

Compact Single-Jet-, Multi-Jet- and Ultrasonic Meters

# F90 Series 3

DE-16-MI004-PTB025

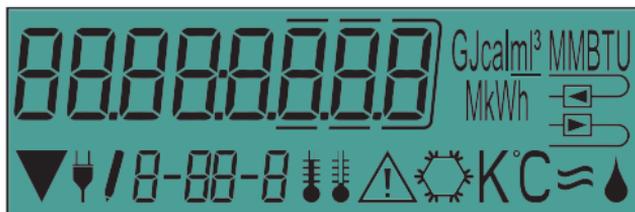


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# Content

Display symbols and pictograms .....	3
General notes .....	4
Operation and readout .....	6
Settings in parameterizing loop 5 .....	11
Tariff register (Index 1-07 and 1-08) .....	12
Error codes .....	14
Error descriptions and causes .....	15
Correct arrangement of measuring points .....	16
Installation of F90S3 and F90U3 heat meters .....	18
Installation of F90M3-IST heat meter - system Ista .....	19
Temperature sensor installation for F90S3, F90U3 and F90M3-IST .....	20
Installation of F90M3-A heat meter - system Allmess .....	22
Wall mounting of energy calculator .....	24
Electrical connection, power supply .....	26
Option modules .....	28
M-Bus interface (module 9) .....	28
Structure of the M-Bus telegram .....	29
Radio-interface, wireless M-Bus OMS (module 8) .....	30
Optical infrared interface (standard) .....	32
Two pulse outputs (module 10) .....	33
Three pulse inputs (included in module 8 and 9) .....	34
Installing and removing an option module .....	35
Technical data .....	36
Dimensions F90S3 .....	39
Dimensions F90U3 .....	40
Dimensions F90M3-IST - System Ista .....	41
Dimensions F90M3-A - System Allmess .....	42
EC Examination Certificate Series 3 .....	43

## Display symbols and pictograms



- $\text{GJcalm}^3 \text{MMBTU}$   
 $\text{MkWh}$  - Unit of displayed energy, volume, power and flow (GJ, Gcal, MMBTU, MWh, kWh, m<sup>3</sup>, l, kW, m<sup>3</sup>/h, l/h)
- Display of place of installation, here return flow (cold strand)
- Display of place of installation, here supply flow (hot strand)
- Not documented
- The meter is powered by mains supply
- Editing mode
- $8-88-8$  - Index: Display of level, value and subsequent values
- Temperature of hot strand sensor (supply flow)
- Temperature of cold strand sensor (return flow)
- Temperature difference
- Attention error
- Cooling energy for combined heat meters with cold tariff
- $\text{K}^\circ\text{C}$  - Temperature unit (Kelvin or °C)
- Flow detected
- Not documented

## General notes

This manual is intended for trained personnel. Thus basic work steps are not listed. All installation and maintenance work may only be carried out by a trained and authorized specialist.

### **IMPORTANT**

The security seals on the meter are intended to protect the meter against manipulation. However you have to break the seals of the calculator to install an option module. Please make sure to replace the broken seals after installation of an option module with the seals included in the accessory kit of the option module. A damaged seal indicates modification or manipulation.

- Leads of temperature sensors must not be shortened or otherwise altered.
- Applicable standards for the use of heat meters: EN1434 (Part 1 to 6), directive 2014/32/EU (attachment I and MI-004) and the relevant calibration legislation of the country in which the heat meter will be used.
- The operator is responsible for complying with the legal requirements.
- Heat meters are calibrated for a period of 5 years according to German legislation. The meters have to be replaced with new ones after calibration has expired.
- The register for accumulated cooling energy in combined heat-/ cold meters is not officially calibrated. Therefore it may not be used for billing purposes.
- National regulations for the consumption measurement of cooling energy must be observed.
- The regulations for electrical installations must be observed during installation. The product complies with the essential requirements of the EMC Directive 2014/30 / EU.
- The accuracy of the energy measurement can only be guaranteed if the water quality corresponds to the conditions of the AGFW recommendation FW-510 and the VDI 2035.
- Heat meters must be stored and shipped under frost-free conditions.
- **It is strongly prohibited to ship devices with activated radio signal via airfreight.**
- The place of installation of the heat meter and the flow direction must be observed.

## General notes

- All cables must be routed to a minimum distance of 50 cm to sources of electromagnetic interference (power switches, regulators, pumps, etc.) and at a distance of at least 10 cm from other current conducting cables.
- The F90 is calibrated with water as a heat conveying medium. Additives are prohibited because they change the physical properties of water and distort the measurement results.
- The energy unit (MWh, kWh, Gcal, etc.) and the place of installation of the heat meter (supply or return flow) can be set once by pressing the display-button (see page 11) or alternatively by using the software "Device Monitor".
- F90Solar3 only: The type of glycol and the concentration in the heat conveying medium can be set once before commissioning with the software "Device Monitor".
- For configuration and readout of the heat meter with the software "Device Monitor" an opto-coupler is required, which is available under <https://www.brummerhoop.com>.
- The display of the heat meter is generally deactivated to protect the battery. It can be activated by pressing the display button and remains activated for about 2 minutes.
- The pictogram on the type plate indicates whether the meter is a heat meter or a cold meter.



**Heat meter (possibly with cooling tariff)**



**Cold meter**

## Operation and readout

The F90 has a liquid crystal display (LCD) with 8 digits and special characters. The representable values are summarized in five display loops. All data are queried via the display button.

The display is normally deactivated and can be activated by briefly pressing the display button. Initially, the accumulated heat energy since commissioning will be displayed. This value is located within the main loop (level 1), index 1-01.

By pressing and holding the display key for more than 4 seconds you can invoke the different display loops.

Press and hold the button until you reach the desired display loop. The number of the loop is indicated at the bottom of the display.

Within a display loop or level, you can navigate to the desired value/ index by repeatedly briefly pressing the display button.

If the F90 is idle for at least 2 minutes it will automatically deactivate the display to protect the battery.

The following lists give an overview of the display values/ indexes within the respective levels.

## Display level 1 = Main loop

Index	Description
1-01	Accumulated heat energy since commissioning (standard display) and alternating display of accumulated cooling energy (only combined heat and cold meter); negative flow; error codes
1-02	Display test (all icons are displayed simultaneously)
1-03-1 to 1-03-9	Reporting date followed by heat energy, cooling energy, volume, tariff register 1 and tariff register 2 <sup>1)</sup> . When the module 'pulse input' is installed, the values of the three pulse inputs <sup>2)</sup> follow.
1-04	Accumulated volume in m <sup>3</sup>
1-05-1 / 1-05-2	Current date alternating with current time
1-06-1 / 1-06-2	Error display (binary and hexadecimal display, alternating)
1-07-1 / 1-07-2	Tariff register 1: value alternating with tariff register and criteria <sup>2)</sup>
1-08-1 / 1-08-2	Tariff register 2: value alternating with tariff register and criteria <sup>2)</sup>
1-09-1 / 1-09-2	Pulse input 1: Pulse value alternating with counter reading <sup>2)</sup>
1-10-1 / 1-10-2	Pulse input 2: Pulse value alternating with counter reading <sup>2)</sup>
1-11-1 / 1-11-2	Pulse input 3: Pulse value alternating with counter reading <sup>2)</sup>

<sup>1)</sup> The meter displays a zero for reporting date and energy until the last day of the year or month has passed.

<sup>2)</sup> Pulse inputs are optional accessory and can be set with software "Device Monitor".

## Display level 2 = Technical loop

Index	Description
2-01	Actual output in kW
2-02	Actual flow rate in m <sup>3</sup> /h (in case of backflow, the value is shown as negative)
2-03	Supply temperature in °C
2-04	Return temperature in °C
2-05	Temperature difference in K (value has a negative sign in case of cold metering)
2-06	<u>Before commissioning:</u> Operating days since production
2-06-1 / 2-06-2	<u>After commissioning:</u> Operating days since production alternating with operating days after reaching an energy consumption >10 kWh
2-07	M-bus address (Primary address)
2-08	Serial number (Secondary address)
2-09	Firmware version

## Display level 3 = Statistics loop

Index	Description
3-01-1 to 3-01-6	Half-month values 3-01 to 3-30: Date alternating with heat energy, cold energy, volume, tariff register 1, tariff register 2.
⋮	
3-30-1 to 3-30-6	If the module 'pulse input' is installed, then the values of the three pulse inputs <sup>1)2)</sup> follow

## Display level 4 = Maximum values loop

Index	Description
4-01-1 to 4-01-3	Maximum power alternating with date and time
4-02-1 to 4-02-3	Maximum volume alternating with date and time
4-03-1 to 4-03-3	Maximum supply temperature alternating with date and time
4-04-1 to 4-04-3	Maximum return temperature alternating with date and time
4-05-1 to 4-05-3	Maximum temperature difference alternating with date and time

<sup>1)</sup> The meter displays a zero for reporting date and energy until the last day of the year or month has passed.

<sup>2)</sup> Pulse inputs are optional accessory and can be set with software "Device Monitor".

## Display level 5 = Parameterizing loop

<b>Index</b>	<b>Description</b>
5-01	Parameterizing energy unit
5-02	Parameterizing place of installation
5-03	Test mode energy test <sup>1)</sup>
5-04	Test mode energy test with simulated volume <sup>1)</sup>

<sup>1)</sup> For internal test purposes only

## Settings in parameterizing loop 5

The following characteristics of the meter can be set on-site via the display-button or via the software "Device Monitor" and an opto-coupler:

- Energy unit (kWh, MWh, GJ, MMBTU, Gcal)
- Place of installation (supply- or return pipe).

