Modbus RTU
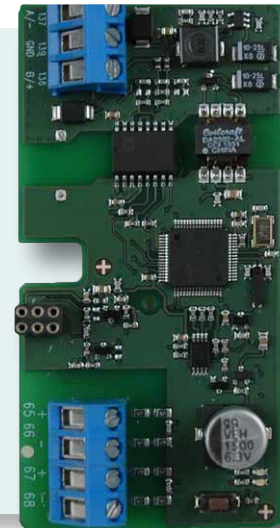## Slave Module

DATA SHEET

- **RS-485 based RTU communication**

- **Communication speed of up to 76,800 bits/sec.**

- **Programmable communication speed and parity settings**

- **Two pulse inputs for additional water and electricity meters**

- **RS-485 galvanically isolation from meter**

Modbus communication module for MULTICAL® 62/601/602/801

Application

Modbus is an open, widespread and well- established serial communication protocol used within building automation.

The Modbus base module for MULTICAL® ensures a simple integration from Kamstrup's heat, cooling and water meters into a Modbus based system.

The Modbus module is mounted in MULTICAL® and is used for data transfer from MULTICAL® heat, cooling and water meters to a Modbus system.

Functionality

The Modbus module communicates as a RTU* slave device on RS-485.

The Modbus module transfers a number of both actual data as well as accumulated data.

Furthermore, MULTICAL® info codes for general alarm, flow error, temperature error, water leakage, pipe burst, air in system and wrong flow direction can be transmitted to the Modbus system.

The two pulse inputs allow connection and reading of two additional meters for e.g. water and electricity with pulse output.

Reliability

The RS-485 port of the Modbus module is galvanically separated from the meter's voltage potential, thereby improving the security for smooth operations. At the same time, the risk of influencing the meter due to influences of the RS-485 port is reduced to a minimum.

The Modbus module is in full compliance with and included in the MID approval for MULTICAL®.

*) RTU: Remote Terminal Unit

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Addressing range

The module can be addressed as a slave in the range of 1-247.

By default, the Modbus address equals the last three digits of the meter's customer number.

If the customer number of the meter results in an address larger than 247, only the last two digits are used for the Modbus address of the module.

Note: If the customer number of the meter ends with 000, the Modbus module automatically changes to address 247.

Configuration

Address, baud rate and parity of the Modbus module is changeable via the optical interface of the meter and the PC program MULTI-CAL® Module Programmer.

Connection
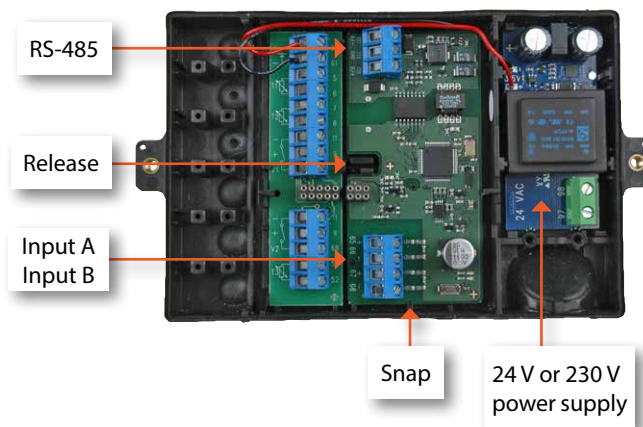
The module is mounted in the connecting base of the meter in the following way:

The module is placed in the "Snap" at an angle and is thereafter pushed towards the connecting base until the "Release" clicks around the meter's PCB.

The module is removed in the following way:

The module is released by pressing the "Release" upwards and at the same time drawing the connection terminals at the top of the module.

Electrical connection:

The Modbus module is automatically connected with the meter via the 6-pole connector just below the "Release" when the top part of the meter is mounted.

The RS-485 cable is connected via the cable inlets on the connecting base.

Transferred data

- Customer number (programmable)
- Serial number
- Accumulated heat energy (E1)
- Accumulated cooling energy (E3)
- Accumulated volume flow (V1)
- Accumulated volume flow (V2)
- Inlet temperature (T1)
- Outlet temperature (T2)
- Temperature (T3)
- Actual flow in (V1)
- Actual power
- Max power

- Accumulated values from additional meters via pulse InA and pulse InB
- MULTICAL® info codes
- Program number
- Config number 1 (DDDEE)
- Config number 2 (FFGGMN)
- Hour counter
- Meter type
- Tariff TA2
- Tariff TL2
- Tariff TA3
- Tariff TL3

