# Modbus Manual Version 1.03

# Modbus Manual for Clean Room Panel CRP5

This manual is for persons who will use the Clean Room Panel Modbus protocol. It describes how messages are constructed and how transactions take place using Modbus protocol.

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# 1 Modbus protocol

The Clean Room Panel (CRP5) can handle Modbus RTU (asynchronous communication over RS485) and Modbus TCP (client-server communication over Ethernet). Modbus ASCII is not supported.

For detailed information about Modbus protocol see:
(http://modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf).

**Attention!**
Changes to register content (especially Holding Registers) in the CRP5 can change the functionality of the CRP5. This may cause the CRP5 to become inoperable.
Changes of register contents should only be made with the necessary knowledge of the Modbus protocol.

## 1.1 *Structure of the Modbus protocol*

### 1.1.1 Modbus RTU / TCP

#### *1.1.1.1 Modbus RTU*

Modbus RTU is an asynchronous communication protocol. The CRP5 handles Modbus RTU over the included RS485 interface. The communication parameters are 19200 Baud, 8-bit data, no parity and cannot be changed.

**Note!**
Modbus RTU Address of the CRP5 is always the CRP5 RS485 Network Address + 1!

#### *1.1.1.2 Modbus TCP*

Modbus TCP is a client-server communication protocol over Ethernet. The CRP5 handles Modbus TCP over the port 502 and cannot be changed.

Modbus TCP needs a Modbus Application Protocol Header (MBAP 7 Bytes) in front of the Protocol Data Unit (PDU).
Modbus commands are integrated in PDU. Every Modbus command has his own PDU.

#### *1.1.1.3 Difference between Modbus RTU and TCP*

A Modbus RTU message looks like:

| **Modbus RTU Message** | | | |
|---|---|---|---|
| Slave ID | Command | Data | CRC |
| | PDU | | |

A Modbus TCP message includes a MBAP-Header and looks like:

| **Modbus TCP Message** | | | | | |
|---|---|---|---|---|---|
| Transaction ID | Protocol ID | Length | Unit ID | Command | Data |
| MBAP-Header | | | | PDU | |

For detailed information look at (http://modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf).

## 1.2 *Modbus Data Format*

The Modbus protocol only specifies the 16-bit integer data type and is declared as “Big-Endian” protocol.

### 1.2.1 16-bit Integer Value

#### 16-bit Integer for Modbus Devices

| Modbus Field N | |
| --- | --- |
| MSB | LSB |
| 12 | 34 |
| Byte x | Byte x+1 |

For other data types, as 32-bit floating point, there is no specification how they should be mapped to the Modbus address range. It is up to the device manufacturer to specify this format.

### 1.2.2 32-bit Float corresponding to IEEE 754

| MSB | | | LSB |
| --- | --- | --- | --- |
| SEEEEEEE | EMMMMMMM | MMMMMMMM | MMMMMMMM |

S – Sign
E – Exponent
M - 23 bit Mantissa

#### 32-bit Float for Rotronic Modbus Devices

The 32-Bit Float value is represented by two 16-bit registers. The 4 Bytes have to be mapped to the Modbus address range as shown below

| Modbus Field N | | Modbus Field N+1 | |
| --- | --- | --- | --- |
| | LSB | MSB | |
| MMMMMMMM | MMMMMMMM | SEEEEEEE | EMMMMMMM |
| Byte x | Byte x+1 | Byte x+2 | Byte x+3 |

### 1.2.3 32-bit Integer Value

**Example: Integer Value 0x12345678**

| MSB | | | LSB |
| --- | --- | --- | --- |
| 12 | 34 | 56 | 78 |

#### 32-bit Integer for Rotronic Modbus Devices

The 32-Bit Integer value represents two 16-bit registers. The 4 bytes of the 32-bit Integer value have to be mapped to the Modbus address range as shown below.

| Modbus Field N | | Modbus Field N+1 | |
| --- | --- | --- | --- |
| | LSB | MSB | |
| 56 | 78 | 12 | 34 |
| Byte x | Byte x+1 | Byte x+2 | Byte x+3 |

Because there is no standard and it is mostly a matter of personal preference, it is configurable how the four bytes are being mapped to the two registers.

### 1.2.4 Selectable Swap Modes for Rotronic Devices

Selectable swap modes (see Device Settings -> *Modbus Operation Mode*) only for 32-bit Float and 32-bit Integer values based on Little Endian memory organisation.

| Swap Mode | Source Bytes a,b,c,d | Target Bytes a,b,c,d |
| --- | --- | --- |
| No change | [ a b ] [ c d ] | [ a b c d ] |
| byte and word swap | [ a b ] [ c d ] | [ d c b a ] |
| byte swap | [ a b ] [ c d ] | [ b a d c ] |
| word swap **(Rotronic Default)** | [ a b ] [ c d ] | [ c d a b ] |

# 2 CRP5 Modbus Fields and Mapping

## 2.1 *CRP5 Modbus Fields*

| Primary Tables | Type | Read / Write | Coils / Registers | Function Code | |
|---|---|---|---|---|---|
| Coils | Bit | Read/Write | 1 … 9'999 | 0x01 | Read Coils |
| | | | | 0x05 | Write Single Coil |
| | | | | 0x0F | Write Multiple Coils |
| Discrete Inputs | Bit | Read Only | 10'001 … 29'999 | 0x02 | Read Discrete Inputs |
| Input Registers | 16-bit | Read Only | 30'001 … 39'999 | 0x04 | Read Input Register |
| Holding Registers | 16-bit | Read/Write | 40'001 … 49'999 | 0x03 | Read Holding Registers |
| | | | | 0x06 | Write Single Register |
| | | | | 0x10 | Write Multiple Registers |

**Attention!**
Coils and registers in Modbus are addressed starting at zero. Therefore coils numbered 1…16 are addressed as 0…15 or registers numbered e.g. 10'001…10'016 are addressed as 10'000…10'015!

**Note!**
The content of not specified coils/registers are undefined!

## 2.2 *Device Specific Coils*

With Modbus **Coils** you can get the state of one or more coils or activate/deactivate one or more coils.

Assisted Modbus commands are *Read Coils* (0x01), *Write Single Coil* (0x05) and, for the CRP5, in some cases *Write Multiple Coils* (0x0F).

### 2.2.1 Relays 1 to 6

Commands to energize/de-energize the relays of the CRP5 manually.

**Attention!**
If in Relay Settings the flag *Relay x Alarm OFF* is set, it is not possible to energize the relay x manually. The relay will be de-energized every measuring cycle, when alarm is off!

| Coil | Name | Type | Description |
|---|---|---|---|
| 1 | Relay 1 | *! | • Get state of relay 1<br>• Switch relay 1 ON/OFF |
| 2 | Relay 2 | *! | • Get state of relay 2<br>• Switch relay 2 ON/OFF |
| 3 | Relay 3 | *! | • Get state of relay 3<br>• Switch relay 1 ON/OFF |
| 4 | Relay 4 | *! | • Get state of relay 4<br>• Switch relay 4 ON/OFF |
| 5 | Relay 5 | *! | • Get state of relay 5<br>• Switch relay 5 ON/OFF |
| 6 | Relay 6 | *! | • Get state of relay 6<br>• Switch relay 6 ON/OFF |

| | | | |
|---|---|---|---|
| 7 | Reserved | | • Undefined |
| 8 | Reserved | | • Undefined |
| | | | |
| * | It is possible to one or more relays with the Modbus command 0x0F | | |
| ! | An energized relay stays energized until the related coil is de-energized, an *Alarm Off after…* event (see Relay Settings) or a device reset occurs | | |

### 2.2.2 Valves A to D

Commands to energize/de-energize the valves of the CRP5 manually.

| Coil | Name | Type | Description |
|---|---|---|---|
| 9 | Valve A (Zero+) | * | • Get state of valve A<br>• Switch valve A ON/OFF |
| 10 | Valve B (Zero-) | * | • Get state of valve B<br>• Switch valve B ON/OFF |
| 11 | Valve C (Front+) | * | • Get state of valve C<br>• Switch valve C ON/OFF |
| 12 | Valve D (Front-) | * | • Get state of Valve D<br>• Switch Valve D ON/OFF |
| 13 | Reserved | | • Undefined |
| 14 | Reserved | | • Undefined |
| 15 | Reserved | | • Undefined |
| 16 | Reserved | | • Undefined |
| | | | |
| * | It is possible to set one or more valves with the Modbus command 0x0F | | |
| ! | An energized valve stays energized until the related coil is de-energized or a device reset occurs | | |

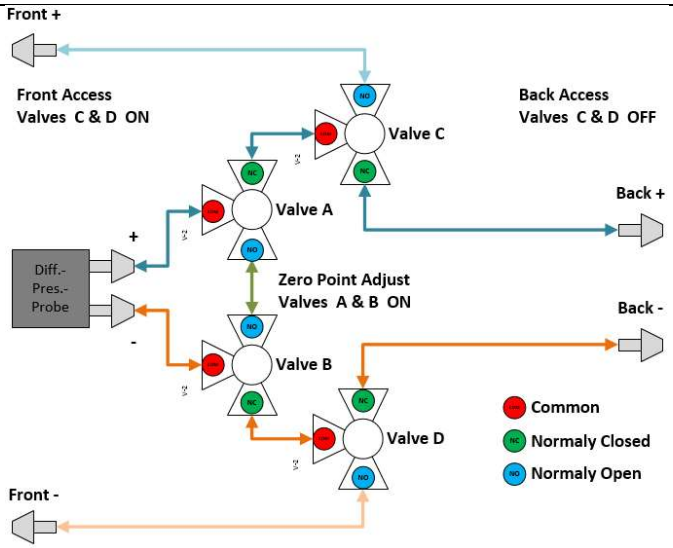
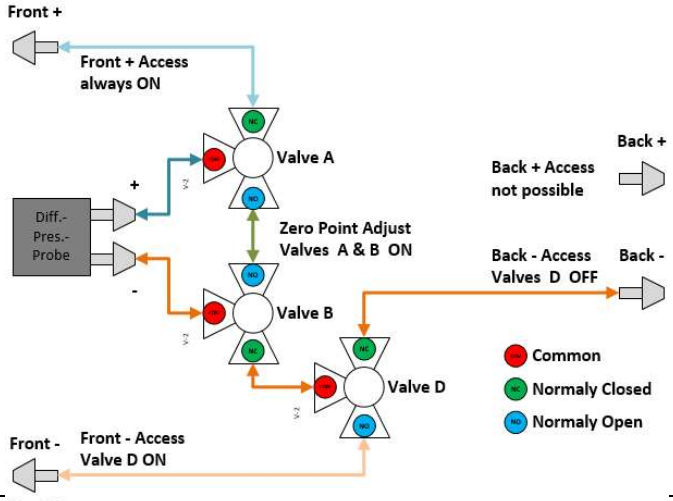
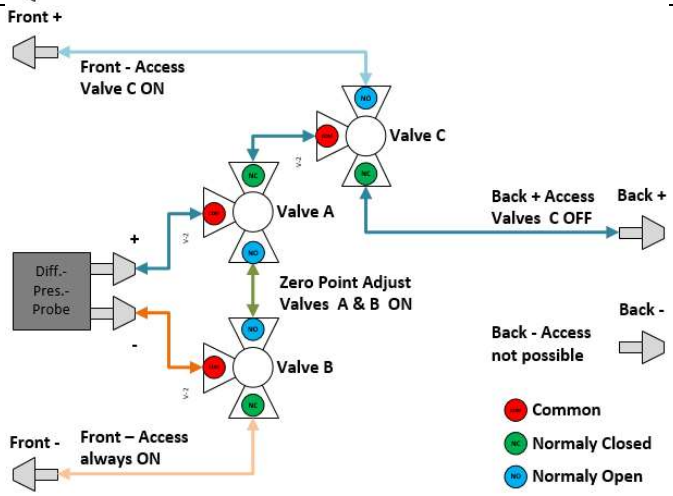
### 2.2.3 Maintenance/Calibration

The External Maintenance mode will have activated in case of maintenance services: clean room cleaning and during calibration process.
Modbus command *Write Multiple Coils* (0x0F) is **not** possible.

| Coil | Name | Type | Description |
|---|---|---|---|
| 17 | External Maintenance | | • Get state of external maintenance<br>• Switch external maintenance ON/OFF |
| 18 | Calibration Back Access | ! | • Get state of calibration back access<br>• Switch calibration back access ON/OFF |
| 19 | Calibration Front Access | ! | • Get state of calibration front access<br>• Switch calibration front access ON/OFF |
| 20 | Reserved | | • Undefined |
| 21 | Reserved | | • Undefined |
| 22 | Reserved | | • Undefined |
| 23 | Reserved | | • Undefined |
| 24 | Reserved | | • Undefined |
| | | | |
| ! | Only one of these calibration accesses (back or front) can be active at the same time | | |

**External Maintenance:** By starting this action, maintenance services are possible, e.g. clean room cleaning or calibration processes.

