Bedienungsanleitung Kommunikationsschnittstellen / Mode d'emploi Interfaces de communication / Manual de instrucciones Interfaces de comunicación / Manuale d'uso Interfacce di comunicazione / Operating Instructions Communication Interfaces / Instrukcja obsługi Interfejsy komunikacyjne / Руководство по эксплуатации коммуникационных интерфейсов / Návod k obsluze Komunikační rozhraní / Návod na obsluhu Komunikačné rozhranie:

PolluStat & PolluTherm F

Übersicht Schnittstellen und Optionen / Aperçu Interfaces et options / Resumen Interfaces y opciones / Panoramica Interfacce e optional / Overview Interfaces and Options / Przegląd interfejsów i opcji / Обзор интерфейсов и опций / Přehled rozhraní a možností / Prehľad rozhraní a možností:

1.1 Optische (Infrarot-)Schnittstelle / Interface optique (infrarouge) / Interfaz óptica / Interfaccia ottica a infrarossi / Optical (infrared) interface / Optyczny (podczerwony) interfejs / Оптический (ИК) интерфейс / Optické (infračervené) rozhraní / Optické (infračervené) rozhranie

Optional / en option / opcional / opzionale / optional / opcjonalnie / опционально / volitelné / voliteľné

1.2 M-Bus

1.3 Modbus

1.4 Kabellose Schnittstellen / Interfaces radio sans fil / Interfaces inalámbricas / Interfacce wireless / Wireless Interfaces / Interfejsy bezprzewodowe / Беспроводные интерфейсы / Bezdrátová rozhraní / Bezdrôtové rozhrania

1.4.1 wireless M-Bus
1.4.2 LoRaWAN

1.5 Drei zusätzliche Impulseingänge / Trois entrées d'impulsions supplémentaires / Tres entradas de impulsos adicionales / Ingressi impulsi aggiuntivi / Three additional pulse inputs / Trzy dodatkowe wejścia impulsowe / Три дополнительных импульсных входа / Tři další impulzní vstupy / Tri prídavné impulzné vstupy

1.6 Ein Impulsausgang potenzialfrei / Une sortie d'impulsions sans potentiel / Una salida de impulsos de libre potential / Uscita impulsi a potenziale libero / One potential-free pulse output / Jedno wyjście impulsowe bezpotencjałowe / Один беспотенциальный импульсный выход / Jeden beznapěťový impulzní výstup / Jeden beznapäťový impulzný výstup

1.7 Zwei Impulsausgänge potenzialfrei / Deux sorties d'impulsions sans potentiel / Dos salidas de impulsos de libre de potencial / Uscite impulsi a potenziale libero / Two potential-free pulse outputs / Dwa wyjścia impulsowe bezpotencjałowe / Два беспотенциальных импульсных выхода / Dva beznapěťové impulzní výstupy / Dva beznapäťové impulzné výstupy

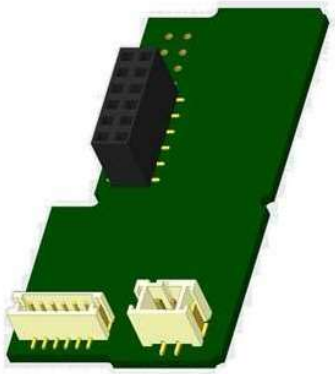
1 Interfaces and Options

1.1 Optical (infrared) interface

For communication with the optical interface an optocoupler and a suitable configuration software are necessary. The optocoupler and the configuration software are available as accessory equipment.
The optical infrared interface will be activated by automatically sending a header (according to EN 13757-3). Baud rate: 2400 baud.
Then you can communicate with the meter for 4 seconds. After every valid communication the meter is open for another 4 seconds. Afterwards the display is deactivated.
The number of read-outs per day via the optical interface is limited. During daily read-out at least 4 communications are possible. If read-outs are carried out more rarely, the possible number of communications will increase.

1.2 M-Bus (optional)

The M-Bus is a galvanically isolated interface for the transmission of meter data (absolute values).



General information about the M-Bus interface:
It is important to note that the acknowledged state of the art technology rules and the relevant legal restraints (international and local; see "Relevant Norms / Standards / Literature M-Bus") are to be observed.
The installation has to be performed by authorized, skilled persons.
If the regulations and the information in the installation and operating instruction manuals are not strictly followed, or if the installation is shown to be faulty, any resulting expenses will be charged to the company responsible for the installation.
Recommended type of cable: Telephone cable J-Y(ST)Y 2x2x0.8mm².
It is important to make sure that the topology of the M-Bus network (cable lengths and cross-sections) is suitable for the **baud rate (2400 Bd)** of the end instruments.

