BA 164R/24/ae/04.04

easytemp™ TSM 470 G / TSM 470 F / TSM 470 P
compact RTD transmitter

Operating instructions

Endress+Hauser
The Power of Know How

Safety message

Instructions and procedures in the operating instructions may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by safety pictograms and symbols. Please refer to the safety messages before performing an operation preceded by pictograms and symbols, see chapter 1.5.
Though the information provided herein is believed to be accurate, be advised that the information contained herein is NOT a guarantee of satisfactory results. Specifically, this information is neither a warranty nor guarantee, expressed or implied, regarding performance; merchantability, fitness, or other matter with respect to the products; and recommendation for the use of the product / process information in conflict with any patent. Please note that the manufacturer reserves the right to change and / or improve the product design and specifications without notice.

Warning!
Failure to follow these installation guidelines could result in death or serious injury.
– Make sure only qualified personnel perform the installation.

Process leaks could result in death or serious injury.

– Do not remove the compact RTD transmitter while in operation.
– Install and tighten compact RTD transmitter before applying pressure.

Electrical shock could cause death or serious injury.

– Use extreme caution when making contact with the M12 plug-in micro-connector.

Brief overview

Using the following short form instructions you can commission your system easily and swiftly:

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Display and operating elements Preparing the communication with PC configuration software	Page 10
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Instrument configuration (including a description of the unit functions) A complete description of all the functions as well as a detailed overview of the functionality can be found in this chapter.	Page 11

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1 Safety notes

Safe and secure operation of the compact RTD transmitter can only be guaranteed if the operating instructions and all safety notes are read, understood and followed.

1.1 Designated use

- The unit is a universal, presettable compact RTD temperature transmitter include resistance thermometer (RTD).
- The manufacturer cannot be held responsible for damage caused by misuse of the unit.

1.2 Installation, commissioning and operation

The unit is constructed using the most up-to-date production equipment and complies to the safety requirements of the local guidelines. The compact RTD transmitter is fully factory tested according to the specifications indicated on the order. However, if it is installed incorrectly or is misused, certain application dangers can occur. Installation, wiring and maintenance of the unit must only be done by trained, skilled personnel who are authorized to do so by the plant operator. This skilled staff must have read and understood these instructions and must follow them to the letter. The plant operator must make sure that the measurement system has been correctly wired to the connection schematics.

Electrical temperature sensors such as RTD's produce low-level signals proportional to their sensed temperature. The compact RTD transmitter converts the low-level sensor signal to a standard 4 to 20 mA DC signal that is relatively insensitive to lead length and electrical noise. This current signal is then transmitted to the control room via two wires.

The transmitter electronics module is permanently sealed within the housing, resisting moisture and corrosive damage. Verify that the operating atmosphere of the compact RTD transmitter is consistent with the appropriate hazardous locations certifications.

Warning!
Electrical shock could cause death or serious injury. If the compact RTD transmitter is installed in a high voltage environment and a fault or installation error occurs, high voltage may be present on the M12 plug-in micro-connector and / or the body.

Temperature Effects
The transmitter will operate within specifications for ambient temperatures between -40 and 185 °F (-40 and 85 °C). Heat from the process is transferred from the thermowell to the transmitter housing. If the expected process temperature is near or beyond specification limits, consider the use of additional thermowell lagging, and extension nipple, or a remote mounting configuration to isolate the transmitter from the process.

1.3 Operational safety

The measuring device complies with the general safety requirements in accordance with IEC61010, the EMC requirements of IEC61326 and NAMUR recommendation NE21 and NE43.

Technical advancement
The manufacturer reserves the right to modify technical data without prior notice. Your distributor can supply you with current information and updates to these Operating Instructions.

1.4 Returns

Please follow the Return Authorization Policy at the end of these instructions.

1.5 Safety pictograms and symbols

Safe and reliable operation of this unit can only be guaranteed if the safety notes and warnings in these operating instructions are followed. The safety notes in these instructions are highlighted using the following symbols.

Note!
This icon indicates activities and actions that, if not followed correctly, could have an indirect influence on the unit operation or could lead to an unforeseen unit reaction.

Caution!
This icon indicates activities and actions that, if not followed correctly, could lead to faulty device operation or even damage to the unit.

Warning!
This icon indicates activities and actions that, if not followed correctly, could lead to personal injury, a safety risk or even total damage to the unit.


Explosion protected, type examined operating equipment!
If one of these icons is on the device's nameplate, the device can be used in hazardous areas.

Hazardous area!
This symbol identifies the hazardous area in the diagrams in these Operating Instructions.

– Devices that are used in hazardous areas or cables for such devices must have the corresponding type of protection.

Safe area (non-hazardous areas)!
This symbol identifies the non-hazardous area in the diagrams in these Operating Instructions.

– Devices in non-hazardous areas must also be certified if connection cables run through a hazardous area.

