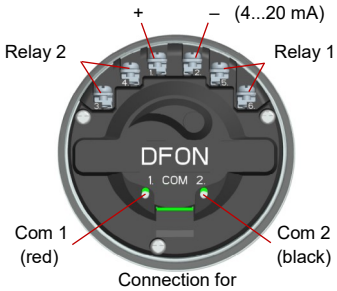


Electrical connection DFON display

CombiView DFON display



Connection with 4 … 20 mA loop



Connection for FlexProgrammer 9701

Electrical connection with cable gland

Cable diameter	M16 plastic	5 … 10 mm
	M16 stainless steel	5 … 9 -
	M20 plastic	8 … 13 -
	M20 stainless steel	11 … 15 -

⚠ Check the maximum temperature for the cable used
Be sure to fixate the instrument before tightening the cable gland.
When using M16 stainless steel and M20 stainless steel the maximum tightening torque is 4 Nm.

⚠ When upgrading the TFRx without display with a DFON touch screen, remember to remove the O-ring from the sealing. Otherwise the sealing won't be tight.

Mounting for TFRN

The CombiTemp™ TFRN can be mounted in several different ways.

1. Sensor tube without connection
Baumer offers compression glands fitting Ø6 and Ø8 mm sensor diameter. This type of mounting is normally used for mounting a sensor direct into a non-pressurized application. If pressurized, ensure that the connection is tightened correctly, so no leakage occur.
A duct channel mounting flange for 8 mm sensor is also available.





All threaded connections can be mounted directly into the application without thermowell, however often a thermowell is required to enable the user to take out the sensor for e.g. calibration without opening the system.

2. Sensor with male threaded process connection G 1/2 A
This is suitable in a Baumer thermowell type ZPT4. The process connections available for ZPT4 are R 1/2, G 1/2 A, G 3/4 A, M20 or with hygienic ISO 2852 clamp DN 38.



3. Sensor with male threaded process connection G 3/4 A and G 1 A and sensors with G 1/2 or G 3/4 female thread can be supplied with a special thermowell. Please contact Baumer.

Mount the gland/pocket into the application and install the sensor after the gland/pocket is fixed to the application. This will ensure that the cable is not twisted during mounting.

Baumer recommends to use a thermal compound filled into the thermowell to ensure best possible heat transfer between the pocket and the CombiTemp TFRN. Baumer offers a 6 gram bag Thermal compound, type ZPX1-001



Mounting for TFRH

Installation of 3-A approved and EHEDG certified products:

Generally for welding adapters in a tank

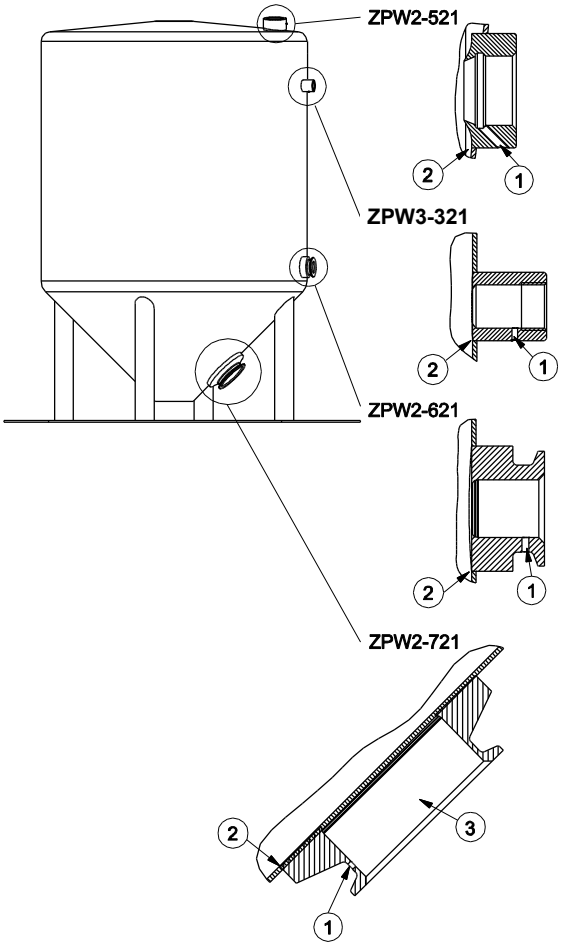
1 Use only a 3-A approved counterpart.

