



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



Solutions

Technical Information

Omnigrad S TC88

Modular TC assembly

Extension neck and threaded connection for installation in an existing thermowell



Application

- Universal application
- Suitable for installation in already existing thermowells
- Measuring range: $-40 \dots 1100 \text{ }^{\circ}\text{C}$ ($-40 \dots 2012 \text{ }^{\circ}\text{F}$)
- Installation without thermowell possible in unpressurized processes
- Degree of protection up to IP 68

Head transmitters

All Endress+Hauser transmitters are available with enhanced accuracy and reliability compared to directly wired sensors. Easy customizing by choosing one of the following outputs and communication protocols:

- Analog output 4...20 mA
- HART®
- PROFIBUS® PA
- FOUNDATION Fieldbus™

Your benefits

- High degree of flexibility thanks to modular design with standard terminal heads and customer-specific immersion lengths
- Variable total length in suitable thermowells thanks to compression fitting on extension neck
- Types of protection for use in hazardous locations:
Intrinsic Safety (Ex ia)
Non-sparking (Ex nA)

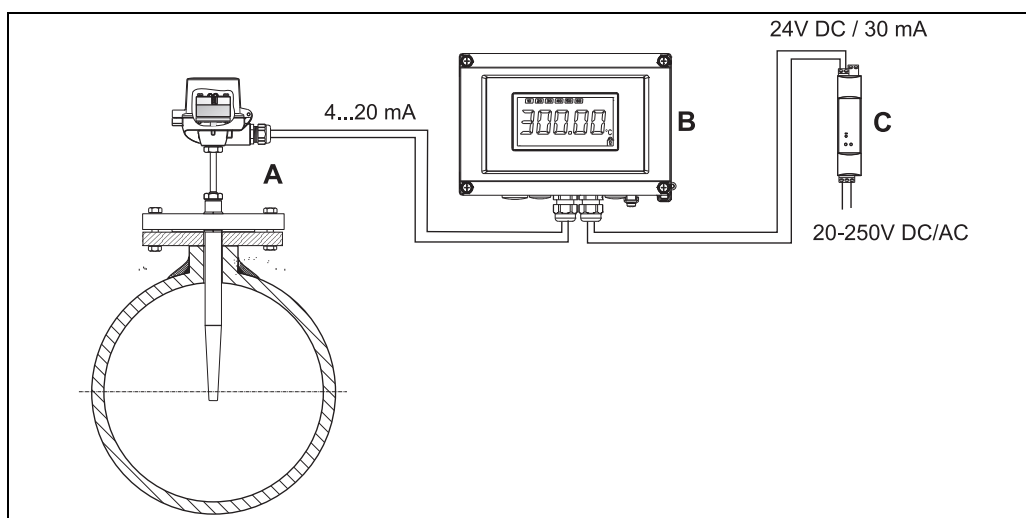


Function and system design

Measuring principle

Thermocouples are comparatively simple, robust temperature sensors which use the Seebeck effect for temperature measurement: if two electrical conductors made of different materials are connected at a point, a weak electrical voltage can be measured between the two open conductor ends if the conductors are subjected to a thermal gradient. This voltage is called thermoelectric voltage or electromotive force (emf.). Its magnitude depends on the type of conducting materials and the temperature difference between the "measuring point" (the junction of the two conductors) and the "cold junction" (the open conductor ends). Accordingly, thermocouples primarily only measure differences in temperature. The absolute temperature at the measuring point can be determined from these if the associated temperature at the cold junction is known or is measured separately and compensated for. The material combinations and associated thermoelectric voltage/temperature characteristics of the most common types of thermocouple are standardized in the IEC 60584 and ASTM E230/ANSI MC96.1 standards.

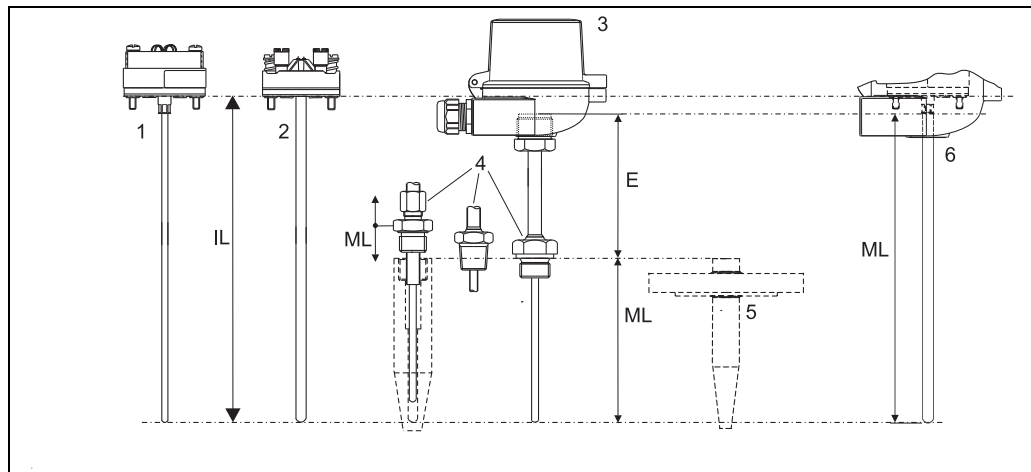
Measuring system



Example of an application

- A Thermometer with fitted head transmitter mounted in an existing onsite thermowell
- B RIA16 field display unit
 - The display unit records the analog measuring signal from the head transmitter and shows this on the display. The LC display shows the current measured value in digital form and as a bar graph indicating a limit value violation. The display unit is looped into the 4 to 20 mA circuit and gets the required energy from there. More information on this can be found in the Technical Information (see "Documentation").
- C Active barrier RN221N
 - The RN221N active barrier (24 V DC, 30 mA) has an galvanically isolated output for supplying voltage to loop powered transmitters. The universal power supply works with an input supply voltage of 20 to 250 V DC/AC, 50/60 Hz, which means that it can be used in all international power grids. More information on this can be found in the Technical Information (see "Documentation").