2 Identification

2.1 Unit identification

2.1.1 Legend plate

Compare the legend plates on the compact RTD transmitter with the following figures:

Fig. 1: Example: Compact RTD transmitter legend plate with order code - K = Standard model, North America region

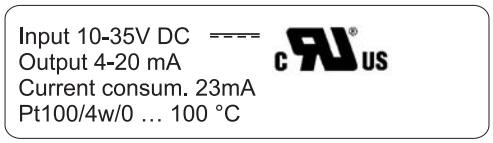


Fig. 2: Legend plate with technical data and configuration (example)

CE Mark, declaration of conformity CE

The devices are designed to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with IEC61010 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures" and with the EMC requirements of IEC61326.The measuring system described in these Operating Instructions thus complies with the statutory requirements of the EC Directives. The manufacturer confirms successful testing of the device by affixing to it the CE mark.

UL recognized component to UL 3111-1

3-A Sanitary Standard

Authorization to continue to apply the 3-A Symbol to the models of equipment, conforming to 3-A Sanitary Standards for Sensors and Sensor Fittings and Connections Used on Fluid Milk and Milk Products, Number: 74-02 for TSM470P and TSM470F.

American Bureau of Shipping (ABS)

Ship Building Type Approval (TSM470G).

2.2 Delivery contents

The delivery contents of the compact RTD transmitter are as follows:

- Compact RTD transmitter
- Operating instructions

Note!
Please take note of the compact RTD transmitter accessories in chapter 8 "Accessories".

2.3 Registered trademarks

- easytemp™ and ReadWin® 2000
  are registered trademarks of Endress+Hauser Wetzer GmbH + Co. KG, Nesselwang, Germany

3 Installation

3.1 Installation conditions

- When installing and operating the unit, please take note of the allowable ambient temperature (see chapter 10 "Technical Data").

3.1.1 Dimensions

The compact RTD transmitter dimensions can be found in chapter 10 "Technical data".

3.1.2 Specific mounting condition

Mounting location

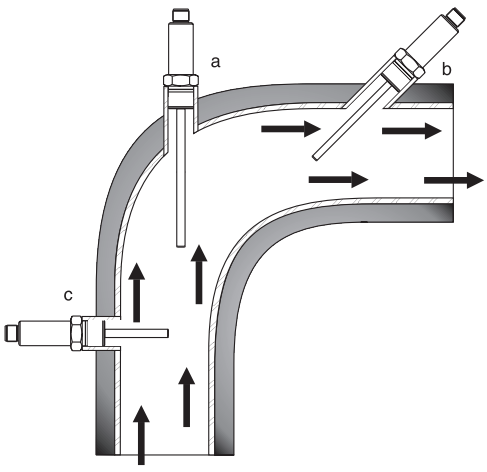


Fig. 3: Pipe installation example of TSM470 G

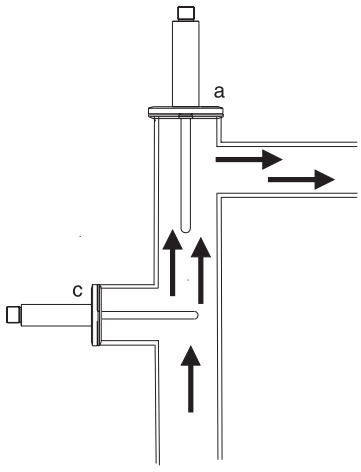


Fig. 4: Pipe installation example of TSM470 F and TSM470 P

a. At angle sections, against the direction of flow
b. In smaller pipes, turned against the direction of flow
c. Perpendicular to the direction of flow

3.2 Installation

For installation, proceed as follows:

1. Seal the ½" NPT process connection with silicone tape (TSM 470 G) before screwing in the device.
2. Make sure that the hygienic process fitting (TSM 470 F and TSM 470 P) and the clamp assembly match the maximum specified process pressure (see Chapter 10, 'Technical Data').
3. Install and tighten the compact RTD transmitter before applying process pressure.
4. Plug in the 4-pin M12 micro-connector at the compact RTD transmitter and connect the cable cores from Spike 1 and 3 to a power supply (Terminal layout of the M12 plug-in micro-connector; see Chapter 10, Technical Data).

Note!
The requirement to ensure NEMA 6P rating is that the female connector to plug the compact RTD transmitter to a power supply also has NEMA 6P rating or better.

Caution!
The unit must only be powered by a power supply that operates using an IEC 61010-1 compliant energy limited circuit.

Caution!
In order to avoid damaging the compact RTD transmitter, do not over-tighten the nut from on M12 micro-connector.

4 Wiring

4.1 Overview

Terminal layout of the M12 plug-in micro-connector see Chapter 10, 'Technical Data'.

4.2 Measurement unit connection

Caution!

- Switch off power supply before connecting the compact RTD transmitter. Do not install or connect the unit during installation to power supply. If this is not followed parts of the electronic circuit will be damaged.
- **Output signal and power supply:**
  Connect the M12 x 1 plug-in micro-connector for output signal and power supply.
- **PC configuration (SETUP socket):**
  Connect the PC serial interface connection cable (TTL/RS 232C) to the M12 x 1 plug-in micro-connector → Fig. 5.