For the F90Solar3, which are designed to measure water-glycol-mixtures, the glycol type and concentration can also be set once with the software "Device Monitor":

- Glycol type → ethylene glycol or propylene glycol
- Glycol concentration → 20%w/w, 30%w/w, 40%w/w or 50%w/w

These settings can only be made as long as the cumulated heat energy has not exceeded a maximum of 10 kWh.

Therefore make sure that the necessary adjustments are made prior to regular heat meter operation.

To start the editing mode for parameterization, press and hold the key until you reach display level 5.

Now you can invoke the desired index with short keystrokes, e.g. index 5-02 for changing the place of installation.

Then press the button again for approx. 2-3 seconds until the editing icon (pencil) appears in the lower left of the display (see page 3).

Once the pencil is visible, release the button. The current display starts flashing.

Press the button briefly again to toggle between the parameter options. Press and hold the button for another 2-3 seconds to save the desired value.

If no action takes place for more than 60 seconds the meter will return to the start screen and deactivate its display without saving any changes.

## Tariff register (Index 1-07 and 1-08)

The F90 series 3 are equipped with two tariff registers, which can be configured with the software "Device Monitor" and the USB opto-coupler (item no. 50041745).

Energy, output, flow rate and temperatures can be summed up in these tariff registers depending on threshold values or time periods. These criteria can be set individually via the software "Device Monitor". The tariff registers are displayed in the main loop (level 1) alternating with the corresponding criteria (see also page 7).

It is possible to choose from a total of 11 criteria to record energy or time when an entered threshold value is exceeded or undercut.

- Tariff 0 = No tariff defined
- Tariff 1 = Consumed energy measured in between timespan from [hh:mm] to [hh:mm]
- Tariff 2 = Consumed energy when the threshold value for the power is exceeded  
or  
The timespan for which the power is greater than or equal to the set threshold value
- Tariff 3 = Consumed energy when the threshold value for the power is undercut  
or  
The timespan for which the power is less than or equal to the set threshold value
- Tariff 4 = Consumed energy when the threshold value for the flow rate is exceeded  
or  
The timespan for which the flow rate is greater than or equal to the set threshold value
- Tariff 5 = Consumed energy when the threshold value for the flow rate is undercut  
or  
The timespan for which the flow rate is less than or equal to the entered threshold value

- Tariff 6 = Consumed energy when the threshold value for the supply temperature is exceeded  
or  
The timespan for which the supply temperature is greater than or equal to the set threshold value
- Tariff 7 = Consumed energy when the threshold value for the supply temperature is undercut  
or  
The timespan for which the supply temperature is less than or equal to the set threshold value
- Tariff 8 = Consumed energy when the threshold value for the return temperature is exceeded  
or  
The timespan for which the return temperature is greater than or equal to the set threshold value
- Tariff 9 = Consumed energy when the threshold value for the return temperature is undercut  
or  
The timespan for which the return temperature is less than or equal to the set threshold value
- Tariff 10 = Consumed energy when the threshold value for the temperature difference is exceeded  
or  
The timespan in which the temperature difference is greater than or equal to the set threshold value
- Tariff 11 = Consumed energy when the threshold value for the temperature difference is undercut  
or  
The timespan in which the temperature difference is less than or equal to the set threshold value

#### Example:

The energy which is generated or consumed at a return temperature greater than or equal to 50°C shall be stored and displayed in tariff register 1.

For this purpose you have to allocate tariff 8 (energy consumption in conjunction with return temperature) and the threshold value for the return temperature to tariff register 1 via the software "Device Monitor".

## Error codes

If the device detects an error, the error symbol  $\triangle$  is indicated in the display.

The error can be called up in the main loop (level 1, index 1-06) by briefly pressing the display button repeatedly. The error code display alternates between hexadecimal and binary values. There are eight possible error codes, which can also occur in combination.

For all errors except

- H80 (low battery)
- H40 (reset)
- H10 (error in the flow measuring system, e.g. air in the measuring tube),

the device has to be replaced and returned for examination.

Error codes		Short description
binary	hexadecimal	
1 0 0 0 0 0 0 0	H 8 0	Low battery
0 1 0 0 0 0 0 0	H 4 0	Device reset
0 0 1 0 0 0 0 0	H 2 0	Faulty electronic part
0 0 0 1 0 0 0 0	H 1 0	Error in flow sensor
0 0 0 0 1 0 0 0	H 0 8	Short circuit temperature sensor cold
0 0 0 0 0 1 0 0	H 0 4	Cable break temperature sensor cold
0 0 0 0 0 0 1 0	H 0 2	Short circuit temperature sensor hot
0 0 0 0 0 0 0 1	H 0 1	Cable break temperature sensor hot

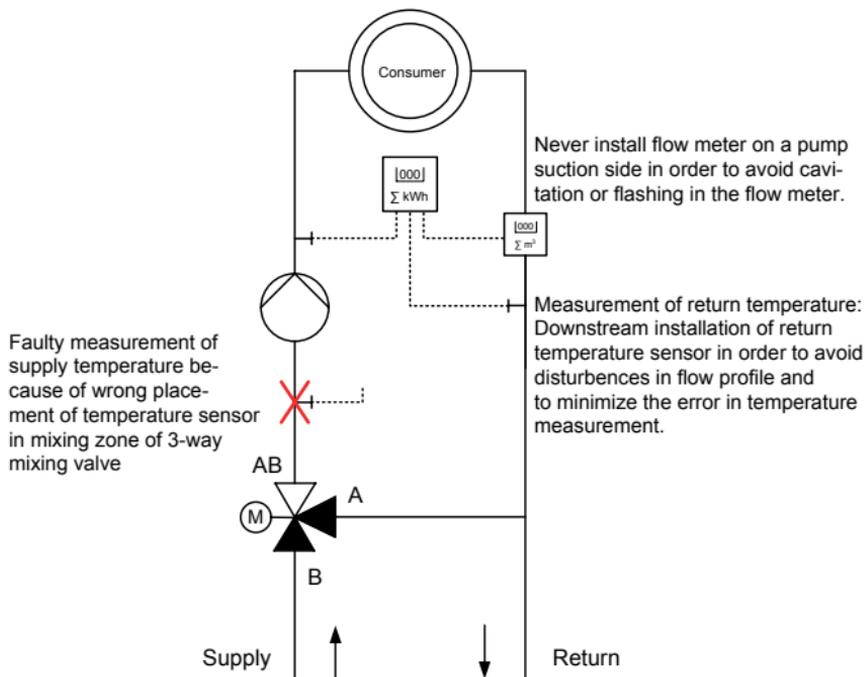
## Error descriptions and causes

Error	Description	Cause	Error description
H80	Low battery. This error has no effect on the energy calculation.	Adverse environmental conditions, long service life, frequent readout	Replace the battery or use a 230V AC mains supply
H40	Device reset. This error has no effect on the energy calculation	EMC, electromagnetic interference	If the device is installed near sources of interference (pump, motor, power cables), these must be removed or the device must be installed elsewhere.
H20	Faulty electronic part. Energy calculation and measurement stops. The register for energy will not change.	Defective component, defect on the circuit board	Device must be replaced by a new one.
H10	Error in the flow sensor. Energy calculation and measurement stops. The register for energy will not change.	All devices: Connection cable between the electronics housing and the flow sensor is damaged F90U3: Air, residue or dirt inside the flow sensor F90S3 and F90M3: Faulty volume scanning; residue or dirt inside the flow sensor; impeller blocked	Check if there is air, residue or dirt in the system. Vent the system and, if necessary, change the place of installation of the meter (no installation close to the inlet of a pump, cavitation). Check the device for soiling and any foreign bodies in the flow sensor. If the cable is damaged, the device must be replaced.
H08 H04 H02 H01	Temperature sensor or sensor cable damaged. Energy calculation and measurement stops. The register for energy will not change.	The ferrule of the temperature sensor was deformed due to wrong installation and / or inappropriate sensor seating (maximum immersion depth exceeded), Sensor cable was cut, forcefully kinked, twisted or ripped off the ferrule or calculator.	Device must be replaced by a new one.

## Correct arrangement of measuring points

The Technical Guideline K9 of the German Physikalisch-Technische Bundesanstalt (PTB) for 'Commissioning of Heat and Cooling Meters' provides examples of installations, to illustrate where to place the temperature sensors and the flow sensor of an energy measuring point accurately.

Sketch 1: Heat exchanger circuit with admixture



### Key (EN 12792 / EN 806-1 / DIN 2481)



Calculator



Flow sensor



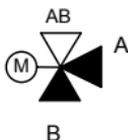
Temperature sensor



wrong placement of temperature sensor

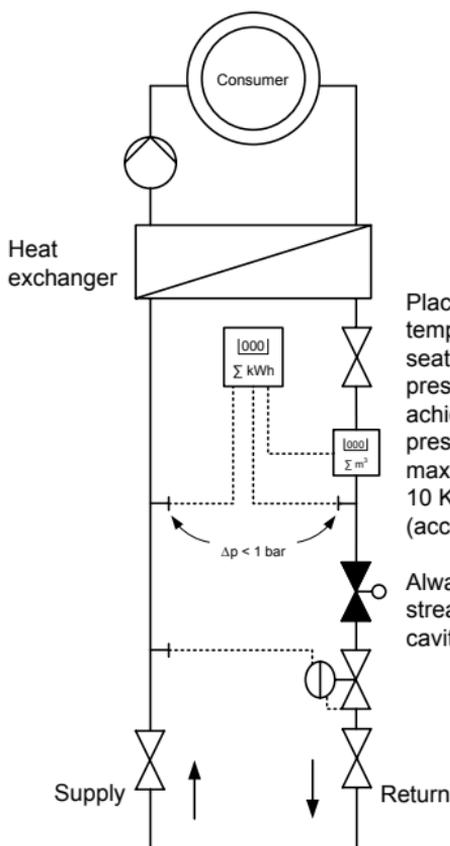


Pump



3-way mixing valve

## Sketch 2: Heat exchanger circuit with throttle circuit (e.g. district heating)



Placement of flow sensor and return temperature sensor upstream of the seated valve and the differential pressure control valve in order to achieve a smaller difference in pressure than the recommended maximum value of e.g. 1 bar at 10 K temperature difference (according to PTB TR K9, annex C).

