



## TDM-1 Temperature transmitter

QSG-TDM-1-01, Revision: A, June 2018



### Quick start guide

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### Electrical installation

The TDM-1 requires an external power supply supplying in the range 12-30 VDC. The external power supply shall be with safe isolation according to PELV (Protective Extra Low Voltage) requirements of EN60204-1.

The transmitter is protected against momentary overvoltage on the supply line. The internal 100 mA thermal fuse will limit current draw in case of overvoltage to limit overheating. Additionally, the transmitter is protected against reverse polarity caused by incorrect wiring to the power supply.

The transmitter electronics have a high level of immunity against external electromagnetic interference. It is not required to use braided shielded cables to comply with the immunity requirements according to EN61326-1 industrial locations, but it is recommended for best measurement performance.

To ensure that the product complies with its IP (ingress protection) rating proper mating connectors with sealing material must be used.

The integrated hydrophobic membrane prevents internal moisture accumulation and water condensation when changes in ambient pressure, temperature and humidity occur.

### User configuration of output scaling

The S4-Connect™ interface enables flexible user configuration of the analog output. The minimum and maximum output voltage and pressure can be set to any value within the valid range for the transmitter. For more information refer to the full operating instructions or visit [www.sens4.com/s4-connect.html](http://www.sens4.com/s4-connect.html)

### General information

Thank you for purchasing this Sens4 product. This quick start guide contains important safety information and we encourage you to read this guide prior to installation and use of this product.

### Symbols used

Following symbols are used in the quick start guide:

**WARNING!** Critical information to prevent dangerous situations that can result in serious injury or death.

**CAUTION!** Important information to prevent dangerous situations that can damage the device or auxiliary equipment.

**ACTION!** Requires action or attention.

**INFORMATION:** Important recommendations and information for efficient use and best practice.

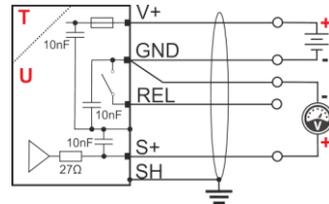
### Intended use

The TDM-1 temperature transmitter is intended for gas and liquid temperature measurement and control within the limits listed in the specifications. The device is designed for screw-in fittings mounting.

The device complies to EMC (Electro Magnetic Compatibility) class B immunity requirements for industrial environments.

### Electrical connection (0-10 VDC voltage output)

The voltage output transducer provides a voltage signal proportional to the measured temperature.



The high resolution 16-bit voltage signal can be interfaced to a PLC, A/D converter, voltmeter or other readout devices.

**INFORMATION:** It is recommended to use a differential input to measure the output signal that uses a separate signal return wire connected to the transmitter connector. If power supply return and signal return share the same wire connection the voltage drop as function of supply current will cause a measurement deviation. In that case, the measurement deviation will increase with the cable length.

### Safety information

This product should be installed and operated by technically skilled or trained personnel only.

**WARNING!** This product is not intended for installation and use in the presence of flammable gases or other explosive environments.

**WARNING!** Ensure that the gases or liquids exposed to the wetted materials are compatible with the wetted materials described in the specifications table and the used sealing materials.

**WARNING!** The pressure rating of the connecting process fittings and sealing must comply with the possible maximum pressure in the application. The CE marking on the device does not apply to the pressure equipment directive. Special precautions must be taken, if the transmitter sensor probe is exposed to fluid flow. An assessment of stresses induced by fluid flow might be needed (following the guidelines of ASME PTC 19.3 TW – 2016).

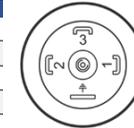
**WARNING!** Ensure that the process connection is tightened according to the recommended torque specification. Ensure that there are no leaks from the process connection before pressurizing the installation.

Do not remove the transmitter from the installation when the installation is pressurized or contains hazards fluids.