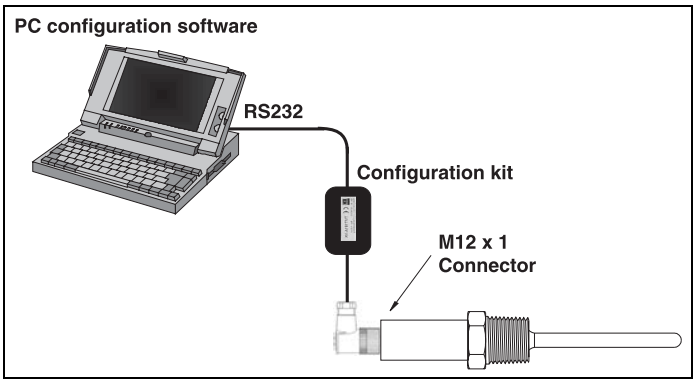


Fig. 5: Connection to PC for configuration

4.3 Potential equalization

The transmitter will operate with the current signal loop either floating or grounded. However, the extra noise in floating systems affects many types of readout devices. If the signal appears noisy or erratic, grounding the current signal loop at a single point may solve the problem. The best place to ground the loop is at the negative terminal of the power supply. Do not ground the current signal loop at more than one point.

5 Operation

5.1 Communication

The compact RTD transmitter must be set up using a PC and configuration set. The following points must be taken into account if trouble-free setup is to be achieved:

- Configuration software installation
  More details and download see:
  www.readwin2000.com
- Connect the compact RTD transmitter to the PC using the connection cable from the configuration kit (TSM470A-VM).

5.1.1 Configuration software installation (ReadWin® 2000)

System conditions	– IBM PC or compatible computer (min. Pentium 166 MHz) – Windows 95/98/ME/NT4.0/2000/XP – 64 MB RAM – Mouse – CD-ROM drive – Screen resolution 800 x 600 Pixel – free serial interface
Recommended minimum configuration	– Pentium 400 MHz – 128 MB main RAM – 120 MB free hard drive memory – Screen resolution 1024 x 768 Pixel
Installation start	Start Windows®: 1. Place installations-CD in the respective drive 2. Generally, the 'Autorun'-file starts. If not, start "Setup.exe "and follow the installation instructions 3. If required the help/operating manual can be printed out once the software has been successfully installed.

5.1.2 Connecting the compact RTD transmitter to the PC using the configuration kit connection cable

1. Connect the M12 plug-in connection of the interface connecting cable to the M12 x 1 micro-connector in the compact RTD transmitter (see 'Fig. 5' in Chapter 4.2).
2. Connect the RS232C connector to a free serial interface socket on the PC. In order to achieve optimum connection, tighten the RS232C connector screws to the PC.
3. If the PC does not have a RS232 serial interface, use a USB (UNIVERSAL SERIAL BUS) converter. Full compliance with the USB specifications Version 1.0.11.1 and USB CDC Version 1.1 are required to support the RS232 serial interface.

6 Commissioning

6.1 Installation and function check

Installation check
Monitor all connections making sure they are tight. In order to guarantee fault-free operation, the terminal screws must be screwed tightly onto the connection cables.

Function check
Measuring the analog 4 to 20 mA output signal or following failure signals as per NAMUR NE 43:

		Signal (mA)
Under ranging	Standard	3.8
Over ranging	Standard	20.5
Sensor break; sensor short circuit low	To NAMUR NE 43	≤ 3.6
Sensor break; sensor short circuit high	To NAMUR NE 43	≥ 21

6.2 Switch on the device

Once the power supply has been connected, the compact RTD transmitter is operational.

6.3 Configuration

6.3.1 Setting up using the PC configuration software

The operating and readout software is an universally applicable service and configuration software. The operating software offers the user the following possibilities:

- Set-up device functions
- Measured value visualization
- Device parameter data storage
- Measuring point documentation

The compact RTD transmitter left the factory with a default parameter configuration. If no customer specific configuration was mentioned on the order then the default parameter configuration is constructed as follows:

Sensor	Pt100 (RTD)
Connection mode	4-wire
Measuring range and units	0 to +100 °C

Note!
If a change has been made to the measurement point then, the compact RTD transmitter can be re-configured. In order to re-configure the parameters follow these instructions:

- Install the configuration software and make connection to the PC (see Chap. 5, 'Operation').
- For detailed operating instructions for the PC configuration software please read the online documentation (**BA137R/09/ae**) contained in the PC operation and readout software (see folder '**Doc**').

This software can be downloaded free of charge from the Internet at the following address:
www.readwin2000.com

6.3.2 Description of device functions

All parameters that can be read out and set-up for the configuration of the compact RTD transmitter are listed and described in the following table. Also the menu structure in the PC configuration software is shown in the following table.

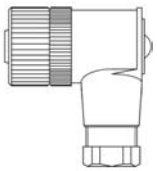
Configurable parameters (default settings in bold)				
Standard settings				
Sensor type	**Sensor type** **Pt100**	**Range start value** -60 °F (-51 °C)	**Range end value** 320 °F (160 °C)	**min. range** 18 °F (10 °C)
Unit	Input for unit Input: **° C** or °F			
Measurement range start value	Input of 4 mA value. Input: Limitation values see **'Sensor type'** **0 °C**			
Measurement range end value	Input of 20 mA value. Input: Limitation values see **'Sensor type'** **100 °C**			
Expanded settings				
2-wire compensation	Input of cable resistance compensation on a 2-wire RTD connection. Input: **0.00** to 20.00 Ω ✎ Note! Function is only active when a 2-wire RTD connection has been selected, see **'connection mode'**.			
Fault condition	Input of the output signal on sensor rupture or short circuit. Input: • **max (≥ 21.0 mA)** • min (≤ 3.6 mA)			
Output	Input of the standard (4 to 20 mA) or inverse (20 to 4 mA) current output signal. Input: • **4 to 20 mA** • 20 to 4 mA			
Damping	Selection of the digital filter 1. order (filter time constant). Input: **0** to 8 s			
Offset	Input of the zero point correction (offset). Input: -9.9 to 9.9 °C (-17.8 to 17.8 °F) **0.00 °C**			
Measuring point ident	Measuring point description Input: 8 characters			