**Calibration Back/Front Access:** Calibration can either occur on the front or back inputs of the differential pressure sensor – never set both calibration access points, front and back the same time.
There are 3 possibilities to access the differential pressure sensor of the CRP5 (see below).

| | |
|---|---|
| **Front or Back Access** |  |
| **Fixed Front + Access** |  |
| **Fixed Front - Access** |  |

### 2.2.4 Sensor Actions

Direct sensor actions!

**Attention!**
Be careful to use these commands, due to any possible miss adjustments.

Modbus command *Write Multiple Coils* (0x0F) is **not** possible.

| Coils | Name | Type | Description |
| --- | --- | --- | --- |
| 25 | Differential Pressure Zero Adjust | * | • Zero adjust of the differential pressure sensor<br>• These action takes about 15 seconds to execute |
| 26 | Differential Pressure Gain Adjust | *! | • Setting the gain of the differential pressure sensor<br>• These action takes about 2 seconds to execute |
| 27 | Differential Pressure Reset Adjustment | * | • Resets differential pressure gain and offset settings to 1.0 (gain) and 0.0 (offset) |
| 28 | Acquire Humidity Data | *! | • Acquires a reference value for the humidity<br>• It's possible to acquire more than one different reference values |
| 29 | Delete Acquired Humidity Data | * | • Deletes all acquired humidity reference values |
| 30 | Adjust Acquired Humidity Data | * | • The acquired humidity data will be sent to the humidity sensor |
| | **Attention!** If no reference values has acquired, humidity adjust is not possible! | | |
| 31 | Adjust Temperature Data | *! | • The reference temperature data will be sent to the temperature sensor |
| 32 | Reserved | | • Undefined |

| | |
| --- | --- |
| * | During these action, communication with the device is not possible |
| ! | Before activating these action, a reference value has to be set for the desired sensor (see Reference Value Settings) |

**Note!**
For adjustment procedures, you need a stable environment no matter what sensor will have adjusted.

**Differential Pressure Gain Adjust**: By starting this action, the differential pressure sensor will be adjusted to a reference value that is applied to the chosen pressure inputs (front or back). This reference value must be entered in the appropriate reference register (see Reference Value Settings -> *Differential Pressure*) before the adjustment procedure is started. Beside the zero adjust point, only one further differential pressure value can be acquired as a reference value.

**Differential Pressure Reset Adjustment**: The adjustment parameters determined during the production of the CRP5 will be restored.

**Acquire Humidity Data**: By starting this action, the CRP5-probe will be adjusted to a reference humidity value. This reference humidity in the unit of the applied reference must be entered in the appropriate reference register (see Reference Value Settings -> *Humidity*) before the acquiring procedure is started. Up to 99 humidity values can be acquired as reference values.

**Delete Acquired Humidity Data**: By starting this action, all acquired data will get lost.

**Adjust Acquired Humidity Data**: By starting this action, the CRP5-probe will be adjusted to the acquired reference values. If no reference values has been acquired, a humidity adjustment is not possible.

**Adjust Temperature Data**: By starting this action, the CRP5-probe will be adjusted to a reference temperature value. This reference temperature in the unit of the applied reference must be entered in the appropriate reference register (see Reference Value SettingsReference Value Settings -> *Temperature*) before the adjust procedure is started. Only one temperature value can be acquired as a reference value.

### 2.2.5 Device Actions

Direct device actions!

**Attention!**
Be careful to use these commands, due to any possible wrong configurations.

Modbus command *Write Multiple Coils* (0x0F) is **not** possible.

| Coils | Name | Type | Description |
| --- | --- | --- | --- |
| 33 | Reset Device | * | • Reset device |
| 34 | Store Device Settings | * | • Stores the actual settings of the device into FLASH |
| 35 | Restore All Device Settings | * | • Restores the device (factory) settings in FLASH to the device |
| 36 | Restore Device Settings without Ethernet Data | * | • Restores the device (factory) settings in FLASH to the device, without the Ethernet settings |
| 37 … 64 | Reserved | | • Undefined |
| 65 … 9’999 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |
| | | | |
| * | During these action, communication with the device is not possible | | |

**Reset Device:** The device will be restarted.

**Store Device Settings:** All device-relevant data will be stored in the FLASH. **Be careful, executing this command, will overwrite older (factory) settings in the FLASH.**

**Restore All Device Settings:** All device-relevant data will be restored from the FLASH to the device. Be careful, all individual device settings by customer will be overwritten by the factory settings.

**Restore All Device Settings without Ethernet Data:** All device-relevant data, except Ethernet settings, will have restored from the FLASH to the device. Be careful, all device settings will have overwritten, except the Ethernet settings.

## 2.2.6 Example: Read Single Coil

### *2.2.6.1 Red Relay 1 to 6*

**Initial situation:** The relays 1, 3 and 5 are set.
**RTU Example:**

| | |
|---|---|
| **Transmit** | 01 01 00 00 00 07 7d c8 |
| **Receive** | 01 01 01 15 90 47 |

**TCP Example:**

| | |
|---|---|
| **Transmit** | MBAP 01 01 00 00 00 07 |
| **Receive** | MBAP 01 01 01 15 |

| Field | Bytes | Value | Description |
|---|---|---|---|
| MBAP | 7 | MBAP | MBAP header (see Modbus RTU / TCP) |
| Checksum | 2 | CRC | CRC Checksum (see Modbus RTU / TCP) |
| RTU number | 1 | 0x01 | Modbus RTU Address (RS485 Address + 1)<br>(see Device Descriptions) |
| Function code | 1 | 0x01 | Read Single Coil |
| Starting address | 2 | 0x0000 | = 0, means address of the 1. coil<br>( Attention! coil number – 1 ) |
| Quantity of coils | 2 | 0x0007 | = 7, 1 to 7 gives the same result 1 byte (8 coils)<br>8 to 15 will give back 2 bytes (16 coils) etc.<br>(maximal value for CRP5 0x003f = 63 ≙ 8 bytes) |
| Byte count | 1 | 0x01 | = 1 ≙ **N**, means quantity of coils / 8, if the remainder is different of 0 => N = N+1 |
| Coil status<br>(see Relays) | n | 0x15 | n = N or N+1 = 8 bits |

| Bit | State | State of Relais 1 to 6 |
|---|---|---|
| 0 | **ON** | Coil 1 = Relais 1 (ON = 1, OFF = 0) |
| 1 | OFF | Coil 2 = Relais 2 (ON = 1, OFF = 0) |
| 2 | **ON** | Coil 3 = Relais 3 (ON = 1, OFF = 0) |
| 3 | OFF | Coil 4 = Relais 4 (ON = 1, OFF = 0) |
| 4 | **ON** | Coil 5 = Relais 5 (ON = 1, OFF = 0) |
| 5 | OFF | Coil 6 = Relais 6 (ON = 1, OFF = 0) |
| 6 | OFF | Not used |
| 7 | OFF | Not use |

For detailed information about Modbus protocol *Read Single Coil* see:
(http://modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf).

## 2.2.7 Example: Write Single Coil

### *2.2.7.1 Set State of Relay 2*

**RTU Example:**

| | |
|---|---|
| **Transmit** | 01 05 00 01 ff 00 dd fa |
| **Receive** | 01 05 00 01 ff 00 dd fa |

**TCP Example:**

| | |
|---|---|
| **Transmit** | MBAP 01 05 00 01 ff 00 |
| **Receive** | MBAP 01 05 00 01 ff 00 |

| Field | Bytes | Value | Description |
|---|---|---|---|
| MBAP | 7 | MBAP | MBAP header (see Modbus RTU / TCP) |
| Checksum | 2 | CRC | CRC Checksum (see Modbus RTU / TCP) |
| RTU number | 1 | 0x01 | Modbus RTU Address (RS485 Address + 1)<br>(see Device Descriptions) |
| Function code | 1 | 0x05 | Write Single Coil |
| Starting address | 2 | 0x0001 | = 1, means address of the 2. coil<br>( Attention! coil number – 1 ) |
| Output value | 2 | 0xff00 | 0xff00 for setting the selected coil<br>0x0000 for resetting the selected coil |

Test the change with Modbus commands in example Read coil 1 to coil 8

For detailed information about Modbus protocol *Write Single Coil* see:
(http://modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf).

## 2.2.8 Example: Write Multiple Coils

### *2.2.8.1 Set State of Relay 1 to 6*

**RTU Example:**

| | |
|---|---|
| **Transmit** | 01 0f 00 00 00 07 01 2a 4f 49 |
| **Receive** | 01 0f 00 00 00 07 14 09 |

**TCP Example:**

| | |
|---|---|
| **Transmit** | MBAP 01 0f 00 00 00 07 01 2a |
| **Receive** | MBAP 01 0f 00 00 00 07 |

| Field | Bytes | Value | Description |
|---|---|---|---|
| MBAP | 7 | MBAP | MBAP header (see Modbus RTU / TCP) |
| Checksum | 2 | CRC | CRC Checksum (see Modbus RTU / TCP) |
| RTU number | 1 | 0x01 | Modbus RTU Address (RS485 Address + 1)<br>(see Device Descriptions) |
| Function code | 1 | 0x0f | Write Multiple Coils |
| Starting address | 2 | 0x0000 | = 0, means address of the 1. coil<br>( Attention! coil number – 1 ) |
| Quantity of outputs | 2 | 0x0007 | = 7 for coils 0 to 7 |

| | | | |
|---|---|---|---|
| Byte count | 1 | 0x01 | = 1 ≙ **N**, means quantity of coils / 8, if the remainder is different of 0 => N = N+1 |
| Output values (see Relays) | N * 1 | 0x2a | |

| Bit | State | State of Relais 1 to 6 |
|---|---|---|
| 0 | OFF | Coil 1 = Relais 1 (ON = 1, OFF = 0) |
| 1 | **ON** | Coil 2 = Relais 2 (ON = 1, OFF = 0) |
| 2 | OFF | Coil 3 = Relais 3 (ON = 1, OFF = 0) |
| 3 | **ON** | Coil 4 = Relais 4 (ON = 1, OFF = 0) |
| 4 | OFF | Coil 5 = Relais 5 (ON = 1, OFF = 0) |
| 5 | **ON** | Coil 6 = Relais 6 (ON = 1, OFF = 0) |
| 6 | OFF | Not used |
| 7 | OFF | Not use |

Test the change with Modbus commands in example Read coil 1 to coil 8

For detailed information about Modbus protocol *Write Single Coil* see:
(http://modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf).