Technical data

Modbus functions

- Communicates with the bus using RS-485 (default 19200, 8, E, 1)
- Supported baud rates: 300, 2400, 9600, 19200, 38400, 76800
- Supported parity settings: none, odd and even
- Supported stop bit settings: one and two
- Supported data bits: 8
- The module can be addressed as a slave in the range of 1-247
- Baud rate, parity and address are stored in MULTICAL® and can be changed using Kamstrup Optical Eye and the PC application Kamstrup MULTICAL® Module Programmer.
- Supports RTU transmission mode
- Supported function codes and their possible exception codes:
  - 0x03 Read Holding Registers with exception codes:
    - 0x02 – Illegal data address
    - 0x03 – Illegal data value
  - 0x04 Read Input Registers with exception codes:
    - 0x02 – Illegal data address
    - 0x03 – Illegal data value
  - 0x08 Diagnostics with exception code:
    - 0x01 – Illegal function
  - Subcode 0x01 Restart with exception code:
  - 0x03 – Illegal data value
  - 0x2B Encapsulated interface transport with exception code:
    - 0x01 – Illegal function
  - Subcode 0x0E Read Device Identification with exception code:
    - 0x03 – Illegal data value
  - 0x41 and 0x42 Reserved as Kamstrup Specific Function code

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Modbus data model mapping of MULTICAL® values

The PDU address region from 0 to 168 is described in details below. The PDU address is in bytes so that a 32-bit register results in the following register to be placed at an address 4 higher. The data are separated into 13 different tables. The data inside each table is of the same size and should be interpreted in the same way. Table 7 is reserved and therefore does not figure in the table below. A more detailed description of each column is be given later on.

Data model mapping for byte-addressed region

Memory	Memory (hex)	Individual description	Size in bytes	Table	Contents	Data type	Update status
0	0x0000	Heat energy E1	4	1	Values in float	IEEE Float - 32 bit	Dynamic
4	0x0004	Actual flow	4	1	Values in float	IEEE Float - 32 bit	Dynamic
8	0x0008	Volume V1	4	1	Values in float	IEEE Float - 32 bit	Dynamic
12	0x000C	Actual power	4	1	Values in float	IEEE Float - 32 bit	Dynamic
16	0x0010	Inlet temperature T1	4	1	Values in float	IEEE Float - 32 bit	Dynamic
20	0x0014	Outlet temperature T2	4	1	Values in float	IEEE Float - 32 bit	Dynamic
24	0x0018	Pulse input A	4	1	Values in float	IEEE Float - 32 bit	Dynamic
28	0x001C	Pulse input B	4	1	Values in float	IEEE Float - 32 bit	Dynamic
32	0x0020	Heat energy E1	2	2	Units	Word - 16 bit	Dynamic
34	0x0022	Actual flow	2	2	Units	Word - 16 bit	Dynamic
36	0x0024	Volume V1	2	2	Units	Word - 16 bit	Dynamic
38	0x0026	Actual power	2	2	Units	Word - 16 bit	Dynamic
40	0x0028	Heat energy E1	4	3	Values in integer	Double Word - 32 bit	Dynamic
44	0x002C	Actual flow	4	3	Values in integer	Double Word - 32 bit	Dynamic
48	0x0030	Volume V1	4	3	Values in integer	Double Word - 32 bit	Dynamic
52	0x0034	Actual power	4	3	Values in integer	Double Word - 32 bit	Dynamic
56	0x0038	Inlet temperature T1	4	3	Values in integer	Double Word - 32 bit	Dynamic
60	0x003C	Outlet temperature T2	4	3	Values in integer	Double Word - 32 bit	Dynamic
64	0x0040	Pulse input A	4	3	Values in integer	Double Word - 32 bit	Dynamic
68	0x0044	Pulse input B	4	3	Values in integer	Double Word - 32 bit	Dynamic
72	0x0048	Heat energy E1	2	4	Decimal	Word - 16 bit	Dynamic
74	0x004A	Actual flow	2	4	Decimal	Word - 16 bit	Dynamic
76	0x004C	Volume V1	2	4	Decimal	Word - 16 bit	Dynamic
78	0x004E	Actual power	2	4	Decimal	Word - 16 bit	Dynamic
80	0x0050	Pulse input A	2	4	Decimal	Word - 16 bit	Dynamic
82	0x0052	Pulse input B	2	4	Decimal	Word - 16 bit	Static
84	0x0054	Version	2	5	Program version	Word - 16 bit	
86	0x0056	Info code	2	6	Info code	Word - 16 bit	Dynamic
88	0x0058	Reserved	4	N/A		IEEE Float - 32 bit	
92	0x005C	Cooling energy E3	4	8	Values in float	IEEE Float - 32 bit	Dynamic
96	0x0060	Volume - V2	4	8	Values in float	IEEE Float - 32 bit	Dynamic
100	0x0064	Temperature T3	4	8	Values in float	IEEE Float - 32 bit	Dynamic
104	0x0068	Cooling energy E3	2	9	Units	Word - 16 bit	Dynamic
106	0x006A	Volume - V2	2	9	Units	Word - 16 bit	Dynamic
108	0x006C	Cooling energy E3	4	10	Values in integer	Double Word - 32 bit	Dynamic
112	0x0070	Volume - V2	4	10	Values in integer	Double Word - 32 bit	Dynamic
116	0x0074	Temperature T3	4	10	Values in integer	Double Word - 32 bit	Dynamic
120	0x0078	Cooling energy E3	2	11	Decimal	Word - 16 bit	Dynamic
122	0x007A	Volume - V2	2	11	Decimal	Word - 16 bit	Dynamic
124	0x007C	Max power	4	12	Values in float	IEEE Float - 32 bit	Dynamic
128	0x0080	Tarif 2	4	12	Values in float	IEEE Float - 32 bit	Dynamic
132	0x0084	Tarif 3	4	12	Values in float	IEEE Float - 32 bit	Dynamic
136	0x0088	Tarif limit 2	4	12	Values in float	IEEE Float - 32 bit	Static
140	0x008C	Tarif limit 3	4	12	Values in float	IEEE Float - 32 bit	Static
144	0x0090	Meter type	4	13	Parameters	Double Word - 32 bit	Static
148	0x0094	Meter number 1	4	13	Parameters	Double Word - 32 bit	Static
152	0x0098	Serial number	4	13	Parameters	Double Word - 32 bit	Static
156	0x009C	Program number	4	13	Parameters	Double Word - 32 bit	Static
160	0x00A0	Config number 1	4	13	Parameters	Double Word - 32 bit	Static
164	0x00A4	Config Number 2	4	13	Parameters	Double Word - 32 bit	Static
168	0x00A8	Hour counter	4	13	Parameters	Double Word - 32 bit	Dynamic