Equipment architecture



Thermometer design

- | | |
|---|--|
| 1 Insert (Ø 3 mm, 0.12 in) with mounted head transmitter (example) | 5 Existing onsite thermowell located in the process |
| 2 Insert (Ø 6 mm, 0.24 in) with mounted ceramic connection socket (example) | 6 Version without extension neck, if thermowell and extension neck are present on site in the process (E = 0 mm) |
| 3 Terminal head | E Length of extension neck |
| 4 Thermowell connection: Threaded connection or compression fitting on extension neck | IL Total length of insert = ML + E + 10 mm (0.4 in) |
| | ML Insertion length for existing onsite components |

The thermocouple thermometers from the Omnigrad S TC88 series have a modular design. The terminal head is used as a connection module for the mechanical and electrical connection of the insert. The thermocouple insert is manufactured from mineral insulated thermocouple wire complying with IEC 61515 and is thus sufficiently robust to withstand the high stresses of industrial processes. The measuring point of the thermocouple is located close to the tip of the insert. The thermocouple wire combinations of iron/cupronickel and nickel-chromium/nickel (thermocouple type J and type K as per IEC 60584 and ASTM E230/ANSI MC96.1) are used as standard. The operating temperature ranges (→ 3) and permissible deviation limits of the thermoelectric voltages from the standard characteristic (→ 4) vary according to the type of thermocouple used. If installed in a thermowell, the insert can be replaced and calibrated without interrupting the process. Either ceramic connection sockets or transmitters can be mounted on the internal connection socket.

The TC88 is designed for installation in an existing onsite thermowell. Different threaded connections are available on the bottom of the extension neck for installation in the thermowell. Insofar as the thermowell is suited to this purpose (interior bore > 12 mm), the thermometer may also be mounted using a suitable compression fitting on the extension neck. The insertion length (ML) of the thermometer is varied by sliding the compression fitting. This allows it to be installed in thermowells of various length and also ensures optimum thermal contact between the tip of the insert and the bottom of the thermowell.

Measuring range

Input	Designation	Measuring range limits	Min. span
Thermocouples (TC) as per IEC 60584, part 1 - using an Endress+Hauser - iTEMP® temperature head transmitter	Type J (Fe-CuNi)	-40 to +750 °C (-40 to 1382 °F)	50 K
	Type K (NiCr-Ni)	-40 to +1100 °C (-40 to 2012 °F) ¹⁾	50 K
Thermocouples (TC) - flying leads - as per IEC 60584 and ASTM E230	Type J (Fe-CuNi)	-210 to +760 °C (-346 to 1400 °F), Typical sensitivity above 0 °C approx. 55 µV/K	-
	Type K (NiCr-Ni)	-270 to +1100 °C (-454 to 2012 °F) ¹⁾ , Typical sensitivity above 0 °C approx. 40 µV/K	-

1) Limited by jacket material of insert

Performance characteristics

Operating conditions

Ambient temperature

Terminal head	Temperature in °C (°F)
Without mounted head transmitter	Depends on the terminal head used and the cable gland or fieldbus connector, see 'Terminal heads' section, → 8
With mounted head transmitter	-40 to 85 °C (-40 to 185 °F)
With mounted head transmitter and display	-20 to 70 °C (-4 to 158 °F)

Process pressure

The maximum process pressure depends on the thermowell into which the thermometer is screwed. For an overview of the Endress+Hauser thermowells which may be used, see → 18.

Permitted flow rate as a function of immersion length

The maximum permitted flow rate to which the thermometer can be subjected, reduces the greater the immersion depth of the thermowell in the flowing medium. In addition, it is dependent on the diameter of the tip of the thermowell, the medium type, process temperature and process pressure. For an overview of the Endress+Hauser thermowells which may be used, see → 18.

Shock and vibration resistance

4g / 2 to 150 Hz as per IEC 60068-2-6

Accuracy

Permissible deviation limits of thermoelectric voltages from standard characteristic for thermocouples as per IEC 60584 and ASTM E230/ANSI MC96.1:

Standard	Type	Standard tolerance		Special tolerance	
		Class	Deviation	Class	Deviation
IEC 60584	J (Fe-CuNi)	2	±2.5 °C (-40 to 333 °C) ±0.0075 t ¹⁾ (333 to 750 °C)	1	±1.5 °C (-40 to 375 °C) ±0.004 t ¹⁾ (375 to 750 °C)
	K (NiCr-Ni)	2	±2.5 °C (-40 to 333 °C) ±0.0075 t ¹⁾ (333 to 1200 °C)	1	±1.5 °C (-40 to 375 °C) ±0.004 t ¹⁾ (375 to 1000 °C)

Standard	Type	Standard tolerance	Special tolerance
ASTM E230/ MC 96.1		Deviation, the larger respective value applies	
	J (Fe-CuNi)	±2.1 K or ±0.0075 t ¹⁾ (0 to 760 °C)	±1.1 K or ±0.004 t ¹⁾ (0 to 760 °C)
	K (NiCr-Ni)	±2.2 K or ±0.02 t ¹⁾ (-200 to 0 °C) ±2.1 K or ±0.0075 t ¹⁾ (0 to 1260 °C)	±1.1 K or ±0.004 t ¹⁾ (0 to 1260 °C)

1) |t| = Absolute temperature value in °C



Note!

In order to obtain the maximum tolerances in °F, the results in °C must be multiplied by a factor of 1.8.

Response time

Tests in water at 0.4 m/s (1.3 ft/s), according to IEC 60584; 10 K temperature step change:

Insert diameter	Response time	
6 mm (0.24 in)	t ₅₀	2.5 s
	t ₉₀	6 s
3 mm (0.12 in)	t ₅₀	1 s
	t ₉₀	3 s



Note!

Response time for TC insert without transmitter.

Insulation resistance

Insulation resistance $\geq 100 \text{ M}\Omega$ at ambient temperature.
 Insulation resistance between each terminal and the sheath is measured with a voltage of 100 V DC.

Calibration specifications

Endress+Hauser provides comparison temperature calibration from -80 to $+1400$ °C (-110 °F to 2552 °F) based on the International Temperature Scale (ITS90). Calibrations are traceable to national and international standards. The calibration report is referenced to the serial number of the thermometer. Only the measurement insert is calibrated.

