



Operating Instructions

Communication Interfaces S3(C)

1 Interfaces and Options

1.1 Optical (infrared) interface

For communication with the optical interface an optocoupler and the “Device Monitor” software are necessary. The optocoupler and “Device Monitor” 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)

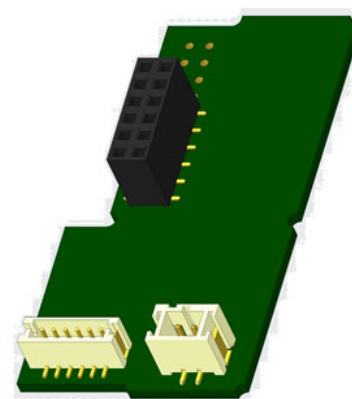
The M-Bus is a galvanically isolated interface for the transmission of meter data (absolute values).

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

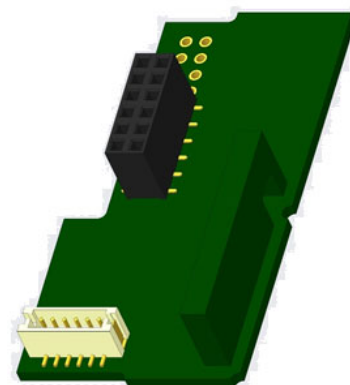
The radio interface is for the transmission of meter data (absolute values).

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 section “Activation of the radio interface”.

1.3.1 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	<ul style="list-style-type: none"> - 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

1.3.2 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 5 th week)	1 – 4 (4: uninterrupted)
Months	1 - 12	1 - 12
Radio activation date	01.01. - 31.12. (day. month)	not set

AES-128-Encryption	<ul style="list-style-type: none"> - not encrypted; - encrypted according to MODE 5 or MODE 7: <ul style="list-style-type: none"> - Master Key - key per instrument 	Master Key
Type of telegram	<ul style="list-style-type: none"> - short telegram in conformity to AMR (OMS-Spec_Vol2_Primary_v301 and _v402) - long telegram for walk-by read-out 	long telegram (walk-by)

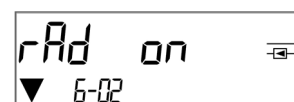
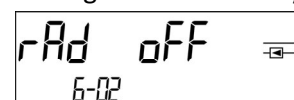
1.3.3 Activation of the radio interface

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 Engelmann "Read-out Software walk-by". 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.

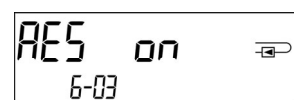
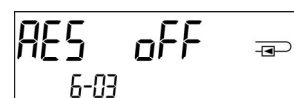
1.3.4 Later activation of the radio encryption

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 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.

1.4.1 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

1.4.2 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 μ A
High level input threshold	$U \geq 2$ V
Low level input threshold	$U \leq 0,5$ V
Pull-up resistor	2 M Ω
Pulse length	≥ 100 ms
Pulse frequency	≤ 5 Hz

1.4.3 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

1.4.4 Setting up the three additional pulse inputs

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

1.4.5 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 the “Device Monitor” software.

For transmitting the values of the pulse inputs via radio, transmission must be set using the “Device Monitor” software, if the meters were not already ordered with the transmission of these values set.

Select the menu item „Parameterization of the module“ in the software. Set the radio transmission in the menu item „Transmission of values for the pulse inputs“. (The transmission of these values via M-Bus is always set in the factory setting.)

1.4.6 Pin assignments 6-wire cable

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

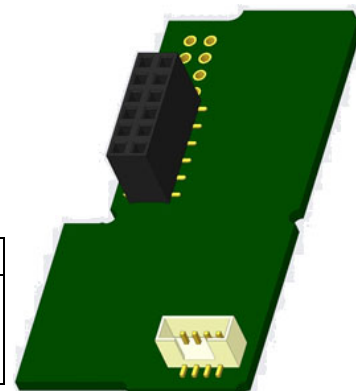
1.5 One potential-free pulse output (optional)

Important note: This module can be used for the compact heat meter S3 from firmware version 1.03 on, for the calculator S3C from firmware version 1.00 on.