### 2.2.9 Example: Reset Device

**RTU Example:**

| | |
|---|---|
| **Transmit** | 01 05 00 20 ff 00 0d f0 |
| **Receive** | 01 05 00 20 ff 00 0d f0 |

**TCP Example:**

| | |
|---|---|
| **Transmit** | MBAP 01 05 00 20 ff 00 |
| **Receive** | MBAP 01 05 00 20 ff 00 |

| Field | Bytes | Value | Description |
|---|---|---|---|
| MBAP | 7 | MBAP | MBAP header (see Modbus RTU / TCP) |
| Checksum | 2 | CRC | CRC Checksum (see Modbus RTU / TCP) |
| RTU number | 1 | 0x01 | Modbus RTU Address (RS485 Address + 1)<br>(see Device Descriptions) |
| Function code | 1 | 0x05 | Write Single Coil |
| Starting address | 2 | 0x0020 | = 32, means address of the 33. Coil (Reset Device)<br>( Attention! coil number – 1 ) |
| Output value | 2 | 0xff00 | 0xff00 for setting the selected action |

For detailed information about Modbus protocol *Write Single Coil* see:
(http://modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf).

## 2.3 *Device Specific Discrete Inputs (read only)*

With Modbus **Discrete Inputs** you can get the state of the digital inputs of the CRP5.

Assisted Modbus command is *Read Discrete Input* (0x02).

### 2.3.1 Digital Inputs 1 and 2

Current state of the digital inputs of the CRP5, updated every measurement cycle, which means every second.

| Coil | Name | Type | Description |
|---|---|---|---|
| 10'001 | Digital Input | | Bit: State of Initialization bits<br>0: Digital Input 1 (ON = 1, OFF = 0)<br>1: Digital Input 2 (ON = 1, OFF = 0)<br>2…15: 0 |
| 10'002 … 10'063 | Reserved | | • Undefined |
| 10'064 … 29'999 | Reserved | | • Gives back Modbus Exception Code 02 |

### 2.3.2 Example: Read Discrete Inputs

#### *2.3.2.1 Read Modbus Coil 10'001*

**RTU Example:**

| | |
|---|---|
| **Transmit** | 01 02 27 10 00 01 b2 bb |
| **Receive** | 01 02 01 01 60 48 |

**TCP Example:**

| | |
|---|---|
| **Transmit** | MBAP 01 02 27 10 00 01 |
| **Receive** | MBAP 01 02 01 01 |

| Field | Bytes | Value | Description |
|---|---|---|---|
| MBAP | 7 | MBAP | MBAP header (see Modbus RTU / TCP) |
| Checksum | 2 | CRC | CRC Checksum (see Modbus RTU / TCP) |
| RTU number | 1 | 0x01 | Modbus RTU Address (RS485 Address + 1) (see Device Descriptions) |
| Function code | 1 | 0x02 | Read Discret Inputs |
| Starting address | 2 | 0x2710 | = 10'000 ( Attention! coil number – 1 ) |
| Quantity of inputs | 2 | 0x0001 | = 1, means read 1 byte (8 bits) |
| Byte count | 1 | 0x01 | = 1 ≙ **N**, means numbers of returned bytes |
| Input status (see Digital Inputs) | **N * 1** | 0x01 | Bit: State of Digital Inputs<br>0: Digital Input 1 (ON = 1, OFF = 0)<br>1: Digital Input 2 (ON = 1, OFF = 0)<br>2…7: not used |

For detailed information about Modbus protocol *Read Discrete Inputs* see:
(http://modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf).

## 2.4 *Device Specific Input Registers (read only)*

With Modbus **Input Registers** you can read some device specific data of the CRP5.

Assisted Modbus command is *Read Input Registers* (0x04).

### 2.4.1 Device Data

CRP5-specific data.

| Register | Name | Type | Description |
|---|---|---|---|
| 30'001 | Serial Number | & | • Serial number of the device (part 1) |
| 30'002 | | & | • Serial number of the device (part 2) |
| 30'003 | Serial Number Probe | & | • Serial number of the CRP5-probe (part 1) |
| 30'004 | | & | • Serial number of the CRP5-probe (part 2) |
| 30'005 | Device Name | | • Device name (part 1 – character 1 & 2) *e.g. "CR"* |
| 30'006 | | | • Device name (part 2 – character 3 & 4) *e.g. "P-"* |
| 30'007 | | | • Device name (part 3 – character 5 & 6) *e.g. "1 "* |
| 30'008 | | | • Device name (part 4 – character 7 & 8) *e.g. "ab"* |
| 30'009 | | | • Device name (part 5 – character 9 & 10) *e.g. "cd"* |
| 30'010 | | | • Device name (part 6 – character 11 & 12) *e.g. "ef"* |
| 30'011 | Differential Pressure Sensor Type | | No. / Differential pressure sensor type:<br>0 ± 10Pa<br>1 ± 25Pa<br>2 ± 50Pa<br>3 ± 100Pa<br>4 ± 250Pa<br>5 ± 500Pa<br>6 ± 50Pa (Second source supplier)<br>7 ± 100Pa (Second source supplier)<br>8 ± 250Pa (Second source supplier) |
| 30'012 | Hardware Version | | • Hardware version |
| 30'013 | Production Date | &! | • Production date (part 1) |
| 30'014 | | &! | • Production date (part 2) |
| 30'015 | Reserved | | • Undefined |
| 30'016 | Reserved | | • Undefined |
| 30'017 | State of Reset | | • Internal use only |
| 30'018 | State of Initialization | | • Internal use only |
| 30'019 | State of Alarms | | Bit / State of Alarm bits:<br>0 Alarm Differential Pressure Hi<br>1 Alarm Differential Pressure Low<br>2 Alarm Humidity Hi<br>3 Alarm Humidity Low<br>4 Alarm Temperature Hi<br>5 Alarm Temperature Low<br>6 Alarm Calculation Hi<br>7 Alarm Calculation Low<br>8 Alarm Analog Input 1 Hi<br>9 Alarm Analog Input 1 Low<br>10 Alarm Analog Input 2 Hi |

| | | | |
|---|---|---|---|
| | | | 11 Alarm Analog Input 2 Low<br>12 Alarm Digital Input 1<br>13 Alarm Digital Input 2<br>14…15 0<br>0 = alarm OFF; 1 = alarm ON |
| 30'020 | State of Other Alarms | | Bit: State of Other Alarm bits<br>0 Internal use only<br>1 Internal use only<br>2…7 0<br>8 Missing Probe Maintenance<br>9 Internal Maintenance<br>10 External Maintenance<br>11 Calibration Back Access<br>12 Calibration Front Access<br>13…15 0<br>0 = alarm OFF; 1 = alarm ON |
| 30'021 | State of Relays and Valve | | Bit: State of Relay/Valve bits<br>0 Relay 1<br>1 Relay 2<br>2 Relay 3<br>3 Relay 4<br>4 Relay 5<br>5 Relay 6<br>6…7 0<br>8 Valve A<br>9 Valve B<br>10 Valve C<br>11 Valve D<br>12…15 0<br>0 = deactivated; 1 = activated |
| 30'022 …<br>30'500 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| & | These are 32-bit values, separated in two succeeding registers (16-bits). How to bring together part 1 and part 2 of the 32-bit value, depends on the *Swap Mode* of the Modbus communication (see Device Settings -> *Modbus Operation Mode* and Selectable Swap Modes for Rotronic Devices) |
| " | Character values separated in succeeding registers, *e.g. "CRP5-1 abcdef"* |
| ! | Represents the Unix Time (UTC) since 1.1.1970 in seconds |

**State of Alarms:** Shows all possible sensor alarms. You have to enable the appropriate alarm bit and alarm level (see "Holding Registers" -> "Alarm Settings" -> "Alarm Bits" resp. "*Sensors*") before an alarm can be activated.

**State of Other Alarms:** Shows all possible "other" alarms, like maintenance modes, calibration access and differential pressure offset limits.

**State of Relays and Valves:** Shows the current state of the relays and valves.

## 2.4.2 Current Values: Float Values

Current values in 32-bit IEEE754 float format of all CRP5 sensors, updated every measurement cycle (see "Holding Registers" -> "Device Settings" -> "Measurement Interval").

**Note!**
These values are changing every measurement cycle, so always read the two corresponding registers in one Modbus command.
The transmitted values are always in the basic unit of the measurement.

| Register | Name | Type | Description |
|---|---|---|---|
| 31'001 | Humidity [%rh] | & | • Current humidity value (part 1) |
| 31'002 | | & | • Current humidity value (part 2) |
| 31'003 | Temperature [°C] | & | • Current temperature value (part 1) |
| 31'004 | | & | • Current temperature value (part 2) |
| 31'005 | Differential Pressure [Pa] | & | • Current differential pressure value (part 1) |
| 31'006 | | & | • Current differential pressure value (part 2) |
| 31'007 | Calculation [basic unit]<br>(Unit depends on calculation) | & | • Current calculation value (part 1) |
| 31'008 | | & | • Current calculation value (part 2) |
| 31'009 | Analog Input 1 [selected unit] | & | • Current analog input 1 value (part 1) |
| 31'010 | | & | • Current analog input 1 value (part 2) |
| 31'011 | Analog Input 2 [selected unit] | & | • Current analog input 2 value (part 1) |
| 31'012 | | & | • Current analog input 2 value (part 2) |
| 31'013 | Digital Input 1 | & | • Current digital input 1 value (part 1) |
| 31'014 | | & | • Current digital input 1 value (part 2) |
| 31'015 | Digital Input 2 | & | • Current digital input 2 value (part 1) |
| 31'016 | | & | • Current digital input 2 value (part 2) |
| 31'017 | Ambient Pressure [hPa] | & | • Current ambient pressure value (part 1) |
| 31'018 | | & | • Current ambient pressure value (part 2) |
| 31'019 | Internal Temperature | & | • Current internal temperature value (part 1) |
| 31'020 | | & | • Current internal temperature value (part 2) |
| 31'021 …<br>31'999 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| & | These are float-values (32-bit IEEE754), separated in two succeeding registers (16-bits).<br>How to bring together part 1 and part 2 of the 32-bit float-value, depends on the *Swap Mode* of the Modbus communication (see Device SettingsDevice Settings -> *Modbus Operation Mode* and Selectable Swap Modes for Rotronic Devices) |

## 2.4.3 Current Values: Integer Values

Current values in 16-bit integer format of all CRP5 sensors, updated every measurement cycle, which means all every second.
The current values are the result of the reduction to 16-bit values of the multiplication of the current 32-bit IEEE754 float values (see Current Values: Float Values) and the corresponding scaling values (see Integer Value Scaling).