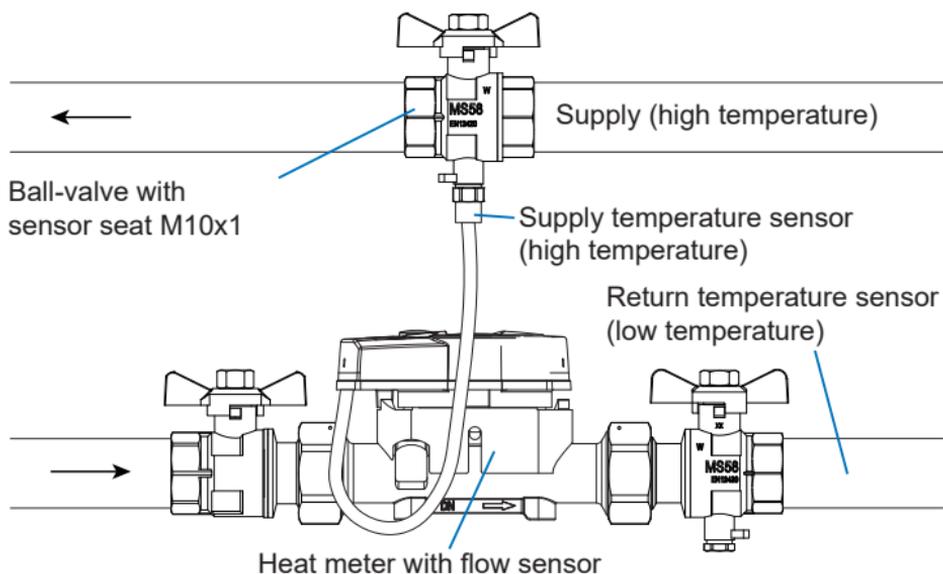
Always install control valves downstream of flow meter in order to avoid cavitation or distortion of flow profile.

### Key (EN 12792 / EN 806-1 / DIN 2481)

	Calculator		Flow sensor
	Temperature sensor		Differential pressure control valve
	Pump		2-way seated valve

## Installation of F90S3 and F90U3 heat meters

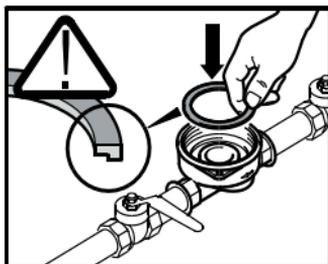
- Before installing the meter, rinse all pipes thoroughly.
- For F90U3: Remove a possibly installed strainer to avoid disturbances which can result in a falsified measurement or a complete signal loss.
- To avoid air accumulation in the flow sensor, install the meter at the lowest possible point of the plant.
- Close the ball valves, depressurize and empty the meter.
- Unscrew the union nuts on the old heat meter or on the fitting piece of the installation kit, remove old gaskets and thoroughly clean the sealing surfaces.
- Install the heat meter tension-free and use the new gaskets, included in the delivery. The place of installation has to match the meters configuration (supply- or return pipe). Pay attention to the flow direction and make sure that the arrow on the flow sensor points into the correct flow direction (arrow marking on the flow sensor).
- After installation, fill the measuring section cautiously in order to protect the meter against damaging water hammers/ pressure shocks.
- The heat meter must always be filled completely with water.
- Seal the heat meter with the attached security seals to prevent manipulation.



## Installation of F90M3-IST heat meter - system Ista

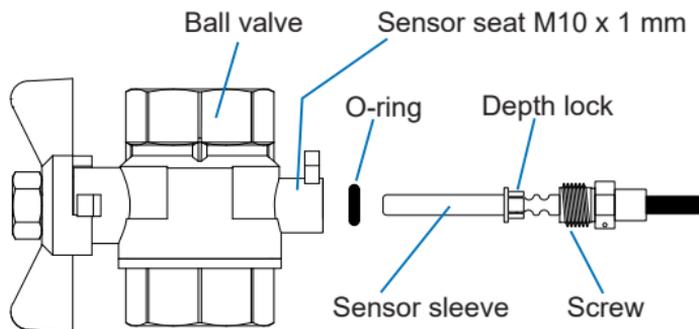
The multi-jet heat meter F90M3-IST has a 2" KOAX connection thread according to EN14154 (IST) for installation in a correspondingly compatible single-pipe-connection piece (EAS) and must be installed without a transition adapter. Please check before installation whether the EAS is marked with EN14154 (IST). If the EAS is not marked, it may have to be replaced by a marked one (item no. EM8051799 or EM8066311).

- Before installing the meter, rinse all pipes thoroughly.
- Install a strainer upstream before the flow meter to protect the mechanical parts of the flow sensor against soiling or clean an already installed dirt filter.
- Close the ball valves, depressurize and empty the meter
- Remove the temperature sensors and detach the old heat meter with a hook wrench (item no. 59940900) from the EAS.
- Remove the old gasket, clean the sealing surfaces and threads of the EAS thoroughly and check for any imperfections.
- Insert the new gasket into the EAS with the smooth surface facing upwards, see picture.
- Grease the thread of the F90M3-IST with silicone grease lightly.
- Check the O-ring at the bottom of the F90M3-IST for correct seating.
- Screw the F90M3-IST hand-tight into the EAS and then tighten it with a hook wrench up to its metallic stop without the use of excessive force.
- Install the temperature sensors as described on page 20.
- After installation, fill the measuring section cautiously in order to protect the meter against damaging water hammers/ pressure shocks.
- The heat meter must always be filled completely with water.
- Seal the heat meter with the attached security seals to prevent manipulation.



## Temperature sensor installation for F90S3, F90U3 and F90M3-IST

- When installing the temperature sensors into already present thermowells, these thermowells must be classified and marked. The installer is legally obliged to provide a clear marking to yet unmarked thermowells by using the labels included in the delivery.
- The free temperature sensor can be installed into a ball valve with sensor seat or a T-piece with adapter 1/2" on M10 x 1 mm.
- In Germany, for new installations of heat meters, the installation of the temperature sensors into thermowells is no longer permitted for pipe diameters  $\leq$  DN25. In such cases, direct immersed installation of the temperature sensors is obligatory. In EU countries (except Germany), MID-compliant short thermowells (shorter than 60 mm) are permitted.
- For the best result it is important to install the sensors direct immersed.
- Do not shorten or lengthen the cables because this will irreversibly destroy the meter.
- Close the ball valves, depressurize and empty the fittings.
- Remove the blind screw or the old sensor and O-ring from the ball valve and clean the sealing surfaces.
- Remove the O-ring from the new temperature sensor and make sure that the depth lock is latched into the first groove as seen from the sensor tip.  
**The depth lock must not be moved!** The sensor tip must not touch the opposite wall of the ball valve or T-piece.
- Insert the O-ring into the sensor seat of the ball valve or the T-piece adapter, slide the sensor sleeve into the ball valve or T-piece **by holding the temperature sensor only at the screw** and then tighten it. Ensure that the sensor slides through the O-ring without much effort and that the screw can easily be tightened by hand almost to its last turn.
- Secure the sensor against manipulation with the security seal (included accessory) and open the ball valves.

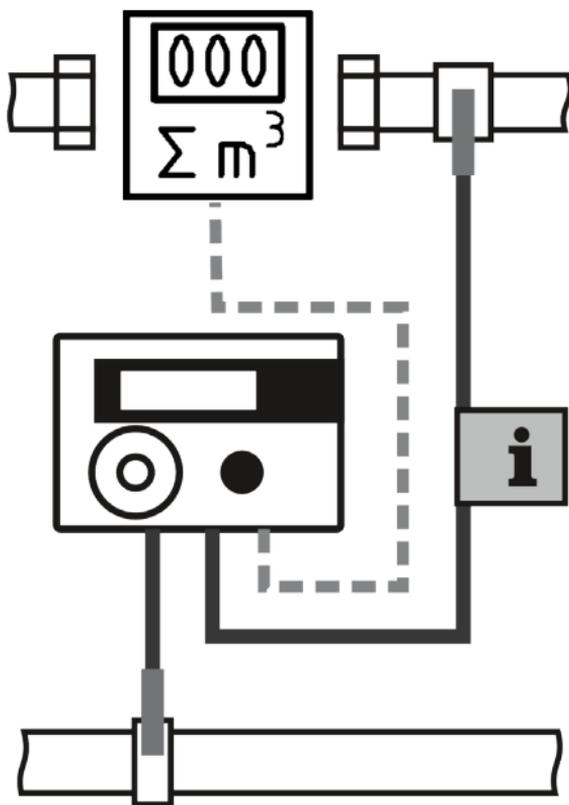


Please note:

For the heat meters F90S3, F90U3 and F90M3-IST, one temperature sensor has already been installed in the flow sensor ex works. For heat meters, configured for installation into the return pipe (cold strand), the free sensor must be installed into the supply pipe (hot strand). If the meter is configured for installation into the supply pipe, the free sensor must be installed into the return pipe.