Configurable parameters (default settings in bold)	
Service functions	
Output simulation	Activate simulation mode. Input: • **OFF** • ON Input of the simulation value (current). Input: 3.8 to 20.5 mA
Connection mode	Input of RTD connection mode. Input: • 2-wire • 3-wire • **4-wire**

7 Maintenance

The compact RTD transmitter has no moving parts and requires minimal scheduled maintenance.

8 Accessories

Order number	Accessory
TSM470A-VM 	Configuration kit: Setup program (ReadWin® 2000) and PC serial interface connection cable (TTL/RS 232C) for configuration of the TSM470 G / TSM470 F / TSM470 P.
TSM470A-VN 	Connector unshielded, female, angeled, M12 A coded, 4-pos.
SONDTT-AG 	CD-ROM with all operation and instruction manuals, Endress+Hauser temperature measurement
52010285	5 m PVC connecting cable with M12x1 micro-connector

9 Trouble-shooting

9.1 Trouble-shooting instructions

If faults occur after commissioning or during measurement always start any fault finding sequence using the following checklists. The user is guided to the possible fault cause and its removal by question and answer.

9.2 Application errors without messages

9.2.1 General application errors

Error	Cause	Action/cure
No communication	4 wire connection incorrect	Re-connect correctly (see connection diagram)
	No power supply on the 2-wire connection	Check the current loop
	Power supply too low (< 10 V)	Check power supply
	Defective interface cable	Check interface cable
	Defective interface	Check PC interface
	Defective device	Replace device

9.2.2 Application errors for RTD connection (Pt100)

Error	Cause	Action/cure
Fault current (≤ 3.6 mA or ≥ 21 mA)	No power supply on the M12x1 micro-connector	Check current loop; the supply should be > 10 V
	Defective device	Replace device

Error	Cause	Action/cure
Measured value incorrect/ inaccurate	Faulty sensor installation	Install sensor correctly
	Heat conducted by sensor	Take note of sensor installation point
	Transmitter setup faulty (number of wires)	Change device function 'Connection mode'
	Transmitter setup faulty (scale)	Change scale
	Offset incorrectly set	Check offset

9.3 Returns

Please follow the return Authorization Policy at the end of these instructions.

9.4 Disposal

Due to its construction, the compact RTD transmitter cannot be repaired. When disposing of the compact RTD transmitter please take note of the local disposal regulations.

9.5 Software history

Software version / date	Changes to software	Changes to documentation
1.00.00 / 12.2002	Original firmware compatible with: • ReadWin® 2000 1.10.1.0 and higher	
1.01.00 / 06.2003	New oscillator frequency compatible with: • ReadWin® 2000 1.13.0.0 and higher	

10 Technical Data

10.0.1 Function and system design

Measuring principle

Electronic acquisition and conversion of input signals in industrial temperature measurement.

Measuring system

The compact thermometer consists of a complete sensor with Pt100 (class A, 4-wire connection), process connection and built-in electronics with an M12x1 micro-connector and convert the Pt100 input signal into a temperature proportional 4 to 20 mA signal.

10.0.2 Input

Measuring variable

Temperature

Measuring range

Designation	Measuring range limits	Min. span
Pt100 as per IEC 751	-60 to 320 °F (-51 to 160 °C)	18 °F (10 °C)
• Connection type: 4-wire connection • Sensor current: ≤ 0.6 mA		

10.0.3 Output values

Output signal

analog 4 to 20 mA, 20 to 4 mA

Breakdown information

Breakdown information to NAMUR NE 43
Breakdown information is created when the measuring information is invalid or not present anymore and gives a complete listing of all errors occuring in the measuring system.

		Signal (mA)
Under ranging	Standard	3.8
Over ranging	Standard	20.5
Sensor break; sensor short circuit low	To NAMUR NE 43	≤ 3.6
Sensor break; sensor short circuit high	To NAMUR NE 43	≥ 21

Source impedance

max. ($V_{power\ supply}$ - 10V) / 0.022 A (current output)
e. g. (24 V -10 V) / 0.022 A = 636.4 Ω

Transmission behavior

temperature linear

Min. current consumption

≤ 3.5 mA

Current limit ≤ 23 mA

Switch-on delay 2 s (during power up $I_a \leq 3.8$ mA)

