DIEHL RS485 High Precision Calculator Installation Guide

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Contents

General

This guide is intended for trained specialised personnel. Therefore, it does not include basic working steps.

⚠ The seal on the energy meter must not be damaged!
A damaged seal will result in immediate invalidation of the factory warranty and verification. The cables supplied with the meter must neither be shortened, extended nor changed in any other way.

ℹ The regulations on the use of energy meters must be observed!
The installation must only be carried out by a specialist installation or electrical company. The personnel must be trained in the installation and handling of electrical equipment and be cognisant of the Low Voltage Directive.

ℹ **Medium**
water, as per AGFW Instruction Sheet FW510.
If water additives are used (e.g. corrosion protection), the user must make sure that the corrosion resistance is adequate.

- Optional also as a separate variant for the medium Tyfocor LS (see loop 3) available.

- The medium temperature is specified as 5 … 130 °C (150 °C)

- The temperature range depends on variant and nominal size.

- The exact temperature range is shown on the type plate.

- The operating/ambient conditions are 5 to 55 °C; IP 54/64; 93 % rel. humidity.

- Ambient temperatures below 35 °C have a positive effect on battery lifetime.

⚠ **Pipeline insulation**
In the case of the pipeline insulation, the housing with the electronics must remain free.

Detailed user guide available at **https://www.diehl.com/metering/en/support-center/download-center/**. It must

be observed without fail.
The IZAR@Mobile 2 software is used for readout/parametrization and is obtainable on the internet at:
https://www.diehl.com/metering/en/support-center/download-center/

Changing of communication relevant parameters can result in the loss of OMS certification.

Transport and storage

Unpacking
Energy meters are measuring devices and must be handled with care. To protect against damage and soiling, they should only be unpacked immediately prior to installation.

Transport
The transport of the meter is permitted only in the original package.

[i] When sending wireless measuring instruments / components by air, disable the wireless (place in aircraft mode) before shipping.
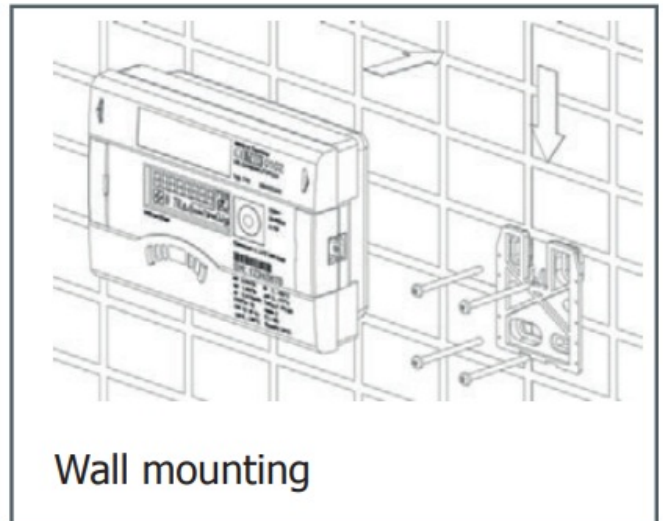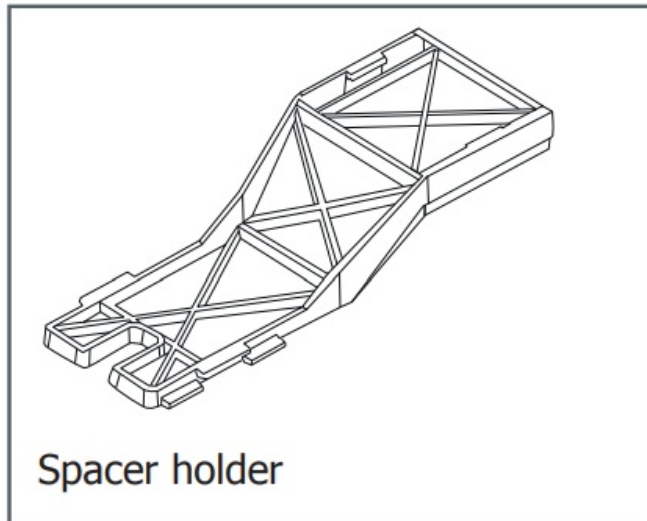
Calculator Installation

- Depending on the design and application (heat or cooling meter), the calculator is installed in either the hot or cold line of the system.
- Depending on the version, the integrator is programmed according to the associated volume measurement part for the use in inlet or outlet. The installation position is displayed in the info loop 3.5 (see "Information loop (3)" on page 43) and, if necessary, also by means of a pictogram.

| Inlet | Outlet | no pictogram (Installation position can be set on site,) |
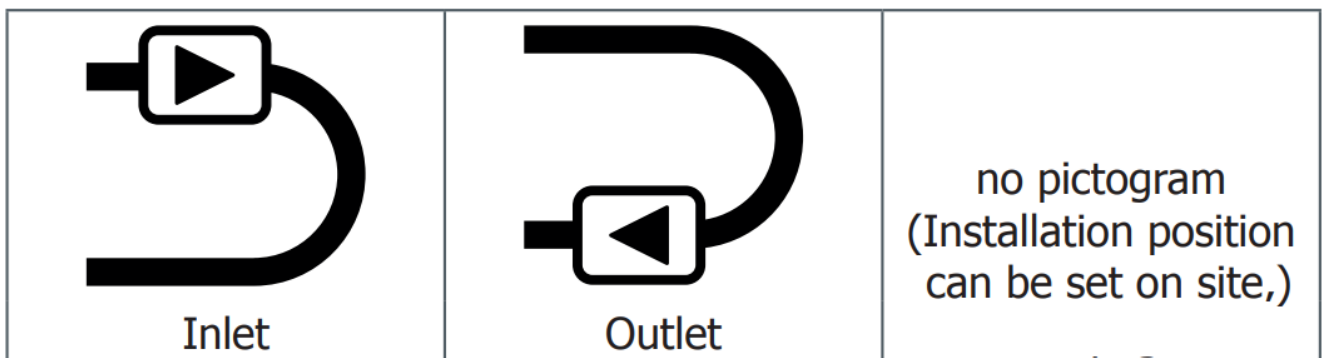
- Make sure the meter is installed sufficiently far away from possible sources of electromagnetic interference (switches, electric motors, fluorescent lamps etc.).
- If possible install the cables of the assigned flow sensor together with the cables of the temperature sensor freely suspended (not bundled – antennae effect) with sufficient distance to electromagnetic interference sources.