1.2.1 Relevant norms / standards / literature M-Bus

IEC 60364-4-41 (2005-12)	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock
IEC 60364-4-44 (2007-08)	Low-voltage electrical installations - Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances
IEC 60364-5-51 (2005-04)	Electrical installations of buildings - Part 5-51: Selection and erection of electrical equipment - Common rules
IEC 60364-5-54 (2011-03)	Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors
EN 50310 (2011)	Application of equipotential bonding and earthing in buildings with information technology equipment
EN 13757-1_2015, -2_2004, -3_2013	Communication systems for meters and remote reading of meters
The M-Bus	A Documentation, Version 4.8, M-Bus User Group

1.2.2 Additional technical specifications

The installation has to fulfill the requirements of the relevant norms / standards / literature (see paragraph 2.1) and the specifications as follows:

Maximum voltage M-Bus	42 V
Minimum voltage M-Bus	24 V
Maximum ripple voltage	200 mV; EN 13757-2_2004; 4.3.3.6
Maximum voltage potential differences	2 V

1.2.3 Technical data M-Bus

Primary address	0 (factory setting); 1 - 250 (configurable)
Baud rate	2400; 300
Connecting cable length	1 m
Number of possible read-outs	unlimited
Refresh of data	120 s; using a power pack: 2 s

1.3 Modbus RTU (optional)

The Modbus RTU Module is a galvanically isolated interface for the transmission of meter data (absolute values). It is designed for use with PolluStat heat meter and PolluTherm F calculator to connect them to Modbus RTU network using EIA-485 channel.

1.3.1 Technical data Modbus

Connector A	PowerSupply 12 V – 24V DC ± 10% (SELV power supply only)
Connector B	Modbus Network
Maximum power consumption	500 mW
Communication protocol	Modbus RTU
Channel	EIA-485 (galvanically isolated)
Baud rate	1200, 2400, 4800, 9600, 14400, 19200, 38400, 56000, 57600, 115200

1.3.2 Default factory settings

Communication parameters	9600 bps, 8N1 data format (8 data bits, none parity, 1 stop bit)
Update Rate Data from Meter	600 s
Modbus Slave ID*	1
Automatic Slave ID**	0 (deactivated)

* Acceptable values: 1 … 247

** If the automatic Slave ID is activated (set to = 1), the M-Bus address which is set in the meter is used for communication.

1.4 Wireless Interfaces

Sensus offers the following radio interfaces:

- wireless M-Bus interface EN 13757-3, -4 (see chapter 1.4.1)
- LoRaWAN communication interface (see chapter 1.4.2)

General information about the radio interface:

Installation of radio components between or behind heating pipes, or the presence of other bulky metallic obstacles directly over or in front of the housing must be avoided.

The transmission quality (range, telegram processing) of radio components can be negatively influenced by instruments or equipment with electromagnetic emissions, such as telephones (particularly LTE mobile radio standard), wi-fi routers, baby monitors, remote control units, electric motors, etc.

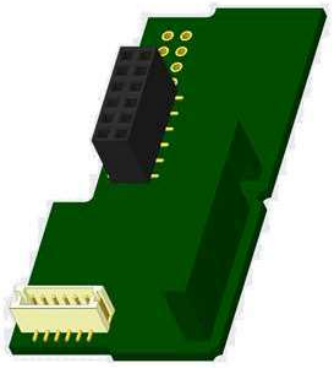
In addition, the construction of the building has a strong influence on the transmission range and coverage. Furthermore, when using installation boxes (substations) they must be equipped with non-metallic covers or doors.

The factory-setting of the clock in the meter is standard (winter) Central European Time (GMT +1). There is no automatic changeover to daylight savings (summer) time.

The radio function is deactivated upon delivery (factory-setting). See chapter 1.4.1.3 & 1.4.2.3 regarding the activation of the radio interface.

1.4.1 Radio interface wireless M-Bus EN 13757-3, -4 (optional)

The radio interface transmits meter data (absolute values).