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 (S3) and 1.00 (S3C) 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.

S3 - 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

S3 - pulse output for volume:

The pulse value for volume is always determined as follows: Display shows m³ -> pulse value: 100 l/pulse (0,1 m³/pulse).

S3C - pulse output for energy:

The pulse value for energy is always determined by **the second-to-last place** of the energy display.

Examples:

Display: 0 kWh -> pulse value: 10 kWh/pulse
Display: 0,000 MWh -> pulse value: 0,01 MWh/pulse
Display: 0,000 GJ -> pulse value: 0,01 GJ/pulse.

S3C - pulse output for volume:

The pulse value for volume is always determined by **the third-to-last place** of the volume display. Examples:

Display: 0,000 m³ -> pulse value: 100 l/pulse (0,1 m³/pulse)
Display: 0 m³ -> pulse value: 100 m³/pulse.

1.5.1 Pin assignments 4-wire cable

Color	Connection
Yellow	IA1
Green	IA1
Brown / White	not reserved

1.5.2 Technical data for one pulse output and two pulse outputs

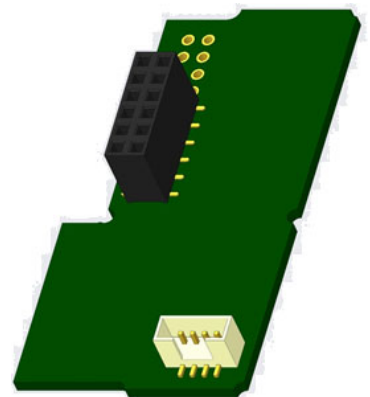
Pulse outputs class	OA (electronic switch) according to EN 1434-2:2016
Connecting cable length	1 m
Switching voltage, maximum	30 V
Switching current, maximum	27 mA
Contact resistance (on) max.	74 Ω
Contact resistance (off) min.	6 MΩ
Closure time	100 ms
Interval between pulses	100 ms

1.6 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 outputs for volume:

The pulse value for volume is always determined by **the second-to-last place** of the volume display.

Example:

Display: 0,000 m³ -> pulse value: 10 l/pulse (0,01 m³/pulse)

1.6.1 Pin assignments 4-wire cable

Color	Connection
Yellow	IA1
Green	IA1
Brown	IA2
White	IA2

2 Retrofitting with an Additional Communication Interface

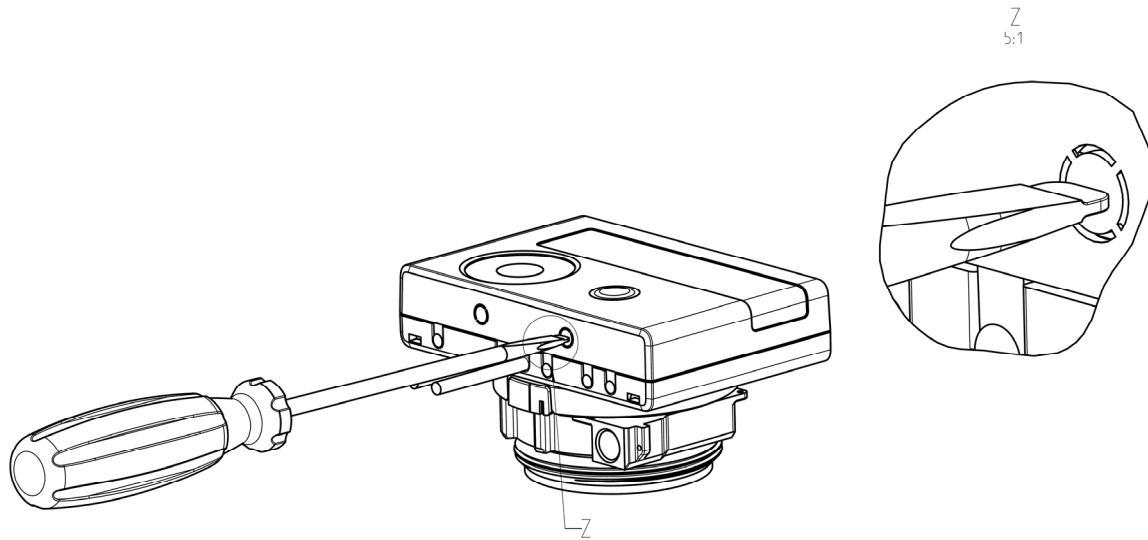
During installation of the retrofitting module observe the ESD requirements according to EN 61340-5-1.