The heat meter F90M3-A has two free temperature sensors.

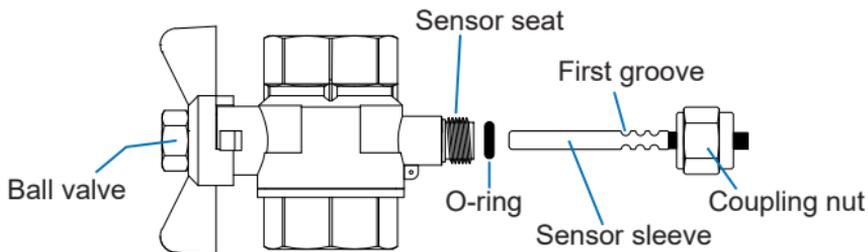
When installing the F90M3-A with two free temperature sensors, make sure to install the sensor marked with the flag as shown in the picture into the same pipe as the flow sensor.

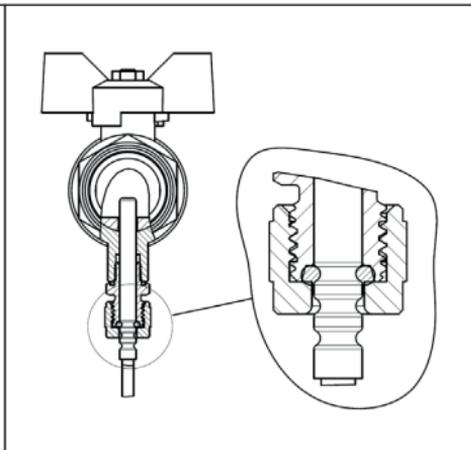
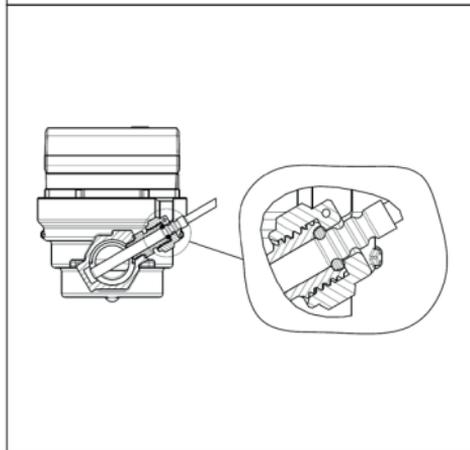
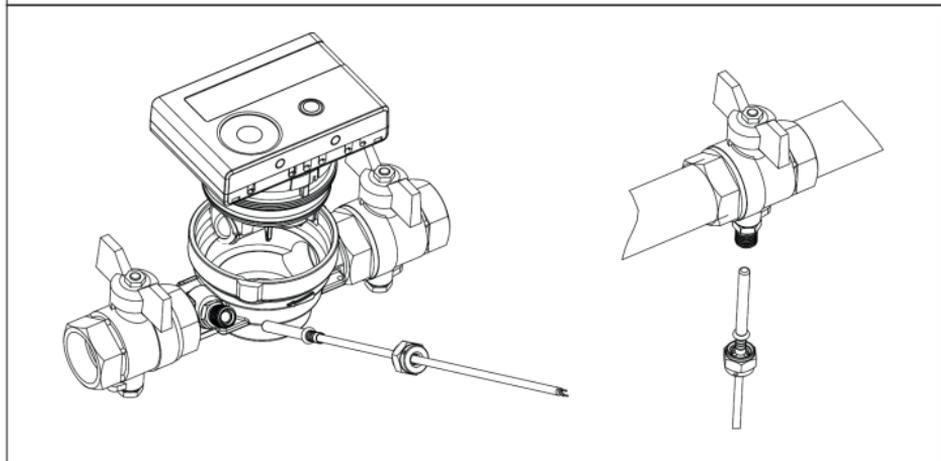
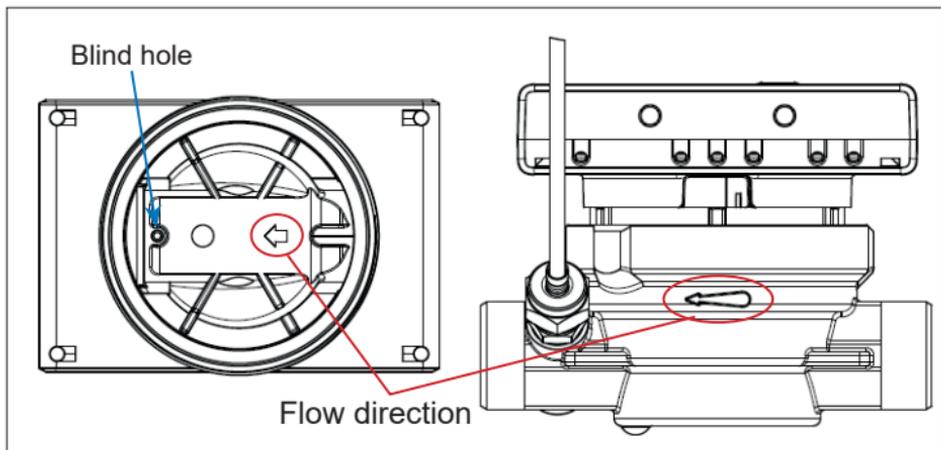


## Installation of F90M3-A heat meter - system Allmess

The multi-jet heat meter F90M3-A - system Allmess has a M77 x 1.5 mm connection thread for installation into a single-pipe-connection piece (EAS) according to EN14154 (A1) and must be installed without a transition adapter.

- Check EAS (compatibility, direction of flow).
- Before installing the meter, rinse the pipes thoroughly.
- Install a strainer upstream before the flow meter to protect the mechanical parts of the flow sensor against soiling or clean an already installed dirt filter.
- Close the ball valves, depressurize and empty the meter
- Remove the temperature sensors and remove the old heat meter with a hook wrench (item no. 59940900) from the EAS.
- Remove the old seals, clean the sealing surfaces and threads of the EAS thoroughly and check for any imperfections.
- Grease the thread of the F90M3-A lightly with silicone grease and put it into the EAS. Please compare and observe the flow direction, indicated by an arrow on both the EAS and the bottom of the meter, and make sure that the blind hole of the meter and the pin of the EAS are matching.
- Screw the F90M3-A hand-tight into the EAS and then tighten it with a hook wrench up to its metallic stop without the use of excessive force.
- Slide the O-rings of the temperature sensors into the first groove of the sensor (see picture).
- Insert the temperature sensors into the corresponding sensor seats of the EAS and the ball valve (please note page 21) and tighten the coupling nut.
- After installation, fill the measuring section cautiously in order to protect the meter against damaging water hammers/ pressure shocks.
- The heat meter must always be filled completely with water.
- Seal the heat meter with the attached security seals to prevent manipulation.





## Wall mounting of energy calculator

The calculator can be detached from the flow sensor and can then be mounted on a wall. The calculator should always be mounted above the flow sensor. It has to be accessible without tools and the display has to be readable at all times.

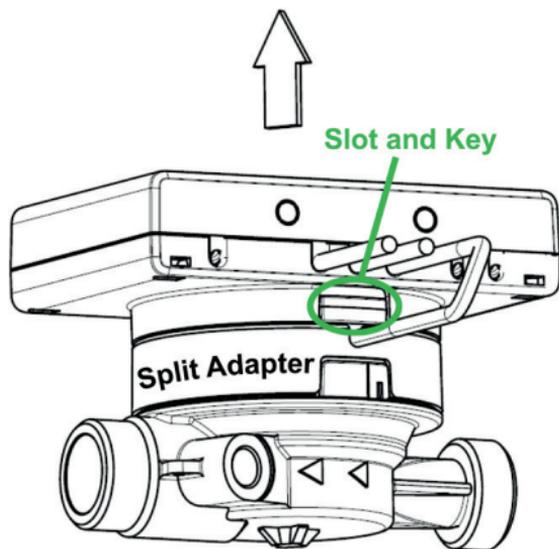
Use the included wall bracket for mounting the calculator onto an even wall. The wall bracket sits on the split adapter of the flow sensor, between calculator and flow sensor. It can be released and installed after detaching the calculator according to the following steps.

1. Pull the calculator off of the flow sensor by gently tilting it back and forth.
2. Rotate the wall bracket attached to the split adapter counterclockwise and lift it off the flow sensor.
3. Attach the wall bracket to an even, dry and clean wall, so that the key at the outer radius of the bracket points downwards.
4. Place the calculator on the wall bracket so that the slot engages with the key and push it under slight pressure onto the bracket until it clicks.
5. Fasten the cables with cable clamps or cable ties.