1.4.1.1 Technical data radio

Frequency	868 MHz
Transmission power	up to 12 dBm
Protocol	wireless M-Bus based on EN 13757-3, -4
Selectable modes	S1 / T1 / C1
Telegrams	- short telegram in conformity to AMR (OMS-Spec_Vol2_Primary_v301 and _v402): energy (heat/cooling energy, pulse input 1 to pulse input 3), total volume, flow, power, information message, outlet flow temperature, temperature difference - long telegram for walk-by read-out: energy (heat/cooling energy, pulse input 1 to pulse input 3), total volume, information message, 15 monthly or 30 semimonthly values (compact mode)
Encryption	AES: Advanced Encryption Standard; key length: 128 bits

1.4.1.2 Radio configuration

Parameter	**Possible settings**	**Factory setting** (Battery lifetime, estimated: 10 years)
Mode	S1 / T1 / C1; unidirectional	T1 (unidirectional)
Transmission period	00:00 - 24:00; any time period in the day	8:00 am - 6:00 pm
Transmission interval	10 seconds - 240 minutes	120 seconds (heat meters)
Weekdays	Monday – Sunday (any weekday)	Monday - Friday
Weeks in a month	1 – 4 (4: uninterrupted, incl. a possible 5th week)	1 – 4 (4: uninterrupted)
Months	1 - 12	1 - 12
Radio activation date	01.01. - 31.12. (day. month)	not set

AES-128-Encryption	- not encrypted;
	- encrypted according to MODE 5 or MODE 7:
	  - Master Key
	  - key per instrument
		Master Key

Type of telegram	- short telegram in conformity to AMR (OMS-Spec_Vol2_Primary_v301 and _v402) - long telegram for walk-by read-out	long telegram (walk-by)

1.4.1.3 Activation of the radio interface

The radio interface **leaves the factory deactivated**. It can be activated as follows:

a) The radio function can be activated by pressing the push-button.
Press the push-button until you change to the display loop “6” (module loop). Then change with a brief keystroke to the 2nd item “rad(io) off“ (see picture).

In order to start the editing mode you afterwards must press the push-button once again for 2-3 seconds. As an aid, after 2 seconds the “editing pen“ will be displayed bottom left in the LCD. As soon as it appears you have to let go of the button. Now the display shows “rad(io) on“ and in all display loops a black triangle (see picture).

b) The radio function can also be activated using the software “Device Monitor”.
This software can be ordered separately as an option.

The radio function can only be deactivated using the software “Device Monitor”.

After activation of the radio function or modification of the radio parameters the meter remains in installation mode for 60 minutes. During this time he sends telegrams in a 36-seconds-interval.

If using the **compact mode**, after activation the meter transmits during installation mode format telegrams and compact telegrams alternately.
During installation mode at least one meter of the version being installed (inlet or outlet flow, heat or heat/cooling, pulse inputs, display units) must be read out with the Sensus “DIAVASO”. The format of the telegram will be stored locally in the PC in an .xml file.
After completion of the installation mode only compact telegrams will be transmitted.

1.4.1.4 Later activation of the radio encryption

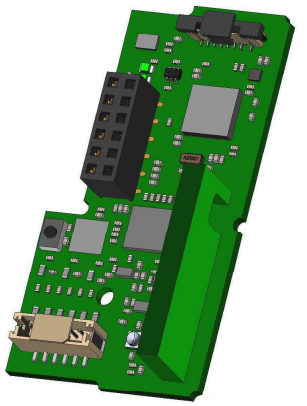
The AES encryption can also be activated later. It can be activated as follows:

a) The encryption can be activated by pressing the push-button.
Press the push-button until you change to the display loop “6” (module loop). Then change with a brief keystroke to the 3rd item “AES off“ (see picture).
In order to start the editing mode you afterwards must press the push-button once again for 2-3 seconds. As an aid, after 2 seconds the “editing pen“ will be displayed bottom left in the LCD. As soon as it appears you have to let go of the button. Now the display shows “AES on“ (see picture).

b) The encryption can also be activated using the software “Device Monitor”. This software can be ordered separately as an option. The encryption can only be deactivated using the software “Device Monitor”.

1.4.2 LoRaWAN interface

The LoRaWAN interface transmits meter data (absolute values).



1.4.2.1 Technical data

Radio characteristics	
Frequency 868 MHz	Frequency 868 MHz
Output power 14 dBm	Output power 14 dBm
Receiver sensitivity -135 dBm	Receiver sensitivity -135 dBm

LoRaWAN characteristics

Device class	Class A, Bi-directional
LoRa version	1.0.2 Rev B
Activation	OTAA* or ABP*
Data rate	DR0-DR5 (250 bit/s-5470 bit/s)

*OTAA = Over-the-air activation
** ABP = Activation by personalization

1.4.2.2 LoRa module configuration

The module can be configurated by using the Device Monitors or the OTC App.

