

# Immersion Heaters ROTKAPPE®

ROTKAPPE Immersion Heaters are most suitable for direct heating of nearly all process liquids and corresponding applications. Excellent chemical resistance is ensured by the use of different immersion tube materials and variable fitting options help you to meet the individual requirements of heating installations. A long life span with optimum reliability is assured by using high quality materials thereby ensuring faultless operation of your system.

The ROTKAPPE immersion heater is constructed on a modular basis and consists of a tube, a long-life heating cartridge, a terminal casing and the lead.

## The Immersion Heater Tube

We can offer you the optimum material for every application. The heated length (minimum immersion depth) is marked by a ring which is generally two-thirds of the tube length. The tube is not heated above this mark. The heated portion must always be covered with liquid even in the case of high liquid level fluctuation.

## The Long-Life Heating Cartridge

Long-life heating cartridges are made from ceramic groove bodies with high electrical insulation values and good mechanical strength. A high temperature resistance heating wire is fitted as a coil in order to achieve the best possible heat radiation from tube to liquid. The cartridges for immersion heaters are available in rated power voltages up to a maximum of 500 volts for one, two and three phase connections.

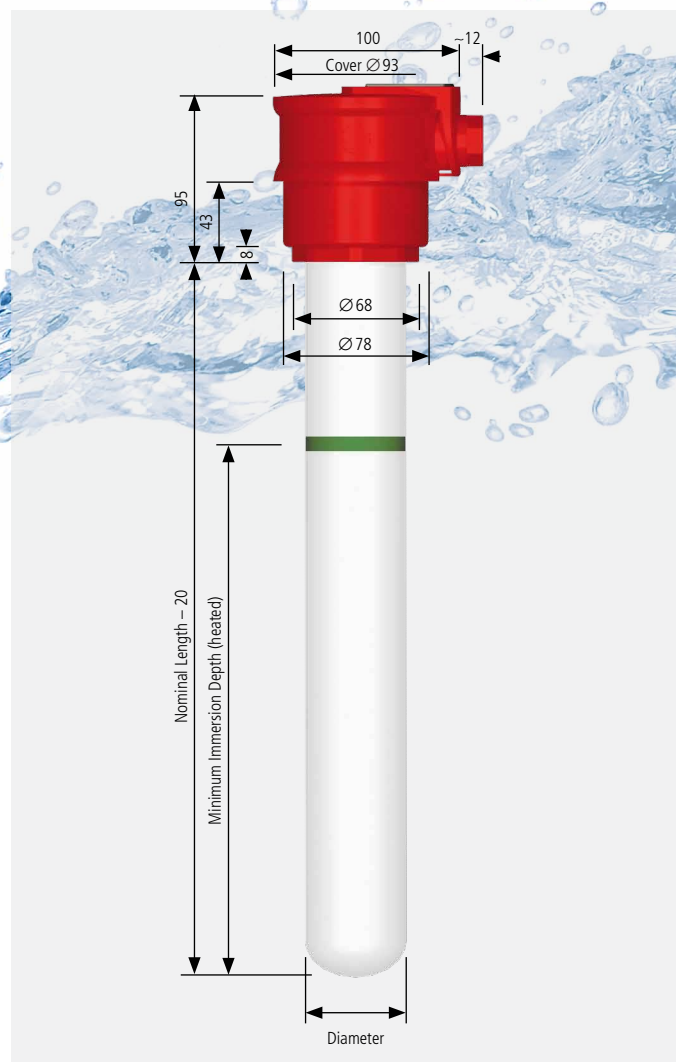
## The Terminal Casing BC

The BC terminal casing for immersion heaters consists of high temperature stabilized PP. Problem-free use in most process liquids is ensured by good mechanical and thermal strength as well as wide ranging chemical resistance. The PVDF terminal casing (BC/L) is recommended in cases of extreme temperature (liquid temperature  $>80^{\circ}\text{C}$ ) or when subjected to strongly oxidizing chemicals (e.g. chrome electrolyte or  $\text{HNO}_3$ ). The protective casing is IP 65 (jet-waterproof) according to EN 60529.

Easy access to the terminal (after fitting) when connecting the lead is also ensured by unscrewing the cap with the mounting wrench SB.

## The Lead

The PVC connecting lead is with a standard length of 1.6 m. Other lead lengths can be provided if desired.



Immersion Heater ROTKAPPE

## Electrical Safety

The immersion heaters are classified as "safety class 1" according to EN 60519 / 1-2. All metal parts that are not protected from human contact are securely connected to earth. Using non-conductive tubes made of porcelain or glass, a "protective coil" is also fitted to the heating cartridges in order to earth these tubes. The highest possible electrical safety is therefore ensured by using an earth leakage circuit breaker (ELCB).

ROTKAPPE immersion heaters type B-... carry the VDE label.

## Accessories

- Mounting Sleeve EM
- Holding Sleeve HM
- Support HB
- Protective Tube SRF
- Mounting Wrench SB
- Support THB
- Support SHB



# Safety and Quality Heating



The chemicals in your treatment liquids demand the utmost chemical resistance of the materials used. When choosing the materials the physical processes (possible encrustment) and thermal limits (surface

power density) have to be taken equally into consideration. The advantages and disadvantages of the individual materials are illustrated in the chemical resistance list. The following table gives an overview

of the standard types available. The specific surface power density for the immersion heater tube is stated in  $W/cm^2$  according to the minimum immersion depth and the rated power.

## Standard Material Specifications

Type	Tube diameter [mm]
PS 54	Special hard porcelain, glazed
TG 50	Technical glass (hydrolytic class 1, acid class 1, alkaline class 2 according to DIN 12111, 12116 & 52322)
QS 52	Quartz glass (hydrolytic class 1, acid class 1, alkaline class 1, according to DIN 12111, 12116 & 52322)
FC 48	Polytetrafluorethylene (PTFE)-compound
KB 45	Stainless steel (material no. 316Ti)
TI 45	Titanium (material no. 3.7035)

## ROTKAPPE Immersion Heater Overview (Summary)

Nominal Length [mm]	Rated Power [kW]	Minimum Immersion Depth [mm]	Rated Voltage		Surface Power Density [ $W/cm^2$ ]					
					PS	TG	QS	FC	KB	TI
			230V~	400V3~						
315	0,40	225	x	-	1,6	-	-	-	1,9	1,9
315	0,63	225	x	-	2,5	-	-	-	3,0	3,0
400	0,63	275	x	x	1,9	2,0	-	2,1	2,3	2,3
400	1,00	275	x	x	3,0	3,2	-	-	3,6	3,6
500	0,80	360	x	x	1,6	1,7	1,7	1,8	1,9	1,9
500	1,00	360	x	x	2,0	2,2	2,1	2,3	2,4	2,4
500	1,40	360	x	x	2,8	3,0	2,9	-	3,4	3,4
630	1,25	460	x	x	1,9	2,0	2,0	2,1	2,3	2,3
630	1,60	460	x	x	2,4	2,6	2,5	-	2,9	2,9
630	2,00	460	x	x	3,0	3,2	3,1	-	3,6	3,6
800	1,00	560	x	x	1,2	1,3	1,2	1,4	1,4	1,4
800	1,60	560	x	x	1,9	2,1	2,0	2,2	2,3	2,3
800	2,00	560	x	x	2,4	2,6	2,5	-	2,9	2,9
800	2,50	560	x	x	3,0	3,2	3,1	-	3,6	3,6
1000	1,25	725	x	x	1,2	1,2	1,2	1,3	1,4	1,4
1000	1,60	725	x	x	1,5	1,6	1,5	1,7	1,8	1,8
1000	2,00	725	x	x	1,9	2,0	1,9	2,1	2,2	2,2
1000	2,50	725	x	x	2,3	2,5	2,4	-	2,8	2,8
1000	3,15	725	x	x	2,9	3,1	3,0	-	3,5	3,5
1000	3,50	725	x	x	3,2	3,5	3,4	-	3,9	3,9
1250	1,00	875	x	x	0,8	0,8	0,8	0,8	0,9	0,9
1250	1,60	875	x	x	1,2	1,3	1,3	1,4	1,4	1,4
1250	2,00	875	x	x	1,5	1,6	1,6	1,7	1,8	1,8
1250	2,50	875	x	x	1,9	2,0	2,0	2,1	2,3	2,3
1250	2,80	875	x	x	2,1	2,3	2,2	-	2,6	2,6
1250	3,50	875	x	x	2,6	2,8	2,7	-	3,2	3,2
1250	4,00	875	-	x	3,0	3,2	3,1	-	3,6	3,6
1600	2,00	1125	x	x	-	1,3	-	1,4	1,4	1,4
1600	3,15	1125	x	x	-	2,0	-	2,1	2,3	2,3
1600	3,50	1125	x	x	-	2,3	-	2,3	2,5	2,5
1600	4,00	1125	-	x	-	2,6	-	-	2,9	2,9
1600	4,50	1125	-	x	-	2,9	-	-	3,2	3,2
1600	6,00	1125	-	x	-	3,9	-	-	4,3	4,3
2000	4,00	1400	-	x	-	-	-	2,1	2,2	2,2
2000	4,50	1400	-	x	-	-	-	2,3	2,5	2,5
2000	5,00	1400	-	x	-	-	-	-	2,8	2,8
2000	6,00	1400	-	x	-	-	-	-	3,3	3,3
2500	4,50	1750	-	x	-	-	-	1,8	2,0	2,0
2500	6,30	1750	-	x	-	-	-	-	2,8	2,8
3150	5,00	2200	-	x	-	-	-	-	1,7	1,7
3150	7,00	2200	-	x	-	-	-	-	2,4	2,4



# Safety Immersion Heaters ROTKAPPE® with Anti-Burn System

ROTKAPPE safety immersion heaters with Anti-Burn System minimise possible thermal damage to plants and tanks in the event of partial or complete loss of the liquid being heated.

Although EN 60519/1-2 specifies that electrically heated systems must be equipped by the user with safety technology (overheating protection and dry-running protection), even the best safety technology cannot protect the systems against mistakes by the operator or against the results of faulty maintenance.

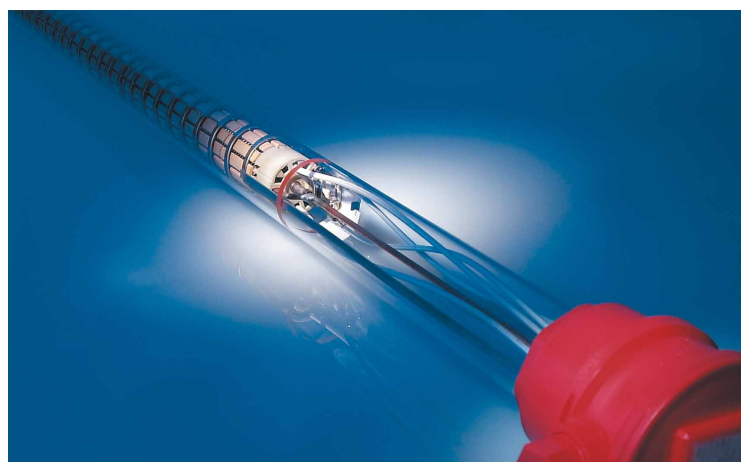
The following „critical” situations in liquid solutions up to 100°C can be avoided by using a safety immersion heater with Anti-Burn System:

- Continuous operation of the heater with low fluid levels (due, for example, to evaporation of the fluid)
- Continuous operation of the heater with no fluid (due, for example, to a sudden, unexpected loss of fluid)
- Continuous operation of the heater when the transfer of heat from the heated immersion tube to the fluid is restricted (by, for example, heavy incrustation on the immersion tube)

ROTKAPPE safety immersion heaters with Anti-Burn System can be installed either vertically or horizontally in tanks and other plants. This flexibility simplifies the planning and installation of electrical immersion heaters to meet a wide range of requirements for such applications.

Please note that it is still necessary to install the normal overheating and dry-running protection devices in plants and tanks with electrical heating systems, even when using ROTKAPPE immersion heaters with Anti-Burn System.

The optimum solution to this can be found in our product range of float switches, conductive level probes and the related electronic controllers. We will gladly advise you in the solution of your safety problems.



## 1- or 2-phase connection

The integrated Anti-Burn System reacts to unpermissibly high immersion tube temperatures and switches off the heater. The heater remains off until the safety circuit is reset manually. This can be done only if the other safety devices are operating correctly and the tank and the heater are in good condition.

The heater cartridges are available for all rated voltages up to 400V and with rated powers of up to 6.0 kW.

## 3- phase connection

The integrated Anti-Burn System is tripped if the immersion tube temperature becomes too high and switches off the heater with the aid of our differential current monitor DSW 3/2 and a power relay. The heater then remains switched off until the safety circuits in the immersion heater and on the differential current monitor are reset manually.

A prerequisite for this is that all other safety devices are functioning correctly and that the tank and the heater are in good condition.

The Anti-Burn System can be installed in all three-phase immersion heaters with rated voltages of up to 400V and a current consumption of 1,8 to 16A.



# Safety Immersion Heaters ROTKAPPE® with Anti-Burn System



The differential current monitor DSW 3/2 monitors the currents in the individual phases (L1, L2, L3) of a three-phase mains supply.

When the limit value set for power consumption imbalance is exceeded, the power contactor is switched off via the relay contact. The limit value recommended for power consumption imbalance is 5.0 %.

The effective process parameters (e.g. Phase current) are indicated on the display. If values exceed or fall below the set limits, the contact switches and the display shows the respective error message.

The DSW 3/2 differential current monitor reacts in the following situations:

- Overload protection (for current consumption monitoring)
- Current phase failure (if the temperature limiter in the immersion heater is activated)
- Current phase failure (if the heating coil fails or in case of cable breakage)

## Technical data DSW 3/2

<b>Dimensions</b>	w = 45 mm, h = 86 mm, d = 80 mm
<b>Mounting</b>	on 35 mm rails (in accordance with EN 60715)
<b>Ambient temperature</b>	-25...60°C
<b>Maximum humidity</b>	10...95 % (no condensation)
<b>Supply voltage</b>	24VDC ± 15 %
<b>Power consumption</b>	2,5W at 24VDC
<b>Measuring inputs</b>	3 x I with I <sub>MAX</sub> = 16A~
<b>Output</b>	Relay contact 230V/3A~
<b>Terminal cross-section</b>	1,5 mm²...4 mm²

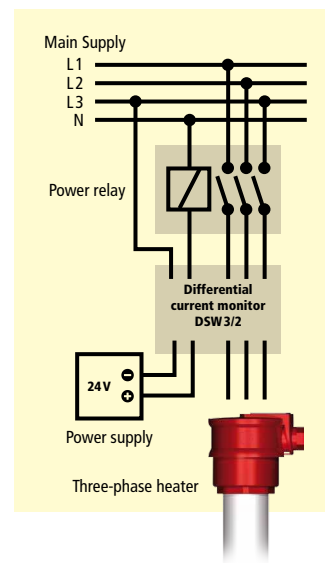
After phase failure, the DSW 3/2 differential current monitor can be reset directly via the control keys ➡. If the error is not resolved, the differential current monitor goes into alarm state again and the respective error message is displayed.

The DSW 3/2 differential current monitor is an IO link device. It can therefore be used as an intelligent sensor / actuator for parameter data transfer to a PLC (via the IO link protocol).

