

Modbus Manual Version 1.1

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Modbus Manual for PF4/5



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1 Modbus protocol

The PF4/5 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 PF4/5 can change the functionality of the PF4/5. This may cause the PF4/5 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 PF4/5 handles Modbus RTU over the included RS485 interface. The communication parameters are 19200 Baud, 8-bit data, no parity, one stop bit and cannot be changed.

Note!

Modbus RTU Address of the PF4/5 is always the PF4/5 RS485 Network Address + 1.

See also [Device Specific Settings](#)

1.1.1.2 Modbus TCP

Modbus TCP is a client-server communication protocol over Ethernet. The PF4/5 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.

Attention!

• Active Modbus TCP Connection

If no Modbus request is sent during an active Modbus communication for more than 30 seconds, the active TCP socket is reset and must be reopened for a new Modbus request

• Physical interruption of the Ethernet line

After a physical interruption of the Ethernet line, the Ethernet connection with the PF4/5 cannot be re-established for at least 30 seconds

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 Specific Settings](#) -> *Modbus Operation Mode*) only for 32-bit Float and 32-bit Integer values based on Little Endian memory organisation.

Swap Mode	Source Bytes	Target Bytes
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 PF4/5 Modbus Fields and Mapping

2.1 PF4/5 Modbus Fields

Primary Tables	Type	Read / Write	Coils / Registers	Function Code	
				Code	Description
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!

Function Codes 0x02 and 0x0F are not supported by PF4/5 device.

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). Modbus Command *Write Multiple Coils* (0x0F) is not supported.

2.2.1 Relay and Valve

Command to energize/de-energize the relay and/or the valve of the PF4/5 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	Flags	Description
1	Relay	*	<ul style="list-style-type: none"> Get state of relay Switch relay ON/OFF
	➤ If in Relay Settings one or more <i>Relay Alarm Bits</i> are set, it is not possible to energize the relay manually. The relay will be de-energized every measuring cycle, when alarm is off		
2	Valve	*	<ul style="list-style-type: none"> Get state of valve Switch valve ON/OFF
	➤ Note: A Valve is only included in PF5 devices. In PF4 devices activating the Valve will have no effect		
2...8	Reserved		<ul style="list-style-type: none"> Undefined
*	An energized relay/valve stays energized until the related coil is de-energized		

2.2.2 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 supported.

Coils	Name	Flags	Description
9	Zero Adjustment of Differential Pressure		<ul style="list-style-type: none"> Zero adjust of the differential pressure sensor
	➤ This action takes about 15 seconds to execute. During this time, communication with the device is not possible		
10	Acquire Differential Pressure Data	*	<ul style="list-style-type: none"> Acquire a previously set reference value (see Reference Value Settings)
11	Delete Acquired Differential Pressure Data		<ul style="list-style-type: none"> Deletes all previously acquired values
12	Adjust Acquired Differential Pressure Data	!	<ul style="list-style-type: none"> The acquired data will be transferred to the corresponding lookup table (<i>Customer Lookup Table</i>)
13	Acquire Humidity Data	*	<ul style="list-style-type: none"> Acquire a previously set reference value (see Reference Value Settings)

			➤ Only available for devices including HC2 Probe
14	Delete Acquired Humidity Data		<ul style="list-style-type: none"> • Deletes all previously acquired values ➤ Only available for devices including HC2 Probe
15	Adjust Acquired Humidity Data	!	<ul style="list-style-type: none"> • The acquired data will be transferred to the HC2 Probe ➤ Only available for devices including HC2 Probe
			➤ This action takes about 2 seconds to execute. During this time, communication with the device is not possible
16	Adjust Temperature Data	* !	<ul style="list-style-type: none"> • The previously set reference temperature (see Reference Value Settings) will be sent to the temperature sensor ➤ Only available for devices including HC2 or Pt100 Probe
*	Before acquiring data, a reference value must be set (see Reference Value Settings) It's possible to acquire more than one reference value before executing the adjustment (not for temperature adjustment)		
!	The device must be restarted to take over the new data (see Device Actions)		

2.2.3 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	Flags	Description
17	Reset Device		<ul style="list-style-type: none"> Restart device
➤ The device will be restarted. Communication will get lost			
18	Store Device Settings	*	<ul style="list-style-type: none"> All device-relevant data will be stored in the memory Executing this command, will overwrite older (factory) settings in the memory
19	Restore All Device Settings	* !	<ul style="list-style-type: none"> All device-relevant data will be restored from the memory to the device All individual device settings by customer will be overwritten by the factory settings in memory
20	Restore Device Settings without Communication Data	* !	<ul style="list-style-type: none"> All device-relevant data will be restored from the memory to the device except communication parameter (Ethernet, RS485) All individual device settings by customer, except communication parameter (Ethernet, RS485) will be overwritten by the factory settings in memory
21 ... 64	Reserved		<ul style="list-style-type: none"> Undefined
65 ... 9'999	Reserved		<ul style="list-style-type: none"> Undefined Gives back Modbus Exception Code 02
*	During these action, communication with the device is not possible		
!	Attention! All customer settings for the Differential Pressure (<i>Zero Adjustment (Offset), Acquired Data, Customer Lookup Table</i>) are also deleted		

2.2.4 Example: Read Single Coil

2.2.4.1 Read Relay

Initial situation: The relays 1 is set, Valve (only PF5) doesn't exist.

RTU Example:

Transmit	01 01 00 00 00 01 fd ca
Receive	01 01 01 01 90 48

TCP Example:

Transmit	MBAP 01 01 00 00 00 01
Receive	MBAP 01 01 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	0x01	Read Single Coil																											
Starting address	2	0x0000	= 0, means address of the 1. coil (Attention! coil number – 1)																											
Quantity of coils	2	0x0001	= 1 1 to 7 gives the same result 1 byte (8 coils) 8 to 15 will give back 2 bytes (16 coils) etc.																											
Byte count	1	0x01	= $1 \triangleq N$, means quantity of coils / 8, if the remainder is different of 0 => $N = N+1$																											
Coil status (see Relay and Valve)	n	0x01	n = N or N+1 = 8 bits																											
			<table border="1"> <thead> <tr> <th>Bit</th> <th>State</th> <th>State of Relais 1 to 6</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>ON</td> <td>Coil 1 = Relais (ON = 1, OFF = 0)</td> </tr> <tr> <td>1</td> <td>OFF</td> <td>Coil 2 = Valve (ON = 1, OFF = 0) (Valve exist only with PF5)</td> </tr> <tr> <td>2</td> <td>OFF</td> <td>Not used</td> </tr> <tr> <td>3</td> <td>OFF</td> <td>Not used</td> </tr> <tr> <td>4</td> <td>OFF</td> <td>Not used</td> </tr> <tr> <td>5</td> <td>OFF</td> <td>Not used</td> </tr> <tr> <td>6</td> <td>OFF</td> <td>Not used</td> </tr> <tr> <td>7</td> <td>OFF</td> <td>Not use</td> </tr> </tbody> </table>	Bit	State	State of Relais 1 to 6	0	ON	Coil 1 = Relais (ON = 1, OFF = 0)	1	OFF	Coil 2 = Valve (ON = 1, OFF = 0) (Valve exist only with PF5)	2	OFF	Not used	3	OFF	Not used	4	OFF	Not used	5	OFF	Not used	6	OFF	Not used	7	OFF	Not use
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7	OFF	Not use																												

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

2.2.5 Example: Write Single Coil

2.2.5.1 Set State of Relay

RTU Example:

Transmit	01 05 00 00 ff 00 8c 3a
Receive	01 05 00 00 ff 00 8c 3a

TCP Example:

Transmit	MBAP 01 05 00 00 ff 00
Receive	MBAP 01 05 00 00 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) (see Device Descriptions)
Function code	1	0x05	Write Single Coil
Starting address	2	0x0000	= 0, means address of the 1. Coil (relay) (Attention! coil number – 1)
Output value	2	0xff00	0xff00 for setting the selected coil 0x0000 for resetting the selected coil

Test the change with Modbus commands in example [Read Relay](#).

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

2.2.6 Example: Reset Device

RTU Example:

Transmit	01 05 00 10 ff 00 8d ff
Receive	01 05 00 10 ff 00 8d ff

TCP Example:

Transmit	MBAP 01 05 00 10 ff 00
Receive	MBAP 01 05 00 10 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) (see Device Descriptions)
Function code	1	0x05	Write Single Coil

Starting address	2	0x0010	= 16, means address of the 17. Coil (Reset Device) (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)

There are no active PF4/5 **Discrete Inputs**.

2.4 Device Specific Input Registers (read only)

With Modbus **Input Registers** you can read some device specific data of the PF4/5 device.

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

2.4.1 Device Data

PF4/5-specific data.