The PDU address region from 256 to 340 is described in detail below. The PDU address is in words so that a 32-bit register results in the following register to be placed at an address 2 higher. Besides the different way of addressing the memory, it is identical to the table seen above.

Data model mapping for word-addressed region

Memory	Memory (hex)	Individual description	Size in bytes	Table	Contents	Data type	Update status
256	0x0100	Heat energy E1	4	1	Values in float	IEEE Float - 32 bit	Dynamic
258	0x0102	Actual flow	4	1	Values in float	IEEE Float - 32 bit	Dynamic
260	0x0104	Volume V1	4	1	Values in float	IEEE Float - 32 bit	Dynamic
262	0x0106	Actual power	4	1	Values in float	IEEE Float - 32 bit	Dynamic
264	0x0108	Inlet temperature T1	4	1	Values in float	IEEE Float - 32 bit	Dynamic
266	0x010A	Outlet temperature T2	4	1	Values in float	IEEE Float - 32 bit	Dynamic
268	0x010C	Pulse input A	4	1	Values in float	IEEE Float - 32 bit	Dynamic
270	0x010E	Pulse input B	4	1	Values in float	IEEE Float - 32 bit	Dynamic
272	0x0110	Heat energy E1	2	2	Units	Word - 16 bit	Dynamic
273	0x0111	Actual flow	2	2	Units	Word - 16 bit	Dynamic
274	0x0112	Volume V1	2	2	Units	Word - 16 bit	Dynamic
275	0x0113	Actual power	2	2	Units	Word - 16 bit	Dynamic
276	0x0114	Heat energy E1	4	3	Values in integer	Double Word - 32 bit	Dynamic
278	0x0116	Actual flow	4	3	Values in integer	Double Word - 32 bit	Dynamic
280	0x0118	Volume V1	4	3	Values in integer	Double Word - 32 bit	Dynamic
282	0x011A	Actual power	4	3	Values in integer	Double Word - 32 bit	Dynamic
284	0x011C	Inlet temperature T1	4	3	Values in integer	Double Word - 32 bit	Dynamic
286	0x011E	Outlet temperature T2	4	3	Values in integer	Double Word - 32 bit	Dynamic
288	0x0120	Pulse input A	4	3	Values in integer	Double Word - 32 bit	Dynamic
290	0x0122	Pulse input B	4	3	Values in integer	Double Word - 32 bit	Dynamic
292	0x0124	Heat energy E1	2	4	Decimal	Word - 16 bit	Dynamic
293	0x0125	Actual flow	2	4	Decimal	Word - 16 bit	Dynamic
294	0x0126	Volume V1	2	4	Decimal	Word - 16 bit	Dynamic
295	0x0127	Actual power	2	4	Decimal	Word - 16 bit	Dynamic
296	0x0128	Pulse input A	2	4	Decimal	Word - 16 bit	Dynamic
297	0x0129	Pulse input B	2	4	Decimal	Word - 16 bit	Static
298	0x012A	Version	2	5	Program version	Word - 16 bit	
299	0x012B	Info code	2	6	Info code	Word - 16 bit	Dynamic
300	0x012C	Reserved	4	N/A		IEEE Float - 32 bit	
302	0x012E	Cooling energy E3	4	8	Values in float	IEEE Float - 32 bit	Dynamic
304	0x0130	Volume - V2	4	8	Values in float	IEEE Float - 32 bit	Dynamic
306	0x0132	Temperature T3	4	8	Values in float	IEEE Float - 32 bit	Dynamic
308	0x0134	Cooling energy E3	2	9	Units	Word - 16 bit	Dynamic
309	0x0135	Volume - V2	2	9	Units	Word - 16 bit	Dynamic
310	0x0136	Cooling energy E3	4	10	Values in integer	Double Word - 32 bit	Dynamic
312	0x0138	Volume - V2	4	10	Values in integer	Double Word - 32 bit	Dynamic
314	0x013A	Temperature T3	4	10	Values in integer	Double Word - 32 bit	Dynamic
316	0x013C	Cooling energy E3	2	11	Decimal	Word - 16 bit	Dynamic
317	0x013D	Volume - V2	2	11	Decimal	Word - 16 bit	Dynamic
318	0x013E	Max power	4	12	Values in float	IEEE Float - 32 bit	Dynamic
320	0x0140	Tarif 2	4	12	Values in float	IEEE Float - 32 bit	Dynamic
322	0x0142	Tarif 3	4	12	Values in float	IEEE Float - 32 bit	Dynamic
324	0x0144	Tarif limit 2	4	12	Values in float	IEEE Float - 32 bit	Static
326	0x0146	Tarif limit 3	4	12	Values in float	IEEE Float - 32 bit	Static
328	0x0148	Meter type	4	13	Parameters	Double Word - 32 bit	Static
330	0x014A	Meter number 1	4	13	Parameters	Double Word - 32 bit	Static
332	0x014C	Serial number	4	13	Parameters	Double Word - 32 bit	Static
334	0x014E	Program number	4	13	Parameters	Double Word - 32 bit	Static
336	0x0150	Config number 1	4	13	Parameters	Double Word - 32 bit	Static
338	0x0152	Config Number 2	4	13	Parameters	Double Word - 32 bit	Static
340	0x0154	Hour counter	4	13	Parameters	Double Word - 32 bit	Dynamic