**Note!**
The transmitted values are always in the basic unit of the measurement.

| Register | Name | Type | Description |
|---|---|---|---|
| 32'001 | Humidity [%rh] | | • Current humidity value |
| 32'002 | Temperature [°C] | | • Current temperature value |
| 32'003 | Differential Pressure [Pa] | | • Current differential pressure value |
| 32'004 | Calculation [basic unit]<br>(Unit depends on calculation) | | • Current calculation value |

| | | | |
|---|---|---|---|
| 32’005 | Analog Input 1 [selected unit] | | • Current analog input 1 value |
| 32’006 | Analog Input 2 [selected unit] | | • Current analog input 2 value |
| 32’007 | Digital Input 1 | | • Current digital input 1 value |
| 32’008 | Digital Input 2 | | • Current digital input 2 value |
| 32’009 | Ambient Pressure [hPa] | | • Current ambient pressure value |
| 32’010 | Internal Temperature [°C] | | • Current internal temperature value |
| 32’011 … 32’999 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

### 2.4.4 FDA Data

FDA Data fields contain information about firmware update, sensor adjustments and device properties.

| Register | Name | Type | Description |
|---|---|---|---|
| 33’001 | FDA Date FW Update | &! | • FDA date firmware update (part 1) |
| 33’002 | | &! | • FDA date firmware update (part 2) |
| 33’003 | FDA ID FW Update | & | • FDA ID firmware update (part 1) |
| 33’004 | | & | • FDA ID firmware update (part 2) |
| 33’005 | FDA Date DiffP. Adjust (RAG) | &! | • DA date differential pressure adjust RAG (part 1) |
| 33’006 | | &! | • DA date differential pressure adjust RAG (part 2) |
| 33’007 | FDA ID DiffP. Adjust (RAG) | & | • FDA ID differential pressure adjust RAG (part 1) |
| 33’008 | | & | • FDA ID differential pressure adjust RAG (part 2) |
| 33’009 | FDA Date DiffP. Adjust (User) | &! | • FDA date differential pressure adjust user (part 1) |
| 33’010 | | &! | • FDA date differential pressure adjust user (part 2) |
| 33’011 | FDA ID DiffP. Adjust (User) | & | • FDA ID differential pressure adjust user (part 1) |
| 33’012 | | & | • FDA ID differential pressure adjust user (part 2) |
| 33’013 | FDA Date Properties | &! | • FDA date device properties (part 1) |
| 33’014 | | &! | • FDA date device properties (part 2) |
| 33’015 | FDA ID Properties | & | • FDA ID device properties (part 1) |
| 33’016 | | & | • FDA ID device properties (part 2) |
| 33’017 … 33’999 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| & | These are 32-bit values, separated in two succeeding registers (16-bits). How to bring together part 1 and part 2 of the 32-bit value, depends on the *Swap Mode* of the Modbus communication (see Device SettingsDevice Settings -> *Modbus Operation Mode* and Selectable Swap Modes for Rotronic Devices) |
| ! | Represents the Unix Time (UTC) since 1.1.1970 in seconds |

**FDA Date DiffP. Adjust (User):**
**FDA ID DiffP. Adjust (User):**
**FDA Date Properties:**
**FDA ID Properties:**
If you change the device properties or set the offset/gain of the differential pressure over the menu of the CRP5 or Modbus, the date and ID of the FDA-fields *Diffp. Adjust (User)* and *Properties* would be changed.

| | Date | ID |
|---|---|---|
| Change in the CRP5-menu | 0, representing 1.1.1970 | Serial Number of the CRP5 |
| Change over Modbus | 0, representing 1.1.1970 | 0xFFFFFFFF |

### 2.4.5 Example: Read Input Register

#### *2.4.5.1 Read Current Values: Float Value (Registers 31'001 to 31'006)*

**RTU Example:**

| | |
|---|---|
| **Transmit** | 01 04 79 18 00 06 e9 53 |
| **Receive** | 01 04 0c 41 f3 70 a3 41 ba 00 00 3d 80 e9 a2 97 8a |

**TCP Example:**

| | |
|---|---|
| **Transmit** | MBAP 01 04 79 18 00 06 |
| **Receive** | MBAP 01 04 0c 41 f3 70 a3 41 ba 00 00 3d 80 e9 a2 |

| Field | Bytes | Value | Description |
|---|---|---|---|
| MBAP | 7 | MBAP | MBAP header (see Modbus RTU / TCP) |
| Checksum | 2 | CRC | CRC Checksum (see Modbus RTU / TCP) |
| RTU number | 1 | 0x01 | Modbus RTU Address (RS485 Address + 1) (see Device Descriptions) |
| Function code | 1 | 0x04 | Read Discret Inputs |
| Starting address | 2 | 0x7918 | = 31'000 ( Attention! register number – 1 ) |
| Quantity of input registers | 2 | 0x0006 | = 6, means read 6 registers |
| Byte count | 1 | 0x0c | = 12 ≙ **2 * N**, means numbers of returned bytes |
| Input registers (see Current Values: Float Values) | **2 * N** | 0x41f370a3 | = 30.43 %rh Humidity |
| | | 0x41ba0000 | = 23.25 °C Temperature |
| | | 0x3d80e9a2 | = 0.063 Pa Differential Pressure |

For detailed information about Modbus protocol *Read Discrete Inputs* see:
(http://modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf).

## 2.5 *Device Specific Holding Registers*

With Modbus **Holding Registers** you can read and write device specific data to the CRP5.

Assisted Modbus commands are *Read Holding Registers* (0x03), *Write Single Register* (0x06) and *Write Multiple Registers* (0x10).

**Attention!**

Changes to register content in the CRP5 can change the functionality of the CRP5. This may cause the CRP5 to become inoperable.

Changes of register contents should only be made with the necessary knowledge of the Modbus protocol.

### 2.5.1 Value Type

Selection of the possible calculation and analog input modes.

| Register | Name | Type | Description | |
|---|---|---|---|---|
| 40’001 | Calculation Type | ! | No. | Select Calculation |
| | | | 0 | Dew Point |
| | | | 1 | Frost Point |
| | | | 2 | Wet Bulb Temperature |
| | | | 3 | Enthalpy |
| | | | 4 | Vapour Concentration |
| | | | 5 | Specific Humidity |

| | | | |
|---|---|---|---|
| | | | 6 Mixing Ratio<br>7 Saturation Vapour Concentration<br>8 Vapour Partial Pressure<br>9 Vapour Saturation Pressure |
| 40’002 | Analog Input 1 Type | ! | No. / Description of the Analog Input 1 type<br>0 Voltage Input<br>1 Current Input (120Ω) |
| 40’002 | Analog Input 2 Type | ! | No. / Description of the Analog Input 2 type<br>0 Voltage Input<br>1 Current Input (120Ω) |
| 40’003 … 40’099 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |
| ! | Change of these registers needs a restart of the device (see Device Actions) | | |

**Calculation Type:** Select the calculation showed on display (row 4), if selected (see Display Settings -> *Display Row 4*).

**Analog Input x Type:** Select the analog input type, voltage or current (120Ω internal resistance).

## 2.5.2 Value Unit

Select the unit shown on display for the different sensors and calculation values.

| Register | Name | Type | Description |
|---|---|---|---|
| 41'001 | Temperature<br>*For Calculation:*<br>Dew Point, Frost Point, Wet Bulb Temperature | ! | No. / Temperature Units<br>0 / °C<br>1 / °F |
| 41'002 | Differential Pressure | ! | No. / Differential Pressure Units<br>0 / Pa<br>1 / $inH_2O$<br>2 / mpsi<br>3 / mbar<br>4 / mmHg<br>5 / $mmH_2O$<br>6 / Torr<br>7 / $g/cm^2$ |
| 40'003 | Ambient Pressure<br>*For Calculation:*<br>Vapour Partial Pressure Vapour Saturation Pressure | ! | No. / Ambient Pressure Unit<br>0 / hPa<br>1 / inHg<br>2 / psi |
| 41'004 | *For Calculation:*<br>Enthalpy | ! | No. / Enthalpy Units<br>0 / kJ/kg<br>1 / BTI/lb |
| 41'005 | *For Calculation:*<br>Vapour Concentration<br>Saturation Vapour Concentration | ! | No. / Concentration Units<br>0 / $g/m^3$<br>1 / $g/ft^3$ |
| 41'006 | *For Calculation:*<br>Specific Humidity<br>Mixing Ratio | ! | No. / Weight Units<br>0 / g/kg<br>1 / gr/lb |
| 41'007 | Reserved | | • undefined |
| 41'008 | Reserved | | • undefined |
| 41'009 | Humidity | !* | • For humidity the unit is always **%rh** |
| 41'010 | Analog Input 1 Unit | !* | • Characters 1 & 2 of the unit of the analog input 1 |
| 41'011 | | !* | • Characters 3 & 4 of the unit of the analog input 1 |
| 41'012 | Analog Input 2 Unit | !* | • Characters 1 & 2 of the unit of the analog input 2 |
| 41'013 | | !* | • Characters 3 & 4 of the unit of the analog input 2 |
| 41'014 … 41'099 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| ! | Change of these registers needs a restart of the device (see Device Actions) |
| * | It is not possible to verify the value, written to this register! |

**Humidity:** It is not possible to change the unit for humidity. It is always set to **%rh**.

**Analog Input x Unit:** Select the characters showed on display (row 4) for analog input 1/2, e.g. "ppm".

### 2.5.3 Integer Value Scaling

Selection of the scaling factor of the current values for data conversion float to integer. Scaling factor should be between 1 and 1000.

| Register | Name | Type | Description |
|---|---|---|---|
| 42'001 | Humidity | ! | • Scaling factor for the humidity value |
| 42'002 | Temperature | ! | • Scaling factor for the temperature value |
| 42'003 | Differential Pressure | ! | • Scaling factor for the differential pressure value |
| 42'004 | Calculation | ! | • Scaling factor for the calculation value |
| 42'005 | Analog Input 1 | ! | • Scaling factor for the analog input 1 value |
| 42'006 | Analog Input 2 | ! | • Scaling factor for the analog input 1 value |
| 42'007 | Digital Input 1 | ! | • Scaling factor for the digital input 1 value |
| 42'008 | Digital Input 2 | ! | • Scaling factor for the digital input 1 value |
| 42'009 | Ambient Pressure | ! | • Scaling factor for the ambient pressure value |
| 42'010 | Internal Temperature | ! | • Scaling factor for the internal temperature value |
| 42'011 … 43'999 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| ! | Change of these registers needs a restart of the device (see Device Actions) |

### 2.5.4 Reference Value Settings

Settings of reference values for adjustments of differential pressure, humidity and temperature (see Sensor Actions).
Values in these registers are only valuable until the next restart of the device!

| Register | Name | Type | Description |
|---|---|---|---|
| 44'001 | Humidity | ?&* | • Reference value humidity (part 1) |
| 44'002 | | ?&* | • Reference value humidity (part 2) |
| 44'003 | Temperature | ?&* | • Reference value temperature (part 1) |
| 44'004 | | ?&* | • Reference value temperature (part 2) |
| 44'005 | Differential Pressure | ?&* | • Reference value differential pressure (part 1) |
| 44'006 | | ?&* | • Reference value differential pressure (part 2) |
| 44'007 … 44'099 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| ? | After reset of the device, the *Reference Values* are always set to 0.0 |
| & | These are float-values (32-bit IEEE754), separated in two succeeding registers (16-bits).<br>How to bring together part 1 and part 2 of the 32-bit float-value, depends on the *Swap Mode* of the Modbus communication (see Device Settings -> *Modbus Operation Mode* and Selectable Swap Modes for Rotronic Devices) |
| * | It is not possible to verify the value, written to this register! |

### 2.5.5 Device Settings

Device specific settings.

| Register | Name | Type | Description |
|---|---|---|---|
| 44'101 | Device Bits | ! | Bit: Description of the Device bits<br>0: Trend Enable (OFF/ON)<br>1…15: Reserved |
| 44'102 | Measurement Interval | | • Fixed to 1 second. Cannot be changed |
| 44'103 | Logging Interval | | • Not yet implemented, undefined |

| | | | |
|---|---|---|---|
| 44'104 | Differential Pressure Filter | ! | • Filter for the Differential Pressure<br>• 0 <= filter <= 10 |
| 44'105 | Device Protection | ! | No. / Description of the Device Protection<br>**171** / Device Write Protection ON<br>x / Device Write Protection OFF |
| | **Attention!** After writing this command with parameter **171**, it's not possible to overwrite the content of the FLASH until executing the same command without parameter **171** | | |
| 40'106 | Calculation Select | ! | No. / Select Calculation<br>0 Dew Point<br>1 Frost Point<br>2 Wet Bulb Temperature<br>3 Enthalpy<br>4 Vapour Concentration<br>5 Specific Humidity<br>6 Mixing Ratio<br>7 Saturation Vapour Concentration<br>8 Vapour Partial Pressure<br>9 Vapour Saturation Pressure |
| | The same selection as in "Holding Registers" -> "Value Type" -> "Calculation Type" | | |
| 44'107 | RS485 Address | ! | • RS485 address<br>• 0 <= addr <= 63<br>• **Attention!** Modbus address = RS485 address + 1 |
| 44'108 | Modbus Operation Mode | ! | • Modbus Operation Mode for 32-bit float and integer values |
| 44'109 | Valve Bits | | • Not yet implemented, undefined |
| 44'110 | Offset Adjust Repeat Time | !&* | • Repeat time for the automatic zero point adjustment of differential pressure, in minutes (part 1) |
| 44'111 | | !&* | • Repeat time for the automatic zero point adjustment of differential pressure, in minutes (part 2) |
| 44'112 | Switch Bits | | • Not yet implemented, undefined |
| 44'113 | Menu Protection | ! | No. / Menu Protection<br>0 Menu protection OFF<br>1 Menu protection ON |
| 44'114 … 44'199 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| ! | Change of these registers needs a restart of the device (see Device Actions) |
| & | These are 32-bit values, separated in two succeeding registers (16-bits). How to bring together part 1 and part 2 of the 32-bit value, depends on the *Swap Mode* of the Modbus communication (see Device Settings -> *Modbus Operation Mode* and Selectable Swap Modes for Rotronic Devices) |
| * | It is not possible to verify the value, written to this register! |

**Measurement Interval:** It is not possible to change the measurement interval. It is fixed to 1 second.

**Logging Interval:** Currently the logging function is not used. The address is reserved for futures implementation of this function.