Using a PLC and an IO link allows additional monitoring of the following parameters:

- Phase overcurrent monitor
- Phase undercurrent monitor
- Overcurrent and undercurrent monitor
- Current imbalance monitor
- 3-phase undercurrent detection
- Phase sequence detection (at inductive load)

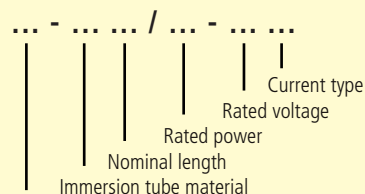
Block diagram  
for 3-phase-connection



## Relation Heaters DSW 3/2

Immersion heaters with rated power [kW] for 400V3~	Max. number of heaters per DSW 3/2
1,6 / 2,0	5
2,5	4
3,15 / 3,5	3
4,0 / 5,0	2
6,3 / 7,0 / 8,0 / 10,0	1

## Type designations



T = Safety ROTKAPPE immersion heater with Anti-Burn System, 1/2-phase  
A = Safety ROTKAPPE immersion heater with Anti-Burn System, 3-phase

**Example:** T-PS630/1,6-230Ws:

Safety ROTKAPPE immersion heater with Anti-Burn System, porcelain tube, nominal tube length 630 mm; rated power 1.6 kW; rated voltage 230V (single-phase).

**Restriction note:** The differential current monitor DSW 3/2 cannot be used in connection with control interventions with a phase angle control or for signal packages which change the sinus waves.



# Compact Heating Control System KHS

In accordance with EN 60519-1/2 any electrically heated container must be equipped with a thermostat and a level monitoring system. It is, however, often not possible to integrate all necessary components into a large control cabinet. Our solution – the Compact Heating Control System KHS.

All components necessary for the safe operation of the heating system are contained in a light grey, glass fibre reinforced polyester enclosure (protection type IP 65 in accordance with EN 60529). The control cabinet can be mounted with stainless steel mounting brackets onto a wall directly next to the container.

The enclosure can withstand a permanent temperature of up to 70°C (and a peak temperature of 150°C). It is also self-extinguishing, halogen-free and corrosion-resistant. It meets the safety class IK 10 in accordance with EN 62262, which protects it from external mechanical stress. Its rated insulation voltage is 1.000V.

The main operating elements can be reached from the front without opening the heating control system:

- The heating control system can be safely switched on and off with the main red/yellow emergency switch. This switch ensures the disconnection of all poles.
- the red LED warning light indicating the fill level (minimum level cut-out active)
- the thermostat MTR 1000, whose desired value can easily be set and adjusted with the buttons that can be accessed from the front of cabinet; the actual temperature value is indicated on the large LED display; the LED display also indicates the operating status of the heating systems.
- The door of the control cabinet can only be opened with a suitable key that has a two-point closure.



Compact Heating Control System KHS

The following components can be found inside the heating control system:

- the line fuses and the power protection elements
- a FI-protection switch, which in the case of malfunction disconnects the heating systems quickly and safely
- the electronic level monitoring system ETS 100 that can be connected to a floating switch or a conductive level rod probe
- the clamping strips for the electrical connection



# Compact Heating Control System KHS



Compact Heating Control System KHS

The cables and sensors of the heating systems are inserted into the control cabinet via cable glands situated at its base and are tightly wired at the clamping strips. A temperature probe with a Pt 100 sensor element must be connected for temperature control; a MTSu floating switch or alternatively a conductive NS 2 level rod probe must be connected for fluid level measurement.

A floating switch with an integrated temperature probe (MTSt) or a level rod probe with an integrated

temperature probe (NT 2) can of course be connected in place of individual sensors. The connection of a separate temperature probe is in this case not necessary.

Unused cable seals are closed with blind plugs.

When connecting single-phase immersion heaters use safety immersion heaters with an anti-burn system to improve the safety of the whole system. These immersion heaters have a temperature monitor built-in at their heating insert, which safely disconnects them at inadmissibly high immersion pipe temperatures (e.g. complete heating liquid loss).

## Technical Data

	KHS 230	KHS 400
Dimensions (h x w x d in mm)	515 x 415 x 230	515 x 415 x 230
Weight	12,6 kg	13,9 kg
Supply voltage	230V~, 50/60 Hz or 400V 3~, 50/60 Hz	400V 3~, 50/60 Hz
Rated maximum current	16 A	40 A
Max. total connected load	3,6 kW/230V~ oder 10,5 kW/400V 3~	27 kW/400V 3~
Heating connection	at supply voltage 230V~ max. 3 x 1,2 kW/230V~ max. 2 x 1,6 kW/230V~ max. 1 x 3,5 kW/230V~	at supply voltage 400V 3~ max. 3 x 9 kW/400V 3~ max. 2 x 9 kW/400V 3~ max. 1 x 9 kW/400V 3~
	at supply voltage 400V 3~ max. 3 x 3,5 kW/230V~ max. 2 x 3,5 kW/230V~ max. 1 x 3,5 kW/230V~ max. 1 x 10 kW/400V 3~	
Ambient conditions	Condensation within the device must be avoided	
	Internal temperature max. 50°C	
	Rel. humidity max. 75%	
	Ambient temperature max. 35°C	

# Small Immersion Heater ROTKAPPE®

ROTKAPPE Small Immersion Heaters are most suitable for direct heating of nearly all process liquids and corresponding applications. Excellent chemical resistance is ensured by the use of different immersion tube materials and variable fitting options help you to meet the individual requirements of heating installations. A long life span with optimum reliability is assured by using high quality materials thereby ensuring faultless operation of your system.

The small immersion heaters are used primarily in smaller plants and tanks for surface treatment and in the laboratory sector.

The ROTKAPPE small immersion heater is constructed on a modular basis and consists of a tube, a long-life heating cartridge, a terminal casing and a lead.

## The Immersion Heater Tube

We can offer you the optimum material for every application. The heated length (minimum immersion depth) is marked by a ring which is generally two-thirds of the tube length. The tube is not heated above this mark. The heated portion must always be covered with liquid even in the case of high liquid level fluctuation.

## The Long-Life Heating Cartridge

Long-life heating cartridges are made from ceramic groove bodies with high electrical insulation values and good mechanical strength. A high temperature resistance heating wire is fitted as a coil in order to achieve the best possible heat radiation from tube to liquid. The cartridges for small immersion heaters are available in 230 volts for a single phase connection.

## The Terminal Casing LC

The Terminal Casing LC for small immersion heaters is made from high temperature stabilized PP (LC) or PVDF (LC/L). The protective casing is IP 65 (jet-waterproof) according to EN 60529.

Access to the terminal (after fitting) when connecting the lead is also ensured by unscrewing the cap with the mounting wrench SL.

The support HL offers space-saving mounting at the rim of the tank.

Small Immersion Heater ROTKAPPE

## The Lead

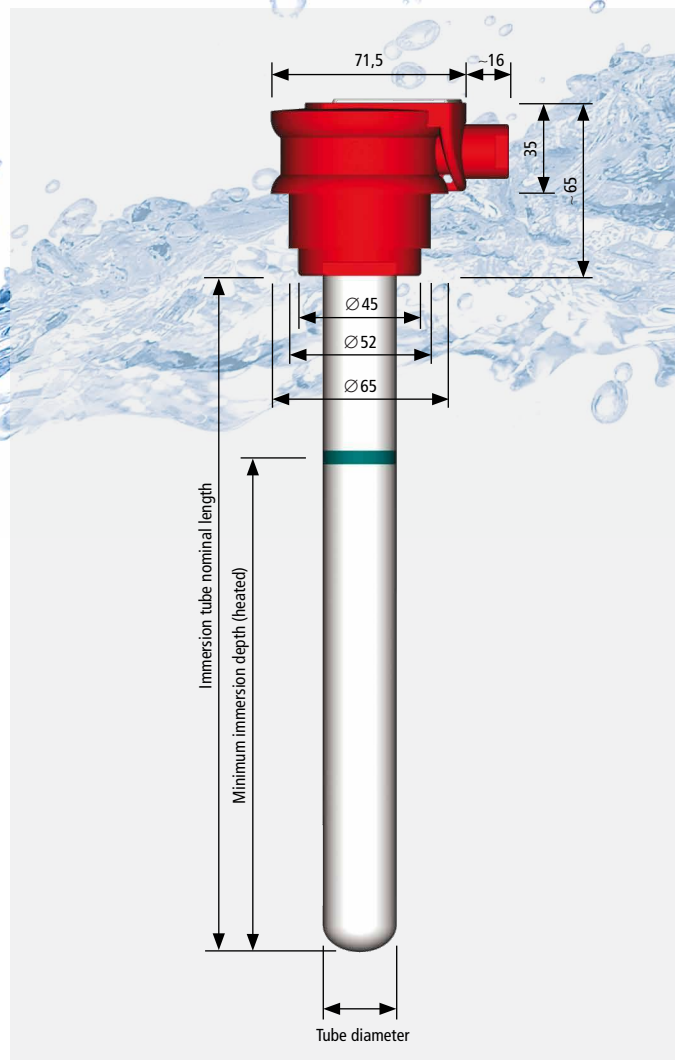
The PVC connecting lead is with a standard length of 1.6 m. Other lead lengths can be provided if desired.

## Accessories

- Mounting wrench SL
- Mounting Sleeve ML
- Support HL

## Electrical Safety

The small immersion heaters are classified as "safety class 1" according to EN 60519/1-2. All metal parts that are not protected from human contact are securely connected to earth. Using non-conductive tubes made of porcelain or glass, a "protective coil" is also fitted to the heating cartridges in order to earth these tubes. The highest possible electrical safety is therefore ensured by using an earth leakage circuit breaker (ELCB).





# Safety and Quality Heating

The chemicals in your treatment liquids demand the utmost of the chemical resistance of the materials used. When choosing the materials the physical processes (possible encrustment) and thermal limits (surface power density) have to be taken equally into consideration. The advantages and disadvantages of the individual materials are illustrated in the chemical resistance list. The following table gives an overview of the standard types available. The specific surface power density for the immersion heater tube is stated in  $W/cm^2$  according to the minimum immersion depth and the rated power.

## Immersion Tube Material Specifications

	Type	Tube diameter [mm]
PS 28	Special hard porcelain, glazed	
TG 28	Technical glass (hydrolytic class 1, acid class 1, alkaline class 2 according to DIN 12111, 12116 & 52322)	
KB 25	Stainless steel (material no. 316Ti)	
TI 25,4	Titanium (material no. 3.7035)	

## ROTKAPPE Small Immersion Heater Tube Overview (Summary)

Nominal length [mm]	Rated power [kW]	Minimum immersion depth [mm]	Surface power density [ $W/cm^2$ ]			
			PS	TG	KB	TI
200	0,315	130	3,7	3,7	4,1	4,1
300	0,250	180	1,9	1,9	2,2	2,2
300	0,315	180	2,4	2,4	2,7	2,7
300	0,400	180	3,1	3,1	3,5	3,5
400	0,400	280	1,9	1,9	2,1	2,1
400	0,800	280	3,7	3,7	4,2	4,2
500	0,500	330	1,9	1,9	2,2	2,2
500	0,800	330	3,1	3,1	3,5	3,5
500	1,000	330	3,9	3,9	4,3	4,3
630	0,500	460	-	-	1,6	1,6
630	1,000	460	-	-	3,2	3,2
630	1,250	460	-	-	4,1	4,1
800	0,500	560	-	-	1,3	1,3
800	1,000	560	-	-	2,6	2,6
800	1,500	560	-	-	3,9	3,9
1000	1,000	725	-	-	2,0	2,0
1000	1,600	725	-	-	3,2	3,2

## Accessories for Small Immersion Heaters with Terminal Casing LC



### Mounting Wrench SL

For opening and closing the terminal cap LC and the lead screw fixing.

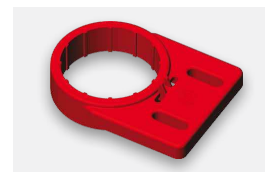
Material: Grivory GVN



### Mounting Sleeve ML

Enables space-saving fitting in tank tops or tank cross-beams. Drill-hole diameter: 63 mm.

Material: EPDM



### Support HL

A very simple method of safely fixing small immersion heaters is guaranteed by using this support. It is screwed firmly onto the tank rim and the terminal casing is a simple push-fit.

Material: PP and PVDF (HL/L)



# Accessories

## For Fitting of Products with Big Terminal Casing BC and BC/L

### Set of Seals

O-rings/sealing inserts



### Terminal Casing BC

Material: PP

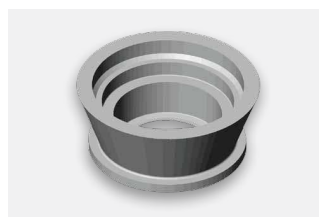
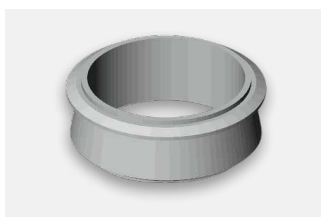
### Terminal Casing BC/L

Material: PVDF

### Mounting Sleeve EM

for space-saving fitting in supports or in tank cross-beams. Drill-hole diameter: Ø 87 mm to Ø 90 mm.

Material: EPDM



### Holding Sleeve HM

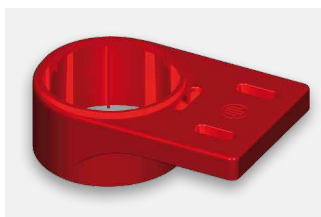
for fixing in tank cross-beams in cases of high liquid temperature (> 60°C) and exposure of the underside of the casing to highly concentrated steam. Drill-hole diameter Ø 70 mm to Ø 76 mm.

Material: EPDM

### Support HB

for simple fixing to the tank rim (e.g. for immersion heaters with a max. nominal tube length of 800 mm).

Material: PP or PVDF (HB/L)



### Support HWB

for fixing long probes and angular immersion heaters.

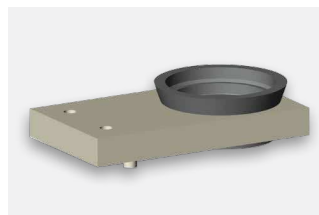
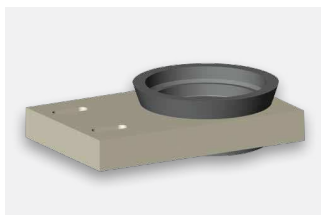
Material: PP or PVDF (HWB/L)

### Support SHB

with integrated holding sleeve HM for fixing immersion heaters with nominal tube length > 800 mm.

Material of support: PP

Material of sleeve: EPDM



### Support THB

with integrated holding sleeve HM for fixing immersion heaters with Anti-Burn-System.

Material of support: PP

Material of sleeve: EPDM

### Protective Tube SRF

with a welded support and integrated holding sleeve protects „sensitive“ immersion tubes (porcelain, glass, PTFE) against mechanical damage. It enables safe fixing of very long immersion tubes up to 2000 mm to the tank rim.

Material of protective tube

and support: PP

Material of holding sleeve: EPDM



### Mounting Wrench SB

for opening and closing the terminal cap of big terminal casings BC, as well as dismantling the screw thread and the lead screw fixing.

Material: Grivory GVN



**MAZURCZAK**  
THERMOPROSSESSE

# Accessories

## For Fitting of Products with Small Terminal Casing LC and LC/L

### Set of Seals

O-rings / sealing inserts



### Mounting Wrench SL

for opening and closing the terminal cap of small terminal casings LC and the lead screw fixing.

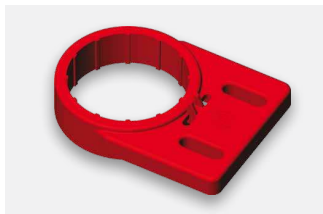
Material: Grivory GVN



### Support HL

is screwed firmly onto the tank rim and the terminal casing LC is a simple push-fit.

Material: PP or PVDF (HL/L)



### Terminal Casing LC

Material: PP

### Terminal Casing LC/L

Material: PVDF



### Mounting Sleeve ML

enables space-saving fitting in container lid or tank cross-beams. Drill-hole diameter: Ø 63 mm.

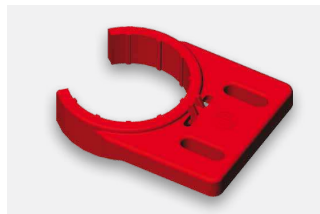
Material: EPDM



### Support HWL

for fixing long probes.