T: 5 to 90 °C
$T_{water} > T_{ambient}$

T: 5 to 130 / 150 °C
$T_{water} < T_{ambient}$
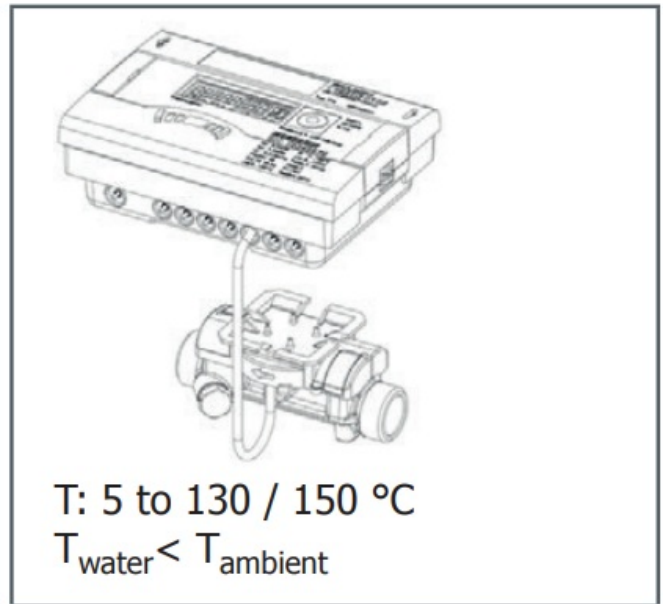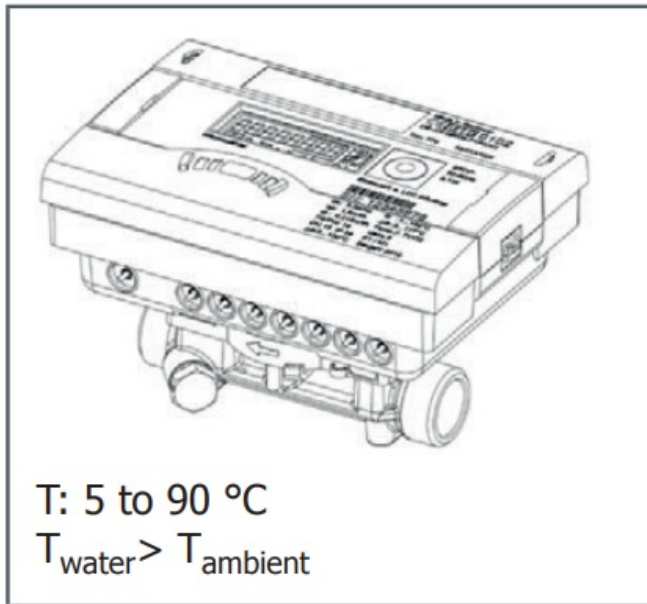
- For medium temperatures from 90°C or for T Water< T Ambient (cooling meter application or heat meter with cooling tariff application) the calculator must be removed and fitted at a sufficient distance from any heat sources. A wall holder (supplied with meter) or a spacer holder (optional) is available for this purpose.

Spacer holder

Wall mounting

- It is recommended that shut-off valves are fitted before and after the energy meter to simplify removing the meter.
- The calculator should be installed in a conveniently accessible position for service and operating personnel.
- Initial operation is to be carried out and recorded after installation.

Installation of the temperature sensors

Handle the temperature sensor carefully!
The sensor cables are provided with coloured type plates:
Red: Sensor in the hot line
Blue: Sensor in the cold line

- Sensors must be installed symmetrically.
- The maximum cable length for PT100 and PT500 is up to 10 m.
- The connecting cables must not be shortened or extended.

- The free temperature sensor can be installed in a ball valve or in a conformity-tested pocket for this type of sensor.
- Ensure that the temperature sensors are permanently connected during operation.

Installation positions

Meter type	Sensor marking	2-Conductor terminals	4-Conductor terminals	Installation position
Calculator heat in the cold line	Red	5 TH 6	1/5 TH 6/2	in the hot line
	Blue	7 TC 8	3/7 TC 8/4	in the cold line
Calculator heat in the hot line	Red	5 TH 6	1/5 TH 6/2	in the hot line
	Blue	7 TC 8	3/7 TC 8/4	in the cold line
Calculator cold in the hot line	Blue	7 TC 8	3/7 TC 8/4	in the cold line
	Red	5 TH 6	1/5 TH 6/2	in the hot line
Calculator cold in the cold line	Blue	7 TC 8	3/7 TC 8/4	in the cold line
	Red	5 TH 6	1/5 TH 6/2	in the hot line
Calculator climate in the cold line	Red	5 TH 6	1/5 TH 6/2	in the hot line
	Blue	7 TC 8	3/7 TC 8/4	in the cold line
Calculator climate in the hot line	Red	5 TH 6	1/5 TH 6/2	in the hot line
	Blue	7 TC 8	3/7 TC 8/4	in the cold line

Installation in the ball valve with adapter

(coupling set in a separate bag)
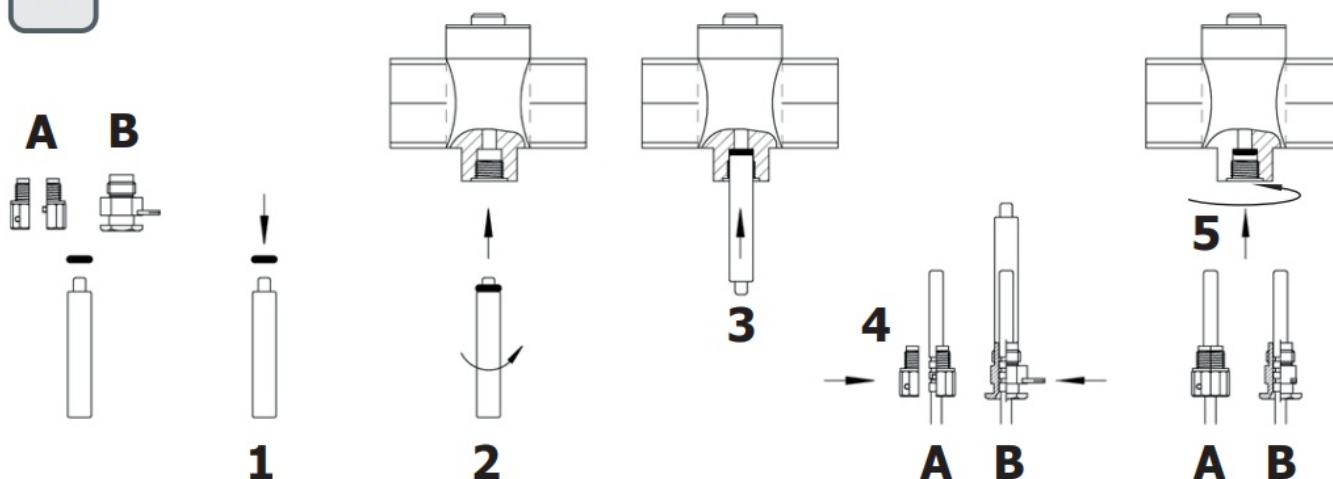Use ball valves with installation option for temperature sensor with thread M10 x 1.