2 Level the inner surface of the tank with the welding adapter.

3 If it is possible, always face the inspection hole downwards, so a leaking gasket can be observed quickly and if necessary replaced. The inspection hole should always be visible and drainable.

4 Weld from the inside of the tank if possible. Welds shall be free from cracks, burr and grooves. Welding should be grinded to Ra 0,8 µm.

5 Tighten the connection with the torque stated below



Generally for welding adapters in a tube

1 Use only a 3-A approved welding adapter

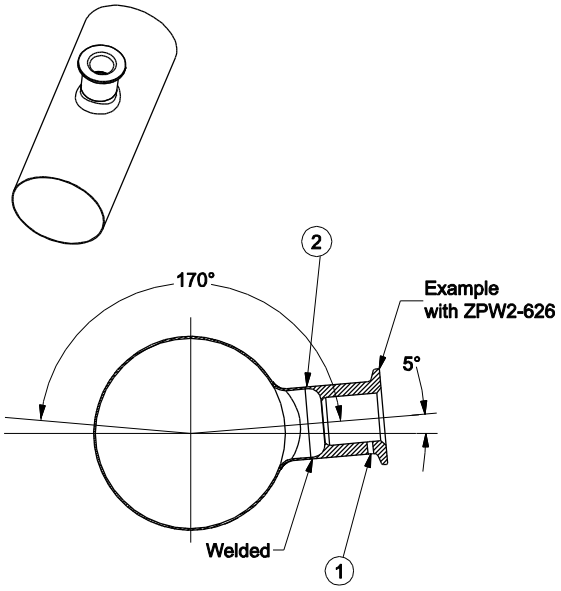
2 Level the inner surface of the pipe with the welding adapter.

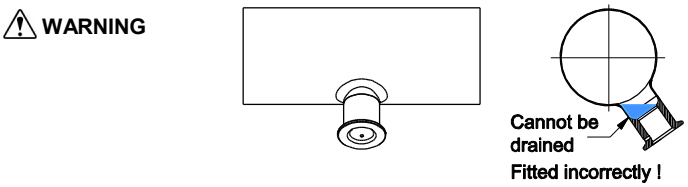
3 Welds shall be free from cracks, crevices and groves. Welding should be grinded to Ra ≤ 0.8 µm.

4 The 3-A mark or arrow shall be placed upwards. Always face the inspection hole downwards, so a leaking gasket can be observed quickly. If necessary to be replaced. The inspection hole should be visible and drainable.

5 Always mount the welding adapter in a self-draining position. On a tube; >5° from horizontal. This will give an optional placement of 170° for the location of measuring point (as shown in the drawing)

6 Tighten the connection with the torque stated below





Tighten the connection with a torque of:

CombiTemp TFRH	G 1/2 A hygienic	20 Nm

After installation and configuration

- Check the leak tightness between the welding sleeve and the instrument
- Check the tightness of glands or M12 plugs.
- Check the tightness of the instrument cover

It is important that a 3-A marked adapter are installed according to these instructions. Always try to limit cracks, crevices and holes where remaining media can accumulate and provide bacteria.

Always replace gaskets or O-rings that are damaged or defect.

Hazardous area (ATEX)

The CombiTemp™ TFRx can be supplied for hazardous area. Either as a Simple Apparatus with RDT output or with built in transmitter with 4 … 20 mA output.

A CombiTemp™ TFRx with built in transmitter will have two possible ATEX approvals, Ex ia (zone 0, 1 or 2) or Ex nA (zone 2).