Material: PP or PVDF (HWL/L)



### Recommendations for Usage

As with all products with terminal casing care has to be taken, when installing them on the container rim, that the terminal casing does not submerge in the process liquid or is exposed to highly concentrated steam. Direct exposure of the underside of the casing to steam must be prevented by suitable installation measures (i.e. holding sleeve HM or a flange)

### Service

Every process liquid puts specific demands on the materials of the products used. Please see our "Resistance List" showing the chemical resistance of the materials often used in the most common solutions. For efficient planning of heating your container or system we offer you our computer-aided calculation of the energy necessary for heating up the treatment liquids to the temperature you require and maintaining it. Take advantage of our service.

# Angular Immersion Heaters ROTKAPPE®



Angular Immersion Heater  
with HWB Support

ROTKAPPE angular immersion heaters are the ideal method of direct heating for all containers with a low liquid level or high level fluctuation. The heating of the liquid from the container bottom is achieved by the horizontal heated immersion tube and this ensures optimum heat radiation as well as good heat distribution.

The rated power is determined by the length of the horizontal immersion tube. A relatively high heating performance is also possible because the entire tube length can be used for heating. The vertical, unheated immersion tube section can be adapted to the container depth.

Nearly every desired adaptation to the container size can be realized according to specific customer requirements. The compact type of construction saves space and as a result you can plan more cost effectively.

The table shows an overview of some standard types. The respective specific surface power density for the immersion tubes is stated in  $W/cm^2$  according to the heated horizontal immersion tube's nominal length and to the rated power.

An adaptation to the maximum permissible surface power density of the process liquid can be easily done by variation of the rated power and the immersion tube length.

ROTKAPPE angular immersion heaters consist of the heated horizontal immersion tube, the long-life heating cartridge, the unheated vertical immersion tube, the terminal casing and the lead.



ROTKAPPE Angular Immersion Heater

## The Immersion Heater Tube

The horizontal and the vertical immersion tubes are welded together. Good chemical resistance is ensured by using the various metal immersion tube materials. A long lifespan with optimum reliability is assured by using high quality materials, thereby ensuring faultless operation of your system. Angle shaped supports are welded onto the horizontal immersion tube in order to observe the minimum distance to the container bottom or fixing.

## The Long-life Heating Cartridge

Long-life heating cartridges are made from ceramic groove bodies with high electrical insulation values and good mechanical strength. A high temperature resistance heating wire is fitted as a coil in order to achieve the best possible heat radiation from tube to liquid. The cartridges for angular immersion heaters are available in rated voltages up to a maximum of 500 volts for one, two and three phase connections. The cartridges cannot be replaced by the user.





# Angular Immersion Heaters ROTKAPPE®

## Angular Immersion Heater Overview

(Vertical immersion tube: any length, min. 200 mm)

Angular Immersion Heater Materials		Horiz. Immersion Tube [mm]	Rated Power [kW]		Rated Voltage		Surface Power Density [W/cm²]	
							KB	TI
					230V~	400V3~		
Type	Immersion tube diameter [mm]	250	0,63	x	-	-	3,1	3,1
		500	2,00	x	x	x	3,6	3,6
KB 45	Stainless Steel (Material No. 316Ti)	750	3,00	x	x	x	3,4	3,4
		1000	4,00	-	x	x	3,2	3,2
TI 45	Titanium (Material No. 3.7035)	1250	5,00	-	x	x	3,2	3,2
		1500	6,00	-	x	x	3,1	3,1
		1750	7,00	-	x	x	3,1	3,1
		2000	8,00	-	x	x	3,1	3,1
		2250	9,00	-	x	x	3,1	3,1
		2500	10,00	-	x	x	3,0	3,0
		2750	11,00	-	x	x	3,0	3,0

### The Terminal Casing

The BC terminal casing for angular immersion heaters consists of high temperature stabilized PP. Problem-free use in most process liquids is ensured by good mechanical and thermal strength as well as wide ranging chemical resistance. The PVDF terminal casing (BC/L) is recommended in cases of extreme temperature (liquid temperature >80°C) or when subjected to strongly oxidizing chemicals (e.g. chrome electrolyte or HNO<sub>3</sub>). The protective casing is IP 65 (jet-waterproof) according to EN 60529.

Easy access to the terminal (after fitting) when connecting the lead is also ensured by unscrewing the cap with the mounting wrench SB.

### The Lead

The PVC connecting lead is with a standard length of 1.6 m. Other lead lengths can be provided if desired.

### Safety Technology

Please remember that electrical heating systems are supposed to be equipped with safety technology (temperature limiter and dry-out protection) on the part of the user according to EN 60519/1-2.

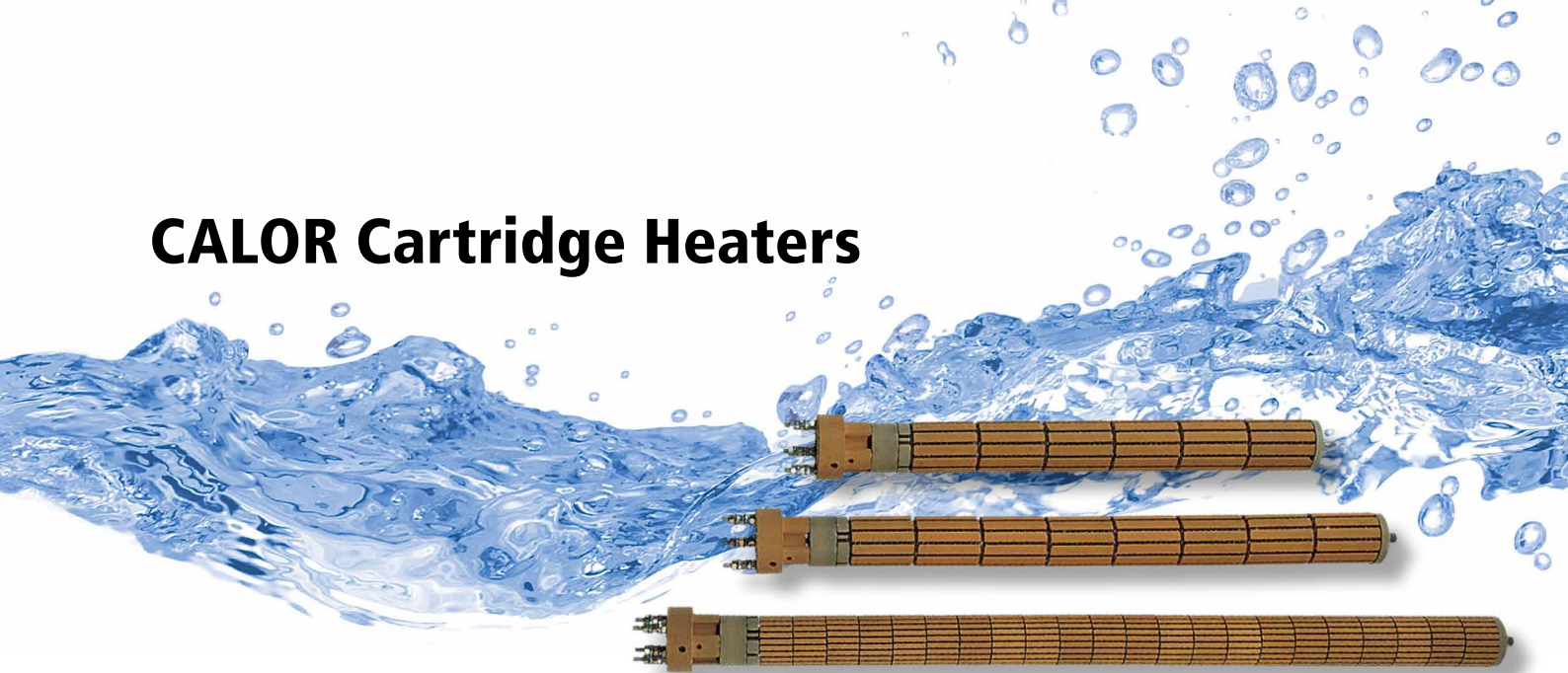
This can be most effectively implemented by level rod-probes and floating switches with integrated temperature sensors and the relevant electronics. We can also offer you suitable products for this and we can advise you in all aspects of safety technology.

### Accessories

Standard supports are available for secure fixing of the angular immersion heater or a specific flange connection can be planned to suit your needs. We would be glad to advise you on the best possible fixing.

- Support HWB (PP)
- Support HWB/L (PVDF)
- Mounting Wrench SB

# CALOR Cartridge Heaters



## CALOR Cartridge Heater Overview

Nominal length [mm]	Installation length [mm]	Rated power [kW] at 230V~			Rated power [kW] at 400V3~		
		PHK 40	PHK 46	PHK 57	PHK 40	PHK 46	PHK 57
400	375	1,5	1,75	2,0	1,5	-	-
500	475	2,0	2,2	2,8	2,0	2,2	2,8
600	575	2,5	2,8	3,5	2,5	2,8	3,5
700	675	3,0	3,5	-	3,0	3,5	4,0
800	775	3,5	-	-	3,5	4,0	5,0
900	875	-	-	-	4,0	4,5	5,5
1000	975	-	-	-	4,5	5,0	6,0
1200	1175	-	-	-	5,0	5,5	7,5
1400	1375	-	-	-	6,0	7,5	8,5
1600	1575	-	-	-	7,0	8,5	10,0
1800	1775	-	-	-	8,0	9,5	11,0
2000	1975	-	-	-	9,0	11,0	12,0

CALOR cartridge heaters are especially suitable for direct heating of cleaning solutions and alkalines.

We adapt our products to customers' individual and respective requirements in order to allow you as much freedom as possible when planning your system:

- Tubeless cartridge heaters with different diameters, installation lengths and heating performances specially tailored to your needs.
- Immersion tube cartridge heaters made from different materials with diverse fixing options such as flange or threaded nipple.

### Cartridge Heater Specifications

The cartridge heaters consist of ceramic groove bodies with high electrical insulation values, good mechanical strength and excellent temperature fluctuation resistance. A high temperature heating wire is fitted as a coil in order to ensure good heat radiation and a long life-span of the cartridge.

There is a 50 mm unheated area below the connecting terminal. We can also lengthen this unheated area if so desired.

The cartridges are available in every rated power voltage up to a maximum of 500V. The connection can be one, two or three phase. The list above represents an overview of possible executions. Individual requirements regarding nominal length, rated voltage and rated power can be realized at any time due to the modular construction.

### Immersion Tube Material Specifications

We can offer you different metallic materials with the most varied fixing methods according to your requirements or demands. The chemical resistance list illustrates our analysis of the respective materials. The surface power density of the immersion tube can be customized to suit your application. This individual custom design guarantees you the faultless operation of your system, a long life span and prevents damage to the heated liquid.

## CALOR Cartridge Heater Tubes

Cartridge Heater	Tube materials with dimensions, tube diameter [mm] x wall thickness [mm]	
	Stainless steel n°. 316TI	Titanium n°. 3.7035
PHK 40	44,5 x 1,5	44,5 x 0,9
PHK 46	52 x 1,5	-
PHK 57	-	-



**MAZURCZAK**  
THERMOPROSSESSE



# Safety and Quality Heating



Terminal casing BC 62 (PP) and BC 62/L (PVDF); protection IP 64



Terminal casing B (steel, zinc-plated); protection IP 64

## Possible Fixings and Terminal Casings for Immersion Tubes

We have planned the widest variety of possible fixings for your application. The immersion tubes can be equipped without a flange, with a welded or screw-on flange, or a threaded nipple according to your particular application.

We would recommend a central terminal casing for several immersion heater tubes in a row. If single immersion tubes (or tubes fitted further apart) are planned, then an individual casing has to be chosen for each immersion tube.

There is the choice of either the polypropylene (PP) BC 62 terminal casing or the polyvinylidenfluoride (PVDF) BC 62/L. The casing can be easily and quickly fitted by using

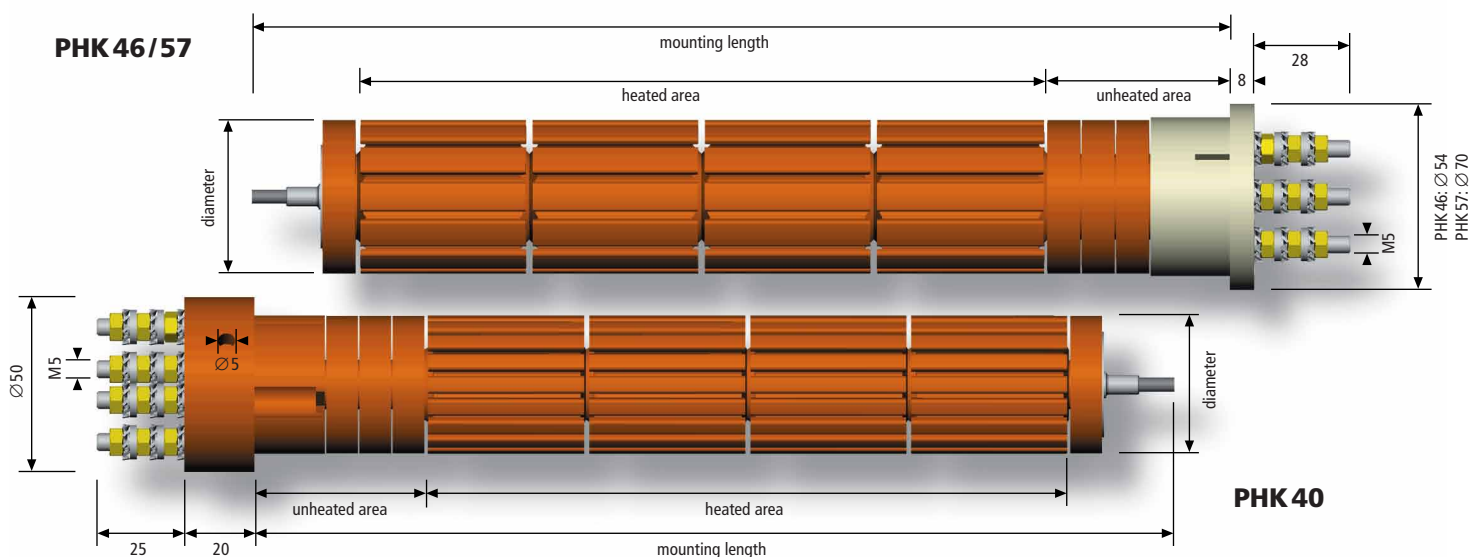
the mounting wrench. Alternatively the zinc-plated steel B terminal casing can be used specially for high temperatures.

## Electrical Safety

The cartridge heaters are classified as safety class 1 according to EN 60519-1/2. All metal parts (immersion heater tubes) that are not protected from human contact are securely connected to earth.

## Fixing Types and Terminal Casings

	Tube material	
	Stainless steel	Titanium
<b>Fixing types</b>		
without fixing flange	K	T
with welded flange	K 1	T 1
with screw-on flange	K 2	T 2
with threaded nipple G 2"	K 3	-
<b>Terminal casing</b>		
without casing	- OA	- OA
with terminal casing BC	- BC	- BC
with terminal casing B	- B	- B





# Storage Tank Heater GALMATHERM®

Direct heating of liquids in storage tanks and containers efficiently prevents freezing, crystallizing out and thickening. The type approval of your container is not affected in any way by fitting GALMATHERM storage tank heaters.

Storage tank heaters are always planned, designed and built individually for our customers. They consist of a heater GALMATHERM, which can be complemented with a temperature probe and a level sensor.

## Storage Tank Heater GALMATHERM

The very good chemical resistance of the heating cable is achieved by the use of a special coating made of FEP or PFA. The surface load is only  $1\text{ W/cm}^2$ . This makes it suitable for heating of acids and alkalines.



### Construction

The heaters consist of a metal heating wire in a fluoroplastics coating, wound on a flexible PP, PVDF or FEP support. The necessary distance between the heater and the tank bottom is ensured by the support feet attached to the stable frame. PVDF, PP, FEP or stainless steel can be used as frame material. An optional loading ensures that the heater can not float.