Parameter	Possible settings	Factory setting
Power mode	Active Inactive	Inactive
Configuration Lock	Open Locked	Open
Synchronize meter time	on off	off
Activation type	OTAA ABP	OTAA
EcoMode	off 6 years 10 years	EcoMode 10 years
Transmit interval *[Min.]	5 … 1440	60
Message format**	Standard Sensus Compact JSON Scheduled - daily redundant Scheduled - extended Combined heat/cooling	Standard
Pulse input selection	Choice between 0-3 pulse inputs	0

* The actual transmission interval depends on the type of telegram and the current data rate. The transmission interval is adjusted accordingly in order to guarantee the set battery life (Eco Mode 10 or 6 years). You can find more information in the „Manual LoRa Module“.

** For pulse input option, the telegram type „Sensus“ must be selected.

1.4.2.3 Activation of the radio interface

The radio interface is deactivated by default and can be activated in one of the three following ways:

a) **NTC interface – via Elvaco OTC App**; further information is available in the operating instructions of the Elvaco OTC App: https://www.elvaco.se/Image/GetDocument/en/269/elvaco-otc-app-manual-english.pdf

b) **Optical interface – via the Sensus configuration software Device Monitor** – from version 2.22; further information is available in the operating instructions of the Device Monitor. The software can be ordered separately.

c) **Via the heat meter menu;**

Press and hold the button to switch to display loop "6" (= module loop; see Chapter 3 Display in the Module Loop (Optional)). Then switch to the second loop with a short press of the button – 6-02 – „EnA oFF“ (see image).

In order to start the edit mode, you must then press the key press once more for 2-3 seconds. As an aid, an “editing pen” symbol appears in the lower left corner of the LCD after 2 seconds. As soon as it can be seen, you must release the button. The display now shows „EnA on“ and a black triangle in all display loops (see image).

1.4.2.4 Connection to the LoRaWAN Network

To check whether the meter has already connected to the LoRaWAN network, change from loop 6-02 to loop 6-03 by briefly pressing the button. As long as the meter is searching for the LoRaWAN network, „LorA Pen“ appears in the LCD; the time between each connection attempt is gradually reduced to at least once a day.

As soon as the meter has connected to the LoRaWAN network, “LorA Con” appears in the LCD.

1.5 Three additional pulse inputs (optional; only in conjunction with M-Bus or radio)

With this option, additional instruments with pulse outputs can be read out via optical interface, M-Bus or radio.

General information about pulse inputs:

It is important to note that the acknowledged state of the art technology rules and the relevant legal restraints (international and local; see "Relevant Norms / Standards / Literature Pulse Inputs") are to be observed.

The installation has to be performed by authorized, skilled persons.

If the regulations and the information in the installation and operating instruction manuals are not strictly followed, or if the installation is shown to be faulty, any resulting expenses will be charged to the company responsible for the installation.

1.5.1 Relevant norms / standards / literature pulse inputs

IEC 60364-4-41 (2005-12)	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock
IEC 60364-4-44 (2007-08)	Low-voltage electrical installations - Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances
IEC 60364-5-51 (2005-04)	Electrical installations of buildings - Part 5-51: Selection and erection of electrical equipment - Common rules
IEC 60364-5-54 (2011-03)	Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors
EN 50310 (2011)	Application of equipotential bonding and earthing in buildings with information technology equipment
EN 1434-2 (2016)	Heat Meters - Part 2: Constructional requirements

1.5.2 Technical data pulse inputs

Pulse input class	IB according to EN 1434-2:2016
Connecting cable length	1 m
Voltage supply	+ 3 V DC
Source current	= 1,5 µA
High level input threshold	U ≥ 2 V
Low level input threshold	U ≤ 0,5 V
Pull-up resistor	2 MΩ
Pulse length	≥ 100 ms
Pulse frequency	≤ 5 Hz

1.5.3 Possible combinations of the different input (class IB) and output (class OA) devices

	Class IA	Class IB	Class IC	Class ID	Class IE
Class OA	yes	yes	no	yes	no
Class OB	yes	no	no	yes	yes
Class OC	no	yes	yes	no	no
Class OD	no	no	yes	no	no
Class OE	no	no	no	no	yes

1.5.4 Setting up the three additional pulse inputs

The optional pulse inputs 1 + 2 + 3 for external meters can be set up using a suitable configuration software. You can configure serial number, manufacturer, version (0 … 255), medium code, input pulse value, unit and starting value of the external meters.

