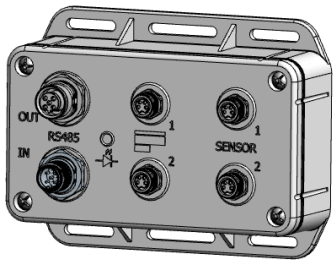
OEM Modbus RTU- Converter: 24 V

The OEM Modbus- Converter: 24 V is an electronic device for making two standard actuators digital for controlling via Modbus RTU. The area of application is the energy-efficient control of water-bearing valves in the area of building services and automation.

The OEM Modbus RTU- Converter: 24 V is controlled by Modbus RTU based on a RS485 signal. The device is equipped with a LED display, two inputs for temperature sensors (passive or 4-20 mA) and two outputs for 0-10V actuators, mainly with feedback- signal.



1.1 Features

- Operating voltage 24 V, appropriate for AC and DC operation
- Pluggable via M12- and M8- connectors
- Modbus In M12 male, Modbus Out M12 Female
- Only Slave Mode
- For two actuators, thermal on/off or thermal / motoric 0-10V actuators with or without feedback
- Automatic baud rate- detection
- DIP-Switches for setting modbus address 1 to 62, CRC- swapping on/ off, baud rate, parity and termination
- Wide range control registers for setting the converter, the plugged actuators and sensors
- Function display via LED
- Four inputs for thermal sensors, passive 2x 22k NTC and 2x 4- 20 mA transmitters
- Water- and moisture- protection (> IP 54)
- Working as adopted to Standard Modbus.ORG
  http://www.modbus.org/

2 Function

The control with Modbus RTU- signal works with a register- control.
There are different areas of registers.

- Setting of the modbus RTU box
- Setting of the connected actuators and sensors
- Functional registers read/write for control the actuators and sensors

Control commands for the actuators are immediately valid.
By using actuators with feedback, the current position of the actuator is readable.

2.1 Automatic Baud rate control:

The system controller sends commands and the Modbus- Converter will measure the timing and stores the measured baud rate. Changing the baud rate at the system controller side, the on-board controller requires a POWER-OFF/POWER-ON sequence to accept the new baud rate setting. The possible baud rate is in a range of 4.800 to 115.200 bps.
The default setting is automatic baud rate destection, even- parity, 8 data bits, 1 start- and 1 stop- bit.

For activating automatic baud rate control, always after power-on, send at first a command to box address 01, (also when this box is not available) to switch all boxes to a required baud rate.

2.2 LED- Function:

Green	for normal function.
Green flashing	during public Modbus- traffic
Yellow flashing	sending modbus telegrams
Yellow	Stand-by
(white flashing:	when box is sending via Modbus)
Red flashing:	when fuse is defect (main display)

2.3 Commissioning

Standard- address setting is 1, because dip-switch is setted to 255, but this address is not allowed.
If DIP- switch is set to the addresses 0 or >= 248 the address is automatically 1.
Before open the box switch- off power supply.
Open the box with the 4 screws and change the basic setting via DIP-switch.
It is not needed to lose the screws completely. When you see two windings you can open the front panel.

Switch		Meaning	default
1		Modbus address Bit 0	On
2		Modbus address Bit 1	On
3		Modbus address Bit 2	On
4		Modbus address Bit 3	On
5		Modbus address Bit 4	On
6		Modbus address Bit 5	On
7		Modbus address Bit 6	On
8		Modbus address Bit 7	On
9	on	Automatic baud rate control: even- parity, 8 data bits, 1 start bit, 1 stop bit	On
9	off	Fixed Baud rate 19.200, E, 8,1,1	On
10		Termination	On

Caution: The assignment of identical addresses in an RS-485 bus system leads to faulty operation!

When the address, baud rate and termination are set, the Modbus converter can be commissioned via Modbus.
First of all, set the box for the connected actuators and sensors. If a special setting is required, the Modbus converter is also available with a customer-specific setting.

It is possible to connect max. 32 Modbus converters to the RS485 bus

2.4 Modbus-Register

See also attached PDF-File.