### Connector pinout and cable wiring (0-10 VDC voltage output)

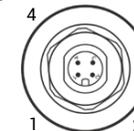
#### Connector pinout 4 pin DIN175301-803A

Pin	Symbol	Description
1	V+	Positive supply voltage
2	GND	Supply voltage return
3	S+	Signal output
	SH	Shield
	SH	Shield



#### Connector pinout 4 pin M12, IEC61076-2-101

Pin	Symbol	Description
1	V+	Positive supply voltage
2	REL	Solid state relay <sup>(1)</sup> or NC
3	GND	Supply voltage return
4	S+	Voltage signal output
	SH	Shield



#### Cable (Color code DIN41700)

Color	Symbol	Description
White	V+	Positive supply voltage
Brown	GND	Supply voltage return
Green	S+	Voltage signal output
Grey	GND	Voltage signal return
Pink	REL	Solid state relay or NC
Yellow	SH	Shield



(1) The solid-state relay is a hardware option and needs to be specified when ordering the part. The setpoint value can be programmed using the S4-Connect™ interface. For programming of setpoint values refer to the full operating instructions.

### Mechanical installation

The transmitter is intended for installation in a screw-in process fitting.

**!** Refer to maximum allowed pressure, sealing method and assembly practices for the different process connector types.

#### DIN 3852-E installation

The DIN 3852-E flange is delivered with a sealing O-ring. Do not use thread seal material.

1. Ensure that the O-ring and its sealing surfaces are clean and free of scratches or other damages.
2. Screw the transmitter into the corresponding flange thread by hand.
3. Tighten it with a wrench. For G1/4": approx. 5 Nm; for G1/2" NPT: approx. 10 Nm.

**CAUTION!** Do not exceed tightening torque values.

#### NPT flange installation

The NPT flange requires a suitable thread seal tape.

4. Screw the transmitter into the corresponding flange thread by hand.
5. Tighten it with a wrench. For 1/4" NPT: approx. 30 Nm; for 1/2" NPT: approx. 70 Nm.

**CAUTION!** Do not exceed tightening torque values.

Ensure that the process connection is leak tight using proper leak testing methods.

### Signal to temperature conversion (0-10 VDC voltage output)

The transmitter with 0-10 VDC output is available with different pre-configured output scaling.

Output voltage VDC	Temperature value					
	0-10 °C	0-5 °C	0 to 50 °C	0 to 100 °C	0 to 150 °C	-50 to +150 °C
0	0	0	<=0	<=0	<=0	<=-50
1	0.5	1	5	10	15	-30
2	1	2	10	20	30	-10
3	1.5	3	15	30	45	10
4	2	4	20	40	60	30
5	2.5	5	25	50	75	50
6	3	6	30	60	90	70
7	3.5	7	35	70	105	90
8	4	8	40	80	120	110
9	4.5	9	45	90	135	130
10	5	10	50	100	150	150

The voltage signal (u) can be converted to temperature using the following linear expression:

Temperature in degrees Celsius =  $a \cdot u + b$

0-10 VDC conversion				
Constants	0-50 °C	0-100 °C	0-150 °C	-50 - 150 °C
a	5	10	15	20
b	0	0	0	-50
0-5 VDC conversion				
Constants	0-50 °C	0-100 °C	0-150 °C	-50 - 150 °C
a	10	20	30	40
b	0	0	0	-5
1-10 VDC conversion				
Constants	0-50 °C	0-100 °C	0-150 °C	-50 - 150 °C
a	5.5556	11.1111	16.6667	22.2222
b	-5.5556	-11.1111	-16.6667	-72.2222

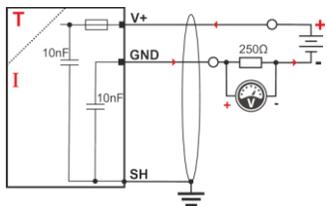
**!** **ATTENTION!** In case one of the two sensors fail the measurement of the defect sensor will be disregarded. The transmitter will signal this failure mode by setting the output voltage to 0 VDC during the first four seconds after power on. Normal operation is then resumed.

## Electrical connection (4-20 mA current output)

The two-wire 4-20 mA current loop combines the transmitter output signal and supply voltage in one cable where the current consumption represents the measurement signal. The 4-20 mA signal complies with the NAMUR NE 43 standard.

A current loop resistor ( $r$ ) value of 250 ohms is commonly used and will provide a 1-5 VDC across the resistor. The current loop resistor value can be chosen freely up to a maximum of 800 Ohm, provided that the minimum and maximum supply voltage range is respected.

**INFORMATION:** The loop current resistor should have a low temperature drift coefficient to ensure best measurement performance.

