



OPTITEMP TRA-H6X/-C6X Technical Datasheet

Temperature sensors for hygienic applications
Type TRA-H65, TRA-C65, TRA-H61, TRA-C61

- Class A - accuracy at short insertion depth
- Fast responding sensor, $t_{50} \leq 2$ s
- G1/2 hygienic adapter systems



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1.1 Temperature sensors for hygienic applications

The food and beverage industry is subject to constant change and faces rather short product life cycles. On top of that, there are strict hygienic and legal regulations that must be adhered to. KROHNE is facing these challenges. We offer a wide range of temperature measuring instruments including complete solutions plus services.

Our temperature sensors of the **TRA-H65, TRA-C65, TRA-H61 and TRA-C61** series are used to measure the temperature of gases, liquids, vapour and solids in industrial and hygienic applications.

The devices are particularly suited to the measurement of liquids with low viscosity, water and chemicals with low corrosiveness, saturated steam and superheated steam.

Our temperature sensors are the devices, which are required most in the food process. Many processes as, e.g., pasteurisation or the mashing process are temperature controlled. All hygienic temperature sensor assemblies feature a robust design, meticulous workmanship and dimensional accuracy.

Certified materials, testing throughout the production process and consistent final inspections guarantee the consistently high quality of our products.



Figure 1-1: Different designs

- ① Type TRA-H65 is a standard hygienic sensor with clamp connection
- ② Type TRA-H61 is a standard hygienic sensor with G1/2 thread
- ③ Type TRA-C65 is a compact hygienic sensor with clamp connection
- ④ Type TRA-C61 is a compact hygienic sensor with G1/2 thread

Highlights

- Class A accuracy at short insertion depth
- Fast responding sensor: $t_{50} \leq 2$ s
- Standard and compact sensor design
- Compact, fast and precise measurement
- Replaceable and non-replaceable Pt100 insert
- Very good repeatability and long-term stability
- Manufactured in hygienic design, EHEDG or 3-A
- Surface roughness of $Ra \leq 0.8$ μ m
- Stainless steel connection head, M24 x 1.5
- Optional with 4...20 mA temperature transmitter
- Rugged, vibration-proof sensor design
- Ingress protection IP66/67, optional IP69
- G1/2 hygienic adapter system, compatible with a broad variety of hygienic connections

Industries

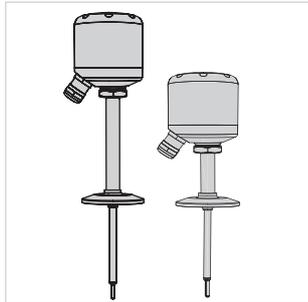
- Food & Beverage

Applications

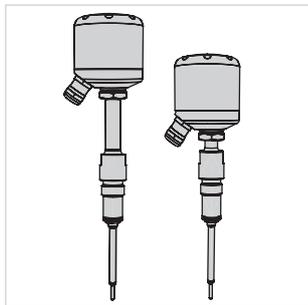
- Temperature measurement in the mash tun
- Temperature control in the sugar dissolving tank
- Temperature measurement before separator
- Pasteurisation control
- Temperature control after heat exchanger
- CIP temperature control
- Temperature control in the extraction tower at sugar plants
- Tempering of chocolate
- Fermentation control in breweries
- Temperature control at the wort cooler

1.2 Options and variants

Standard temperature sensor



(Temperature sensor with clamp connection)



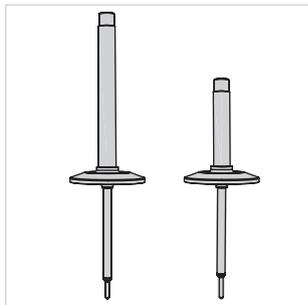
(Temperature sensor with G1/2 thread)

A hygienic standard temperature sensor consists besides a process connection of a neck tube ending in a connection head, suitable to include a head-mounted transmitter.

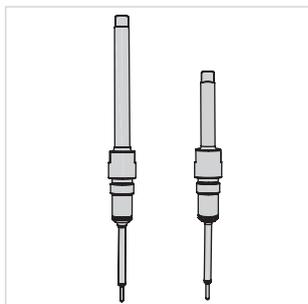
They are available as temperature sensors with clamp connection and with G1/2 thread. Both types are available in two versions:

- With a $\varnothing 6$ mm / $\varnothing 0.24$ " thermowell reduced to $\varnothing 4$ mm / $\varnothing 0.16$ ", suitable to take a replaceable $\varnothing 3$ mm / $\varnothing 0.12$ " Pt100 insert
- With a $\varnothing 6$ mm / $\varnothing 0.24$ " sensor rod reduced to $\varnothing 3$ mm / $\varnothing 0.12$ " including a completely sealed fast responding Pt100 RTD

Compact temperature sensor



(Temperature sensor with clamp connection)



(Temperature sensor with G1/2 thread)

Compact temperature sensors have a small form factor and are suitable for almost any application.

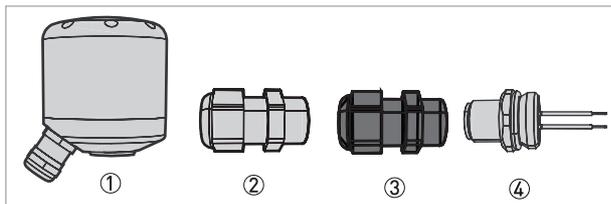
They are easy to commission and maintain.

Compact temperature sensors don't use heads, head-mounted transmitters or replaceable inserts. Their solid mechanical design has no removable parts, which makes them highly resistant to mechanical stress and less cost intensive.

If a 4...20 mA output signal is selected, transmitter electronics is installed inside the $\varnothing 13.5$ mm / $\varnothing 0.53$ " housing tube. If a bare Pt100 signal is required, the housing tube remains empty.

They are available as temperature sensors with clamp connection and with G1/2 thread.

Connection head



[Available connection head and cable entries]

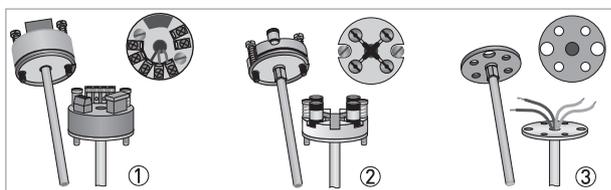
- ① Hygienic head type BHY
- ② Stainless steel cable gland
- ③ PA cable gland
- ④ M12 connector

Connection heads protect the terminals and the temperature transmitter from environmental influences (e.g. dirt, dust and moisture).

They have an M24 x 1.5 mm neck connection. It's lid features an oil-resistant rubber gasket.

Connection heads for the food and beverage industry are typically made from stainless steel.

Measuring inserts



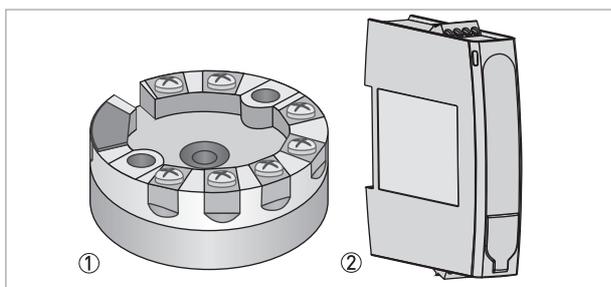
[Available measuring insert versions]

- ① With head-mounted temperature transmitter
- ② With ceramic terminal block
- ③ With flying wires

The $\varnothing 3$ mm / $\varnothing 0.12$ " replaceable measuring insert contains the Pt100 sensing element which is used for hygienic temperature sensors.

The measuring insert is inserted through the open connection head into the temperature assembly and attached using two spring loaded M4 screws, guaranteeing that the inserts tip is in constant contact with the bottom of the thermowell.

Temperature transmitters



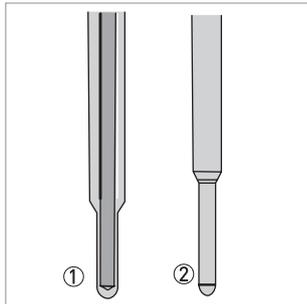
[Types of temperature transmitters]

In most cases head-mounted transmitters are used together with hygienic temperature sensors.