Installed storage tank heater GALMATHERM  
with a stainless steel frame and protective cover

The unheated connection cable leaving the heater is also coated in fluoroplastics as far as the connection sleeve and is secured in a PP expandable braided sleeving. This part of the heater can be immersed in the process liquid and is attached to the container lid with a threaded nipple (250 mm below the connection sleeve).

From the PVC connection sleeve (degree of protection IP 64 according to EN 60529), a PVC connection cable leads to the control cabinet. The connection sleeve may not be immersed in the liquid.

For containers installed outside, we can offer a protective cover to protect the connection sleeve from

direct sunlight and other effects caused by weather.

The dimensions and performance data can be found in the product data sheet Heaters GALMATHERM.

### The Threaded Nipple

The threaded nipple is for fastening the heater to the container. As materials are used PP or PVDF. It is mounted in a drilling with  $\varnothing 75\text{ mm}$ .



# GALMATHERM® as Storage Tank Heater



Storage tank heater GALMATHERM with a PVDF frame

## Electronic Controlling and Monitoring Devices

Our electronic devices necessary for controlling and monitoring temperature and liquid level are designed for installation in control cabinets or for panel mounting.

### The Temperature Probe

The TF temperature probe with integrated Pt 100-sensor registers the liquid temperature. It is led by the threaded nipple along the unheated connecting cable. The result is transferred to an electronic controller in order to maintain the desired temperature.

The temperature probe can be fitted with two Pt 100-sensors so as to combine temperature control and monitoring.

### The Level Sensor

Float switches or level rod-probes can be mounted with a flange as level sensors. They monitor the minimum liquid level in order to protect the heater and the container from damage in case of drying out. If necessary the heating is switched off.

## Safety Technology

Overheating of the fluoroplastics coating can cause thermal destruction. Take care that there is always sufficient convection and take precautions to prevent dirt or deposits on the heater.

Also, please take care that electrical heating systems are supposed to be equipped with safety technology (temperature limiter and dry-out protection) by the user. This can be most effectively implemented by level rod-probes, float switches and the relevant electronics from our wide sensor program. We gladly provide advice to you.

## Electrical Safety

The products are individually tested according to EN 60519/1-2 which ensures the safety and operative ability of each individual immersion heater. The storage tank heater GALMATHERM is assigned to protection class 1 according to EN 60519/1-2. The heating cable is wrapped inside with a copper earthing cable. The effectiveness of the earth and the highest possible electrical safety are fully ensured by using an earth leakage circuit breaker (ECLB).

# PFA Rod Heaters GALMAFORM®

The PFA rod heaters GALMAFORM are electric heaters for direct heat transfer designed for the use in plants and tanks with a minimum physical size. They have excellent resistance to aggressive process liquids. The very high chemical resistance is achieved by a special coating with PFA (perfluoralkoxy-polymer).

The fluoropolymer coating comprises a two-layered structure.

The inner black PFA compound layer of the rod heaters GALMAFORM increases the thermal conductivity by enhancing the heat transfer.

The surface layer made of transparent fluoropolymer prevents encrustation and fouling for effortless cleaning and easy maintenance.

The rod heaters GALMAFORM can be used to heat autocatalytic (electroless) electrolytes, since they are electrically non-conductive and therefore metal reduction is prevented.

The individual shape of the rods allows for a variety of installation options. As the contact box and the cable can also be immersed in the process liquid, you can adjust the maximum immersion depth to your specific requirements. The use of high-quality materials guarantees a long operating life-time with optimum reliability and failure-free operation.



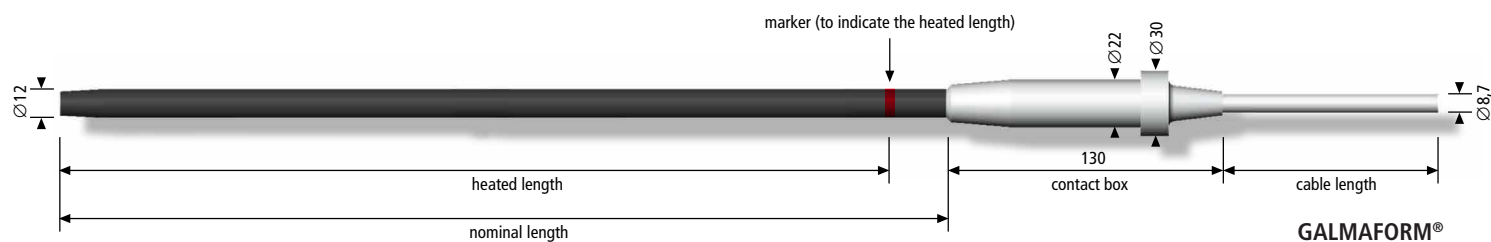
## Construction

The rod heaters are based on a PFA-coated stainless steel tubular heater with an electrical connection at one end. The contact box and the PTFE cable are welded together with a gas-tight seam to allow for complete immersion.

The heated length of the rod (minimum immersion depth) is indicated by a permanent ring-shaped marker. The rod is not heated above this mark.

Even in applications where the liquid level is subject to abrupt or drastic rise or fall the heated length of the rod must always be immersed!

The distance pieces AW 12 set the necessary distance between the rod heater and the wall of the tank. The support UH is designed for secure mounting of the rod heater on the edge of the tank.





# PFA Rod Heaters GALMAFORM®

Due to the individual shape of the rod heaters different types of installation are possible. The various bending shapes of the rods are individually planned and implemented for you. Alternatively, you can bend the rods to the desired shape yourself, matching them to the installation conditions.

The available space can be optimally used by means of the various installation possibilities:

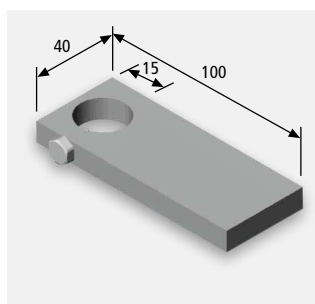
- on the tank wall
- on the floor of the tank
- hanging freely in the tank

## Electrical safety

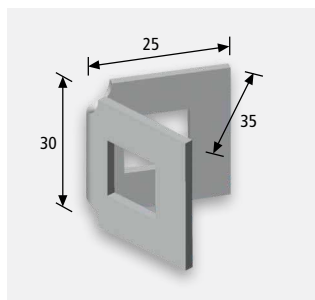
In accordance with EN 60519-1/2, the heaters are classified as devices of protection class I. All metal parts are connected to the neutral conductor. The connection cable of the rod heaters GALMAFORM additionally contains a bare earth cable. If used together with an earth leakage circuit breaker (ELCB), the maximum possible electrical safety is ensured.



PFA rod heaters GALMAFORM bear the VDE test mark



Support UH, material PVDF

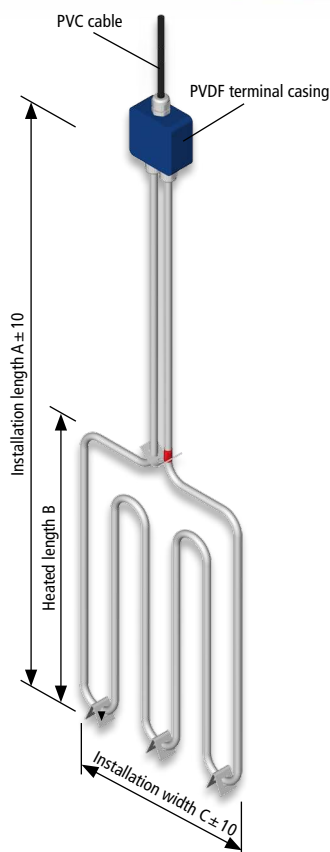


Distance piece AW 12, material PTFE, pure white

## Technical data

	U-FG 25200	U-FG 25200/9	U-FG 14090
<b>Rod coating</b>	PFA-Compound	PFA-Compound	PFA-Compound
<b>Electrical conductivity of coating</b>	no	no	no
<b>Rated power</b>	2.000W	2.000W	900W
<b>Surface loading</b>	2,4W/cm <sup>2</sup>	2,4W/cm <sup>2</sup>	2,2W/cm <sup>2</sup>
<b>Rated voltage</b>	230V ~	230V ~	230V ~
<b>Nominal length</b>	2.500 mm	2.500 mm	1.350 mm
<b>Heated length</b>	2.350 mm	2.350 mm	1.200 mm
<b>Cable length</b>	2 m	6 m	2 m
<b>Rod diameter</b>	Ø 12 mm	Ø 12 mm	Ø 12 mm
<b>Minimum bending radius</b>	30 mm	30 mm	30 mm
<b>Accessories</b>			
<b>Support</b>	UH	UH	UH
<b>Distance piece</b>	AW 12	AW 12	AW 12

# Flat Immersion Heater GALMAFLON



The GALMAFLON immersion heater has been specifically designed for use in applications where overall space is restricted. The compact design permits space-saving installation in very narrow containers while the FEP sheath provides the highest levels of chemical resistance.

## Structure

GALMAFLON immersion heaters consist of a high-compressed stainless steel tubular heating element designed for use in alkaline fluids.

For use in acid fluids, the stainless steel tubular heating elements are provided with a 1 mm thick FEP sheath.

This sheath is also very well suited for use with highly aggressive process fluids and extreme levels of chemical pollution such as in chrome electrolytes or autocatalytically (chemically) functioning electrolytes.

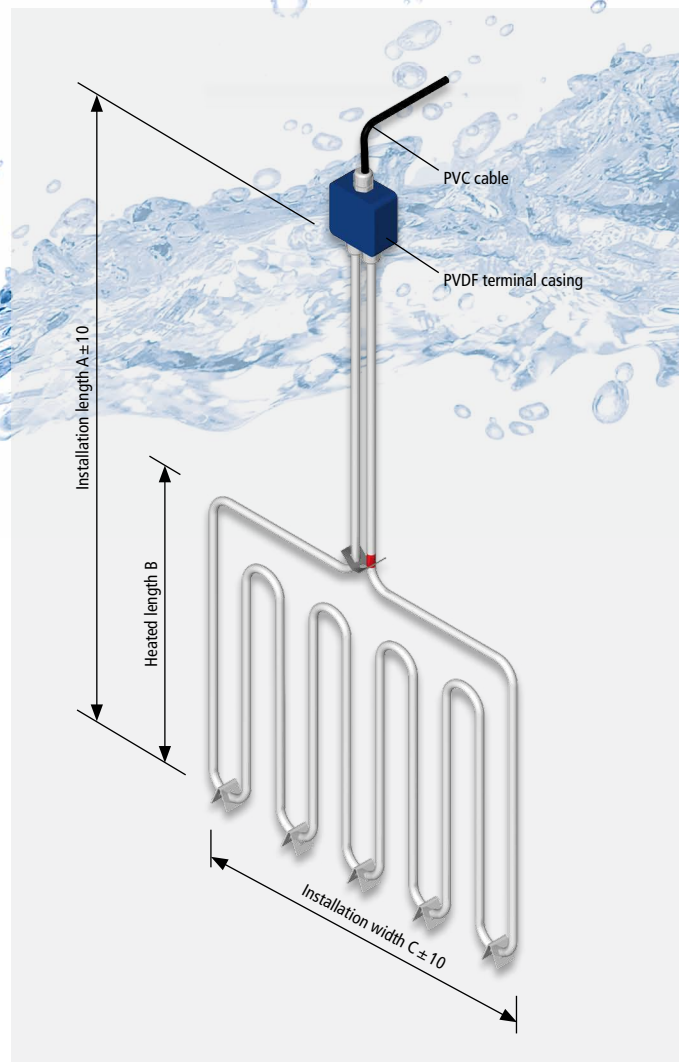
To avoid the risk of encrustations on the heater and/or thermal damage to electrolytes, the surface load of the heater is designed to be very low. Maximum 2W/cm<sup>2</sup>.

Nominal power values from 2 and 3 kW are available. Connection voltage is 230 V~. The maximum operation temperature is 80°C.

Degree of protection is IP 65 (jet-waterproof according to EN 60529). Applicable to the PVDF connection complete with 1.6 m long PVC cable.

Different bending shapes permit optimum installation in high or low containers.

Spacers made from FEP ensure the minimum distance between the heater and the container wall.



Nominal power [kW]	Heated length B [mm]		Type designation
	Installation length A [mm]	Installation width C [mm]	
2	1305	785	R 04 202 ... 13051 R1
2	1005	525	R 06 202 ... 10051 R1
2	805	400	R 08 202 ... 8051 R1
2	665	320	R 10 202 ... 6651 R1
3	1360	990	R 04 302 ... 13601 R1
3	1100	665	R 06 302 ... 11001 R1
3	985	660	R 06 302 ... 9851 R1
3	970	500	R 08 302 ... 9701 R1
3	820	405	R 10 302 ... 8201 R1
3	750	500	R 08 302 ... 7501 R1
3	605	405	R 10 302 ... 6051 R1

**R08 302 F9701 R1:** Flat immersion heater with 3 kW power and FEP sheath, dimensions 970x500 mm

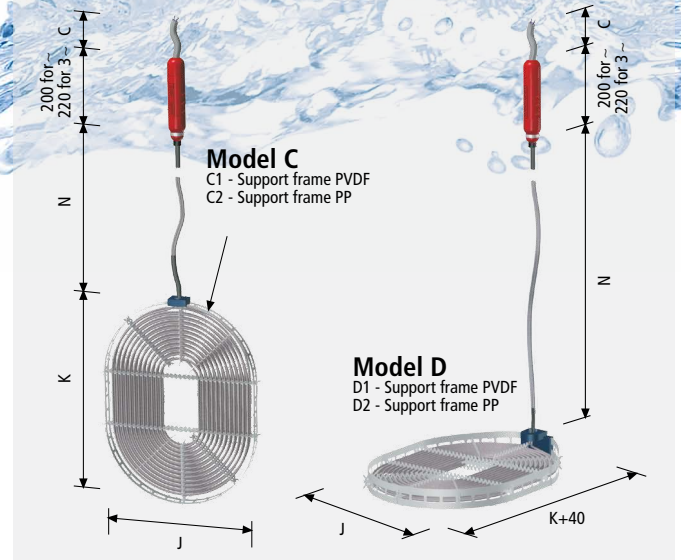
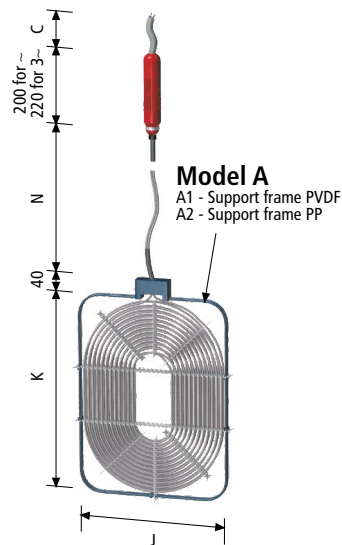
**F = Fluorinated ethylenpropylene (FEP)**





# GALMATHERM® Heaters

GALMATHERM heaters are designed specifically for use as direct electric heaters in plants and tanks where space is at a premium and high heating capacities and excellent resistance to aggressive process liquids are required. The very good chemical resistance of the heating cable is achieved by the use of a special sheath made of FEP or PFA. The surface power density is only  $1 \text{ W/cm}^2$ .



