

Data sheet

## Modbus Module

### Communication module for MULTICAL® 403 and MULTICAL® 603

- Modbus RTU communication
- Communication speed up to 115200 bits/s
- Programmable data, communication speed and parity settings
- Two pulse inputs for additional water and electricity meters
- RS-485 galvanic isolated from meter
- Complies with Modbus implementation guide V1.02



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## Introduction

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A new high performance and flexible Modbus module has been introduced with the MULTICAL® 403 and MULTICAL® 603 energy meters. The Modbus communication module enables the MULTICAL® 403 and MULTICAL® 603 to be integrated into a building automation system or to participate in industrial applications. The Modbus RTU is based on an RS-485 communication bus.

## Applications

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The Modbus module is designed with focus on high flexibility to fulfill a wide pallet of applications. The Modbus module supports rapid exchange of meter data, e.g. flow, energy and temperatures to facilitate monitoring and control tasks.

### Analysis

The MULTICAL® energy meter supports high quantities of data, and all relevant data for analysis can be read out.

### 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.

### Control and regulation

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

## Installation

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The module is easily mounted in the module slot of the meter. A configuration might be necessary if a specific slave address is required. Configuration of the Modbus slave address, bus speed and selection of datagram can be done with METERTOOL HCW through the optical read-out head 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 supply module.

## Cable connections

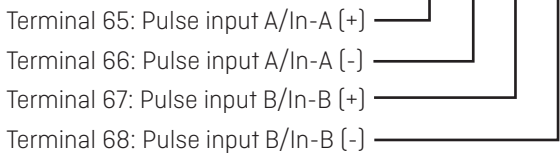
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### Wire size

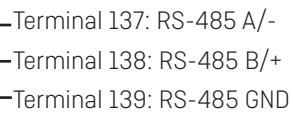
Max cable size 1.5 mm<sup>2</sup>



### Pulse input connection



### Modbus connection



### Modbus connection

Screw terminals for the Modbus RS-485 signals A/-, B/+ twisted pair and GND.

### Pulse inputs

Screw terminals for connection of the two pulse inputs. The pulse inputs are used for collecting and accumulating 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

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### Protocol

According to the Modbus over Serial Line, Specification and Implementation Guide V1.02

### Modbus addressing

The module may be addressed as a Modbus slave unit in the range from 1-247.

### Communication speed

The module supports baud rates from 300 to 115200 baud. The parity and stop bits are to be selected as one of the following: no parity 1 stop, no parity 2 stop, even parity 1 stop or odd parity 1 stop.

### 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
- 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

## Modbus datagrams

The Modbus module supports the most common registers used for heating and cooling applications. The legacy datagram is partly compatible with MULTICAL® 602.

| Default datagram    |   | Legacy datagram   |
|---------------------|---|-------------------|
| Flow V1 actual      |   | Heat energy E1    |
| Flow V2 actual      | * | Flow V1 actual    |
| Actual Power        |   | Volume V1         |
| t1 actual           |   | Actual Power      |
| t2 actual           |   | t1 actual         |
| t3 actual           | * | t2 actual         |
| t4 actual           | * | Pulse input A1    |
| t1-t2 diff. temp.   |   | Pulse input B1    |
| P1 actual           | * | Cooling energy E3 |
| P2 actual           | * | Power max year    |
| Heat energy E1      |   | Info code         |
| Heat energy E2      | * | Modul SW revision |
| Cooling energy E3   |   | Customer No. 1    |
| Inlet energy E4     | * | Serial No.        |
| Outlet energy E5    | * | Operating hours   |
| 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             | * |                   |
| Info code           |   |                   |
| Operating hours     |   |                   |
| Error hour counter  |   |                   |
| Date (yy.mm.dd)     |   |                   |
| Time (hh.mm.ss)     |   |                   |
| Config No. 1        |   |                   |
| Config No. 2        |   |                   |
| Config No. 3        |   |                   |
| Config No. 4        |   |                   |
| Customer No. 2      |   |                   |
| Customer No. 1      |   |                   |
| Serial No.          |   |                   |
| Meter type          |   |                   |
| Meter Main/Sub type |   |                   |
| Meter SW revision   |   |                   |

\* Only valid in MULTICAL® 603

## Default datagram, Modbus register mapping

The following tables show how the MULTICAL® 403 and MULTICAL® 603 memory data are 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.

| Modbus Register | Address (hex) | Description           | No of regs | 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 |
| 67              | 0042          | t5 limit              | 2          | Value    | 32 bit IEEE Float |
| 69              | 0044          | Power Input B1        | 2          | Value    | 32 bit IEEE Float |

