

Operating Instructions **Memograph M, RSG45**

Advanced Data Manager

Additional Instructions for Modbus RTU / TCP Master



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1 General information

1.1 Safety symbols

⚠ DANGER

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

⚠ WARNING

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

⚠ CAUTION

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE

This symbol contains information on procedures and other facts which do not result in personal injury.

All of the descriptions below that are relevant to device settings refer to **Setup** → **Advanced setup** unless otherwise specified.

1.2 Scope of delivery

NOTICE

This manual contains an additional description for a special software option.

This supplementary description is not intended to replace the accompanying Operating Instructions!

- Detailed information can be found in the Operating Instructions and the additional documentation.

Available for all device versions via:

- Internet: www.endress.com/deviceviewer
- Smartphone/tablet: Endress+Hauser Operations App

1.3 Firmware history

Overview of unit software history:

Unit software Version / date	Software modifications	Operating Instructions
V2.00.06 / 12.2015	Original software	BA01390R/09/EN/01.15
V2.01.04 / 06.2016	Extended functionality AOP/ bug fixes	BA01390R/09/EN/02.15
V2.04.06 / 10.2022	Bug fixes	BA01390R/09/EN/03.22-00

1.4 Requirements

The Modbus Master function can be used in parallel with the Fieldbus slave options (Modbus TCP, Profibus DP, etc.). The device can thus be master of a Modbus bus and can be scanned as a slave by a control system.

Modbus Master RTU and Modbus Slave RTU cannot be used simultaneously because the same interface is used.

Modbus Master RTU and Modbus Master TCP cannot be used simultaneously.

The combination of Modbus Master RTU and tele-alarm software option is possible. However, the device's RS485/232 interface is used by the Modbus master wiring. The Internet/email functionality of the tele-alarm software can thus be used but modem connection is not possible via RS232.

1.5 Required settings

As Modbus master, the device can scan other Modbus slaves via RS485 or Ethernet. The following settings are required for this purpose:

1.5.1 Modbus Master RTU

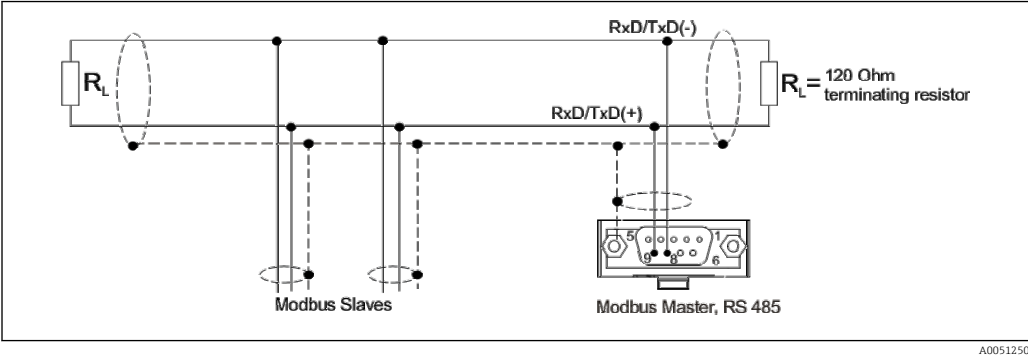
Setup → Advanced setup → Communication → Modbus Master

Modbus		RS485
Scan cycle		1, 2, 5, 10, 30s, 1, 2, 5, 10min
Timeout for response		1, 2, 5, 10s, 30s, 1min
Serial interface		
	Baud rate	9600, 19200, 38400, 57600, 115200
	Parity	none, odd, even
	Stop bits	1, 2
Expert mode		
	Register per command	3 to 125
	Connection attempts	1 to 10
	Command distribution	Distributed over scan cycle, At the start of the scan cycle, Continuously
	Pause between commands	5 to 600000 ms

Setup → Advanced setup → Inputs → Universal inputs → Universal input x

Universal input (max. 40)		
	Signal	Modbus Master
	Measured value type	Instantaneous value, counter
	Slave address	1 to 255
	Readout function	Read Input Register, Read Holding Register
	Register address	1 to 65535
	Data type	INT16, UINT16, INT32_B, INT32_L, UINT32_B, UINT32_L, FLOAT_B, FLOAT_L, DOUBLE_B, DOUBLE_L
	Calc. factor	(If "Counter" is selected)
	Start value range End value range Range start Meas. range end	(Scaling for measured value type Instantaneous value and data type .INT..)

Electrical connection



Initial setting

The commands used are evenly distributed over the scan cycle.

If a response timeout occurs, the request is made once more at the next scan cycle. If there is still no response, all of the values of the slave are declared as invalid. (Counting stops if "Counter" is selected).

The counter that is read in is interpreted as the overall counter.

1.5.2 Modbus Master TCP

Setup → Advanced setup → Communication → Modbus Master

Modbus	Ethernet
Expert mode	
Register per command	3 to 125

Setup → Advanced setup → Inputs → Universal inputs → Universal input x

Universal input (max. 40)		
	Signal	Modbus Master
	Measured value type	Instantaneous value, counter
	Transmission protocol	Modbus TCP, Modbus TCP with slave address, Modbus RTU or TCP
	IP address	x.x.x.x
	Port	502
	Slave address	1 to 255 (for Modbus TCP with slave address)
	Readout function	Read Input Register, Read Holding Register
	Register address	1 to 65535
	Data type	INT16, UINT16, INT32_B, INT32_L, UINT32_B, UINT32_L, FLOAT_B, FLOAT_L, DOUBLE_B, DOUBLE_L
	Calc. factor	(If "Counter" is selected)
	Start value range End value range Range start Meas. range end	(Scaling for measured value type Instantaneous value and data type ..INT..)