1.5.5 Set-up possibilities

Pulse value	Units
1	liters / kWh / pulse without unit
2,5	liters / kWh / pulse without unit
10	liters / kWh / pulse without unit
25	liters / kWh / pulse without unit
100	liters / kWh / pulse without unit
250	liters / kWh / pulse without unit
1000	liters / kWh / pulse without unit

Installation notes for pulse inputs:

It is important that the pulse cables not be affected by (or exposed to) an external voltage!

Check the polarity of pulse generators with “open collector“ outputs.

The cable wires must not touch each other during installation, otherwise pulses will be counted in the instrument.

When setting up the meter it may be necessary to adjust the meter reading of the instruments connected and the pulse value using a suitable configuration software.

For transmitting the values of the pulse inputs via radio, transmission must be set using a suitable configuration software, if the meters were not already ordered with the transmission of these values set.

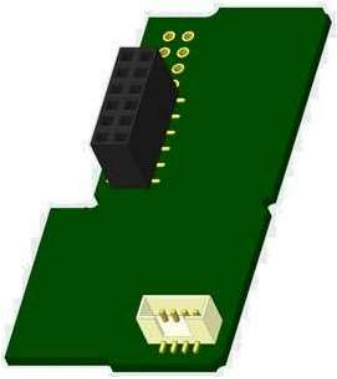
1.5.6 Pin assignments 6-wire cable

Color	Connection
Pink	IE1+
Grey	IE1⊥
Yellow	IE2+
Green	IE2⊥
Brown	IE3+
White	IE3⊥

1.6 One potential-free pulse output (optional)

The potential-free pulse output provides counting pulses of the meter.

The pulse output closes corresponding to the pulse value, see item „pulse value pulse output 1“ in display loop “6” (module loop).



	Heat meter	Cooling meter	Heat/cooling meter
Possible settings pulse output 1	heat energy (factory setting) or volume	cooling energy (factory setting) or volume	heat energy (factory setting) or volume

From firmware version 1.03 (PolluStat) and 1.00 (PolluStat & PolluTherm F) on the meter recognizes nominal size and unit of energy and autonomously sets the pulse values for energy and volume according to the following notes.

PolluStat – pulse output for energy:

	Display shows kWh / MWh	Display shows Gcal	Display shows GJ	Display shows MMBTU
q_p 0,6 m^3/h	1 kWh/pulse	1 Mcal/pulse	10 MJ/pulse	10 MMBTU/pulse
q_p 1,5 m^3/h	1 kWh/pulse	1 Mcal/pulse	10 MJ/pulse	10 MMBTU/pulse
q_p 2,5 m^3/h	1 kWh/pulse	1 Mcal/pulse	10 MJ/pulse	10 MMBTU/pulse
q_p 3,5 m^3/h	10 kWh/pulse	10 Mcal/pulse	10 MJ/pulse	10 MMBTU/pulse
q_p 6 m^3/h	10 kWh/pulse	10 Mcal/pulse	10 MJ/pulse	10 MMBTU/pulse
q_p 10 m^3/h	10 kWh/pulse	10 Mcal/pulse	10 MJ/pulse	10 MMBTU/pulse

1.6.1 Pin assignments 4-wire cable

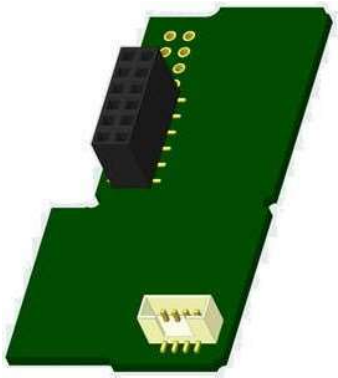
Color	Connection
Yellow	IA1
Green	IA1
Brown / White	not reserved

1.6.2 Technical data for one pulse output and two pulse outputs

Pulse outputs class	OA (electronic switch) according to EN 1434-2:2016
Connecting cable length	1 m
Switching voltage, maximum	30 V
Switching current, maximum	27 mA
Contact resistance (on) max.	74 Ω
Contact resistance (off) min.	6 MΩ
Closure time	100 ms
Interval between pulses	100 ms

1.7 Two potential-free pulse outputs (optional)

The potential-free pulse outputs provide counting pulses of the meter.
The pulse outputs close corresponding to the pulse value, see items „pulse value pulse output 1“ and „pulse value pulse output 2“ in display loop “6” (module loop).