## Default datagram, Modbus register mapping

| Modbus Register | Address (hex) | Description           | No of regs | Contents | Data type               |
|-----------------|---------------|-----------------------|------------|----------|-------------------------|
| 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 |
| 113             | 0070          | * Pulse input A2      | 1          | Unit     | 16 bit Unsigned Integer |



## Default datagram, Modbus register mapping

| Modbus Register | Address (hex) | Description                 | No of regs | Contents | Data type               |
|-----------------|---------------|-----------------------------|------------|----------|-------------------------|
| 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   |

## Default datagram, Modbus register mapping

| Modbus Register | Address (hex) | Description           | No of regs | 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 |

## Default datagram, Modbus register mapping

| Modbus Register | Address (hex) | Description           | No of regs | Contents | Data type             |
|-----------------|---------------|-----------------------|------------|----------|-----------------------|
| 243             | 00F2          | t1-t2 diff. temp.     | 1          | Factor   | 16 bit Signed Integer |
| 244             | 00F3          | * P1 actual           | 1          | Factor   | 16 bit Signed Integer |
| 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 |

\* Only valid in MULTICAL® 603

## Default datagram, Modbus register mapping

### For the default datagram table

|                      |  |
|----------------------|--|
| Modbus register      | The Modbus register count starts at number 1, and corresponds to the memory address 0. Each register is 16 bits. A 32-bit value requires two 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 = $10^{\text{factor}} * 32\text{-bit signed value}$ . |
| - 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                  |
| 34            | 0x0028    | m <sup>3</sup>     |

| Decimal value | Hex value | SI unit of measure |
|---------------|-----------|--------------------|
| 41            | 0x0029    | l/h                |
| 42            | 0x002A    | M <sup>3</sup> /h  |
| 43            | 0x002B    | M <sup>3</sup> *C  |
| 44            | 0x002C    | ton                |
| 47            | 0x002F    | Time: hh:mm:ss     |
| 48            | 0x0030    | Date: yy:mm:dd     |
| 49            | 0x0031    | Date: yyyy:mm:dd   |
| 52            | 0x0034    | bar                |
| 55            | 0x0037    | M <sup>3</sup> x10 |
| 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 are stored in the Modbus register, and is important information in order to make a correct reading of the value. If a register does not exist in the attached meter, the corresponding Modbus register will contain an invalid value.

| Numerical format      | Minimum value              | Maximum value            | Invalid value |
|-----------------------|----------------------------|--------------------------|---------------|
| 16-bit signed integer | 0                          | 65535                    | 0x0000        |
| 32-bit integer        | 0                          | 4294967295               | 0xFFFFFFFF    |
| 32-bit signed integer | -2147483648                | 2147483647               | 0x7FFFFFFF    |
| 32-bit IEEE float     | $\pm 1.17 \times 10^{-38}$ | $\pm 3.4 \times 10^{38}$ | 0x4F800000    |

## Legacy datagram, Modbus register mapping

The legacy datagram not only differs in data content, but also in how data must be interpreted. The datagram is reduced and contains fixed zero-values to fill gaps for those MULTICAL® 602 registers which are not available in MULTICAL® 403 and MULTICAL® 603. The legacy datagram duplicates the same data in two different memory areas. The Modbus register range from address 1 to 169 is byte-addressed. The address is incremented by the number of bytes in the data (2 for 16 bits and 4 for 32 bits).