Insert-Ø: 6 mm (0.24 in) and 3 mm (0.12 in)	Minimum insertion length IL in mm (in)	
Temperature range	without head transmitter	with head transmitter
-80 °C to -40 °C (-110 °F to -40 °F)	200 (7.87)	
-40 °C to 0 °C (-40 °F to 32 °F)	160 (6.3)	
0 °C to 250 °C (32 °F to 480 °F)	120 (4.72)	150 (5.9)
250 °C to 550 °C (480 °F to 1020 °F)	300 (11.81)	
550 °C to 1400 °C (1020 °F to 2552 °F)	450 (17.75)	

Material

Neck, measuring insert.

The temperatures for continuous operation specified in the following table are only intended as reference values for use of the various materials in air and without any significant compressive load. The maximum operation temperatures are reduced considerably in some cases where abnormal conditions such as high mechanical load occur or in aggressive media.

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1200 °F) ¹⁾	<ul style="list-style-type: none"> ■ Austenitic, stainless steel ■ High corrosion resistance in general ■ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration) ■ Increased resistance to intergranular corrosion and pitting ■ Compared to 1.4404, 1.4435 has even higher corrosion resistance and a lower delta ferrite content
AISI 316Ti/ 1.4571	X6CrNiMoTi17-12-2	700 °C (1292 °F) ¹⁾	<ul style="list-style-type: none"> ■ Properties comparable to AISI316L ■ Addition of titanium means increased resistance to intergranular corrosion even after welding ■ Broad range of uses in the chemical, petrochemical and oil industries as well as in coal chemistry ■ Can only be polished to a limited extent, titanium streaks can form
Inconel600/ 2.4816	NiCr15Fe	1100 °C (2012 °F)	<ul style="list-style-type: none"> ■ A nickel/chromium alloy with very good resistance to aggressive, oxidizing and reducing atmospheres, even at high temperatures ■ Resistant to corrosion caused by chlorine gas and chlorinated media as well as many oxidizing mineral and organic acids, sea water etc. ■ Corrosion from ultrapure water ■ Not to be used in a sulfur-containing atmosphere

1) Can be used to a limited extent up to 800 °C (1472 °F) for low compressive loads and in non-corrosive media. Please contact your Endress+Hauser sales team for further information.

Transmitter specifications

	TMT181 PCP TC, mV	TMT182 HART® TC, mV	TMT84 PA / TMT85 FF TC, mV
Measurement accuracy	0.5 °C (0.9 °F) or 0.08% % is related to the adjusted measurement range (the larger value applies)		± typ. 0.25 K (0.45 °F)
Galvanic isolation (input/output)	U = 2 kV AC		

Components

Family of temperature transmitters

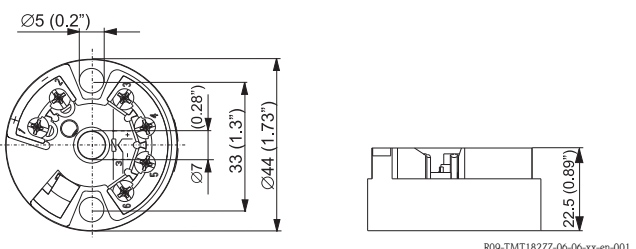
Thermometers fitted with iTEMP® transmitters are an installation ready complete solution to improve temperature measurement by increasing accuracy and reliability, when compared to direct wired sensors, as well as reducing both wiring and maintenance costs.

PC programmable head transmitter TMT180 and TMT181

They offer a high degree of flexibility, thereby supporting universal application with low inventory storage. The iTEMP® transmitters can be configured quickly and easily at a PC. Endress+Hauser offers the ReadWin® 2000 configuration software for this purpose. This software can be downloaded free of charge at **www.readwin2000.com**. More information can be found in the Technical Information (see "Documentation" section).

HART® TMT182 head transmitter

HART® communication is all about easy, reliable data access and getting additional information about the measurement point more inexpensively. iTEMP® transmitters integrate seamlessly into your existing control system and provide painless access to numerous diagnostic information. Configuration with a hand-held (Field Xpert SFX100 or DXR375) or a PC with configuration program (FieldCare, ReadWin® 2000) or configure with AMS or PDM. Details see Technical Information (see chapter 'Documentation').

Type of transmitter	Specification
iTEMP® TMT18x 	<ul style="list-style-type: none"> ■ Material: Housing (PC), Potting (PUR) ■ Terminals: Cable up to max. ≤ 2.5 mm² / 16 AWG (secure screws) or with wire end ferrules ■ Eyelets for easy connection of a HART®-handheld terminal with alligator clips ■ Degree of protection NEMA 4 (see also type of terminal head) Details see Technical Information (see chapter 'Documentation')

PROFIBUS® PA TMT84 head transmitter

Universally programmable head transmitter with PROFIBUS® PA communication. Converting various input signals into a digital output signal. High accuracy over the complete ambient temperature range. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e. g. using operating software such as FieldCare, Simatic PDM or AMS.

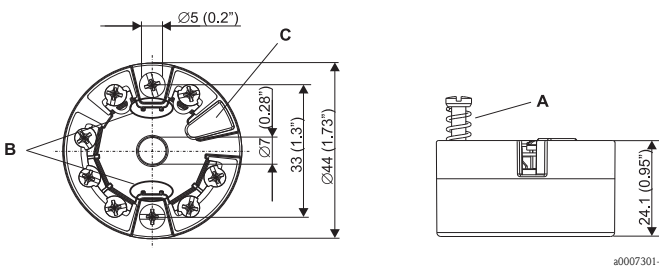
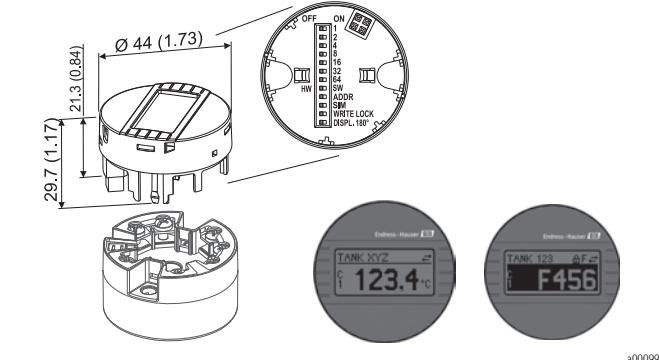

Benefits are: dual sensor input, highest reliability in harsh industrial environments, mathematic functions, thermometer drift monitoring, sensor back-up functionality, sensor diagnosis functions and sensor-transmitter matching using Callendar-Van Dusen coefficients. Details see Technical Information (see chapter 'Documentation').