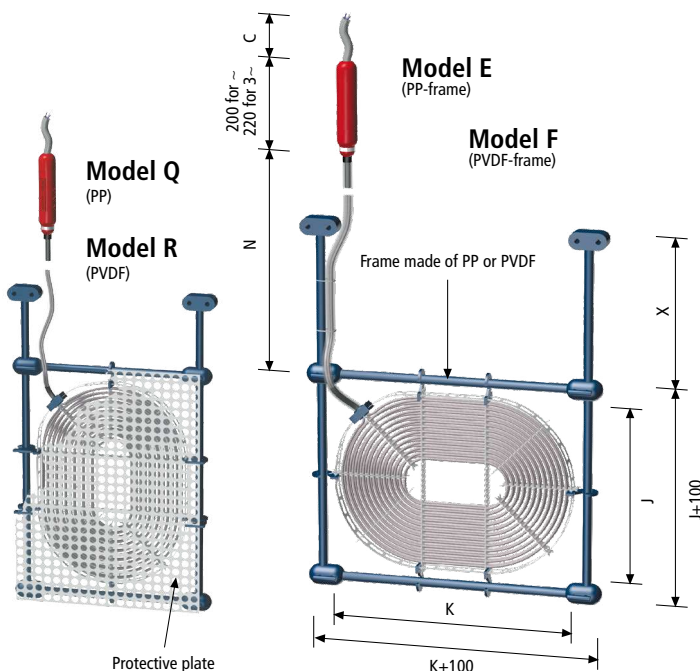
The PFA sheath should be selected for particularly critical operating conditions in extremely aggressive process liquids (such as mixed-acid chrome electrolyte) and for very high liquid temperatures (max.  $100^\circ\text{C}$ ). The wide range of different shapes and designs provides simple solutions to even difficult installation problems. Small dimensions, combined with relatively high heating powers, permit space-saving installation. The use of high-quality materials guarantees a long operating lifetime with optimum reliability and thus ensures problemfree operation of the plant.

A protective plate made of PP or PVDF (Models Q/R) protects the heater against mechanical damage.

The unheated connection cable leaving the heater is also sheathed in as far as the connection sleeve and is secured in a PP expandable braided sleeving. This part of the heater can be immersed in the process liquid and carries markings for the minimum and maximum immersion depth. Even in applications with extreme level variations, the liquid level must remain within this range! From the PVC connection sleeve (degree of protection IP 64 to EN 60529), a PVC connection cable leads to the switchgear cabinet. The connection sleeve may not be immersed in the liquid, nor may it be directly exposed to vapours.

## Construction

These heaters consist of a metal heating wire in a FEP/PFA sheath, wound on a flexible PP or PVDF support frame. The mounting elements and the spacers which prevent direct contact between the windings of the heating cable and between the windings and the tank, are also made of PP or PVDF. The mechanical strength can be improved by mounting the heater in a steel frame with PP/PVDF sheath (Model A) or in a robust PP/PVDF frame (Models E/F).







## Flat Heater GALMATHERM (Type P30/P40)

Rated power [kW]				Rated power [kW]				Rated power [kW]			
Dimensions J x K [mm] for rated voltage		Type designation for rated voltage		Dimensions J x K [mm] for rated voltage		Type designation for rated voltage		Dimensions J x K [mm] for rated voltage		Type designation for rated voltage	
230V~	400V3~	230V~	400V3~	400V3~	400V3~			400V3~	400V3~		
1,0	150 x 605	-	P 3003102	-	4,5	240 x 905	P 3008455	12,0	430 x 1075	P 3018125	
1,0	170 x 520	-	P 3004102	-	4,5	275 x 750	P 3010455	12,0	440 x 1070	P 3019125	
1,0	185 x 365	-	P 3005102	-	4,5	295 x 730	P 3011455	12,0	510 x 885	P 3023125	
1,0	205 x 335	-	P 3006102	-	4,5	315 x 625	P 3012455	12,0	585 x 785	P 3027125	
1,0	220 x 290	-	P 3007102	-	4,5	350 x 535	P 3014455	12,0	385 x 915	P 4014125	
1,0	240 x 250	-	P 3008102	-	4,5	370 x 520	P 3015455	12,0	405 x 860	P 4015125	
1,0	165 x 395	-	P 4003102	-	4,5	385 x 505	P 3016455	12,0	425 x 800	P 4016125	
1,0	185 x 305	-	P 4004102	-	4,5	405 x 460	P 3017455	12,0	465 x 740	P 4018125	
1,0	205 x 255	-	P 4005102	-	4,5	420 x 440	P 3018455	12,0	485 x 705	P 4019125	
1,0	225 x 230	-	P 4006102	-	4,5	265 x 595	P 4008455	12,0	505 x 680	P 4020125	
1,5	165 x 680	170 x 680	P 3004152	P 3004155	4,5	285 x 535	P 4009455	12,0	545 x 625	P 4022125	
1,5	205 x 425	205 x 475	P 3006152	P 3006155	4,5	305 x 480	P 4010455	12,0	585 x 595	P 4024125	
1,5	220 x 355	225 x 440	P 3007152	P 3007155	4,5	325 x 445	P 4011455	15,0	430 x 1245	P 3018135	
1,5	240 x 315	240 x 360	P 3008152	P 3008155	4,5	345 x 425	P 4012455	15,0	445 x 1235	P 3019135	
1,5	260 x 285	280 x 340	P 3010152	P 3010155	4,5	365 x 395	P 4013455	15,0	465 x 1140	P 3020135	
1,5	185 x 375	185 x 380	P 4004152	P 4004155	4,5	380 x 380	P 4014455	15,0	485 x 1125	P 3021135	
1,5	205 x 345	205 x 375	P 4005152	P 4005155	6,0	275 x 990	P 3010605	15,0	500 x 1045	P 3022135	
1,5	225 x 275	225 x 325	P 4006152	P 4006155	6,0	295 x 855	P 3011605	15,0	520 x 1030	P 3023135	
1,5	245 x 245	245 x 275	P 4007152	P 4007155	6,0	310 x 825	P 3012605	15,0	540 x 1035	P 3024135	
1,5	245 x 245	270 x 270	P 4008152	P 4008155	6,0	350 x 720	P 3014605	15,0	555 x 950	P 3025135	
2,0	170 x 765	-	P 3004202	-	6,0	365 x 645	P 3015605	15,0	575 x 940	P 3026135	
2,0	185 x 635	-	P 3005202	-	6,0	385 x 635	P 3016605	15,0	595 x 925	P 3027135	
2,0	205 x 565	-	P 3006202	-	6,0	405 x 625	P 3017605	15,0	375 x 1125	P 4013135	
2,0	220 x 475	-	P 3007202	-	6,0	420 x 570	P 3018605	15,0	395 x 1055	P 4014135	
2,0	240 x 420	-	P 3008202	-	6,0	440 x 550	P 3019605	15,0	415 x 1000	P 4015135	
2,0	260 x 380	-	P 3009202	-	6,0	455 x 545	P 3020605	15,0	435 x 940	P 4016135	
2,0	275 x 340	-	P 3010202	-	6,0	475 x 540	P 3021605	15,0	455 x 890	P 4017135	
2,0	295 x 315	-	P 3011202	-	6,0	265 x 785	P 4008605	15,0	475 x 850	P 4018135	
2,0	185 x 515	-	P 4004202	-	6,0	305 x 635	P 4010605	15,0	495 x 810	P 4019135	
2,0	210 x 420	-	P 4005202	-	6,0	325 x 585	P 4011605	15,0	515 x 780	P 4020135	
2,0	225 x 350	-	P 4006202	-	6,0	350 x 550	P 4012605	15,0	535 x 750	P 4021135	
2,0	245 x 305	-	P 4007202	-	6,0	365 x 505	P 4013605	15,0	555 x 725	P 4022135	
2,0	265 x 275	-	P 4008202	-	6,0	390 x 470	P 4014605	15,0	575 x 700	P 4023135	
3,0	205 x 925	205 x 905	P 3006302	P 3006305	6,0	405 x 455	P 4015605	15,0	595 x 690	P 4024135	
3,0	225 x 790	225 x 910	P 3007302	P 3007305	6,0	425 x 425	P 4016605	15,0	615 x 660	P 4025135	
3,0	240 x 690	240 x 700	P 3008302	P 3008305	9,0	400 x 975	P 3017905	15,0	635 x 640	P 4026135	
3,0	260 x 620	260 x 705	P 3009302	P 3009305	9,0	435 x 870	P 3019905				
3,0	275 x 555	275 x 580	P 3010302	P 3010305	9,0	475 x 800	P 3021905				
3,0	295 x 510	295 x 575	P 3011302	P 3011305	9,0	490 x 790	P 3022905				
3,0	315 x 460	315 x 490	P 3012302	P 3012305	9,0	525 x 720	P 3024905				
3,0	330 x 440	330 x 465	P 3013302	P 3013305	9,0	545 x 705	P 3025905				
3,0	345 x 410	350 x 450	P 3014302	P 3014305	9,0	565 x 695	P 3026905				
3,0	365 x 390	370 x 410	P 3015302	P 3015305	9,0	600 x 675	P 3028905				
3,0	370 x 385	380 x 395	P 3016302	P 3016305	9,0	345 x 890	P 4012905				
3,0	205 x 685	205 x 735	P 4005302	P 4005305	9,0	385 x 775	P 4014905				
3,0	225 x 575	230 x 615	P 4006302	P 4006305	9,0	405 x 730	P 4015905				
3,0	245 x 500	250 x 545	P 4007302	P 4007305	9,0	425 x 685	P 4016905				
3,0	265 x 445	265 x 470	P 4008302	P 4008305	9,0	445 x 655	P 4017905				
3,0	285 x 400	285 x 420	P 4009302	P 4009305	9,0	465 x 625	P 4018905				
3,0	325 x 340	325 x 360	P 4011302	P 4011305	9,0	505 x 575	P 4020905				
3,0	340 x 340	340 x 340	P 4012302	P 4012305	9,0	525 x 565	P 4021905				
4,0	225 x 880	-	P 3007402	-							
4,0	260 x 700	-	P 3009402	-							
4,0	315 x 545	-	P 3012402	-							
4,0	330 x 515	-	P 3013402	-							
4,0	350 x 475	-	P 3014402	-							
4,0	385 x 435	-	P 3016402	-							
4,0	405 x 420	-	P 3017402	-							
4,0	205 x 810	-	P 4005402	-							
4,0	225 x 685	-	P 4006402	-							
4,0	245 x 595	-	P 4007402	-							
4,0	285 x 475	-	P 4009402	-							
4,0	310 x 435	-	P 4010402	-							
4,0	325 x 400	-	P 4011402	-							
4,0	345 x 375	-	P 4012402	-							

**Legend:**  
  
**Type:**  
J = unheated connection cable N  
on the short side J  
K = unheated connection cable N  
on the long side K  
  
**Sheath material:**  
F = Fluorinated ethylene propylene (FEP)  
P = Perfluoroalkoxy (PFA)

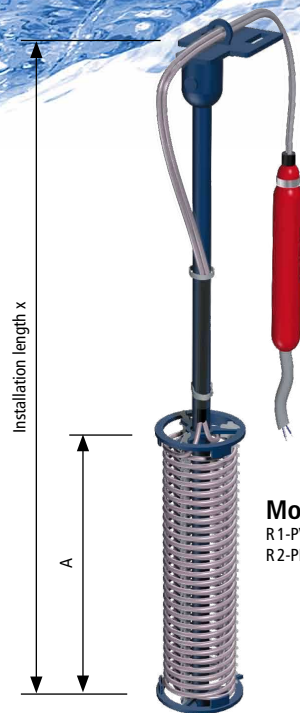
Type designation	Type	Sheath heater cable	Length of unheated connection cable N			Length of connection cable C			Model
			0=1 m	1=1,5 m	2=2 m	0=1 m	1=1,5 m	2=2 m	
P . . . . .	J or K	F or P	3=2,5 m	4=3 m	5=3,5 m	3=2,5 m	4=3 m	5=3,5 m	A1, A2, C1, C2, D1, D2, E, F, M1, M2, Q, R
			6=4 m	7=4,5 m	8=5 m	6=4 m	7=4,5 m	8=5 m	
Example:	J	F	2			0			E

**P4010402JF20E:** Flat heater, 4 kW, dimensions J x K for 230V~ (310 x 435 mm), connection cable N on short side J, FEP sheath, 2 m connection cable N, 1 m connection cable C, PP frame without protective plate.

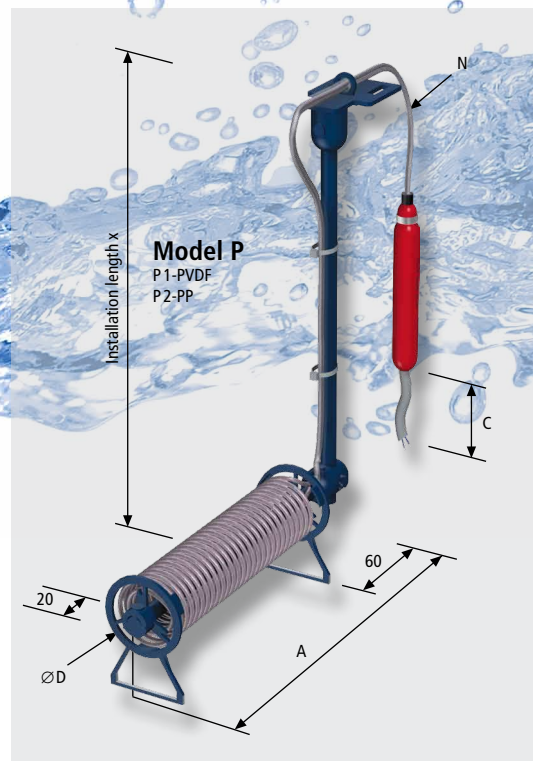
# Cylindrical Heaters GALMATHERM®

## GALMATHERM Cylindrical Heaters (Type C85 / C12)

The heater model P is an alternative to the ROTKAPPE angular heaters made of metal for heating very aggressive liquids. Since the horizontal part of the heater is heated, the contents of the tank are heated from the bottom, thus ensuring good heat transfer and distribution even at low or widely varying liquid levels. This cylindrical model permits the use of high power even in restricted spaces. Also, you can choose the type of the coating of the heating cable (FEP or PFA) and the lengths of the immersed, unheated connection cable [N] and of the external PVC connection cable [C] to meet your requirements.



**Model R**  
R1-PVDF  
R2-PP



**Model P**  
P1-PVDF  
P2-PP

## GALMATHERM cylindrical heaters (Type C85 / C12)

Rated power [kW]	ØD [mm]	Model R Dimensions A [mm] for rated voltage		Model P Dimensions A [mm] for rated voltage		Type designation for rated voltage	
		230V~	400V3~	230V~	400V3~	230V~	400V3~
1,0	85	280	-	320	-	C8500102	-
1,5	85	330	465	370	505	C8500152	C8500155
2,0	85	410	-	450	-	C8500202	-
3,0	85	640	775	680	815	C8500302	C8500305
4,0	85	750	-	790	-	C8500402	-
4,5	85	-	920	-	960	-	C8500455
6,0	85	-	1160	-	1200	-	C8500605
9,0	125	-	1160	-	1200	-	C1200905
12,0	125	-	1340	-	1380	-	C1200125

Type designation	coating heating cable F or P	Length of unheated connection cable N			Length of connection cable C			Model
		0=1 m	1=1,5 m	2=2 m	0=1 m	1=1,5 m	2=2 m	
C.....								R1, R2, P1, P2
		3=2,5 m	4=3 m	5=3,5 m	3=2,5 m	4=3 m	5=3,5 m	
		6=4 m	7=4,5 m	8=5 m	6=4 m	7=4,5 m	8=5 m	
Example:	F	6			1			P1

**C85003020F61P1:** cylindrical heater, 3 kW, dimensions for 230V~ (ØD=85 mm, A=680 mm),  
FEP coating, 4 m unheated connection cable N, 1.5 m connection cable C, Model P1 (PVDF)



# Float Switches MTS... made of PP or PVDF

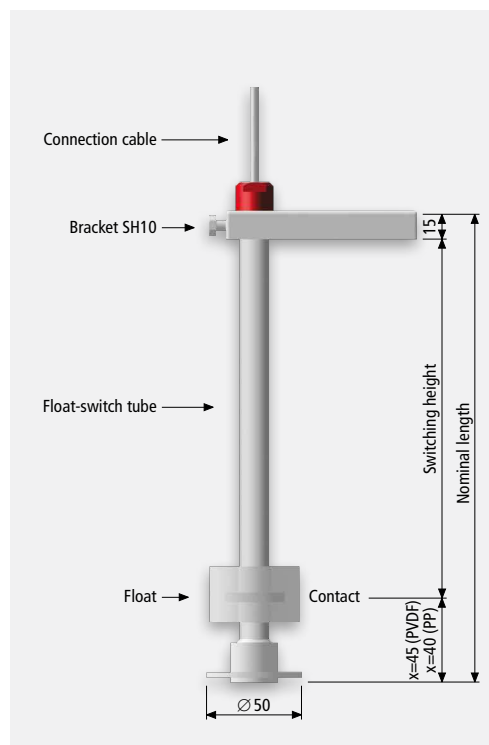
Liquid levels in process and storage tanks need to be measured and monitored, since unwanted variations in these levels (due to evaporation or removal of the liquids) must be corrected. In this respect, a distinction must be made between two general tasks:

- controlling of the level in order to permit automatic execution of process operations (such as dosing of liquids)
- monitoring of the level in order to prevent possible damage (dry-running, heating without sufficient liquid) to the devices (pumps, heaters) installed in the tanks or to prevent an overflow of the process liquid from the tanks.

