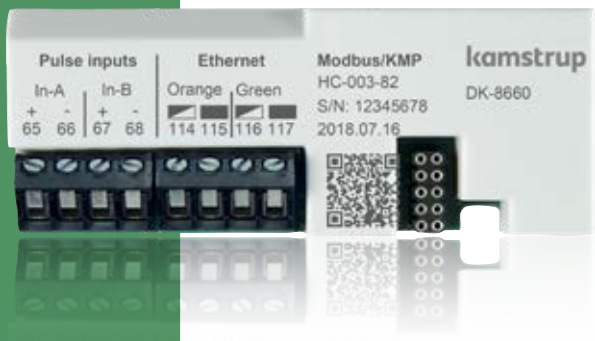
kamstrup

Data sheet

Modbus/KMP TCP/IP module

Communication module for MULTICAL® 603

- Ethernet 10/100base t
- Modbus TCP or KMP communication
- IP assigned via DHCP or fixed IP
- Modbus TCP complies with "Modbus Messaging on TCP/IP Implementation Guide V1.0b"



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Introduction

A high performance TCP/IP module developed for the MULTICAL® energy meter. The module supports two communication protocols, the Modbus TCP protocol and the KMP (Kamstrup Meter Protocol). Modbus TCP enables MULTICAL® to be integrated into a building automation system or to be part of industrial applications. The KMP enables remote reading of actual data, logged values and configuration parameters.

Applications

The Modbus/KMP TCP/IP module is designed with focus on high flexibility to fulfill any applications for monitoring, control and data analysis. The Modbus TCP protocol facilitates various formatting of meter data to cope with various reading equipment. The fast exchange of meter data makes the Modbus TCP module particularly suitable for monitoring and control tasks.

Alarms
The MULTICAL® info codes for general alarm, flow error, temperature error, water leakage, very high flow, air in the system and wrong flow direction are available to the Modbus system.

Applications

Control and regulation
Data can be read out in few seconds intervals at a very high speed, whereby the data can be used for control and regulation purposes.

Installation

The module is easily mounted into one of the module slots of the meter. A configuration might be necessary if a specific IP/port address is required. Selection of the module protocol and TCP/IP properties can be done with METERTOOL HCW through the optical eye on MULTICAL® or through the 10-pole connector on the module.

The module is power-supplied from the meter's internal 230 VAC or 24 VAC High-Power supply module.

Cable connections

Wire size
Max cable size 1.5 mm²

Pulse input connection
Terminal 65: Pulse input A/In-A (+)
Terminal 66: Pulse input A/In-A (-)
Terminal 67: Pulse input B/In-B (+)
Terminal 68: Pulse input B/In-B (-)

Ethernet connections
Green
Green/White
Orange
Orange/White

Pulse inputs
The pulse inputs are used to collect and accumulate pulses remotely, e.g. from water meters and electricity meters. The pulse inputs are physically placed on the Modbus module. However, the accumulation and data logging of values are made by the MULTICAL® calculator.

Communication from module

Protocol
Modbus TCP is a standard for exchange of messages between equipment.

KMP is short for Kamstrup Meter Protokol. The KMP is developed by Kamstrup, and tools and documentation can be requested by relevant utilities and companies.

Network options
The module supports both DHCP and Static IP assignment. When set for Static IP assignment, the following parameters must be entered: IP address, Subnet mask and Default gateway.

Hostname
The module's IP address can be found by pinging its hostname. The hostname is "kammet" followed by the serial number of the meter. To find the IP address of the meter with serial number 80002051, you must send a ping request to "kammet80002051".

Port addresses
By default, Modbus TCP connections use port 502. The KMP TCP connection uses port 1025 by default.

Connections
Modbus TCP allows up to 4 simultaneous connections. KMP allows only 1 connection at a time.

Supported Modbus function codes
The module supports a subset of Modbus function codes for reading and writing. Generally, function codes and addresses are written in hexadecimal format shown by the prefix 0x.

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
- 0x2B Encapsulated interface transport with exception code:
  - 0x01 – Illegal function
  - Subcode 0x0E Read Device Identification with exception code:
    - 0x03 – Illegal data value

Modbus datagrams

The module supports the most common registers used for heating and cooling applications.