Electrical thermometers have just one, weak, interference-prone output signal. If this signal has to travel a great distance or if a standard signal of 4...20 mA is required, the use of a temperature transmitter is recommended.

- ① Head-mounted transmitter:
Located on the measuring insert and thus in the connection head of the temperature assembly during operation, recognisable by the "C" in the product name (e.g. TT 22 C).
- ② Rail-mounted transmitter:
Located in the control cabinet or field housing, recognisable by the "R" in the product name (e.g. TT 22 R). They are usually used when the temperature in the connection head does not allow the use of a head-mounted transmitter.

Thermowells, sensor rods and different tip designs



(Different tip designs)

- ① Ø4 mm / Ø0.16" sensor with replaceable Pt100 insert
- ② Ø3 mm / Ø0.12" sensor with fast responding Pt100 tip

The thermowell is designed to prevent external loads, e.g. static pressure and flow from damaging the measuring insert respectively the sensing element.

As a rule, thermowells are made of the same material as the system in which the measuring is done. For hygienic applications, it's typically stainless steel.

Depending on the required thermal response time, hygienic temperature sensors can be equipped with a protective thermowell or directly immersed into the medium if this is allowed.

The thermowells advantage is that the temperature assembly is more rugged and that the sensing element, here the Pt100 insert, can be exchanged without opening the process.

However, a sensor with thermowell responds slower than a directly immersed sensor.

To decrease response time, all sensors have a 15 mm / 0.59" reduced tip in general, either Ø4 x 15 mm / Ø0.16 x 0.59" or Ø3 x 15 mm / Ø0.12 x 0.59".

1.3 Measuring principle

All of the temperature assemblies described here belong to the class known as "contact temperature assemblies". Unlike "radiation temperature assemblies", these temperature assemblies come into direct contact with the medium whose temperature they are to measure.

The "OPTITEMP TR/TC 100" handbook goes into more detail regarding the various basic physical foundations of temperature measurement using measuring inserts with e.g. a Pt100 RTD.

2.1 Technical data tables

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

Measuring system

Application range	Measuring the temperature of gases, liquids and vapours in hygienic processes. The devices are particularly suited to liquids with low viscosity, water and substances with low corrosiveness as well as saturated steam.
Measuring principle	Contact temperature sensor
Measured value	Temperature

Design

Modular design	Standard hygienic temperature sensors consist of several components which form an assembly: <ul style="list-style-type: none"> • Measuring insert with sensing element • Thermowell with neck tube (short or long) or sensor rod • Hygienic connection head • Temperature transmitter
	Compact hygienic temperature sensors have no exchangeable parts and may include a sealed transmitter or not.
Transmitter	Temperature transmitters of the TT family as head-mount or rail-mount version.
	Integrated transmitter on compact sensors.
Temperature sensor	Thin film Pt100 RTD elements following IEC 60751.
	Type TRA-H65 is a standard hygienic sensor with clamp connection.
	Type TRA-C65 is a compact hygienic sensor with clamp connection.
	Type TRA-H61 is a standard hygienic sensor with G1/2 thread.
	Type TRA-C61 is a compact hygienic sensor with G1/2 thread.

Measuring accuracy

Reference conditions	Ambient temperature: +23°C / +73.4°F Fluctuations due to air pressure and density have no impact on measuring accuracy.
Maximum measuring error	The maximum measuring error depends on the type of sensor. Measuring insert with Pt100 RTD: measuring error in accordance with tolerance classes A and B according to IEC 60751
Accuracy of sensor	Class A from -30...+200°C \pm (0.15 + 0.002 x abs[t]) Class B from -50...-30°C \pm (0.30 + 0.005 x abs[t])
Compact sensors with integrated 4...20 mA transmitter	\pm 0.15°C or \pm 0.15% of span, whatever is more
For further information refer to <i>Measuring accuracy</i> on page 19.	

Operating conditions

Load limits	The load limits depend on several factors e.g. dimensions, design, material and process connections (e.g. used process adapters).
Temperature	
Process temperature	
TRA-H61, TRA-H65	With fast responding sensor tip: -50...+200°C / -58...+392°F With replaceable measuring insert: -50...+300°C / -58...+572°F
TRA-C61, TRA-C65	Without transmitter: -50...+200°C / -58...+392°F With transmitter: -50...+150°C / -58...+302°F
Ambient and storage temperature	
TRA-H61, TRA-H65 without transmitter	With cable gland: -40...+100°C / -40...+212°F With M12 connector: -30...+100°C / -22...+212°F
TRA-H61, TRA-H65 with transmitter	With cable gland: -40...+80°C / -40...+176°F With M12 connector: -30...+80°C / -22...+176°F
TRA-C61, TRA-C65 without transmitter	With M12 connector: -30...+100°C / -22...+212°F
TRA-C61, TRA-C65 with transmitter	With M12 connector: -30...+80°C / -22...+176°F
For further information refer to <i>Permissible temperatures</i> on page 20.	
Pressure	
Process pressure	0...40 bar / 0...580 psi, depending on used adapter
Other conditions	
Ingress protection	IP66/67 or IP69 according to DIN EN 60529, depending on cable gland and connector

Installation conditions

Insertion angle	90° to the flow, directly against or diagonally against the flow
Insertion length (recommended)	Pipes \geq DN25 / 1": DN25: 22 mm / 0.87"; DN40, DN50, DN65: 30 mm / 1.18"; DN80: 40 mm / 1.57"; DN100: 50 mm / 1.97"; DN125, DN150: 70 mm / 2.76" Vessels, tanks: 80...200 mm / 3.15...7.87"

Materials

Wetted parts, process connections	1.4404 / 316 L
Connection heads	1.4408
Neck tubes, extensions	1.4404 / 316 L or similar
Measuring inserts	1.4404 / 316 L or similar
Compact sensor housings	1.4404 / 316 L
Hygienic process adapters	1.4404 / 316 L (for details refer to <i>Hygienic adapters</i> on page 17)
Gaskets (optional)	PEEK

Process connections

Basic process connections	G1/2 hygienic thread
	Tri-Clamp 1...1 1/2" and 2"
	ISO 2852, 25 mm, 38 mm, 40 mm and 51 mm (standard rejected)
	DIN 32676: DN25, DN40 and DN50
G1/2 hygienic adapters	For detailed information refer to <i>Hygienic adapters</i> on page 17.

Sensor properties

Sensing element	1 x Pt100-4-wires according to IEC 60751
Thermal response time	Ø3 x 15 mm / Ø0.12 x 0.59" tip: t_{05}/t_{09} : 2 s / 6.1 s in water, 0.4 m/s
	Ø4 x 15 mm / Ø0.16 x 0.59" tip: t_{05}/t_{09} : 5.8 s / 22 s in water, 0.4 m/s with replaceable Ø3 mm / Ø0.12" Pt100 RTD insert
Isolation resistance	20°C ± 15°C / 68°F ± 27°F: > 100 MΩ
	200°C ± 15°C / 212°F ± 27°F: > 20 MΩ
Self heating error	Ø3 mm / Ø0.12" fast responding sensor: 0.07 K/mW
	Ø4 mm / Ø0.16" well with Ø3 mm / Ø0.12" insert: 0.23 K/mW

Connection head

Hygienic connection head	Type BHY
Design	Size B according to DIN EN 50446:2007-04
Dimensions	Ø61 x 66 mm / Ø2.40 x 2.60"
Weight	476 g / 1.05 lb
Process thread	M24 x 1.5
Cable thread	M16 x 1.5