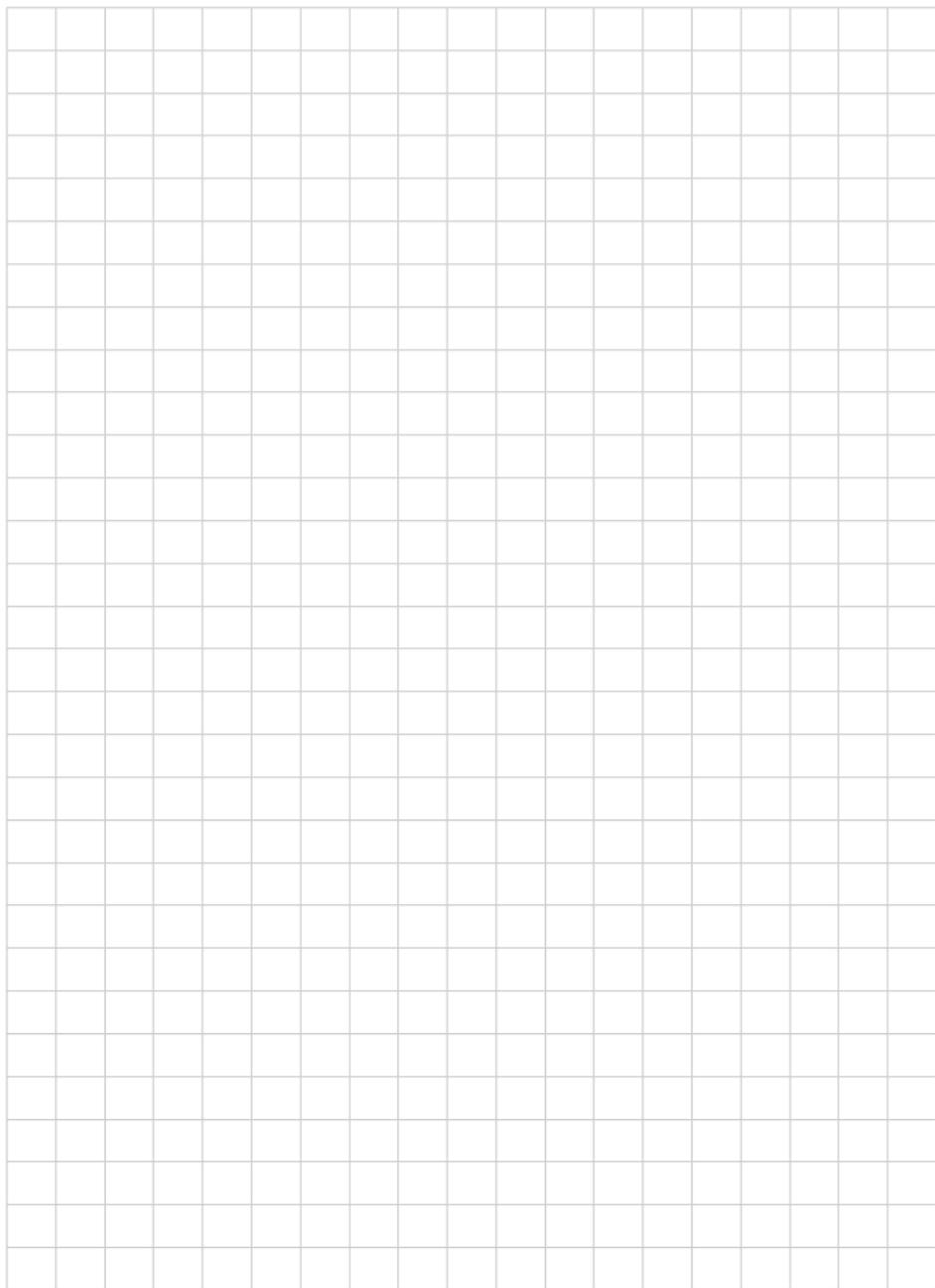
We recommend you to always operate the heat meter with a detached calculator.

For cold meters and combined heat- / cold meters it is obligatory to detach the calculator from the flow sensor to prevent damage through condensation.

The same goes with high temperature heat meters like the F90U3-H (for up to 130°C) and F90S3-H/ F90-M3..-H (for up to 120°C) as the battery in the calculator is not designed for such high temperatures.



# Notes



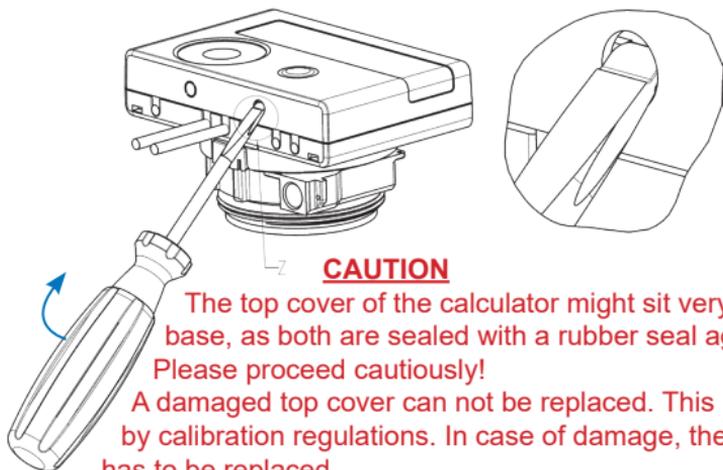
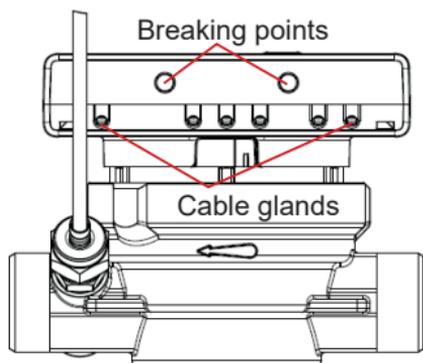
## Electrical connection, power supply

All F90 energy meters are equipped with a battery and therefore do not require any connection to an external power supply.

The energy consumption of the meter is optimized so that the battery provides a more than sufficient reserve for the meter to operate within the intended lifetime. Nevertheless, it may be useful or necessary to connect the meter to an external power supply or, if necessary, to replace the battery. This may be the case if the meter is e.g. used for monitoring in process automation, adverse conditions or when the readout rates via the optional M-Bus or radio interface are very high.

The energy calculator must be opened for retrofitting it with the optionally available mains module, for replacing the battery or for installing an option module.

Use a flathead screwdriver (4 - 5 mm) and push the two round predetermined breaking points, which are located above the cable glands, inwards until you get a free opening. Then use the screwdriver as a lever to lift the top cover cautiously upwards. To do so, insert the screwdriver at an angle of approx. 45°, as shown below, one after another into each of the two openings and lever repeatedly and alternately until the top cover comes loose.



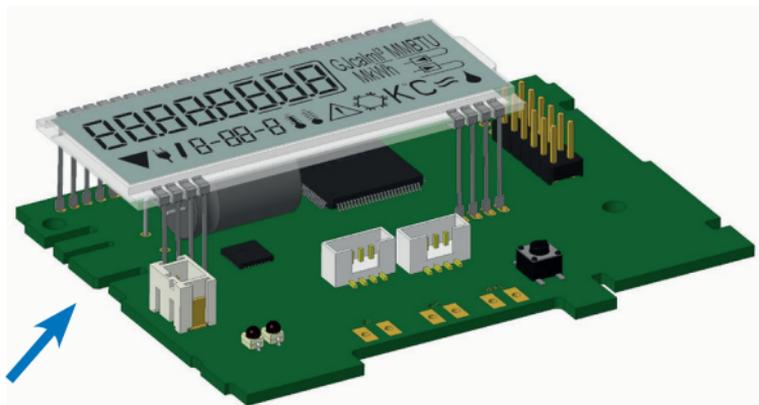
### **CAUTION**

The top cover of the calculator might sit very firmly on the base, as both are sealed with a rubber seal against moisture. Please proceed cautiously!

A damaged top cover can not be replaced. This is prohibited by calibration regulations. In case of damage, the entire meter has to be replaced.

Lift the top cover like you would open a hinged door until the rear latches will unsnap and the top cover can be lifted completely off the base. Remove the battery from the calculator and plug it into the battery socket of the mains module. The battery continues to serve as a backup power supply in case of power failure. Attach the service plug, which is supplied with the mains module, to the contact fingers on the left side of the board (see arrow).

Then, after removing the rubber plug of the cable gland at the far left of the



base, press the cable of the mains module into the then free cable gland. The cable has two connections: One connection has to be connected to the battery socket on the board, the other connection to the service plug. Put the top cover back on, close the calculator and secure it against manipulation with the enclosed security seals.

The mains module shall be connected to mains voltage by authorized personnel only and must be externally protected against overvoltage.

If the meter detects a connected external power supply, the plug icon will appear in the display at the bottom left.



Please Note:

When installing or replacing a power supply or option module with due regard to this manual, the heat meter **retains** its valid calibration and warranty, despite the fact that the security seals had to be broken to open the top cover.

## Option modules

Please Note:

When installing or replacing a power supply or option module with due regard to this manual, the heat meter **retains** its valid calibration and warranty, despite the fact that the security seals had to be broken to open the top cover.

### M-bus interface (module 9, item no. 50041607)

The F90..3 can be equipped or retrofitted with an optional M-bus interface. The valid standards for the M-bus protocol are EN13757-2 and -3, the protocol according to EN1434-3 and the M-bus recommendation (version 4.8) with the basic standard IEC 870 part 1, 2 and 4.

When connecting to an M-bus network, make sure that the maximum permissible bus voltage ( $\pm 42$  V) is not exceeded.

Protective measures against overvoltage must be carried out on the side of the level converter. Make sure that the topology, cable length and cable cross-section of the M-bus network is designed according to a baud rate of 2400 Bd.

Recommended cable type: telephone cable J-Y (ST) Y2 x 2 x 0.8 mm<sup>2</sup>

The M-bus interface is galvanically isolated and non-reactive. Additional power supply via the M-bus is not possible. The maximum possible number of readouts per day depends on the length of the telegram, that is the number of transmitted values, the baud rate and the number of meters in the entire M-bus network. The smallest readout interval is 2 minutes.