**Differential Pressure Filter:** Low pass filter of the differential pressure sensor data. Possible values are between 0 and 10. The filter number x represents the average calculation of the last actual x measurements.

0 no average, min. low pass filter function, pressure changes will be shown best.

10 max. average of the last 10 measurements of the last 10 seconds, max. low pass filter function, short time pressure changes will damped strongly.

**Device Protection:** If the device protection is set to 171, it is not possible anymore to write into the internal FLASH! You have to write a value unequal 171 to this register to suspend the blockade.
**Be careful to use this command over Modbus! If writing Modbus commands to a device with *Device Protection ON*, you don't get an error back, because the Modbus writing process was successful - only writing to FLASH was not possible.**

**RS485 Address:** The RS485 address is used in conjunction with a RS485 network. Each network address should be unique and within the values of 1 to 63.

**Note!**
The default factory RS-485 address of the CRP5 is 0. On the menu *Device Information* of the CRP5, you can see the RS485 address of the device.

**Attention!**
The Modbus address for Modbus RTU is always the RS485 address + 1.

**Modbus Operation Mode:** Defines the order of the bytes and registers of 32-bit and float-values (see Selectable Swap Modes for Rotronic DevicesSelectable Swap Modes for Rotronic Devices).

**Offset Adjust Repeat Time:** Repeat time for the automatic zero point adjustment of differential pressure in minutes.

**Note!**
Repeat time is minimal 1 minute, maximal $2^{32}$ minutes.

**Menu Protection:** If set, it is not possible to select the menus of the CRP5. Only the first menu *Device Informations* of the CRP5 is reachable.

## 2.5.6 Device Descriptions

Name for the different parts of the device, which is clearly related with its function. For *Digital Input 1/2 Low/High* a text which describes the meaning of the input states *Low* and *High*.

| Register | Name | Type | Description |
|---|---|---|---|
| 44'201 | Device | "!* | • Description device (part 1 – char. 1 & 2) |
| 44'202 | | "!* | • Description device (part 2 – char. 3 & 4) |
| 44'203 | | "!* | • Description device (part 3 – char. 5 & 6) |
| 44'204 | | "!* | • Description device (part 4 – char. 7 & 8) |
| 44'205 | | "!* | • Description device (part 5 – char. 9 & 10) |
| 44'206 | | "!* | • Description device (part 6 – char. 11 & 12) |
| 44'207 | Differential Pressure | "!* | • Desc. diff. pressure sensor (part 1 – char. 1 & 2) |
| 44'208 | | "!* | • Desc. diff. pressure sensor (part 2 – char. 3 & 4) |
| 44'209 | | "!* | • Desc. diff. pressure sensor (part 3 – char. 5 & 6) |
| 44'210 | | "!* | • Desc. diff. pressure sensor (part 4 – char. 7 & 8) |
| 44'211 | | "!* | • Desc. diff. pressure sensor (part 5 – char. 9 & 10) |
| 44'212 | | "!* | • Desc. diff. pressure sensor (part 6 – char. 11 & 12) |
| 44'213 | Relay 1 | "!* | • Description relay 1 (part 1 – char. 1 & 2) |
| 44'214 | | "!* | • Description relay 1 (part 2 – char. 3 & 4) |
| 44'215 | | "!* | • Description relay 1 (part 3 – char. 5 & 6) |
| 44'216 | | "!* | • Description relay 1 (part 4 – char. 7 & 8) |
| 44'217 | | "!* | • Description relay 1 (part 5 – char. 9 & 10) |
| 44'218 | | "!* | • Description relay 1 (part 6 – char. 11 & 12) |
| 44'219 | Relay 2 | "!* | • Description relay 2 (part 1 – char. 1 & 2) |
| 44'220 | | "!* | • Description relay 2 (part 2 – char. 3 & 4) |

| | | | |
|---|---|---|---|
| 44’221 | | “!* | • Description relay 2 (part 3 – char. 5 & 6) |
| 44’222 | | “!* | • Description relay 2 (part 4 – char. 7 & 8) |
| 44’223 | | “!* | • Description relay 2 (part 5 – char. 9 & 10) |
| 44’224 | | “!* | • Description relay 2 (part 6 – char. 11 & 12) |
| 44’225 | Relay 3 | “!* | • Description relay 3 (part 1 – char. 1 & 2) |
| 44’226 | | “!* | • Description relay 3 (part 2 – char. 3 & 4) |
| 44’227 | | “!* | • Description relay 3 (part 3 – char. 5 & 6) |
| 44’228 | | “!* | • Description relay 3 (part 4 – char. 7 & 8) |
| 44’229 | | “!* | • Description relay 3 (part 5 – char. 9 & 10) |
| 44’230 | | “!* | • Description relay 3 (part 6 – char. 11 & 12) |
| 44’231 | Relay 4 | “!* | • Description relay 4 (part 1 – char. 1 & 2) |
| 44’232 | | “!* | • Description relay 4 (part 2 – char. 3 & 4) |
| 44’233 | | “!* | • Description relay 4 (part 3 – char. 5 & 6) |
| 44’234 | | “!* | • Description relay 4 (part 4 – char. 7 & 8) |
| 44’235 | | “!* | • Description relay 4 (part 5 – char. 9 & 10) |
| 44’236 | | “!* | • Description relay 4 (part 6 – char. 11 & 12) |
| 44’237 | Relay 5 | “!* | • Description relay 5 (part 1 – char. 1 & 2) |
| 44’238 | | “!* | • Description relay 5 (part 2 – char. 3 & 4) |
| 44’239 | | “!* | • Description relay 5 (part 3 – char. 5 & 6) |
| 44’240 | | “!* | • Description relay 5 (part 4 – char. 7 & 8) |
| 44’241 | | “!* | • Description relay 5 (part 5 – char. 9 & 10) |
| 44’242 | | “!* | • Description relay 5 (part 6 – char. 11 & 12) |
| 44’243 | Relay 6 | “!* | • Description relay 6 (part 1 – char. 1 & 2) |
| 44’244 | | “!* | • Description relay 6 (part 2 – char. 3 & 4) |
| 44’245 | | “!* | • Description relay 6 (part 3 – char. 5 & 6) |
| 44’246 | | “!* | • Description relay 6 (part 4 – char. 7 & 8) |
| 44’247 | | “!* | • Description relay 6 (part 5 – char. 9 & 10) |
| 44’248 | | “!* | • Description relay 6 (part 6 – char. 11 & 12) |
| 44’249 | CRP5 Probe | “!* | • Description CRP5 probe (part 1 – char. 1 & 2) |
| 44’250 | | “!* | • Description CRP5 probe (part 2 – char. 3 & 4) |
| 44’251 | | “!* | • Description CRP5 probe (part 3 – char. 5 & 6) |
| 44’252 | | “!* | • Description CRP5 probe (part 4 – char. 7 & 8) |
| 44’253 | | “!* | • Description CRP5 probe (part 5 – char. 9 & 10) |
| 44’254 | | “!* | • Description CRP5 probe (part 6 – char. 11 & 12) |
| 44’255 | Analog Input 1 | “!* | • Description analog input 1 (part 1 – char. 1 & 2) |
| 44’256 | | “!* | • Description analog input 1 (part 2 – char. 3 & 4) |
| 44’257 | | “!* | • Description analog input 1 (part 3 – char. 5 & 6) |
| 44’258 | | “!* | • Description analog input 1 (part 4 – char. 7 & 8) |
| 44’259 | | “!* | • Description analog input 1 (part 5 – char. 9 & 10) |
| 44’260 | | “!* | • Description analog input 1 (part 6 – char. 11 & 12) |
| 44’261 | Analog Input 2 | “!* | • Description analog input 2 (part 1 – char. 1 & 2) |
| 44’262 | | “!* | • Description analog input 2 (part 2 – char. 3 & 4) |
| 44’263 | | “!* | • Description analog input 2 (part 3 – char. 5 & 6) |
| 44’264 | | “!* | • Description analog input 2 (part 4 – char. 7 & 8) |
| 44’265 | | “!* | • Description analog input 2 (part 5 – char. 9 & 10) |
| 44’266 | | “!* | • Description analog input 2 (part 6 – char. 11 & 12) |
| 44’267 | Digital Input 1 | “!* | • Description digital input 1 (part 1 – char. 1 & 2) |
| 44’268 | | “!* | • Description digital input 1 (part 2 – char. 3 & 4) |
| 44’269 | | “!* | • Description digital input 1 (part 3 – char. 5 & 6) |
| 44’270 | | “!* | • Description digital input 1 (part 4 – char. 7 & 8) |