Default datagram	
Flow V1 actual	Info code
Flow V2 actual	Operating hours
Actual Power	Error hour counter
t1 actual	Date (yy.mm.dd)
t2 actual	Time (hh.mm.ss)
t3 actual	Config No. 1
t4 actual	Config No. 2
t1-t2 diff. temp.	Config No. 3
P1 actual	Config No. 4
P2 actual	Customer No. 2
Heat energy E1	Customer No. 1
Heat energy E2	Serial No.
Cooling energy E3	Meter type incl. SW edition
Inlet energy E4	Meter Main/Subtype
Outlet energy E5	Meter SW revision
Tap water energy E6	
Tap water energy E7	
Energy E8	
Energy E9	
Energy E10	
Energy E11	
Tariff TA2	
Tariff TA3	
Tariff TA4	
Heat energy A1	
Heat energy A2	
Volume V1	
Volume V2	
Pulse input A1	
Pulse input B1	
Pulse input A2	
Pulse input B2	
COP	
t5 limit	
Power Input B1	
QP average time	
Tariff limit TL2	
Tariff limit TL3	
Tariff limit TL4	
Mass M1	
Mass M2	

Modbus register mapping

The following table shows how the MULTICAL® internal data is mapped into Modbus registers. Most values can be read at two different addresses, either as IEEE Float or as 32-bit signed integers. All registers used for units and factors are 16-bit values, all others are 32-bit Float or integer values.

Reading of data is done either by using Modbus function code 0x03 "Read Registers" or function code 0x04 "Read Inputs".

Modbus register	Address (hex)	Description	No. of registers	Contents	Data type
1	0000	Flow V1 actual	2	Value	32-bit IEEE Float
3	0002	Flow V2 actual	2	Value	32-bit IEEE Float
5	0004	Actual Power	2	Value	32-bit IEEE Float
7	0006	t1 actual	2	Value	32-bit IEEE Float
9	0008	t2 actual	2	Value	32-bit IEEE Float
11	000A	t3 actual	2	Value	32-bit IEEE Float
13	000C	t4 actual	2	Value	32-bit IEEE Float
15	000E	t1-t2 diff. temp.	2	Value	32-bit IEEE Float
17	0010	P1 actual	2	Value	32-bit IEEE Float
19	0012	P2 actual	2	Value	32-bit IEEE Float
21	0014	Heat energy E1	2	Value	32-bit IEEE Float
23	0016	Heat energy E2	2	Value	32-bit IEEE Float
25	0018	Cooling energy E3	2	Value	32-bit IEEE Float
27	001A	Inlet energy E4	2	Value	32-bit IEEE Float
29	001C	Outlet energy E5	2	Value	32-bit IEEE Float
31	001E	Tap water energy E6	2	Value	32-bit IEEE Float
33	0020	Tap water energy E7	2	Value	32-bit IEEE Float
35	0022	Energy E8	2	Value	32-bit IEEE Float
37	0024	Energy E9	2	Value	32-bit IEEE Float
39	0026	Energy E10	2	Value	32-bit IEEE Float
41	0028	Energy E11	2	Value	32-bit IEEE Float
43	002A	Tariff TA2	2	Value	32-bit IEEE Float
45	002C	Tariff TA3	2	Value	32-bit IEEE Float
47	002E	Tariff TA4	2	Value	32-bit IEEE Float
49	0030	Heat energy A1	2	Value	32-bit IEEE Float
51	0032	Heat energy A2	2	Value	32-bit IEEE Float
53	0034	Volume V1	2	Value	32-bit IEEE Float
55	0036	Volume V2	2	Value	32-bit IEEE Float
57	0038	Pulse input A1	2	Value	32-bit IEEE Float
59	003A	Pulse input B1	2	Value	32-bit IEEE Float
61	003C	Pulse input A2	2	Value	32-bit IEEE Float
63	003E	Pulse input B2	2	Value	32-bit IEEE Float
65	0040	COP	2	Value	32-bit IEEE Float