| Modbus Register | Memory Address (hex) | Description       | Contents | Data type               |
|-----------------|----------------------|-------------------|----------|-------------------------|
| 1               | 0000                 | Heat energy E1    | Value    | 32 bit IEEE Float       |
| 5               | 0004                 | Flow V1 actual    | Value    | 32 bit IEEE Float       |
| 9               | 0008                 | Volume V1         | Value    | 32 bit IEEE Float       |
| 13              | 000C                 | Actual Power      | Value    | 32 bit IEEE Float       |
| 17              | 0010                 | t1 actual         | Value    | 32 bit IEEE Float       |
| 21              | 0014                 | t2 actual         | Value    | 32 bit IEEE Float       |
| 25              | 0018                 | Pulse input A1    | Value    | 32 bit IEEE Float       |
| 29              | 001C                 | Pulse input B1    | Value    | 32 bit IEEE Float       |
| 33              | 0020                 | Heat energy E1    | Units    | 16 bit Unsigned Integer |
| 35              | 0022                 | Flow V1 actual    | Units    | 16 bit Unsigned Integer |
| 37              | 0024                 | Volume V1         | Units    | 16 bit Unsigned Integer |
| 39              | 0026                 | Actual Power      | Units    | 16 bit Unsigned Integer |
| 41              | 0028                 | Heat energy E1    | Value    | 32 bit Signed Integer   |
| 45              | 002C                 | Flow V1 actual    | Value    | 32 bit Signed Integer   |
| 49              | 0030                 | Volume V1         | Value    | 32 bit Signed Integer   |
| 53              | 0034                 | Actual Power      | Value    | 32 bit Signed Integer   |
| 57              | 0038                 | t1 actual         | Value    | 32 bit Signed Integer   |
| 61              | 003C                 | t2 actual         | Value    | 32 bit Signed Integer   |
| 65              | 0040                 | Pulse input A1    | Value    | 32 bit Signed Integer   |
| 69              | 0044                 | Pulse input B1    | Value    | 32 bit Signed Integer   |
| 73              | 0048                 | Heat energy E1    | Decimals | 16 bit Unsigned Integer |
| 75              | 004A                 | Flow V1 actual    | Decimals | 16 bit Unsigned Integer |
| 77              | 004C                 | Volume V1         | Decimals | 16 bit Unsigned Integer |
| 79              | 004E                 | Actual Power      | Decimals | 16 bit Unsigned Integer |
| 81              | 0050                 | Pulse input A1    | Decimals | 16 bit Unsigned Integer |
| 83              | 0052                 | Pulse input B1    | Decimals | 16 bit Unsigned Integer |
| 85              | 0054                 | Modul SW revision | Value    | 16 bit Unsigned Integer |
| 87              | 0056                 | Info code         | Value    | 16 bit Unsigned Integer |
| 89              | 0058                 | ZERO              | 0        | 32 bit Unsigned Integer |
| 93              | 005C                 | Cooling energy E3 | Value    | 32 bit IEEE Float       |
| 97              | 0060                 | ZERO              | 0        | 32 bit IEEE Float       |
| 101             | 0064                 | ZERO              | 0        | 32 bit IEEE Float       |
| 105             | 0068                 | Cooling energy E3 | Units    | 16 bit Unsigned Integer |
| 107             | 006A                 | ZERO              | 0        | 16 bit Unsigned Integer |

## Legacy datagram, Modbus register mapping

| Modbus Register | Memory Address (hex) | Description       | Contents | Data type               |
|-----------------|----------------------|-------------------|----------|-------------------------|
| 109             | 006C                 | Cooling energy E3 | Value    | 32 bit Signed Integer   |
| 113             | 0070                 | ZERO              | 0        | 32 bit Signed Integer   |
| 117             | 0074                 | ZERO              | 0        | 32 bit Signed Integer   |
| 121             | 0078                 | Cooling energy E3 | Decimals | 16 bit Unsigned Integer |
| 123             | 007A                 | ZERO              | 0        | 16 bit Unsigned Integer |
| 125             | 007C                 | Power max year    | Value    | 32 bit IEEE Float       |
| 129             | 0080                 | ZERO              | 0        | 32 bit IEEE Float       |
| 133             | 0084                 | ZERO              | 0        | 32 bit IEEE Float       |
| 137             | 0088                 | ZERO              | 0        | 32 bit Unsigned Integer |
| 141             | 008C                 | ZERO              | 0        | 32 bit Unsigned Integer |
| 145             | 0090                 | ZERO              | 0        | 32 bit Unsigned Integer |
| 149             | 0094                 | Customer No. 1    | Value    | 32 bit Unsigned Integer |
| 153             | 0098                 | Serial No.        | Value    | 32 bit Unsigned Integer |
| 157             | 009C                 | ZERO              | 0        | 32 bit Unsigned Integer |
| 161             | 00A0                 | ZERO              | 0        | 32 bit Unsigned Integer |
| 165             | 00A4                 | ZERO              | 0        | 32 bit Unsigned Integer |
| 169             | 00A8                 | Operating hours   | Value    | 32 bit Unsigned Integer |

The Modbus register range from address 257 to 341 is word-addressed. The address is incremented by the number of words in the data (1 for 16 bits and 2 for 32 bits).