Electrical connections

Electrical properties for standard sensors, optional with head-mounted transmitter	
Power supply	Only necessary when using a temperature transmitter and depends on transmitter type, typically 24 VDC
Power consumption	Relevant only when using a temperature transmitter; typically 550 mW
Cable entry	M16 x 1.5 or M12 connector, compact sensors always M12
Cable connection	Sensors with head: ceramic socket, replaceable Pt100 insert or printed boards with screw connector
	Compact sensors: M12 male connector
Current output	
Output range	Relevant only when using a temperature transmitter; typically 4...20 mA, HART®
Error signal	According to NAMUR NE 43; selectable: upper value ≥ 21.0 mA, lower value ≤ 3.6 mA
Load	Relevant only when using a temperature transmitter and then dependent on transmitter type; typically 700 Ω at 24 VDC
Other electrical characteristics	
Galvanic isolation	Relevant only when using a temperature transmitter (refer to handbook for transmitter).
Ambient temperature influence	Relevant only when using a temperature transmitter (refer to handbook for transmitter).
Inductance and capacitance	$\varnothing 3 \times 15$ mm / $\varnothing 0.12 \times 0.59$ " with fast responding tip: $L_i < 1$ μ H, $C_i < 50$ pF
	$\varnothing 4 \times 15$ mm / $\varnothing 0.16 \times 0.59$ " with replaceable insert: $L_i < 1$ μ H, $C_i < 200$ pF
Electrical properties for compact sensors with integrated 4...20 mA transmitter	
Load	750 Ω at 24 VDC
Cable entry	M12 connector
Error signal	According to NAMUR NE 43; selectable: upper value ≥ 21.0 mA, lower value ≤ 3.6 mA
Galvanic separation	Without
Long-term stability, drift	0.1% of span per year
Power supply, consumption	Nominal 24 VDC; range 7.5...32 VDC, 550 mW max.
Range	-50...+200°C / -58...+392°F, configurable

Approvals and compliance

CE	The device fulfils the statutory requirements of the EU directives. The manufacturer certifies that these requirements have been met by applying the CE marking.
Electromagnetic compatibility	TRA-H6x standard sensors: refer to temperature transmitter handbook
	TRA-C6x compact sensors: according to IEC 61326-1
ATEX, intrinsical safety	"Simple apparatus certificate" is available on request.
Functional safety	SIL 2 with temperature transmitter TT 51 C/R
EHEDG compliance	TRA-H61, TRA-C61: approval EL class I
3-A certification	TRA-H65, TRA-C65
RoHS, China RoHS	Declaration of conformity (DoC)
Regulation 1935/2004 EU	Declaration of conformity (DoC) Materials and articles intended to come into contact with food
Regulation 2023/2006 EU	Good manufacturing practise for materials and articles intended to come into contact with food

Regulation 10/2011 EU	On plastic materials and articles intended to come into contact with food
Vibration resistance	Compact sensors according to: IEC 60751, section 6.6.4, method IEC 60068-2-6: 10...500 Hz, 30 m/s ²
	Standard sensors with stainless steel head according to: IEC TR 60721-4-4, class 4M5, method IEC 60068-2-6: 5...200 Hz, 10 m/s ² , ±3.5 mm IEC 61298-3: endurance, method IEC 60068-2-6: 10...1000 Hz, 20 m/s ² , ±0.15 mm
Shock resistance	All sensors according to: IEC TR 60721-4-4 class 4M5, method IEC 60068-2-27: 600 shocks, 25 g, 6 ms IEC 60751, section 6.6.5: drop test: 10 drops, 250 mm on 6 mm steel plate
Climate conditions	IEC 60654-1, class C

2.2 Dimensions

2.2.1 Connection heads

Recommended head for hygienic applications

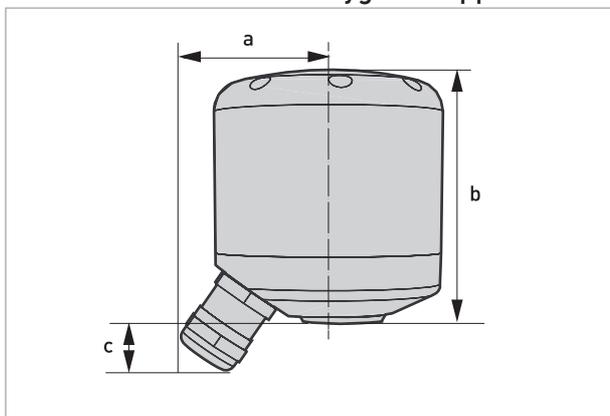


Figure 2-1: Hygienic connection head Type BHY (stainless steel, IP66/67/69)

Dimensions	[mm]	[inch]
a	39	1.5
b	66	2.6
c	21	0.8

Table 2-1: Dimensions in mm and inch

The inside dimensions of the connection heads depicted here comply with DIN 43735.

2.2.2 Standard hygienic sensors with clamp connection

Hygienic sensors with clamp connection and $\varnothing 3$ mm / $\varnothing 0.12$ " replaceable insert, respectively sensors with fix installed Pt100 are available in following dimensions:

TRA-H65, $\varnothing 6$ mm / $\varnothing 0.24$ " reduced to $\varnothing 4$ mm / $\varnothing 0.16$ " respectively $\varnothing 3$ mm / $\varnothing 0.12$ "

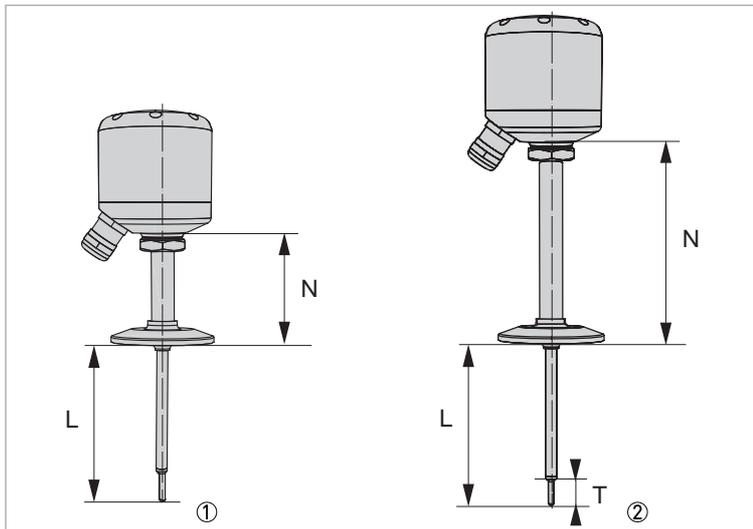


Figure 2-2: Dimensions of sensors with clamp connection

- ① Short neck
- ② Long neck

	Short neck ①	Long neck ②
N	50 mm / 1.97"	90 mm / 3.54"
T (replaceable)	$\varnothing 4 \times 15$ mm / $\varnothing 0.16 \times 0.59$ "	$\varnothing 4 \times 15$ mm / $\varnothing 0.16 \times 0.59$ "
T (fast responding)	$\varnothing 3 \times 15$ mm / $\varnothing 0.12 \times 0.59$ "	$\varnothing 3 \times 15$ mm / $\varnothing 0.12 \times 0.59$ "

Table 2-2: Dimensions of sensors with clamp connection

Insertion length, L		Pt100 measuring insert length, Li			
Tightening surface to tip		Short neck sensor		Long neck sensor	
[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
50	1.97	125	4.92	165	6.50
70	2.76	145	5.71	185	7.28
80	3.15	155	6.10	195	7.68
90	3.54	165	6.50	205	8.07
100	3.94	175	6.89	215	8.46
130	5.12	205	8.07	245	9.65
150	5.91	225	8.86	265	10.43
180	7.09	255	10.04	295	11.61
200	7.87	275	10.83	315	12.40

Table 2-3: Dimensions of well and insert

2.2.3 Compact hygienic sensors with clamp connection

Compact hygienic sensors don't contain a replaceable insert but a fast responding Pt100 sensing element sealed at the end of the tip. They are available in following dimensions:

TRA-C65, Ø6 mm / Ø0.24" reduced to Ø3 mm / Ø0.12"

