

TFRN

RTD temperature sensor for industrial applications

TFRN-####-##0#-####-####-####

Overview

- User-configurable according to individual requirements
- Optional with touch display
- Immersion depth 20 ... 3000 mm
- 4 ... 20 mA, HART or Pt100 output
- Convenient installation and reliable operation



Technical data

Performance characteristics

Pt100 accuracy class (EN 60751)	B ($\pm 0.3 \text{ }^{\circ}\text{C}$ at $0 \text{ }^{\circ}\text{C}$) $\pm (0.3 + 0.005 \times t) \text{ }^{\circ}\text{C}$ A ($\pm 0.15 \text{ }^{\circ}\text{C}$ at $0 \text{ }^{\circ}\text{C}$) $\pm (0.15 + 0.002 \times t) \text{ }^{\circ}\text{C}$ 1/3 B ($\pm 0.1 \text{ }^{\circ}\text{C}$ at $0 \text{ }^{\circ}\text{C}$) $\pm 1/3 \times (0.3 + 0.005 \times t) \text{ }^{\circ}\text{C}$ 1/6 B ($\pm 0.05 \text{ }^{\circ}\text{C}$ at $0 \text{ }^{\circ}\text{C}$) $\pm 1/6 \times (0.3 + 0.005 \times t) \text{ }^{\circ}\text{C}$
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Thermal response time, T50	$< 1.5 \text{ s}$, $\varnothing 4 \text{ mm}$ $< 6.1 \text{ s}$, $\varnothing 6 \text{ mm}$ $< 7.6 \text{ s}$, $\varnothing 8 \text{ mm}$
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Process pressure	Refer to section "Operating conditions"
Process temperature	Refer to section "Operating conditions"

Process connection

Connection variants	Refer to section "Dimensional drawings"
Sensor length	20 ... 3000 mm
Sensor diameter outside	$\varnothing 6 \text{ mm}$ $\varnothing 8 \text{ mm}$
Mounting position	Any, top, bottom, side
Standard response tip	$\varnothing 6 \text{ mm}$ $\varnothing 8 \text{ mm}$
Fast response tip	$\varnothing 4 \text{ mm}$
Sensor tube material	AISI 316L (1.4404)
Surface roughness wetted parts	$R_a \leq 1.6 \text{ }\mu\text{m}$

Ambient conditions

Operating temperature range	$-30 \text{ ... } 80 \text{ }^{\circ}\text{C}$, with DFON touch screen $-40 \text{ ... } 85 \text{ }^{\circ}\text{C}$, with transmitter $-40 \text{ ... } 160 \text{ }^{\circ}\text{C}$, with Pt100
Storage temperature range	$-30 \text{ ... } 80 \text{ }^{\circ}\text{C}$, with DFON touch screen $-40 \text{ ... } 85 \text{ }^{\circ}\text{C}$, without DFON touch screen
Degree of protection (EN 60529)	IP67 IP69K, with appropriate cable

Ambient conditions

Humidity	$< 98 \text{ \% RH}$, condensing
Vibration (sinusoidal) (EN 60068-2-6)	1.6 mm p-p (2 ... 25 Hz), 4 g (25 ... 100 Hz), 1 octave / min.

Output signal

Without transmitter	1 x Pt100, 2-wire 1 x Pt100, 4-wire 2 x Pt100, 2-wire
With transmitter	4 ... 20 mA, 2-wire 4 ... 20 mA, 2-wire + HART®

Housing

Style	Field housing, $\varnothing 55 \text{ mm}$ FlexHousing, $\varnothing 80 \text{ mm}$
Overall size	Refer to section "Dimensional drawings"
Material	AISI 304 (1.4301)

Electrical connection

Connector	M12-A, 5-pin, stainless steel M12-A, 8-pin, stainless steel
Cable	M16 plastic, cable dia. 5 ... 10 mm M16 stainless steel, cable dia. 5 ... 9 mm M20 plastic, cable dia. 8 ... 13 mm M20 stainless steel, cable dia. 9 ... 13 mm
Cable gland	M16x1.5, plastic M16x1.5, stainless steel M20x1.5, plastic M20x1.5, stainless steel