2.5 Operation

Reg.	Reg.-Adress	Bit=n	Def.	Co	Bit	Funktion
1	FFH	16	0	W		Global function, all boxes switch to stand-by, drives off, sensors off 1= Stand-by- Reset only with Register 12 (10H) Yellow LED is on
2	01H	16	0	R/W		Drive 1: Write new position 0,0 to 100,0% 10 mV = 1 Bit, 0 to 1000 mV, D0 to D1.000, H0000 to H03E8 No function during reset
3	02H	16	0	R/W		Drive 2: Write new position 0,0 to 100,0% 10 mV = 1 Bit, 0 to 1000 mV, D0 to D1.000, H0000 to H03E8 No function during reset
4	03H	16		R		Drive 1: Read current position 0,0 to 100,0 % D0 to D1.000, H0000 to H03E8 When Feedback- voltage < 1 V then Position =0,0 % and Error bit 16.13 is set. When Feedback- voltage > 9 V then Position =0,0 % and Error bit 16.12 is set FFFFH when Feedback is deactivated (Bit 13.12) No valid data during reset FFFFH when Feedback is deactivated, Reg. 13.12
5	04H	16		R		Drive 2: Read current position 0,0 to 100,0 % D0 to D1.000, H0000 to H03E8 When Feedback- voltage < 1 V then Position =0.0 % and Error bit 16.11 is set. When Feedback- voltage > 9 V then Position =0.0 % and Error bit 16.10 is set FFFFH when Feedback is deactivated (Bit 14.12) No valid data during reset FFFFH when Feedback is deactivated, Reg. 14.12
6	05H	16	FFFFH	R		Sensor 1.1: Read out active sensor 0…20 mA, of connector sensor 1 Current value 0- 20 mA, resolution 10 µA (Value range D0- D2.000, H0000- H07D0H Value H0000, when sensor is not connected Value HFFFF, when startup-& breaktime is 0, or sensor is shorted
7	06H	16	FFFFH	R		Sensor 2.1: Read out active sensor 0…20 mA, of connector sensor 2 Current value 0- 20 mA, resolution 10 µA (Value range D0- D2.000, H0000- H07D0H Value H0000, when sensor is not connected Value HFFFF, when startup-& breaktime is 0, or sensor is shorted
8	07H	16	FFFFH	R		Sensor 1.2 Read out passive sensor, on connector Sensor 1 Temperature 0,0- 100,0 °C, resolution 0,1 K (Value range H0-H03E8, D0-D1.000) Value FFFFH, when sensor not connected or shorted
9	08H	16	FFFFH	R		Sensor 2.2: Read out passive sensor, on connector Sensor 2 Temperature 0,0- 100,0 °C, resolution 0,1 K (Value range H0-H03E8, D0-D1.000) Value FFFFH, when sensor not connected or shorted
10	09H	16		R/W		Drive 1: on/off value H0000 = off, value > H0000 = On
11	0AH	16		R/W		Drive 2: on/off value H0000 = off, value > H0000 = On
12	10H	16	0	R/W	15	Switch single box to stand-by, drives off, active sensors off 0 = normal function 1 = Stand-by After switch to normal function, the drives and the sensors have to be switched on separately. Yellow LED is on. Reset-functionality is not possible during stand-by.
13	11H	16	0000h	R/W	15	Drive setting: Drive 1 and Drive 2 are working separate = 0 (default) Drive 1 and Drive 2 are working parallel = 1 (data of Drive 1 are important, Feedback is still separate) Condition for 1: identical actuators on both ports. All commands of Drive 1 is also valid for Drive 2. This pertains for Reg. 2&10. Feedback Reg. 4&5 is still separate. Reset-functionality is also always separate.
					14	For reset conditions Drive 1 is a motoric drive = 0 (default) Drive 1 is a thermal drive = 1
					13	for reset conditions Drive 1 is an APV/APO = 0 (default) Drive 1 is an APR
					12	Drive 1 is equipped with Feedback like APO/ MPO = 0 (default) Drive 1 is without Feedback = 1
					11	Drive 1 & Drive 2: default: 0= APO/MPO 1-9 V scaled to 0-100% 1= FB 0-10 V, not scaled- but no error functionality