| Modbus Register | Address (hex) | Description    | Contents | Data type               |
|-----------------|---------------|----------------|----------|-------------------------|
| 257             | 0100          | Heat energy E1 | Value    | 32 bit IEEE Float       |
| 259             | 0102          | Flow V1 actual | Value    | 32 bit IEEE Float       |
| 261             | 0104          | Volume V1      | Value    | 32 bit IEEE Float       |
| 263             | 0106          | Actual Power   | Value    | 32 bit IEEE Float       |
| 265             | 0108          | t1 actual      | Value    | 32 bit IEEE Float       |
| 267             | 010A          | t2 actual      | Value    | 32 bit IEEE Float       |
| 269             | 010C          | Pulse input A1 | Value    | 32 bit IEEE Float       |
| 271             | 010E          | Pulse input B1 | Value    | 32 bit IEEE Float       |
| 273             | 0110          | Heat energy E1 | Units    | 16 bit Unsigned Integer |
| 274             | 0111          | Flow V1 actual | Units    | 16 bit Unsigned Integer |
| 275             | 0112          | Volume V1      | Units    | 16 bit Unsigned Integer |
| 276             | 0113          | Actual Power   | Units    | 16 bit Unsigned Integer |
| 277             | 0114          | Heat energy E1 | Value    | 32 bit Signed Integer   |
| 279             | 0116          | Flow V1 actual | Value    | 32 bit Signed Integer   |
| 281             | 0118          | Volume V1      | Value    | 32 bit Signed Integer   |

## Legacy datagram, Modbus register mapping

| Modbus Register | Address (hex) | Description       | Contents        | Data type               |
|-----------------|---------------|-------------------|-----------------|-------------------------|
| 283             | 011A          | Actual Power      | Value           | 32 bit Signed Integer   |
| 285             | 011C          | t1 actual         | Value           | 32 bit Signed Integer   |
| 287             | 011E          | t2 actual         | Value           | 32 bit Signed Integer   |
| 289             | 0120          | Pulse input A1    | Value           | 32 bit Signed Integer   |
| 291             | 0122          | Pulse input B1    | Value           | 32 bit Signed Integer   |
| 293             | 0124          | Heat energy E1    | Decimals        | 16 bit Unsigned Integer |
| 294             | 0125          | Flow V1 actual    | Decimals        | 16 bit Unsigned Integer |
| 295             | 0126          | Volume V1         | Decimals        | 16 bit Unsigned Integer |
| 296             | 0127          | Actual Power      | Decimals        | 16 bit Unsigned Integer |
| 297             | 0128          | Pulse input A1    | Decimals        | 16 bit Unsigned Integer |
| 298             | 0129          | Pulse input B1    | Decimals        | 16 bit Unsigned Integer |
| 299             | 012A          | Modul SW revision | Program version | 16 bit Unsigned Integer |
| 300             | 012B          | Info code         | Info code       | 16 bit Unsigned Integer |
| 301             | 012C          | ZERO              | 0               | 32 bit Unsigned Integer |
| 303             | 012E          | Cooling energy E3 | Value           | 32 bit IEEE Float       |
| 305             | 0130          | ZERO              | 0               | 32 bit IEEE Float       |
| 307             | 0132          | ZERO              | 0               | 32 bit IEEE Float       |
| 309             | 0134          | Cooling energy E3 | Units           | 16 bit Unsigned Integer |
| 310             | 0135          | ZERO              | 0               | 16 bit Unsigned Integer |
| 311             | 0136          | Cooling energy E3 | Value           | 32 bit Signed Integer   |
| 313             | 0138          | ZERO              | 0               | 32 bit Signed Integer   |
| 315             | 013A          | ZERO              | 0               | 32 bit Signed Integer   |
| 317             | 013C          | Cooling energy E3 | Decimals        | 16 bit Unsigned Integer |
| 318             | 013D          | ZERO              | 0               | 16 bit Unsigned Integer |
| 319             | 013E          | Power max year    | Value           | 32 bit IEEE Float       |
| 321             | 0140          | ZERO              | 0               | 32 bit IEEE Float       |
| 323             | 0142          | ZERO              | 0               | 32 bit IEEE Float       |
| 325             | 0144          | ZERO              | 0               | 32 bit Unsigned Integer |
| 327             | 0146          | ZERO              | 0               | 32 bit Unsigned Integer |
| 329             | 0148          | ZERO              | 0               | 32 bit Unsigned Integer |
| 331             | 014A          | Customer No. 1    | Value           | 32 bit Unsigned Integer |
| 333             | 014C          | Serial No.        | Value           | 32 bit Unsigned Integer |
| 335             | 014E          | ZERO              | 0               | 32 bit Unsigned Integer |
| 337             | 0150          | ZERO              | 0               | 32 bit Unsigned Integer |
| 339             | 0152          | ZERO              | 0               | 32 bit Unsigned Integer |
| 341             | 0154          | Operating hours   | Value           | 32 bit Unsigned Integer |