Ⓔx II 1 G, EX ia IIC T4/T5, Gas

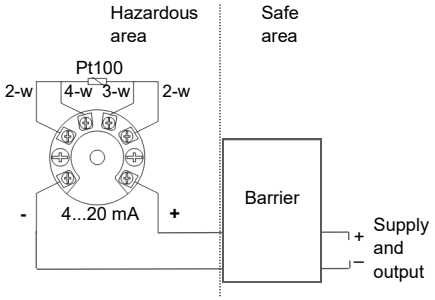
Ⓔx II 3 G, Ex nA IIC T4/T5, Gas

The remaining Ex parameters depend on the type of transmitter and display selected for the product. See detailed data below.

The CombiTemp™ TFRx with Ex ia must be installed in accordance with prevailing guidelines for zone 0 and zone1 and a certified intrinsically safe zener barrier with the listed maximum values must be used. Electrical connection for the temperature transmitter as per below diagram.

CombiTemp™ TFRx with Ex nA must be installed in accordance with prevailing guidelines for zone 2 without a barrier.

Electrical connection ATEX ia



Ex-data for FlexTop ™ 2202

Approval	ATEX II 1G, Ex ia IIC T5/T6	
Voltage supply range	8...28 V DC	
Internal inductivity	L_i	≤10 µH
Internal capacity	C_i	≤10 nF
Temperature class	T1...T5:	-40 <Tamb <85°C
	T6:	-40 <Tamb <50°C
Barrier data	U_i:	≤28 VDC
	I_i:	≤0,1A
	P_i:	≤0,7 W

Ex-data for FlexTop ™ 2211 and 2221

Approval	ATEX II 1G, Ex ia IIC T5/T6	
Voltage supply range	2211	6,5...30 V DC
	2221	8 … 30 V DC
Internal inductivity	L_i	≤15 µH
Internal capacity	C_i	≤5 nF
Temperature class	T1...T5:	-40 <Tamb <85°C
	T6:	-40 <Tamb <50°C
Barrier data	U_i:	≤28 VDC
	I_i:	≤0,1A
	P_i:	≤0,7 W

Ex-data for FlexTop ™ with nA approval

Approval	ATEX II 3G, Ex nA IIC T4/T5	
Voltage supply range		
2202, 2221:	U_i:	8...30 V DC,
2211:	U_i:	6,5...30 V DC,
	I_i:	<100 mA
Temperature class	T4:	-20 <Tamb <70°C
	T5:	-20 <Tamb <60°C

Ex-data for Simple apparatus (no transmitter or display)

Approval	ATEX II 1G, Ex ia IIC T5/T6	
Internal inductivity	L_i	≤0 µH
Internal capacity	C_i	≤0 nF
Temperature class	T1...T5:	-40 <Tamb <75°C
	T6:	-40 <Tamb <60°C
Barrier data	U_i:	≤15 VDC
	I_i:	≤50 mA
	P_i:	≤25 mW

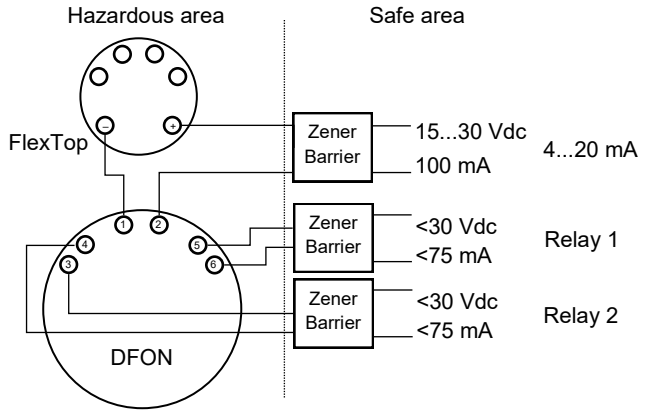
ATEX Gas ia for DFON display

Approval:	Zone 0/1	ATEX II 1G, Ex ia IIC T5 Ga	
Voltage drop	U_{Disp}	4,5 or 6,5 VDC	
Temperature class	T1…T5	Zone 0	-20°C…60°C
		Zone 1/2	-40°C…65°C
Internal inductivity	L_i	<10 µ	
Internal capacity	C_i	<15 nF	
Barrier data	U_i	<30 VDC	
	I_i	<0,1 A	
	P_i	<0,75 W	