Initial setting

The requests are combined as follows:

- A separate connection is established for every different IP address combined with the port.
- If the IP address and port are the same, the same transmission protocols are combined with the slave address into one connection.

The commands used are evenly distributed over the time period of 0.5 s and sent in one connection.

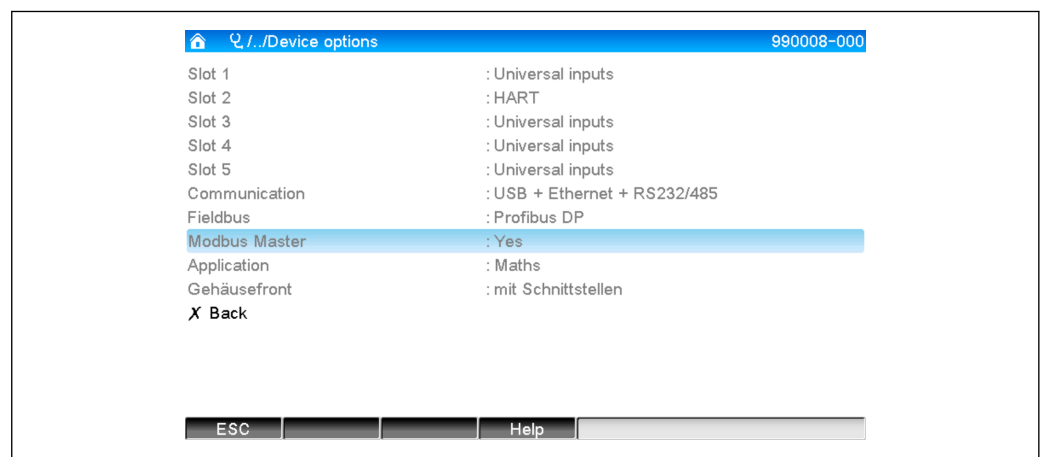
Slaves with different IP addresses or transmission protocols are scanned in parallel.

If a response timeout occurs, the request is made once more at the next scan cycle. If there is still no response, all of the values of the slave are declared as invalid. (Counting stops if "Counter" is selected).

The counter that is read in is interpreted as the overall counter.

1.6 Checking if the Modbus Master option exists

To establish if the **Modbus Master** option exists, check in the main menu under **Diagnostics → Device information → Device options**.

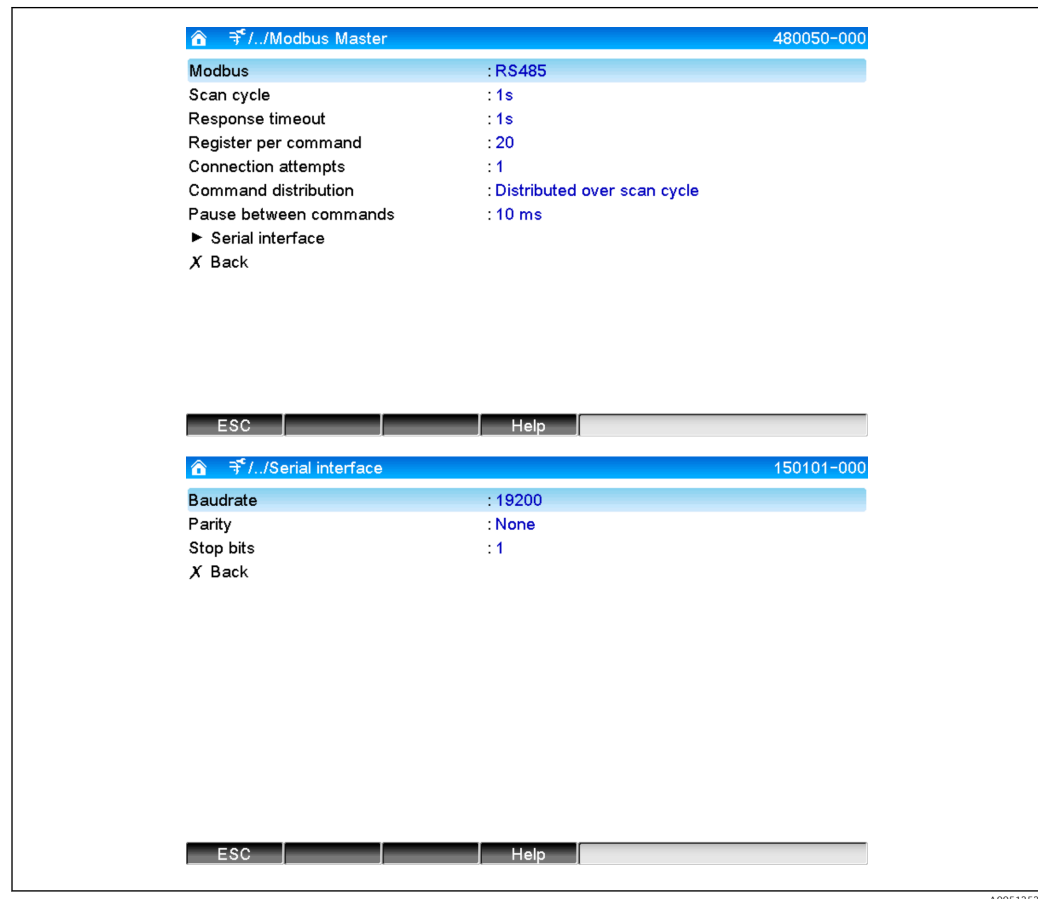


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2 Basic settings

2.1 Activating Modbus Master RTU

The Modbus Master RTU functionality must first be activated in the main menu under **Expert → Communication → Modbus Master** in order to use it.