This means that on location an antistatic wrist strap with an integrated 1 M Ω 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.

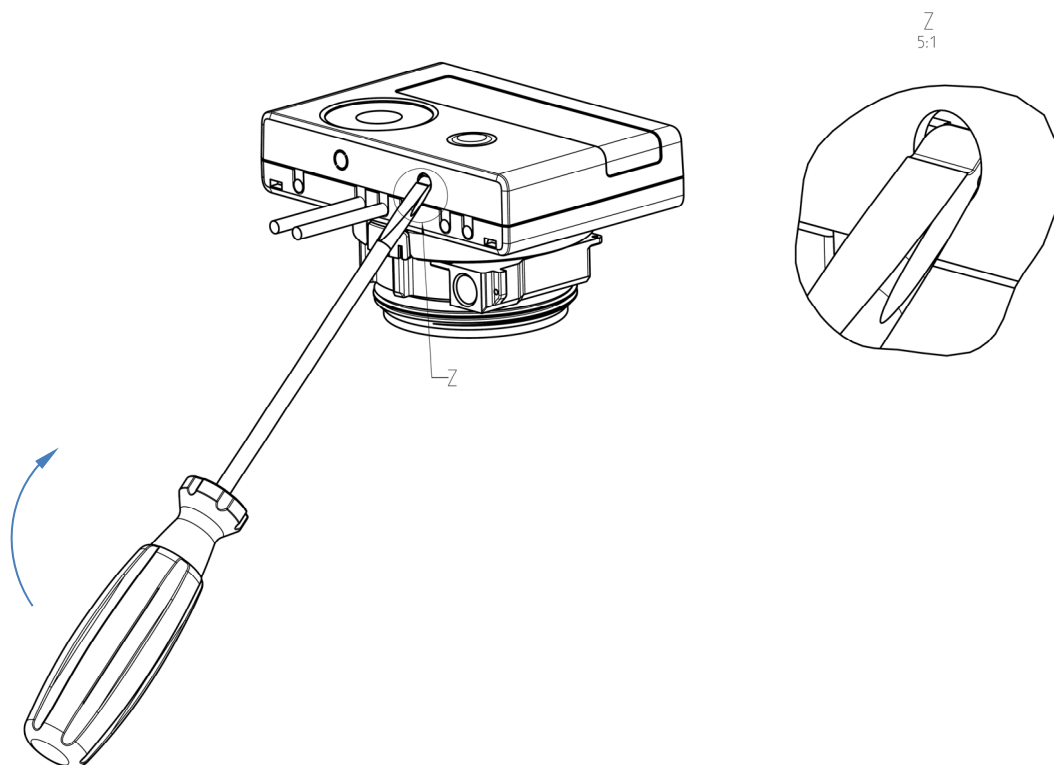
2.1 Retrofitting S3 with an additional communication interface (optional)