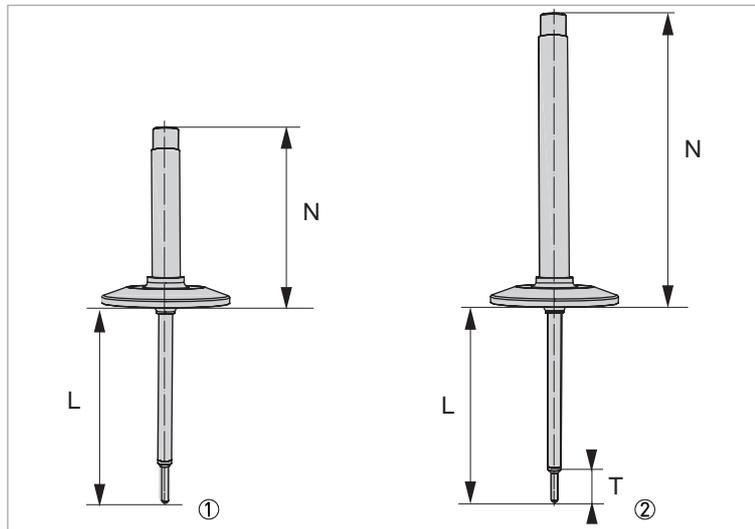


Figure 2-3: Dimensions of sensors with clamp connection

- ① Short neck
- ② Long neck

	Short neck ① without transmitter	Long neck ② with transmitter
N	79 mm / 3.11"	129 mm / 5.08"
Sensor tip T	Ø3 x 15 mm / Ø0.12 x 0.59"	Ø3 x 15 mm / Ø0.12 x 0.59"

Table 2-4: Dimensions of sensors with clamp connection

Compact clamp sensors insertion lengths, L corresponds to the insertion lengths of standard clamp sensors. For further information refer to *Standard hygienic sensors with clamp connection* on page 13.

ISO 2852	DIN 32676	Tri-Clamp
25/38 mm	DN25/DN40	1 1/2"
40/51 mm	DN50	2"

Table 2-5: Dimensions of clamp

2.2.4 Standard hygienic sensors with G1/2 thread

Hygienic sensors with 1/2 inch hygienic thread and $\varnothing 3$ mm / $\varnothing 0.12$ " replaceable insert, respectively sensors with fix installed Pt100 are available in following dimensions:

TRA-H61, $\varnothing 6$ mm / $\varnothing 0.24$ " reduced to $\varnothing 4$ mm / $\varnothing 0.16$ " respectively $\varnothing 3$ mm / $\varnothing 0.12$ "

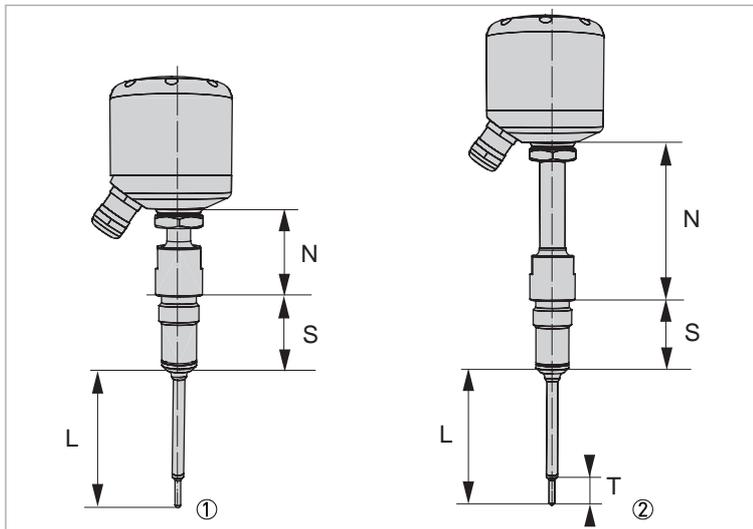


Figure 2-4: Dimensions of sensors with G1/2 thread

- ① Short neck
- ② Long neck

	Short neck ①	Long neck ②
N	44 mm / 1.73"	84 mm / 3.31"
Nozzle S	36 mm / 1.42	36 mm / 1.42
T (replaceable)	$\varnothing 4 \times 15$ mm / $\varnothing 0.16 \times 0.59$ "	$\varnothing 4 \times 15$ mm / $\varnothing 0.16 \times 0.59$ "
T (fast responding)	$\varnothing 3 \times 15$ mm / $\varnothing 0.12 \times 0.59$ "	$\varnothing 3 \times 15$ mm / $\varnothing 0.12 \times 0.59$ "

Table 2-6: Dimensions of sensors with G1/2 thread

The sensors tip size depends on the selected variant. The fast responding sensors tip is $\varnothing 3$ mm / $\varnothing 0.12$ " in diameter, the variant with replaceable insert measures $\varnothing 4$ mm / $\varnothing 0.16$ ".

Insertion length, L		Pt100 measuring insert length, Li			
Tightening surface to tip		Short neck sensor		Long neck sensor	
[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
22	0.87	127	5.00	167	6.57
30	1.18	135	5.31	175	6.89
50	1.97	155	6.10	195	7.68
70	2.76	175	6.89	215	8.46
80	3.15	185	7.28	225	8.86
90	3.54	195	7.68	235	9.25
100	3.94	205	8.07	245	9.65
130	5.12	235	9.25	275	10.83

Insertion length, L		Pt100 measuring insert length, Li			
Tightening surface to tip		Short neck sensor		Long neck sensor	
[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
150	5.91	255	10.04	295	11.61
180	7.09	285	11.22	325	12.80
200	7.87	305	12.01	345	13.58

Table 2-7: Dimensions of well and insert

2.2.5 Compact hygienic sensors with G1/2 thread

Compact hygienic sensors don't contain a replaceable insert but a fast responding Pt100 sensing element sealed at the end of the tip. They are available in following dimensions:

TRA-C61, Ø6 mm / Ø0.24" reduced to Ø4 mm / Ø0.16" respectively Ø3 mm / Ø0.12"

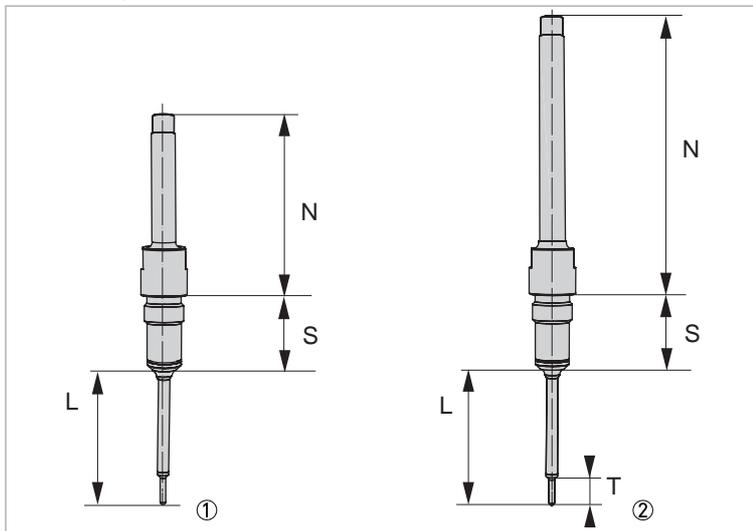


Figure 2-5: Dimensions of sensors with G1/2 thread

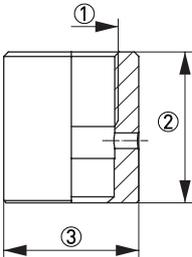
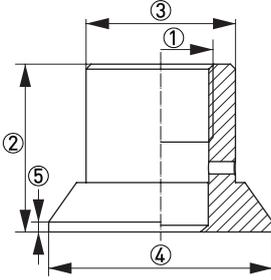
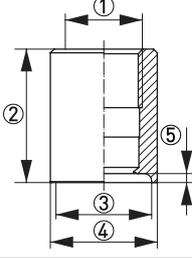
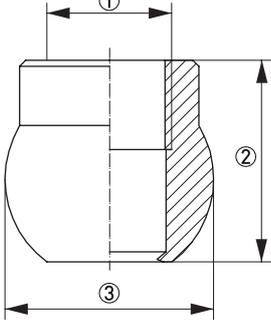
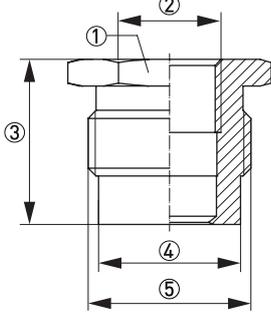
- ① Short neck
- ② Long neck

