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# CALEC® ST II
# RS 485 Modbus RTU

## Table of contents

# 1   General information

**Content**

In this operating manual are only Modbus specific information on CALEC® ST II, for more details, the technical documentation of CALEC® ST II is necessary.

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**REFERENCE!**

**Main operating manual!**
The main operating manual and additional documents can be found on the
following website: http://www.aquametro.ch/qr/prod/calec-st/11111.html

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General information to Modbus: www.modbus.org.

**CALEC® ST II: Overview of supported functions**

| Function | Parameter | Description | More information |
|---|---|---|---|
| Addressing range | Slave: 1-247 | Factory setting: 1 | See chapter: Configuration of the Modbus interface on CALEC® ST II |
| Baud rate | 300, 2400, 9600, 19200, 38400 | Factory setting: 19200 | See chapter: Configuration of the Modbus interface on CALEC® ST II |
| Broadcast | Yes | Address 0 | |
| Parity | Even, Odd or None | Factory setting: Even | See chapter: Configuration of the Modbus interface on CALEC® ST II |
| Function code | 03 | Read Holding Register<br><br>Reads one or more registers of the Modbus slave.<br><br>1 to a maximum of 125 consecutive registers (1 register = 2 byte) can be read with a telegram. | |
| Modbus Unit Codes | | All the values are always transmitted via Modbus in the basic units. | See chapter: Modbus register |

# 2 Commissioning

**Line termination**

A termination resistor must be connected to each end of the segments. The modbus specification recommends a 120 Ohm resistor.
If the CALEC® ST II is at the end of a segment, the internal termination resistor can be used.
Operating menu: Bus ⇨ Modbus ⇨ TRN.

**Configuration of the Modbus interface on CALEC® ST II**

After connecting the RS 485 to terminal 90 and 91, the default parameters can be adapted. Set the necessary Modbus parameter in the CALEC® ST II operating menu, e.g. bus address from 1 to a valid address.

The parameters

• Bus address
• Baud rate
• Parity

are changeable in the menu structure under :

Modbus ⇨ 1 ⇨ Address
       ⇨ 2 ⇨ Baud
           ⇨ Parity

The relevant bus number for the configuration results from the assembly of the Modbus interface in socket # 1 or socket # 2.

# 3  RS 485 Modbus RTU technology

Modbus is an open, standardized field bus system which is used in the areas of manufacturing automation, process automation and building automation. RS 485 Modbus RTU (Remote Terminal Unit) allows the heat calculator CALEC® ST ll to be easily integrate to DDC, BMS, PLC or SCADA systems .

The Modbus RS 485 distinguishes between master and slave devices. The CALEC® ST ll of Aquametro AG works as a slave station.

- **Master devices:**
  Master devices determine the data traffic on the field bus system. They can send request telegram to one (Standard) or all (only Broadcast Address = 0) slaves.

- **Slave devices:**
  Slave devices are able to send their data only in response to a request of a master.

# 4  Modbus protocol

The protocol defines the way in which messages will be transmitted between CALEC® ST ll and a Modbus master.

**Modbus telegram**
The data is transferred between the master and slave by means of a telegram. A request telegram from the master contains the following telegram fields:

- **Slave Address:**
  The bus address of the CALEC® ST ll has to be in an address range from 1 to 247. The master talks to all the slaves simultaneously by means of the slave address 0 (Broadcast Message).

- **Function Code:**
  The function code determines which read, write and test operations should be executed by means of the Modbus protocol.

- **Data:**
  Depending of the function code, the following values are transmitted in this data field:
  - Register start address (from which data are transmitted)
  - Number of registers
  - Read Data
  - Data length

- **Check sum:**
  The telegram check sum forms the end of the telegram.

If an error occurs during data transfer or if the slave cannot execute the command from the master, the slave returns an error telegram to the master.

## Modbus register

In general a device parameter has its own register address. The master uses follow register addresses to access the data of CALEC® ST II.