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| | | | |
|---|---|---|---|
| 44’271 | | “!* | • Description digital input 1 (part 5 – char. 9 & 10) |
| 44’272 | | “!* | • Description digital input 1 (part 6 – char. 11 & 12) |
| 44’273 | Digital Input 2 | “!* | • Description digital input 2 (part 1 – char. 1 & 2) |
| 44’274 | | “!* | • Description digital input 2 (part 2 – char. 3 & 4) |
| 44’275 | | “!* | • Description digital input 2 (part 3 – char. 5 & 6) |
| 44’276 | | “!* | • Description digital input 2 (part 4 – char. 7 & 8) |
| 44’277 | | “!* | • Description digital input 2 (part 5 – char. 9 & 10) |
| 44’278 | | “!* | • Description digital input 2 (part 6 – char. 11 & 12) |
| 44’279 | Ambient Pressure | “!* | • Description ambient pressure (part 1 – char. 1 & 2) |
| 44’280 | | “!* | • Description ambient pressure (part 2 – char. 3 & 4) |
| 44’281 | | “!* | • Description ambient pressure (part 3 – char. 5 & 6) |
| 44’282 | | “!* | • Description ambient pressure (part 4 – char. 7 & 8) |
| 44’283 | | “!* | • Description ambient pressure (part 5 – char. 9 & 10) |
| 44’284 | | “!* | • Description ambient pressure (part 6 – char. 11 & 12) |
| 44’285 | Digital Input 1 Text Low | ”!* | • Description dig. input 1 text low (part 1 – char. 1 & 2) |
| 44’286 | | “!* | • Description dig. input 1 text low (part 2 – char. 3 & 4) |
| 44’287 | | “!* | • Description dig. input 1 text low (part 3 – char. 5 & 6) |
| 44’288 | | “!* | • Description dig. input 1 text low (part 4 – char. 7 & 8) |
| 44’289 | | “!* | • Description dig. input 1 text low (part 5 – char. 9 & 10) |
| 44’290 | | “!* | • Descript. dig. input 1 text low (part 6 – char. 11 & 12) |
| 44’291 | Digital Input 1 Text High | “!* | • Description dig. input 1 text high (part 1 – char. 1 & 2) |
| 44’292 | | “!* | • Description dig. input 1 text high (part 2 – char. 3 & 4) |
| 44’293 | | “!* | • Description dig. input 1 text high (part 3 – char. 5 & 6) |
| 44’294 | | “!* | • Description dig. input 1 text high (part 4 – char. 7 & 8) |
| 44’295 | | “!* | • Descript. dig. input 1 text high (part 5 – char. 9 & 10) |
| 44’296 | | “!* | • Descript. dig. input 1 text high (part 6 – char. 11 & 12) |
| 44’297 | Digital Input 2 Text Low | “!* | • Description dig. input 2 text low (part 1 – char. 1 & 2 |
| 44’298 | | “!* | • Description dig. input 2 text low (part 2 – char. 3 & 4) |
| 44’299 | | “!* | • Description dig. input 2 text low (part 3 – char. 5 & 6) |
| 44’300 | | “!* | • Description dig. input 2 text low (part 4 – char. 7 & 8) |
| 44’301 | | “!* | • Description dig. input 2 text low (part 5 – char. 9 & 10) |
| 44’302 | | “!* | • Descript. dig. input 2 text low (part 6 – char. 11 & 12) |
| 44’304 | Digital Input 1 Text High | “!* | • Description dig. input 2 text high (part 1 – char. 1 & 2) |
| 44’305 | | “!* | • Description dig. input 2 text high (part 2 – char. 3 & 4) |
| 44’306 | | “!* | • Description dig. input 2 text high (part 3 – char. 5 & 6) |
| 44’307 | | “!* | • Description dig. input 2 text high (part 4 – char. 7 & 8) |
| 44’308 | | “!* | • Descript. dig. input 2 text high (part 5 – char. 9 & 10) |
| 44’309 | | “!* | • Descript. dig. input 2 text high (part 6 – char. 11 & 12) |
| 44’310 … 44’399 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| “ | Character values separated in succeeding registers |
| ! | Change of these registers needs a restart of the device (see Device Actions) |
| * | It is not possible to verify the value, written to this register! |

## 2.5.7 Fix Value Settings

Fixed values are used to simulate an output value for testing purposes. To activate the *Fix Values*, you have to set the corresponding *Fix Value Bit* to *ON*. The fixed values must be within the following limits:

- Differential Pressure: ±120% of the measuring range (for instance 300 Pa for a 250 Pa sensor)
- Humidity: 0 … 100%
- Temperature: -100 … 200

- Calculation: -9999 … 9999
- Analog Input: -9999 … 9999

| Register | Name | Flags | Description |
|---|---|---|---|
| 44'401 | Fix Value Bits | ! | Bit / Description of the Fix Value bits:<br>0 Differential Pressure<br>1 Humidity<br>2 Temperature<br>3 Analog Input 1<br>4 Analog Input 2<br>5 Digital Input 1<br>6 Digital Input 2<br>7 Calculation<br>8…15 Reserved<br>0 = fix value is OFF, 1 = fix value is ON |
| 44'402 | Differential Pressure | !&* | • Fix value differential pressure (part 1) |
| 44'403 | | !&* | • Fix value differential pressure (part 2) |
| 44'404 | Humidity | !&* | • Fix value humidity (part 1) |
| 44'405 | | !&* | • Fix value humidity (part 2) |
| 44'406 | Temperature | !&* | • Fix value temperature (part 1) |
| 44'407 | | !&* | • Fix value temperature (part 2) |
| 44'408 | Analog Input 1 | !&* | • Fix value analog Input 1 (part 1) |
| 44'409 | | !&* | • Fix value analog Input 1 (part 2) |
| 44'410 | Analog Input 2 | !&* | • Fix value analog Input 2 (part 1) |
| 44'411 | | !&* | • Fix value analog Input 2 (part 2) |
| 44'412 | Digital Input 1 | ! | • Fix value digital Input 1 |
| 44'413 | Digital Input 2 | ! | • Fix value digital Input 2 |
| 44'414 | Calculation | !&* | • Fix value calculation (part 1) |
| 44'415 | | !&* | • Fix value calculation (part 2) |
| 44'416 …<br>44'499 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| ! | Change of these registers needs a restart of the device (see Device Actions) |
| & | These are float-values (32-bit IEEE754), separated in two succeeding registers (16-bits).<br>How to bring together part 1 and part 2 of the 32-bit float-value, depends on the *Swap Mode* of the Modbus communication (see Device Settings -> *Modbus Operation Mode* and Selectable Swap Modes for Rotronic Devices) |
| * | It is not possible to verify the value, written to this register! |

## 2.5.8 Analog Output Settings

The CRP5 can provide up to four analog output signals. The analog signal type can be set individually to every analog output.

| Register | Name | Flags | Description |
|---|---|---|---|
| 44'501 | Source for Analog Output 1 | ! | No. / Select Source:<br>0 Unused<br>1 Differential Pressure<br>2 Humidity<br>3 Temperature<br>4 Analog Input 1<br>5 Analog Input 2<br>6 Digital Input 1 |

| | | | |
|---|---|---|---|
| | | | 7 Digital Input 2 |
| 44'502 | Output Range Analog Output 1 | ! | No. Select Output Range<br>0 Output Range 0…1V<br>1 Output Range 0…5V<br>2 Output Range 0…10V<br>3 Output Range 0…20mA<br>4 Output Range 4…20mA |
| 44'503 | Scale Low Analog Output 1 | !* | • Output value scale low |
| 44'504 | Scale High Analog Output 1 | !* | • Output value scale high |
| 44'505 | Source for Analog Output 2 | ! | No. Select Source<br>- Same as for Analog Output 1 |
| 44'506 | Output Range Analog Output 2 | ! | No. Select Output Range<br>- Same as for Analog Output 1 |
| 44'507 | Scale Low Analog Output 2 | !* | • Output value scale low |
| 44'508 | Scale High Analog Output 2 | !* | • Output value scale high |
| 44'509 | Source for Analog Output 3 | ! | No. Select Source<br>- Same as for Analog Output 1 |
| 44'510 | Output Range Analog Output 3 | ! | No. Select Output Range<br>- Same as for Analog Output 1 |
| 44'511 | Scale Low Analog Output 3 | !* | • Output value scale low |
| 44'512 | Scale High Analog Output 3 | !* | • Output value scale high |
| 44'513 | Source for Analog Output 4 | ! | No. Select Source<br>- Same as for Analog Output 1 |
| 44'514 | Output Range Analog Output 4 | ! | No. Select Output Range<br>- Same as for Analog Output 1 |
| 44'515 | Scale Low Analog Output 4 | !* | • Output value scale low |
| 44'516 | Scale High Analog Output 4 | !* | • Output value scale high |
| 44'517 | Load Value Analog Output 1 | ! | • Load value used at the analog output 1, used only by selected output range 3 and 4 (0/4 to 20 [mA])<br>• 0 [Ω] <= Load <= 500 [Ω] |
| 44'518 | Load Value Analog Output 2 | ! | • Load value used at the analog output 2, used only by selected output range 3 and 4 (0/4 to 20 [mA])<br>• 0 [Ω] <= Load <= 500 [Ω] |
| 44'519 | Load Value Analog Output 3 | ! | • Load value used at the analog output 3, used only by selected output range 3 and 4 (0/4 to 20 [mA])<br>• 0 [Ω] <= Load <= 500 [Ω] |
| 44'520 | Load Value Analog Output 4 | ! | • Load value used at the analog output 4, used only by selected output range 3 and 4 (0/4 to 20 [mA])<br>• 0 [Ω] <= Load <= 500 [Ω] |
| 44'521 … 44'599 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| ! | Change of these registers needs a restart of the device (see Device Actions) |
| * | It is not possible to verify the value, written to this register! |

**Output Range Analog Output x**: Select a possible analog output range (Voltage or Current).

**Scale Low/High**: Enter the numerical values corresponding to the analog signal minimum and maximum output values (Output Range Analog Output x). **The Scale Low/High Values must be between -32'768 to 32'767 in steps of 1**.

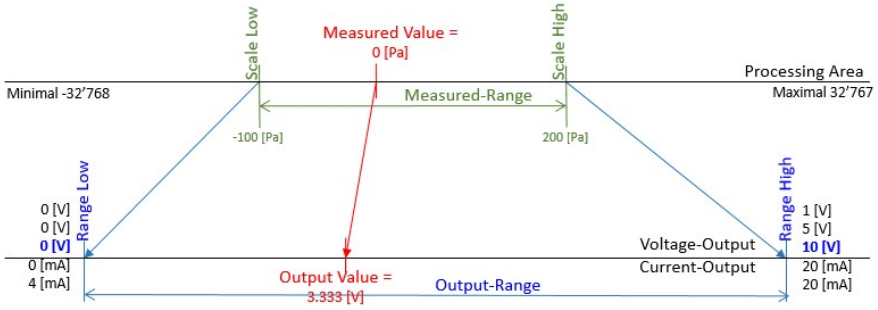
**Example with fixed Output Range of 0…10 [V]:**
With a changed input scale, the input and the fixed output ranges can be adapted to the customer's needs.

| | Input Scale | | Fixed Output Range | |
|---|---|---|---|---|
| Analog Output | Scale Low | -32'768 to +32767 | Range Low | 0 [V] |
| | Scale High | -32'768 to +32767 | Range High | 10 [V] |

The input value in the range of **-100** to **+200 [Pa]** will be scaled to the output value in the range of **0** to **10 [V]**. This means that a measured value of **0 [Pa]** is shown on the analog output as a value of **3.333 [V]**.

**Calculation:**

$$\text{Displayed Value} = \frac{(\text{ADC Value} - \text{Range Low}) * (\text{Scale High} - \text{Scale Low})}{\text{Range High} - \text{Range Low}} + \text{Scale Low}$$




## 2.5.9 Display Settings

Adjustments to the CRP5 display concerning appearance and content can be configured.

| Register | Name | Flags | Description |
|---|---|---|---|
| 44'601 | Display Bits | ! | • Not yet used, undefined |
| 44'602 | Display Row 1 | ! | No. / Select Display Row 1<br>0 Differential Pressure<br>1 Humidity<br>2 Temperature |
| 44'603 | Display Row 2 | ! | No. / Select Display Row 2<br>- Same as for Display Row 1 |
| 44'604 | Display Row 3 | ! | No. / Select Display Row 3<br>- Same as for Display Row 1 |
| 44'605 | Display Row 4 | ! | No. / Select Display Row 4<br>0 None<br>1 Calculation<br>2 Analog Input 1<br>2 Analog Input 2 |
| 44'606 | Display Row 5 | ! | No. / Select Display Row 5<br>0 None<br>1 Digital Input 1<br>2 Digital Input 2<br>2 Ambient Pressure |
| 44'607 | Display Row 6 | ! | No. / Select Display Row 6<br>- Same as for Display Row 5 |
| 44'608 | Reserved | | • Undefined |
| 44'609 | Reserved | | • Undefined |

| | | | |
|---|---|---|---|
| 44’610 | Pixel Color | !* | • Pixel Color (see Example Colors) |
| 44’611 | Pixel Color Alarm | !* | • Pixel Color Alarm (see Example Colors) |
| 44’612 | Reserved | | • Undefined |
| 44’613 | Reserved | | • Undefined |
| 44’614 | Background Color | !* | • Background Color (see Example Colors) |
| 44’615 | Brightness | ! | No. / Select Brightness Value<br>0 Display Brightness 100%<br>1 Display Brightness 90%<br>2 Display Brightness 80%<br>3 Display Brightness 70%<br>4 Display Brightness 60%<br>5 Display Brightness 50%<br>6 Display Brightness 40%<br>7 Display Brightness 30%<br>8 Display Brightness 20% |
| 44’616 … 44’699 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| ! | Change of these registers needs a restart of the device (see Device Actions) |
| * | It is not possible to verify the value, written to this register! |
| Example Colors | Color Bits: 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0<br>Red Green Blue<br>e.g. Red: 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 |