Modbus register mapping

Modbus register	Address (hex)	Description	No. of registers	Contents	Data type
67	0042	t5 limit	2	Value	32-bit IEEE Float
69	0044	Power Input B1	2	Value	32-bit IEEE Float
71	0046	QP average time	2	Value	32-bit IEEE Float
73	0048	Tariff limit TL2	2	Value	32-bit IEEE Float
75	004A	Tariff limit TL3	2	Value	32-bit IEEE Float
77	004C	Tariff limit TL4	2	Value	32-bit IEEE Float
79	004E	Mass M1	2	Value	32-bit IEEE Float
81	0050	Mass M2	2	Value	32-bit IEEE Float
83	0052	Flow V1 actual	1	Unit	16-bit Unsigned Integer
84	0053	Flow V2 actual	1	Unit	16-bit Unsigned Integer
85	0054	Actual Power	1	Unit	16-bit Unsigned Integer
86	0055	t1 actual	1	Unit	16-bit Unsigned Integer
87	0056	t2 actual	1	Unit	16-bit Unsigned Integer
88	0057	t3 actual	1	Unit	16-bit Unsigned Integer
89	0058	t4 actual	1	Unit	16-bit Unsigned Integer
90	0059	t1-t2 diff. temp.	1	Unit	16-bit Unsigned Integer
91	005A	P1 actual	1	Unit	16-bit Unsigned Integer
92	005B	P2 actual	1	Unit	16-bit Unsigned Integer
93	005C	Heat energy E1	1	Unit	16-bit Unsigned Integer
94	005D	Heat energy E2	1	Unit	16-bit Unsigned Integer
95	005E	Cooling energy E3	1	Unit	16-bit Unsigned Integer
96	005F	Inlet energy E4	1	Unit	16-bit Unsigned Integer
97	0060	Outlet energy E5	1	Unit	16-bit Unsigned Integer
98	0061	Tap water energy E6	1	Unit	16-bit Unsigned Integer
99	0062	Tap water energy E7	1	Unit	16-bit Unsigned Integer
100	0063	Energy E8	1	Unit	16-bit Unsigned Integer
101	0064	Energy E9	1	Unit	16-bit Unsigned Integer
102	0065	Energy E10	1	Unit	16-bit Unsigned Integer
103	0066	Energy E11	1	Unit	16-bit Unsigned Integer
104	0067	Tariff TA2	1	Unit	16-bit Unsigned Integer
105	0068	Tariff TA3	1	Unit	16-bit Unsigned Integer
106	0069	Tariff TA4	1	Unit	16-bit Unsigned Integer
107	006A	Heat energy A1	1	Unit	16-bit Unsigned Integer
108	006B	Heat energy A2	1	Unit	16-bit Unsigned Integer
109	006C	Volume V1	1	Unit	16-bit Unsigned Integer
110	006D	Volume V2	1	Unit	16-bit Unsigned Integer
111	006E	Pulse input A1	1	Unit	16-bit Unsigned Integer
112	006F	Pulse input B1	1	Unit	16-bit Unsigned Integer