Preparatory measures

- Close the ball valve.
- Unscrew the plug screw from the ball valve.

Installation

(see fig. I)

1. Place the O-ring from the attached coupling set (type A or B) on the mounting pin.
2. Insert the O-ring with the mounting pin into the sensor hole of the ball valve (turn the mounting pin).
3. Position the O-ring in its final position using the other end of the mounting pin.
4. Fastening screws
    - Type A (plastic) – plug the fastening screw onto the temperature sensor.
    - Type B (brass) – slide the fastening screw onto the temperature sensor and attach the fastening screw with the dowel pin. Press in the dowel pin completely and remove the mounting pin from the temperature sensor.
5. Insert the temperature sensor with adapter fitting into the ball valve and tighten fastening screw by hand (2-3 Nm).

Installation in a pocket

For new installations, temperature sensors for nominal sizes DN25 or smaller should only be installed directly immersed.
This ensures higher measuring accuracy.

Pulse input Volume pulses

Flow meter connection with pulse input and, if required, with power supply at the terminals 9 (+Vcc), 10 (volume pulse), 11 (- Gnd) of the calculatorINFOCAL 8.

Flow sensor connection	Sensor marking
External Vcc 3.6 V	9 (+)
Pulse input (open collector)	10
Ground	11 (-)

- Pulse frequency < 200Hz
- Pulse duration > 3 msec
- Pulse rate in display "Loop 3 – INFO" (In0)
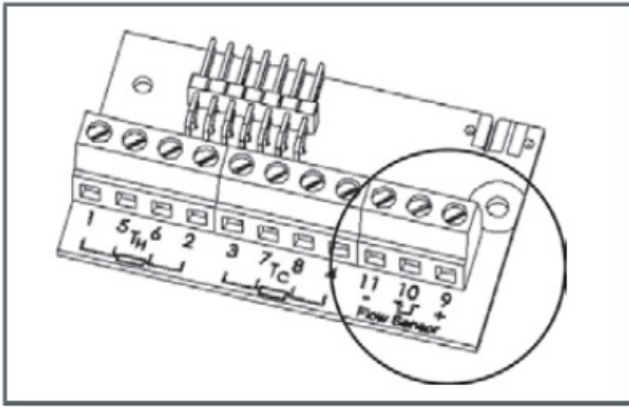
SHARKY 473	Calculator terminal
Vcc (brown)	9 (+) external power supply (option)
Pulse (white)	10
GND (blue)	11 (-)
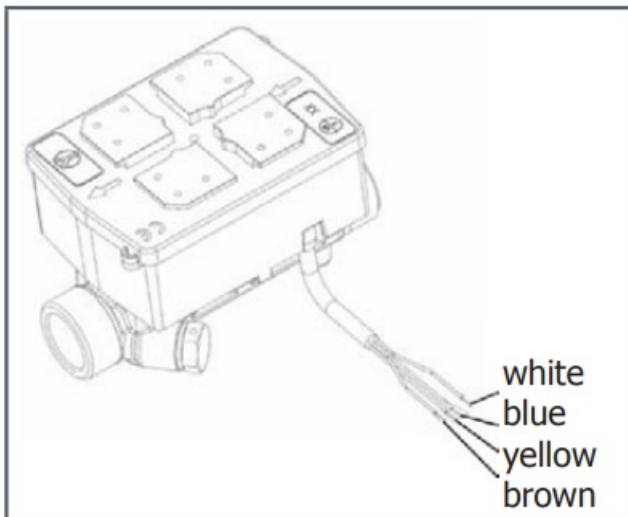
Switch (Reed)	Calculator terminal
Pulse (white)	10
GND (blue)	11 (-)
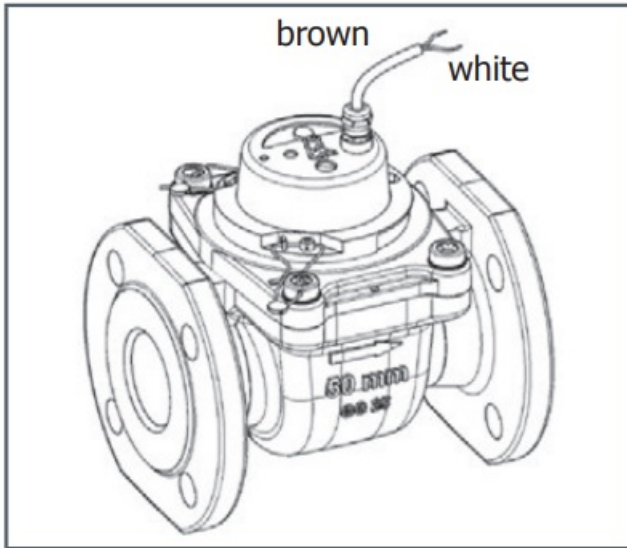
Power supply

Battery
A 3.6 VDC lithium battery is fitted in the standard version.

- The battery must not be recharged or short-circuited.
- Ambient temperatures below 35 °C have a positive effect on battery lifetime.

[!]

Used batteries must be disposed of at suitable waste collection points! Caution: Risk of explosion if battery is replaced by an incorrect type.

Power supply unit

- 24 VAC or 230 AC power supply units can be changed or retrofitted at any time.

  [!] It is strictly necessary to have the protective safety cover installed at all times.

  Under no circumstances connect between the two phases otherwise the power supply unit will be destroyed.
- The conduit is to be fused at max. 6 A and protected against manipulation.
- The power supply unit notifies the meter if mains voltage is present.
- If the power supply fails, the backup battery (CR2032) provides the power supply for up to 1 year. The LCD readings (on pressing button) and the date and time are still updated, but none of the measuring functions work, incl. the flow rate measurement. Communication still functions over the optional M-Bus, RS485, RS232 modules or the optical interface, but reduces the life of the backup battery. The wireless function is switched off in the event of power supply failure.

Start-up operation

Once the calculator has been installed, the components (calculator, volume measuring component and both temperature sensors) must be sealed and the calculator taken into operation.

Check the display for a plausible indication of flow rate and temperatures.

User guide for further Information is available.
https://www.diehl.com/metering/en/support-center/download-center/

Inlet / outlet setting (optional ex works)

Optionally, the installation position of the meter can be set in-situ in loop 3 ("3.5" on page 44). Consequently installation in the inlet (flow) or outlet
(return) is possible.

ℹ️ This setting must be made prior to initial operation of the meter.