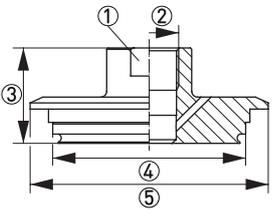
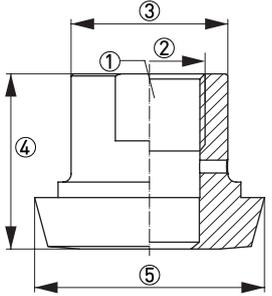
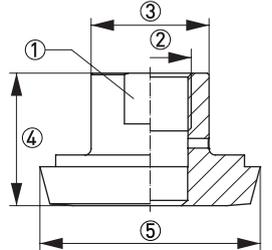
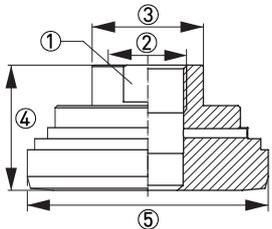
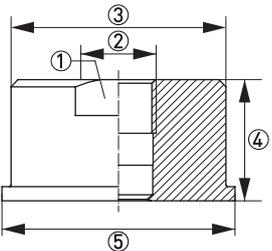
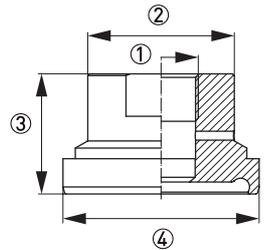
	Short neck ①	Long neck ②
N	96 mm / 3.78"	146 mm / 5.75"
Nozzle S	36 mm / 1.42	36 mm / 1.42
Sensor tip T	Ø3 x 15 mm / Ø0.12 x 0.59"	Ø3 x 15 mm / Ø0.12 x 0.59"

Table 2-8: Dimensions of sensors with G1/2 thread

Compact threaded sensors insertion lengths, L corresponds to the insertion lengths of standard threaded sensors. For further information refer to *Standard hygienic sensors with G1/2 thread* on page 15.

2.2.6 Hygienic adapters

Type of connection	Order code	Type / order code	Max. pressure	Drawing	Dimensions
Straight weld-in sleeve Ø30 mm / Ø1.2"	A	KPW3-321	100 bar / 1450 psi		<ul style="list-style-type: none"> ① G1/2 ② 34 mm / 1.3" ③ Ø30 mm / 1.2" EHEDG certified
Collared weld-in sleeve	L	KPW3-322	40 bar / 580 psi		<ul style="list-style-type: none"> ① G1/2 ② 34 mm / 1.3" ③ 10 mm / 0.4" ④ Ø45 mm / 1.8" ⑤ 2 mm / 0.08" EHEDG certified
Weld-in sleeve with shoulder DN25...50	K	KPW2-326	40 bar / 580 psi		<ul style="list-style-type: none"> ① G1/2 ② 36.5 mm / 1.4" ③ 26 mm / 1" ④ Ø29 mm / 1.1" ⑤ 2.5 mm / 0.1"
Spherical weld-in sleeve Ø35 x 34 mm / Ø1.4 x 1.3"	G	KPW2-324	-		<ul style="list-style-type: none"> ① G1/2 ② 34 mm / 1.3" ③ Ø35 mm / 1.4"
Hygienic G1 to G 1/2 adapter	F	KPH1-32CB	40 bar / 580 psi		<ul style="list-style-type: none"> ① WS36 ② G1/2 ③ 34 mm / 1.3" ④ Ø29 mm / 1.1" ⑤ G1A

Type of connection	Order code	Type / order code	Max. pressure	Drawing	Dimensions
VARIVENT N (DN40/DN50) O-ring	B	KPH3-324E KPX2-323	10 bar / 145 psi		① WS27 ② G1/2 ③ 34 mm / 1.3" ④ Ø68 mm / Ø2.7" ⑤ Ø84 mm / Ø3.3" EHEDG certified
Dairy connection DIN 11851, DN25 Union nut Gasket	C	KPH3-3221 KPX4-140 KPX3-9110	40 bar / 580 psi		① WS27 ② G1/2 ③ Ø30 mm / 1.2" ④ Ø34 mm / 1.3" ⑤ Ø44 mm / 1.7"
Dairy connection DIN 11851, DN40 Union nut Gasket	D	KPH3-3224 KPX4-440 KPX3-9140	40 bar / 580 psi		① WS27 ② G1/2 ③ Ø30 mm / 1.2" ④ Ø34 mm / 1.3" ⑤ Ø56 mm / 2.2"
Dairy connection DIN 11851, DN50 Union nut Gasket	E	KPH3-3225 KPX3-9150 KPX4-540	10 bar / 145 psi		① WS27 ② G1/2 ③ Ø30 mm / 1.2" ④ Ø34 mm / 1.3" ⑤ Ø65 mm / 2.6"
SMS 1145 (DN51) Union nut Gasket	H	KPH1-3236 KPX4-630 KPX3-8160			① WS55 ② G1/2 ③ Ø60 mm / 2.4" ④ Ø34 mm / 1.3" ⑤ Ø65 mm / 2.6"
Hygienic adapters according to DIN 11864-1 Form A, DN40 Union nut Gasket	M	KPH3-3254 KPX4-440 KPX3-9140	40 bar / 580 psi		① G1/2 ② Ø41 mm / 1.6" ③ Ø34 mm / 1.3" ④ Ø54.9 mm / 2.16" EHEDG certified

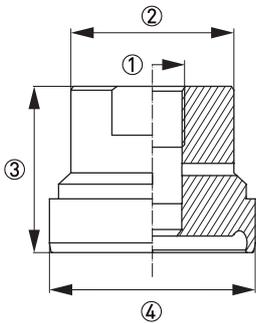
Type of connection	Order code	Type / order code	Max. pressure	Drawing	Dimensions
Hygienic adapters according to DIN 11864-1 Form A, DN50 Union nut Gasket	N	KPH3-3255 KPX4-540 KPX3-9150	25 bar / 362 psi		① G1/2 ② Ø53 mm / 2.1" ③ Ø34 mm / 1.3" ④ Ø66.9 mm / 2.6" EHEDG certified

Table 2-9: Available hygienic adapters

Union nuts and gaskets are not within the scope of delivery. In case they are needed as well, they can be ordered as a spare part. For further information on hygienic adapters please refer to the "Hygienic Accessories Data-Sheet" available from our website.

2.3 Measuring accuracy

The measuring accuracy depends largely on the following factors:

- The tolerance of the selected measuring insert, respectively sensor. For further information refer to *Technical data tables* on page 8.
- The sufficient insertion length of the thermowell, respectively sensor rod, for good thermal coupling to the process temperature. The longer the insertion depth, the better the thermal coupling and the smaller the heat conduction error. Recommended minimum insertion depth of these sensors is 22 mm / 0.87".
- The type of temperature transmitter used. If a transmitter is used, its uncertainty should be added to the sensor error respectively sensor tolerance.

Please consult the appropriate handbook for further information regarding the accuracy of the measuring inserts and the temperature transmitters.

The recommended temperature transmitters generate an analogue 4...20 mA output signal. For this reason, the following table indicates their measuring accuracy:

Type	Accuracy	Remarks
TT 12 C	0.15°C or 0.15% of span	Programmable, NFC, non-isolated
TT 22 C	0.10°C or 0.10% of span ①	Programmable, non-isolated
TT 33 C	0.08°C or 0.08% of span	Programmable, NFC, isolated, (Bluetooth®)
TT 51 C	0.10°C or 0.05% of span	HART® 6, dual input, SIL2
TT 53 C	0.08°C or 0.08% of span	HART® 7, single input, wireless, NFC, (Bluetooth®)

Table 2-10: Measuring accuracies of the temperature transmitters

① Compact sensor transmitter accuracy complies with TT 22

2.4 Process connections

Standard process connections are G1/2 hygienic and clamp connections (for details refer to *Standard hygienic sensors with clamp connection* on page 13). In addition, various G1/2 adapters with typical hygienic process connections are available as accessories (for details refer to *Hygienic adapters* on page 17).