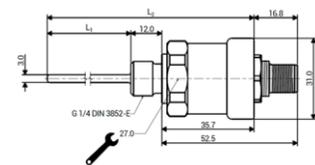


Calculation of current ( $i$ ):  $i = \frac{u}{r}$

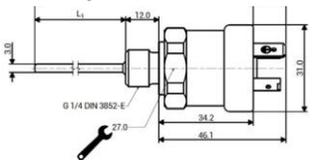
Calculation of voltage ( $u$ ):  $u = r \cdot i$

Calculation of resistor ( $r$ ):  $r = \frac{u}{i}$

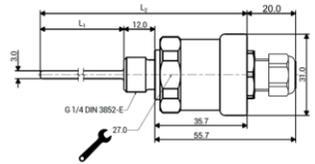
## Dimensions



P/N: TDM-1-xxxxxx1  
M12 IEC 61076-2-101



P/N: TDM-1-xxxxxx2  
DIN 175301-803A



P/N: TDM-1-xxxxxx3  
P/N: TDM-1-xxxxxx4  
P/N: TDM-1-xxxxxx5

Cable with flying leads

Probe length	L1	L2
[mm]	[mm]	[mm]
15	0.59	50.7
40	1.57	75.7
90	3.54	125.7
140	5.51	175.7

All dimensions are in mm unless otherwise stated – General tolerance ISO 2768-1 M  
3D step files are available online at: [www.sens4.com/support.html](http://www.sens4.com/support.html)

## Connector pinout and cable wiring (4-20 mA current output)

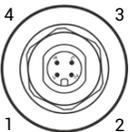
### Connector pinout 4 pin DIN175301-803A

Pin	Symbol	Description
1	V+	Positive supply voltage
2	GND	Supply voltage return
3	NC	Not connected
SH	SH	Shield



### Connector pinout 4 pin M12, IEC61076-2-101

Pin	Symbol	Description
1	V+	Positive supply voltage
2	NC	Not connected
3	GND	Supply voltage return
4	NC	Not connected
SH	SH	Shield



### Cable (Color code DIN41700)

Color	Symbol	Description
White	V+	Positive supply voltage
Brown	GND	Supply voltage return
Green	SH	Shield



## Maintenance

Maintenance is not required during the life cycle of this product. The calibration may shift during the life-time and re-calibration can be performed by the user. Refer to configuration manual.

The TDM-1 can be user configured, calibrated and tested using the S4-Connect™ USB adapter.

## Return

Before returning a product to Sens4 proper return forms and a return materials authorization (RMA) must be filled out. The RMA procedure can be found on:

[www.sens4.com/support.html](http://www.sens4.com/support.html)

## Disposal in the European Union

At the end of life of this product, it must be disposed according to the European Directive 2012/19/EU (WEEE). This product should not be mixed with general household waste.



**WARNING!** If the product has been exposed to human or environmental hazards materials during its use, ensure proper decontamination before disposal.

For proper treatment, recovery and recycling, please take this product to designated collection points. Please contact your local authority for further details of your nearest designated collection point.

For questions regarding disposal please contact your dealer or Sens4 for further information.

## Signal to temperature conversion (4-20 mA current output)

The transmitter with 4-20 mA output is available with different pre-configured output scaling.

Signal mA	0 to 50 °C	0 to 100 °C	0 to 150 °C	-50 to +150 °C
4	<=0	<=0	<=0	<=-50
6	6,25	12,5	18,75	-25
8	12,5	25	37,5	0
10	18,75	37,5	56,25	25
12	25	50	75	50
14	31,25	62,5	93,75	75
16	37,5	75	112,5	100
18	43,75	87,5	131,25	125
20	50	100	150	150

The current signal ( $i$ ) can be converted to temperature using the following linear expression:

Temperature in degrees Celsius =  $a \cdot i + b$

Constants	0-50 °C	0-100 °C	0-150 °C	-50 - 150 °C
a	3.25	6.25	9.375	12.5
b	-1.25	-25	-3.75	-100

**ATTENTION!** The TDM-1 has a built-in self-diagnostic and in case of product failure the current output will provide a fault signal in the range of 3.2 to 3.6 mA in compliance with the NAMUR NE43 standard. Replace the unit in case of receiving a fault signal.