FOUNDATION Fieldbus™ TMT85 head transmitter

Universally programmable head transmitter with FOUNDATION Fieldbus™ communication. Converting various input signals into a digital output signal. High accuracy over the complete ambient temperature range.

Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e. g. using operating software such as ControlCare from Endress+Hauser or the NI Configurator from National Instruments.

Benefits are: dual sensor input, highest reliability in harsh industrial environments, mathematic functions, thermometer drift monitoring, sensor back-up functionality, sensor diagnosis functions and sensor-transmitter matching using Callendar-Van Dusen coefficients. Details see Technical Information (see chapter 'Documentation').

Type of transmitter	Specification
<p>iTEMP® TMT84 and TMT85</p>  <p>a0007301-en</p>	<ul style="list-style-type: none">■ Spring range $L \geq 5 \text{ mm}$ (0.2"), see Pos. A■ Fixing elements for pluggable measured value display, see Pos. B■ Interface for contacting measured value display, see Pos. C■ Material (RoHS-compliant) Housing: PC Potting: PU■ Terminals: Screw terminals (cable up to max. $\leq 2.5 \text{ mm}^2 / 16 \text{ AWG}$) or spring terminals (e. g. from 0.25 mm^2 to $0.75 \text{ mm}^2 / 24 \text{ AWG}$ to 18 AWG for flexible wires with wire-end ferrules with plastic ferrule)■ Degree of protection NEMA 4 (see also type of terminal head) <p>Details see Technical Information (see chapter 'Documentation')</p>
<p>Pluggable display TID10 as option</p>  <p>a0009955</p>	<ul style="list-style-type: none">■ Displays the actual measured value and the measurement point identification■ Displays fault events in inverse color with channel ident and diagnostics code■ DIP-switches on the rear for hardware set-up, e. g. PROFIBUS® PA bus address <p> Note! Display is only available with suitable terminal head with display window, e.g. TA30</p>

Terminal heads

All terminal heads have an internal shape and size in accordance with DIN EN 50446, flat face and a thermometer connection of M24x1.5.

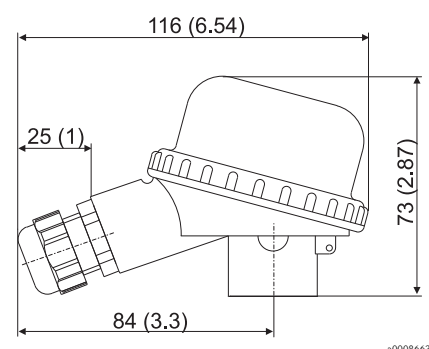
All dimensions in mm (in). The cable glands in the diagrams correspond to M20x1.5 connections.

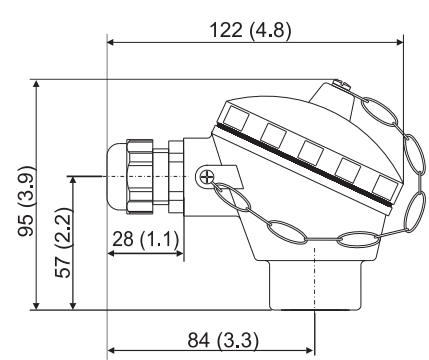
Specifications without head transmitter installed. For ambient temperatures with head transmitter installed, see 'Operating conditions' section.

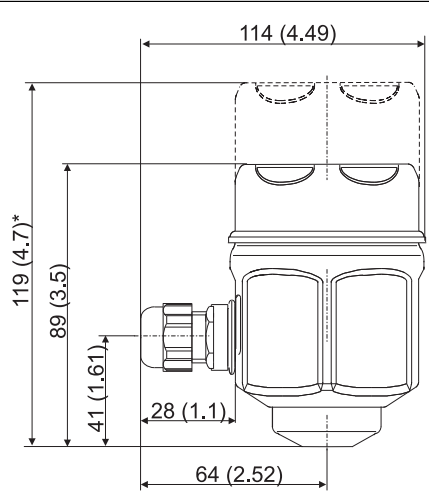
TA30A	Specification
	<ul style="list-style-type: none"> ■ Degree of protection: IP66/68 ■ Max. temperature: 150 °C (300 °F) ■ Material: aluminum, polyester powder coated ■ Seals: silicone ■ Cable entry incl. glands: ½" NPT and M20x1.5, only thread: G ½", plugs: M12x1 PA, 7/8" FF ■ Protection armature connection: M24x1.5 ■ Head color: blue RAL 5012 ■ Cap color: grey RAL 7035 ■ Weight: 330 g (11.64 oz)

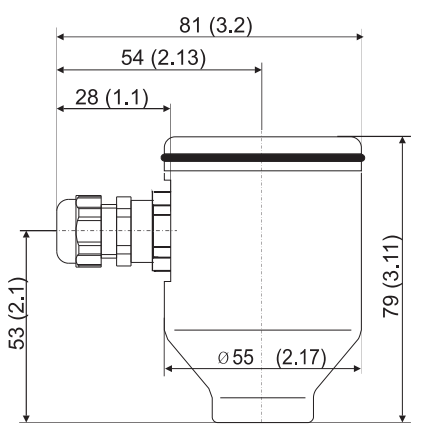
TA30A with display window	Specification
	<ul style="list-style-type: none"> ■ Degree of protection: IP66/68 ■ Max. temperature: 150 °C (300 °F) ■ Material: aluminum, polyester powder coated ■ Seals: silicone ■ Cable entry incl. glands: ½" NPT and M20x1.5, only thread: G ½", plugs: M12x1 PA, 7/8" FF ■ Protection armature connection: M24x1.5 ■ Head color: blue RAL 5012 ■ Cap color: grey RAL 7035 ■ Weight: 420 g (14.81 oz) ■ Head transmitter optional with TID10 display

TA30D	Specification
	<ul style="list-style-type: none"> ■ Degree of protection: IP66/68 ■ Max. temperature: 150 °C (300 °F) ■ Material: aluminum, polyester powder coated ■ Seals: silicone ■ Cable entry incl. glands: ½" NPT and M20x1.5, only thread: G ½", plugs: M12x1 PA, 7/8" FF ■ Protection armature connection: M24x1.5 ■ Two head transmitters can be mounted. In the standard version, one transmitter is mounted in the terminal head cover and an additional terminal block is installed directly on the insert. ■ Head color: blue RAL 5012 ■ Cap color: grey RAL 7035 ■ Weight: 390 g (13.75 oz)