Modbus register mapping

Modbus register	Address (hex)	Description	No. of registers	Contents	Data type
113	0070	Pulse input A2	1	Unit	16-bit Unsigned Integer
114	0071	Pulse input B2	1	Unit	16-bit Unsigned Integer
115	0072	COP	1	Unit	16-bit Unsigned Integer
116	0073	t5 limit	1	Unit	16-bit Unsigned Integer
117	0074	Power Input B1	1	Unit	16-bit Unsigned Integer
118	0075	QP average time	1	Unit	16-bit Unsigned Integer
119	0076	Tariff limit TL2	1	Unit	16-bit Unsigned Integer
120	0077	Tariff limit TL3	1	Unit	16-bit Unsigned Integer
121	0078	Tariff limit TL4	1	Unit	16-bit Unsigned Integer
122	0079	Mass M1	1	Unit	16-bit Unsigned Integer
123	007A	Mass M2	1	Unit	16-bit Unsigned Integer
124	007B	Info code	2	Value	32-bit Unsigned Integer
126	007D	Operating hours	2	Value	32-bit Unsigned Integer
128	007F	Error hour counter	2	Value	32-bit Unsigned Integer
130	0081	Date (yy.mm.dd)	2	Value	32-bit Unsigned Integer
132	0083	Time (hh.mm.ss)	2	Value	32-bit Unsigned Integer
134	0085	Config No. 1	2	Value	32-bit Unsigned Integer
136	0087	Config No. 2	2	Value	32-bit Unsigned Integer
138	0089	Config No. 3	2	Value	32-bit Unsigned Integer
140	008B	Config No. 4	2	Value	32-bit Unsigned Integer
142	008D	Customer No. 2	2	Value	32-bit Unsigned Integer
144	008F	Customer No. 1	2	Value	32-bit Unsigned Integer
146	0091	Serial No.	2	Value	32-bit Unsigned Integer
148	0093	Meter type incl. SW edition	2	Value	32-bit Unsigned Integer
150	0095	Meter Main/Sub type	2	Value	32-bit Unsigned Integer
152	0097	Meter SW revision	2	Value	32-bit Unsigned Integer
154	0099	Flow V1 actual	2	Value	32-bit Signed Integer
156	009B	Flow V2 actual	2	Value	32-bit Signed Integer
158	009D	Actual Power	2	Value	32-bit Signed Integer
160	009F	t1 actual	2	Value	32-bit Signed Integer
162	00A1	t2 actual	2	Value	32-bit Signed Integer
164	00A3	t3 actual	2	Value	32-bit Signed Integer
166	00A5	t4 actual	2	Value	32-bit Signed Integer
168	00A7	t1-t2 diff. temp.	2	Value	32-bit Signed Integer
170	00A9	P1 actual	2	Value	32-bit Signed Integer
172	00AB	P2 actual	2	Value	32-bit Signed Integer
174	00AD	Heat energy E1	2	Value	32-bit Signed Integer
176	00AF	Heat energy E2	2	Value	32-bit Signed Integer

Modbus register mapping

Modbus register	Address (hex)	Description	No. of registers	Contents	Data type
178	00B1	Cooling energy E3	2	Value	32-bit Signed Integer
180	00B3	Inlet energy E4	2	Value	32-bit Signed Integer
182	00B5	Outlet energy E5	2	Value	32-bit Signed Integer
184	00B7	Tap water energy E6	2	Value	32-bit Signed Integer
186	00B9	Tap water energy E7	2	Value	32-bit Signed Integer
188	00BB	Energy E8	2	Value	32-bit Signed Integer
190	00BD	Energy E9	2	Value	32-bit Signed Integer
192	00BF	Energy E10	2	Value	32-bit Signed Integer
194	00C1	Energy E11	2	Value	32-bit Signed Integer
196	00C3	Tariff TA2	2	Value	32-bit Signed Integer
198	00C5	Tariff TA3	2	Value	32-bit Signed Integer
200	00C7	Tariff TA4	2	Value	32-bit Signed Integer
202	00C9	Heat energy A1	2	Value	32-bit Signed Integer
204	00CB	Heat energy A2	2	Value	32-bit Signed Integer
206	00CD	Volume V1	2	Value	32-bit Signed Integer
208	00CF	Volume V2	2	Value	32-bit Signed Integer
210	00D1	Pulse input A1	2	Value	32-bit Signed Integer
212	00D3	Pulse input B1	2	Value	32-bit Signed Integer
214	00D5	Pulse input A2	2	Value	32-bit Signed Integer
216	00D7	Pulse input B2	2	Value	32-bit Signed Integer
218	00D9	COP	2	Value	32-bit Signed Integer
220	00DB	t5 limit	2	Value	32-bit Signed Integer
222	00DD	Power Input B1	2	Value	32-bit Signed Integer
224	00DF	QP average time	2	Value	32-bit Signed Integer
226	00E1	Tariff limit TL2	2	Value	32-bit Signed Integer
228	00E3	Tariff limit TL3	2	Value	32-bit Signed Integer
230	00E5	Tariff limit TL4	2	Value	32-bit Signed Integer
232	00E7	Mass M1	2	Value	32-bit Signed Integer
234	00E9	Mass M2	2	Value	32-bit Signed Integer
236	00EB	Flow V1 actual	1	Factor	16-bit Signed Integer
237	00EC	Flow V2 actual	1	Factor	16-bit Signed Integer
238	00ED	Actual Power	1	Factor	16-bit Signed Integer
239	00EE	t1 actual	1	Factor	16-bit Signed Integer
240	00EF	t2 actual	1	Factor	16-bit Signed Integer
241	00F0	t3 actual	1	Factor	16-bit Signed Integer
242	00F1	t4 actual	1	Factor	16-bit Signed Integer
243	00F2	t1-t2 diff. temp.	1	Factor	16-bit Signed Integer
244	00F3	P1 actual	1	Factor	16-bit Signed Integer