Register	Name	Flags	Description																																								
30'001	Serial Number	i	• Serial number of the PF4/5 device (part 1)																																								
30'002		i	• Serial number of the PF4/5 device (part 2)																																								
30'003	Serial Number HC2 Probe <i>Only if HC2 is used</i>	i	• Serial number of the HC2-probe (part 1)																																								
30'004		i	• Serial number of the HC2-probe (part 2)																																								
30'005	Device Name	"	• Device name (part 1 – character 1 & 2) <i>e.g. "PF"</i>																																								
30'006		"	• Device name (part 2 – character 3 & 4) <i>e.g. "5 "</i>																																								
30'007		"	• Device name (part 3 – character 5 & 6) <i>e.g. "+ "</i>																																								
30'008		"	• Device name (part 4 – character 7 & 8) <i>e.g. "HC"</i>																																								
30'009		"	• Device name (part 5 – character 9 & 10) <i>e.g. "2 "</i>																																								
30'010		"	• Device name (part 6 – character 11 & 12) <i>e.g. " "</i>																																								
30'011	Differential Pressure Sensor Type <i>(*) Only for PF5</i> <i>(**) Only for PF4</i>		<table border="1"> <thead> <tr> <th>No.</th> <th>Shows differential pressure sensor type</th> </tr> </thead> <tbody> <tr><td>0</td><td>PF5: ± 10Pa (*)</td></tr> <tr><td>1</td><td>PF5: ± 25Pa (*)</td></tr> <tr><td>2</td><td>PF5: ± 50Pa (*)</td></tr> <tr><td>3</td><td>PF5: ± 100Pa (*)</td></tr> <tr><td>4</td><td>PF5: ± 250Pa (*)</td></tr> <tr><td>5</td><td>PF5: ± 500Pa (*)</td></tr> <tr><td>6</td><td>PF5: ± 1000Pa (* by order only)</td></tr> <tr><td>7</td><td>PF5: ± 2500Pa (* by order only)</td></tr> <tr><td>8</td><td>PF5: ± 5000Pa (* by order only)</td></tr> <tr><td>7</td><td>PF5: ± 7500Pa (* by order only)</td></tr> <tr><td>8</td><td>PF5: ± 15kPa (* by order only)</td></tr> <tr><td>11..15</td><td>Not used</td></tr> <tr><td>16</td><td>PF4: ± 10Pa (**)</td></tr> <tr><td>17</td><td>PF4: ± 25Pa (**)</td></tr> <tr><td>18</td><td>PF4: ± 50Pa (**)</td></tr> <tr><td>19</td><td>PF4: ± 100Pa (**)</td></tr> <tr><td>20</td><td>PF4: ± 250Pa (**)</td></tr> <tr><td>21</td><td>PF4: ± 500Pa (**)</td></tr> <tr><td>22...</td><td>Not used</td></tr> </tbody> </table>	No.	Shows differential pressure sensor type	0	PF5: ± 10Pa (*)	1	PF5: ± 25Pa (*)	2	PF5: ± 50Pa (*)	3	PF5: ± 100Pa (*)	4	PF5: ± 250Pa (*)	5	PF5: ± 500Pa (*)	6	PF5: ± 1000Pa (* by order only)	7	PF5: ± 2500Pa (* by order only)	8	PF5: ± 5000Pa (* by order only)	7	PF5: ± 7500Pa (* by order only)	8	PF5: ± 15kPa (* by order only)	11..15	Not used	16	PF4: ± 10Pa (**)	17	PF4: ± 25Pa (**)	18	PF4: ± 50Pa (**)	19	PF4: ± 100Pa (**)	20	PF4: ± 250Pa (**)	21	PF4: ± 500Pa (**)	22...	Not used
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30'012	Hardware Version		• Hardware version																																								
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30'015	Device Type		<table border="1"> <thead> <tr> <th>Bit</th> <th>Shows type of device</th> </tr> </thead> <tbody> <tr><td>0</td><td>PFx solo</td></tr> </tbody> </table>	Bit	Shows type of device	0	PFx solo																																				
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	For bit 0 to 2 only one selection is possible		<table border="1"> <tr><td>1</td><td>PFx + PT100 Probe</td></tr> <tr><td>2</td><td>PFx + HC2 Probe</td></tr> <tr><td>3</td><td>0</td></tr> <tr><td>4</td><td>PF4/5 (0 = PF4; 1 = PF5)</td></tr> <tr><td>5</td><td>Flow (0 = Off; 1 = On)</td></tr> <tr><td>6...15</td><td>0</td></tr> </table> <p>0 = deactivated; 1 = activated</p>	1	PFx + PT100 Probe	2	PFx + HC2 Probe	3	0	4	PF4/5 (0 = PF4; 1 = PF5)	5	Flow (0 = Off; 1 = On)	6...15	0																				
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6...15	0																																		
30'016	Interface Type More than one selection is possible		<table border="1"> <thead> <tr> <th>Bit</th> <th>Shows included communication interfaces</th> </tr> </thead> <tbody> <tr><td>0</td><td>Ethernet</td></tr> <tr><td>1</td><td>0 (Not used)</td></tr> <tr><td>2</td><td>RS485</td></tr> <tr><td>13...15</td><td>0</td></tr> </tbody> </table> <p>0 = deactivated; 1 = activated</p>	Bit	Shows included communication interfaces	0	Ethernet	1	0 (Not used)	2	RS485	13...15	0																						
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30'017	State of Alarms (*) If HC2 or PT100 probe is connected (**) If option Flow is selected More than one active alarm is possible		<table border="1"> <thead> <tr> <th>Bit</th> <th>Shows state of alarm bits</th> </tr> </thead> <tbody> <tr><td>0</td><td>Alarm Differential Pressure Low</td></tr> <tr><td>1</td><td>Alarm Differential Pressure High</td></tr> <tr><td>2</td><td>Alarm Humidity Low (*)</td></tr> <tr><td>3</td><td>Alarm Humidity High (*)</td></tr> <tr><td>4</td><td>Alarm Temperature Low (*)</td></tr> <tr><td>5</td><td>Alarm Temperature High (*)</td></tr> <tr><td>6</td><td>Alarm Calculation Low (*)</td></tr> <tr><td>7</td><td>Alarm Calculation High (*)</td></tr> <tr><td>8</td><td>Alarm Analog Input Low</td></tr> <tr><td>9</td><td>Alarm Analog Input High</td></tr> <tr><td>10</td><td>Alarm Flow Low (**)</td></tr> <tr><td>11</td><td>Alarm Flow High (**)</td></tr> <tr><td>12</td><td>Alarm Volume Low (**)</td></tr> <tr><td>13</td><td>Alarm Volume High (**)</td></tr> <tr><td>14...15</td><td>0</td></tr> </tbody> </table> <p>0 = alarm OFF; 1 = alarm ON</p>	Bit	Shows state of alarm bits	0	Alarm Differential Pressure Low	1	Alarm Differential Pressure High	2	Alarm Humidity Low (*)	3	Alarm Humidity High (*)	4	Alarm Temperature Low (*)	5	Alarm Temperature High (*)	6	Alarm Calculation Low (*)	7	Alarm Calculation High (*)	8	Alarm Analog Input Low	9	Alarm Analog Input High	10	Alarm Flow Low (**)	11	Alarm Flow High (**)	12	Alarm Volume Low (**)	13	Alarm Volume High (**)	14...15	0
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5	Alarm Temperature High (*)																																		
6	Alarm Calculation Low (*)																																		
7	Alarm Calculation High (*)																																		
8	Alarm Analog Input Low																																		
9	Alarm Analog Input High																																		
10	Alarm Flow Low (**)																																		
11	Alarm Flow High (**)																																		
12	Alarm Volume Low (**)																																		
13	Alarm Volume High (**)																																		
14...15	0																																		
30'018	State of Pre-Alarms (*) If HC2 or PT100 probe is connected (**) If option Flow is selected More than one active alarm is possible		<table border="1"> <thead> <tr> <th>Bit</th> <th>Shows state of pre-alarm bits</th> </tr> </thead> <tbody> <tr><td>0</td><td>Pre-Alarm Differential Pressure Low</td></tr> <tr><td>1</td><td>Pre-Alarm Differential Pressure High</td></tr> <tr><td>2</td><td>Pre-Alarm Humidity Low (*)</td></tr> <tr><td>3</td><td>Pre-Alarm Humidity High (*)</td></tr> <tr><td>4</td><td>Pre-Alarm Temperature Low (*)</td></tr> <tr><td>5</td><td>Pre-Alarm Temperature High (*)</td></tr> <tr><td>6</td><td>Pre-Alarm Calculation Low (*)</td></tr> <tr><td>7</td><td>Pre-Alarm Calculation High (*)</td></tr> <tr><td>8</td><td>Pre-Alarm Analog Input Low</td></tr> <tr><td>9</td><td>Pre-Alarm Analog Input High</td></tr> <tr><td>10</td><td>Pre-Alarm Flow Low (**)</td></tr> <tr><td>11</td><td>Pre-Alarm Flow High (**)</td></tr> <tr><td>12</td><td>Pre-Alarm Volume Low (**)</td></tr> <tr><td>13</td><td>Pre-Alarm Volume High (**)</td></tr> <tr><td>14...15</td><td>0</td></tr> </tbody> </table> <p>0 = alarm OFF; 1 = alarm ON</p>	Bit	Shows state of pre-alarm bits	0	Pre-Alarm Differential Pressure Low	1	Pre-Alarm Differential Pressure High	2	Pre-Alarm Humidity Low (*)	3	Pre-Alarm Humidity High (*)	4	Pre-Alarm Temperature Low (*)	5	Pre-Alarm Temperature High (*)	6	Pre-Alarm Calculation Low (*)	7	Pre-Alarm Calculation High (*)	8	Pre-Alarm Analog Input Low	9	Pre-Alarm Analog Input High	10	Pre-Alarm Flow Low (**)	11	Pre-Alarm Flow High (**)	12	Pre-Alarm Volume Low (**)	13	Pre-Alarm Volume High (**)	14...15	0
Bit	Shows state of pre-alarm bits																																		
0	Pre-Alarm Differential Pressure Low																																		
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13	Pre-Alarm Volume High (**)																																		
14...15	0																																		
30'019	State of Other Alarms (*) If HC2 or PT100 probe is connected.		<table border="1"> <thead> <tr> <th>Bit</th> <th>Shows state of other alarm bits</th> </tr> </thead> <tbody> <tr><td>0</td><td>Maximal/minimal sensor limit exceeded</td></tr> </tbody> </table>	Bit	Shows state of other alarm bits	0	Maximal/minimal sensor limit exceeded																												
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0	Maximal/minimal sensor limit exceeded																																		

