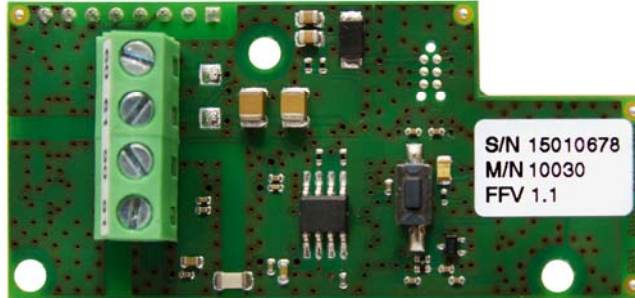


1. Use of the option module

The Modbus RTU option module are used to connect the PolluStat heat meter to Modbus RTU network using EIA-485 channel.



Picture 1: Modbus RTU module

The module bases on Modbus RTU Slave protocol which is realized according to newest specifications published by Modbus Organization. The module EIA-485 network interface is compliant to TIA/EIA-485 standard.

1.1. Power supply

The Modbus RTU module should be powered by AC or DC (polarity insensitive) SELV power supply only.

SELV Power Supply Voltage	12-24 V AC/DC $\pm 10\%$
Power Consumption	max. 0.5 W
Typical Supply Current	29 mA @12 V DC

1.2. Communication interface

Connection to Modbus RTU network is realized by using galvanic isolated EIA-485 network interface.

Communication Protocol	Modbus RTU
Network Polarity	90 (non-inverting, +) and 91 (inverting, -)
Transmission Speed/Baud Rate (bits per second)	1200, 2400, 4800, 9600, 14400, 19200, 38400, 56000, 57600, 115200
Data Format	8E1 (8 data bits, even parity bit, 1 stop bit), 8O1 (8 data bits, odd parity bit, 1 stop bit), 8N1 (8 data bits, none parity bit, 1 stop bit), 8N2 (8 data bits, none parity bit, 2 stop bits)
Galvanic Isolation between Network and Option Module	299 VRMS (0-60 Hz)
Number of Devices per EIA-485 Segment Channel	Up to 256 ($\frac{1}{8}$ UL)
EIA-485 Network Topology	Bus Topology
EIA-485 Segment Channel Length	max. 1200 m

The default communication parameters are: 9600 bps baud rate, 8N1 data format, Modbus Slave ID – 1.

Use only the dedicated two terminators on both ends of EIA-485 network channel segment. The maximum wire length values for channel could be increased by using the EIA-485 repeaters to connect two channel segments. In case of any question, please contact technical support.

1.3. Environmental requirements

Operating Temperature (ambient)	+5 to +50°C
Storage Temperature	-10 to +65°C
Operating and Storage Humidity	25 to 90 % RH @50°C, non-condensing