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2.1.1 Register per command

Initial setting: 20 (3 to 125)

This option is used to set the maximum number of registers combined in one command if several registers are read by one slave,

e.g. registers 1-3 and registers 10-12 should be read so registers 1-12 are read with one command.

If this parameter was set to 6 for example, two individual commands are sent.

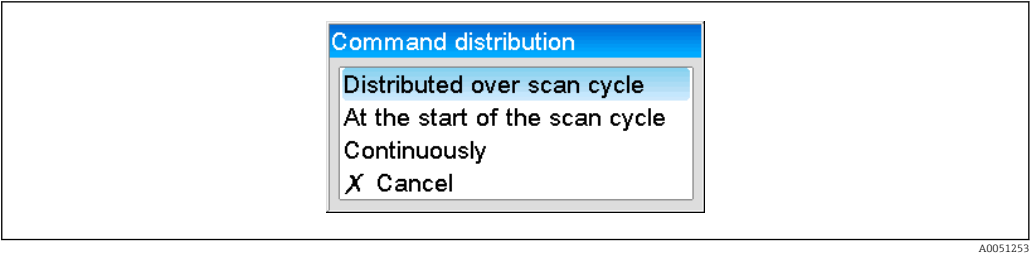
2.1.2 Connection attempts

Initial setting: 1 (1 to 10)

If a slave does not respond within the configured time, an attempt is once again made to build a connection at the next scan cycle. The number of attempts can be set. The last value configured is reused during the attempts. The value is then flagged as invalid.

2.1.3 Command distribution

Initial setting: Distributed over scan cycle



- Distributed over scan cycle: The commands are evenly distributed over the scan cycle.
- At the start of the scan cycle: The commands are sent at intervals (pause) at the start of the scan cycle. A new request starts after the scan cycle is completed.
- Continuously: The commands are continuously sent at intervals (pause) irrespective of the scan cycle.

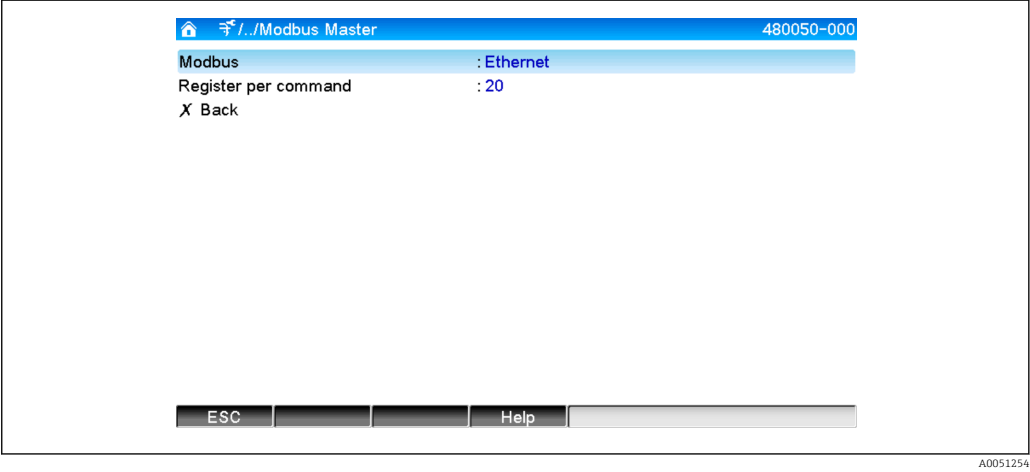
2.1.4 Pause between commands

Initial setting: 10 ms (5 to 600000)

The minimum duration of the pause between the commands to be sent.

2.2 Activating Modbus Master TCP

The Modbus Master TCP functionality must first be activated in the main menu under **Expert → Communication → Modbus Master** in order to use it.



2.2.1 Register per command

Initial setting: 20 (3 to 125)

This option is used to set the maximum number of registers combined in one command if several registers are read by one slave,

e.g. registers 1-3 and registers 10-12 should be read so registers 1-12 are read with one command.

If this parameter was set to 6 for example, two individual commands are sent.

2.2.2 Transmission behavior

Transmission follows an established pattern that includes the following key data:

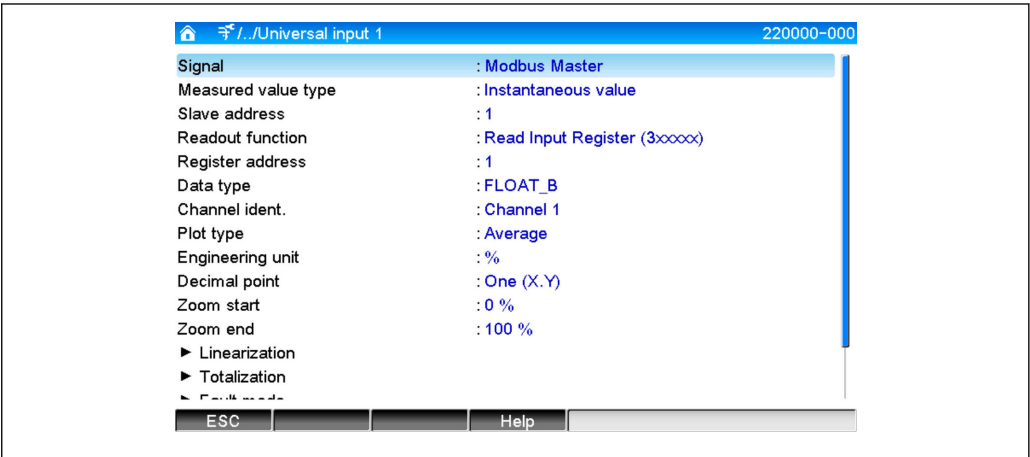
- Connection timeout 5 s
- Resumption of connection after 2 s
- Response timeout 2 s
- Pause between the individual commands in a connection 500ms/number of commands in the connection
- If the following properties (see 3.2 →  13) are identical, the same connection is used
 - IP address
 - Port
 - Transmission protocol
 - Slave address