| Register no. | Register Name | Description | R / W | Data Type |
|---|---|---|---|---|
| **General device parameters** | | | | |
| 0 | Device | 0xC0 = CALEC® ST<br>0xC1 = CALEC® ST MASSE<br>0xC2 = CALEC® ST Flow<br>0xC4 = CALEC® ST BDE<br>0xC7 = CALEC® ST TGR<br>0xC8 = CALEC® ST BDV<br>0xC9 = CALEC® ST DTF | Read Only | 16 Bit Integer |
| 1 | Status | OK = 0<br>ERROR = 1<br>ALARM = 2 | Read Only | 16 Bit Integer |
| 2 | Medium<br>(mounting-side) | Cold = 0x04<br>Heat = 0x0C<br>Water = 0x07<br>Unknown = 0x0F | Read Only | 16 Bit Integer |
| 4, 5 | Serial Number | 0…99999999 | Read Only | 32 Bit Integer |
| 6, 7 | Operating hours | 0…99999999 | Read Only | 32 Bit Integer |
| 8, 9 | Error hours | 0…99999999 | Read Only | 32 Bit Integer |
| 10, 11 | Alarm hours | 0…99999999 | Read Only | 32 Bit Integer |
| 12, 13 | Firmware Version | z.B. 10500 | Read Only | 32 Bit Integer |
| 14, 15 | Hardware Version | z.B. 1011010 | Read Only | 32 Bit Integer |
| 20 | Address | 1 - 247 | Read Only | 16 Bit Integer |
| 21 | Baud rate | 0 = 300<br>1 = 2400<br>2 = 9600<br>3 = 19200<br>4 = 38400 | Read Only | 16 Bit Integer |
| 22 | Parity | 0 = even<br>1 = add<br>2 = none | | |
| **Energy Counter** | | | | |
| 100, 101 | Value Energy 1 | | Read Only | IEEE754 Float |
| 102 | Unit Energy 1* | | Read Only | 16 Bit Integer |
| 110, 111 | Value Energy 2 (BDE, BDV, DTF, TGR) | | Read Only | IEEE754 Float |
| 112 | Unit Energy 2* | | Read Only | 16 Bit Integer |
| 120, 121 | Value Energy 3 (BDE, BDV, DTF, TGR) | | Read Only | IEEE754 Float |
| 122 | Unit Energy 3* | | Read Only | 16 Bit Integer |
| * | Unit Energy: | 0: [KWh] | | |
| **Volume Counter** | | | | |
| 200, 201 | Value Volume 1 | | Read Only | IEEE754 Float |
| 202 | Unit Volume 1* | | Read Only | 16 Bit Integer |
| 210, 211 | Value Volume 2 (BDE, BDV, DTF) | | Read Only | IEEE754 Float |
| 212 | Unit Volume 2* | | Read Only | 16 Bit Integer |
| * | Unit Volume: | 1: [m³] | | |
| **Mass Counter** | | | | |
| 300, 301 | Value Mass | | Read Only | IEEE754 Float |
| 302 | Unit Mass | 2: [t] | Read Only | 16 Bit Integer |

| Register no. | Register Name | Description | R / W | Data Type |
|---|---|---|---|---|
| **Auxiliary Counter** | | | | |
| Counter **1** | | | | |
| 400, 401 | Value auxiliary | | Read Only | IEEE754 Float |
| 402 | Unit auxiliary* | | Read Only | 16 Bit Integer |
| Counter **2** | | | | |
| 410, 411 | Value auxiliary | | Read Only | IEEE754 Float |
| 412 | Unit auxiliary* | | Read Only | 16 Bit Integer |
| Counter **3** | | | | |
| 420, 421 | Value auxiliary | | Read Only | IEEE754 Float |
| 422 | Unit auxiliary* | | Read Only | 16 Bit Integer |
| * | Units auxiliary: | 0: [kwh]<br>1: [m$^3$]<br>2: [t]<br>3: without unit [1] | | |
| **Power Values** | | | | |
| 500, 501 | Value Power | | Read Only | IEEE754 Float |
| 502 | Unit Power | 10: [KW] | Read Only | 16 Bit Integer |
| **Volume Counter** | | | | |
| 600, 601 | Value Flow | | Read Only | IEEE754 Float |
| 602 | Unit Flow | 11: [m$^3$/h] | Read Only | 16 Bit Integer |
| **Mass flow Values** | | | | |
| 700, 701 | Value Mass flow | | Read Only | IEEE754 Float |
| 702 | Unit Mass flow | 12: [t/h] | Read Only | 16 Bit Integer |
| **Temperature Values** | | | | |
| 800, 801 | Value Temperature Hot | | Read Only | IEEE754 Float |
| 802 | Unit Temperature Hot | 13: [°C] | Read Only | 16 Bit Integer |
| 810, 811 | Value Temperature Cold | | Read Only | IEEE754 Float |
| 812 | Unit Temperature Cold | 13: [°C] | Read Only | 16 Bit Integer |
| 820, 821 | Value Temperature difference | | Read Only | IEEE754 Float |
| 822 | Unit Temperature difference | 14: [K] | Read Only | 16 Bit Integer |
| **Values Density** | | | | |
| 900, 901 | Value Density | | Read Only | IEEE754 Float |
| 902 | Unit Density | 15: [kg/m$^3$] | Read Only | 16 Bit Integer |

## Modbus status messages

Also the status messages are linked to Modbus registers. Aquametro AG will differentiate between follow types of status messages:

- **Device status „Error ":**
  All important device errors , like „System Error" must be checked.

- **Measurement value status „Alarm":**
  Specific messages like „dt Alarm" must be checked.
  (For more information please see error messages in the operating manual of CALEC® ST II).

# 5 Troubleshooting

**No communication**

If no communication via Modbus possible, please check the following:

• Are the connections to clamp 90 and 91 O.K.?

• Is the polarity „+" / „–" O.K.?

• Menu „MODBUS" avaiable?

• Is the Modbus setup at CALEC® ST II (Address, Baud rate and Parity) O.K.?

• Please check the address and baud rate of all Modbus slaves in the network.

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