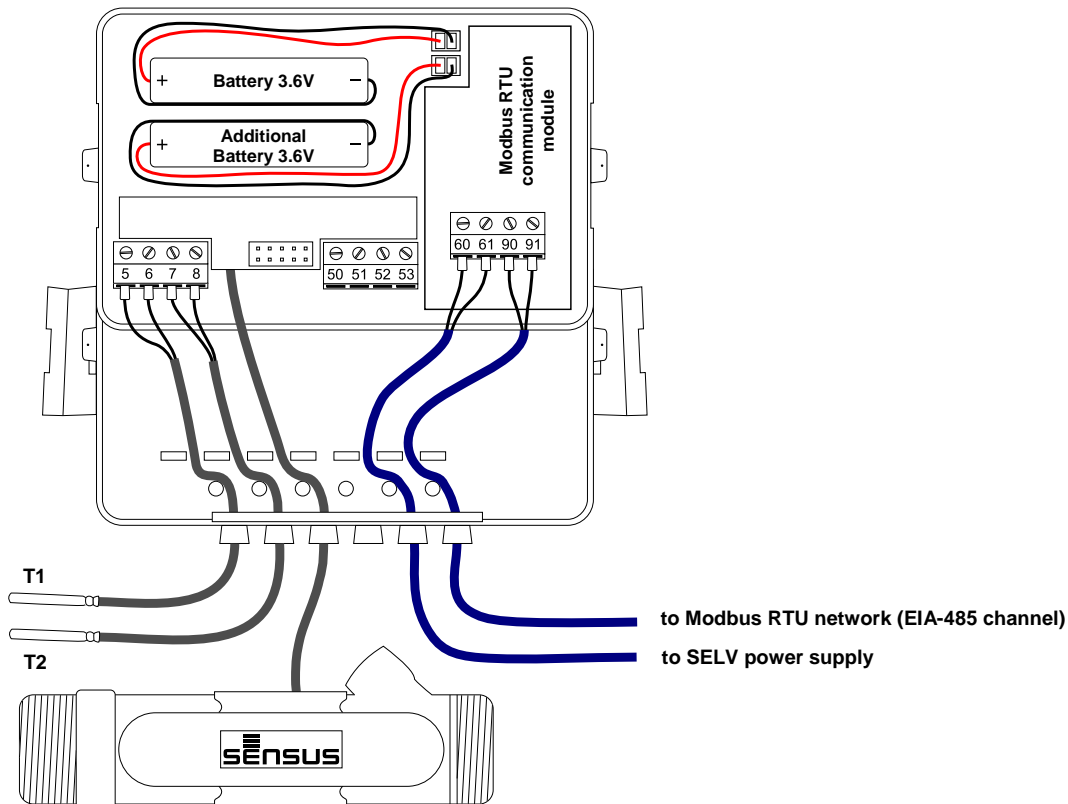
2. Safety instructions

- The installation, electrical connection and commissioning the module should be made by qualified specialists only.
- The Modbus RTU option modules may only be used for the PolluStat meter, otherwise the modules or the heat meter could be damaged.
- The included lithium battery and the meter battery must not be recharged, short-circuited, put in contact with water or exposed to temperatures of more than 80°C.
- Batteries and module waste may only be disposed at suitable collection centers for professional waste disposal.
- The communication modules are delivered in the form of circuit board. It is highly recommended that normal static precautions be taken in handling and assembly of this module to prevent damage and/or degradation which may be induced by ESD. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure.



3. Installation the option module in the Modbus RTU network

3.1. Connection diagram



Picture 2: electrical connection diagram

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Table 1: Number markers on the screw connector clamps

Calculator:

clamp no.	description
5	temperature sensor T1 (warmer pipe/supply pipe)
6	temperature sensor T1 (warmer pipe/supply pipe)
7	temperature sensor T2 (colder pipe/return pipe)
8	temperature sensor T2 (colder pipe/return pipe)
50	GND for 2 nd additional pulse input or output
51	2 nd additional pulse input or output (In / Out2) (Volume output on TEST mode)
52	GND for 1 st additional pulse input or output
53	1 st additional pulse input or output (In / Out1) (Energy output on TEST mode)

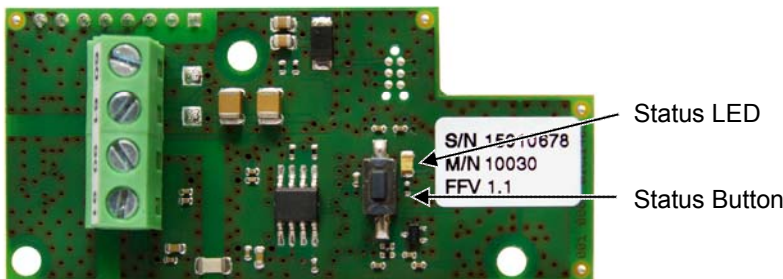
Modbus RTU module:

clamp no.	Description
60	12-24 V AC/DC SELV power supply
61	12-24 V AC/DC SELV power supply
90	Modbus RTU EIA-485 channel interface (non-inverting, +)
91	Modbus RTU EIA-485 channel interface (inverting, -)

The pair of clamps 60 and 61 (for connect SELV power supply) is polarity insensitive. The pair of clamps 90 and 91 is polarity sensitive. Please look on the description in the table above.

3.2. Status LED and Status Button functionality

The placement of the Status LED and Status Button is shown on the picture below.



Picture 3: Status Button and Status LED placement on the Modbus RTU option module

Status LED is signaling every Modbus RTU communication event. Status LED is blinking on during request receiving and response sending.