Float switches offer a simple and economical solution for the controlling and monitoring of liquid levels in tanks. A float switch can even be used without connecting an additional electronic controller!

The function of a float switch is based on the moving float and can be guaranteed only in liquids which do not form encrustation. Dirt in the tank (such as coarse metal chips) can also block the movement of the float.

In such cases, where a float switch cannot be used, we recommend the use of our level rod-probes, providing the liquid is electrically conductive.



Float switch with one contact, version PG

The float switches are available in various versions:

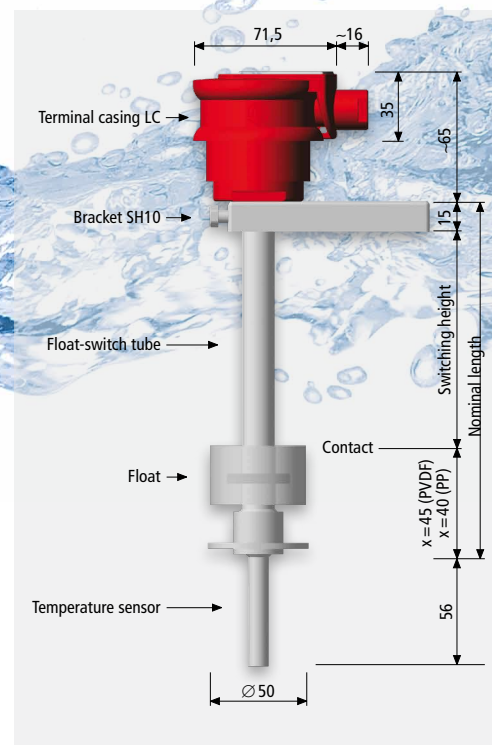
- with one switch contact (with or without an integrated temperature sensor),
- with two switch contacts,
- with three switch contacts.

All switch contacts are changeover contacts.

## Function

A magnet inside the moving float actuates a reed contact mounted in a fixed position within the tube of the float switch.

In order to ensure optimal chemical and thermal resistance, the float switches are made of polypropylene



Float switch with one contact and integrated temperature sensor, version LC

The BC version can be mounted on the edge of a tank with the support HB (PP) and HB/L (PVDF) or on a crossbeam with the aid of the mounting sleeve EM or the holding sleeve HM.

## PG version

On float switches without a terminal casing and with a permanently connected cable 1.6 m long (other cable lengths to order), the cable enters the tube of the float switch via a cable gland. Degree of protection IP 64 (splash-proof) according to EN 60529.

(PP) or polyvinylidene fluoride (PVDF). They are available without a terminal casing (version PG) and a permanently connected cable (length of 1.6 m), with the small terminal casing LC (material PP) or LC/L (material PVDF) and with the large terminal casing BC (material PP) or BC/L (material PVDF). The versions with terminal casings permit easy connection of the cables.

On the PG and LC versions, the brackets on the tube of the float switch permit adjustment to any desired height and simple mounting of the float switches on the edges of tanks.





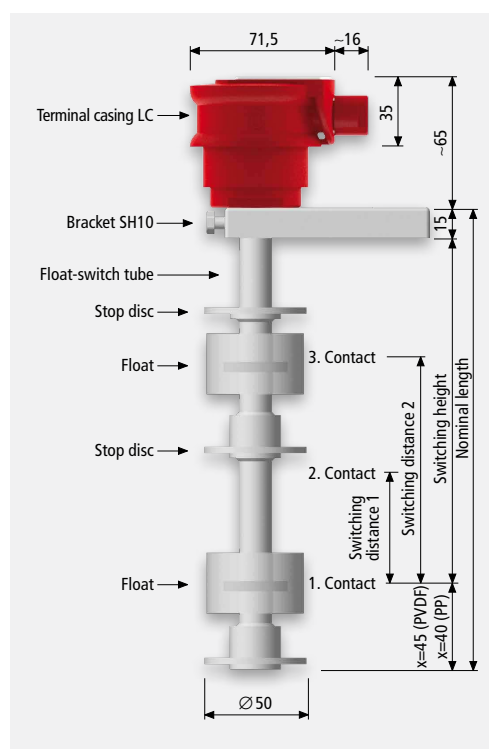
# Controlling and Monitoring with Safety and Quality

## BC version

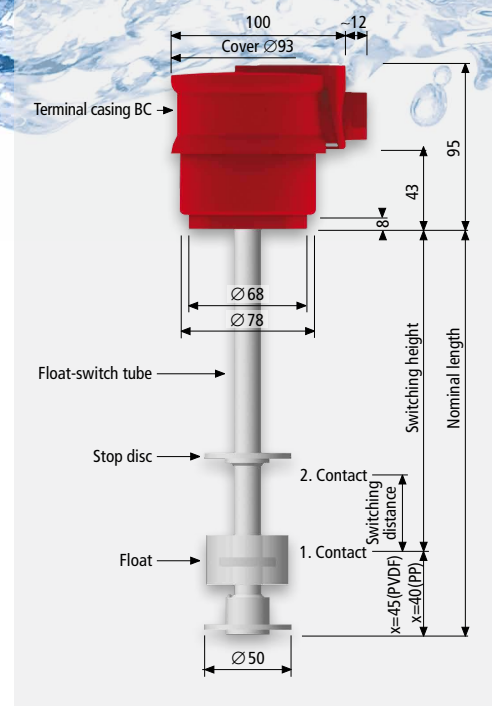
The terminal casing BC (Ø93mm), made of PP, permits connection of the cable and has the degree of protection IP 65 (jet waterproof) in accordance with EN 60529. If the switch is exposed to high temperatures (liquid temperature >80°C) or strongly oxidizing chemicals (such as chrome electrolyte or HNO<sub>3</sub> solutions), the PVDF terminal casing BC/L should be used. The cover can be unscrewed with the mounting wrench SB for access to cable terminals.

## LC version

The small terminal casing LC, made of PP or LC/L, made of PVDF, permits cable connection and has the degree of protection IP 65 (jet waterproof) in accordance with EN 60529. The cover can be unscrewed with the mounting wrench SL.



Float switch with 3 contacts, LC version



Float switch with 2 contacts, BC version

## Switching points

The switching points are set in the factory and cannot be changed. For this reason, you must precisely specify the first switching point and the distances from this to any further contacts when ordering the float switches.

The nominal length of the float switch is easily determined on the basis of the drawing.

**PG-/LC version** (in cm) Nominal length = 1.5 cm (bracket) + switching height + dimension X

**BC version** (in cm) Nominal length = switching height + dimension X

## Technical Data

	Float Switches			
	MTSu	MTSt	MTS2u	MTS3u
<b>Number of contacts</b>	1 changeover	1 changeover	2 changeover	3 changeover
<b>Integrated temp. sensor</b>	no	Pt100	no	no
<b>Switching current</b>	max. 1.0A	max. 1.0A	max. 1.0A	max. 1.0A
<b>Switching voltage</b>	1 V AC/DC - 250V AC	1 V AC/DC - 250V AC	1 V AC/DC - 250V AC	1 V AC/DC - 250V AC
<b>Switching power</b>	max. 60VA/60W	max. 60VA/60W	max. 60VA/60W	max. 60VA/60W
<b>Switching delay</b>	none	none	none	none
<b>Switching hysteresis</b>	5 mm	5 mm	5 mm	5 mm
<b>Min. distance between contact 1 and 2</b>	-	-	25 mm	40 mm
<b>Min. distance between contact 1 and 3</b>	-	-	-	110 mm
<b>Min. nominal length</b>	100 mm	100 mm	125 mm	210 mm
<b>Versions</b>	PG, LC, LC/L BC, BC/L	LC, LC/L BC, BC/L	PG, LC, LC/L BC, BC/L	PG, LC, LC/L BC, BC/L

## Selection Table for Control and Monitoring Electronics

	Float Switches			
	MTSu	MTSt	MTS2u	MTS3u
<b>Monitoring Devices</b>				
Level monitor	ETS100	ETS100	ETS200	-
Temperature limiter	-	ETB100	-	-
<b>Control Devices</b>				
Level controller	-	-	ENR200	ENR300
Temperature controller	-	MTR	-	-

# Float Switches MTS... made of Stainless Steel

Liquid levels in process and storage tanks need to be measured and monitored, since unwanted variations in these levels (due to evaporation or removal of the liquids) must be corrected. In this respect, a distinction must be made between two general tasks:

- controlling of the level in order to permit automatic execution of process operations (such as dosing of liquids)
- monitoring of the level in order to prevent possible damage (dry-running, heating without sufficient liquid) to the devices (pumps, heaters) installed in the tanks or to prevent an overflow of the process liquid from the tanks.

Float switches made of stainless steel (mat. no. 316Ti) offer a simple and economical solution for the controlling and monitoring of liquid levels in tanks. A float switch can even be used without connecting an additional electronic controller!

The function of a float switch is based on the moving float and can be guaranteed only in liquids which do not form encrustation. Dirt in the tank (such as coarse metal chips) can also block the movement of the float.

In such cases, where a float switch cannot be used, we recommend the use of our level rod-probes, providing the liquid is electrically conductive.

The float switches are available in various versions:

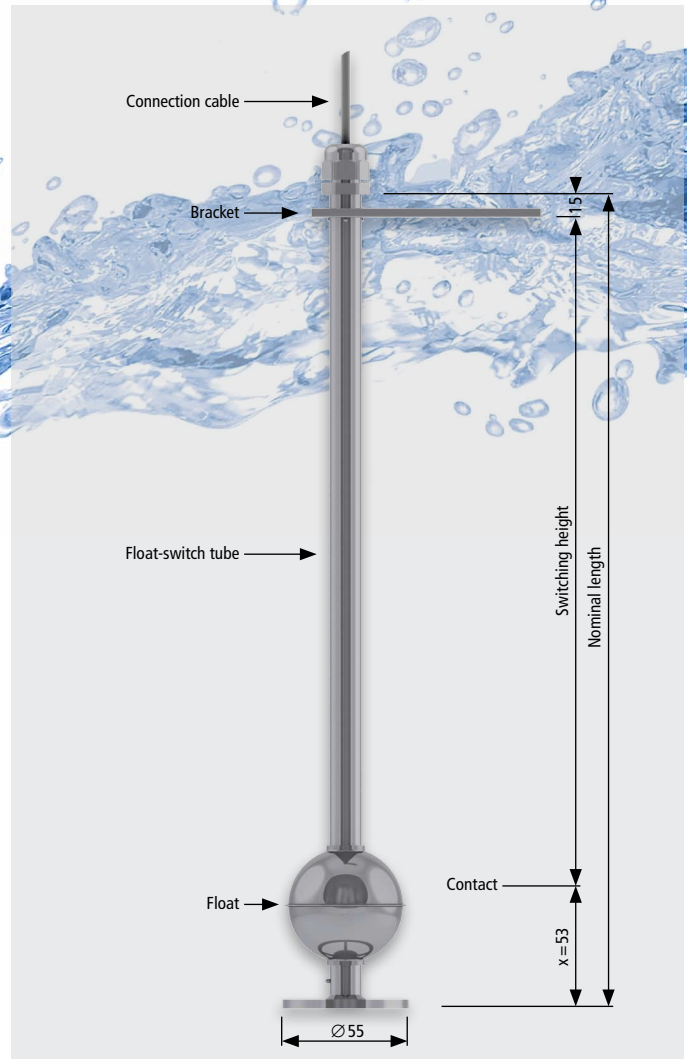
- with one switch contact
- with two switch contacts
- with three switch contacts

All switch contacts are changeover contacts.

## Function

A magnet inside the moving float actuates a reed contact mounted in a fixed position within the tube of the float switch.

The float switches are available without a terminal casing (version PG) and a permanently connected cable (length of 1.6 m), with the small terminal casing LC (material PP) or LC/L (material PVDF) and with the large terminal casing BC (material PP) or BC/L (material PVDF). The versions with terminal casings permit easy connection of the cables.



Float switch made from stainless steel with one contact, version PG

On the PG and LC versions, the position of the bracket, the screw-on flange or the welded flange has to be specified precisely when ordering.

The BC version can be mounted on the edge of a tank with the support HB (PP) and HB/L (PVDF) or on a crossbeam with the aid of the mounting sleeve EM or the holding sleeve HM.

## PG version

On float switches without a terminal casing and with a permanently connected cable 1.6 m long (other cable lengths to order), the cable is led out of the stainless steel tube of the float switch via a cable gland. Degree of protection IP 64 (splash-proof) according to EN 60529.



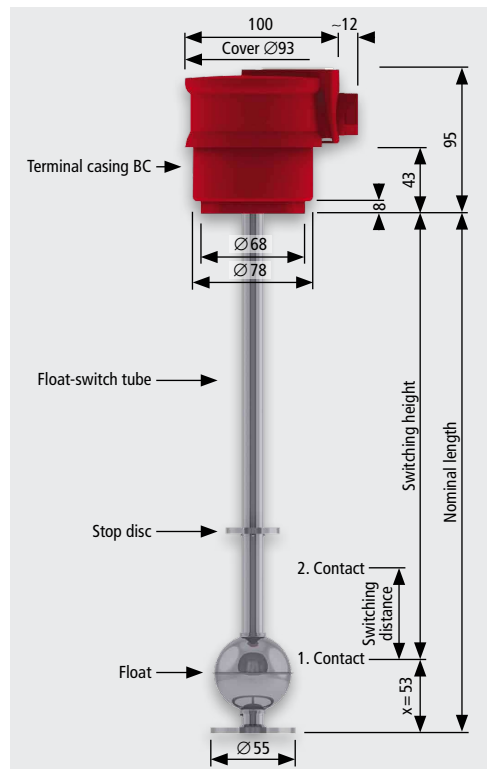
# Controlling and Monitoring with Safety and Quality

## BC version

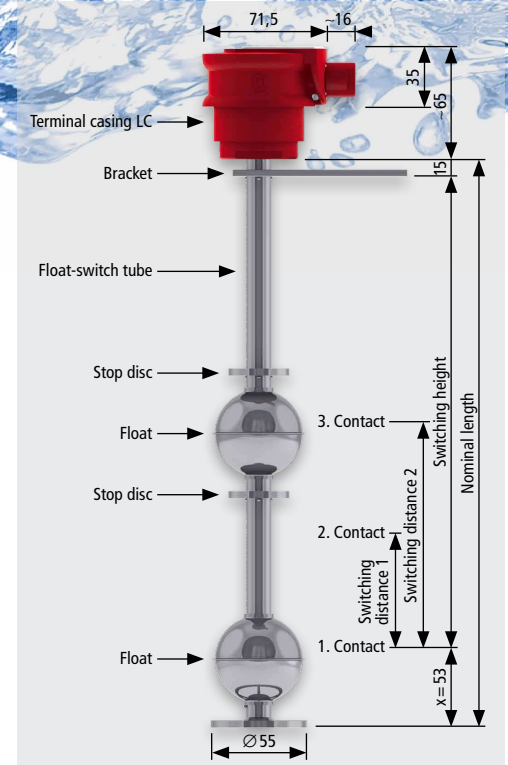
The terminal casing BC (Ø93 mm), made of PP, permits connection of the cable and has the degree of protection IP 65 (jet waterproof) in accordance with EN 60529. If the switch is exposed to high temperatures (liquid temperature >80°C), the PVDF terminal casing BC/L should be used. The cover can be unscrewed with the mounting wrench SB for access to cable terminals.