	More than one active alarm is possible		<table border="1"> <tr> <td>1</td> <td>No communication with sensor possible</td> </tr> <tr> <td>2</td> <td>Missing Probe (*)</td> </tr> <tr> <td>3</td> <td>Fix Value(s) is(are) activated</td> </tr> <tr> <td>14...15</td> <td>0</td> </tr> </table> <p>0 = alarm OFF; 1 = alarm ON</p>	1	No communication with sensor possible	2	Missing Probe (*)	3	Fix Value(s) is(are) activated	14...15	0		
1	No communication with sensor possible												
2	Missing Probe (*)												
3	Fix Value(s) is(are) activated												
14...15	0												
30'020	State of Relay and Valve (*) Only if PF5 device is used		<table border="1"> <thead> <tr> <th>Bit</th> <th>Shows state of relay and valve bits</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Relay</td> </tr> <tr> <td>1...7</td> <td>0</td> </tr> <tr> <td>8</td> <td>Valve (*)</td> </tr> <tr> <td>9...15</td> <td>0</td> </tr> </tbody> </table> <p>0 = deactivated; 1 = activated</p>	Bit	Shows state of relay and valve bits	0	Relay	1...7	0	8	Valve (*)	9...15	0
Bit	Shows state of relay and valve bits												
0	Relay												
1...7	0												
8	Valve (*)												
9...15	0												
30'021	Numbers of Analog Outputs		<table border="1"> <thead> <tr> <th>No.</th> <th>Shows number of analog outputs</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1 Analog Output</td> </tr> <tr> <td>2</td> <td>2 Analog Outputs</td> </tr> <tr> <td>3</td> <td>3 Analog Outputs</td> </tr> </tbody> </table>	No.	Shows number of analog outputs	1	1 Analog Output	2	2 Analog Outputs	3	3 Analog Outputs		
No.	Shows number of analog outputs												
1	1 Analog Output												
2	2 Analog Outputs												
3	3 Analog Outputs												
30'022	Device Address		<ul style="list-style-type: none"> Device address ➤ Device address is the same as RS485 address 										
30'023	MAC-Address Only if Ethernet is used		Ethernet MAC address, e.g. C8-8E-D1-20-00-2F										
30'024			• Ethernet MAC address (part 1) (e.g. 0xC88E)										
30'025			• Ethernet MAC address (part 2) (e.g. 0xD120) • Ethernet MAC address (part 3) (e.g. 0x002F)										
30'026	Fixed IP Ethernet Address Only if Ethernet is used	i	Fixed IP Address, e.g. 192.168.100.101										
30'027		i	• Ethernet IP address (part 1) (e.g. 0xC0A8) • Ethernet IP address (part 2) (e.g. 0x6465)										
30'028	DHCP State Only if Ethernet is used		<p>DHCP State: On or Off</p> <ul style="list-style-type: none"> ➤ ON: IP Address will be received from DHCP Server ➤ Off: Fixed IP Address will be used 										
30'029	DHCP IP Ethernet Address Only if Ethernet is used and DHCP is ON, otherwise DHCP IP Address = 0.0.0.0	i	DHCP IP Address, e.g. 192.168.100.151										
30'030		i	• DHCP Ethernet IP address (part 1) (e.g. 0xC0A8) • DHCP Ethernet IP address (part 2) (e.g. 0x6597)										
30'031 ... 31'000	Reserved		<ul style="list-style-type: none"> Undefined Gives back Modbus Exception Code 02 										

2.4.2 Current Values: Float Values

Current values in 32-bit IEEE754 float format of all PF4/5 sensors.

Note!

These values are changing every measurement cycle, so always read the two corresponding registers in one Modbus command.

Register	Name	Flags	Description
31'001	Humidity	f *	• Current humidity value (part 1)
31'002		f *	• Current humidity value (part 2)
31'003	Temperature	f *	• Current temperature value (part 1)
31'004		f *	• Current temperature value (part 2)
31'005	Differential Pressure	f *	• Current differential pressure value (part 1)
31'006		f *	• Current differential pressure value (part 2)
31'007	Calculation	f *	• Current calculation value (part 1)
31'008		f *	• Current calculation value (part 2)
31'009	Analog Input	f *	• Current analog input value (part 1)
31'010		f *	• Current analog input value (part 2)
31'011	Flow	f *	• Current flow value (part 1)
31'012		f *	• Current flow value (part 2)
31'013	Volume Flow	f *	• Current volume flow value (part 1)
31'014		f *	• Current volume flow value (part 2)
31'015	Ambient Pressure	f *	• Current ambient pressure value (part 1)
31'016		f *	• Current ambient pressure value (part 2)
31'017	Internal Temperature	f *	• Current internal temperature value (part 1)
31'018		f *	• Current internal temperature value (part 2)
31'019 ... 31'999	Reserved		• Undefined • Gives back Modbus Exception Code 02

2.4.3 Current Values: Integer Values

Current values in 16-bit integer format of all PF4/5 sensors, updated every measurement cycle.

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](#)).

Register	Name	Flags	Description
32'001	Humidity	*	• Current humidity value
32'002	Temperature	*	• Current temperature value
32'003	Differential Pressure	*	• Current differential pressure value
32'004	Calculation	*	• Current calculation value
32'005	Analog Input	*	• Current analog input value
32'006	Flow	*	• Current flow value

32'007	Internal Temperature	*	• Current volume flow value
32'008	Ambient Pressure	*	• Current ambient pressure value
32'009	Internal Temperature	*	• Current internal temperature value
32'010 ... 39'999	Reserved		• Undefined • Gives back Modbus Exception Code 02

2.4.4 Explanation of Flags

i	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 <i>Swap Mode</i> of the Modbus communication (see Device Specific Settings and Selectable Swap Modes for Rotronic Devices)
t	Represents the Unix Time (UTC) since 1.1.1970 in seconds
"	Character values separated in succeeding registers. 2 characters per register
f	These are float-values (32-bit IEEE754), separated in two succeeding registers (16-bits). How to bring together part 1 and part 2 of the 32-bit float-value, depends on the <i>Swap Mode</i> of the Modbus communication (see Device Specific Settings and Selectable Swap Modes for Rotronic Devices)
*	The showed values depend also of the selected unit (see Value Unit)

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	= $12 \triangleq 2 * N$, 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

Via the Modbus **Holding Registers** you can read and write device specific data to the PF4/5.

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.

Notes!

Most of the *Specific Holding Registers* cannot be validated, if Modbus command *Write Multiple Register* is used.

Changing values in the Holding Registers needs normally a restart of the device (see [Device Actions](#)).

Changing values in the Holding Registers will always change the FDA settings of the internal device data except, changing the reference value registers of the [Reference Value Settings](#).

2.5.1 Value Type

Selection of the possible calculation and analog input modes.

Register	Name	Flags	Description	
			No.	Select Calculation
40'001	Calculation Type Only if HC2 is used		0	Dew Point
			1	Frost Point
			2	Wet Bulb Temperature
			3	Enthalpy
			4	Vapour Concentration
			5	Specific Humidity
			6	Mixing Ratio
			7	Saturation Vapour Concentration
			8	Vapour Partial Pressure
			9	Vapour Saturation Pressure
40'002	Analog Input Type		No.	Shows the analog input type
			0	Voltage (0 ... 10V)
			1	Current (0 ... 24mA)
40'003 ... 40'099	Reserved		<ul style="list-style-type: none"> • Undefined • Gives back Modbus Exception Code 02 	

2.5.2 Value Unit

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

Register	Name	Flags	Description	
41'001	Temperature <i>For Calculation:</i> Dew Point, Frost Point, Wet Bulb Temperature		No.	Shows selectable temperature units
			0	°C
			1	°F
41'002	Differential Pressure		No.	Shows selectable differential pressure units
			0	Pa
			1	inH ₂ O
			2	mpsi
			3	mbar
			4	mmHg
			5	mmH ₂ O
			6	Torr
40'003	Ambient Pressure <i>For Calculation:</i> Vapour Partial Pressure Vapour Saturation Pressure		No.	Shows selectable ambient pressure units
			0	hPa
			1	inHg
41'004	<i>For Calculation only:</i> Enthalpy Only if HC2 is used		No.	Shows selectable enthalpy units
			0	kJ/kg
41'005	<i>For Calculation only:</i> Vapour Concentration Volume Only if HC2 is used		No.	Shows selectable volume units
			0	g/m ³
41'006	<i>For Calculation only:</i> Vapour Concentration Weight Only if HC2 is used		No.	Shows selectable weight units
			0	g/kg
41'007	Flow Only if Flow is activated		No.	Shows selectable flow units
			0	m/s
			1	km/h
			2	ft/s
41'008	Volume Flow Only if Flow is activated		No.	Shows selectable volume flow units
			0	m ³ /h
			1	m ³ /min
			0	l/min
			3	l/s
			4	cfm
41'009	Duct Area Only if Flow is activated		No.	Shows selectable volume flow units
			0	cm ²
			1	m ²
			2	in ²
			3	ft ²

41'010	Humidity Unit String <i>Only if HC2 is used</i>	" !	• Characters 1 & 2 of the unit of Humidity
41'011		" !	• Characters 3 & 4 of the unit of Humidity
41'012		" !	• Characters 5 of the unit of Humidity
	➤ Customer selectable unit for Humidity (maximal 5 characters). If there are only space characters in these registers, the unit for Humidity will be "%rh"		
41'013	Analog Input Unit String	" !	• Characters 1 & 2 of the unit of the analog input
41'014		" !	• Characters 3 & 4 of the unit of the analog input
	➤ Customer selectable unit for Analog Input (maximal 4 characters). If there are only space characters in these registers, the unit for Analog Input will be "V", resp. "mA", depending on the value of Analog Input Type (see Value Type or Analog Input Settings). be "V", resp. "mA" will only be showed if Auto Unit bit is set (see Analog Input Settings).		
41'015 ... 41'099	Reserved		<ul style="list-style-type: none"> • Undefined • Gives back Modbus Exception Code 02

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	Flags	Description
42'001	Humidity <i>Only if HC2 is used</i>		• Scaling factor for the humidity value
42'002	Temperature <i>Only if HC2 or Pt100 is used</i>		• Scaling factor for the temperature value
42'003	Differential Pressure		• Scaling factor for the differential pressure value
42'004	Calculation <i>Only if HC2 is used</i>		• Scaling factor for the calculation value
42'005	Analog Input		• Scaling factor for the analog input value
42'006	Flow <i>Only if Flow is activated</i>		• Scaling factor for the flow value
42'007	Volume Flow <i>Only if Flow is activated</i>		• Scaling factor for the volume flow value
42'008	Ambient Pressure		• Scaling factor for the ambient pressure value
42'009	Internal Temperature		• Scaling factor for the internal temperature value
41'010 ... 41'099	Reserved		<ul style="list-style-type: none"> • Undefined • Gives back Modbus Exception Code 02

2.5.4 Reference Value Settings

Settings of reference values for adjustments of differential pressure, humidity and temperature (see [Sensor Actions](#)).