As supplied, the outlet (return) is pre-set and is shown as follows in the display.
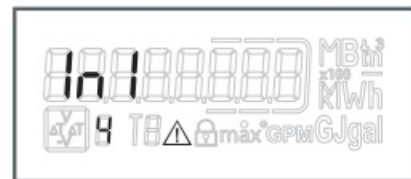

Setting and number of possible changes.

To changeover, switch to the "OUTLET" window in loop 3 (see 9. Operation).
Pressing and holding the button for > 6 s changes the display/setting to "INLET".
This setting can be changed a total of 8 times by pressing the button.

ℹ️

The display changes during the 6 s.
This does not influence functioning.

Sequence during changing

Button pressed <3s Button pressed >3s If the button is pressed and then held for > 6 s, the meter performs the command shown in the display.

In each change, the framed number in the display is reduced by 1.

After 8 changes, it is no longer possible to change the installation position.

[i]

The possibility of changing lapses either immediately upon detection of water, or after three hours' operation without error detection (pre-set ex works).

The following indication appears in the display (example):

The changes indication disappears.

[i] When changing the installation position, the sensors must be matched to the actual installation.

Optional modules

The calculator has two slots for optional modules.
They can be mixed, but two pulse modules of the same kind must not be installed.
The analogue module occupies both positions.
These modules have no effect on consumption recording and can be fitted retrospectively without damaging the verification mark.
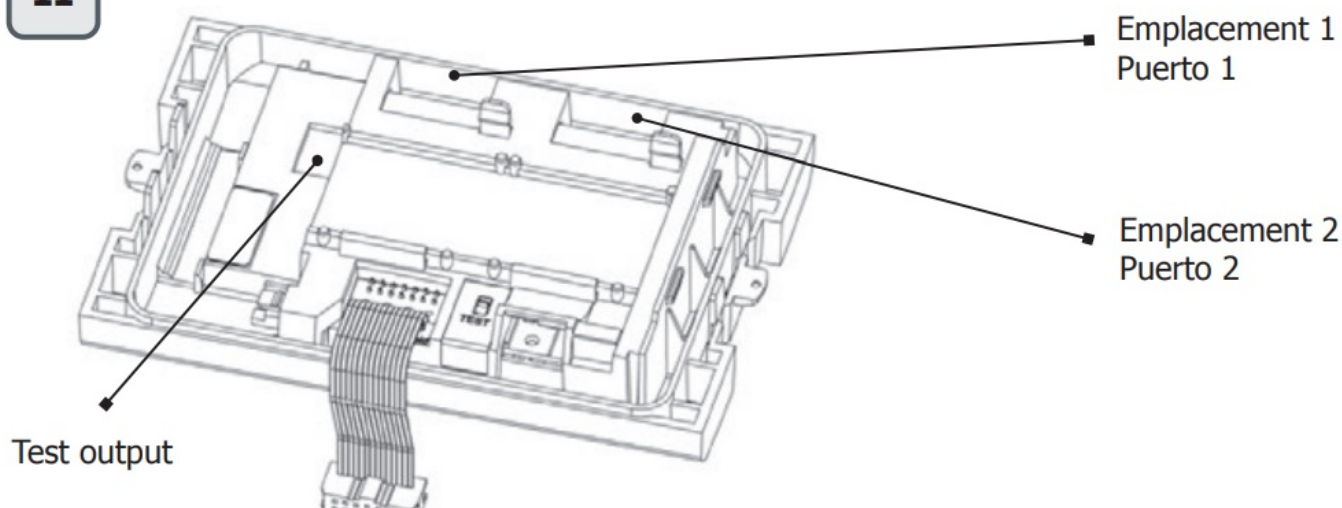
The relevant ESD regulations (electrostatic discharge) must be observed.
No responsibility is accepted for damage (especially to the electronics), resulting from non-observation of the rules.

Module installation

(Fig. II)

II

Emplacement 1
Puerto 1

Emplacement 2
Puerto 2

Test output

1. Open the calculator by folding down the side catches.

2. Lock the module into the appropriate slot and carefully connect the pre-formed ribbon cable at both ends.

3. Close the lid and check the meter for correct operation by pressing the push button. Apply the tamper-evident seal of the housing lid if the meter functions correctly.

Communication

The calculator supports three communications channels.
With wireless operation, two additional communication modules can be used, whereby the radio telegram has to have the same content as module 2 (e.g. two M-Bus modules). The protocol of the two channels can be different for both ports and is preset at factory, whereby protocol 2 is identical to the radio telegram. Customer specific requirements can be defined by using the IZAR@Mobile 2 software.
Each port has its own primary address. Both ports have a common secondary address, which is set to the serial number ex works.

Communication via radio

The integrated radio module is an interface for communication with Diehl Metering radio receivers.
Unidirectional communication has the following specification:

- The module transmits every 8 …256 s (variable, send period 0.1 % duty cycle (min. 8 s); depending on protocol length and programming)
- The communication always transfers the currently measured data
- Transmission frequency: 868MHz or 434MHz
- Various Diehl Metering receivers are available for receiving the protocol (e.g. Bluetooth, GPRS, LAN, …)
- The protocol corresponds to OMS Profile A or Profile B and is encrypted.
- Reading modes: Walk-By, Drive-By, Fixed-Network
- For problematic radio installations (shield) the external wireless module set can also be used

M-Bus Communication module

The M-Bus communication module is a serial interface for communication with external devices (M-Bus control centres), e.g. IZAR CENTER. A number of meters can be connected to a control centre. The module contains a 2-pole terminal strip with terminals marked 24, 25.

- The connection is not polarity-sensitive and is electrically isolated
- M-Bus protocol to EN 1434 standard;
- 300 or 2400 baud (auto baud detect)
- Connection option 2 x 2.5 mm²;
- Power consumption: One M-Bus load
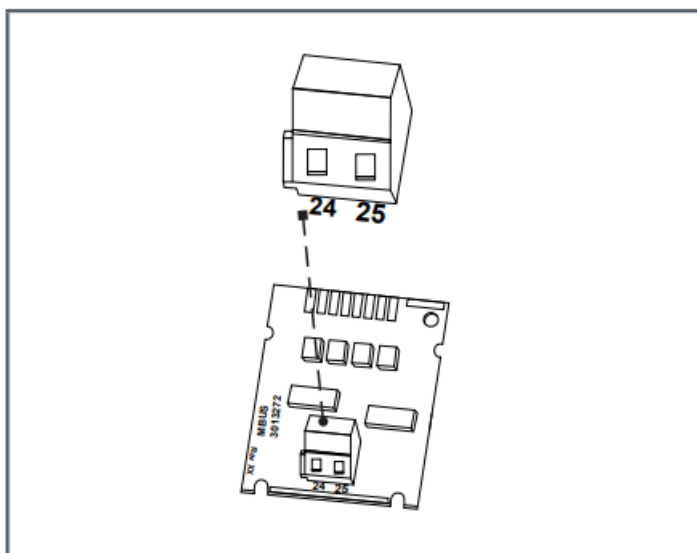
RS232 Communication module