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

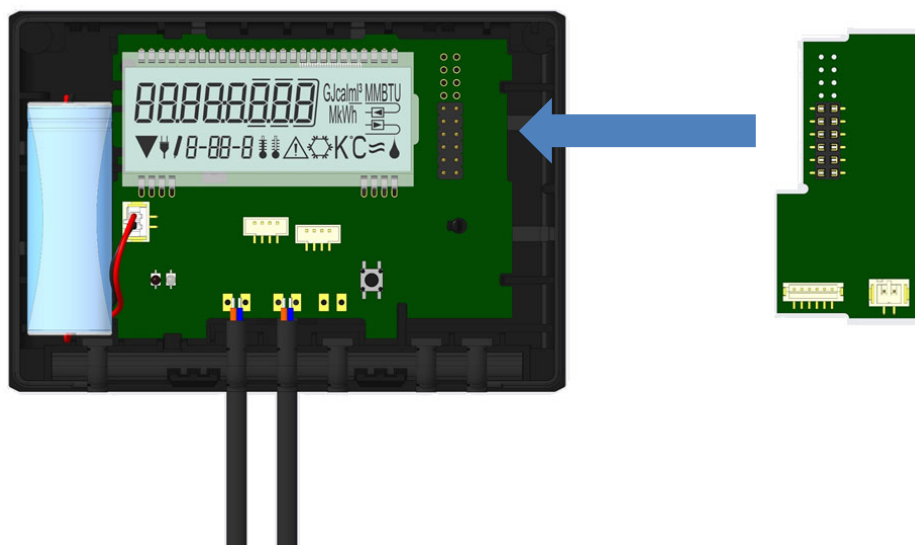
To retrofit such a meter with an additional communication interface the calculator's adhesive seal has to be destroyed and the device's calculator to be opened. Use a screwdriver with a wide tip (4 - 5 mm) and carefully press in the two round predetermined breaking points above the cable feedthroughs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



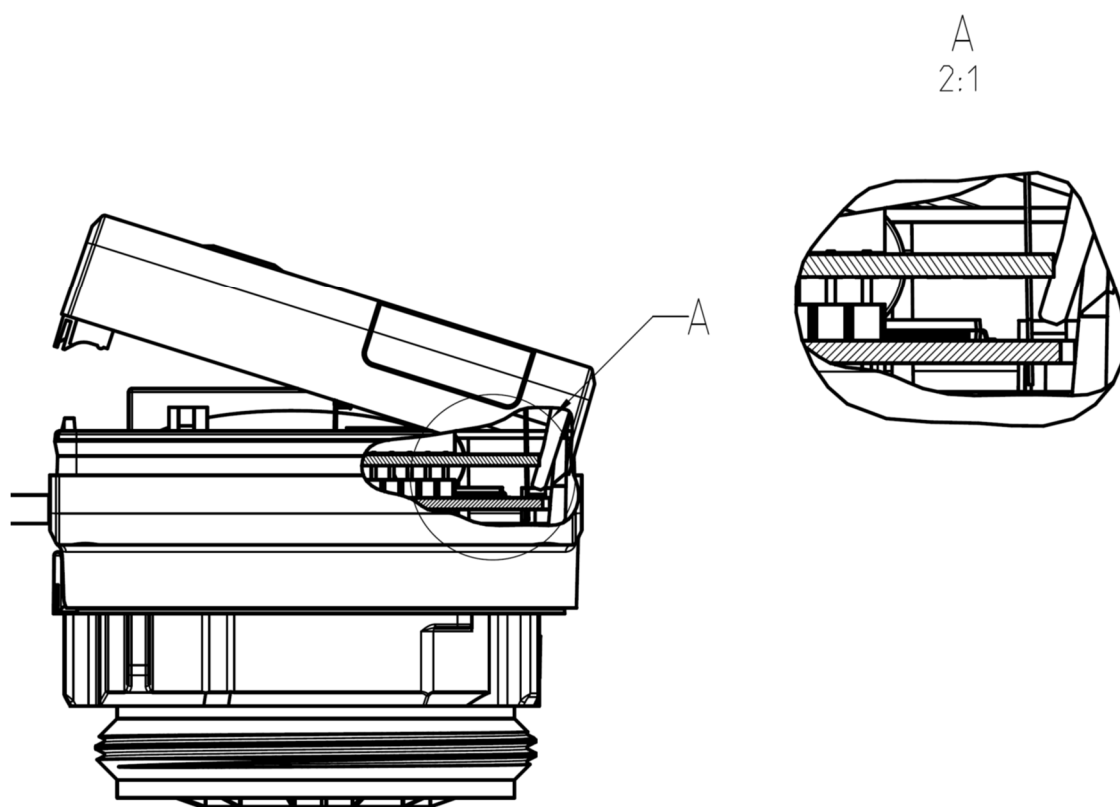
Then insert the screwdriver into one of the two openings at an angle of approx. 45° and carefully lift the handle up to approx. 90° (see picture 2). The upper housing piece of the calculator is then no longer latched on this side. Repeat this with the other opening. Now the upper housing piece can be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