2.5 Measuring range and permitted load

To prevent destruction or damage, never operate the temperature assembly outside of its permissible mechanical, thermal or chemical limits. For further information refer to the rest of this section and the "Technical data" section.

The information in this subsection is informative only and does not reflect the vibration load caused by flow-induced vibration. If necessary, prior to purchasing and installing an industrial temperature assembly, have a specific strength calculation performed.

2.6 Permissible temperatures

Depending on a sensor configuration, the permitted maximum temperature may differ.

Sensor	Design	T _{min.}		T _{max.}		Remarks
		[°C]	[°F]	[°C]	[°F]	
TRA-H61, TRA-H65	Standard with cable gland	-40	-40	+100	+212	Without transmitter
	Standard with M12 connector	-30	-22	+100	+212	
TRA-H61, TRA-H65	Standard with cable gland	-40	-40	+80	+176	With transmitter
	Standard with M12 connector	-30	-22	+80	+176	
TRA-C61, TRA-C65	Compact	-30	-22	+100	+212	Without transmitter
TRA-C61, TRA-C65	Compact	-30	-22	+80	+176	With transmitter

Table 2-11: Ambient temperatures

Sensor	Design	T _{min.}		T _{max.}		Remarks
		[°C]	[°F]	[°C]	[°F]	
TRA-H61, TRA-H65	Fast responding	-50	-58	+200	+392	With or without transmitter
TRA-H61, TRA-H65	With replaceable insert	-50	-58	+300	+572	
TRA-C61, TRA-C65	Compact	-50	-58	+200	+392	Without transmitter
TRA-C61, TRA-C65	Compact	-50	-58	+150	+302	With transmitter

Table 2-12: Process temperatures

When using sensors with EHEDG certified hygienic adapters maximum temperature is limited to +140°C / +284°F with respect to the mandatory PEEK gasket.

2.7 Sensor response times

Sensor response times are generally indicated as "50% time" (t_{05}) and "90% time" (t_{09}). "50% time" refers to the time needed for a temperature assembly signal to achieve 50% of its end value in the face of erratic temperature changes (this applies analogously to "90% time").

Following results had been archived with Pt100 sensors (without transmitter) in water at 0.4 m/s, according to VDI/VDE 3522-2014:

Sensor	Design	$t_{(50\%)}$	$t_{(63.2\%)}$	$t_{(90\%)}$	$t_{(95\%)}$
		[s]			
TRA-C61, TRA-C65	Compact design	2.0	2.7	6.1	8.0
TRA-H61, TRA-H65	With fast responding tip	2.0	2.7	6.1	8.0
TRA-H61, TRA-H65	With measuring insert $\varnothing 3$ mm / $\varnothing 0.12$ "	5.8	8.1	22.0	34.0

Table 2-13: Sensor response times

3.1 Intended use

Responsibility for the use of the measurement devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The temperature sensors of the TRA-Hxx and TRA-Cxx series are used to measure the temperature of gases, liquids, vapour and solids in industrial and hygienic applications. The devices are particularly suited to the measurement of

- liquids with low viscosity,
- water and chemicals with low corrosiveness,
- saturated steam and superheated steam.

Type TRA-H65 is a standard hygienic sensor with clamp connection.

Type TRA-C65 is a compact hygienic sensor with clamp connection.

Type TRA-H61 is a standard hygienic sensor with G1/2 thread.

Type TRA-C61 is a compact hygienic sensor with G1/2 thread.

3.2 Installation instructions

Take the following points into consideration prior to installing the device:

- *The dimensions of the thermowell (length, diameter, wall thickness, type of tip) comply with the requirements of the measuring point. The mechanical load as a result of flowing media, vibration and resonances is the focus here. In addition, incorrect dimensions can lead to measurement errors.*
- *The thermowell is sufficiently resistant to chemically aggressive media (refer to the generally accessible corrosion tables). Otherwise, corrosion may occur or the medium may penetrate into the thermowell. When in doubt, select a thermowell made from the same material as your system.*

3.2.1 Possible installations

Installation site, angle and length

Installations include the parameters "installation site", "installation angle" and "insertion length". Depending on the space available and the diameter of the pipe, three installations are recommended for pipes with flowing product:

- Small pipe diameter: Installation directly against the direction of flow in a bend in the pipe (①).
- Small pipe diameter: Installation diagonally against the direction of flow, if a bend in the pipe is available (②).
- Large pipe diameter: Vertical installation, if flow-induced periodic vortex shedding does not cause the temperature assembly to vibrate in its resonance frequency (③).

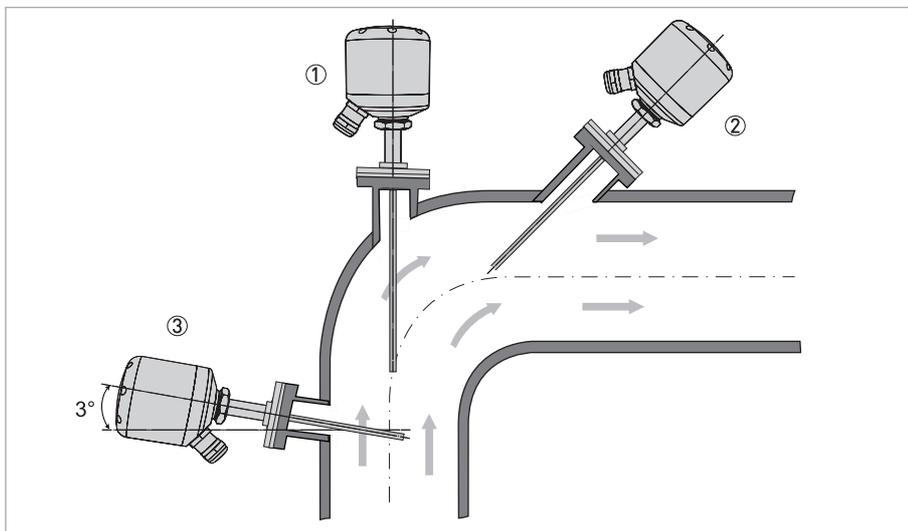


Figure 3-1: Recommended installations

Permitted insertion length of the thermowell or measuring insert

The insertion length (b) of the thermowell or measuring insert refers to the distance from the seal of the process connection or the bottom of the flange to the tip of the thermowell or sensor rod. This length determines how far the sensor projects into the measured medium.

To avoid measurement errors and fulfil hygienic requirements as well, ensure that the insertion length (b) meets the following requirements:

- Insertion length in pipelines: $b \geq L + 22 \text{ mm} / 0.87''$
- Pipes with $(a) < \varnothing 200 \text{ mm} / 7.87''$: sensor/thermowell's tip should project past the middle of the pipe if possible
- The relation $L \leq (D - d)$ must be maintained for cleanability reasons

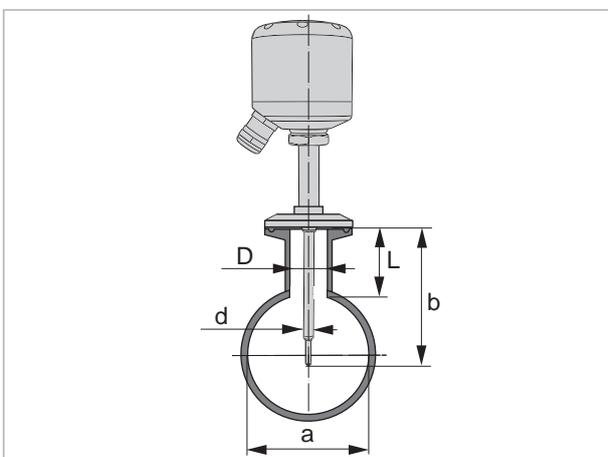


Figure 3-2: Recommended insertion length

L: length of the nozzle

b: insertion length into the pipe

D: inner diameter of the nozzle

a: inner diameter of the pipe

d: outer diameter of sensor rod/thermowell

Pipe size (a), min.	Pipe size (a), max.	Direct insertion length (b-L)	Flow velocity ①
DN25 / 1"	DN40 / 1 1/2"	22 mm / 0.87"	25 m/s
DN40 / 1 1/2"	DN65 / 2 1/2"	30 mm / 1.18"	22 m/s
DN80 / 3"	DN100 / 4"	50 mm / 1.97"	15 m/s
DN100 / 4"	DN125 / 5"	70 mm / 2.76"	10 m/s
DN125 / 5"	DN150 / 6"	80 mm / 3.15"	9 m/s
DN150 / 6"	DN200 / 8"	90 mm / 3.54"	8 m/s
DN200 / 8"	DN225 / 9"	100 mm / 3.94"	7 m/s
DN225 / 9"	DN250 / 10"	130 mm / 5.12"	6 m/s
DN250 / 10"	DN350 / 12"	150 mm / 5.91"	5 m/s
DN350 / 12"	DN400 / 16"	180 mm / 7.09"	4 m/s

Table 3-1: Examples for recommended sensor insertion length in pipes

① Maximum permitted flow velocity of water at ambient temperature

A sensors insertion length into a pipeline is also limited due to vortex shredding. Vortexes induce vibration into sensor rods and thermowells, leading sooner or later to breakage. Vortex frequency rises with flow velocity. The shorter the insertion length, the lower the risk of the well getting permanent into resonance and getting damaged. In tanks, where normally no stress through flow occurs, longer insertions are possible.