ATEX II 1G Ex ia IIC T4/T5

Maximum values for barrier selection, Ui	28 V DC
Maximum values for barrier selection, li	0.1 A
Maximum values for barrier selection, Pi	0.7 W
Internal capacitance, Ci	36 nF

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Technical data

ATEX II 1G Ex ia IIC T4/T5

Internal inductance, Li	11 µH
Temperature class, T1 ... T4	-20 < Tamb < 65 °C
Temperature class, T1 ... T5	-20 < Tamb < 60 °C

ATEX II 3G Ex ec IIC T4/T5

Voltage supply range, Un	8 ... 30 V DC , with FlexTop 2202 / 2221 6.5 ... 30 V DC , with FlexTop 2211
Current rating, In	≤ 0.1 A
Temperature class, T1 ... T4	-20 < Tamb < 70 °C
Temperature class, T1 ... T5	-20 < Tamb < 60 °C

Compliance and approvals

EMC	EN 61000-6-2 EN 61000-6-3 EN 61326-1
Explosion protection	ATEX II 1 G Ex ia IIC T6...T4 Ga ATEX II 3 G Ex ec IIC T5...T4 Ex ia Simple apparatus, gas and dust IECEx Ex ia IIC T6...T4 Ga

Display

General information

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

Ambient conditions

Optimal readability temperature range	-10 ... 70 °C
Operating temperature range	-30 ... 80 °C
Degree of protection (EN 60529)	IP 67 IP 0

Input signal

Input signal from transmitter	FlexTop 2202 / 2211 / 2221: Analog, current loop FlexTop 2212 / 2222: Digital, 2-way for communication between transmitter and display
Update time	1 s , max. 0.3 s , typ.

User configurable data

Error- / Warning-indication	Individually configurable display and backlight indication in white, green or red colour, steady or flashing light. Configurable limits over the range
Measuring unit	°C °F K
User defined measuring unit	8 × 20 pixel matrix

Relays

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

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Transmitter

FlexTop 2202

Input Accuracy	$\leq \pm 0.25\text{ }^{\circ}\text{C}$
Min. measuring span	25 °C
Output	4 ... 20 mA , 2-wire
Output Accuracy	$\leq \pm 0.1\text{ }%$, measuring span $\leq \pm 0.016\text{ mA}$
Power supply	8 ... 35 V DC
Programmability	With FlexProgrammer 9701
Please note	For further information please see data sheet for FlexTop 2202

FlexTop 2211

Input Accuracy	$\leq \pm 0.1\text{ }^{\circ}\text{C}$
Min. measuring span	25 °C
Output	4 ... 20 mA , 2-wire 20 ... 4 mA , programmable
Output Accuracy	$\leq \pm 0.1\text{ }%$, measuring span $\leq \pm 0.016\text{ mA}$
Power supply	8 ... 35 V DC
Programmability	With FlexProgrammer 9701
Please note	For further information please see data sheet for FlexTop 2211

FlexTop 2221

Input Accuracy	$\leq \pm 0.1\text{ }^{\circ}\text{C}$
Min. measuring span	25 °C
Output	4 ... 20 mA , 2-wire + HART® 20 ... 4 mA , programmable
Output Accuracy	$\leq \pm 0.1\text{ }%$, measuring span $\leq \pm 0.016\text{ mA}$
Power supply	8 ... 35 V DC
Programmability	With FlexProgrammer 9701 With HART® modem
Please note	For further information please see data sheet for FlexTop 2221

FlexTop 2212

Input Accuracy	$\leq \pm 0.06\text{ }^{\circ}\text{C}$
Min. measuring span	10 °C
Output	4 ... 20 mA , 2-wire 20 ... 4 mA , programmable
Output Accuracy	$\leq \pm 0.025\text{ }%$, measuring span $\leq \pm 0.004\text{ mA}$
Power supply	7 ... 40 V DC
Programmability	With FlexProgram
Please note	For further information please see data sheet for FlexTop 2212