Press the button, then power on the module and hold the button pushed longer than 15 seconds to reset device to factory settings (set Modbus Slave ID to default value 1, the Update Rate parameter to default value 10 min and the communication interface to the defaults parameters – 9600 bps baud rate and 8N1 data format).

3.3. Firmware Update

The option module firmware update can be done by user. Downloading the firmware to device is performed by dedicated USB dongle and software run on Microsoft Windows operating system.

The newest firmware image file for the option module is distributed on demand after request with the serial numbers of devices to which they relate only. In case of any question, please contact technical support.

4. Modbus data register list

Designation	Modbus Register	Modbus Register Type	Modbus Address	Data Value Range	Unit ¹	Read only (RO) Read/write (R/W)
Heating Energy	30001 or 40001	Input or Holding	0	Int32	kWh, MWh, MJ, GJ	RO
Heating Energy (Unit factor)	30003 or 40003	Input or Holding	2	UInt16	-	RO
Heating Energy (Unit)	30004 or 40004	Input or Holding	3	4 char ASCII	-	RO
Heating Energy (Float)	30006 or 40006	Input or Holding	5	IEEE754	kWh, GJ	RO
Cooling Energy	30008 or 40008	Input or Holding	7	Int32	kWh, MWh, MJ, GJ	RO
Cooling Energy (Unit factor)	30010 or 40010	Input or Holding	9	UInt16	-	RO
Cooling Energy (Unit)	30011 or 40011	Input or Holding	10	4 char ASCII	-	RO
Cooling Energy (Float)	30013 or 40013	Input or Holding	12	IEEE754	kWh, GJ	RO
Tariff Energy 1	30015 or 40015	Input or Holding	14	Int32	kWh, MWh, MJ, GJ	RO
Tariff Energy 1 (Unit factor)	30017 or 40017	Input or Holding	16	UInt16	-	RO
Tariff Energy 1 (Unit)	30018 or 40018	Input or Holding	17	4 char ASCII	-	RO
Tariff Energy 1 (Float)	30020 or 40020	Input or Holding	19	IEEE754	kWh, GJ	RO
Tariff Energy 2	30022 or 40022	Input or Holding	21	Int32	kWh, MWh, MJ, GJ	RO
Tariff Energy 2 (Unit factor)	30024 or 40024	Input or Holding	23	UInt16	-	RO
Tariff Energy 2 (Unit)	30025 or 40025	Input or Holding	24	4 char ASCII	-	RO
Tariff Energy 2 (Float)	30027 or 40027	Input or Holding	26	IEEE754	kWh, GJ	RO
Volume	30029 or 40029	Input or Holding	28	Int32	l (dm ³), m ³	RO
Volume (Unit factor)	30031 or 40031	Input or Holding	30	UInt16	-	RO
Volume (Unit)	30032 or 40032	Input or Holding	31	4 char ASCII	-	RO
Volume (Float)	30034 or 40034	Input or Holding	33	IEEE754	m ³	RO
Pulse Input Volume 1	30036 or 40036	Input or Holding	35	Int32	l (dm ³), m ³	RO
Pulse Input Volume 1 (Unit factor)	30038 or 40038	Input or Holding	37	UInt16	-	RO
Pulse Input Volume 1 (Unit)	30039 or 40039	Input or Holding	38	4 char ASCII	-	RO
Pulse Input Volume 1 (Float)	30041 or 40041	Input or Holding	40	IEEE754	m ³	RO
Pulse Input Volume 2	30043 or 40043	Input or Holding	42	Int32	l (dm ³), m ³	RO
Pulse Input Volume 2 (Unit factor)	30045 or 40045	Input or Holding	44	UInt16	-	RO
Pulse Input Volume 2 (Unit)	30046 or 40046	Input or Holding	45	4 char ASCII	-	RO
Pulse Input Volume 2 (Float)	30048 or 40048	Input or Holding	47	IEEE754	m ³	RO