## Legacy datagram, Modbus register mapping

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### For the legacy datagram table

|                      |   |
|----------------------|---|
| Modbus register      | The Modbus register count starts at number 1 and corresponds to the memory address 0. Each register is 16 bits. A 32-bit value requires two 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.  |
| - Decimals           | The address holds a multiplication factor ( $10^{-x}$ ) to scale the 32-bit signed values. The final result = $10^{-\text{decimal}} * 32\text{-bit signed value}$ . |
| - 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  |
|---------------|-----------|---------------------|
| 1             | 0x0001    | kW                  |
| 2             | 0x0002    | MW                  |
| 17            | 0x0011    | kWh                 |
| 18            | 0x0012    | MWh                 |
| 33            | 0x0021    | l                   |
| 34            | 0x0022    | m <sup>3</sup>      |
| 35            | 0x0023    | m <sup>3</sup> x 10 |
| 49            | 0x0031    | l/h                 |
| 50            | 0x0032    | m <sup>3</sup> /h   |
| 65            | 0x0041    | ton                 |
|               | 0xFxxx    | Undefined *         |

\* An undefined value may occur if a register in the meter has an SI unit not found in this table.



## Technical specifications

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### Physical

Usage Only suitable for installation in MULTICAL® 403 and MULTICAL® 603

### Communication

Protocol Modbus RTU

Address range 1 - 247

Baud rates  
 300 bits/s  
 2400 bits/s  
 9600 bits/s  
 19200 bits/s  
 38400 bits/s  
 57600 bits/s  
 76800 bits/s  
 115200 bits/s

Parity, stop  
 No parity 1 stop  
 No parity 2 stop  
 Odd parity 1 stop  
 Even parity 1 stop

Default setting 19200, 8 data bits, even parity 1 stop bit

### Bus-specific

Type 2-wire RS-485 with ground

Galvanic isolation According to PTB-A50.1

Bus termination External 120  $\Omega$  resistor between A/- and B/+

### Supply

Power supply  
 MULTICAL® with 230 VAC supply  
 MULTICAL® with 24 VAC 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

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CE and EN 1434 in conjunction with the type approval of MULTICAL® 403 and MULTICAL® 603.  
Modbus over Serial Line, Specification and Implementation Guide V1.02.

## Ordering

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| <b>Description</b>                      | <b>Order No.</b>                                       |
|---|--|
| Modbus module + 2 pulse inputs          | HC-003-67  |
| USB configuration cable for H/C modules | 6699-035   |
| Optical read-out head w/USB             | 6699-099   |
| Optical read-out head w/RS-232 D-SUB 9F | 6699-102   |
| METERTOOL HCW                           | <a href="http://www.kamstrup.com">www.kamstrup.com</a> |

## Configuration

| <b>Product type of module</b>                   | <b>XX</b> | <b>Y</b> | <b>Y</b> | <b>ZZZ</b> |
|---|-----------|----------|----------|------------|
| Modbus RTU module + 2 pulse inputs (In-A, In-B) | 67        | 4        | 3        | 100        |
| <b>Communication speed</b>                      |           |          |          |            |
| 300 baud  |           | 1        |          |            |
| 2400 baud                                       |           | 2        |          |            |
| 9600 baud                                       |           | 3        |          |            |
| 19200 baud                                      |           | 4        |          |            |
| 38400 baud                                      |           | 5        |          |            |
| 57600 baud                                      |           | 6        |          |            |
| 76800 baud                                      |           | 7        |          |            |
| 115200 baud                                     |           | 8        |          |            |
| <b>Parity/Stop bits</b>                         |           |          |          |            |
| No parity 1 stop bit                            |           |          | 1        |            |
| No parity 2 stop bits                           |           |          | 2        |            |
| Even parity 1 stop bit                          |           |          | 3        |            |
| Odd parity 1 stop bit                           |           |          | 4        |            |
| <b>Data content configuration</b>               |           |          |          |            |
| Default datagram                                |           |          |          | 100        |
| Legacy datagram                                 |           |          |          | 101        |
| Reserved  |           |          |          | ZZZ        |

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**Kamstrup A/S**

Industrivej 28, Stilling  
DK-8660 Skanderborg  
T: +45 89 93 10 00  
F: +45 89 93 10 01  
info@kamstrup.com  
kamstrup.com