FlexTop 2222

Input Accuracy	$\leq \pm 0.06\text{ }^{\circ}\text{C}$
Min. measuring span	10 °C
Output	4 ... 20 mA , 2-wire + HART® 20 ... 4 mA , programmable
Output Accuracy	$\leq \pm 0.025\text{ }%$, measuring span $\leq \pm 0.004\text{ mA}$
Power supply	7 ... 40 V DC
Programmability	With FlexProgram With HART® modem
Please note	For further information please see data sheet for FlexTop 2222

Factory settings FlexTop 2202

Output range	0 ... 120 °C
Damping	0 s
Output at sensor fault	23 mA

Factory settings FlexTop 2211

Output range	0 ... 100 °C
Damping	0 s
Output at sensor fault	23 mA

Factory settings FlexTop 2221

Output range	0 ... 100 °C
Damping	0 s
Output at sensor fault	23 mA

Factory settings FlexTop 2212

Output range	0 ... 100 °C
Damping	0 s
Output at sensor fault	23 mA

Factory settings FlexTop 2222

Output range	0 ... 100 °C
Damping	0 s
Output at sensor fault	23 mA

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Operating conditions

Ordering key	Process connection	BCID	Continuous			
			Process pressure	Process temperature Standard @ Tamb ≤ 20 °C	Process temperature With cooling neck @ Tamb ≤ 20 °C	Process temperature With cooling neck and spacer @ Tamb ≤ 60 °C
			(bar)	(° C)	(° C)	(° C)
TFRN-####.#000.#000.#000	Sleeve Ø 6	T65	-1 ... 40	-50 ... 250	-50 ... 400	-50 ... 400
TFRN-####.#000.#011.#000.#000	G 1/2 A DIN 3852-E	G51	-1 ... 100	-50 ... 250	-50 ... 400	-50 ... 400
TFRN-####.#000.#012.#000.#000	G 1/2 A DIN 3852-A	G44	-1 ... 100	-50 ... 250	-50 ... 400	-50 ... 400
TFRN-####.#000.#013.#000.#000	R 1/2 ISO 7-1	R06	-1 ... 100	-50 ... 250	-50 ... 400	-50 ... 400
TFRN-####.#000.#030.#000.#000	1/2-14 NPT	N02	-1 ... 100	-50 ... 250	-50 ... 400	-50 ... 400

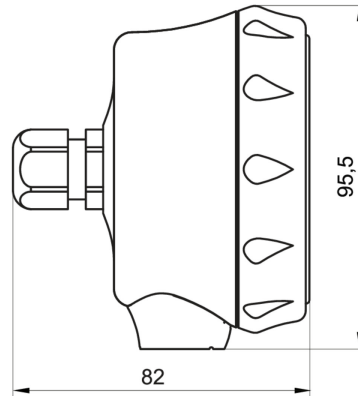
For further information on permissible process and ambient temperatures, please refer to the operating instructions.

Dimensional drawings (mm)

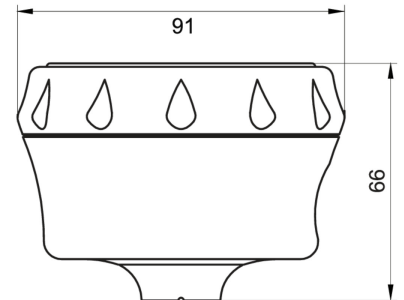
Housing



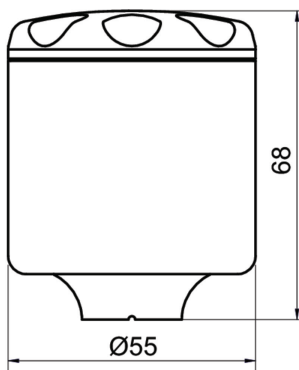
FlexHousing front view



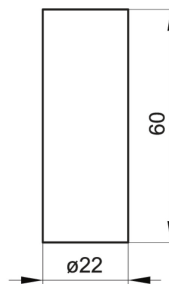
FlexHousing with bottom process connection



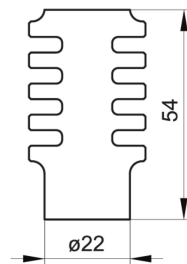
FlexHousing with rear process connection