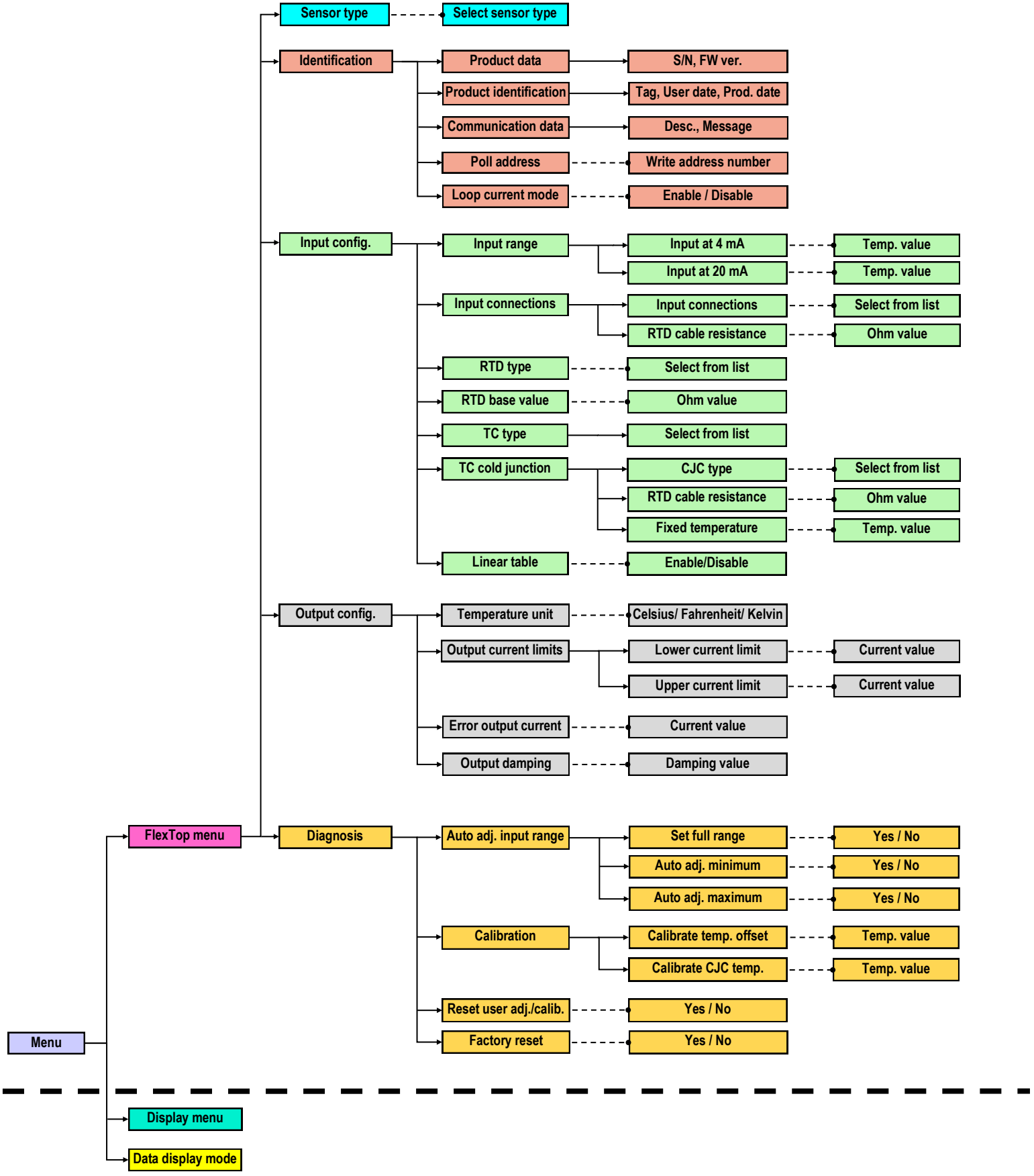
If the relays are enabled, each relay must be protected by a zener barrier. Use a barrier for each relay or a barrier with multiple channels. However the two relays must have each a barrier.