TA20B	Specification
	<ul style="list-style-type: none"> ■ Degree of protection: IP65 ■ Max. temperature: 80 °C (176 °F) ■ Material: polyamide (PA) ■ Cable entry: M20x1.5 ■ Head and cap color: black ■ Weight: 80 g (2.82 oz) ■ 3-A® marked

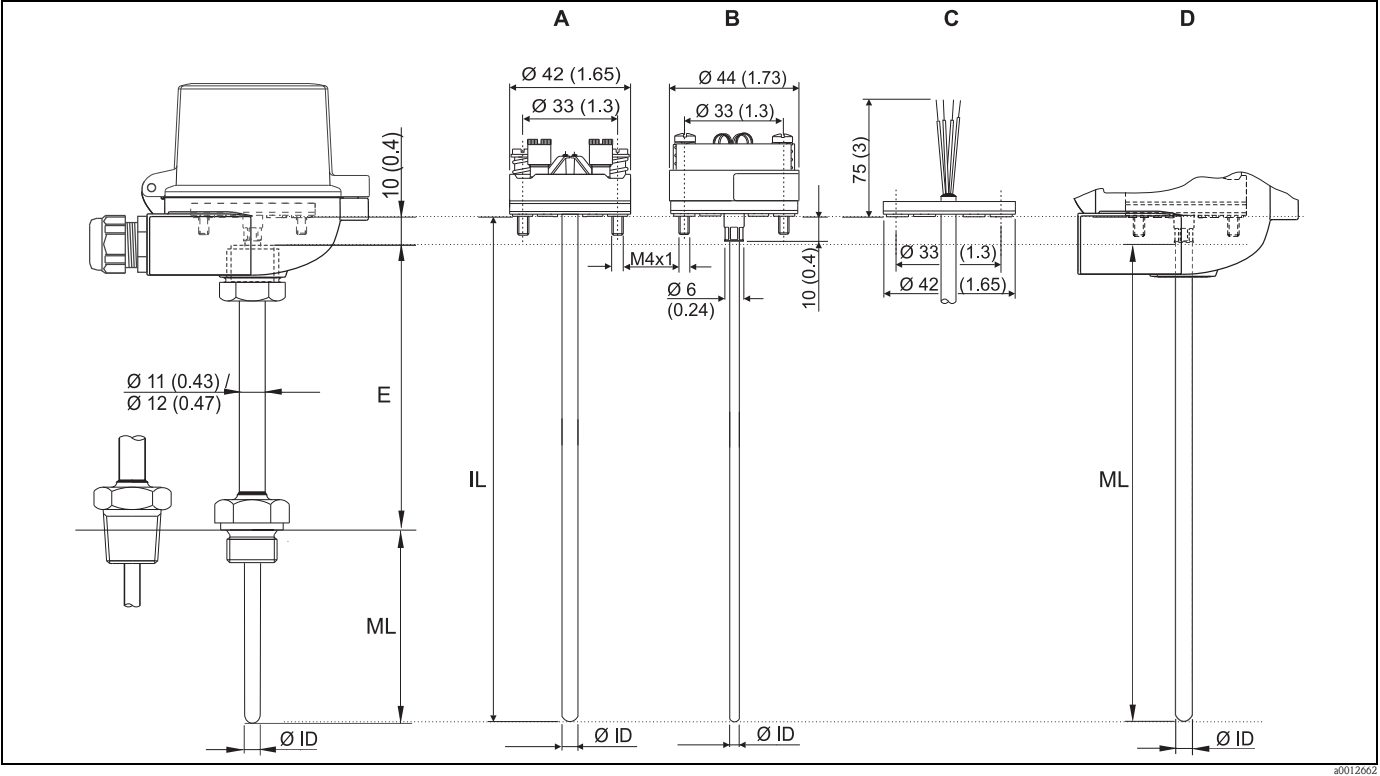
TA21E	Specification
	<ul style="list-style-type: none"> ■ Degree of protection: IP65 ■ Max. temperature: 130 °C (266 °F) silicone, 100 °C (212 °F) rubber (observe max. permitted temperature of the cable gland!) ■ Material: aluminum alloy with polyester or epoxy coating; rubber or silicone seal under the cover ■ Cable entry: M20x1.5 or plug M12x1 PA ■ Protection armature connection: M24x1.5, G 1/2" or NPT 1/2" ■ Head color: blue RAL 5012 ■ Cap color: grey RAL 7035 ■ Weight: 300 g (10.58 oz) ■ 3-A® marked

TA20J	Specification
 <p><i>* dimensions with optional display</i></p>	<ul style="list-style-type: none"> ■ Degree of protection: IP66/IP67 ■ Max. temperature: 70 °C (158 °F) ■ Material: 316L (1.4404) stainless steel, rubber seal under the cover (hygienic design) ■ 4 digits 7-segments LC display (loop powered with 4...20 mA transmitter) ■ Cable entry: 1/2" NPT, M20x1.5 or plug M12x1 PA ■ Protection armature connection: M24x1.5 or 1/2" NPT ■ Head and cap color: stainless steel, polished ■ Weight: 650 g (22.93 oz) with display ■ Humidity: 25 to 95%, no condensation ■ 3-A® marked <p>The programming is executed through 3 keys at the bottom of the display.</p>

TA20R	Specification
	<ul style="list-style-type: none">■ Degree of protection: IP66/67■ Max. temperature: 100 °C (212 °F)■ Material: SS 316L (1.4404) stainless steel■ Cable entry: ½" NPT, M20x1.5 or plug M12x1 PA■ Head and cap color: stainless steel■ Weight: 550 g (19.4 oz)■ LABS - free■ 3-A® marked

Maximum ambient temperatures for cable glands and fieldbus connectors	
Type	Temperature range
Cable gland ½" NPT, M20x1.5 (non Ex)	-40 to +100 °C (-40 to +212 °F)
Cable gland M20x1.5 (for dust ignition-proof area)	-20 to +95 °C (-4 to +203 °F)
Fieldbus connector (M12x1 PA, 7/8" FF)	-40 to +105 °C (-40 to +221 °F)

Design, dimensions All dimensions in mm (in).