Field housing, Ø55 mm



Spacer



Cooling neck

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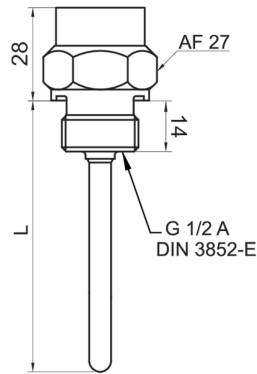
TFRN-####.#0#.#0#.#0#.#0#

Dimensional drawings (mm)

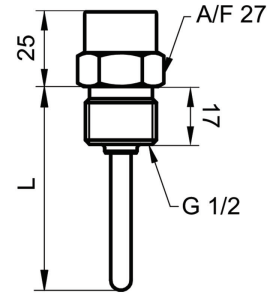
Process connection



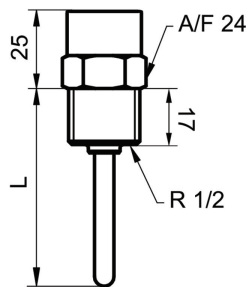
Without thread (BCID: T65)



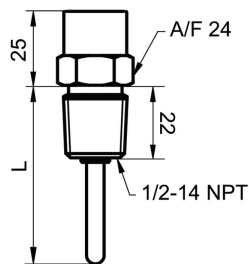
G 1/2 A DIN 3852-E (BCID: G51)



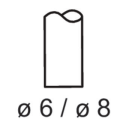
G 1/2 A DIN 3852-A (BCID: G44)



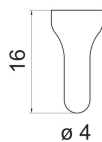
R 1/2 ISO 7/1 (BCID: R06)



1/2-14 NPT (BCID: N02)



Standard response tip



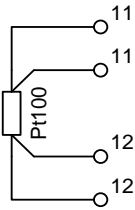
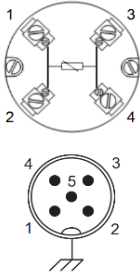
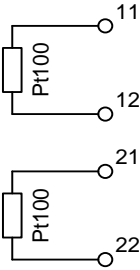
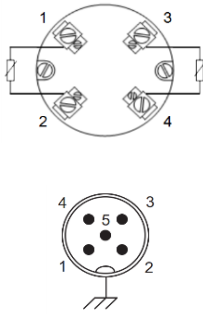
Fast response tip

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Electrical connection

Output type	Equivalent circuit	Electrical connection	Function	Pin assignment
Pt100 (Single element)			Pt100 11	1, 2
			Pt100 12	3, 4
			Pt100 11	1, 2
			Pt100 12	3, 4
			N.C.	5
			Frame ground	Plug thread
Pt100 (Double element)			Pt100 11	1
			Pt100 12	2
			Pt100 21	3
			Pt100 22	4
			Pt100 11	1
			Pt100 12	2
			Pt100 21	3
			Pt100 22	4
			N.C.	5
			Frame ground	Plug thread

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Electrical connection

Output type	Equivalent circuit	Electrical connection	Function	Pin assignment
4 ... 20 mA, 2-wire			+Vs	1
			lout	2
			+Vs	1
			Common for relays 11, 21	2
			lout	3
			Relay 22	4
			Relay 12	5
			Frame ground	Plug thread
			N.C.	1
			+Vs	2
2 x 4 ... 20 mA, 2-wire			+Vs1	1
			lout1	2
			+Vs2	3
			lout2	4
			+Vs1	1
			lout1	2
			lout2	3
			+Vs2	4
			N.C.	5
			Frame ground	Plug thread

Ordering information

Ordering key - Configuration possibilities see website

Product	TFRN	-	#	#	#	#	.	#	#	#	.	#	#	##	.	#	#	#	#	.	####
Housing	TFRN																				
FlexHousing Ø80																					
Stainless steel 1.4301 / AISI304																					
Bottom process connection																					
FlexHousing Ø80																					
Stainless steel 1.4301 / AISI304																					
Rear process connection																					
Field housing Ø55																					
Stainless steel 1.4301 / AISI304																					
Electrical connection																					
M12-A, 5-pins																					
M12-A, 8-pin																					
M16x1.5 cable gland																					
M20x1.5 cable gland																					