The voltage required for a readout will be provided over the M-bus. This facilitates an optimized energy consumption of the meter and thus saves battery power.

During communication via the M-bus, both the display button and the optical interface are deactivated.

### Display level 6 = module loop (M-bus; module 9)

#### Index

#### Description

6-01

Display module type; here module 9

## Structure of the M-bus telegram

The M-bus telegram (RSP-UD) can be configured via the software 'Device Monitor'. The following telegram is set ex works and will be transmitted over the M-bus as a standard:

Meter ID (Secondary address)	Serial number of the meter (ex works), adjustable via Device Monitor
Address (Primary address)	0 (ex works), adjustable via Device Monitor
Manufacturer, version, medium, access number, status, signature, serial number	Manufacturer, device and M-bus specific values according to EN13757 and EN1434
Current: main energy	
Current: volume	
Current: power	
Power (maximum value)	
Current: flow rate	
Flow rate (maximum value)	
Current: supply flow temperature	
Current: return flow temperature	
Current: temperature difference	
Operating days	Number of days since first commissioning
Current: time and date	
Recording date: main energy	
Recording date: volume	
Recording date: date	
Error code (binary)	
Device type / device version	
Current: cooling energy	only for combined heat / cold meters
Recording date: cooling energy	only for combined heat / cold meters
Current: energy tariff register 1	
Recording date: energy tariff register 1	
Current: energy tariff register 2	
Recording date: energy tariff register 2	
Current: pulse input 1	only if M-bus module with pulse input is installed
Recording date: pulse input 1	only if M-bus module with pulse input is installed
Current: pulse input 2	only if M-bus module with pulse input is installed
Recording date: pulse input 2	only if M-bus module with pulse input is installed
Current: pulse input 3	only if M-bus module with pulse input is installed
Recording date: pulse input 3	only if M-bus module with pulse input is installed

## Radio-interface, wireless M-Bus OMS (module 8, item no. 50041624)

The F90..3 can be retrofitted with a wireless M-bus interface according to the OMS standard (Open Metering System).

Operating frequency: 868 MHz

Transmission power: up to 12 dBm

Protocol: wireless M-bus in accordance with EN13757-3

Operating mode: T1, S1 or C1

Telegram: - short; AMR compliant (energy, volume, flow, power, reference code, return temperature, temperature difference)  
- long; for walk-by readout (energy, volume, flow, reference code, 30 half month values)

Encryption: AES; 128 bit (OMS-Standard 3.0.1 or 4.0.2)

## Radio interface parameter values

<b>Parameter</b>	<b>Possible settings (only via software)</b>	<b>Default settings</b>
Transmission mode	S1 / T1 / C1; unidirectional	T1; unidirectional
Transmission time	from 12 am - 12 pm	from 8 am - 6 pm
Transmission interval	10 seconds to 240 minutes; once per month	120 seconds
Days of week	Monday - Sunday	Monday - Friday
Weeks	1 - 4	1 - 4
Month	1 - 12	1 - 12
Radio switch-on date	01.01. - 31.12.	not set
AES encryption	- unencrypted - encrypted (AES-Mode 5 or 7): - master key - key per device	master key
Telegram type	short telegram long telegram	long telegram

## Radio configuration and commissioning

The meter time is set ex works to winter time (GMT + 1). There is no automatic switch to daylight saving time.

Please note that the readout times may need to be adjusted during the summer time period.

The radio interface is deactivated as a standard factory setting and can be activated after installation as follows:

- a) Without additional software and opto-coupler the radio signal can be activated via the display button. To do so, navigate to display loop 6 (module loop) by pressing and holding the button (> 4s) and then to the index 6-02 (rAd oFF) with a short key-stroke. The radio interface can then be activated (rAd on) with a long keystroke (press until edit icon appears) and, along with the activation, the meter will load its radio factory settings
- b) The radio interface can be activated and configured with the software 'Device Monitor' and the USB opto-coupler (item no. 50041745).

In case the meter was set to transmission mode C1, it will transmit for one hour in installation mode. That is, it alternately transmits a format telegram and a compact telegram.

During this time, at least one F90 must be read out using the readout software. The telegram format will be stored locally in a xml file on the PC used.

After completion of the installation mode, only the compact telegram is transmitted.

### Please Note:

The F90 Series 3 with installed radio interface must not be installed between or behind heating pipes. Please also note that the range of the radio signal is limited by other devices with a radio interface, such as WLAN router, baby alarm, radio remote control, etc. and can also be adversely affected by the structure of the building.

## Additional activation of radio encryption

The AES encryption is not mandatory and can also be activated at a later date. To activate the encryption proceed as follows:

- a) Activation via display button: Navigate to display loop 6 (module loop) by pressing and holding the button (> 4s) and then to the index 6-03 (AES oFF) with short keystrokes. The encryption can then be activated (AES on) with a long keystroke (press until edit icon appears) and, along with the activation, the meter will load its encryption factory settings
- b) Activation via software: Use the software 'Device Monitor' in conjunction with the USB opto-coupler (item no. 50041745) to activate and configure encryption.

### Display level 6 = module loop (radio interface; module 8)

<b>Index</b>	<b>Description</b>
6-01	Display module type; here module 8
6-02	Activate radio signal
6-03	Activate encryption

## Optical infrared interface (Standard)

The F90..3 can be read out and configured via the optical infrared interface (protocol: M-bus, baud rate: 2400 Bd) with the optionally available USB opto-coupler and the associated software 'Device Monitor'. The optical interface can be activated by a short keystroke of the display button. After activation, communication with the meter is enabled for 4 seconds. If the communication was interrupted or the meter went to standby mode you can reinstate communication by pressing the display button again.

Because communicating via the optical interface has a high energy consumption, the number of readouts is limited to 300 per day. This helps to maintain the battery lifetime.

## Two pulse outputs (module 10, item no. 50041619)

The potential-free pulse outputs are versatile discrete electronic switches (class OA according to EN1434), which enables the meter to output pulses correlating to the measured energy and volume. The pulse length (closed contact) has a duration of 125 ms. If several consecutive pulses are emitted during a measurement, the idle time of the pulse (open contact) lasts for 125 ms. With due regard of the nominal and limiting values of the pulse outputs, they can be used for a wide variety of applications.

### Technical data pulse outputs

Pulse value:	Energy, 1kWh/p Volume, 10 l/p
Max. switching voltage:	35 V ~/=
Max. switching capacity:	300 mW
Max. current:	120 mA
Contact isolation:	$>10^9$ Ohm
Max. contact resistance (On):	25 Ohm
Contact capacity:	1,5 pF
Electric strength (open contact):	350 V ~/=
Pulse duration (closed contact):	125 ms
Min. pulse duration (open contact):	125 ms

The pulse value for the energy always corresponds to the last digit of the energy display. The pulse value for the volume always corresponds to the penultimate digit of the volume display.

The pulse value can also be retrieved via the module loop 6.

The pulse outputs can be deactivated with the software 'Device Monitor' and the USB opto-coupler (item no. 50041745).

### Display level 6 = module loop (pulse outputs; module 10)

<b>Index</b>	<b>Description</b>
6-01	Display module type; here module 10
6-02	Pulse output 1 (e.g. 0.001 MWh)
6-03	Pulse output 2 (e.g. 0.010 m <sup>3</sup> )

Three pulse inputs (included in module 8 and 9, 6-wire connection cable item no. 50041621 required)

The option modules M-bus and radio interface can sum up and transmit pulses of up to three external meters (water, electricity or gas meters) over a wireless or wired M-bus network by connecting two wires of the 6-wire pulse input connection cable to one external meter. For this purpose, the respective pulse inputs can be configured corresponding to the defaults of the external meter via the software 'Device Monitor'.

The following settings are possible:

- Serial number of the external meter
- Manufacturer code
- Pulse value of the external meter (1 | 2.5 | 10 | 25 | 100 | 250 | 1000)
- Start value (current display value of external meter)
- Pulse unit (litre / kWh / none)

The characteristics of the external meters need to match the following specifications.

Pulse output class: passive output OA (reed contact or electronic switch) or OC (Open Collector)

Pulse length on:  $\geq 100$  ms

Pulse length off:  $\geq 100$  ms

Current: 1.5  $\mu$ A DC

Resistance:  $\geq 6$  M $\Omega$  (open contact)  
 $\leq 3$  k $\Omega$  (closed contact)

Please make sure to connect the pulse inputs to the correct potential of the external meter (not important for potential-free contacts such as reed relays). The pulse inputs detect short-circuits and evaluate them as input pulses. Therefore make sure that the corresponding wires of the connection cable do not touch each other during installation.