Note!
 Values in these registers are only valid until the next restart of the device.

Register	Name	Flags	Description
44'001	Humidity <i>Only if HC2 is used</i>	? f !	• Reference value humidity (part 1)
44'002		? f !	• Reference value humidity (part 2)
44'003	Temperature <i>Only if HC2 or Pt100 is used</i>	? f !	• Reference value temperature (part 1)
44'004		? f !	• Reference value temperature (part 2)

44'005	Differential Pressure	? f!	• Reference value differential pressure (part 1)
44'006		? f!	• Reference value differential pressure (part 2)
44'007 ... 44'099	Reserved		<ul style="list-style-type: none"> • Undefined • Gives back Modbus Exception Code 02

2.5.5 Device Specific Settings

Device specific settings.

Register	Name	Flags	Description																						
44'101	Device Bits		<table border="1"> <thead> <tr> <th>Bit</th> <th>Shows device bits</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Trend Enable (OFF/ON)</td> </tr> <tr> <td>1...15</td> <td>Reserved</td> </tr> </tbody> </table>	Bit	Shows device bits	0	Trend Enable (OFF/ON)	1...15	Reserved																
			Bit	Shows device bits																					
			0	Trend Enable (OFF/ON)																					
1...15	Reserved																								
44'102	Differential Pressure Filter		• Filter for the Differential Pressure (0 ... 10)																						
44'103	Memory Write Protection		<table border="1"> <thead> <tr> <th>No.</th> <th>Shows value for device protection</th> </tr> </thead> <tbody> <tr> <td>171</td> <td>Device Write Protection ON</td> </tr> <tr> <td>x</td> <td>Device Write Protection OFF</td> </tr> </tbody> </table>	No.	Shows value for device protection	171	Device Write Protection ON	x	Device Write Protection OFF																
			No.	Shows value for device protection																					
			171	Device Write Protection ON																					
x	Device Write Protection OFF																								
<p>➤ After writing this command with <i>Device Write Protection ON (171)</i>, it's not possible to overwrite the content of the memory until executing the same command with <i>Device Write Protection OFF</i></p> <p>➤ Be careful to use this command over Modbus! If writing Modbus commands to a device with <i>Device Write Protection ON</i>, you don't get an error back, because the Modbus writing process was successful - only writing to memory was not possible</p>																									
44'104	Menu Protection		<ul style="list-style-type: none"> • Menu protection (On/Off) ➤ If On, the menu of the device can only be activated by entering a correct code, using the keys 																						
44'105	Menu Code		• Menu Code (0...9999)																						
40'106	Calculation Select		<table border="1"> <thead> <tr> <th>No.</th> <th>Shows selectable calculation</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Dew Point</td> </tr> <tr> <td>1</td> <td>Frost Point</td> </tr> <tr> <td>2</td> <td>Wet Bulb Temperature</td> </tr> <tr> <td>3</td> <td>Enthalpy</td> </tr> <tr> <td>4</td> <td>Vapour Concentration</td> </tr> <tr> <td>5</td> <td>Specific Humidity</td> </tr> <tr> <td>6</td> <td>Mixing Ratio</td> </tr> <tr> <td>7</td> <td>Saturation Vapour Concentration</td> </tr> <tr> <td>8</td> <td>Vapour Partial Pressure</td> </tr> <tr> <td>9</td> <td>Vapour Saturation Pressure</td> </tr> </tbody> </table>	No.	Shows selectable calculation	0	Dew Point	1	Frost Point	2	Wet Bulb Temperature	3	Enthalpy	4	Vapour Concentration	5	Specific Humidity	6	Mixing Ratio	7	Saturation Vapour Concentration	8	Vapour Partial Pressure	9	Vapour Saturation Pressure
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			7	Saturation Vapour Concentration																					
8	Vapour Partial Pressure																								
9	Vapour Saturation Pressure																								
➤ The same value as in <i>Value Type</i> -> <i>Calculation Type</i>																									
44'107	Device Number		• Device number (RS485 address) (0...63)																						
			➤ The device number (RS485 address) is used in conjunction with a RS485 network																						
			➤ Each network address should be unique																						
			➤ The Modbus address for Modbus RTU is always the RS485 address + 1																						
➤ Communication is normally lost, changing this value																									
44'108	Modbus Operation Mode		<table border="1"> <thead> <tr> <th>No.</th> <th>Shows Modbus operation mode</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Modbus Word Swap</td> </tr> <tr> <td>1</td> <td>Modbus Byte Swap</td> </tr> </tbody> </table>	No.	Shows Modbus operation mode	0	Modbus Word Swap	1	Modbus Byte Swap																
			No.	Shows Modbus operation mode																					
			0	Modbus Word Swap																					
1	Modbus Byte Swap																								

			2	Modbus Byte Word Swap
			3	Modbus No Change
	➤ See Selectable Swap Modes for Rotronic Devices			
44'109	DHCP Server (On or Off) Only if Ethernet is used	i !	DHCP Server: On or Off	
			➤ ON: IP Address will be received from DHCP Server	
			➤ Off: Fixed IP Address will be used	
44'110	Fixed IP Ethernet Address Only if Ethernet is used	i !	Fixed IP Address, e.g. 192.168.100.101	
44'111		i !	<ul style="list-style-type: none"> Ethernet IP address (part 1) (e.g. 0xC0A8) Ethernet IP address (part 2) (e.g. 0x6465) 	
	➤ Communication is normally lost, changing fixed IP address and DHCP is Off			
44'112	Zero Adjust Repetition Time Only if PF5 is active	i !	• Zero adjust repetition time (part 1)	
44'113		i !	• Zero adjust repetition time (part 2)	
	➤ Repeat time for the automatic zero point adjustment of differential pressure (in minutes) ➤ Attention! If 0, the repetition time is infinite			
44'114 ... 44'199	Reserved		<ul style="list-style-type: none"> Undefined Gives back Modbus Exception Code 02 	

2.5.6 Device Descriptions

Name for the different parts of the device, which is clearly related with its function.

Register	Name	Flags	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	"!	• 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	HC2 Probe Only if HC2 is used	"!	• Description CRP probe (part 1 – char. 1 & 2)
44'220		"!	• Description CRP probe (part 2 – char. 3 & 4)
44'221		"!	• Description CRP probe (part 3 – char. 5 & 6)
44'222		"!	• Description CRP probe (part 4 – char. 7 & 8)
44'223		"!	• Description CRP probe (part 5 – char. 9 & 10)
44'224		"!	• Description CRP probe (part 6 – char. 11 & 12)
44'225	Analog Input	"!	• Description analog input 1 (part 1 – char. 1 & 2)
44'226		"!	• Description analog input 1 (part 2 – char. 3 & 4)
44'227		"!	• Description analog input 1 (part 3 – char. 5 & 6)
44'228		"!	• Description analog input 1 (part 4 – char. 7 & 8)
44'229		"!	• Description analog input 1 (part 5 – char. 9 & 10)
44'230		"!	• Description analog input 1 (part 6 – char. 11 & 12)
44'231	Ambient Pressure	"!	• Description ambient pressure (part 1 – char. 1 & 2)
44'232		"!	• Description ambient pressure (part 2 – char. 3 & 4)
44'233		"!	• Description ambient pressure (part 3 – char. 5 & 6)
44'234		"!	• Description ambient pressure (part 4 – char. 7 & 8)
44'235		"!	• Description ambient pressure (part 5 – char. 9 & 10)
44'236		"!	• Description ambient pressure (part 6 – char. 11 & 12)

44'237	Flow Only if Flow is activated	"!	• Description flow (part 1 – char. 1 & 2)
44'238		"!	• Description flow (part 2 – char. 3 & 4)
44'239		"!	• Description flow (part 3 – char. 5 & 6)
44'240		"!	• Description flow (part 4 – char. 7 & 8)
44'241		"!	• Description flow (part 5 – char. 9 & 10)
44'242		"!	• Description flow (part 6 – char. 11 & 12)
44'243	Volume Flow Only if Flow is activated	"!	• Description volume flow (part 1 – char. 1 & 2)
44'244		"!	• Description volume flow (part 2 – char. 3 & 4)
44'245		"!	• Description volume flow (part 3 – char. 5 & 6)
44'246		"!	• Description volume flow (part 4 – char. 7 & 8)
44'247		"!	• Description volume flow (part 5 – char. 9 & 10)
44'248		"!	• Description volume flow (part 6 – char. 11 & 12)
44'249	Pt100 Only if Pt100 is used	"!	• Description Pt100 (part 1 – char. 1 & 2)
44'250		"!	• Description Pt100 (part 2 – char. 3 & 4)
44'251		"!	• Description Pt100 (part 3 – char. 5 & 6)
44'252		"!	• Description Pt100 (part 4 – char. 7 & 8)
44'253		"!	• Description Pt100 (part 5 – char. 9 & 10)
44'254		"!	• Description Pt100 (part 6 – char. 11 & 12)
44'255 ... 44'399	Reserved		<ul style="list-style-type: none"> • Undefined • Gives back Modbus Exception Code 02

2.5.7 Fix Value Settings

Fixed values are used to simulate a measuring value for testing purposes. To activate *Fix Values*, you have to set the corresponding *Fix Value Bits* to ON.

Note!

The selected fixed values should be in valid ranges. Valid ranges depends on selected measuring value and selected unit.