3 Selecting the Modbus slaves

The Modbus slaves are allocated in the main menu under **Expert** → **Inputs** → **Universal inputs**.

3.1 Setting the universal input for Modbus RTU

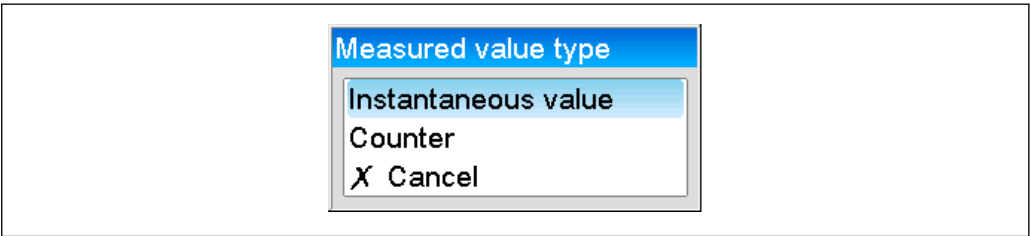
The Modbus Master RTU must first be activated!



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3.1.1 Measured value type

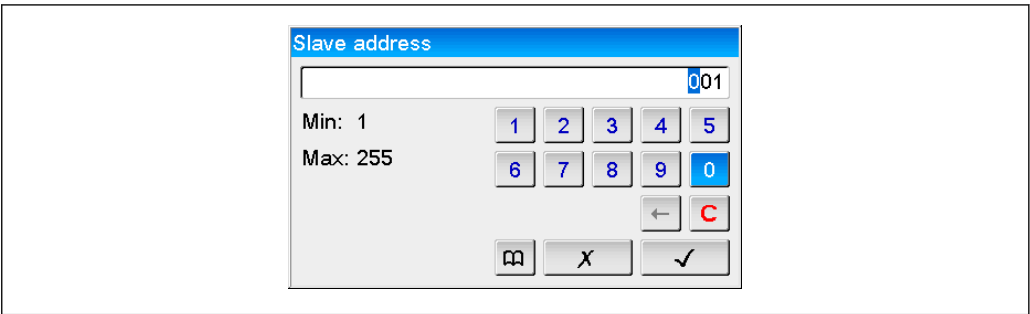
Select how the read measured value should be used.



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3.1.2 Slave address

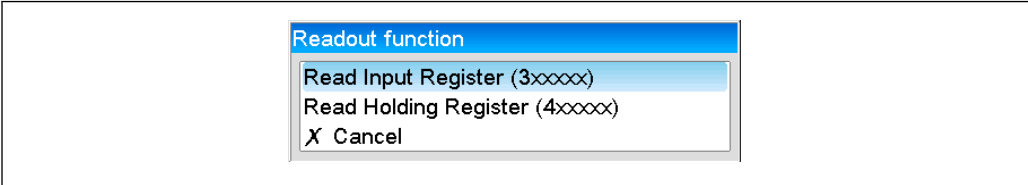
Configure the slave address.



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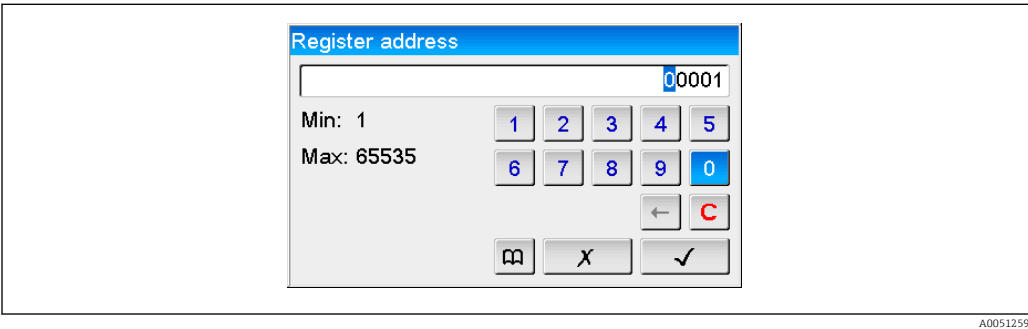
3.1.3 Readout function

Select the function with which the values should be read out.