The RS232 communication module is a serial interface for communicating with external devices, e.g. PC; 300 or 2400 bauds.
The module contains a 3-pole terminal strip with terminals marked 62 (Dat), 63 (Req) and 64 >(GND).
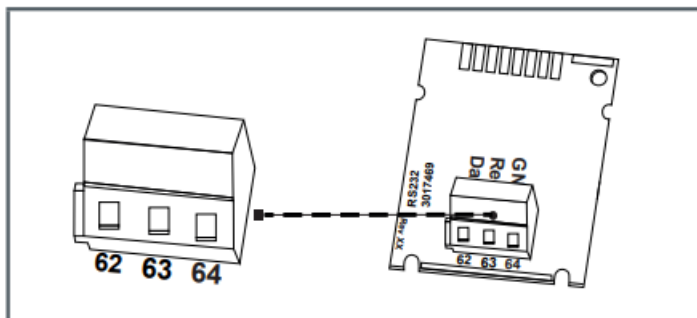A special adapter cable is required for connection (order no. 087H0121).
The coloured wires are to be connected as shown:
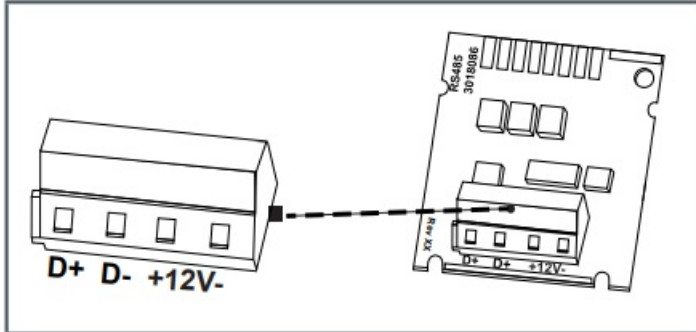
62 = brown
63 = white
64 = green

Module RS232 is only to be fitted on port 2 (right side).

RS485 Communication module

The RS485 communication module is a serial interface for communication with external devices, e.g. PC; 2400 bauds.

The module contains a 4-pole terminal strip with terminals marked D+, D-, +12 V and GND. The module requires an external supply voltage of 12 VDC ±5 V.

Communication module Modbus RTU
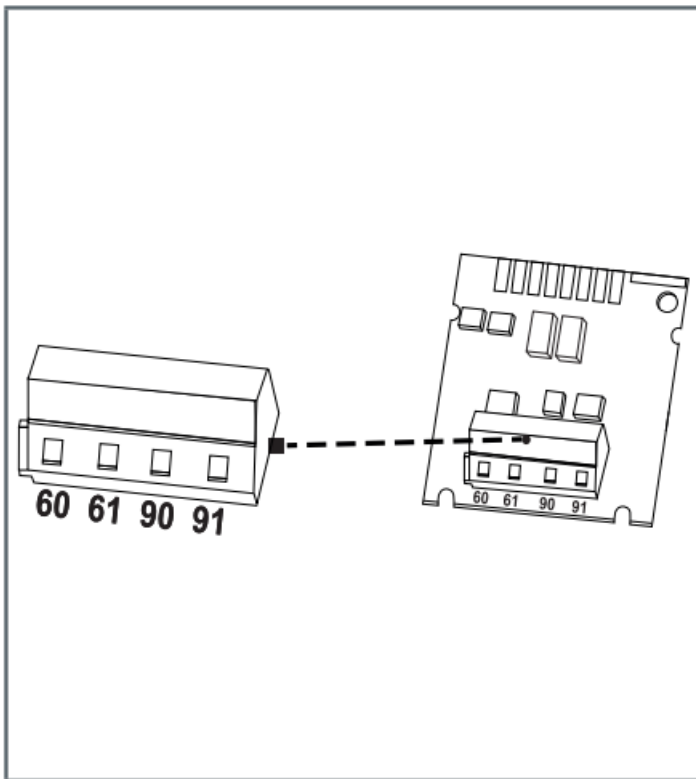
- Polarity independent: Connections 60 and 61
- External power supply: 12-24 V AC/DC
- Energy consumption: max. 150 mW
- Connection 90 (not inverted, +)
- Connection 91 (inverted,+)
- Communications protocol: Modbus RTU
- Channel EIA-485 (electrically isolated)
- Flexible data format: Standard 9600 bits/s, 8N1, Modbus Slave ID-1

Communication module LonWorks

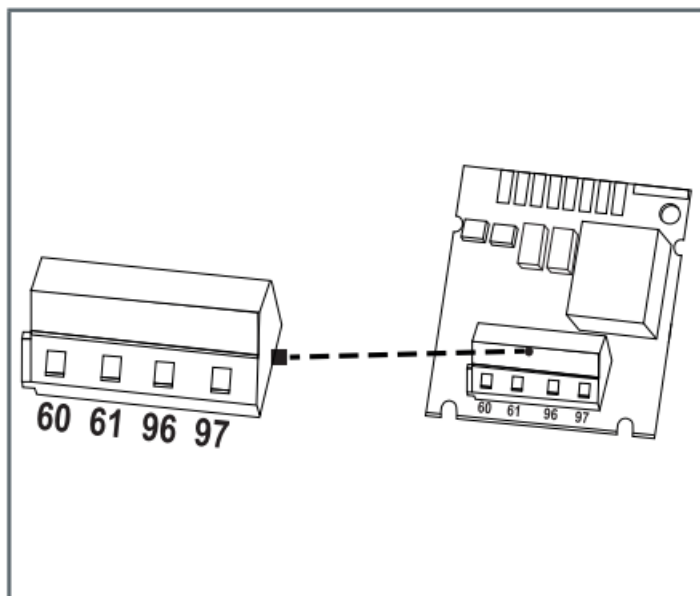- Polarity independent: Connections 60 and 61

- External power supply: 12-24 V AC/DC

- Energy consumption: max. 150 mW

- Polarity independent: Connections 96 (A) and 97 (B)

- Channel TP/FT-10

- Baud rate: 78 kbit/s

- Data format: Differential Manchester encoding

Pulse input function module

Module for two additional meters
Pulse input 1 is marked as "I1- ", input 2 with "I2 – ".
Pulse inputs can be programmed (IZAR@Mobile 2) with a value: 1, 2.5, 10, 25, 100, 250, 1000, 2500 l per pulse.