Modbus register mapping

Modbus register	Address (hex)	Description	No. of registers	Contents	Data type
245	00F4	P2 actual	1	Factor	16-bit Signed Integer
246	00F5	Heat energy E1	1	Factor	16-bit Signed Integer
247	00F6	Heat energy E2	1	Factor	16-bit Signed Integer
248	00F7	Cooling energy E3	1	Factor	16-bit Signed Integer
249	00F8	Inlet energy E4	1	Factor	16-bit Signed Integer
250	00F9	Outlet energy E5	1	Factor	16-bit Signed Integer
251	00FA	Tap water energy E6	1	Factor	16-bit Signed Integer
252	00FB	Tap water energy E7	1	Factor	16-bit Signed Integer
253	00FC	Energy E8	1	Factor	16-bit Signed Integer
254	00FD	Energy E9	1	Factor	16-bit Signed Integer
255	00FE	Energy E10	1	Factor	16-bit Signed Integer
256	00FF	Energy E11	1	Factor	16-bit Signed Integer
257	0100	Tariff TA2	1	Factor	16-bit Signed Integer
258	0101	Tariff TA3	1	Factor	16-bit Signed Integer
259	0102	Tariff TA4	1	Factor	16-bit Signed Integer
260	0103	Heat energy A1	1	Factor	16-bit Signed Integer
261	0104	Heat energy A2	1	Factor	16-bit Signed Integer
262	0105	Volume V1	1	Factor	16-bit Signed Integer
263	0106	Volume V2	1	Factor	16-bit Signed Integer
264	0107	Pulse input A1	1	Factor	16-bit Signed Integer
265	0108	Pulse input B1	1	Factor	16-bit Signed Integer
266	0109	Pulse input A2	1	Factor	16-bit Signed Integer
267	010A	Pulse input B2	1	Factor	16-bit Signed Integer
268	010B	COP	1	Factor	16-bit Signed Integer
269	010C	t5 limit	1	Factor	16-bit Signed Integer
270	010D	Power Input B1	1	Factor	16-bit Signed Integer
271	010E	QP average time	1	Factor	16-bit Signed Integer
272	010F	Tariff limit TL2	1	Factor	16-bit Signed Integer
273	0110	Tariff limit TL3	1	Factor	16-bit Signed Integer
274	0111	Tariff limit TL4	1	Factor	16-bit Signed Integer
275	0112	Mass M1	1	Factor	16-bit Signed Integer
276	0113	Mass M2	1	Factor	16-bit Signed Integer

Modbus register mapping

Explanation of table columns:

Modbus register	The Modbus register count starts at number 1 and corresponds to memory address 0. A Modbus register is 16 bits, thus a 32-bit value requires two successive Modbus registers.
Memory address (Hex)	The memory address is the location of the register in the module's memory.
Description	The name of the register variable.
Contents	
– Value	The address holds the value of the variable.
– Factor	The address holds a multiplication factor (10^x) to scale the 32-bit signed values. The final result = 10^{factor} * 32-bit signed value.
– Unit	The address holds the variable's SI units. The value of units must be translated according to this table:

Decimal value	Hex value	SI unit of measure
0	0x0000	No unit
1	0x0001	Wh
2	0x0002	kWh
3	0x0003	MWh
4	0x0004	GWh
5	0x0005	j
6	0x0006	kj
7	0x0007	Mj
8	0x0008	Gj
21	0x0015	W
22	0x0016	kW
23	0X0017	MW
24	0x0018	GW
37	0x0025	°C
38	0x0026	Kelvin
39	0x0027	l

Decimal value	Hex value	SI unit of measure
40	0x0028	m^3
41	0x0029	l/h
42	0x002A	M^3/h
43	0x002B	M^3 *C
44	0x002C	ton
47	0x002F	hh:mm:ss
48	0x0030	yy:mm:dd
49	0x0031	yyyy:mm:dd
55	0x0037	M^3x10
58	0x003A	Minutes
85	0x0055	%RH
86	0x0056	%O2
87	0x0057	m/s
88	0x0058	kJ/kg
89	0x0059	pH
90	0x005A	g/kg

Data type

The data type indicates how data is stored in the Modbus registers and is important information in order to make a correct reading of the value. If a register does not exist in the actual meter, the corresponding Modbus register will contain an invalid value.

Numerical format	Minimum value	Maximum value	Invalid value
16-bit integer	0	65535	0x0000
32-bit integer	0	4294967295	0xFFFFFFFF
32-bit signed integer	-2147483648	2147483647	0x7FFFFFFF
32-bit IEEE Float	±1.17×10−38	±3.4×1038	0x4F800000

Technical specifications

Physical	
Usage	Only suitable for installation in MULTICAL® 603
Communication	
Protocol	IPV4
Ethernet	10/100 Mbit
Supply	
Power supply	MULTICAL® with 230 VAC High-Power supply MULTICAL® with 24 VAC High-Power supply
Environment	
Operational temperature	5 °C – 55 °C
Humidity	25 – 85 % RH non-condensing
Programming	
Configuration and firmware update	Via optical read-out head or via the multi-pole connector on the module using METERTOOL HCW

Markings/approvals

CE approval	
Measuring instruments	EN 1434 Modbus over Serial Line, Specification and Implementation Guide V1.02

Additional documentation

Modbus conformance certificate, issued by MBS GmbH

Ordering

Description	Order no.
Modbus/KMP TCP/IP module + 2 pulse inputs	HC-003-82
USB configuration cable for H/C modules	6699-035
Optical read-out head w/USB	6699-099
METERTOOL HCW	www.kamstrup.com

Configuration

	XX	Y	Y	ZZZ
Product type of module				
Modbus/KMP TCP/IP + 2 pulse inputs (In-A, In-B)	82	0	1	100
Protocol selection				
Modbus TCP		0	1	
Kamstrup KMP		0	2	
Data content configuration				
Default datagram				100
Reserved				ZZZ

Additional configurations

IP assignment	Selection of static or dynamic (DHCP) IP addressing
IP address	The static IP address
Subnet	Subnet mask, typically set to 255.255.255.0
Gateway	IP address, typically the one assigned to the router

Displayed information

Module information can be read by selecting TECH-loop on the MULTICAL® display.
Module in module slot 1: select menu 2-101 in TECH-loop
Module in module slot 2: select menu 2-201 in TECH-loop

Menu	Menu index	Information	Display example
2-x01	31	Module type and configuration	
2-x01-1	32	Module firmware and revision	
2-x01-2	33	Module serial number	

Displayed information

2-x01-4	47	Link information *	
2-x01-5	49	Module status **	

* Link information has 4 bits of information.

Bit number	Value when bit set	Meaning	Value when bit not set	Meaning
3	8	100 Mbit	0	10 Mbit
2	4	Full duplex	0	Half duplex
1	2	Auto-Negotiation complete	0	Auto-Negotiation in progress
0	1	Link	0	No link

A value of 15 means: 100 Mbit, Full Duplex, Auto-Negotiation Completed and Link

** Module status has 3 bits of information:

Bit number	Value when bit set	Meaning	Value when bit not set	Meaning
2	4	No link	0	Link
1	2	Internal error	0	OK
0	1	No configuration	0	OK

If module status shows other values than 0 or 4, the module must be sent in for repair.

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