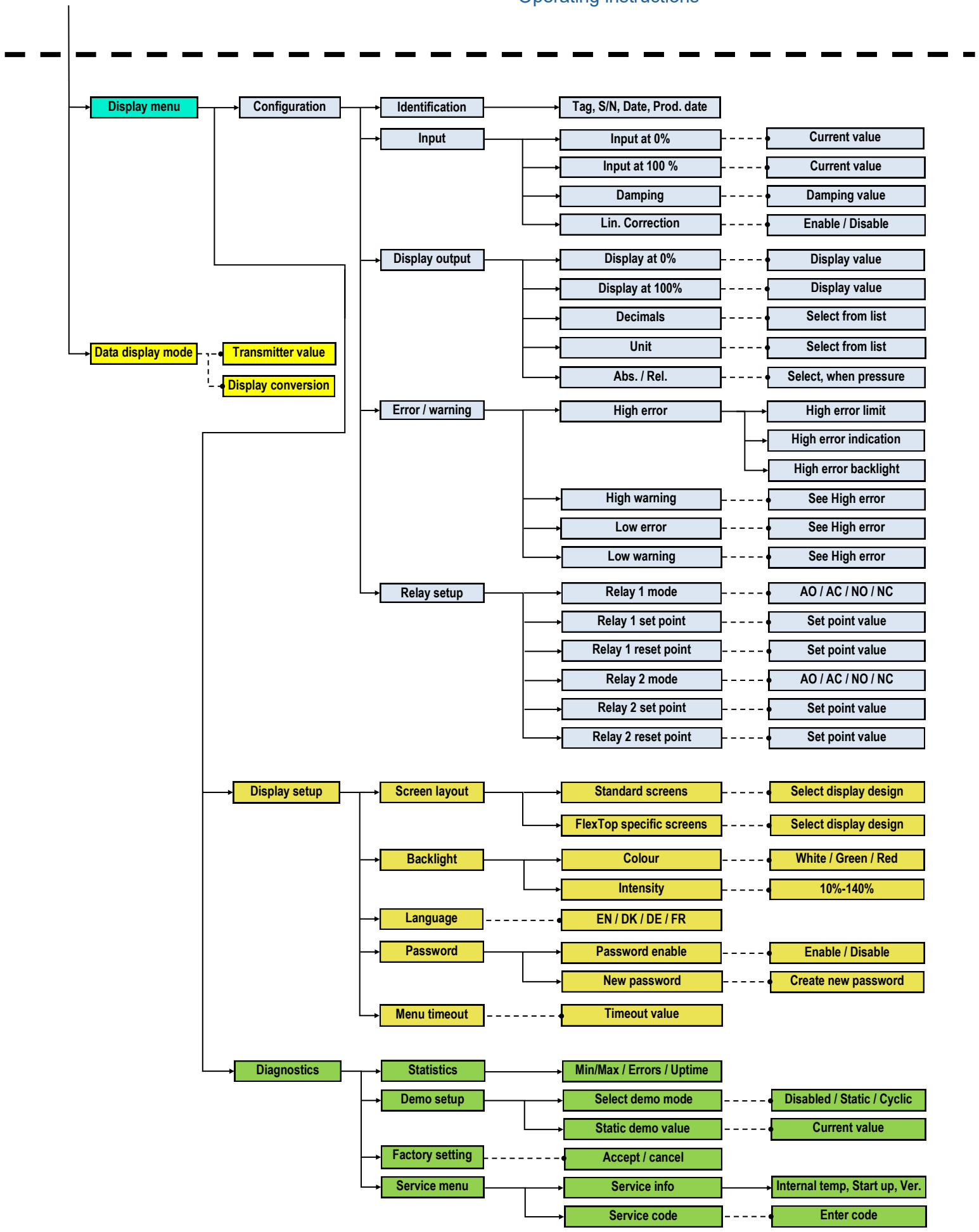
Barrier data	U_i	<30 VDC
	I_i	<75 mA
	P_i	<0,75 W