Wire colour	Assignment
brown	IE 3 (+)
white	IE 3 ( $\perp$ )
green	IE 2 ( $\perp$ )
yellow	IE 2 (+)
grey	IE 1 ( $\perp$ )
pink	IE 1 (+)

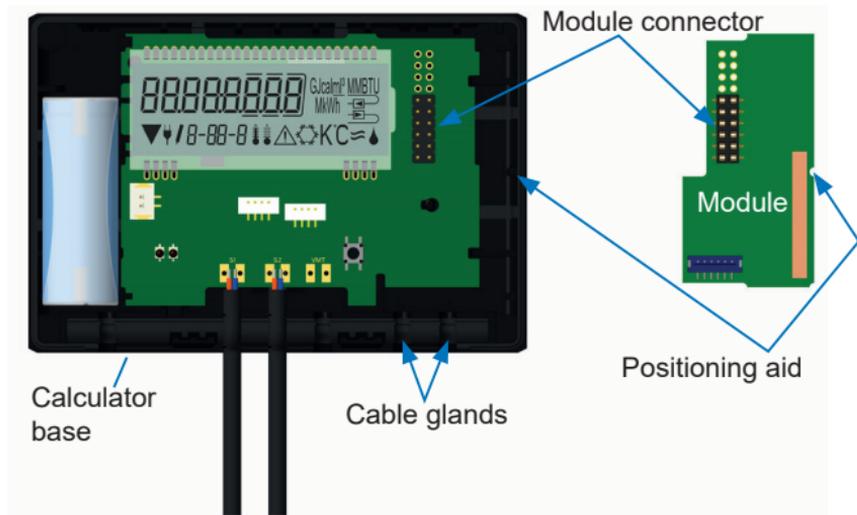
Pin assignment pulse inputs

## Installing and removing an option module

For retrofitting an option module, the heat meter's calculator needs to be opened cautiously as described on page 26.

The option module has to be plugged in on the right side of the electronics board. The cable of the respective module (if a cable is included) has to be put through the cable glands on the right side of the calculator. For this purpose the rubber plug has to be removed from the respective cable gland. The cable must sit tight in the cable gland in order to protect the electronics of the calculator against moisture and to serve as a strain relief.

After successfully plugging in the module, the message 'Mod XX' appears on the display, where XX stands for the respective module number.



Once the module has been installed, put the top cover back on and secure it against manipulation with the enclosed safety seals.

To remove a module, press the top cover carefully against the rear of the calculator base. The rear two housing latches of the top cover lever the module off the board.

# Technical data

## Energy Calculator

Protection class:	IP65
Display:	LCD; 8 digits and special characters
Energy display:	up to 3 decimals
Units:	MWh - kW - m <sup>3</sup> - m <sup>3</sup> /h Optional: kWh - GJ - l - l/h - MW - MMBTU - Gcal
Interface:	Optical infrared interface and 1 free slot for option module
Option modules:	M-Bus incl. 3 pulse inputs; wireless M-Bus incl. 3 pulse inputs; 2 Pulse outputs for energy and volume
Power supply:	3V Lithium metal battery (replaceable) Optional: 230V AC mains module with backup battery and 24V AC mains module with backup battery
Battery life:	10 years with limited number of radio telegrams and without pulse output; otherwise 6 + 1 years
Memory:	Solid state memory (EEPROM)
Reporting dates:	freely selectable annual date; 15 month and half month values via display; 24 month and half month values via optical interface or M-bus
Tariff register:	2 individually adjustable tariff registers
Stored maximum values:	Flow and power
Temperature range:	0...150°C (heat) 0...50°C (cold)
Ambient temperature:	5...55°C at 95% rH
Temperature difference:	3...100 K (heat) 3 .. 50 K (cold)
Minimum temp. difference:	> 0.05 K
Temp. resolution:	0.01 K
Temperature measuring cycle:	Dynamically 2 and 60 seconds
Dimensions:	75 x 110 x 34.5 mm (H x W x D)

## Temperature sensors

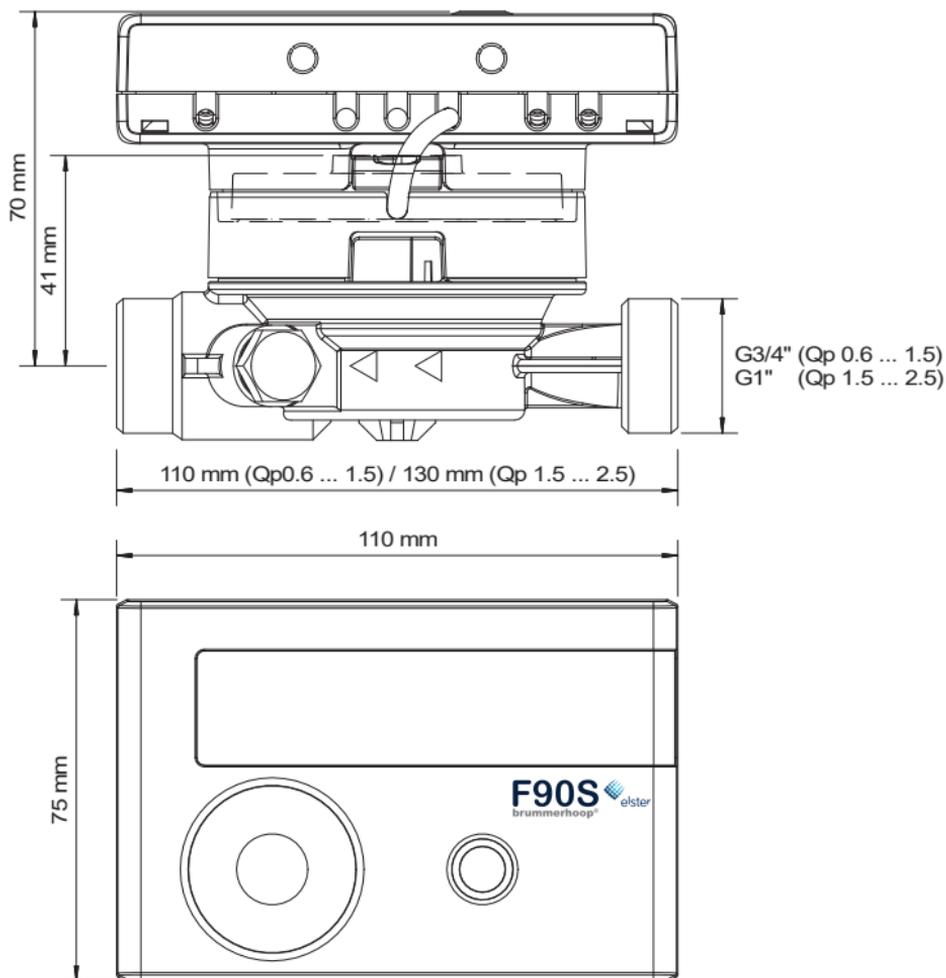
Sensor type:	2-wire, fixed
Sensor resistance:	Platinum Pt1000, Class B
Diameter:	5.2 mm (F90S3 and F90U3) 5.0 mm (F90M3-IST) 6.0 mm (F90M3-A)
Cable length:	1.5 m
Connection cable:	Silicone, unshielded
Protection class:	IP65

## Flow Sensor

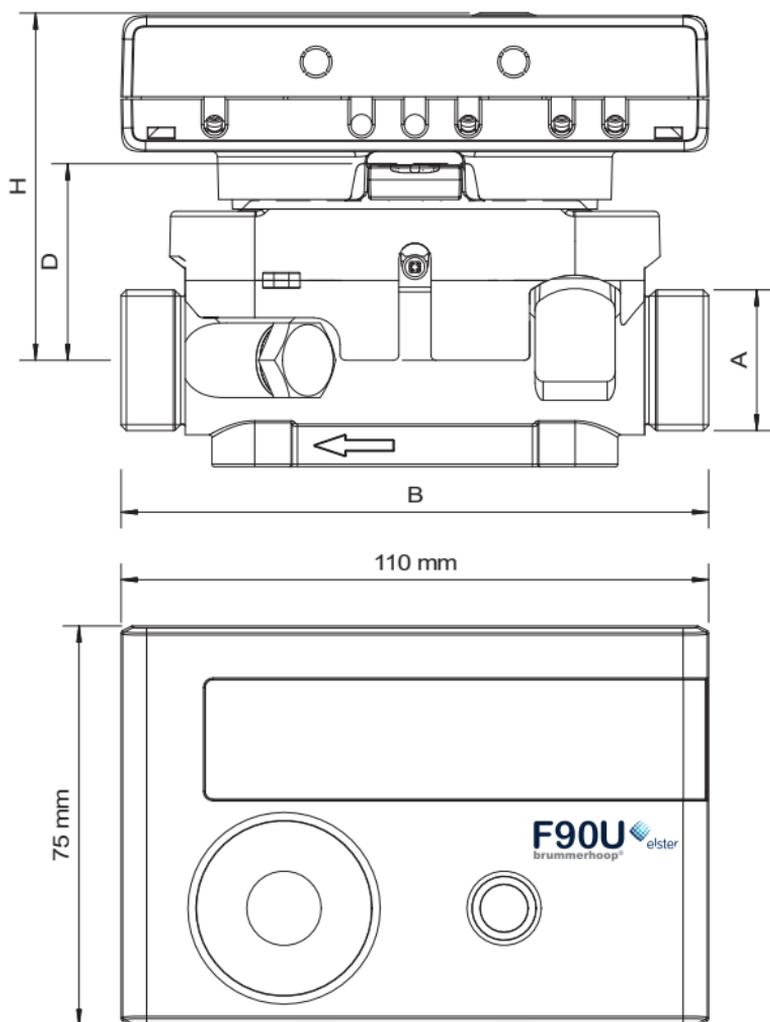
Measuring method:	Single-jet, impeller (F90S3) Multi-jet, impeller (F90M3-IST /-A) Ultrasonic, transit time (F90U3)
Metrological class:	Class 3 (F90S3) Class 3 (F90M3-IST /-A) Class 2 (F90U3)
Place of installation:	Return pipe (cold strand) or supply pipe (hot strand); adjustable once-off
Installation position:	horizontally or vertically
Protection class:	IP65
Heat transfer medium:	Water
Temperature range:	15...90°C (heat) 5...50°C (cold)
Nominal pressure PN:	16 bar