	Heat meter	Cooling meter	Heat/cooling meter
Pulse output 1	heat energy	cooling energy	heat energy
Pulse output 2	volume	volume	cooling energy

Pulse outputs for energy:
The pulse value for energy is always determined by **the last place** of the energy display.
Examples:
Display: 0 kWh -> pulse value: 1 kWh/pulse
Display: 0,000 MWh -> pulse value: 0,001 MWh/pulse Display:
0,000 GJ -> pulse value: 0,001 GJ/pulse

Pulse output for volume:
The pulse value for volume is always determined by **the second-to-last place** of the volume display.
Example:
Display: 0,000 m^3 -> pulse value: 10 l/pulse (0,01 m^3/pulse)

1.7.1 Pin assignments 4-wire cable

Color	Connection
Yellow	IA1
Green	IA1
Brown	IA2
White	IA2

2 Retrofitting with an Additional Communication Interface

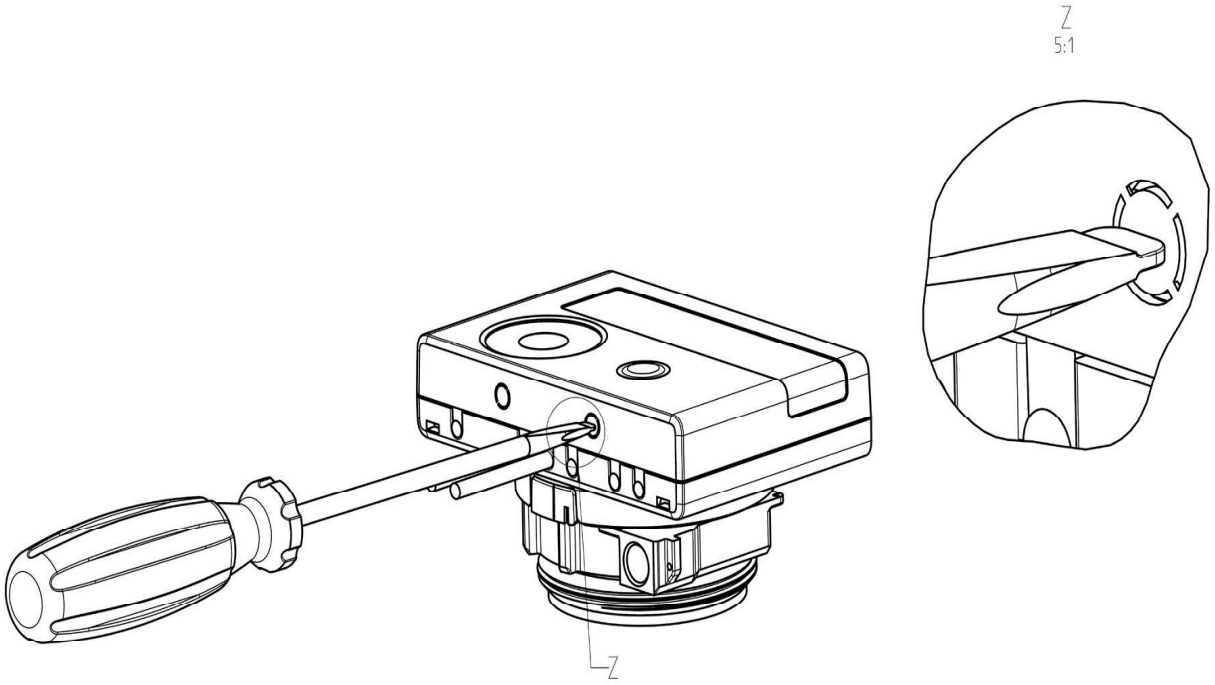
During installation of the retrofitting module observe the ESD requirements according to EN 61340-5-1.

This means that on location an antistatic wrist strap with an integrated 1 MΩ resistor has to be used which must be connected to a proper spot: This is either a grounded pipe or – only with an appropriate adapter! – a Schuko plug grounding socket. The antistatic wrist strap must be worn tightly on the skin of the wrist.