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Ordering information

Ordering key - Configuration possibilities see website

	TFRN	-	#	#	#	#	.	#	#	#	#	.	#	#	##	.	#	#	#	#	.	####
Material el. connection																						
Plastic																						
Stainless steel AISI 304 (1.4301)																						
Display																						
Without display, Ø55 housing																						
Without display, Ø80 housing																						
With display, relays not activated																						
With display, relays activated																						
Transmitter / socket																						
Flying leads																						
Ceramic socket Pt100																						
Transmitter 2202																						
4 ... 20 mA, accuracy ±0,25 °C																						
Transmitter 2211																						
4 ... 20 mA, accuracy ±0,10 °C																						
Transmitter 2221																						
4 ... 20 mA + HART®, accuracy ±0,10 °C																						
Transmitter 2212																						
4 ... 20 mA, accuracy < ±0.06°C																						
Transmitter 2222																						
4 ... 20 mA + HART®, accuracy < ±0.06°C																						
2 x Transmitter 2212																						
4 ... 20 mA, accuracy < ±0.06°C																						
2 x Transmitter 2222																						
4 ... 20 mA + HART®, accuracy < ±0.06°C																						
Safety																						
Standard																						
Ex ia IIC T6...T4 (Gas)																						
Ex ec IIC T5...T4 (Gas)																						
Ex ia Simple apparatus, gas and dust																						
Configuration																						
No configuration																						
Configuration of temperature range																						
Configuration of Range + Display																						
Configuration of Range + Display incl. 2 x relays																						
Sensor element																						
None																						
1 x Pt100, 1/1 B EN 60751																						
2 x Pt100, 1/1 B EN 60751																						
1 x Pt100, 1/3 B EN 60751																						
2 x Pt100, 1/3 B EN 60751																						
1 x Pt100, 1/6 B EN 60751																						
2 x Pt100, 1/6 B EN 60751																						
1 x Pt100, 1/1 A EN 60751																						
2 x Pt100, 1/1 A EN 60751																						
1 x Pt100, 1/1 B EN 60751, < 600°C																						

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Ordering information

Ordering key - Configuration possibilities see website

		TFRN	-	#	#	#	#	.	#	#	#	#	.	#	#	##	.	#	#	#	#	.	####									
Sensor insert type																																
Sensor tube with embedded sensor element 2-wire															1																	
Sensor tube with embedded sensor element 4-wire															2																	
Sensor tube with embedded 2×2-wire sensor element															4																	
Spring loaded insert, DIN 43762, 2-wire															5																	
Spring loaded insert, DIN 43762, 4-wire															6																	
Spring loaded insert, DIN 43762, 2x2-wire															7																	
Cable sensor Pt100 1/1 B EN 60751															A																	
Cable sensor Pt100 1/3 B EN 60751															B																	
Cable sensor Pt100 1/6 B EN 60751															C																	
Cable sensor Pt100 1/1 A EN 60751															D																	
Cooling neck																																
Without															0																	
With cooling neck															4																	
With cooling neck + 1 spacer															5																	
With cooling neck + 2 spacers															6																	
Process connection																																
Tube without connection															10																	
G 1/2 A DIN 3852-E (G51)															11																	
G 1/2 A DIN 3852-A (G44)															12																	
R 1/2 ISO 7/1 (R01)															13																	
1/2-14 NPT (N02)															30																	
Seal																																
Without seal																	0															
Seal NBR																	1															
Seal EPDM																	2															
Seal FKM (Viton®)																	3															
Sensor diameter																																
ø 6 mm, AISI 316L																			1													
ø 8 mm, AISI 316L																			2													
Sensor tip																																
Standard response tip																					1											
Fast response tip, ø 4 mm tip																					2											
Approvals																																
Standard approvals																							0									
EAC (TR CU 020/2011)																							B									
Sensor tube length (mm)																																
20 - 3000																									####							