		F90S3 / F90U3 / F90M3-IST / F90M3-A				F90U3	
Nominal flow rate $Q_p$	$m^3/h$	0.6	1.5	2.5	3.5	6.0	
Nominal diameter DN	mm	15	15	20	20	25	
Pressure loss F90S3 at $Q_p$	mbar	155	210	165	-	-	
Pressure loss F90U3 at $Q_p$	mbar	30	210	115	210	200	
Pressure loss F90M3-IST at $Q_p$	mbar	95	190	250	-	-	
Pressure loss F90M3-A at $Q_p$	mbar	100	190	250	-	-	
Starting value F90S3	l/h	4	7	10	10	-	
Starting value F90U3	l/h	6	6	12	14	30	
Starting value F90M3	l/h	3,5	4	8	-	-	
Dynamic range $Q_i/Q_p$ F90S3	l	1 : 25	1 : 25	1 : 25	-	-	
Dynamic range $Q_i/Q_p$ F90U3	l	1 : 50	1 : 125	1 : 100	1 : 125	1 : 100	
Dynamic range $Q_i/Q_p$ F90M3	l	1 : 50	1 : 50	1 : 50	-	-	
Connection thread F90S3 / F90U3	Inch	G 3/4 B	G 3/4 B	G 1 B	G 1 B	G 5/4 B	
Connection thread F90M3-IST		KOAX 2"	KOAX 2"	KOAX 2"	-	-	
Connection thread F90M3-A	mm	M77 x 1.5	M77 x 1.5	M77 x 1.5	-	-	
Overall length F90S3	mm	110	110	130	-	-	
Overall length F90U3	mm	110	110	130	130	260	
Cable length calculator to flow sensor F90S3 and F90M3	m	0.5	0.5	0.5	-	-	
Cable length calculator to flow sensor F90U3	m	0.85	0.85	0.85	0.85	0.85	

# Dimensions F90S3

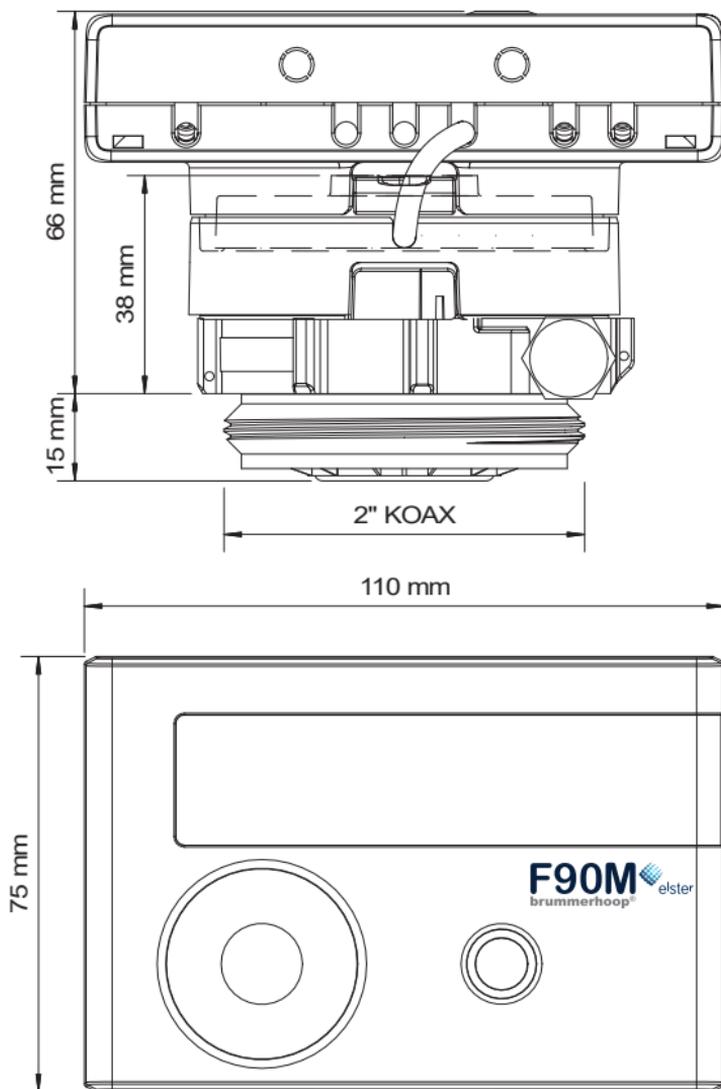


## Dimensions F90U3

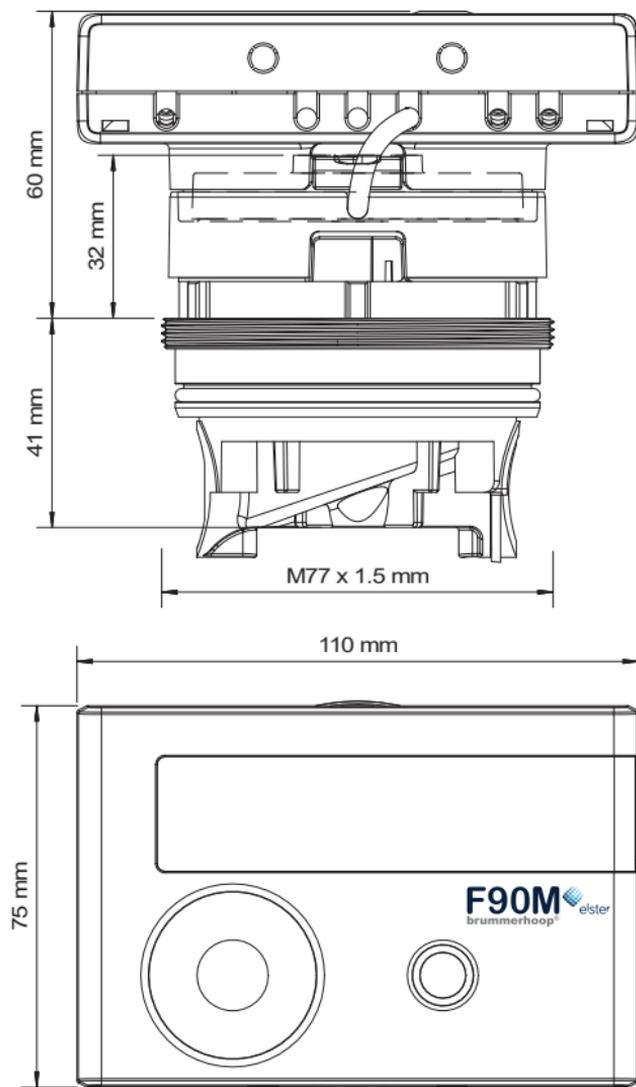


Qp		0.6	1.5		2.5	3.5	6.0
H	mm	65	65		65	65	67.5
D	mm	37	37		37	37	39.5
B	mm	110	110	130	130	130	260
A	Inch	G3/4B	G3/4B	G1B	G1B	G1B	G5/4B

# Dimensions F90M3-IST - System Ista



## Dimensions F90M3-A - System Allmess



## EG-Konformitätserklärung EC-Declaration of Conformity

**Für das Produkt** *For the product*

**Kompaktwärmehöhler**

*Compact Heat Meter*

S3

**EG-Baumusterprüfbescheinigungen**

*EC examination certificate no.*

DE-16-MI004-PTB025

**Benannte Stelle, Modul**

*notified body number, modul*

0102, Physikalisch-Technische Bundesanstalt, D-38166 Braunschweig, Modul D

**bestätigen wir als Hersteller**

*we confirm as the manufacturer*

Engelmann Sensor GmbH, Rudolf-Diesel-Straße 24-28, D-69168 Wiesloch-Baiertal

dass das Produkt die Anforderungen erfüllt, die in den folgenden Richtlinien der Europäischen Gemeinschaft genannt werden, soweit diese Anwendung auf das Produkt finden:

*that the product meets the requirements according to the following directives of the European Parliament as far as these are applied on the product:*

**Messgeräte-Richtlinie 2014/32/EU vom 26.02.2014 (ABl. L 96/149 29.3.2014)**

*Measuring Instruments Directive (2014/32/EC)*

**RED-Richtlinie 2014/53/EU vom 16.04.2014 (ABl. L 153/62 22.5.2014)**

*RED Directive (2014/53/EC)*

Weiterhin entspricht das Produkt den folgenden harmonisierten Normen, normativen Dokumenten, Technischen Richtlinien und sonstigen Rechtsvorschriften, soweit diese Anwendung auf das Produkt finden:

*Furthermore the product complies with the following harmonised standards, normative documents, technical guidelines and other regulations as far as these are applied on the product:*

EN 1434 (2016)

EN 13757-2, -3 (2005)

EN 61000-4-3 (2006+A1:2008+A2:2010)

DIN EN ISO 4064 (2014)

EN 55022 (2010)

EN 61000-4-4 (2004+A1:2010)

OIML R75 (2002/2006)

EN 60751 (2009)

EN 61000-4-6 (2014)

EN 301489-1 (2011)

EN 62479 (2010)

EN 61000-4-8 (2010-11)

EN 301489-3 (2013)

DIN EN 60529 (2000)

PTB-Richtlinie K 7.1 (2006)

EN 300220-2 (2009)

Der Hersteller trägt die alleinige Verantwortung für die Ausstellung der Konformitätserklärung.

*The manufacturer is solely responsible for issuance of the declaration of conformity.*

Wiesloch-Baiertal, 07.10.2016

Engelmann Sensor GmbH



U. Kunstein / CE-Beauftragter CE Manager



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Subject to errors and modifications, Version 3.3.18-en