**ATTENTION!** In case one of the two sensors fail the measurement of the defect sensor will be disregarded. The transmitter will signal this failure mode by providing an output current in the range of 3.2 to 3.6 mA during the first four seconds after power on. Normal operation is then resumed.

## Declaration of Conformity

This declaration of conformity has been made in accordance with EN ISO/IEC 17050-1:2010

Manufacturer: Sens4 A/S  
Address: Nordre Strandvej 119G  
3150 Hellebaek  
Denmark

We hereby declare under our sole responsibility that the following products:

Product description: Temperature Transmitter  
Product part number: TDM-1-xxxx1x

Complies with the requirements of following relevant European Union harmonization directive:

Electromagnetic Compatibility (EMC) Directive 2014/30/EU  
RoHS Directive EU 2015/863

Conformity is assessed in accordance to the following standards:

Reference: Date EN61326-1: 2013 Title: Product family standard, Measurement, control and laboratory equipment  
EN50581: 2012 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Signed on behalf of: Sens4 A/S  
Place of issue: Hellebaek, Denmark  
Date of issue: April 11<sup>th</sup> 2018  
Signature:

Name, Title: Ole Wenzel, Chief Executive Officer

This declaration of conformity is available online at: [www.sens4.com/doc.html](http://www.sens4.com/doc.html)

Document number: DOC-TDM-1-01, Revision: A



## Specifications

Specifications	
Measuring range	-50 to +150 °C (-58 to +302 °F)
Accuracy	+/- 0.1 °C (Class AA, DIN 60751)
Measuring principle	Dual semiconductor diode junction
Sensor probe diameter	Ø3.0 mm (0.12 inch)
Sensor probe length	15-140 mm (0.59 to 5.51 inch)
Output signal (Voltage)	0-10 VDC
Output resolution (Voltage)	16 bit / 150 nV
Output signal (Current)	4-20 mA <sup>(1)</sup>
Output resolution (Current)	16 bit / 244 nA
External current shunt resistor	10-800 Ω
Solid state relay contact rating	250 mA, 50 VDC / VAC peak
<b>Environment conditions</b>	
Operating ambient temperature	-40 to +100 °C
Media temperature	-50 to +150 °C
Storage ambient temperature	-40 to +125 °C
Maximum media pressure <sup>(2)</sup>	50 bar
Mounting position	Any
Protection rating, EN 60529/A2:2013	IP67 <sup>(3)</sup> , IP65 <sup>(4)</sup>
Humidity, IEC 68-2-38	98%, non-condensing
<b>Power supply</b>	
Supply voltage	12-30 VDC
Power consumption (Voltage version)	240 mW (Max)
Power consumption (Current version)	600 mW (Max)
Reverse polarity protection	Yes
Overvoltage protection	Yes
Internal fuse	100 mA (Thermal recoverable)
<b>Materials</b>	
Enclosure	SS 1.4404 / AISI 316
Electrical connector DIN 175301-803A	PA Nylon
Electrical connector M12 IEC 61076-2-101	PA Nylon, Nickel plated Zinc alloy
Process connection	SS 1.4404 / AISI 316L
Process leak tightness (ISO 27895:2009)	<1 · 10 <sup>-9</sup> mbar/l·sec.
<b>Approvals</b>	
CE	EN61000-6-2, EN 61000-6-3 Temperature directive 97/23/CE
RoHS compliance	Directive EU 2015/863

## Warranty and disclaimer

Sens4 warrants this product to be free from defects in materials and workmanship for a period of 24 months from the date of the delivery.

Warranty does not cover:

- Mechanical or corrosive damage to the sensor probe
- Physical or deposition contamination of the sensor probe
- Damage caused by shipping
- Normal wear and tear
- Incorrect use or installation
- Operation beyond the published design limits

Sens4 is not liable for any claims arising from improper use, incorrect installation or use with gases or liquids not compatible with the media wetted materials described in the specifications table. Sens4 is not liable for loss of profits or revenue, overheads, loss of data, reinstallation costs, damage to other equipment or any incidental or consequential damages of any nature.

The Standard Terms and Conditions can be found on [www.sens4.com](http://www.sens4.com) and shall apply to the sales contract and use of this product.

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[www.sens4.com](http://www.sens4.com)