Register	Name	Flags	Description	
			Bit	Shows the fix value bits
44'401	Fix Value Bits	!	0	Differential Pressure
			1	Humidity (Only if HC2 is used)
			2	Temperature (Only if HC2 or Pt100 is used)
			3	Calculation (Only if HC2 is used)
			4	Analog Input
			5	Ambient Pressure
			6	Flow (Only if Flow is activated)
			7	Volume Flow (Only if Flow is activated)
			8...15	Reserved
44'402	Differential Pressure	f!	• Fix value differential pressure (part 1)	
44'403		f!	• Fix value differential pressure (part 2)	
44'404	Humidity Only if HC2 is used	f!	• Fix value humidity (part 1)	
44'405		f!	• Fix value humidity (part 2)	
44'406	Temperature Only if HC2 or Pt100 is used	f!	• Fix value temperature (part 1)	
44'407		f!	• Fix value temperature (part 2)	
44'408	Calculation Only if HC2 is used	f!	• Fix value calculation (part 1)	
44'409		f!	• Fix value calculation (part 2)	
44'410	Analog Input	f!	• Fix value analog Input (part 1)	
44'411		f!	• Fix value analog Input (part 2)	
44'412	Ambient Pressure	f!	• Fix value ambient pressure (part 1)	
44'413		f!	• Fix value ambient pressure (part 2)	
44'414	Flow Only if Flow is activated	f!	• Fix value flow (part 1)	
44'415		f!	• Fix value flow (part 2)	
44'416	Volume Flow Only if Flow is activated	f!	• Fix value volume flow (part 1)	
44'417		f!	• Fix value volume flow (part 2)	
44'418 ... 44'499	Reserved		• Undefined • Gives back Modbus Exception Code 02	

2.5.8 Analog Output Settings

The PF4/5 can provide up to three analog output signals. The measured sensor values can be spent individually on every analog output.

Register	Name	Flags	Description																				
44'501	Source for Analog Output 1 (Depends on device type)		<table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected source for PF4/5 solo</th> </tr> </thead> <tbody> <tr><td>0</td><td>Unused</td></tr> <tr><td>1</td><td>Differential Pressure</td></tr> <tr><td>2</td><td>Not valid! Don't use!</td></tr> <tr><td>3</td><td>Not valid! Don't use!</td></tr> <tr><td>4</td><td>Not valid! Don't use!</td></tr> <tr><td>5</td><td>Analog Input</td></tr> <tr><td>6</td><td>Ambient Pressure</td></tr> <tr><td>7</td><td>Flow (Use only if Flow is activated)</td></tr> <tr><td>8</td><td>Volume Flow (Use only if Flow is activated)</td></tr> </tbody> </table>	No.	Shows selected source for PF4/5 solo	0	Unused	1	Differential Pressure	2	Not valid! Don't use!	3	Not valid! Don't use!	4	Not valid! Don't use!	5	Analog Input	6	Ambient Pressure	7	Flow (Use only if Flow is activated)	8	Volume Flow (Use only if Flow is activated)
			No.	Shows selected source for PF4/5 solo																			
			0	Unused																			
			1	Differential Pressure																			
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			4	Not valid! Don't use!																			
			5	Analog Input																			
			6	Ambient Pressure																			
			7	Flow (Use only if Flow is activated)																			
			8	Volume Flow (Use only if Flow is activated)																			
			<table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected source for PF4/5 + HC2</th> </tr> </thead> <tbody> <tr><td>0</td><td>Unused</td></tr> <tr><td>1</td><td>Differential Pressure</td></tr> <tr><td>2</td><td>HC2 Humidity</td></tr> <tr><td>3</td><td>HC2 Temperature</td></tr> <tr><td>4</td><td>HC2 Calculation</td></tr> <tr><td>5</td><td>Analog Input</td></tr> <tr><td>6</td><td>Ambient Pressure</td></tr> <tr><td>7</td><td>Flow (Use only if Flow is activated)</td></tr> <tr><td>8</td><td>Volume Flow (Use only if Flow is activated)</td></tr> </tbody> </table>	No.	Shows selected source for PF4/5 + HC2	0	Unused	1	Differential Pressure	2	HC2 Humidity	3	HC2 Temperature	4	HC2 Calculation	5	Analog Input	6	Ambient Pressure	7	Flow (Use only if Flow is activated)	8	Volume Flow (Use only if Flow is activated)
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			<table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected source for PF4/5 + Pt100</th> </tr> </thead> <tbody> <tr><td>0</td><td>Unused</td></tr> <tr><td>1</td><td>Differential Pressure</td></tr> <tr><td>2</td><td>Not valid! Don't use!</td></tr> <tr><td>3</td><td>Pt100 Temperature</td></tr> <tr><td>4</td><td>Not valid! Don't use!</td></tr> <tr><td>5</td><td>Analog Input</td></tr> <tr><td>6</td><td>Ambient Pressure</td></tr> <tr><td>7</td><td>Flow (Use only if Flow is activated)</td></tr> <tr><td>8</td><td>Volume Flow (Use only if Flow is activated)</td></tr> </tbody> </table>	No.	Shows selected source for PF4/5 + Pt100	0	Unused	1	Differential Pressure	2	Not valid! Don't use!	3	Pt100 Temperature	4	Not valid! Don't use!	5	Analog Input	6	Ambient Pressure	7	Flow (Use only if Flow is activated)	8	Volume Flow (Use only if Flow is activated)
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<table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected output range</th> </tr> </thead> <tbody> <tr><td>0</td><td>Output Range 0...1V</td></tr> <tr><td>1</td><td>Output Range 0...5V</td></tr> <tr><td>2</td><td>Output Range 0...10V</td></tr> <tr><td>3</td><td>Output Range 0...20mA</td></tr> <tr><td>4</td><td>Output Range 4...20mA</td></tr> </tbody> </table>	No.	Shows selected output range	0	Output Range 0...1V	1	Output Range 0...5V	2	Output Range 0...10V	3	Output Range 0...20mA	4	Output Range 4...20mA											
No.	Shows selected output range																						
0	Output Range 0...1V																						
1	Output Range 0...5V																						
2	Output Range 0...10V																						
3	Output Range 0...20mA																						
4	Output Range 4...20mA																						
44'503	Processing Scale Low 1	f !	• Customer selectable scale low 1 (part 1)																				
44'504		f !	• Customer selectable scale low 1 (part 2)																				

44'505	Processing Scale High 1	f !	• Customer selectable scale high 1 (part 1)
44'506		f !	• Customer selectable scale high 1 (part 2)
	➤ Example see below		
44'507	Source for Analog Output 2 (Depends on device type)	(!)	No. Shows selected source
			-
44'508	Output Range Analog Output 2	(!)	No. Shows selected output range
			-
44'509	Processing Scale Low 2	f !	• Customer selectable scale low 2 (part 1)
44'510		f !	• Customer selectable scale low 2 (part 2)
44'511	Processing Scale High 2	f !	• Customer selectable scale high 2 (part 1)
44'512		f !	• Customer selectable scale high 2 (part 2)
	➤ Example see below		
44'513	Source for Analog Output 3 (Depends on device type)		No. Shows select source
			-
44'514	Output Range Analog Output 3		No. Shows selected output range
			-
44'515	Processing Scale Low 2	f !	• Customer selectable scale low 3 (part 1)
44'516		f !	• Customer selectable scale low 3 (part 2)
44'517	Processing Scale High 2	f !	• Customer selectable scale high 3 (part 1)
44'518		f !	• Customer selectable scale high 3 (part 2)
	➤ Example see below		
44'519	Analog Output 1 Current Load		• Load Resistor for DAC1 (0 ... 500 Ω)
44'520	Analog Output 2 Current Load		• Load Resistor for DAC2 (0 ... 500 Ω)
44'521	Analog Output 3 Current Load		• Load Resistor for DAC3 (0 ... 500 Ω)
	➤ Load Resistor are only for Output Range 0...20mA / 4...20mA for compensation		
44'522 ... 44'599	Reserved		• Undefined • Gives back Modbus Exception Code 02

Description of the analog output

The output range of the measured sensor *Source* can be scaled to the processing area (*Scale Low* and *Scale High*).

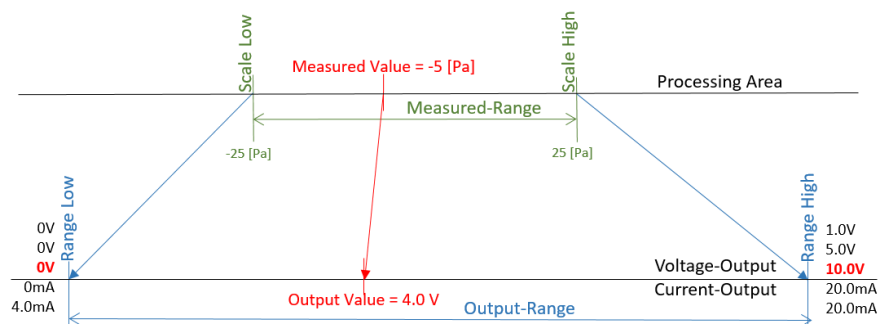
The output range of the analog outputs depends of the selected *Output Stage* and cannot be changed.

The *Scale Low* value will be projected to *Range Low* value and the *Scale High* value to *Range High* value of the selected *Output Range* (0...1V, 0...5V, 0...10V, 0...20mA, 4...20mA).

It applies: *Scale High* must be greater than *Scale Low*

Scale Low and *Scale High* should not exceed the range of $\pm 100'000'000.0$

Example:



Calculation of the resulting value (Output Value):

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

2.5.9 Display Settings

Adjustments to the PF4/5 display concerning appearance and content can be configured.