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Data model address

This contains the address of a particular element within a data block in the Modbus data model.

PDU address

This contains the Modbus PDU (Protocol Data Unit) address to be used when communicating with the Kamstrup Modbus module.

Individual description

Describes which MULTICAL® register value is contained.

Size in bytes

All registers have a size of either 16 bit or 32 bit.

Contents

Describes what kind of data is stored in the particular register. All registers within a table have the same kind of contents.
- Values in float
  - Data should be interpreted as a 32-bit IEEE float.
- Values in integer
  - Data should be interpreted as a 32-bit unsigned integer.
- Units
  - Data is stored in a 16-bit unsigned word and should be interpreted in the following way:

Decimal	Hexadecimal	Unit
1	0x0001	kW
2	0x0002	MW
17	0x0011	kWh
18	0x0012	MWh
33	0x0021	l
34	0x0022	m^3
35	0x0023	m^3x10
49	0x0031	l/h
50	0x0032	m^3/h

- Decimal
  - Data is stored in a 16-bit unsigned word and indicates the number of decimals.
- Parameters
  - Data is stored in a 32-bit unsigned double word.
- Info code
  - Data is stored in a 16-bit unsigned word and indicates the MULTICAL® info code.
- Program version
  - Data is stored in a 16-bit unsigned word and represents the official program version in the module.

Update status

Dynamic indicates that a memory location is continuously updated (every 30 seconds for MULTICAL® 601 and every 10 seconds for other meters) while static means that the memory location is only updated once.

Hardware

The module is power supplied from the meter's internal 230 VAC/3.6 VDC or 24 VAC/3.6 VDC supply module.

Supported meter types:	MULTICAL® 601, MULTICAL® 602, MULTICAL® 801, MULTICAL® 62
Bus communication:	RS-485 twisted pair
RS-485 connection:	Screw terminals for
	• A/-
	• B/+
	• GND
Bus termination:	By use of external resistor

Approvals

CE and MID in conjunction with the specific MULTICAL® meter.

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Ordering

Type no.	Model no.	Description
6700-67	5550-1277	Modbus RTU + pulse inputs
6699-099		Optical eye with USB
6699-102		Optical eye with D-sub 9F for RS-232
	5098-834	Module programmer for Windows 7 + 8, www.kamstrup.com/24058