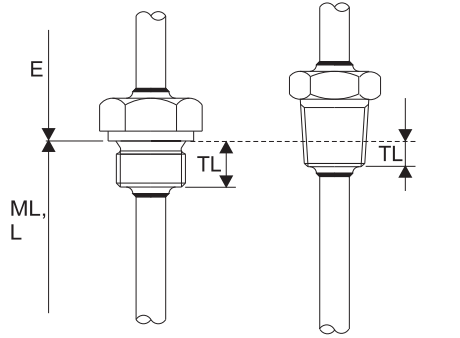
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|---|--|------|--|
| A | Insert with mounted terminal block | Ø ID | Insert diameter |
| B | Insert with mounted head transmitter | | 6 mm (0.24 in) or 3 mm (0.12 in) |
| C | Insert with flying leads | E | Length of extension neck |
| D | Model without extension neck, intended for mounting in an existing onsite extension neck | IL | Total length of insert = ML + E + 10 mm (0.4 in) |
| | | ML | Insertion length |

Weight

From 0.5 to 2.5 kg (1 to 5.5 lbs) for standard options.

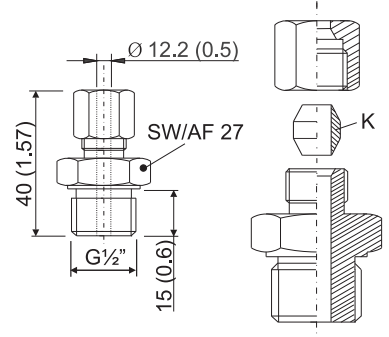
Process connection

The thermometer is designed for installation in an existing onsite thermowell or in a thermowell which can be ordered separately. The installation is done using the threaded connection on the bottom of the extension neck or using a compression fitting.

Threaded connection		Version		Thread length TL in mm (in)	Width across flats AF
Cylindrical (version M, G, R)	Conical (version NPT)	M	M14x1.5	12 (0.47)	17
 <p><i>E = Length of extended neck</i> <i>ML, L = Insertion length, immersion length</i></p>			M18x1.5		24
			M20x1.5	15 (0.6)	
G	G½" as per ISO 6149			15 (0.6)	27
NPT	NPT ½" as per ANSI B1.20.1			8 (0.32)	22
R	R ¾", JIS B 0203				27
	R ½", JIS B 0203				22

Compression fitting

The insert is pushed through a coupling together with the extension neck, Ø 12 mm (0.47 in), and secured using a clamping ring made of 316L stainless steel. The clamping ring can not be reused. The compression fitting must be secured again using a new clamping ring. The insertion length is completely adjustable.

Process connection compression fitting with thread	
 <p><i>K = Clamping ring</i></p>	<ul style="list-style-type: none"> Can be used in the case of thermowells with a sufficiently large internal bore, Ø > 12 mm (0.47 in), to hold the extension neck. If there is no thermowell, the coupling may be used only in unpressurized processes.

Spare parts

- The TC insert is available as spare part TPC100 (see "Documentation" section in the Technical Information).

If the insert is required as a spare part, please note the following formula:

Total length of insert IL = ML + E + 10 mm (0.4 in)

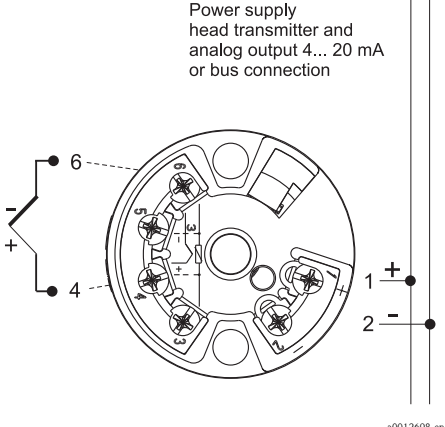
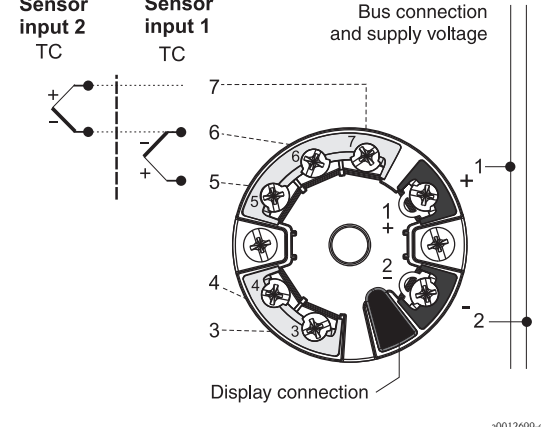
- Extension neck welded with threaded connection to terminal head. DIN flat face, different connections to separate thermowell, **order code TN15-...**
- Compression fitting with thread, Ø 12 mm (0.47 in), process connection thread G½", clamping ring made of 316L stainless steel, **order code TA50-KC**

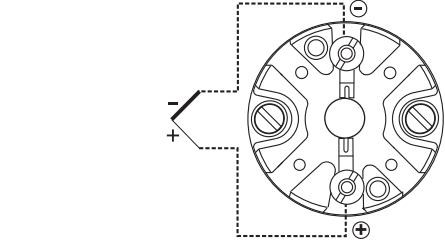
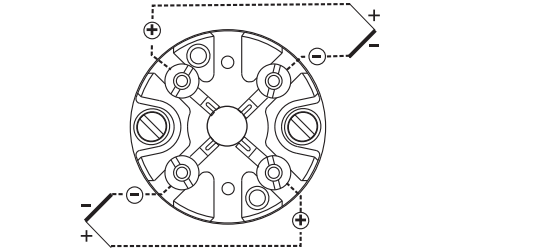
Wiring

Wiring diagrams

Thermocouple wire colors

As per IEC 60584	As per ASTM E230
<ul style="list-style-type: none"> ■ Type J: black (+), white (-) ■ Type K: green (+), white (-) 	<ul style="list-style-type: none"> ■ Type J: white (+), red (-) ■ Type K: yellow (+), red (-)