Electrical connection with DFON display



DFON menu overview for TFRx with 22x2




Display menu
Configuration
Identification
Tag, S/N, Date, Prod. date
Input
Input at 0%
Current value
Input at 100 %
Current value
Damping
Damping value
Lin. Correction
Enable / Disable
Display output
Display at 0%
Display value
Display at 100%
Display value
Decimals
Select from list
Unit
Select from list
Abs. / Rel.
Select, when pressure
Error / warning
High error
High error limit
High error indication
High error backlight
High warning
See High error
Low error
See High error
Low warning
See High error
Relay setup
Relay 1 mode
AO / AC / NO / NC
Relay 1 set point
Set point value
Relay 1 reset point
Set point value
Relay 2 mode
AO / AC / NO / NC
Relay 2 set point
Set point value
Relay 2 reset point
Set point value
Data display mode
Transmitter value
Display conversion
Display setup
Screen layout
Standard screens
Select display design
FlexTop specific screens
Select display design
Backlight
Colour
White / Green / Red
Intensity
10%-140%
Language
EN / DK / DE / FR
Password
Password enable
Enable / Disable
New password
Create new password
Menu timeout
Timeout value
Diagnostics
Statistics
Min/Max / Errors / Uptime
Demo setup
Select demo mode
Disabled / Static / Cyclic
Static demo value
Current value
Factory setting
Accept / cancel
Service menu
Service info
Internal temp, Start up, Ver.
Service code
Enter code

EU-Konformitätserklärung
EU Declaration of Conformity
Déclaration UE de Conformité

Wir erklären in alleiniger Verantwortung, dass die Produkte, auf die sich diese Erklärung bezieht, die grundlegenden Anforderungen der angegebenen Richtlinie(n) erfüllen und basierend auf den aufgeführten Norm(en) bewertet wurden.

We declare under our sole responsibility that the products to which the present declaration relates comply with the essential requirements of the given directive(s) and have been evaluated on the basis of the listed standard(s).

Nous déclarons sous notre seule responsabilité que les produits auxquels se réfère la présente déclaration sont conformes aux exigences essentielles de la directive/ des directives mentionnée(s) et ont été évalués sur la base de la norme/ des normes listée(s).

Hersteller
Manufacturer
Fabricant
Baumer A/S

Bezeichnung
Description
Description
Elektronische Temperaturmessung
Electronic temperature measurement
Electronique mesure de température

Typ(en) / Type(s) /Type(s)

TCR6-xxxx.x1xx.xxxx.xxxx.xxxx	TCR6-xxxx.x3xx.xxxx.xxxx.xxxx
TFR5-xxxx.x1xx.xxxx	TFR5-xxxx.x3xx.xxxx
TFRN-xxxx.x1xx.xxxx.xxxx.xxxx	TFRN-xxxx.x3xx.xxxx.xxxx.xxxx
TFRH-xxxx.x1xx.xxxx.xxxx.xxxx	TFRH-xxxx.x3xx.xxxx.xxxx.xxxx

x = beliebige Zahl oder Buchstabe / any figure or letter / n'importe quel nombre ou lettre

Richtlinie(n)
Directive(s)
Directive(s)
2014/30/EU, 2014/34/EU, 2011/65/EU

Norm(en)
Standard(s)
Norme(s)
EN 61326-1:2013, EN 60079-0:2012+A11:2013, EN 60079-11:2012, EN 60079-15:2010
EN 60079-26:2007

Konformitätsbewertungsstelle:
Conformity assessment center
Centre d'évaluation et de mise en conformité
TÜV Nord 0044
Am TÜV 1
30519 Hannover

EU- Baumusterprüfbescheinigung:
EU type examination certificate
Attestation d'examen UE de type
TÜV 07 ATEX 347158 X

Ort und Datum
Place and date
Lieu et date
Aarhus, 06.07.2016

Unterschrift/Name/Funktion
Signature/name/function
Signature/nom/fonction
Ib V. Pedersen
Managing Director

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