Register	Name	Flags	Description																				
44'601	Display Bits		<ul style="list-style-type: none"> Not yet used, undefined 																				
44'602	Display Row 1 (Depends on device type)		<table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected source for PF4/5 + solo</th> </tr> </thead> <tbody> <tr><td>0</td><td>No value displayed</td></tr> <tr><td>1</td><td>Differential Pressure</td></tr> <tr><td>2</td><td>Not valid! Don't use!</td></tr> <tr><td>3</td><td>Not valid! Don't use!</td></tr> <tr><td>4</td><td>Not valid! Don't use!</td></tr> <tr><td>5</td><td>Analog Input</td></tr> <tr><td>6</td><td>Ambient Pressure</td></tr> <tr><td>7</td><td>Flow (Use only if Flow is activated)</td></tr> <tr><td>8</td><td>Volume Flow (Use only if Flow is activated)</td></tr> </tbody> </table>	No.	Shows selected source for PF4/5 + solo	0	No value displayed	1	Differential Pressure	2	Not valid! Don't use!	3	Not valid! Don't use!	4	Not valid! Don't use!	5	Analog Input	6	Ambient Pressure	7	Flow (Use only if Flow is activated)	8	Volume Flow (Use only if Flow is activated)
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44'603	Display Row 2 (Depends on device type)		<table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected source</th> </tr> </thead> <tbody> <tr><td>-</td><td>Same as for Display Row 1</td></tr> </tbody> </table>	No.	Shows selected source	-	Same as for Display Row 1																
No.	Shows selected source																						
-	Same as for Display Row 1																						
44'604	Display Row 3 (Depends on device type)		<table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected source</th> </tr> </thead> <tbody> <tr><td>-</td><td>Same as for Display Row 1</td></tr> </tbody> </table>	No.	Shows selected source	-	Same as for Display Row 1																
No.	Shows selected source																						
-	Same as for Display Row 1																						
44'605	Display Row 4 (Depends on device type)		<table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected source for PF4/5 + solo</th> </tr> </thead> <tbody> <tr><td>0</td><td>No value displayed</td></tr> <tr><td>1</td><td>Differential Pressure</td></tr> </tbody> </table>	No.	Shows selected source for PF4/5 + solo	0	No value displayed	1	Differential Pressure														
			No.	Shows selected source for PF4/5 + solo																			
0	No value displayed																						
1	Differential Pressure																						

			<table border="1"> <tbody> <tr><td>2</td><td>Not valid! Don't use!</td></tr> <tr><td>3</td><td>Not valid! Don't use!</td></tr> <tr><td>4</td><td>Not valid! Don't use!</td></tr> <tr><td>5</td><td>Analog Input</td></tr> <tr><td>6</td><td>Ambient Pressure</td></tr> <tr><td>7</td><td>Flow (Use only if Flow is activated)</td></tr> <tr><td>8</td><td>Volume Flow (Use only if Flow is activated)</td></tr> <tr><td>9</td><td>Flow Duct Area (Use only if Flow is activated)</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected source for PF4/5 + HC2</th> </tr> </thead> <tbody> <tr><td>0</td><td>No value displayed</td></tr> <tr><td>1</td><td>Differential Pressure</td></tr> <tr><td>2</td><td>HC2 Humidity</td></tr> <tr><td>3</td><td>HC2 Temperature</td></tr> <tr><td>4</td><td>HC2 Calculation</td></tr> <tr><td>5</td><td>Analog Input</td></tr> <tr><td>6</td><td>Ambient Pressure</td></tr> <tr><td>7</td><td>Flow (Only if Flow is activated)</td></tr> <tr><td>8</td><td>Volume Flow (Only if Flow is activated)</td></tr> <tr><td>9</td><td>Flow Duct Area (Only if Flow is activated)</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected source for PF4/5 + Pt100</th> </tr> </thead> <tbody> <tr><td>0</td><td>No value displayed</td></tr> <tr><td>1</td><td>Differential Pressure</td></tr> <tr><td>2</td><td>Not valid! Don't use!</td></tr> <tr><td>3</td><td>Pt100 Temperature</td></tr> <tr><td>4</td><td>Not valid! Don't use!</td></tr> <tr><td>5</td><td>Analog Input</td></tr> <tr><td>6</td><td>Ambient Pressure</td></tr> <tr><td>7</td><td>Flow (Only if Flow is activated)</td></tr> <tr><td>8</td><td>Volume Flow (Only if Flow is activated)</td></tr> <tr><td>9</td><td>Flow Duct Area (Only if Flow is activated)</td></tr> </tbody> </table>	2	Not valid! Don't use!	3	Not valid! Don't use!	4	Not valid! Don't use!	5	Analog Input	6	Ambient Pressure	7	Flow (Use only if Flow is activated)	8	Volume Flow (Use only if Flow is activated)	9	Flow Duct Area (Use only if Flow is activated)	No.	Shows selected source for PF4/5 + HC2	0	No value displayed	1	Differential Pressure	2	HC2 Humidity	3	HC2 Temperature	4	HC2 Calculation	5	Analog Input	6	Ambient Pressure	7	Flow (Only if Flow is activated)	8	Volume Flow (Only if Flow is activated)	9	Flow Duct Area (Only if Flow is activated)	No.	Shows selected source for PF4/5 + Pt100	0	No value displayed	1	Differential Pressure	2	Not valid! Don't use!	3	Pt100 Temperature	4	Not valid! Don't use!	5	Analog Input	6	Ambient Pressure	7	Flow (Only if Flow is activated)	8	Volume Flow (Only if Flow is activated)	9	Flow Duct Area (Only if Flow is activated)
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44'606	Pixel Color	! E	• Color for pixel																																																												
44'607	Pixel Color Alarm	! E	• Color for alarm																																																												
44'608	Pixel Color Pre-Alarm	! E	• Color for pre-alarm																																																												
44'609	Pixel Color Background	! E	• Color for background																																																												
44'610	Display Brightness		<table border="1"> <thead> <tr> <th>No.</th> <th>Shows select display brightness</th> </tr> </thead> <tbody> <tr><td>0</td><td>Display brightness 20%</td></tr> <tr><td>1</td><td>Display brightness 30%</td></tr> <tr><td>2</td><td>Display brightness 40%</td></tr> <tr><td>3</td><td>Display brightness 50%</td></tr> <tr><td>4</td><td>Display brightness 60%</td></tr> <tr><td>5</td><td>Display brightness 70%</td></tr> <tr><td>6</td><td>Display brightness 80%</td></tr> <tr><td>7</td><td>Display brightness 90%</td></tr> <tr><td>8</td><td>Display brightness 100%</td></tr> </tbody> </table>	No.	Shows select display brightness	0	Display brightness 20%	1	Display brightness 30%	2	Display brightness 40%	3	Display brightness 50%	4	Display brightness 60%	5	Display brightness 70%	6	Display brightness 80%	7	Display brightness 90%	8	Display brightness 100%																																								
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44'611 ... 44'699	Reserved		<ul style="list-style-type: none"> • Undefined • Gives back Modbus Exception Code 02 																																																												

2.5.10 Alarm Settings

For most sensors, it is possible to set alarm values for a *Low* and *High* level with *Hysteresis* and pre-alarm values to *Low* and *High* level.

Values of the selected sensor, which are located below the low alarm or above the high alarm (or pre-alarm), trigger an alarm (or pre-alarm). The value specified for the alarm function *Hysteresis* is used for both the *Low* and the *High* alarm. *Hysteresis* is not used for pre-alarm.

To activate the alarm, you have to set the corresponding *Alarm Bit* to *ON*.

Note!

Be sure to select alarm values inside the operating range of the sensors. Valid ranges depends on selected measuring value and selected unit.

Register	Name	Flags	Description																
44'701	Alarm Bits (Depends on device type)	f !	<table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected source for PF4/5 + solo</th> </tr> </thead> <tbody> <tr><td>0</td><td>Differential Pressure</td></tr> <tr><td>1</td><td>Not valid! Don't use!</td></tr> <tr><td>2</td><td>Not valid! Don't use!</td></tr> <tr><td>3</td><td>Not valid! Don't use!</td></tr> <tr><td>4</td><td>Analog Input</td></tr> <tr><td>5</td><td>Flow (Use only if Flow is activated)</td></tr> <tr><td>6</td><td>Volume Flow (Use only if Flow is activated)</td></tr> </tbody> </table>	No.	Shows selected source for PF4/5 + solo	0	Differential Pressure	1	Not valid! Don't use!	2	Not valid! Don't use!	3	Not valid! Don't use!	4	Analog Input	5	Flow (Use only if Flow is activated)	6	Volume Flow (Use only if Flow is activated)
			No.	Shows selected source for PF4/5 + solo															
			0	Differential Pressure															
			1	Not valid! Don't use!															
			2	Not valid! Don't use!															
			3	Not valid! Don't use!															
			4	Analog Input															
			5	Flow (Use only if Flow is activated)															
			6	Volume Flow (Use only if Flow is activated)															
			<table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected source for PF4/5 + HC2</th> </tr> </thead> <tbody> <tr><td>0</td><td>Differential Pressure</td></tr> <tr><td>1</td><td>HC2 Humidity</td></tr> <tr><td>2</td><td>HC2 Temperature</td></tr> <tr><td>3</td><td>HC2 Calculation</td></tr> <tr><td>4</td><td>Analog Input</td></tr> <tr><td>5</td><td>Flow (Use only if Flow is activated)</td></tr> <tr><td>6</td><td>Volume Flow (Use only if Flow is activated)</td></tr> </tbody> </table>	No.	Shows selected source for PF4/5 + HC2	0	Differential Pressure	1	HC2 Humidity	2	HC2 Temperature	3	HC2 Calculation	4	Analog Input	5	Flow (Use only if Flow is activated)	6	Volume Flow (Use only if Flow is activated)
			No.	Shows selected source for PF4/5 + HC2															
			0	Differential Pressure															
			1	HC2 Humidity															
			2	HC2 Temperature															
			3	HC2 Calculation															
			4	Analog Input															
			5	Flow (Use only if Flow is activated)															
			6	Volume Flow (Use only if Flow is activated)															
			<table border="1"> <thead> <tr> <th>No.</th> <th>Shows selected source for PF4/5 + Pt100</th> </tr> </thead> <tbody> <tr><td>0</td><td>Differential Pressure</td></tr> <tr><td>1</td><td>Not valid! Don't use!</td></tr> <tr><td>2</td><td>Pt100 Temperature</td></tr> <tr><td>3</td><td>Not valid! Don't use!</td></tr> <tr><td>4</td><td>Analog Input</td></tr> <tr><td>5</td><td>Flow (Use only if Flow is activated)</td></tr> <tr><td>6</td><td>Volume Flow (Use only if Flow is activated)</td></tr> </tbody> </table>	No.	Shows selected source for PF4/5 + Pt100	0	Differential Pressure	1	Not valid! Don't use!	2	Pt100 Temperature	3	Not valid! Don't use!	4	Analog Input	5	Flow (Use only if Flow is activated)	6	Volume Flow (Use only if Flow is activated)
			No.	Shows selected source for PF4/5 + Pt100															
			0	Differential Pressure															
			1	Not valid! Don't use!															
			2	Pt100 Temperature															
			3	Not valid! Don't use!															
4	Analog Input																		
5	Flow (Use only if Flow is activated)																		
6	Volume Flow (Use only if Flow is activated)																		
0 = Alarm Value is OFF, 1 = Alarm Value is ON																			
44'702	Differential Pressure Low	f !	● Alarm value differential pressure low (part 1)																
44'703		f !	● Alarm value differential pressure low (part 2)																
44'704	Differential Pressure High	f !	● Alarm value differential pressure high (part 1)																
44'705		f !	● Alarm value differential pressure high (part 2)																