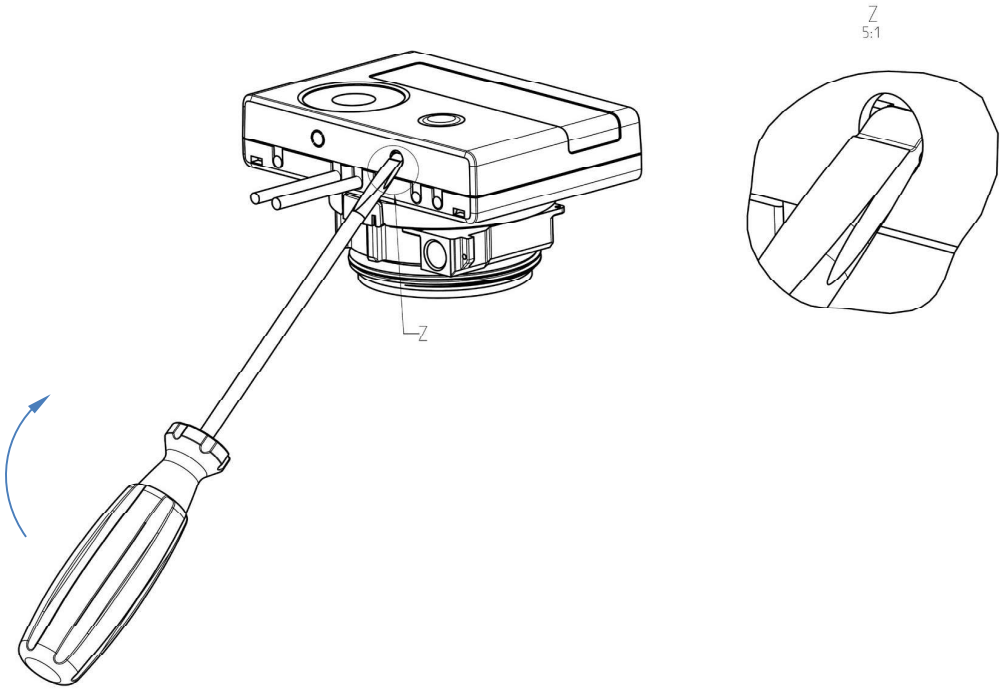
2.1 Retrofitting PolluStat with an additional communication interface (optional)

We also offer a retrofittable meter to which communication interfaces can be added later.

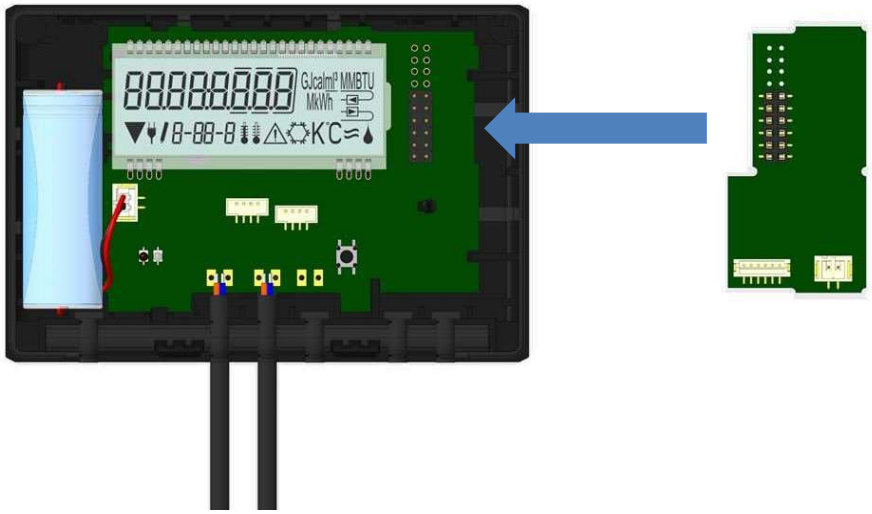
To retrofit such a meter with an additional communication interface the calculator´s adhesive seal has to be destroyed and the device´s calculator to be opened. Use a screwdriver with a wide tip (4 - 5 mm) and carefully press in the two round predetermined breaking points above the cable feedthroughs (see picture 1).