10.0.4 Power supply

Electrical connection

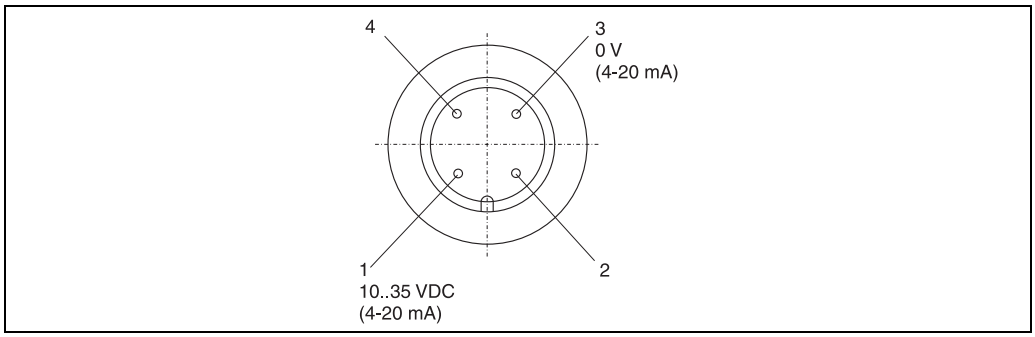


Fig. 6: Electrical connection of the compact thermometer (viewed from above) – M12 plug, 4-pin

Pin 1: Power supply 10 to 35 V DC; Current output 4 to 20 mA
Pin 2: PC configuration cable connection
Pin 3: Power supply 0 V DC; Current output 4 to 20 mA
Pin 4: PC configuration cable connection

The connection cable 5 m is for the 4..20 mA signal and will be connected with pin 1 and 3 as shown in the picture. The pins 2 and 4 are for the communication with the computer. If you look on the communication adapter then you see that there are two male pins that are making connection to the two shortend metal pins 2 and 4. By the way the supply for the TSM470 for the communication is done by the computer interface.

Supply voltage U_b= 10 to 35 V DC, polarity protected

Residual ripple Allowable ripple $U_{ss} \leq 3$ V at $U_b \geq 13$ V, $f_{max.}$ = 1 kHz

10.0.5 Performance characteristics

Electronics response time 1 s

Response time TSM 470 63% response time per ASTM E644

	TSM470 G	TSM470 F	TSM 470 P
Tube diameter 1/4" OD, 316L	8 s	4 s	-
Tube diameter 3/8" OD reduced 3/16" OD, 316L	-	3 s	-
Tube diameter 5/32" OD, 316L	-	-	2 s

Reference operating conditions Calibration temperature: 73.4 °F ± 9 °F (+23 °C ± 5 °C)

Maximum measured error

Electronics

0.18 °F (0.1 °C) or 0.08%.
% refer to the set span. The highest value is valid.

Sensor

- Class A tolerance as per IEC 751, at operating temperature range of -51 to 160 °C (-60 to 320 °F).
- Accuracy = ± 0.15 + 0.002 · ItI [°C]

ItI = numerical value of the temperature in °C, unsigned.

Compact RTD transmitter

Initial accuracy:

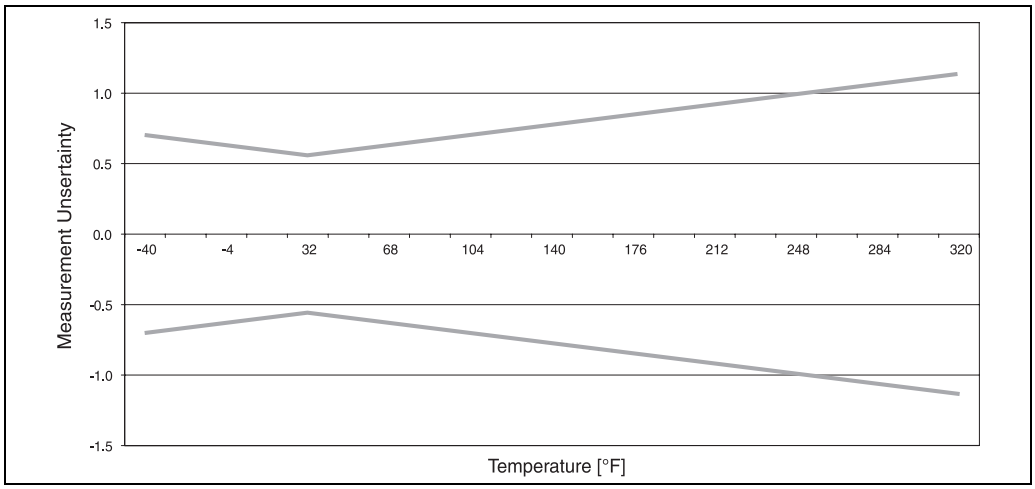


Fig. 7: Transmitter range 360 °F

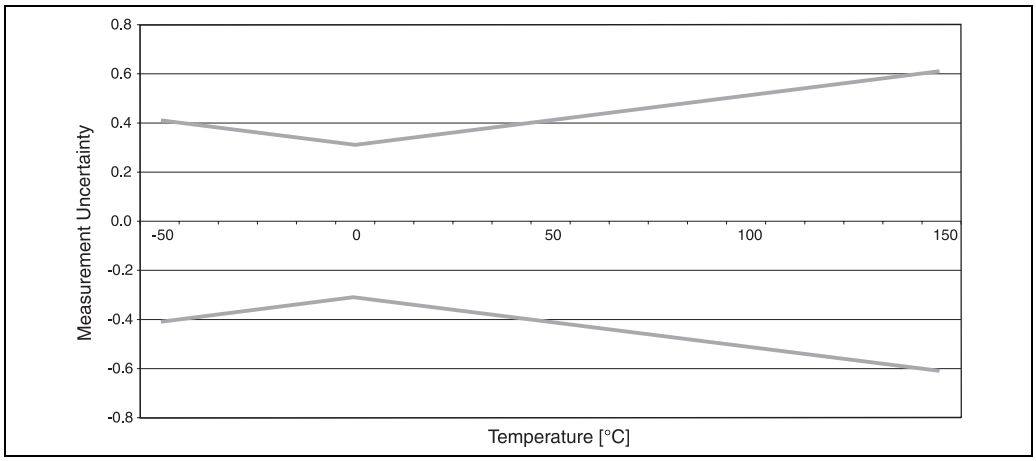


Fig. 8: Transmitter range 200 °C

Influence of power supply

≤ ±0.01%/V deviation from 24 V
Percentages refer to the full scale value.

Long-term stability

≤ 0.18 °F/year (≤ 0.1 °C/year) or ≤ 0.05%/year
Values under reference operating conditions. % refer to the set span. The highest value is valid.

Influence of ambient temperature (temperature drift)	Pt100 resistance thermometer: T_d= ± (8.3 ppm/K * (range end value + 328) + 27.8 ppm/°F * preset meas. range) * $\Delta\vartheta$ $\Delta\vartheta$ = deviation of the ambient temperature according to reference condition (73.4 °F ± 9 °F).
Influence of load	± 0.02%/100 Ω Percentages refer to the full scale value.

10.0.6 Installation conditions

Installation instructions	**Mounting location** see Chapter 3 'Installation'.

10.0.7 Environmental conditions

Ambient temperature limits	-40 to 185 °F (-40 to +85 °C)
Storage temperature	-40 to 212 °F (-40 to +100 °C)
Climate class	As per EN 60 654-1, class C
Degree of protection	NEMA 6P RATED (IP67)
Shock and vibration resistance	4g / 2 to 150 Hz as per IEC 60 068-2-6
Electromagnetic compatibility (EMC)	**CE Electromagnetic Compatibility Compliance** The device meets all requirements listed under IEC 61326 Amendment 1, 1998 and NAMUR NE 21. This recommendation is an uniform and practical way of determining whether the devices used in laboratory and process control are immune to interference with an objective to increase its functional safety.

Discharge of static electricity	IEC 61000-4-2	6 kV contact	
Electromagnetic fields	IEC 61000-4-3	80 to 2000 Hz	10 V/m
Burst (signal)	IEC 61000-4-4	1 kV	
Transient voltage	IEC 61000-4-5	1 kV unsym. / 0.5 kV sym.	
HF coupling	IEC 61000-4-6	0.15 to 80 MHz	10 V
Line interference	IEC 61000-4-16	10 kHz to 150 kHz	10 V

Condensation	allowed

Immersion

Minimum immersion per ASTM E644, $\Delta T \leq 0.09$ °F (0.05 °C)

Version	Minimum Immersion (Inch)
TSM470G	1½ "
TSM470F	¾ "
TSM470P	¾ "

10.0.8 Process

Process temperature limits

-60 to 320 °F (-51 to 160 °C).

Caution!
Restrictions dependent on the process connection and ambient temperature are possible:

max. ambient temperature	max. process temperature
to 75 °F (23.9 °C)	no restrictions
to 100 °F (37.8 °C)	285 °F (140.6 °C)
to 140 °F (60 °C)	250 °F (121.1 °C)
to 185 °F (85 °C)	215 °F (101.7 °C)

Process pressure limits

p/T load curve according to Dittrich for TSM470G. Maximum static pressure: 4000 PSI (at 77 °F/25 °C).