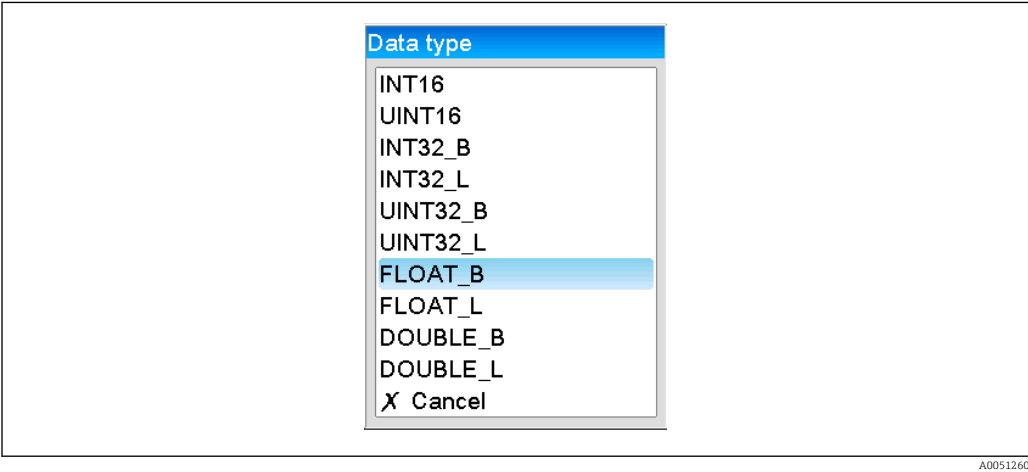
3.1.4 Register address

Enter the register address. Start at 1, which corresponds to address 0 in the transmission protocol.



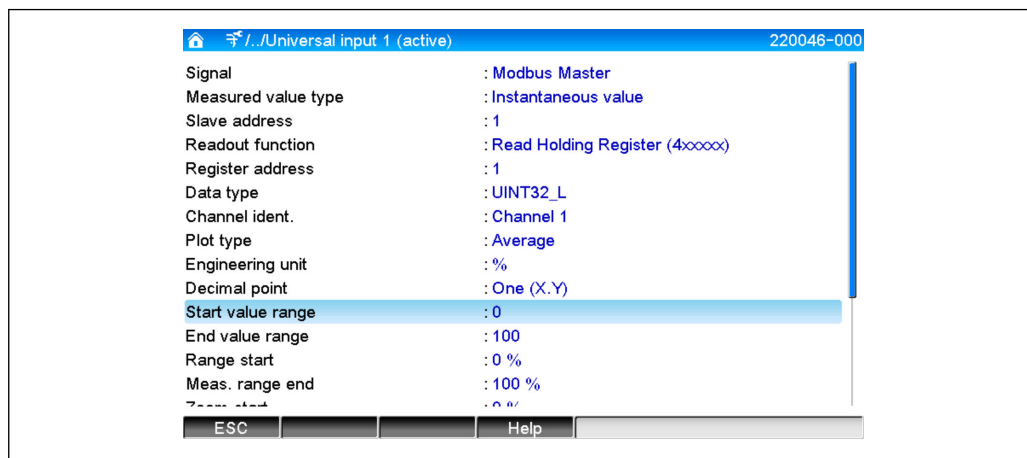
3.1.5 Data type

Select the data type that should interpret the read byte sequences (see also 3.3 Data types → 17).



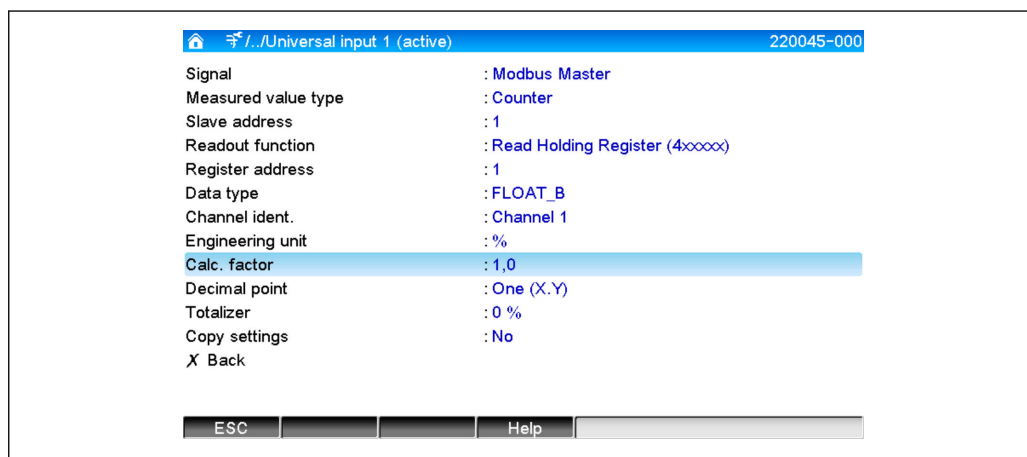
3.1.6 Scaling or calculation factor

The value can be scaled if the data type was set to **..INT..** and the measured value type to **Instantaneous value**.