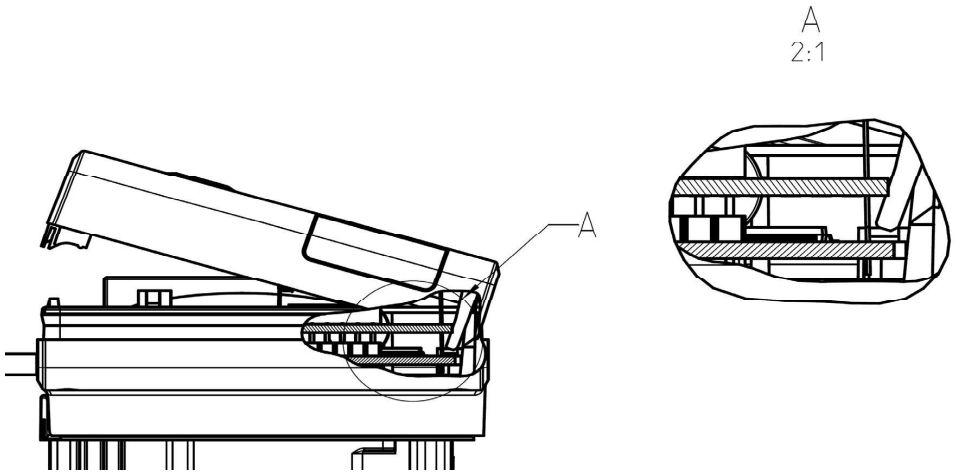
Then insert the screwdriver into one of the two openings at an angle of approx. 45° and carefully lift the handle up to approx. 90° (see picture 2). The upper housing piece of the calculator is then no longer latched on this side. Repeat this with the other opening. Now the upper housing piece can be taken off.



Plug the interface module on the right side of the PC board (see picture 3). The cables are to be fed through the rightmost cable feedthroughs into the calculator after removing the blind grommets. Close the calculator.
Protect the calculator against unauthorized opening using one of the numbered adhesive seals enclosed to the modules (stick it upon the seal destroyed). The added bar code label can be used for the purpose of documentation.



To remove a module the upper housing piece must be carefully pressed against the rear panel of the lower housing piece during opening the calculator. Thus the two rear snap-fits of the upper housing piece lever out the module of the PC board (see picture 4).



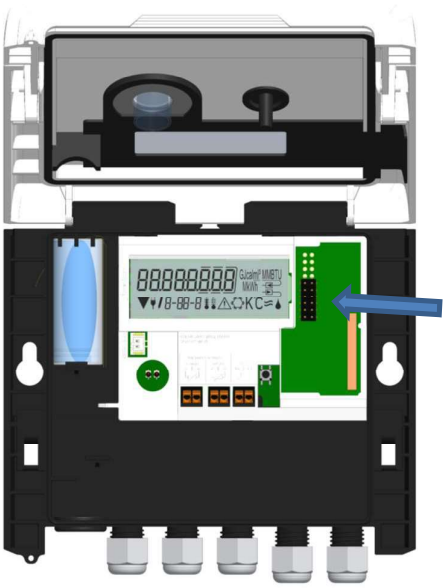
2.2 Retrofitting PolluTherm F with an additional communication interface

To our calculator further communication interfaces can be added later.

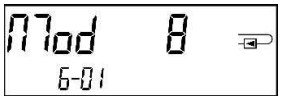
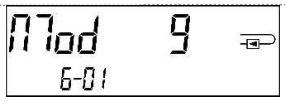
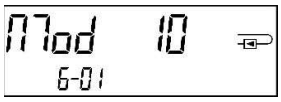
Open the calculator by pulling the clamping bracket at the upper housing´s leading edge up.

Plug the interface module on the right side of the PC board. If there are module cables you have to loosen the needed number of cable glands and to glide them over the cables. Remove the blind plugs from the cable gland openings and feed the cables into the calculator.

Protect the calculator against unauthorized opening using one of the numbered adhesive seals enclosed to the modules (stick it upon the seal destroyed). The added bar code label can be used for the purpose of documentation.



Level 6 / Module Loop:

		
	  or:  	  or:  
		
		
1) Display of plugged module (alternatively):	2) Display depending on plugged module and setup:	3) Display depending on plugged module and setup:
5 = 1 pulse output		
8 = wireless M-Bus + 3 pulse inputs	wireless M-Bus (radio) off/ wireless M-Bus (radio) on; LoRa on / LoRa off	radio encryption (AES) off; radio encryption (AES) on; LoRa pending / LoRa connected
9 = M-Bus + 3 pulse inputs; 9 = Modbus		
10 = 2 pulse outputs	pulse value / pulse output 1	pulse value / pulse output 2