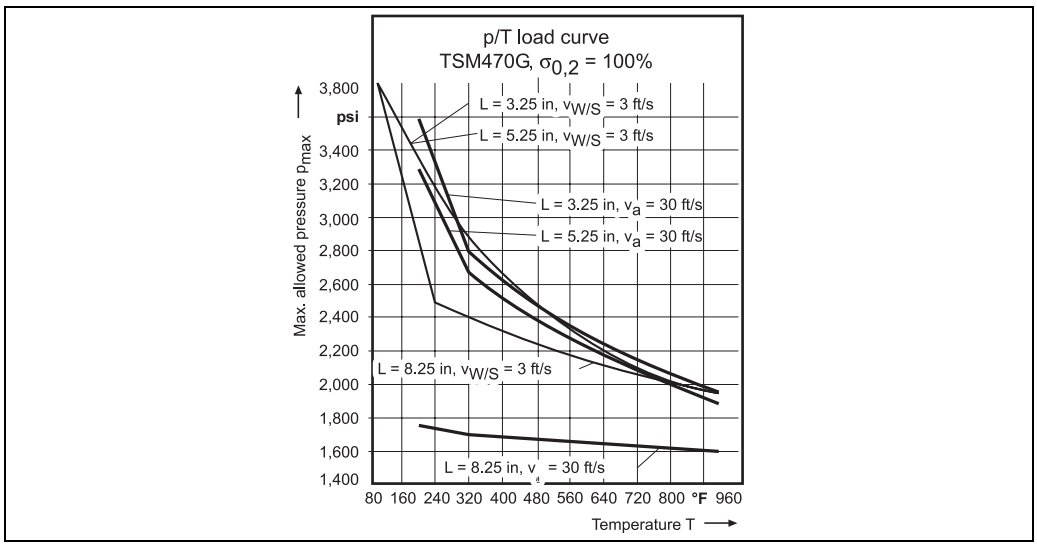


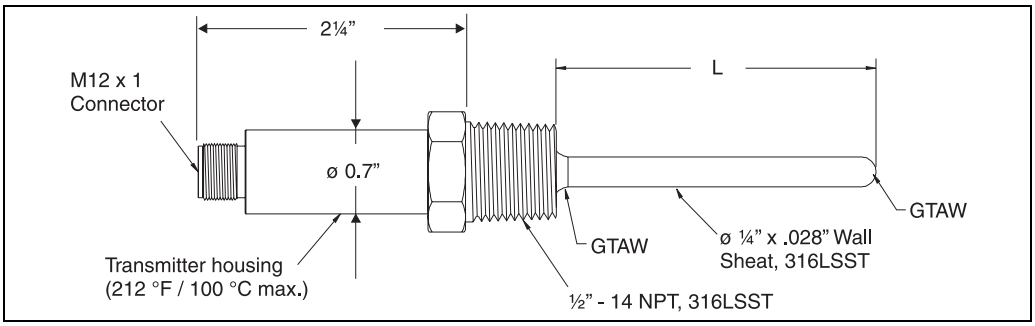
Fig. 9:
L = insertion length
v_a = flow velocity air
$v_{w/s}$ = flow velocity water or steam

(Avoid resonance frequency as this will cause damage to the probe! Resonance frequency occurs when permanent flow velocity is at 31 ft/s (air) for the 5¼" and / or 13 ft/s (air) for 8¼" probe.)

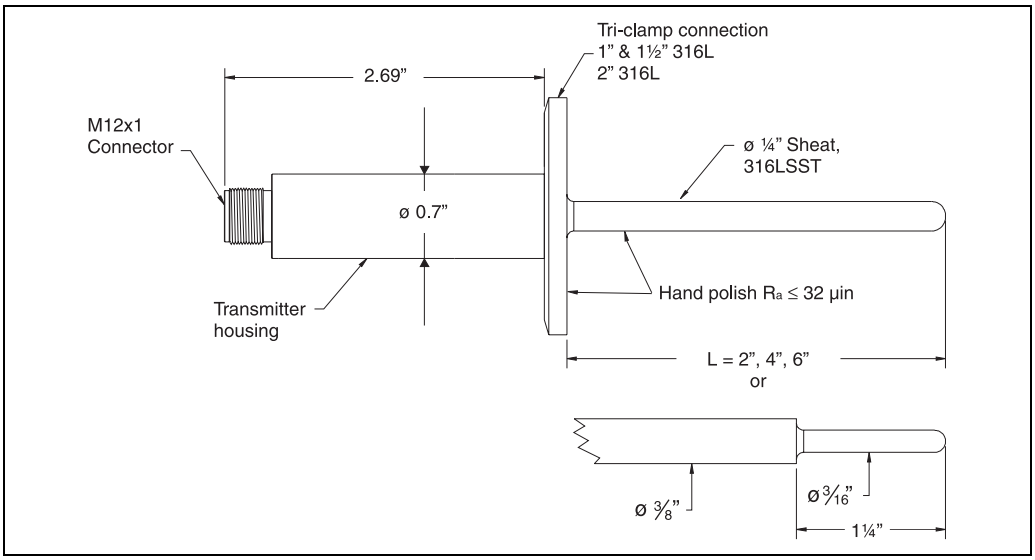
10.0.9 Mechanical construction

Design, dimensions

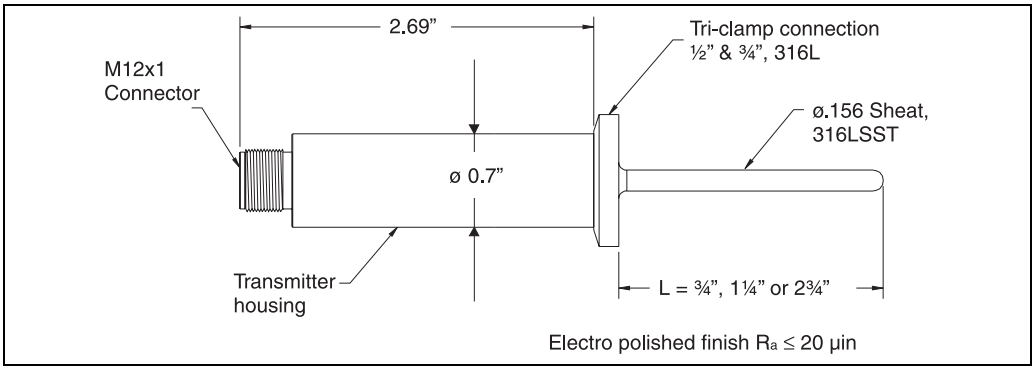
TSM470G



TSM470F



TSM470P



Surface Finish TSM470 F & TSM470 P

32 micro-inches R_a and 20 micro-inches R_a are the two standard finishes provided for Milk service and Bioprocessing Equipment services respectively. The 32 micro-inch R_a maximum is defined in "3-A Sanitary Standards for Sensors and Sensor Fittings and

Connections used on Milk and Milk Products Equipment, Number 74-02". The 20 micro-inch maximum is defined in "ASME BPE-2002, Bioprocessing Equipment".