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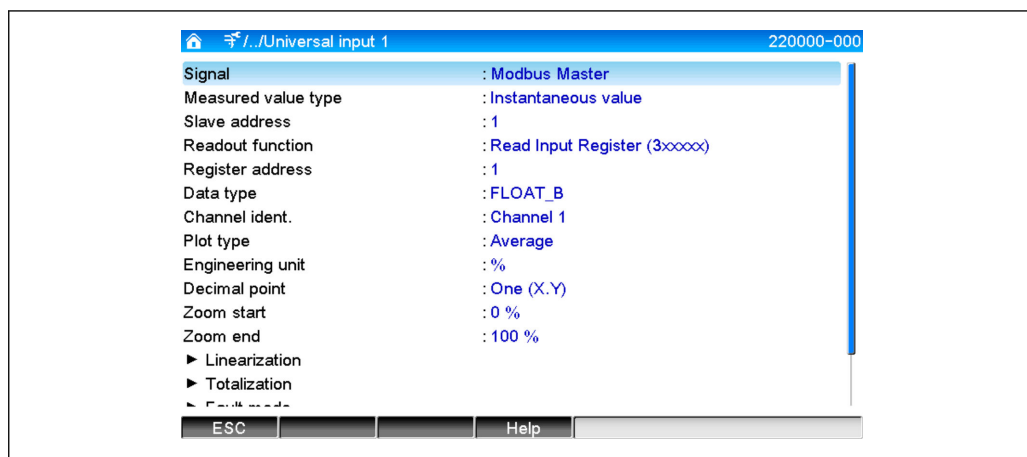
If **Counter** is selected as measured value type, a calculation factor can be specified.



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3.2 Setting the universal input for Modbus TCP

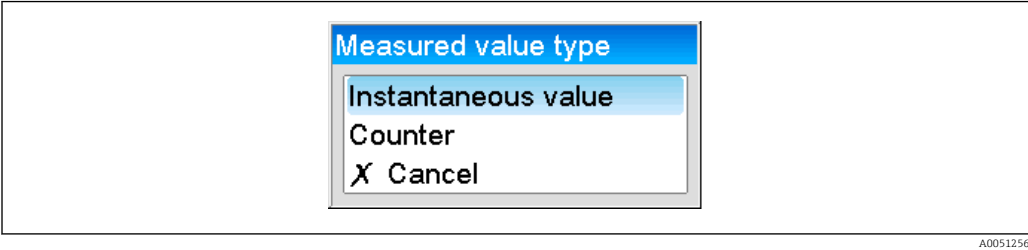
The Modbus Master TCP must first be activated!



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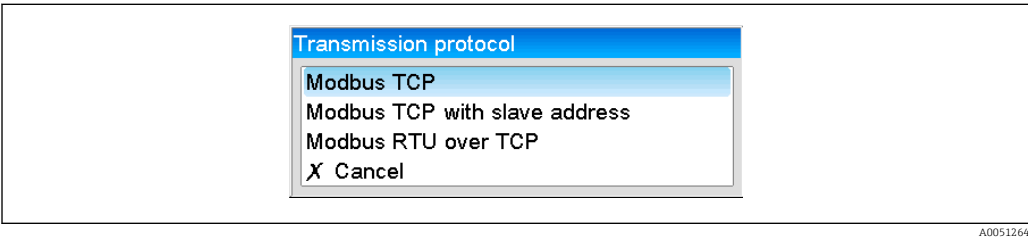
3.2.1 Measured value type

Select how the read measured value should be used.



3.2.2 Transmission protocol

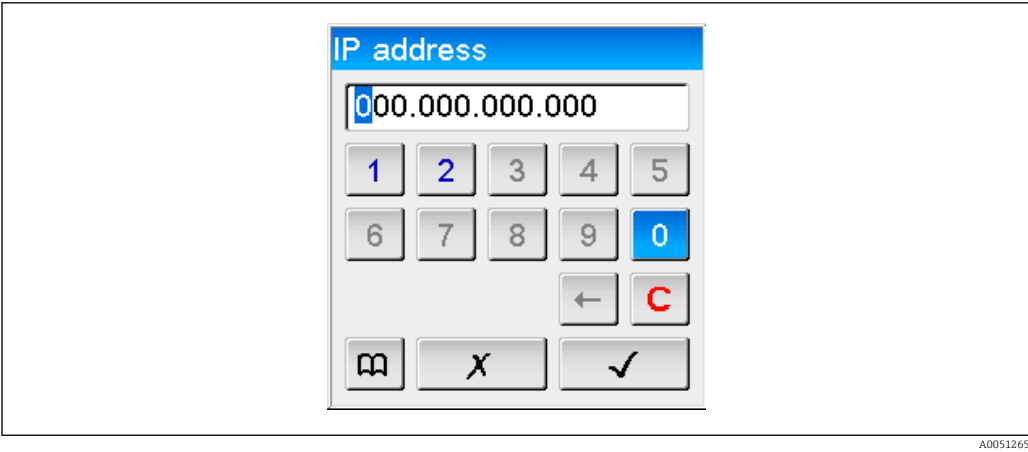
Select the transmission protocol with which the data are transferred.



Modbus TCP:	Communicate with Modbus TCP slaves.
Modbus TCP with slave address:	Communicate with gateways that convert the address to the correct slave using a table.
Modbus RTU over TCP:	Transfer the basic Modbus RTU protocol with CRC sum. Used in Ethernet signal converters -> RS485.

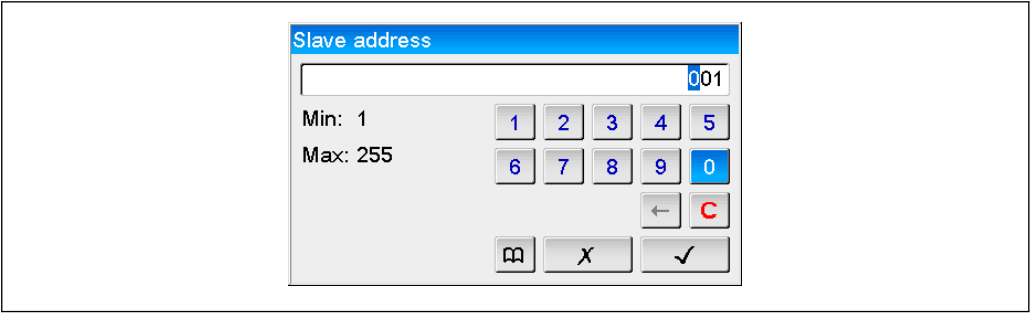
3.2.3 IP address

IP address of the slave or gateway.