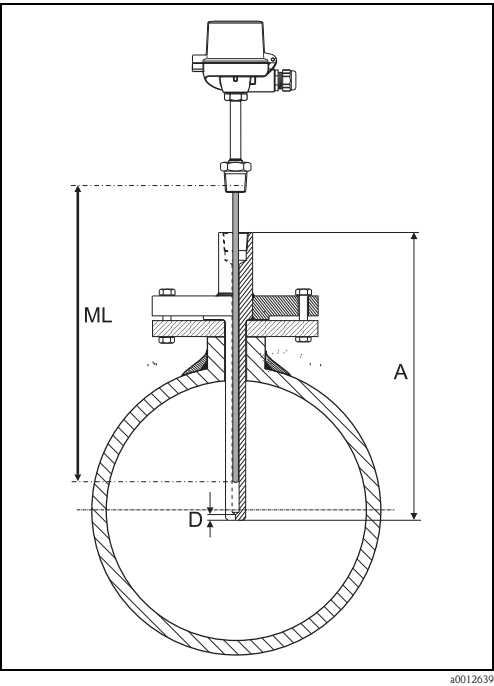
Head mounted transmitter TMT18x (single input)	Head mounted transmitter TMT84 and TMT85 (dual input)
<p>Power supply head transmitter and analog output 4... 20 mA or bus connection</p>  <p>a0012698-en</p>	<p>Sensor input 2 TC</p> <p>Sensor input 1 TC</p> <p>Bus connection and supply voltage</p> <p>Display connection</p>  <p>a0012699-en</p>

Terminal block mounted	
<p>1 x TC</p> 	<p>2 x TC</p>  <p>a0012700</p>

Installation conditions

Orientation No restrictions.

Installation instructions



Thermometer installation

The thermometer is designed for installation in an existing thermowell or in a thermowell which can be ordered separately. Different threaded connections to suit the thermowell are available on the thermometer's extension neck (→ 11).

The necessary insertion length (ML) of the insert depends on the total length of the thermowell (A) and the type of thermowell used. It can be freely selected within the range of 100 to 5000 mm (3.94 and 197 in). Longer insertion lengths are available on request. The same also applies when ordering an insert as a spare part. More detailed information on determining the insertion length (ML) required in each case can be found in the following table (applies to Endress+Hauser thermowells with standard base thicknesses).

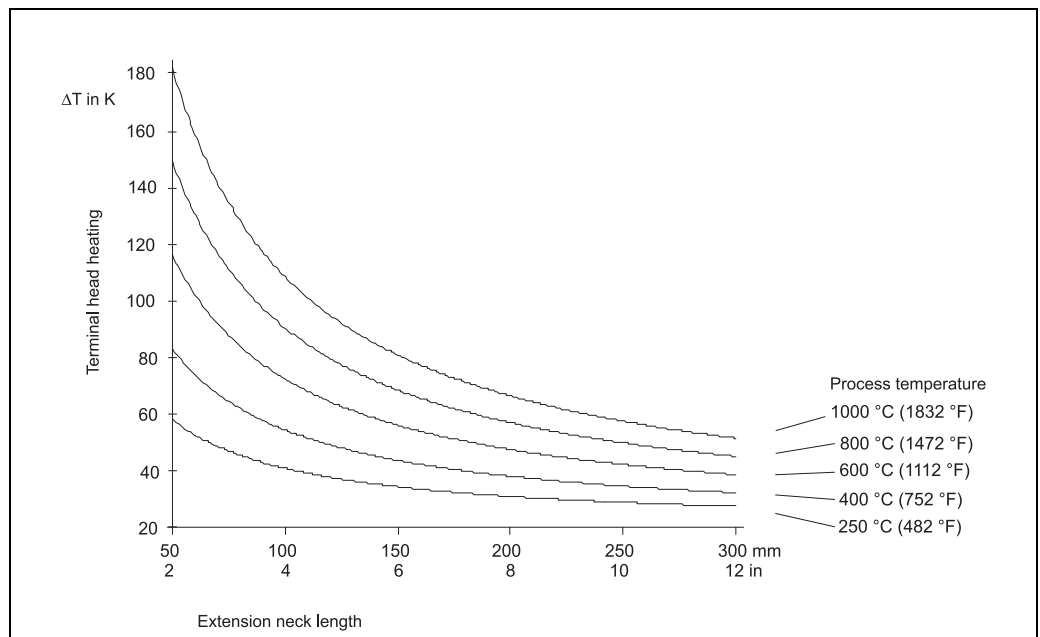
Type of thermowell	ML in mm (in)	Type of thermowell	ML in mm (in)	Type of thermowell	ML in mm (in)
TA535	ML = A	TW15	ML = A	TA570	ML = A - 3 (0.12)
TA540	ML = A - 2 (0.08)	TA560	ML = A - 3 (0.12)	TA571	
TA550	ML = A - 3 (0.12)	TA562		TA572	
TA555	ML = A - 2 (0.08)	TA565		TA575	
TA557		TA566		TA576	ML = A - 2 (0.12)

In the case of thermowells with a noncompliant standard base thickness (D), the following formula must be used: **ML = A - D + 3 (0.12)** in mm (in).

Neck tube length

The neck tube is the part between the process connection and the terminal head.

As illustrated in the following figure, the neck tube length may influence the temperature in the terminal head. It is necessary that this temperature is kept within the limit values defined in the chapter "Operating conditions".



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Heating of the terminal head consequent to the process temperature

Temperature in terminal head = ambient temperature 20 °C (68 °F) + ΔT

Neck tube- \varnothing = 12 mm (0.47 in)

Certificates and approvals

CE Mark	The device meets the legal requirements of the EC directives if applicable. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.
Hazardous area approvals	For further details on the available Ex versions (ATEX, CSA, FM, etc.), please contact your nearest Endress+Hauser sales organization. All relevant data for hazardous areas can be found in separate Ex documentation. If required, please request copies.
Other standards and guidelines	<ul style="list-style-type: none"> ■ IEC 60529: Degrees of protection by housing (IP-Code). ■ IEC 61010-1: Safety requirements for electrical measurement, control and laboratory instrumentation. ■ IEC 60584 and ASTM E230: Thermocouples ■ DIN43772: Thermowells ■ DIN EN 50446, DIN 47229: Terminal heads ■ IEC 61326-1: Electromagnetic compatibility (EMC requirements)
PED approval	The thermometer complies with paragraph 3.3 of the Pressure Equipment Directive (97/23/CE) and is not marked separately.
Test report and calibration	The "Factory calibration" is carried out according to an internal procedure in a laboratory of Endress+Hauser accredited by the European Accreditation Organization (EA) to ISO/IEC 17025. A calibration which is performed according to EA guidelines (SIT or DKD calibration) may be requested separately. The calibration is performed on the replaceable insert of the thermometer. In the case of thermometers without a replaceable insert, the entire thermometer – from the process connection to the tip of the thermometer – is calibrated.