## LC version

The small terminal casing LC, made of PP or LC/L, made of PVDF, permits cable connection and has the degree of protection IP 65 (jet waterproof) in accordance with EN 60529. The cover can be unscrewed with the mounting wrench SL.



Float switch made from stainless steel with 2 contacts, BC version



Float switch made from stainless steel with 3 contacts, LC version

## Switching points

The switching points are set in the factory and cannot be changed. For this reason, you must precisely specify the first switching point and the distances from this to any further contacts when ordering the float switches.

The nominal length of the float switch is easily determined on the basis of the drawing.

**PG-/LC version** (in cm) Nominal length = 1.5 cm (bracket) + switching height + dimension X

**BC version** (in cm) Nominal length = switching height + dimension X

## Technical data

	Float switches		
	MTS <sub>u</sub>	MTS <sub>2u</sub>	MTS <sub>3u</sub>
<b>Number of contacts</b>	1 changeover	2 changeover	3 changeover
<b>Switching current</b>	max. 1.0A	max. 1.0A	max. 1.0A
<b>Switching voltage</b>	1 V AC/DC - 250V AC	1 V AC/DC - 250V AC	1 V AC/DC - 250V AC
<b>Switching power</b>	max. 60 VA/60 W	max. 60 VA/60 W	max. 60 VA/60 W
<b>Switching delay</b>	none	none	none
<b>Switching hysteresis</b>	5 mm	5 mm	5 mm
<b>Min. distance between contact 1 and 2</b>	-	25 mm	40 mm
<b>Min. distance between contact 1 and 3</b>	-	-	120 mm
<b>Min. nominal length</b>	125 mm	160 mm	250 mm
<b>Versions</b>	PG, LC, LC/L, BC, BC/L	PG, LC, LC/L, BC, BC/L	LC, LC/L, BC, BC/L

## Selection table for control and monitoring electronics

	Float switches		
	MTS <sub>u</sub>	MTS <sub>2u</sub>	MTS <sub>3u</sub>
<b>Monitoring devices</b>			
Level monitor	ETS 100	ETS 200	-
<b>Control devices</b>			
Level controller	-	-	ENR 300



# Detecting liquid levels with conductive Level Rod-Probes

Liquid levels in process and storage tanks need to be measured and monitored, since unwanted variations in these levels (due to evaporation or removal of the process liquids) must be corrected. In this respect, there are two different general tasks:

- control of the level in order to permit automatic execution of process operations (such as dosing of liquids)
- monitoring of the level in order to prevent possible damage (dry-running, heating without sufficient liquid) to the devices (pumps, heaters) installed in the tanks or to prevent an overflow of the process liquid from the tanks.

You can assure the safe control and monitoring of the liquid level in your tank by using level rod-probes. Since these are purely passive devices, suitable electronic controllers are needed.

Level rod-probes operate on the conductive principle, which means that they can be used only in electrically conductive liquids (conductivity  $>4\mu\text{S}$ ). Encrustation and contamination in the tank normally have no effect on the function of the probes.

Possible deposits of encrustation between the tips of the probe can be avoided by ensuring that the difference between the probe-rod lengths is at least 60 mm.

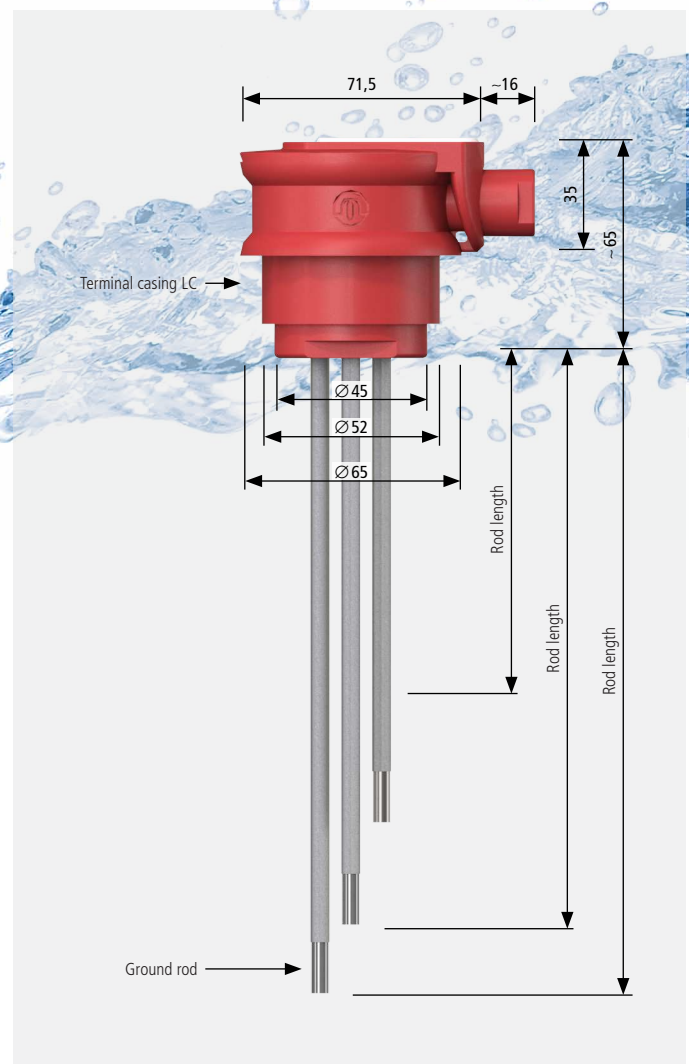
The levels of non-conductive or poorly conducting liquids, in which level rod-probes cannot be used, can be controlled and monitored by our float switches.

The level rod-probes are available in many different versions:

- with two to five rods for detection of one to four different levels and
- with or without an integrated temperature sensor.

A suitable electronic controller applies a low alternating voltage to the probe rods. A current then flows from the electrically conductive tips of the rods and through the conductive liquid to the reference electrode, called the ground rod. The electrical circuit is closed. If the liquid level drops below the tip of a probe rod, the related electrical circuit is opened. The electronic controller detects the two states "current" and "no current".

The ground rod must be at least as long as the longest rod. An additional ground rod must be provided for level rod probes coated with PTFE-Compound, if the distance between the tips of the minimum and maximum rods is more than 1000 mm.



Level rod-probes NS with terminal casing LC

In metallic, electrically conductive tanks, no ground rod is needed if the ground terminal is connected directly to the tank.

In order to prevent the rods from touching each other, PTFE spacers are fitted on probes with rod lengths of 300 mm or more.

The level rod-probes are available with the small terminal casing LC (material PP) or LC/L (material PVDF) and the large terminal casing BC (material PP) or BC/L (material PVDF).

Level rod-probes with terminal casing BC can be mounted onto the edge of the tank by the supports HB (PP) or HB/L (PVDF) or on a cross-beam by means of the mounting sleeve EM or the holding sleeve HM.

Level rod-probes with terminal casing LC are mounted onto the edge of the tank by the supports HL (PP) or HL/L (PVDF), or on crossbeams by means of the holding sleeve ML.





In order to ensure optimal chemical and thermal resistance, the level rod-probes are made from a variety of materials.

### Specifications of the standard materials

Code letter	Probe rod material	Coating	Temp. Sensor material (in case of NT)	Max. liquid temperature
<b>K</b>	PTFE-Compound	PTFE, pure-white	PFA	100°C
<b>B</b>	Stainless steel (Mat. No. 316Ti)	PTFE, pure-white	PFA	90°C
<b>T</b>	Titanium (Mat. No. 3.7035)	PTFE, pure-white	PFA	90°C

### Overview of available level rod-probes

The switching points are determined by the various lengths of the probe rods and can be changed by the customer by cutting the rods to the desired length (not possible in the case of PTFE probe rods).

<b>Number of levels to be detected</b>	1	2	3	4
<b>Number of probe rods</b>	2	3	4	5
<b>Level rod-probes type</b>	NS2	NS3	NS4	NS5
<b>Level rod-probes with integrated Temperature sensor Pt 100</b>	NT2	NT3	-	-

### BC Version

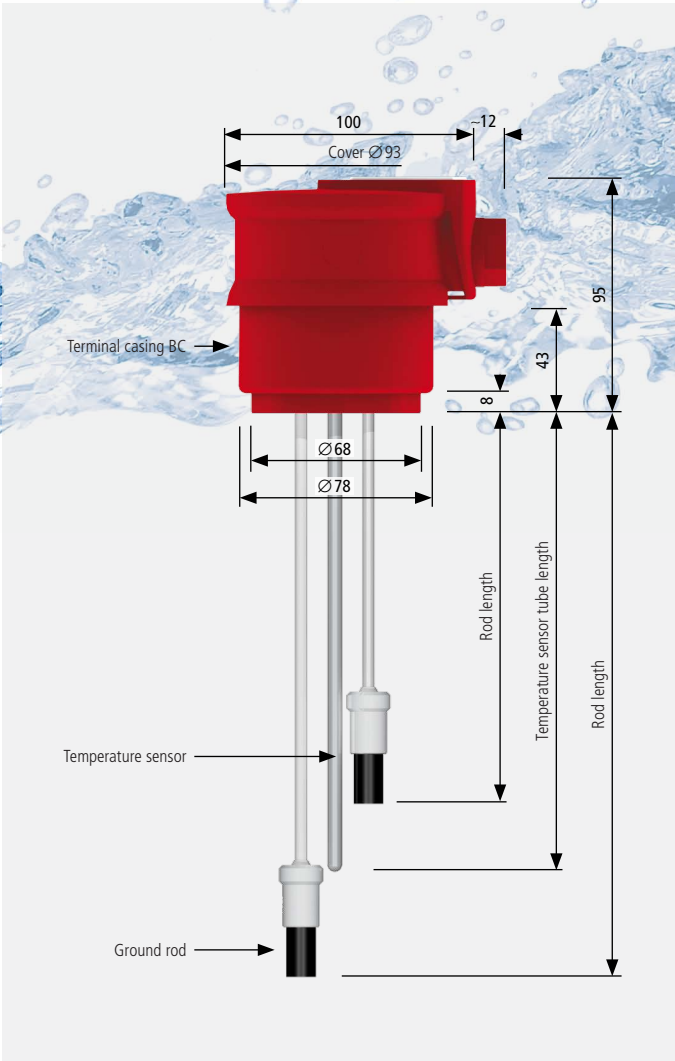
The terminal casing BC made of PP permits the connection of the cable and has the degree of protection IP 65 (jet waterproof) in accordance with EN 60529. In cases of high temperatures (liquid temperature >80°C) or strongly oxidizing chemicals (such as chrome electrolyte or HNO<sub>3</sub> solutions), the PVDF terminal casing BC/L should be used.

### LC Version

The small terminal casing LC made of PP or LC/L made of PVDF permits the cable connection and has the degree of protection IP 65 (jet waterproof) in accordance with EN 60529.

### Cable connection

The covers of the terminal casings can be unscrewed by using the mounting wrench for access to the cable terminals.



Level rod-probes NT with terminal casing BC

Level rod-probes used together with suitable electronic controllers ensure the safe control and monitoring of important process parameters.

### Selection table for control and monitoring electronics

	Level rod-probe types					
	NS2	NS3	NS4	NS5	NT2	NT3
<b>Monitoring devices</b>						
Level monitor	ETS100	ETS200	-	ETS410	ETS100	ETS200
Temperature limiter	-	-	-	-	ETB100	ETB100
<b>Control devices</b>						
Level controller	-	ENR200	ENR300	-	-	ENR200
Temperature controller	-	-	-	-	MTR	MTR

# Electronic Fluid Level Control and Monitoring Equipment



Rod-type level probes in conjunction with electronic control units ensure that important process parameters are controlled and monitored safely. Appropriate types of electronic control unit are mandatory because the probes have to be powered with a low probe voltage (pure sinusoidal AC voltage).

The response sensitivity can be set to different levels according to the conductivity of the process fluid.

## Level control

The **ENR 200** is equipped with a relay output (MIN / MAX control contact) that can be configured as a break or make contact, according to the application.

As well as the MIN / MAX control contact, the **ENR 300** has an independent switching contact. This switching contact is used for monitoring a MIN / MAX alarm fluid level.

## Level monitoring

The **ETS 100** electronic level monitoring system is used for monitoring a fluid level as a MIN or MAX switching contact. The contact switches if the required maximum level is exceeded or the level drops below the defined minimum. The contact is reactivated automatically when the level of the process fluid returns to the „permitted“ range. Run-dry protection for heaters and pumps is a very common type of application for this type of system. The heater or the pump is switched off if the level drops below minimum, and reactivated only when the level rises back above the minimum.

The **ETS 200** is capable of monitoring two fluid levels independently of one another.

The **ETS 410** electronic level monitor offers four separate signal inputs and four relay outputs. This means that four independent fill levels can be detected in one container and evaluated, for instance via an SPS. This facilitates a MIN / MAX control function and two alarm states or alternatively four alarm states. Four LEDs show the status of the outputs on the front.

The electrical connection is made using removable, non-interchangeable plug-in terminals. The LEDs indicate when the electronic control units are ready to operate, as well as the switching status of the outputs.

The electronic control units are installed in the control cabinet, where the relatively small dimensions of their housings permit space-saving installation.





# Controlling and Monitoring Fluid Levels

**Selection table of the control and monitoring electronics**

	Level probes / switches							
	NS2/MTSu	NS3/MTS2u	NS4/MTS3u	NS 5	NT 2/ MTSt	NT 3	NT 4	NT 5
Monitoring technology								
Level monitoring	ETS 100	ETS 200	-	ETS 410	ETS 100	ETS 200	-	ETS 410
Control technology								
Level control	-	ENR 200	ENR 300	-	-	ENR 200	ENR 300	-

## Technical data

	ETS100	ETS200	ETS410	ENR200	ENR300
<b>No. of level switching points</b>	1	2	4	2	3
Contacts (potential-free)	1 Changeover switch	2 Changeover switches	2 CO + 1 NO + 1 NC	1 Changeover switch	2 Changeover switches
<b>Switching status display</b>	1 LED	2 LED	4 LED	1 LED	2 LED
Voltage	20...230V AC/DC	20...230V AC/DC	18...32V DC	20...230V AC/DC	20...230V AC/DC
<b>Power consumption approx.</b>	2VA	2VA	3VA	2VA	2 VA
<b>Output</b>					
Switching voltage	<250V AC	<250V AC	<60V DC	<250V AC	<250V AC
Switching current	≤ 5A	≤ 5A	≤ 2A	≤ 5A	≤ 5A
Test function	yes	yes	no	yes	yes

<b>Input</b>	
Switching delay	2 s / 8 s (can be toggled, not on the ETS 410)
<b>Output voltage / current</b>	0,1...6V~ / <5 mA~
Trigger sensitivity	0,05...250 kΩ (4 μS...2.10 <sup>4</sup> μS) adjustable with 32 stages
<b>Mechanical construction</b>	
Casing material	Polyamide PA 6.6
Flammability class housing	V0 (UL94)
Mounting	on 35 mm mounting rail (acc. to EN 50022)
Dimensions	w=22,5 mm, h=111 mm, d=115 mm
Index of protection	IP 20 (acc. to EN 60529)
<b>Climatic stress</b>	
Ambient temperature	-20...50°C
Transport and storage temp.	-40...60°C
Max. humidity	<75 % (no dew)

# Measuring Temperatures with Temperature Sensors TF...

Particularly in surface treatment, the precise measurement and control of temperatures is of decisive importance for the subsequent quality of the treated items. To keep the temperature of the liquid in storage tanks within the desired range, also prevents negative effects on the process liquids, such as freezing, crystallisation and excessive viscosity.

