

TFRN

RTD temperature sensor for industrial applications

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

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

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

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

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

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

Connector	M12-A, 5-pin, stainless steel M12-A, 8-pin, stainless steel
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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
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Cable gland	M16x1.5, plastic M16x1.5, stainless steel M20x1.5, plastic M20x1.5, stainless steel
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ATEX II 1G Ex ia IIC T4/T5

Maximum values for barrier selection, U _i	28 V DC
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Maximum values for barrier selection, I _i	0.1 A
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Maximum values for barrier selection, P _i	0.7 W
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Internal capacitance, C _i	36 nF
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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	$\leq \pm 0.1 \%$, 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	$\leq \pm 0.1 \%$, 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	$\leq \pm 0.1 \%$, 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	$\leq \pm 0.025 \%$, 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	$\leq \pm 0.025 \%$, 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	Process pressure (bar)	Process temperature Standard @ Tamb ≤ 20 °C (° C)	Continuous	
					Process temperature With cooling neck @ Tamb ≤ 20 °C (° C)	Process temperature With cooling neck and spacer @ Tamb ≤ 60 °C (° C)
					TFRN-####.#10#.#0#.#0#.#0#.#0#	Sleeve Ø 6
TFRN-####.#11#.#0#.#0#.#0#.#0#.#0#	G 1/2 A DIN 3852-E	G51	-1 ... 100	-50 ... 250	-50 ... 400	-50 ... 400
TFRN-####.#12#.#0#.#0#.#0#.#0#.#0#	G 1/2 A DIN 3852-A	G44	-1 ... 100	-50 ... 250	-50 ... 400	-50 ... 400
TFRN-####.#13#.#0#.#0#.#0#.#0#.#0#	R 1/2 ISO 7-1	R06	-1 ... 100	-50 ... 250	-50 ... 400	-50 ... 400
TFRN-####.#30#.#0#.#0#.#0#.#0#.#0#	1/2-14 NPT	N02	-1 ... 100	-50 ... 250	-50 ... 400	-50 ... 400

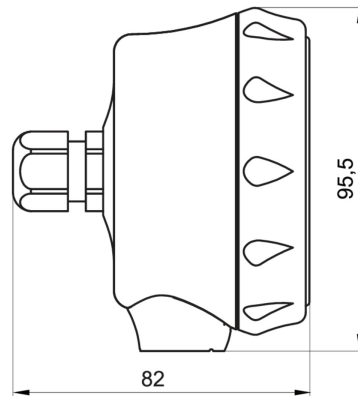
For further information on permissible process and ambient temperatures, please refer to the operating instructions.

Dimensional drawings (mm)

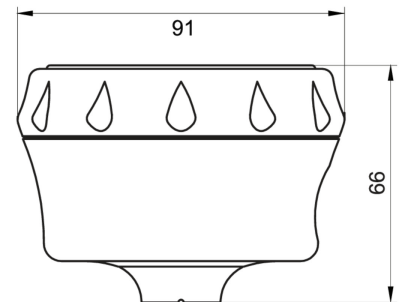
Housing



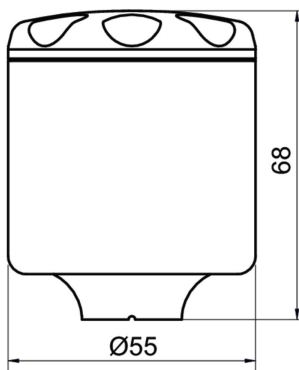
FlexHousing front view



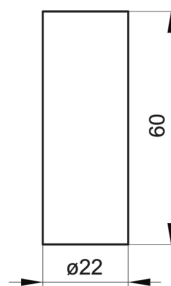
FlexHousing with bottom process connection



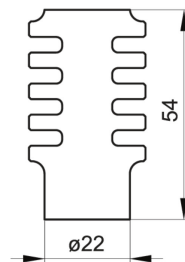
FlexHousing with rear process connection