## 2.5.10 Alarm Settings

For most sensors, it is possible to set alarm values to *Low*, *High* and *Hysteresis*. Values of the selected sensor that are below the *Low Alarm* value or above the *High Alarm* value will trigger an alarm. The value specified for the alarm function *Hysteresis* is used for both the *Low* and the *High Alarm*.
To activate the alarm, you have to set the corresponding Alarm Bit to *ON*.
Be sure to select alarm values inside the operating range of the sensors.

| Register | Name | Flags | Description |
|---|---|---|---|
| 44’701 | Alarm Bits | ! | Bit / Description of the Alarm bits<br>0 Differential Pressure<br>1 Humidity<br>2 Temperature<br>3 Calculation<br>4 Analog Input 1<br>5 Analog Input 2<br>6 Digital Input 1<br>7 Digital Input 2<br>8…15 Reserved<br>0 = Alarm Value is OFF, 1 = Alarm Value is ON |
| 44’702 | Differential Pressure Low | !&* | • Alarm value differential pressure low (part 1) |
| 44’703 | | !&* | • Alarm value differential pressure low (part 2) |
| 44’704 | Differential Pressure High | !&* | • Alarm value differential pressure high (part 1) |
| 44’705 | | !&* | • Alarm value differential pressure high (part 2) |
| 44’706 | Differential Pressure Hysteresis | !&* | • Alarm value differential pressure hysteresis (part 1) |
| 44’707 | | !&* | • Alarm value differential pressure hysteresis (part 2) |
| 44’708 | Humidity Low | !&* | • Alarm value humidity low (part 1) |
| 44’709 | | !&* | • Alarm value humidity low (part 2) |

| | | | |
|---|---|---|---|
| 44’710 | Humidity High | !&* | • Alarm value humidity high (part 1) |
| 44’711 | | !&* | • Alarm value humidity high (part 2) |
| 44’712 | Humidity Hysteresis | !&* | • Alarm value humidity hysteresis (part 1) |
| 44’713 | | !&* | • Alarm value humidity hysteresis (part 2) |
| 44’714 | Temperature Low | !&* | • Alarm value temperature low (part 1) |
| 44’715 | | !&* | • Alarm value temperature low (part 2) |
| 44’716 | Temperature High | !&* | • Alarm value temperature high (part 1) |
| 44’717 | | !&* | • Alarm value temperature high (part 2) |
| 44’718 | Temperature Hysteresis | !&* | • Alarm value temperature hysteresis (part 1) |
| 44’719 | | !&* | • Alarm value temperature hysteresis (part 2) |
| 44’720 | Calculation Low | !&* | • Alarm value calculation low (part 1) |
| 44’721 | | !&* | • Alarm value calculation low (part 2) |
| 44’722 | Calculation High | !&* | • Alarm value calculation high (part 1) |
| 44’723 | | !&* | • Alarm value calculation high (part 2) |
| 44’724 | Calculation Hysteresis | !&* | • Alarm value calculation hysteresis (part 1) |
| 44’725 | | !&* | • Alarm value calculation hysteresis (part 2) |
| 44’726 | Analog Input 1 Low | !&* | • Alarm value analog input 1 low (part 1) |
| 44’727 | | !&* | • Alarm value analog input 1 low (part 2) |
| 44’728 | Analog Input 1 High | !&* | • Alarm value analog input 1 high (part 1) |
| 44’729 | | !&* | • Alarm value analog input 1 high (part 2) |
| 44’730 | Analog Input 1 Hysteresis | !&* | • Alarm value analog input 1 hysteresis (part 1) |
| 44’731 | | !&* | • Alarm value analog input 1 hysteresis (part 2) |
| 44’732 | Analog Input 2 Low | !&* | • Alarm value analog input 2 low (part 1) |
| 44’733 | | !&* | • Alarm value analog input 2 low (part 2) |
| 44’734 | Analog Input 2 High | !&* | • Alarm value analog input 2 high (part 1) |
| 44’735 | | !&* | • Alarm value analog input 2 high (part 2) |
| 44’736 | Analog Input 2 Hysteresis | !&* | • Alarm value analog input 2 hysteresis (part 1) |
| 44’737 | | !&* | • Alarm value analog input 2 hysteresis (part 2) |
| 44’738 | Digital Input 1 | ! | • Alarm Value Digital Input 1 |
| 44’739 | Digital Input 2 | ! | • Alarm Value Digital Input 2 |
| 44’740 … 44’799 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| ! | Change of these registers needs a restart of the device (see Device Actions) |
| & | These are float-values (32-bit IEEE754), separated in two succeeding registers (16-bits).<br>How to bring together part 1 and part 2 of the 32-bit float-value, depends on the *Swap Mode* of the Modbus communication (see Device Settings -> *Modbus Operation Mode* and Selectable Swap Modes for Rotronic Devices) |
| * | It is not possible to verify the value, written to this register! |

## 2.5.11 Relay Settings

Settings of Relays for all Sensors.
**IMPORTANT**: In order to make use of the CRP5 relay outputs, you must first enable the alarm function for each of the parameters that you want to monitor and also define out-of-limit values.

| Register | Name | Flags | Description |
|---|---|---|---|
| 44'801 | Relay 1: Alarm Source | ! | No. / Select Alarm Source<br>0 Alarm: Off<br>1 Alarm: Differential Pressure Low<br>2 Alarm: Differential Pressure High<br>3 Alarm: Humidity Low<br>4 Alarm: Humidity High<br>5 Alarm: Temperature Low<br>6 Alarm: Temperature High<br>7 Alarm: Calculation Low<br>8 Alarm: Calculation High<br>9 Alarm: Analog Input 1 Low<br>10 Alarm: Analog Input 1 High<br>11 Alarm: Analog Input 2 Low<br>12 Alarm: Analog Input 2 High<br>13 Alarm: Digital Input 1 Low<br>14 Alarm: Digital Input 1 High<br>15 Alarm: Digital Input 2 Low<br>16 Alarm: Digital Input 2 High |
| 44'802 | Relay 1: Alarm Off after… | ! | Bit / Select Alarm Off<br>0 Relay 1 Off when Alarm ends<br>1 Relay 1 Off after Timeout<br>2..15 Reserved |
| | **Attention!** If no bit is set, the relay stays energized until you de-energize it manually! | | |
| 44'803 | Relay 1: On Delay for Relay 1 | !* | • Switch on delay for relay 1 in seconds |
| 44'804 | Relay 1: Off Timeout | !* | • Maximal alarm time for relay 1 in seconds |
| 44'805 | Relay 2: Alarm Source | ! | No. / Select Alarm Source<br>- Same as for Relay 1 |
| 44'806 | Relay 2: Alarm Off after… | ! | Bit / Select Alarm Off<br>- Same as for Relay 1 |
| 44'807 | Relay 2: On Delay | !* | • Switch on delay for relay 2 in seconds |
| 44'808 | Relay 2: Off Timeout | !* | • Maximal alarm time for relay 2 in seconds |
| 44'809 | Relay 3: Alarm Source | ! | No. / Select Alarm Source<br>- Same as for Relay 1 |
| 44'810 | Relay 3: Alarm Off after… | ! | Bit / Select Alarm Off<br>- Same as for Relay 1 |
| 44'811 | Relay 3: On Delay | !* | • Switch on delay for relay 3 in seconds |
| 44'812 | Relay 3: Off Timeout | !* | • Maximal alarm time for relay 3 in seconds |
| 44'813 | Relay 4: Alarm Source | ! | No. / Select Alarm Source<br>- Same as for Relay 1 |
| 44'814 | Relay 4: Alarm Off after… | ! | Bit / Select Alarm Off<br>- Same as for Relay 1 |
| 44'815 | Relay 4: On Delay | !* | • Switch on delay for relay 4 in seconds |
| 44'816 | Relay 4: Off Timeout | !* | • Maximal alarm time for relay 4 in seconds |

| | | | |
|---|---|---|---|
| 44'8017 | Relay 5: Alarm Source | ! | No. / Select Alarm Source<br>- / Same as for Relay 1 |
| 44'818 | Relay 5: Alarm Off after… | ! | Bit / Select Alarm Off<br>- / Same as for Relay 1 |
| 44'819 | Relay 5: On Delay | !* | • Switch on delay for relay 5 in seconds |
| 44'820 | Relay 5: Off Timeout | !* | • Maximal alarm time for relay 5 in seconds |
| 44'821 | Relay 6: Alarm Source | ! | No. / Select Alarm Source<br>- / Same as for Relay 1 |
| 44'822 | Relay 6: Alarm Off after… | ! | Bit / Select Alarm Off<br>- / Same as for Relay 1 |
| 44'823 | Relay 6: On Delay | !* | • Switch on delay for relay 6 in seconds |
| 44'824 | Relay 6: Off Timeout | !* | • Maximal alarm time for relay 6 in seconds |
| 44'825 … 44'899 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
|---|---|
| ! | Change of these registers needs a restart of the device (see Device Actions) |
| * | It is not possible to verify the value, written to this register! |

**On Delay**: If the time delay in seconds is not set to zero, the relay will be energized after the specified time provided that the alarm condition persists. Use this control if you want to prevent the relay from being immediately energized when an alarm occurs, e. g. to avoid short time alarms or alarm on-off toggling.
Range: 1 to $2^{16}$ seconds.

**Off Timeout**: Time in seconds between the occurrence of the trigger criterion and the de-energizing of the relay. This timeout will be active when *Off after Timeout* is chosen.
Range: 1 to $2^{16}$ seconds.

**Off when Alarm ends**: The relay will be de-energized as soon as the alarm condition ends.

**Off after Timeout**: When set, the relay will remain energized for the specified duration even if the alarm condition has ended.

**Note!**
When both options are enabled – *Off when Alarm ends* and *Off after Timeout* – the relay will be de-energized as soon as one of the conditions has ended, either the end of the alarm or the end of timeout.

**Attention!**
When both options are disabled – *Off when Alarm ends* and *Off after Timeout* – the relay will never be de-energized. The relay can only be de-energized manually (see Relays 1 to 6).