Ordering information

Product structure

This information provides an overview of the order options available. The information is not exhaustive, however, and may not be fully up to date. **More detailed** information is available from your local Endress+Hauser representative.

Thermocouple TC88				
	Approval:			
	A	Not needed		
	B	ATEX II 1 D Ex iaD 20, II 1 G Ex ia IIC		
	E	ATEX II 1/2 D Ex iaD 21, II 1 G Ex ia IIC		
	G	ATEX II 1 G Ex ia IIC		
	H	ATEX II 3 GD Ex nA II		
	K	TIIIS Ex ia IIC T2		
	L	TIIIS Ex ia IIC T3		
	Head; Cable entry:			
	B	TA30A Alu, IP66/IP68; M20		
	C	TA30A Alu, IP66/IP68; NPT ½"		
	D	TA30A Alu, IP66/IP67; M12 plug PA		
	E	TA21E Alu, screw cap IP65; M20		
	F	TA30A Alu+display, IP66/IP68; M20		
	G	TA30A Alu+display, IP66/IP68; NPT ½"		
	H	TA30A Alu+display, IP66/IP67; M12 plug PA		
	I	TA30A Alu, G½" w/o gland		
	J	TA20J 316L, IP66/IP67; M20		
	K	TA20J 316L, + display, IP66/IP67; M20		
	L	TA30A Alu +display; G1/2" w/o gland		
	M	TA20J 316L, IP66/IP67; M12 plug PA		
	O	TA30D Alu, high cover, IP66/IP68; M20		
	P	TA30D Alu, high cover, IP66/IP68; NPT ½"		
	Q	TA30D Alu, IP66/IP67; M12 plug PA		
	R	TA20R 316L, screw cap IP66/IP67; M20		
	S	TA20R 316L, screw cap IP66; M12 plug PA		
	T	TA30A Alu, IP66/IP67; 7/8" plug FF		
	U	TA30A Alu+display, IP66/IP67; 7/8" plug FF		
	V	TA30D Alu, IP66/IP67; 7/8" plug FF		
	3	TA30D Alu, high cover; G½" w/o gland		
	7	TA20B PA black, IP65; M20		
	Extension E:			
	0	w/o neck		
	1	80 mm		
	2	100 mm		
	3	155 mm		
	4	165 mm		
	5	200 mm		
	8 mm		
	9 mm, as specified		
	Process connection:			
	A	Thread M14x1.5, 316Ti		
	B	Thread M18x1.5, 316Ti		
	C	Thread G½", 316Ti		
	D	Thread M20x1.5, 316Ti		
	E	Thread ½" NPT, 316Ti		
	F	Compression fitting G½"		
	G	Thread R ¾", JIS B 0203, 316Ti		
	H	Thread R ½", JIS B 0203, 316Ti		
	Y	Special version, TSP-no. to be specified		
	0	not needed		
	Neck diameter; Material:			
	1	11 mm; 316Ti		
	2	w/o neck, to build in on side existing neck		
	3	12 mm; 316 Ti		
	Insertion length ML:			
	A	110 mm		
	B	140 mm		

Insertion length ML:										
										C 170 mm D 200 mm E 260 mm F 410 mm X mm Y mm, as specified 1 100 mm 2 160 mm 3 400 mm
Insert diameter:										
										1 3 mm 2 6 mm
Head transmitter; Range:										
										B TMT84 PA C Terminal block D TMT85 FF F Flying leads G TMT181 (PCP); Temp. range to be specified H TMT182 (HART, SIL2); Temp. range to be specified
TC Accuracy; Material:										
										A 1x type K, cl.1; INCONEL600, max. 1100 °C B 2x type K, cl.1; INCONEL600, max. 1100 °C E 1x type J, cl.1; 316L, max. 800 °C F 2x type J, cl.1; 316L, max. 800 °C Y Special version, TSP-no. to be specified
TC Standard; Hot junction:										
										1 IEC584-2, ungrounded 2 IEC584-2, grounded 3 ANSI MC96.1, ungrounded 4 ANSI MC96.1, grounded 9 Special version, TSP-no. to be specified
Factory test:										
										0 not needed 1 Inspection sensor 2 Inspection TC + TMT 9 Special version, TSP-no. to be specified
Additional option:										
										Y Special version, TSP-no. to be specified 0 not needed
TC88-										← Order code (complete)

Documentation

Technical Information:

- TC Insert for Temperature Sensor Omniset TPC100 (TI278t/02/en)
- Temperature head transmitter:
 - iTEMP® PCP TMT181 (TI070r/09/en)
 - iTEMP® HART® TMT182 (TI078r/09/en)
 - iTEMP® TMT84 PA (TI138r/09/en)
 - iTEMP® TMT85 FF (TI134r/09/en)

Technical Informations thermowells:

Type of thermowell					
TA535	TI250t/02/en	TW15	TI265t/02/en	TA570	TI161t/02/en
TA540	TI166t/02/en	TA560	TI159t/02/en	TA571	TI178t/02/en
TA550	TI153t/02/en	TA562	TI230t/02/	TA572	TI179t/02/en
TA555	TI154t/02/en	TA565	TI160t/02/en	TA575	TI162t/02/
TA557	TI156t/02/en	TA566	TI177t/02/en	TA576	TI163t/02/

Hazardous area supplementary documentation:

- Omnigrad TRxx/TCxx RTD/TC Thermometer ATEX II 1GD or II 1/2GD (XA072r/09/a3)
- Omnigrad TRxx/TCxx RTD/TC Thermometer ATEX II 3GD (XA044r/09/a3)

Application example

Technical Information:

- Field display RIA16 (TI144r/09/en)
- Active barrier with power supply RN221N (TI073R/09/en)

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