3.2.2 Other installation requirements

- A well-insulated pipeline or tank around the measuring point reduces thermal dissipation and the distorting influence of the ambient temperature.
- If sensors use measuring inserts, the insert must always be in contact with the bottom of the thermowell to avoid measurement errors caused by poor thermal dissipation. This is normally guaranteed by the spring-loaded design of the measuring insert.

3.3 Load limits

The load limits of hygienic temperature sensor depend on several factors:

- Dimensions and design of the thermowell (especially the insertion length)
- Thermowell material (hygienic sensors material: stainless steel)
- Mechanical conditions of the thermowell is subject due to the measured medium (pressure, temperature, flow velocity, viscosity, density)
- Sealable pressure of the process connection
- Vibration load due to vortex shredding

The sheer number of factors at play illustrates the difficulty in making universally valid statements about the load limits.

The table on the page before gives information about permissible flow velocity at ambient temperature and pressure in relation to pipe size and insertion depth.

3.4 Installation notes on the individual device classes

3.4.1 Threaded sensors with or without adapters

The device has to be installed in such a way that drainability and inspectability is ensured. For the recommended installation refer to *Possible installations* on page 23. Welding connection surface treatment should provide a roughness $< 0.8 \mu\text{m}$.

Observe the following for a measuring point in accordance with EHEDG standards:

- We recommend at least an angle of 3° (for further information refer to *Possible installations* on page 23).
- The device has to be installed in such a way that drainability is ensured.
- Center the clamp or VARIVENT[®] connection over the corresponding fitting and gasket.
- Use a suitable connection element (e.g. half ring or clamp ring connection) to attach the device according to the manufacturer's specification.
- Weld in connections must be welded flush to the inside of the tank or pipeline.

Gaskets

Only gaskets which are listed on the EHEDG position paper are permitted. The user is responsible for:

- Using a suitable material.
- The right dimension of the gasket.
- Defining adequate service intervals.

3.4.2 Clamp sensors with flange connection

The device has to be installed in such a way that drainability and inspectability is ensured. For the recommended installation refer to *Possible installations* on page 23. Welding connection surface treatment should provide a roughness $< 0.8 \mu\text{m}$.

Observe the following for a measuring point in accordance with 3-A standards:

- The wetted part materials agree with the latest version of "3-A Sanitary Standards for Sensors and Sensor fittings and Connections, no. 74-". Please be aware that the gasket corresponds to the product and the pressure limits.
- The device must be assembled according to the latest version of "3-A Sanitary Standards for Sanitary Fittings, no. 63-" using appropriate gaskets.

Gaskets

Only elastomer sealing material according to latest no. "3-A Sanitary Standards for Sensors and Sensor fittings and Connections, no. 74-" is permitted.

The user is responsible for:

- Using a suitable material.
- The right dimension of the gasket.
- Defining adequate service intervals.

4.1 Safety instructions

*All work on the electrical connections may only be carried out with the power disconnected.
Take note of the voltage data on the nameplate!*

Observe the national regulations for electrical installations!

*Observe without fail the local occupational health and safety regulations.
Any work done on the electrical components of the measuring device may only be carried out by
properly trained specialists.*

*Look at the device nameplate to ensure that the device is delivered according to your order.
Check for the correct supply voltage printed on the nameplate.*

4.2 Grounding

The thermowells on the hygienic temperature sensors are grounded via the process connection.
No additional grounding is required.

4.3 Ingress protection

The IP protection class of a temperature sensor depends on the type of connection head, sensor housing, cable gland or M12 connector. The following protection classes are available:

- IP66/67: for all hygienic sensors
- IP69: only if a suitable cable gland and O-ring or an M12 connector is used

4.4 Power supply, electrical connections

Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

The only components of a temperature assembly that require a power supply are the measuring insert and any temperature transmitter used. Please consult the product-specific handbooks for information regarding the power supply of these components.

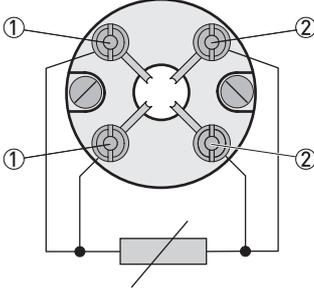
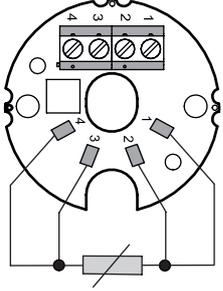
Measuring inserts socket	Printed board connector
	
<p>Ø4 mm / Ø0.16" sensor with Ø3 mm / Ø0.12" insert, connection: 1 x Pt100-A-4W</p> <p>① red; ② white</p>	<p>Non-replaceable Ø3 mm / Ø0.12" sensor connection: 1 x Pt100-A-4W</p>