The following functions need to be implemented:

- Control of the temperature in order to automate process steps (such as keeping the desired process temperature)
- Monitoring of the temperature in order to avoid possible damage to the process, the process liquid (e.g. damage by excessive temperatures) and the tank (e.g. thermal damage)

With the aid of temperature sensors and suitable electronic units, you can control and monitor the temperature of liquids easily and cheaply.

Our temperature sensors are available in the following versions:

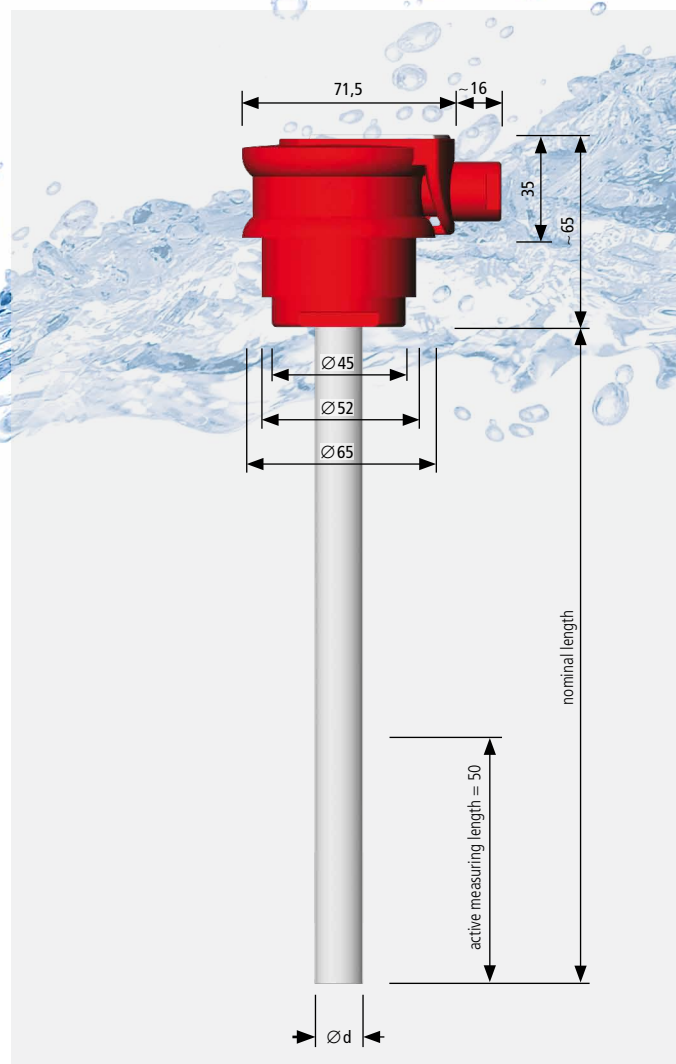
- with rigid immersion tubes made of various materials
- with flexible tube made of PFA

All versions can be equipped with one, two or three Pt 100 elements. Other temperature sensors specified by you can also be integrated.

The function of the temperature sensor results from the integrated Pt 100 sensor element. The temperature is determined from the temperature-dependent change in the electrical resistance of the Pt 100 element. At 0°C, the element has a resistance of exactly 100 Ω. As the temperature increases, the resistance of the element changes in direct proportion to the temperature change.

A suitable electronic unit generates a low, constant current through the Pt 100 element and measures the resulting voltage across the element. The resistance of the element, and thus its temperature, can then be determined with the aid of Ohm's Law ( $R = U/I$ ).

The connection between the electronic unit and the Pt 100 element can be made with 2, 3 or 4 wires. We provide 4-wire connections because these permit compensation for the resistance of the connecting wires.

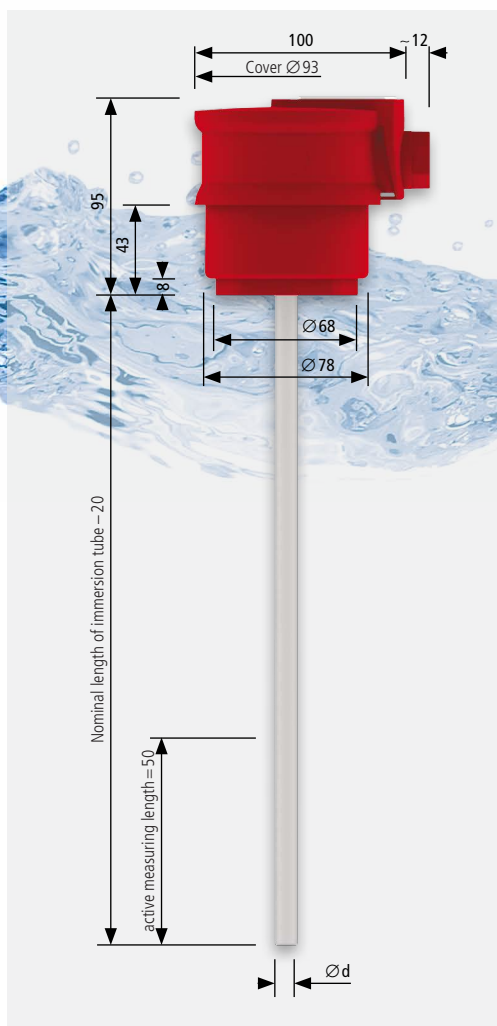


Temperature sensor with terminal casing LC

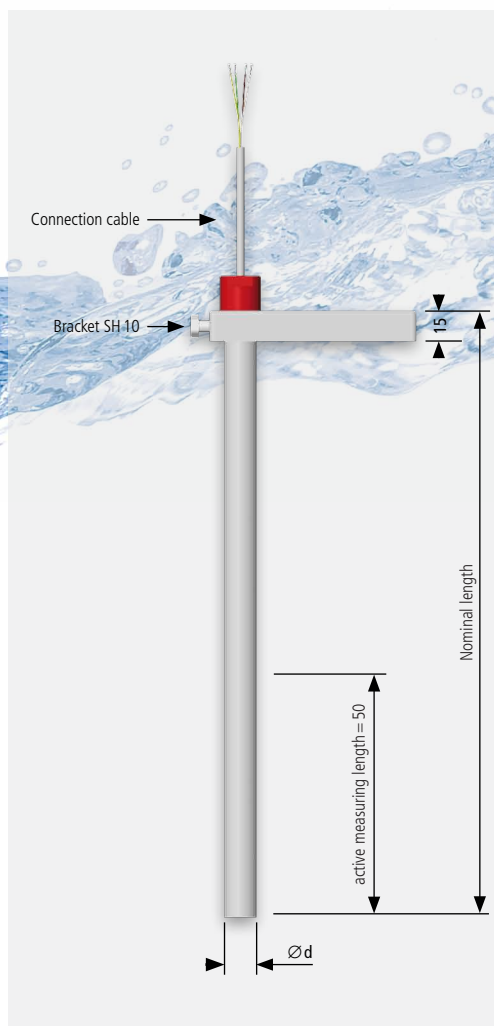
Particularly in the case of long wires, the measurement result can be significantly distorted by the wire resistance. Therefore, the connection of temperature sensors to electronics should not exceed 50 m and should be executed generally with 3 or 4 wires. For longer lengths, it is possible to interpose a temperature transmitter with a standard output signal of 4...20 mA.

**Temperature sensors with a flexible protective tube** made of PFA (Ø 6 mm) with a standard length of 1.6 m (other lengths possible) are extremely resistant to chemicals and the maximum operating temperature is 200°C. They are also suitable for use in cleanroom applications (physiologically benign) and can be mounted to the measuring point in plants and tanks where space is limited. The Pt 100 sensor element, with an active measuring length of 50 mm, is mounted to the end of the protective tube.

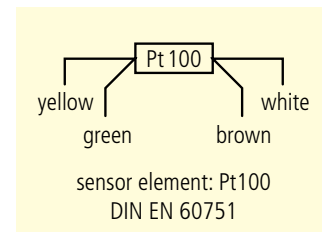




Temperature sensor with terminal casing BC



Temperature sensor in PG version with bracket SH 10



#### LC Version

Temperature sensor with rigid immersion tube. The small terminal casing LC made of PP or LC/L made of PVDF permits connection of a cable and has the degree of protection IP 65 (jet-waterproof) to EN 60529.

#### BC Version

Temperature sensor with rigid immersion tube. The terminal casing BC (Ø 93 mm) made of PP permits connection of a cable and has the degree of protection IP 65 (jet-waterproof) to EN 60529. In the case of extremely high temperatures (liquid temperature > 80°C) or possible exposure to strongly oxidant chemicals (such as chrome electrolyte or HNO<sub>3</sub> solutions), the terminal casing BC/L made of PVDF should be used.

#### Connection of the cable

The cover can be unscrewed with the mounting wrench to provide access to the terminals for connection of the cable.

#### SOG Version

The stranded conductors of the Pt 100 element are led out openly at the end of the protective tube.

#### SMG 00 Version

The terminal casing MG 00 (degree of protection: IP 64) at the end of the protective tube permits easy connection of a cable.

**Temperature sensors with rigid immersion tubes** are available with tubes made from various

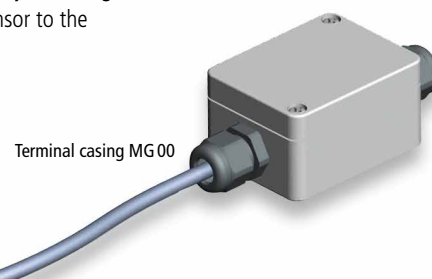
### Specifications of the standard materials

Immersion tube material	Code letter	Ø d	Max. operating temp. (°C)
Stainless steel (Material No. 316Ti)	B	11	100
Polypropylene (PP)	F	16	90
Polytetrafluorethylene (PTFE)	G	12	100
Polyvinylidene fluoride (PVDF)	L	16	100
Perfluoralkoxy (PFA)	M	6 (flexible tube)	200

materials in standard lengths of 300, 500 and 800 mm. Other lengths are possible. We can offer two different terminal casings with various sealing inserts for the connection cable. The Pt 100 elements can be replaced by the user.

#### PG Version

In the case of temperature sensors without a terminal casing the permanently connected cable (standard length 1.6 m) is led out of the rigid immersion tube via a cable gland (degree of protection IP 64). Other cable lengths are available. The bracket SH 10 is attached to the immersion tube and permits adjustment to any desired height of the immersion tube and easy mounting of the temperature sensor to the tank rim.





# Controlling Temperatures with the Electronic Temperature Controllers MTR



Electronic Temperature Controller MTR

The temperature controllers MTR 1000 / 1020 / 2000 are designed specially for the rough operating conditions in surface treatment plants; their front panel is covered with a sheet of polyethylene, which is insensitive to chemicals.

The relatively small dimensions permit installation on control panels or, with the aid of a casing, close to the tank, even when space is at a premium. Easy operation and the clear, 7-segment-LED display guarantee problem-free use. The cables are connected with the aid of plug-in terminals.

The parameters of the temperature controller are easily set with the buttons on the front panel. Amongst other things, the following parameters can be set: hysteresis of the switching contact, correction of the actual value, setpoint limiting, alarm limit value.

In order to ensure the best possible safety, the connected temperature sensor is monitored for breakage or a short-circuit of the sensor element. In the case of a fault, the heater is switched off.

The controller MTR 1000 has a logic input. This input can be used to switch to a lower temperature at night.

The MTR 1020 with an operating voltage of 24V (DC) is perfectly suitable for the use in control cabinets or large switchboards.



MTR 1000 with casing

	MTR 1000	MTR 1020	MTR 2000
<b>Number of setpoints</b>	1	2	2
<b>Output contacts</b>	1 changeover	1 changeover	2 changeovers
<b>Operating voltage</b>	230V~	16...36V (DC)	230V~
<b>Max. switched voltage</b>	250V~	250V~	250V~
<b>Max. switched current</b>	10A	10A	8A + 8A
<b>Max. switched power</b>	2 kW	2 kW	1,5 kW + 1,5 kW

## Technical data

<b>Front dimensions</b>	84 x 42 mm
<b>Installation depth</b>	approx. 85 mm
<b>Panel cut-out</b>	67,5 x 31,5 mm
<b>Degree of protection (front)</b>	IP 65 (to EN 60529)
<b>Degree of protection (rear)</b>	IP 00 (to EN 60529)
<b>Ambient temperature</b>	0...55°C
<b>Max. relative humidity</b>	0...75 % (no condensation)
<b>Supply voltage</b>	230V~ (+10 % / -15 %), 50...60 Hz
<b>Power consumption</b>	max. 4VA
<b>Measuring input</b>	Pt 100 with 3-wire connection
<b>Measuring range</b>	-60,0...400°C
<b>Measuring accuracy</b>	0,5 K ± 0,5 % of measuring range

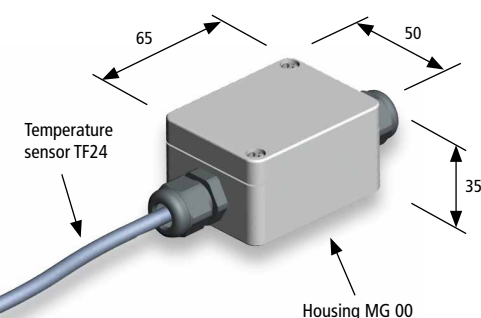


**MAZURCZAK**  
THERMOPROZESSE



# Safety Temperature Limiter ETB 100 with Temperature Sensor TF24

The safety temperature limiter ETB 100 monitors the temperature of process liquids in systems for a set limit value. If this is exceeded then the built-in relay (AC 230V/3A with fusible link for NO contact) switches the system to a safe operating status.



When the temperature of the liquid drops back below the set limit value, it is necessary for the reset button on the safety temperature limiter to be unlocked manually using an appropriate tool. This is a requirement of the DIN EN 14597 standard. Optionally, an external unlocking button can be connected.

A binary output (DC 24V/20 mA) allows an advanced warning to be given at an adjustable temperature prior to the limit value being attained.

The electrical power supply is 110...240V AC (ETB 100) or 20...30V AC/DC (ETB 110); the power consumption of the device is 5VA in this case.

The limiter is mounted on a top hat rail in the switch cabinet. It is connected up using screw terminals with a conductor cross section of max. 2.5 mm<sup>2</sup>. The permitted ambient temperature is 0...+55°C. The narrow housing made from polyamide has the dimensions 22.5 x 109 x 125 mm (W x H x D) with index of protection IP 20.

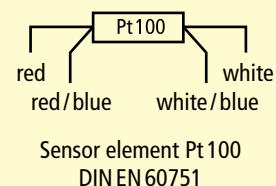
The temperature of the limiter can be easily set using the button on the front, and is displayed on the clear alphanumeric LC display. The maximum measuring range is -200...850°C (0.1 % accuracy over the entire measuring range), with the temperature sensor to be connected covering a temperature application range of -20...200°C.



Safety temperature limiter ETB 100

The temperature limiter approved by the TÜV Nord according to DIN EN 14597, combined with our certified temperature sensor TF 24 - 160 / SMG 00-M, provides a safety enhancing equipment in line with the required standards. The Pt 100 sensor element in 4-wire technology is located in a flexible protective tube made from fluoropolymer PFA with a diameter of 6 mm and a nominal length of 1.6 m.

The small plastic housing MG 00 (index of protection IP 64) at the end of the PFA protective tube makes it possible to connect a cable without difficulty. The maximum application temperature of the temperature sensor is 200°C.



Type name	Article number
ETB 100	3475000001
ETB 110	3482000001
TF 24 - 160 / SMG 00 - M	3932440001