- Pulse transmitter must be electrically isolated, e.g. Reed contact

- Possible units are all the energy units available in the meter, the volume unit m³ or no unit.

input frequency	≤ 8 Hz
Min. pulse duration	10 ms
input resistance	2.2 MΩ
Terminal voltage	3 VDC
cable length	to 10 m

Data is accumulated separately in registers; can be read in the display as IN1 and IN2 and can be transferred via the communication facility.
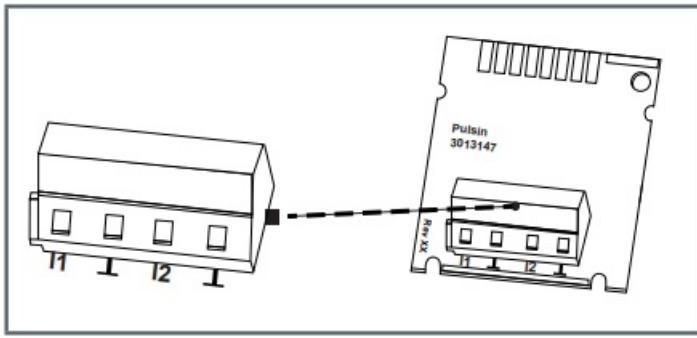
Pulse output function module

The module is equipped with 2 pulse outputs, which can be freely programmed using the IZAR@Mobile 2 software. The outputs are indicated as "O1 – " and "O2 – " on the terminal strip and as Out1 and Out2 in the display.
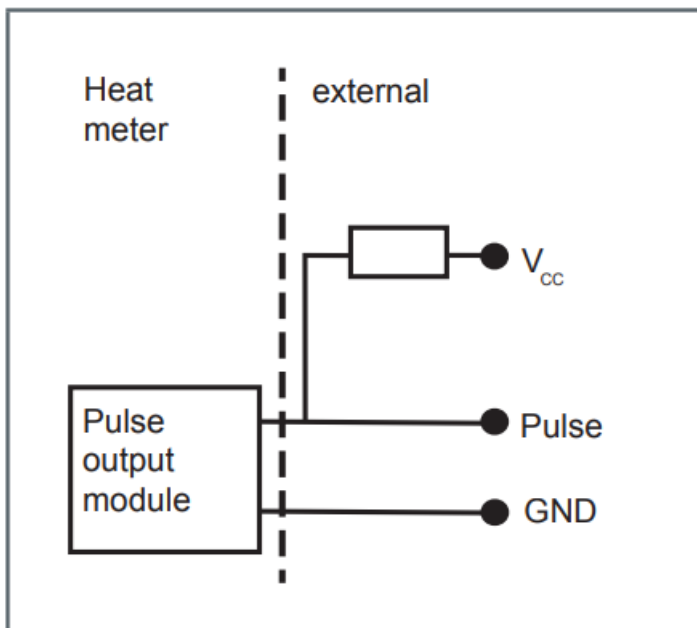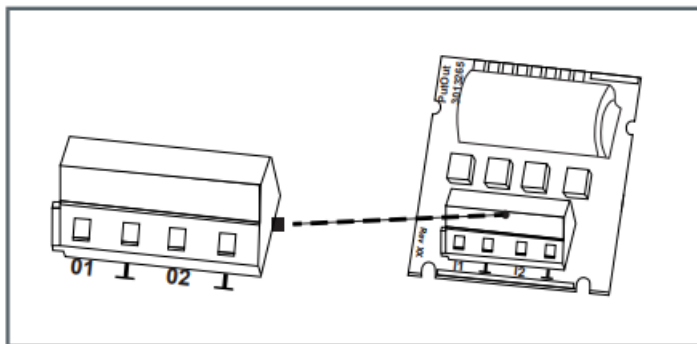
External supply:
Vcc = 3-30 VDC

- output current ≤ 20mA with a residual voltage of ≤ 0.5V
- Open collector (drain)
- Electrically insulated
- Output 1: f ≤ 4 Hz pulse width: 100 – 150 ms pulse duration: 125 ms ± 10 % pulse pause: ≥ 125 ms – 10 %
- Output 2: f ≤ 100 Hz pulse duration/pulse pause~1:1

- The volume pulse weighting can be freely programmed
- Standard: last digit in the display

Combined function module (IN/OUT)

The combined module has 2 inputs and 1 output.

See point 8.3 for the specific characteristics on the pulse input.
The pulse output is specified as pulse output 1 under point 8.4, not however galvanically isolated.
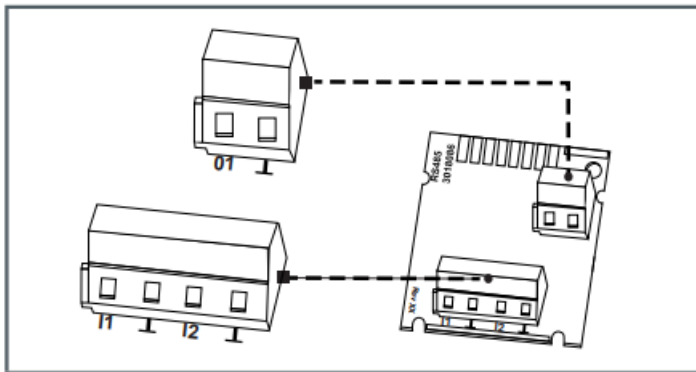
Analogue output function module

The module is equipped with 2 passive analogue outputs, which can be freely programmed using the IZAR@Mobile 2 software. On the terminal strip, the electrically isolated outputs "1" and "2" are marked and the polarity is indicated ("+" and "-").
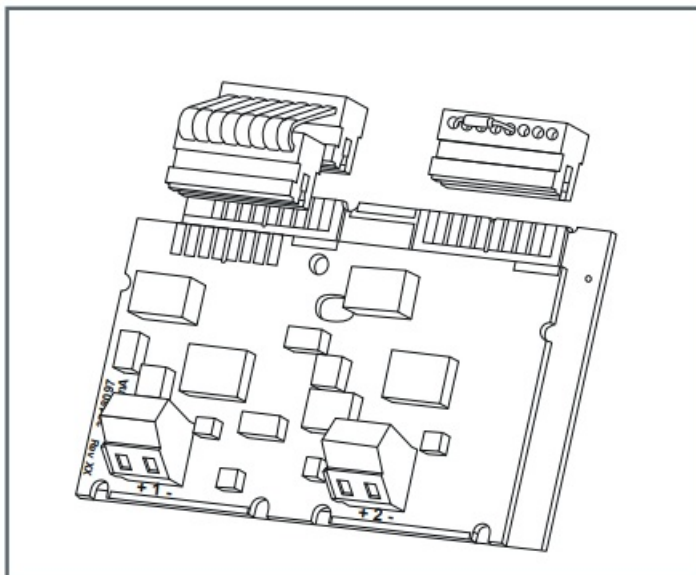
- Passive, external power supply: 10 to 30 VDC
- Current loop 4 to 20 mA whereby 4 mA = 0 value; 20 mA = programmed max. value
- Overload up to 20.5mA, then fault current
- The module displays errors with 3.5mA or 22.6mA (programmable)
- Output values: power, flow, temperatures