Table 4-1: Standard sensors with clamp connection

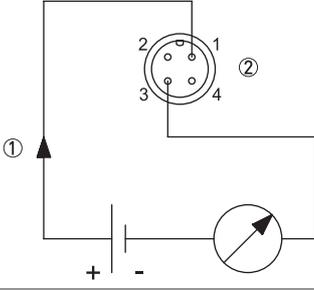
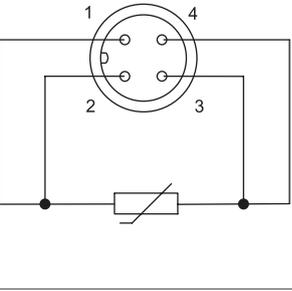
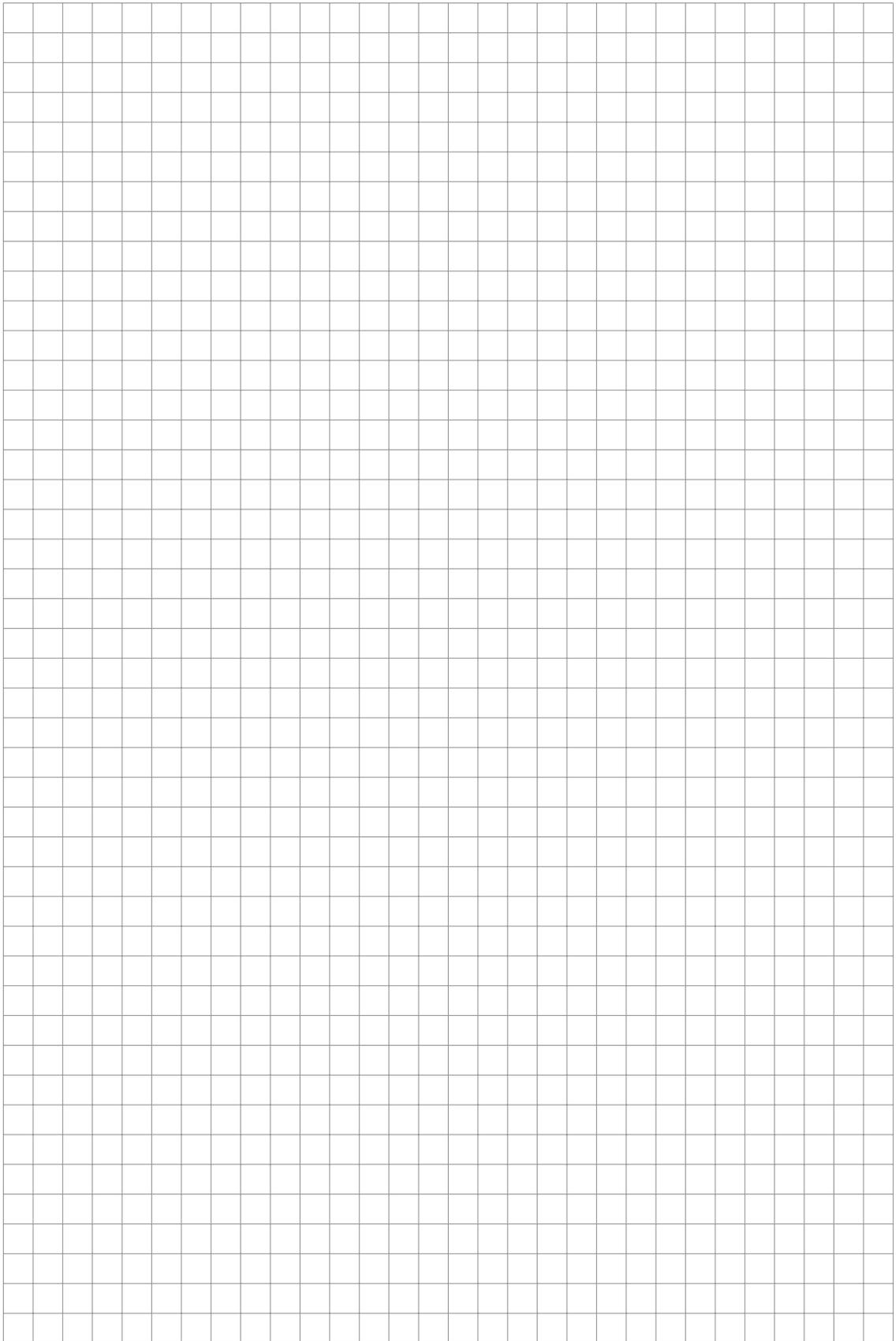
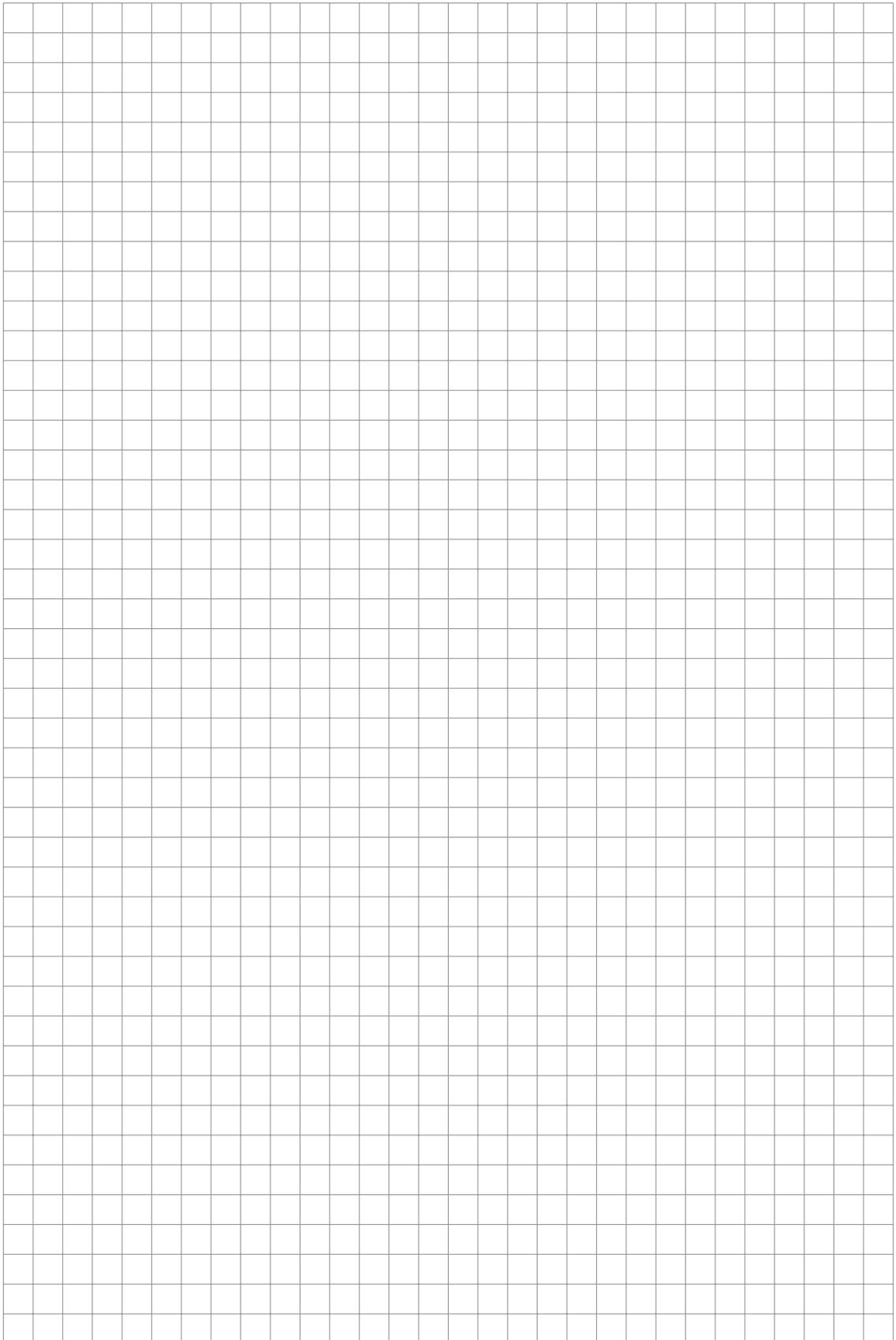
Integrated transmitter output	Pt100 output
	
<p>M12 connector front view 4...20 mA transmitter output</p> <p>① loop +; ② loop -</p>	<p>M12 connector front view 1 x Pt100-4W output</p>

Table 4-2: Sensors with M12 connectors

The characters of the order code highlighted in light grey describe the standard.

VGCH	4	(1) Type
	2	TRA-H61: hygienic G1/2 sensor
	3	TRA-H65: hygienic clamp sensor, welded (L ≥ 50 mm / 1.97")
	B	TRA-C61: compact hygienic G1/2 sensor
	C	TRA-C65: compact hygienic clamp sensor, welded (L ≥ 50 mm / 1.97")
		(2) Approval
	0	Without
	1	EHEDG
	2	3-A
		(3) Connection head - cable connection
	1	Compact sensor design, IP67/(69)
	2	BHY, M16 PA cable gland, IP66/67
	3	BHY, M16 PA cable gland, IP69
	4	BHY, M16 SS cable gland, IP66/67
	5	BHY, M16 SS cable gland, IP69
	6	BHY, M12 SS connector, IP67/(69)
		(4) Measuring insert / Sensor
	2	1 x Pt100 4-wire, class A
		(5) Sheath diameter - tip design
	1	Ø6/4 mm / Ø0.24/0.16" for replaceable Ø3 mm / Ø0.12" inserts
	2	Ø6/3 mm / Ø0.24/0.12" reduced tip, fast response
		(6) Insertion depth
	1	22 mm / 0.9"
	2	30 mm / 1.2"
	3	50 mm / 2.0"
	4	70 mm / 2.8"
	5	80 mm / 3.2"
	6	90 mm / 3.5"
	7	100 mm / 3.9"
	8	130 mm / 5.1"
	A	150 mm / 5.9"
	B	180 mm / 7.1"
	C	200 mm / 7.9"
		(7) Surface finish wetted parts
	1	> 0.8 µm, industrial
	2	≤ 0.8 µm, hygienic





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