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Designation	Modbus Register	Modbus Register Type	Modbus Address	Data Value Range	Unit	Read only (RO) Read/write (R/W)
Power	30050 or 40050	Input or Holding	49	Int32	W	RO
Power (Unit factor)	30052 or 40052	Input or Holding	51	UInt16	-	RO
Power (Unit)	30053 or 40053	Input or Holding	52	4 char ASCII	-	RO
Power (Float)	30055 or 40055	Input or Holding	54	IEEE754	kW	RO
Flow	30057 or 40057	Input or Holding	56	Int32	l/h	RO
Flow (Unit factor)	30059 or 40059	Input or Holding	58	UInt16	-	RO
Flow (Unit)	30060 or 40060	Input or Holding	59	4 char ASCII	-	RO
Flow (Float)	30062 or 40062	Input or Holding	61	IEEE754	m ³ /h	RO
Forward temperature (Fixed)	30065 or 40064	Input or Holding	63	Int32	0.01°C	RO
Forward temperature (Float)	30066 or 40066	Input or Holding	65	IEEE754	°C	RO
Return temperature (Fixed)	30068 or 40068	Input or Holding	67	Int32	0.01°C	RO
Return temperature (Float)	30070 or 40070	Input or Holding	69	IEEE754	°C	RO
Temperature difference (Fixed)	30072 or 40072	Input or Holding	71	Int32	0.001°C	RO
Temperature difference (Float)	30074 or 40074	Input or Holding	73	IEEE754	°C	RO
Heat Meter Serial Number (Fixed)	30076 or 40076	Input or Holding	75	UInt32	-	RO
Heat Meter Serial Number (ASCII)	30078 or 40078	Input or Holding	77	8 char ASCII	-	RO
Error Code	30082 or 40082	Input or Holding	81	UInt32	-	RO
Module Serial Number	32001	Input	2000	UInt32	-	RO
Module Model Number	32003	Input	2002	UInt32	-	RO
Firmware Version ²	32005	Input	2004	UInt16	-	RO
Modbus Slave ID ^{3, 4}	41001	Holding	1000	UInt16	-	R/W
Update Rate Data from Meter ⁵	41002	Holding	1001	UInt16	100 ms	R/W
Baud Rate	41003	Holding	1002	UInt32	-	R/W
Data Bits ⁶	41005	Holding	1004	UInt16	-	R/W
Parity ^{6, 7}	41006	Holding	1005	UInt16	-	R/W
Stop Bits ⁶	41007	Holding	1006	UInt16	-	R/W

¹ Units for Energy, Volume, etc. are available in (Unit) registers and apply to (Float) values as well as integer values multiplied by (Unit factor).

Example on Energy registers - assume Energy = 43, Energy (Unit factor) = 100, Energy (Unit) = "Wh", Energy (Float) = 4300, then:

Energy register * Energy (Unit factor) register in Energy (Unit) register = 43 * 100 Wh = 4300 Wh
 Energy (Float) register in Energy (Unit) register = 4300 Wh

² Higher byte of the register is major number of firmware version (0x##00). Lower byte of the register is minor number of firmware version (0x00##).

³ Lower byte of this register is Modbus address of the module in the range 1-247 (01-F7 hex).

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- 4 If the higher byte is set to 1, the Modbus address will be updated to the heat meter M-Bus address. If the higher byte is set to 0, the Modbus address is static.
- 5 Default Update Rate Data from Meter is 10 minutes. Value in Modbus register is 6000 because $6000 * 100 \text{ ms}$ gives 600 seconds (10 minutes).
- 6 The registers should be set only to the values that represent data format on the EIA-485 serial interface described in chapter Communication interface above.
- 7 This register is set by the ASCII char value – ‘E’ for Even parity (69 dec, 45 hex), ‘O’ for Odd parity (79 dec, 4F hex) and ‘N’ for None parity (78 dec, 4E hex).

More details about Modbus communication and data decoding you find in Modicon Modbus Protocol Reference Guide and MODBUS over Serial Line - Specification and Implementation Guide documents.