3.2.4 Slave address

A slave address must be entered for the **Modbus TCP with slave address** and **Modbus RTU over TCP** transmission protocols.



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3.2.5 Port

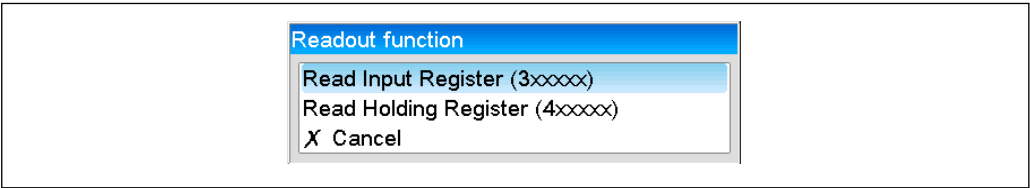
Port for the connection.



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3.2.6 Readout function

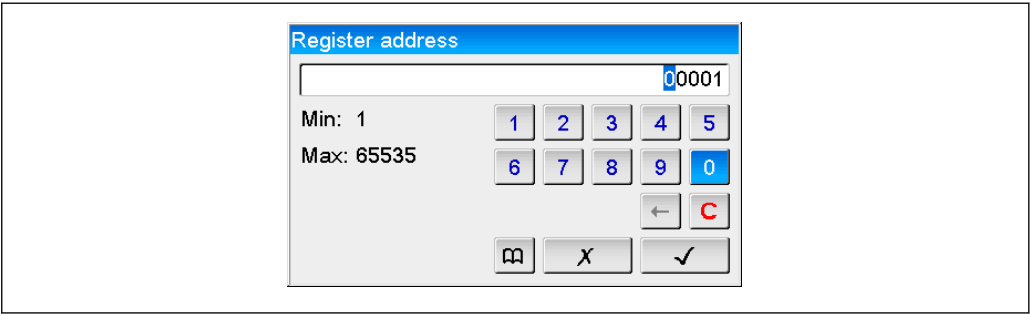
Select the function with which the values should be read out.



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3.2.7 Register address

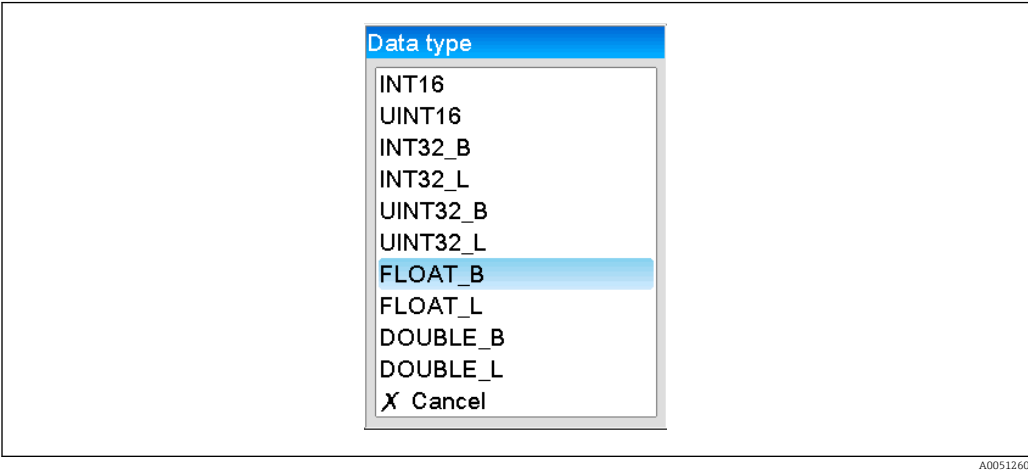
Enter the register address. Start at 1, which corresponds to register address 0 in the transmission protocol.



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3.2.8 Data type

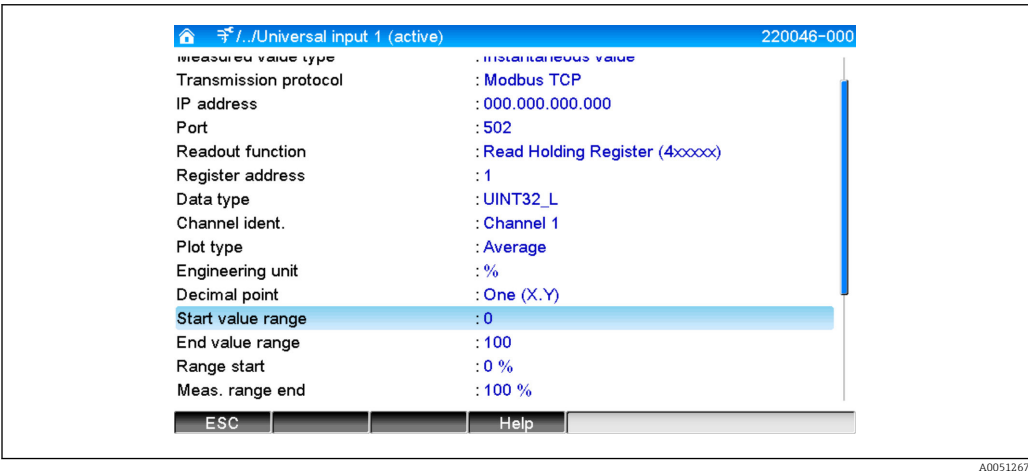
Select the data type that should interpret the read byte sequences (see also 3.3 Data types → 17).