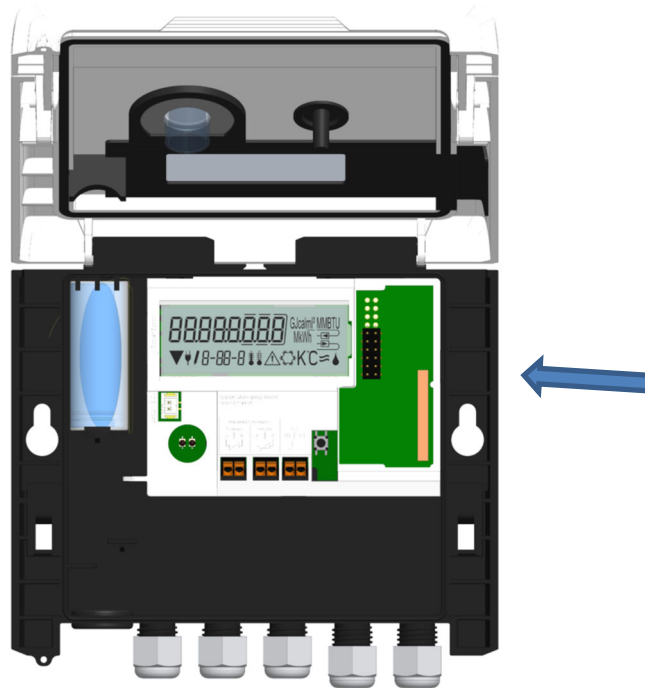
2.2 Retrofitting S3C with an additional communication interface

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.



3 Display in the Module Loop (Optional)

Level 6 / Module Loop:

<div><div>Mod 5</div><div>6-01</div></div> <div><div>Mod 8</div><div>6-01</div></div> <div><div>Mod 9</div><div>6-01</div></div> <div><div>Mod 10</div><div>6-01</div></div> <div>1) Display of plugged module (alternatively): 5 = 1 pulse output; 8 = wireless M-Bus + 3 pulse inputs; 9 = M-Bus + 3 pulse inputs; 10 = 2 pulse outputs</div>	<div><div>rAd off</div><div>6-02</div></div> <div><div>rAd on</div><div>6-02</div></div> <div>or:</div> <div><div>P01 0001</div><div>6-02</div></div> <div>2) Display depending on plugged module and setup: radio off; radio on; pulse value pulse output 1</div>	<div><div>AES off</div><div>6-03</div></div> <div><div>AES on</div><div>6-03</div></div> <div>or:</div> <div><div>P02 0010</div><div>6-03</div></div> <div>3) Display depending on plugged module and setup: radio encryption (AES) off; radio encryption (AES) on; pulse value pulse output 2</div>	
---	--	--	--

4 Imprint

Engelmann Sensor GmbH
Rudolf-Diesel-Str. 24-28
69168 Wiesloch-Baiertal
Germany

E-Mail: info@engelmann.de

www.engelmann.de