5. Error codes meaning

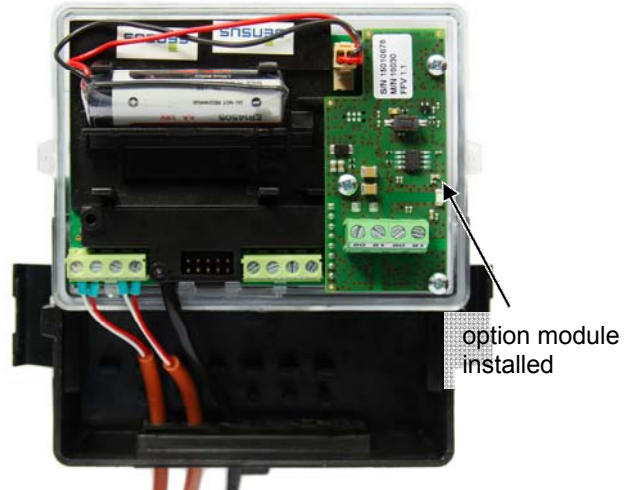
Designation	Error Code value in 30082 or 40082 Modbus Register is sum of following values of each error	Error code indicates on the LCD <Er ####>
No error	0x00000000	0000
Hardware status flag Er02	0x00000004	8000
Hardware status flag Er03	0x00000008	8000
End of battery life time	0x00000010	1000
Hardware status flag Er05	0x00000020	0008
Hardware status flag Er06	0x00000040	0008
Flow sensor is empty > Air in the ultrasonic flow sensor	0x00000400	0001
Reverse direction of the flow	0x00000800	0002
Temperature sensor 1 error > Short circuit or sensor not connected	0x00010000	0080
Temperature 1 < 0°C	0x00040000	00C0
Temperature 1 > 180°C	0x00080000	0080
Temperature sensor 2 error > Short circuit or sensor not connected	0x00100000	0800
Temperature 2 < 0°C	0x00400000	0C00
Temperature 2 > 180°C	0x00800000	0800
Hardware status flag Er30	0x01000000	0880
Temperature difference < 3°C	0x04000000	4000
Temperature difference > 150°C	0x08000000	2000
Flow rate grater 1,2qs	0x10000000	0004
Hardware status flag Er35	0x20000000	8000
Hardware status flag Er37	0x80000000	8000

6. Installation the option module in the calculators

The option module would be installed on the right side in the opened meter.

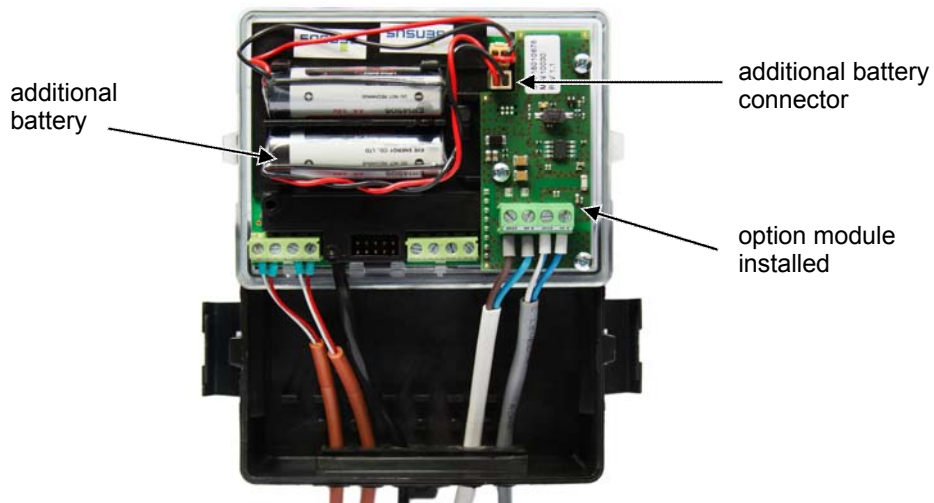


Picture 4: slot for option modules



Picture 5: installed option module

- Remove the user seal from the housing
- Open the housing cover by opening the black housing latches on the right and left side
- Put the option module into the designated contact sockets
- The contact pins must not be bent
- Mount the fixing screws
- Install the additional battery into the second battery holder and plug in the connector to the second battery connector
- Route the connecting cable through an available cable fitting and make a pull relief. Then connect the wires to the respective terminals
- Close the lid and seal the housing with a user seal



Picture 6: finally installed option module

7. Option module firmware changes list

Firmware version	Description
1.1	Changed the default EIA-485 interface data format to 8N1 (8 data bits, none parity bit, 1 stop bit).
1.0	Initial version.

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