## 2.5.12 Analog Input Settings

Voltage or current type *Analog Input 1/2*.
The maximum detectable voltage range is 0…3300 mV, the maximum detectable current range 0…27 mA.

| Register | Name | Flags | Description |
|---|---|---|---|
| 44’901 | Analog Input Bits | ! | Bit: Description of the Analog Input bits<br>0: Auto Unit: Analog Input 1<br>1: Auto Unit: Analog Input 2<br>2…15: Reserved |
| 44’902 | Analog Input 1 Select | ! | No.: Select Analog Input 1 Source<br>0: Voltage Input<br>1: Current Input (120Ω) |
| | The same value as in Value Type -> *Analog Input 1 Select* | | |
| 44’903 | Analog Input 2 Select | ! | No.: Select Analog Input 2 Source<br>0: Voltage Input<br>1: Current Input (120Ω) |
| | The same value as in Value Type -> *Analog Input 2 Select* | | |
| 44’904 | Analog Input 1 Range Low | !* | • Analog input 1 input range low |
| 44’905 | Analog Input 1 Range High | !* | • Analog input 1 input range high |
| 44’906 | Analog Input 1 Scale Low | !* | • Analog input 1 scale low |
| 44’907 | Analog Input 1 Scale High | !* | • Analog input 1 scale high |
| 44’908 | Analog Input 2 Range Low | !* | • Analog input 2 input range low |
| 44’909 | Analog Input 2 Range High | !* | • Analog input 2 input range high |
| 44’910 | Analog Input 2 Scale Low | !* | • Analog input 2 scale low |
| 44’911 | Analog Input 2 Scale High | !* | • Analog input 2 scale high |
| 44’912 … 44’999 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |
| | | | |
| ! | Change of these registers needs a restart of the device (see Device Actions) | | |
| * | It is not possible to verify the value, written to this register! | | |

**Auto Unit: Analog Input x**: If the field *Analog Input Unit x* in the section *Value Unit* (see Value Unit

Value Unit) is empty the following automatic unit will be used:

| ***Analog Input x Select*** | ***Voltage*** | ***Current*** |
| --- | --- | --- |
| Auto Unit | mV | mA |

If the field *Analog Input Unit x* in the section *Value Unit* (see Value Unit

Value Unit) is not empty, e.g. set to [*ppm*], the unit in the field *Analog Input Unit x* will be used, in this case [*ppm*].

**Analog Input x Range Low/High**: Minimum and maximum of the output range of the connected external device. The values must be within the maximum detectable voltage/current ranges selected *Analog Input 1/2 Select* (see examples), **in steps of 1 [mV] resp. 1 [mA]**.

**Analog Input x Scale Low/High:** Minimum and maximum of the measure range to scale the input (see examples). **The Scale Low/High Values must be between -9'999 to 32767 in steps of 1**.

**Example voltage measurement:**

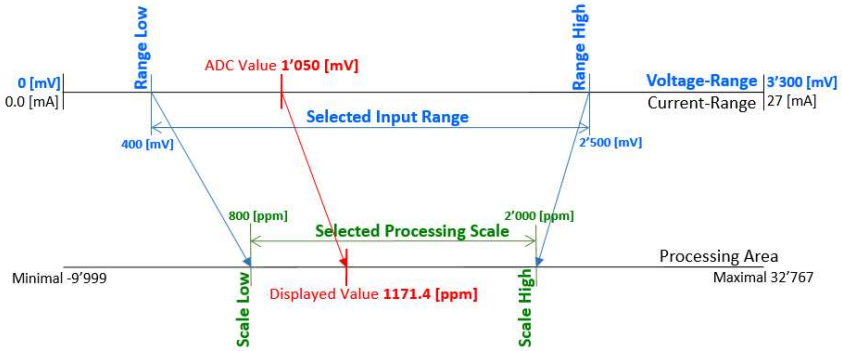
With a changed input range and a scaled output range, the input and the output ranges can be adapted to the customer's needs. The unit used can be adapted to the output signal.

| | Input Range | | Output Range | |
| --- | --- | --- | --- | --- |
| Voltage measurement | **Range Low** | >= 0 [mV] | **Scale Low** | -9'999 to +32767 |
| | **Range High** | <= 3'300 [mV] | **Scale High** | -9'999 to +32767 |

The input value in the range of **400** to **2'500 [mV]** will be scaled to the output value in the range of **800** to **2'000 [ppm]**. This means that an input value of **1'050 [mV]** is shown on the display as a value of **1171.4 [ppm]**.

**Calculation:**

$$\text{Displayed Value} = \frac{(\text{ADC Value} - \text{Range Low}) * (\text{Scale High} - \text{Scale Low})}{\text{Range High} - \text{Range Low}} + \text{Scale Low}$$




The unit [ppm] must be set (see Value Unit

Value Unit -> Analog Input 1/2 Unit to [ppm]).

**Example current measurement:**

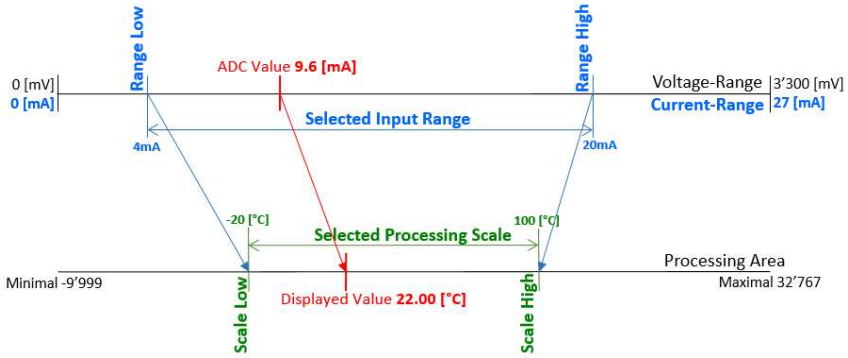
With a changed input range and a scaled output range, the input and the output ranges can be adapted to the customer's needs. The unit used can be adapted to the output signal.

| | Input Range | | Output Range | |
| --- | --- | --- | --- | --- |
| Current measurement | Range Low | >= 0 [mA] | Scale Low | -9'999 to +32767 |
| | Range High | <= 27 [mA] | Scale High | -9'999 to +32767 |

The input value in the range of **4** to **20 [mA]** will be scaled to the output value in the range of **-20** to **+100 [°C]**. This means that an input value of **9.6 [mA]** is shown on the display as a value of **22.0 [°C]**.

**Calculation:**

$$\text{Displayed Value} = \frac{(\text{ADC Value} - \text{Range Low}) * (\text{Scale High} - \text{Scale Low})}{\text{Range High} - \text{Range Low}} + \text{Scale Low}$$




The unit [°C] must be set (see Value Unit

Value Unit -> Analog Input 1/2 Unit to [°C]).

### 2.5.13 Ethernet Settings

It is possible to enter the IP address of the CRP5, the Subnet mask and the Gateway IP-address to make the CRP5 accessible from inside and outside of the existing LAN.

In case of the factory Ethernet setting of the CRP5 does not fit the existing LAN infrastructure, the easiest method to configure these settings by communication via Rotronic Service interface. Please use the AC3006 cable for that. Also the use of RS485 is possible. Both ways supports the Modbus RTU protocol.

| Register | Name | Flags | Description |
| --- | --- | --- | --- |
| 45'001 | Ethernet Bits | | • Not yet used, undefined |
| 45'002 | Ethernet IP Address | !* | • Ethernet IP address (part 1) *e.g. 0xC0A8* |
| 45'003 | | !* | • Ethernet IP address (part 2) *e.g. 0x6465* |
| 45'004 | Ethernet Subnet Mask | !* | • Ethernet subnet mask (part 1) *e.g. 0xFFFF* |
| 45'005 | | !* | • Ethernet subnet mask (part 2) *e.g. 0xFF00* |
| 45'006 | Ethernet Gateway Address | !* | • Ethernet gateway address (part 1) *e.g. 0xC0A8* |
| 45'007 | | !* | • Ethernet gateway address (part 2) *e.g. 0x6401* |
| 45'008 … 45'099 | Reserved | | • Undefined<br>• Gives back Modbus Exception Code 02 |

| | |
| --- | --- |
| ! | Change of these registers needs a restart of the device (see Device Actions) |
| * | It is not possible to verify the value, written to this register! |

**Ethernet IP Address**: Ethernet Address, e.g. 192.168.100.101 (*0xC0.0xA8.0x64.0x65*)

**Note!**
On the menu *Device Information*, you can see the IP address of the device.

**Ethernet Subnet Mask**: Subnet Mask, e.g. 255.255.255.0 (*0xFF.0xFF.0xFF.0x00*)

**Ethernet Gateway Address**: Gateway Address, e.g. 192.168.100.1 (*0xC0.0xA8.0x64.0x01*)

## 2.5.14 Example: Read Holding Register

### *2.5.14.1 Read Display Settings (Registers 44'602 to 44'607)*

**RTU Example:**

| | |
|---|---|
| **Transmit** | 01 03 ae 39 00 06 35 2d |
| **Receive** | 01 03 0c 00 01 00 00 00 02 00 01 00 01 00 02 59 8d |

**TCP Example:**

| | |
|---|---|
| **Transmit** | MBAP 01 03 ae 39 00 06 |
| **Receive** | MBAP 01 03 0c 00 01 00 00 00 02 00 01 00 01 00 02 |

| Field | Bytes | Value | Description |
|---|---|---|---|
| MBAP | 7 | MBAP | MBAP header (see Modbus RTU / TCP) |
| Checksum | 2 | CRC | CRC Checksum (see Modbus RTU / TCP) |
| RTU number | 1 | 0x01 | Modbus RTU Address (RS485 Address + 1)<br>(see Device Descriptions) |
| Function code | 1 | 0x03 | Read Holding Register |
| Starting address | 2 | 0xae39 | = 44'601 ( Attention! register number – 1 ) |
| Quantity of registers | 2 | 0x0006 | = 6, means read 6 registers |
| Byte count | 1 | 0x0c | = 12 ≙ **2 * N**, means numbers of returned bytes |
| Register value<br>(see Display Settings) | **2 * N** | 0x0001 | Display Row 1: Humidity |
| | | 0x0000 | Display Row 2: Differential Pressure |
| | | 0x0002 | Display Row 3: Temperature |
| | | 0x0001 | Display Row 4: Calculation |
| | | 0x0001 | Display Row 5: Digital Input 1 |
| | | 0x0002 | Display Row 6: Digital Input 2 |

For detailed information about Modbus protocol *Read Holding Register*, see:
(http://modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf).

## 2.5.15 Example: Write Holding Register

### *2.5.15.1 Write Display Settings (Registers 44'602 to 44'607)*

**RTU Example:**

| | |
|---|---|
| **Transmit** | 01 10 ae 39 00 06 0c 00 00 00 01 00 02 00 02 00 02 00 01 f3 44 |
| **Receive** | 01 10 ae 39 00 06 b0 ee |

**TCP Example:**

| | |
|---|---|
| **Transmit** | MBAP 01 10 ae 39 00 06 0c 00 00 00 01 00 02 00 02 00 02 00 01 |
| **Receive** | MBAP 01 10 ae 39 00 06 |

| Field | Bytes | Value | Description |
|---|---|---|---|
| MBAP | 7 | MBAP | MBAP header (see Modbus RTU / TCP) |
| Checksum | 2 | CRC | CRC Checksum (see Modbus RTU / TCP) |
| RTU number | 1 | 0x01 | Modbus RTU Address (RS485 Address + 1)<br>(see Device Descriptions) |
| Function code | 1 | 0x10 | Write Multiple Register |
| Starting address | 2 | 0xae39 | = 44'601 ( Attention! register number – 1 ) |
| Quantity of registers | 2 | 0x0006 | = 6, means read 6 registers |
| Byte count | 1 | 0x0c | = 12 ≙ **2 * N**, means numbers of returned bytes |
| Register value<br>(see Display Settings) | **2 * N** | 0x0000 | Display Row 1: Differential Pressure |
| | | 0x0001 | Display Row 2: Humidity |
| | | 0x0002 | Display Row 3: Temperature |
| | | 0x0002 | Display Row 4: Analog Input 1 |
| | | 0x0002 | Display Row 5: Digital Input 2 |
| | | 0x0001 | Display Row 6: Digital Input 1 |

**Note!**
After writing a *Write Multiple Register* command, it needs a restart of the device (see Device Actions or Reset Device) to activate the selected changes.

For detailed information about Modbus protocol *Write Multiple Register*, see:
(http://modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf).

# 3 Document Releases

| Release | Software Ver. | Date | Notes |
| --- | --- | --- | --- |
| _01 | 1.0 | 30.07.2015 | Original release |
| _02 | 1.2 | 03.01.2018 | Updated |
| _03 | 1.2 | 31.01.2018 | Examples and more information included |