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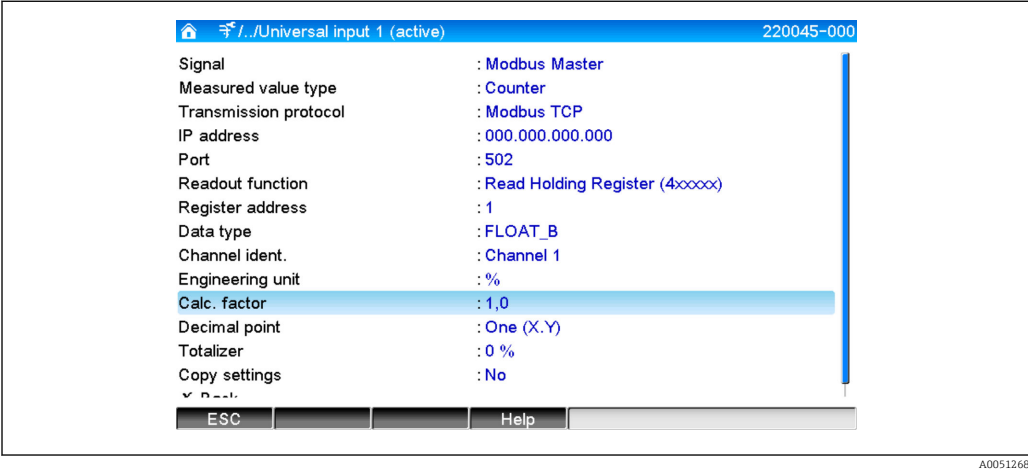
3.2.9 Scaling or calculation factor

The value can be scaled if the data type was set to ..INT.. and the measured value type to **Instantaneous value**.



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If **Counter** is selected as measured value type, a calculation factor can be specified.



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3.3 Data types

The addressing of the bytes, i.e. the order in which they are transmitted, is not defined in the MODBUS specification. It is therefore important to agree or adjust the addressing mode between the master and slave when commissioning.

The following data types are supported by the device:

FLOAT (floating point number IEEE 754)

Data length = 4 bytes (2 registers)

Byte 0	Byte 1	Byte 2	Byte 3
SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM
S = Sign E = Exponent M = Mantissa			

Option	Order			
	1.	2.	3.	4.
FLOAT_L	Byte 2 (MMMMMMMM)	Byte 3 (MMMMMMMM)	Byte 0 (SEEEEEEE)	Byte 1 (EMMMMMMM)
FLOAT_B	Byte 0 (SEEEEEEE)	Byte 1 (EMMMMMMM)	Byte 2 (MMMMMMMM)	Byte 3 (MMMMMMMM)

DOUBLE (floating point number IEEE 754)

Data length = 8 bytes (4 register)

Byte 0	Byte 1	Byte 2	Byte 3
SEEEEEEE	EEEEMMMM	MMMMMMMM	MMMMMMMM
Byte 4	Byte 5	Byte 6	Byte 7
MMMMMMMM	MMMMMMMM	MMMMMMMM	MMMMMMMM
S = Sign E = Exponent M = Mantissa			

Option	Order			
	1.	2.	3.	4.
DOUBLE_L	Byte 6 (MMMMMMMM)	Byte 7 (MMMMMMMM)	Byte 4 (EMMMMMMM)	Byte 5 (MMMMMMMM)
	Byte 2 (MMMMMMMM)	Byte 3 (MMMMMMMM)	Byte 0 (SEEEEEEE)	Byte 1 (EEEEMMMM)
DOUBLE_B	Byte 0 (SEEEEEEE)	Byte 1 (EEEEMMMM)	Byte 2 (MMMMMMMM)	Byte 3 (MMMMMMMM)
	Byte 4 (MMMMMMMM)	Byte 5 (MMMMMMMM)	Byte 6 (MMMMMMMM)	Byte 7 (MMMMMMMM)

UINT32 (unsigned) , INT32 (signed):

Data length = 4 bytes (2 registers)

Byte 0	Byte 1	Byte 2	Byte 3
Most significant byte (MSB)			Least significant byte (LSB)

	Order			
Option	1.	2.	3.	4.
UINT32_L INT32_L	Byte 2	Byte 3 (LSB)	Byte 0 (MSB)	Byte 1
UINT32_B INT32_B	Byte 0 (MSB)	Byte 1	Byte 2	Byte 3 (LSB)

UINT16 (unsigned) , INT16 (signed):

Data length = 2 bytes (1 register)

Byte 1	Byte 2
Most significant byte (MSB)	Least significant byte (LSB)

	Order	
Option	1.	2.
UINT16 INT16	Byte 1 (MSB)	Byte 0 (LSB)

4 Troubleshooting

4.1 Troubleshooting for Modbus TCP

- Is the Ethernet connection between the device and master correct?
- Does the IP address sent by the master correspond to that configured at the device?
- Does the port configured at the master correspond to that configured at the device?

4.2 Troubleshooting for Modbus RTU

- Do the device and master have the same baudrate and parity?
- Is the interface correctly wired?
- Does the device address sent by the master match the configured address of the device?
- Do all the slaves on the Modbus have different device addresses?



www.addresses.endress.com