ℹ️

The module is connected to the counter electronics by a ribbon cable. The separate plug on the module slot 2 is necessary for the proper function of the analogue outputs.

unction module CMi6160
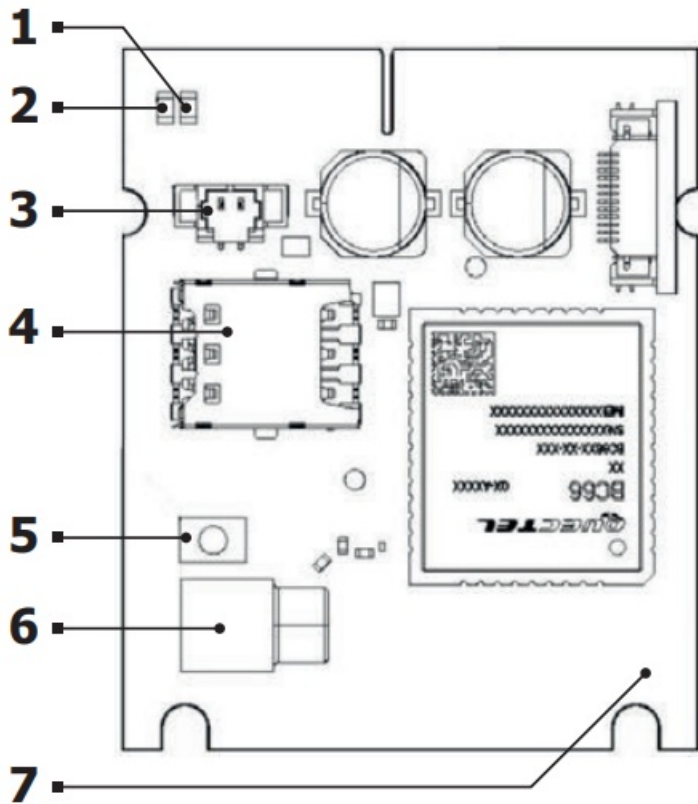
1. Green LED 1
2. Red LED 2
3. Battery Power Connector
4. SIM Card Holder 3
5. Push Button
6. Antenna Connector (MCX) 4
7. NFC Antenna (around whole board)

Mechanics

Dimensions (w x h x d)	43 x 37 x 9 mm
External antenna connector	MCX (female)
SIM card	Size Nano

Electrical connections

Mains supply	–
24 V supply	–
Battery supply	externally mounted (DIEHL Meter- ing D-cell)
Battery life time	13 + 1 year The battery life time is based on ECL0 and hourly read ing (once / day)
Nominal voltage PSU	–
Nominal voltage Battery	3,0 VDC
Power consumption (max.)	400 mA
Power consumption (StandBy)	6 µA

Environmental specification

Operating temperature	+5 °C to +55 °C
Operating humidity	0 – 93 % RH, no condensation
Operating altitude (max.)	2000 m
Pollution degree	Degree 1
Usage environment	Indoors
Storage temperature	-20 °C to +60 °C (Module)

Cellular network

| Band	20, 8, 3
3GPP	Release 14 (NB2)
Transmit power (max.)	23,0 dBm
Receiver sensitivity	-135 dBm

Activation

Upon delivery, CMi6160 has a standard configuration. To change the configuration, please download the OTC Application (One-Touch commissioning) for Android, available in Google Play store.
The OTC connects to the module via NFC.

Make sure to locate the NFC antenna on your phone. When you scan or write new configurations to the module, you should place the phone's NFC antenna as close as possible to the NFC antenna of the module. The NFC is reachable from back side of the meter or from top when lid is removed.

By default, the product is set to passive mode, which means no messages will be transmitted from the device. There are two ways to activate the product:

- Press and hold down the push button (5) for at least 5 seconds until the green LED (1) lights up.
- Via the OTC mobile application. Go to the Apply tab, set the Power mode to "Active", push "Apply" and place the phone on the back side of the meter, next to the module. Make sure to hold the phone still until the phone vibrates.

Upon start-up, the module will attempt to connect to the mobile network.
The phase is indicated by short flashes on the green LED. After successfully connecting to the mobile network, the green LED will light up for 8 seconds, as indicated by the figure below.
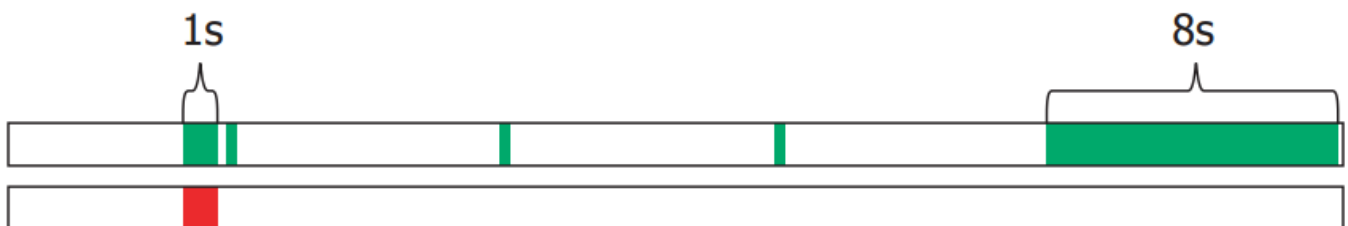
Test output

The internally located test output is intended for testing laboratories.
The manufacturer supplies one special cable:

Energy testing pulses
Please refer to the inspection and testing manual for further specifications (pulse weighting, pulse duration/pause, pulse frequency).

Ensure that the temperature sensors (measurement resistances) remain in contact without interruption during energy verification.

Display

The data generated by the calculator can be viewed in several displays.
These displays contain the assigned system information (e.g. energy quantities, water volumes, operating days, water quantities, actual temperatures, maximum values) and can be accessed by calling the displays in the pre-defined sequence / loop. The calculator has up to 6 different display loops.
Main loop, due date loop, information loop, pulse input loop, tariff loop.
The month loop comprises up to seven value displays alternating in the 2 s – 4 s rhythm. For quick visual identification, the loops are labelled 1 to 6 in the display. As standard, the main loop contains the actual data, e.g. energy, volume, flow and temperatures. The verified register is marked with a padlock icon.