Polishing Procedures

The wetted surfaces of the sensors and sanitary fittings are mechanically polished to achieve a 32 micro-inch maximum surface finish, in accordance with 3-A Standard Number 74-02. Minimal material has been removed to achieve the indicated surface finish. Residual polishing compounds are removed after polishing operations are completed on all surfaces and sanitary end fittings. The end fitting material and sensor sheath are both composed of 316L stainless steel.
The wetted surfaces of the sensors and sanitary fittings are electropolished to achieve a 20 micro-inch maximum surface finish, in accordance with ASME BPE-2002. All electropolished surfaces have not undergone any passivation. Minimal material has been removed to achieve the indicated surface finish. The end fitting material and sensor sheath are both composed of 316L stainless steel.

Packaging

Sanitary sensors and fittings are individually bagged and sealed to ensure cleanliness upon delivery to the final customer.

Weight

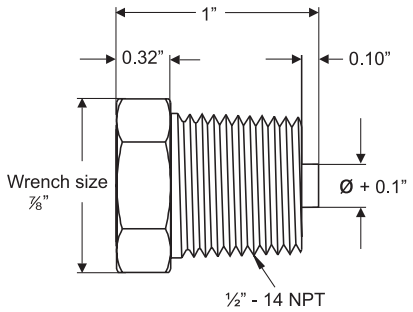
L in Inches (mm)	**3¼" (82.55)**	**5¼" (133.35)**	**8¼" (209.45)**
TSM470G	95 g	103 g	115 g
L in Inches (mm)	**2" (50.8)**	**4" (101.6)**	**6" (152.4)**
TSM470F-_B1	141 g	151 g	161 g
TSM470F-_B2	161 g	188 g	215 g
TSM470F-_C1	198 g	208 g	218 g
TSM470F-_C2	218 g	245 g	272 g
L in Inches (mm)	**¾" (19.05)**	**1¼" (31.75)**	**2¾" (31.75)**
TSM470P	67 g	69 g	72 g

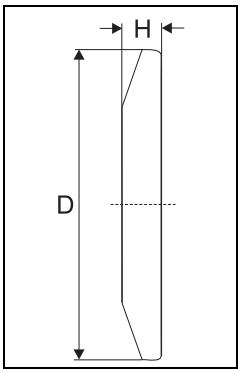
Material

Transmitter housing: stainless steel (SST).
Wetted parts: SS 316L (1.4404).

Process connection

TSM470G



TSM470F/P		D	H
 Material: 316LSS Round bar stock	TSM470F-B... 1" - 1½" Tri-Clamp connection	1.98"	0.25"
	TSM470F-C... 2" Tri-Clamp connection	2.52"	0.25"
	TSM470P-A ½" & ¾" Tri-Clamp connection	0.98"	0.1875"

Terminals

M12 plug-in micro-connector (see Chap. Power supply).

10.0.10 Human interface

Display elements

No display elements are present directly on the display.
The measured value display, for example, can be called up using the ReadWin® 2000 PC software.

Operating elements

No operating elements are present directly on the display. The temperature transmitter is configured via remote operation with the ReadWin® 2000 PC software.

Remote operation

Configuration
TSM470A configuration kit, can be configured using a PC operating program (ReadWin® 2000).

Interface
PC-interface connecting cable TTL -/- RS232 with plug-in connection.

Configurable parameters
Measuring dimension (°C/°F), measuring ranges, failure mode, output signal (4 to 20 / 20 to 4 mA), offset, filter (damping), set tag number (8 characters), output simulation.

10.0.11 Certificates and approvals

CE-Mark	This unit complies with the legal requirements laid out within the EU regulations.
3A	A Sanitary Standards for Sensors, Connections and Sensor Fittings used on Milk and Milk Products Equipment, Number 74-02.
ABS	Ship building type approval, American Bureau of Shipping (TSM 470 G).
Other standards and guidelines	• IEC 60529: Degrees of protection by housing (IP-Code). • IEC 61010: Safety requirements for electrical measurement, control and laboratory instrumentation. • IEC 1326: Electromagnetic compatibility (EMC requirements). • ASTM E644: American society for testing and materials, standard test methods for testing industrial resistance thermometers. • NAMUR Standardization association for measurement and control in chemical and pharmaceutical industries. (www.namur.de). • NEMA - ANSI / NEMA 250 Standardization association for the electrical industry.
UL	Recognized component to UL 3111-1.

10.0.12 Documentation

❑Field of activities (FA) 'Temperature measurement' (FA 006T/09/en)
❑Short form operating manual 'easytemp™ TSM 470' (KA 148R/24/ae)
❑Technical information 'Compact RTD transmitter easytemp™ TSM 470 G / TSM 470 F / TSM 470 P' (TI 101R/24/ae)

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