44'706	Differential Pressure Hysteresis	f!	• Alarm value differential pressure hysteresis (part 1)
44'707		f!	• Alarm value differential pressure hysteresis (part 2)
44'708	Differential Pressure Pre-Alarm Low	f!	• Pre-alarm value differential pressure low (part 1)
44'709		f!	• Pre-alarm value differential pressure low (part 2)
44'710	Differential Pressure Pre-Alarm High	f!	• Pre-alarm value differential pressure high (part 1)
44'711		f!	• Pre-alarm value differential pressure high (part 2)
44'712	Humidity Low	f!	• Alarm value humidity low (part 1)
44'713	Use only if HC2 is used	f!	• Alarm value humidity low (part 2)
44'714	Humidity High	f!	• Alarm value humidity high (part 1)
44'715	Use only if HC2 is used	f!	• Alarm value humidity high (part 2)
44'716	Humidity Hysteresis	f!	• Alarm value humidity hysteresis (part 1)
44'717	Use only if HC2 is used	f!	• Alarm value humidity hysteresis (part 2)
44'718	Humidity Pre-Alarm Low	f!	• Pre-alarm value humidity low (part 1)
44'719	Use only if HC2 is used	f!	• Pre-alarm value humidity low (part 2)
44'720	Humidity Pre-Alarm High	f!	• Pre-alarm value humidity high (part 1)
44'721	Use only if HC2 is used	f!	• Pre-alarm value humidity high (part 2)
44'722	Temperature Low	f!	• Alarm value temperature low (part 1)
44'723	Use only if HC2 or Pt100 is used	f!	• Alarm value temperature low (part 2)
44'724	Temperature High	f!	• Alarm value temperature high (part 1)
44'725	Use only if HC2 or Pt100 is used	f!	• Alarm value temperature high (part 2)
44'726	Temperature Hysteresis	f!	• Alarm value temperature hysteresis (part 1)
44'727	Use only if HC2 or Pt100 is used	f!	• Alarm value temperature hysteresis (part 2)
44'728	Temperature Pre-Alarm Low	f!	• Pre-alarm value temperature low (part 1)
44'729	Use only if HC2 or Pt100 is used	f!	• Pre-alarm value temperature low (part 2)
44'730	Temperature Pre-Alarm High	f!	• Pre-alarm value temperature high (part 1)
44'731	Use only if HC2 or Pt100 is used	f!	• Pre-alarm value temperature high (part 2)
44'732	Calculation Low	f!	• Alarm value calculation low (part 1)
44'733	Use only if HC2 is used	f!	• Alarm value calculation low (part 2)
44'734	Calculation High	f!	• Alarm value calculation high (part 1)
44'735	Use only if HC2 is used	f!	• Alarm value calculation high (part 2)
44'736	Calculation Hysteresis	f!	• Alarm value calculation hysteresis (part 1)
44'737	Use only if HC2 is used	f!	• Alarm value calculation hysteresis (part 2)
44'738	Calculation Pre-Alarm Low	f!	• Pre-alarm value calculation low (part 1)
44'739	Use only if HC2 is used	f!	• Pre-alarm value calculation low (part 2)
44'740	Calculation Pre-Alarm High	f!	• Pre-alarm value calculation high (part 1)
44'741	Use only if HC2 is used	f!	• Pre-alarm value calculation high (part 2)
44'742	Analog Input Low	f!	• Alarm value analog input low (part 1)
44'743		f!	• Alarm value analog input low (part 2)
44'744	Analog Input High	f!	• Alarm value analog input high (part 1)
44'745		f!	• Alarm value analog input high (part 2)
44'746	Analog Input Hysteresis	f!	• Alarm value analog input hysteresis (part 1)
44'747		f!	• Alarm value analog input hysteresis (part 2)
44'748	Analog Input Pre-Alarm Low	f!	• Pre-alarm value analog input low (part 1)
44'749		f!	• Pre-alarm value analog input low (part 2)
44'750	Analog Input Pre-Alarm High	f!	• Pre-alarm value analog input high (part 1)
44'751		f!	• Pre-alarm value analog input high (part 2)
44'752	Flow Low	f!	• Alarm value flow low (part 1)

44'753	Use only if Flow is activated	f !	• Alarm value flow low (part 2)
44'754	Flow High	f !	• Alarm value flow high (part 1)
44'755	Use only if Flow is activated	f !	• Alarm value flow high (part 2)
44'756	Flow Hysteresis	f !	• Alarm value flow hysteresis (part 1)
44'757	Use only if Flow is activated	f !	• Alarm value flow hysteresis (part 2)
44'758	Flow Pre-Alarm Low	f !	• Pre-alarm value flow low (part 1)
44'759	Use only if Flow is activated	f !	• Pre-alarm value flow low (part 2)
44'760	Flow Pre-Alarm High	f !	• Pre-alarm value flow high (part 1)
44'761	Use only if Flow is activated	f !	• Pre-alarm value flow high (part 2)
44'762	Volume Flow Low	f !	• Alarm value volume flow low (part 1)
44'763	Use only if Flow is activated	f !	• Alarm value volume flow low (part 2)
44'764	Volume Flow High	f !	• Alarm value volume flow high (part 1)
44'765	Use only if Flow is activated	f !	• Alarm value volume flow high (part 2)
44'766	Volume Flow Hysteresis	f !	• Alarm value volume flow hysteresis (part 1)
44'767	Use only if Flow is activated	f !	• Alarm value volume flow hysteresis (part 2)
44'768	Volume Flow Pre-Alarm Low	f !	• Pre-alarm value volume flow low (part 1)
44'769	Use only if Flow is activated	f !	• Pre-alarm value volume flow low (part 2)
44'770	Volume Flow Pre-Alarm High	f !	• Pre-alarm value volume flow high (part 1)
44'771	Use only if Flow is activated	f !	• Pre-alarm value volume flow high (part 2)
44'772 ... 44'799	Reserved		• Undefined • Gives back Modbus Exception Code 02

2.5.11 Relay Settings

Setting of relays for all sensors.

Note!

In order to make use of the PF4/5 relay output, you must first enable the *Alarm Bits* and set the corresponding *Alarm Levels* (low and high) for each sensor that you want to monitor (see [Alarm Settings](#)).

Be aware that more than one *Alarm Source* can activate the relay

Register	Name	Flags	Description	
			No.	Shows selected alarm level
44'801	Alarm Level Differential Pressure		0	Off (No differential pressure alarm)
			1	Low (<i>Differential Pressure Low</i> alarm)
			2	High (<i>Differential Pressure High</i> alarm)
			3	Low or High
44'802	Alarm Level Humidity Use only if HC2 is used		No.	Shows selected alarm level
			-	Same as for <i>Alarm Level Differential Pressure</i>
44'803	Alarm Level Temperature Use only if HC2 or Pt100 is used		No.	Shows selected alarm level
			-	Same as for <i>Alarm Level Differential Pressure</i>
44'804	Alarm Level Calculation Use only if HC2 is used		No.	Shows selected alarm level
			-	Same as for <i>Alarm Level Differential Pressure</i>
44'805	Alarm Level Analog Input		No.	Shows selected alarm level
			-	Same as for <i>Alarm Level Differential Pressure</i>
44'806	Alarm Level Flow Use only if Flow is activated		No.	Shows selected alarm level
			-	Same as for <i>Alarm Level Differential Pressure</i>
44'807	Alarm Level Volume Flow Use only if Flow is activated		No.	Shows selected alarm level
			-	Same as for <i>Alarm Level Differential Pressure</i>
44'808	Alarm Off		No.	Shows selected alarm Off sequence
			0	Alarm never ends! ➤ The relay stays energized until it will be de-energized manually
			1	Off when alarm ends ➤ The relay will be de-energized as soon as the alarm condition ends
			2	Off after <i>Timeout</i> ➤ The relay will remain energized for the specified duration (<i>Timeout</i>) even if the alarm condition has ended
			3	Off after alarm ends or after <i>Timeout</i>
44'809	On Delay	!	<ul style="list-style-type: none"> On delay time for relay (0 ... 65536 [s]) ➤ If alarm condition occurs, the relay will be energized after specified <i>OnDelay</i> time 	
44'810	Alarm Time	!	<ul style="list-style-type: none"> Maximal alarm time for relay (0 ... 65536 [s]) 	

	➤ Time in seconds between the occurrence of the trigger criterion and the de-energizing of the relay. This timeout will be active when <i>Off after Timeout</i> is chosen		
44'811	Mute On/Off		<ul style="list-style-type: none"> • If <i>ON</i>: It's possible to mute the alarm for <i>Mute Time</i>
44'812	Mute Time	!	<ul style="list-style-type: none"> • Mute time (0 ... 65536 [s])
	➤ Time in seconds the relay will be muted before the alarm went on again (if alarm is still active)		
44'813 ... 44'899	Reserved		<ul style="list-style-type: none"> • Undefined • Gives back Modbus Exception Code 02

2.5.12 Analog Input Settings

The input range of the analog input covers 0 to 10.0 [V] resp. 0 to 24.0 [mA], depending on [Analog Input Type](#).