Field housing, Ø55 mm



Spacer



Cooling neck

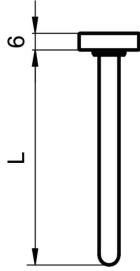
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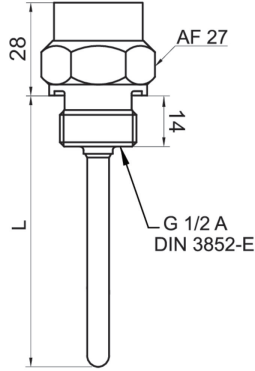
TFRN-####-##0#-####-###0-####

Dimensional drawings (mm)

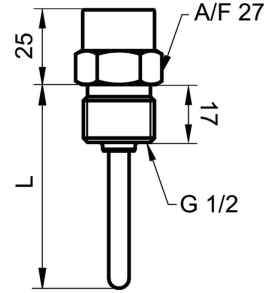
Process connection



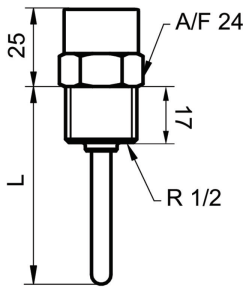
Without thread (BCID: T65)



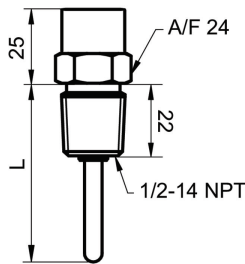
G 1/2 A DIN 3852-E (BCID: G51)



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



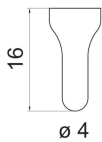
R 1/2 ISO 7/1 (BCID: R06)



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
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
Relay 21	3			
Relay 22	4			
Relay 11	5			
Relay 12	6			
lout	7			
N.C.	8			
Frame ground	Plug thread			

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	-	#	#	#	#	.	#	#	#	.	#	#	##	.	#	#	#	0	.	####
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																					1
M12-A, 8-pin																					3
M16x1.5 cable gland																					5
M20x1.5 cable gland																					B

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Ordering information

Ordering key - Configuration possibilities see website

	TFRN	-	#	#	#	.	#	#	#	.	#	##	.	#	#	#	0	.	####	
Material el. connection																				
Plastic																				1
Stainless steel AISI 304 (1.4301)																				3
Display																				
Without display, Ø55 housing																				0
Without display, Ø80 housing																				1
With display, relays not activated																				2
With display, relays activated																				4
Transmitter / socket																				
Flying leads																				0
Ceramic socket Pt100																				1
Transmitter 2202																				2
4 ... 20 mA, accuracy ±0,25 °C																				
Transmitter 2212																				6
4 ... 20 mA, accuracy < ±0.06°C																				
Transmitter 2222																				7
4 ... 20 mA + HART®, accuracy < ±0.06°C																				
2 x Transmitter 2212																				D
4 ... 20 mA, accuracy < ±0.06°C																				
Safety																				
Standard																				0
Ex ia IIC T6/T5...T4 (Gas)																				1
Ex ec IIC T5...T4 (Gas)																				3
Ex ia Simple apparatus, gas and dust																				9
Configuration																				
No configuration																				0
Configuration of temperature range																				1
Configuration of Range + Display																				2
Configuration of Range + Display incl. 2 x relays																				3
Sensor element																				
None																				0
1 x Pt100, 1/1 B EN 60751																				1
2 x Pt100, 1/1 B EN 60751																				2
1 x Pt100, 1/3 B EN 60751																				5
2 x Pt100, 1/3 B EN 60751																				6
1 x Pt100, 1/6 B EN 60751																				7
2 x Pt100, 1/6 B EN 60751																				8
1 x Pt100, 1/1 A EN 60751																				A
2 x Pt100, 1/1 A EN 60751																				B
1 x Pt100, 1/1 B EN 60751, < 600°C																				C

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Ordering information

Ordering key - Configuration possibilities see website

	TFRN	-	#	#	#	#	.	#	#	#	.	#	#	#	#	0	.	####	
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 2x2-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
Sensor tube length (mm)																			
20 - 3000																			####