Main loop (1)
Important: Overview applies to heat meters and cooling meters only

Sequence	Window 1
1.1	Accumulated energy
1.2	Volume
1.3	Accumulated cold energy (heat meters with cooling tariff)
1.4	Flow
1.5	Power
1.6	Flow/return flow temperature
1.7	Differential temperature
1.8	Operating days
1.9	Error status
1.10	Display test

Due date loop (2)

Sequence	Window 1	Window 2	Window 3

2.1	Due date 1 date	Due date 1 energy	"Accd 1"
2.2	"Accd 1"	Date of future due date 1	
2.3	Due date 1 previous year date	Due date 1 previous year energy	"Accd 1L"
2.4	Due date 2 date	Due date 2 energy	"Accd 2A"
2.5	"Accd 2"	Date of future due date 2	
2.6	Due date 2 previous year date	Due date 2 previous year energy	"Accd 2L"
2.7	Due date 1	Pulse input 1	Volume pulse input 1
2.8	Due date 1 previous year	Pulse input 1	Volume pulse input 1
2.9	Due date 2	Pulse input 1	Volume pulse input 1

2.10	Due date 2 previous year	Pulse input 1	Volume pulse input 1
2.11	Due date 1	Pulse input 2	Volume pulse input 2
2.12	Due date 1 previous year	Pulse input 2	Volume pulse input 2
2.13	Due date 2	Pulse input 2	Volume pulse input 2
2.14	Due date 2 previous year	Pulse input 2	Volume pulse input 2

Information loop (3)

Sequence	Window 1	Window 2
3.1	Actual date	Time
3.2	"Sec_Adr"	Secondary address
3.3	"Pri_Adr 1"	Primary address 1

Sequence	Window 1	Window 2
3.4	"Pri_Adr 2"	Primary address 2
3.5	"coldPIPE" * (installation location)	**(Module type)**
3.6	In0	Pulse weight Volume measurement part
3.7	"Port 1"	0* (no. of the plugged in module at port 1)
3.8	"Port 2"	1* (no. of the plugged in module at port 2)
3.9	"UHF ON" (status of integrated radio)	
3.10	Software version	Check sum

Module type	Index	Module type	Index
No module	0	Analog out	6
MBus	1	Pulse in out	7
RS232	2	Test cable energy	9
RS485	3	Test cable volume	10
Pulse in	4	External radio	18
Pulse out	5		

Pulse loop (4)

Sequence	Window 1	Window 2	Window 3
4.1	Pulse input 1	Cumulative value pulse input 1	Pulse weight
4.2	Pulse input 2	Cumulative value pulse input 2	Pulse weight
4.3	Pulse output 1	Pulse weighting pulse output 1	
4.4	Pulse output 2	Pulse weighting pulse output 2	

Tariff loop (5) 1
Month loop (6)

Sequence	Window 1	Window 2	Window 3	Window 4
6.1	"LOG"	Date	Energy	Max. flow
6.2	"LOG"	Date-1	Energy	Max. flow
:	:	:	:	:
6.24	"LOG"	Date	Energy	Max. flow
* Example	1Only for heat meters with activated cooling tariff			

Operation

Use the push button to page through the individual displays. When doing so a differentiation is made between short and long button presses. With a short button press (<3 seconds) you get to the next display within a loop; with a long button press (>3 seconds) you get to the next display loop. The "Energy" window (sequence 1.1) of the main loop is the basic display. If the button is not pressed for approx.4 minutes, the meter automatically switches off the display to save power (exception: an error exists). If you press the button again, the meter returns to the basic display.

Display Error codes

If an error occurs, the error code is displayed in the main loop. All windows, however, can still be accessed by pressing the button. If the button is not pressed for approx. 4 minutes, the error code is automatically displayed again.

The error message disappears automatically as soon as the source of the error is corrected. All errors that exist for longer than 6 minutes, are saved in the error memory.

Error code	Description
C – 1	Basic parameter error in flash or RAM – Meter must be replaced
E 1	Temperature range outside [-19.9 °C to 199.9 °C] e.g. sensor short-cir- cuit, sensor break
E 3**	Forward and return sensor reversed
E 5	Communication not possible (too frequent read-out)
E 8	No primary power supply (only with power supply unit); supply via backup battery
E 9	Battery nearly discharged, design lifetime reached
E A*	Leak: Pipe break detection
E b*	Leak: Energy meter leak detection
E C*	Leak: Leak pulse input 1
E d*	Leak: Leak pulse input 2

* optional ** application dependent

Disposal

This product must be disposed of separately. Contact a designated collection pointfor old batteries or your Diehl Metering specialist dealer.

Declaration of Conformity for devices according to MID

onwards. Further information as well as the actual declaration of conformity are available at:
https://www.diehl.com/metering/en/support-center/download-center/

EU DECLARATION OF CONFORMITY

Device Type

Type	Designation (4)	No of the EU type examination certificate
548	Calculator	DE-10-MI004-PTB004

This declaration of conformity is issued under the sole responsibility of the manufacturer. The object of the declaration described above is in conformity with the relevant Union harmonisation legislation, insofar as it is applied:

2011/65/EU (OJ L 174, 1.7.2011)	RoHS Directive
2014/30/EU (OJ L 96, 29.3.2014)	Electromagnetic Compatibility Directive
2014/35/EU (OJ L 96, 29.3.2014)	Low Voltage Directive
2014/53/EU (OJ L 153, 22.5.2014)	Radio Equipment Directive

In conformity with the following relevant harmonised standards or normative documents or other technical specifications:

EN 1434-1:2007

EN 1434-1:2015+A1:2018	EN 1434-5:2015+A1:2019	EN 301 489-3 v2.1.1
EN 1434-2:2015+A1:2018	EN 62479:2010	EN 300 220-2 v3.1.1
EN 1434-3:2015+A1:2018	EN 55032:2012/AC:2013	EN 62368-1:2014/AC:2015
EN 1434-4:2015+A1:2018	EN 301 489-1 v2.1.1	EN IEC 63000:2018

Name and address of the manufacturer	DIEHL METERING Donaustraße 120 90451 Nürnberg GERMANY

The contact address marked on the product can be one of the site listed in the module D certificate.

Nürnberg, 2021-05-31

Dr. Christof Bosbach
President of the Division Board
Diehl Metering

Dr. Christof Bosbach (Jun 9, 2021 17:21 GMT+2)

Reiner Edel
Member of the Division Board
Finance & Administration

Reiner Edel (Jun 9, 2021 17:13 GMT+2)

Diehl Metering GmbH
Industriestrasse 13
91522 Ansbach
Phone: +49 981 1806-0
Fax: +49 981 1806-615
metering-germany-info@diehl.com

http://www.diehl.com/metering

Documents / Resources

DIEHL RS485 High Precision Calculator [pdf] Installation Guide
RS485, High Precision Calculator, Precision Calculator, RS485, Calculator