Register	Name	Flags	Description	
44'901	Analog Input Bits		Bit	Description of the Analog Input bits
			0	Auto Unit ➤ See below
			1...1 5	Reserved
44'902	Analog Input Type		No.	Select Analog Input Source
			0	Voltage (0 ... 10V)
			1	Current (0 ... 24mA)
➤ The same value as in Value Type -> Analog Input Select				
44'903	Input Range Low	f!	• Customer selectable input range (low level) (part 1)	
44'904		f!	• Customer selectable input range (low level) (part 2)	
44'905	Input Range High	f!	• Customer selectable input range (high level) (part 1)	
44'906		f!	• Customer selectable input range (high level) (part 2)	
44'907	Processing Range Scale Low	f!	• Customer selectable proc. range scale low (part 1)	
44'908		f!	• Customer selectable proc. range scale low (part 2)	
44'909	Processing Range Scale High	f!	• Customer selectable proc. range scale high (part 1)	
44'910		f!	• Customer selectable proc. range scale high (part 2)	
➤ Example see below				
44'911 ... 44'999	Reserved		<ul style="list-style-type: none"> • Undefined • Gives back Modbus Exception Code 02 	

Auto Unit: Off the text in the field *Unit: Analog Input String* in the section [Value Unit](#) will be showed.

Auto Unit: On if the field *Unit: Analog Input String* in the section [Value Unit](#) is empty, the following automatic unit string will be used:

<i>Analog Input Select</i>	<i>Voltage</i>	<i>Current</i>
Auto Unit	"V"	"mA"

If the field *Unit: Analog Input String* in the section [Value Unit](#) is not empty, e.g. set to "ppm", the unit in the field *Unit: Analog Input String* will be used, in this case "ppm".

Description of the analog input

The input range of the analog input covers 0.0 [V] to 10.0 [V] resp. 0.0 [mA] to 24.0 [mA], depending on [Analog Input Type](#).

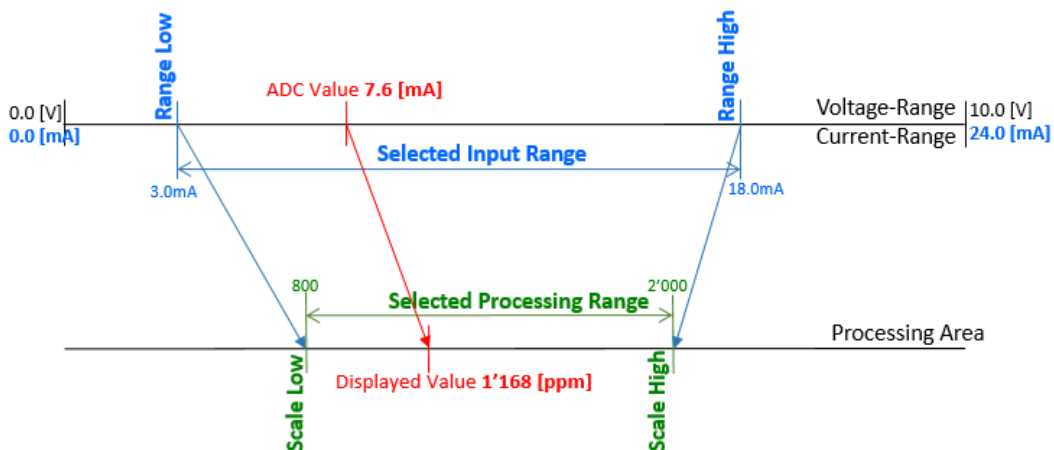
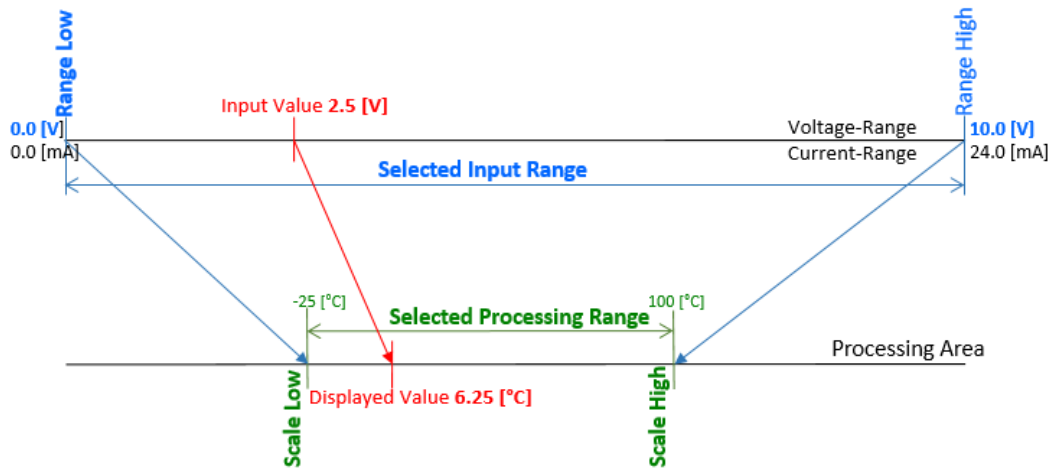
The input range (**Range Low / High**) of the analog input can be scaled to a processing area (**Scale Low / High**).

Note!

Range High must be greater than **Range Low** and **Scale High** must be greater or equal **Scale Low**.

Don't exceed the selected maximal and minimal limits of the input range.

Examples:



Calculation of the resulting value (*Displayed Value*):

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

2.5.13 Flow Settings

Setting of flow specific values.

Register	Name	Flags	Description	
			Bit	Description of the Flow bits
45'001	Flow Bits		0	OFF – Flow measurement is OFF
				ON – Flow measurement is ON
			1...1 5	Reserved
45'002	Duct Area	f !	• Customer selectable flow area (part 1)	
45'003	Only if Flow is activated	f !	• Customer selectable flow area (part 2)	
45'004	KL Factor	f !	• Customer selectable flow KL factor (part 1)	
45'005	Only if Flow is activated	f !	• Customer selectable flow KL factor (part 2)	
45'006 ... 45'099	Reserved		• Undefined • Gives back Modbus Exception Code 02	

Duct Area: Channel area for the calculation of the volume flow. Unit is defined in [Value Unit](#)

KL Factor: Actual KL factor for the calculation of the volume flow

• Calculation formula

$$\text{Velocity (m/s)}^* = K_L \times \sqrt{P_t - P_s}$$

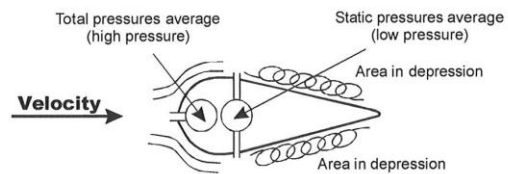
with P_t and P_s in Pa

$$\text{Air flow (m}^3\text{/h)}^* = K_L \times \sqrt{P_d} \times S \times 3600$$

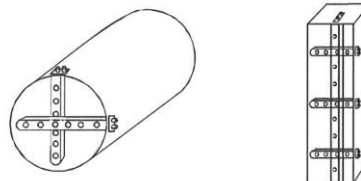
with P_d in Pa and S in m^2

K_L : DEBIMO blade factor
 P_t : total pressure
 P_s : static pressure
 S : duct section (m^2)
 $P_d = P_t - P_s = \text{dynamic pressure}$
 Factor of velocity calculation $K_L = 1$

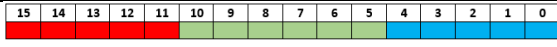
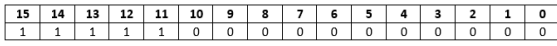
* Theoretical, with the specific weight of the air 1,2Kg /



• Mounting examples



2.5.14 Explanation of Flags

"	Character values separated in succeeding registers. 2 characters per register
?	After restart of the device, the <i>Reference Values</i> are always set to 0.0
f	These are float values (32-bit IEEE754), separated in two succeeding registers (16-bits). How to bring together part 1 and part 2 of the 32-bit float-value, depends on the <i>Swap Mode</i> of the Modbus communication (see Device Specific Settings and Selectable Swap Modes for Rotronic Devices)
!	Attention! It is not possible to verify the value, written to this register. Most of the <i>Specific Holding Registers</i> cannot be validated, if Modbus command <i>Write Multiple Register</i> is used
i	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 <i>Swap Mode</i> of the Modbus communication (see Selectable Swap Modes for Rotronic Devices)
E	Color Bits:  Red Green Blue e.g. Red 

2.5.15 Example: Read Holding Register

2.5.15.1 Read Display Settings (Registers 44'602 to 44'605)

RTU Example:

Transmit	01 03 ae 39 00 04 b4 ec
Receive	01 03 08 00 01 00 02 00 03 00 06 8c d5

TCP Example:

Transmit	MBAP 01 03 ae 39 00 04
Receive	MBAP 01 03 08 00 01 00 02 00 03 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 (Device Number + 1) (see Device Specific Settings)
Function code	1	0x03	Read Holding Register
Starting address	2	0xae39	= 44'601 (Attention! register number – 1)
Quantity of registers	2	0x0004	= 4, means read 4 registers
Byte count	1	0x08	= $8 \triangleq 2 * N$, means numbers of returned bytes
Register value (see Display Settings)	2 * N	0x0001	Display Row 1: Differential Pressure
		0x0002	Display Row 2: Humidity
		0x0003	Display Row 3: Temperature
		0x0006	Display Row 4: Ambient Pressure

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

2.5.16 Example: Write Holding Register

2.5.16.1 Write Display Settings (Registers 44'602 to 44'605)

RTU Example:

Transmit	01 10 ae 39 00 04 08 00 03 00 02 00 01 00 00 67 09
Receive	01 10 ae 39 00 04 31 2f

TCP Example:

Transmit	MBAP 01 10 ae 39 00 04 08 00 03 00 02 00 01 00 00
Receive	MBAP 01 10 ae 39 00 04

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 (Device Number + 1) (see Device Specific Settings)
Function code	1	0x10	Write Multiple Register
Starting address	2	0xae39	= 44'601 (Attention! register number – 1)
Quantity of registers	2	0x0004	= 4, means read 6 registers
Byte count	1	0x08	= $8 \triangleq 2 * N$, means numbers of returned bytes
Register value (see Display Settings)	2 * N	0x0003	Display Row 1: Temperature
		0x0002	Display Row 2: Humidity
		0x0001	Display Row 3: Differential Pressure
		0x0000	Display Row 4: No value displayed

Note!

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

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

3 Document Releases

Doc. Release	Datum	Bemerkung
E-M-PF4_PF5-Modbus	20.03.2019	Release Document