Reg.	Reg.-Adress	Bit=n	Def.	Co	Bit	Funktion
14	12H	16	0000H	R/W	14	Drive Setting 2: For reset conditions Drive 2 is a motoric drive = 0 (default) Drive 2 is a thermal drive = 1
					13	for reset conditions Drive 2 is an APV/APO = 0 (default) Drive 2 is an APR
					12	Drive 2 is equipped with Feedback like APO/ MPO = 0 (default) Drive 2 is without Feedback = 1
15	13H	16	0000H	R/W	15	Drive 1: Start Reset sequence Motoric: 1. Set Bit 13.15 2. Drive 1 off for 2 seconds (Register 09) 3. Reset Bit 13.15 Thermal APR: 1. Set Bit 13.15 2. Drive 1 off for 2 seconds (Register 09) 3. for 45 min 0 V (Register 01) 4. Reset Bit 13.15 Thermal APV/APO: 1. Set Bit 13.15 2. Drive 1 off for 2 seconds (Register 9) 3. for 45 min 0 V (Register 01) 4. for 45 min 10 V (Register 01) 5. Reset Bit 13.15 During Reset, the on/off Function for Drive 1&2 is blocked. Reset of this Bit will stop Reset sequence
					7	Drive 2: Start Reset sequence Motoric: 1. Set Bit 13.7 2. Drive 2 off for 2 seconds (Register 0A) 3. Reset Bit13.7 Thermal APR: 1.Set Bit 13.7 3. Drive 2 off for 2 seconds (Register 0A) 4. for 45 min 0 V (Register 02) 5. Reset Bit 13.7 Thermal APV/APO: 1. Set Bit 13.7 2. Drive 2 off for 2 seconds (Register 0A) 3. for 45 min 0 V (Register 02) 4. for 45 min 10 V (Register 02 Reset Bit 13.7 During Reset, the on/off Function for Drive 1&2 is blocked. Reset of this Bit will stop Reset sequence
16	14H	16	0000H	R/W	15	
					14	Fuse defect, power- supply of the actuators Flashing red LED
					13	Drive 1: Feedback signal < 1 V
					12	Drive 1: Feedback signal > 9 V
					11	Drive 2: Feedback signal < 1 V
					10	Drive 2: Feedback signal > 9 V
					9	
					8	
					7	AC- operation detected = 1

Reg.	Reg.-Adress	Bit=n	Def.	Co	Bit	Funktion
17	15H	16	00FFH	R/W	15	Active Sensor inputs (active mode) Sensors are off = 0 (default) Sensor function is enabled = 1 (4- 20 mA output is still off)
					13	Method of measurement (active mode) 0 = trigger (default) startup- time must be defined, Working with Start-up time, adding the values of bit 7 to 4. If startup-time = 0 then error reg.19 bit 15 1 = interval (automatic mode, Working with Start-up time, adding the values of bit 7 to 4 and Break time, adding bit 3 to 0), if startup and break is 0 then error reg.19 bit 15
					12	Later: Enable passive Sensor 1.2 default: 0 (off, no errors) 1 = on (will generate error- bits)
					11	Later: Enable passive sensor 2.2 defaul1:0 (off, no errors) 1 = on (will generate error- bits)
					7	Start-up time bit 3 = 8 seconds (default = 1)
					6	Start-up time bit 2 = 4 seconds (default = 1)
					5	Start-up time bit 1 = 2 seconds (default = 1)
					4	Start-up time Bit 0 = 1 seconds (default = 1)
					3	Break time bit 3 = 30 seconds (default = 1)
					2	Break time bit 2 = 10 seconds (default = 1)
					1	Break time bit 1 = 5 seconds (default = 1)
					0	Break time Bit 0 = 2 seconds (default = 1)
18	16H	16	0000H	R/W	15	Sensor 1 + 2 status measurement Trigger Mode: Trigger measurement = set to 1 Switch on outputs sensors Wait for ending start-up time Measurement current and store Reset bit 18.15 Switch off output sensors Measurement completed = 0 (default) Interval mode: Loop: Set Bit 18.15 Switch on outputs sensors Wait for ending start-up time Measurement current and store Reset bit 18.15 Switch off output sensors Wait for ending Break time Goto loop When Bit is set, 4-20 mA output is on for the time of measurement
19	17H	16	0000H	R/W	15	Active Sensor 1+2: no startup or breaktime defined Value in Reg 6 & 7= FFFFH
					14	
					13	
					12	
					11	Sensor 1.1 active 4- 20 mA not found (no current)
					10	Sensor 1.1 active 4- 20 mA current overflow, connector shorted
					9	Sensor 1.2 passive not found, no current
					8	Sensor 1.2 passive connectors shorted
					7	
					6	
					5	
					4	
					3	Sensor 2.1 active 4- 20 mA not found (no current)
					2	Sensor 2.1 active 4- 20 mA current overflow, connector shorted
					1	Sensor 2.2 passive not found, no current
					0	Sensor 2.2 passive connectors shorted

2.6 Active Sensors:

Before starting measurement the box must be configurated.
The function must be switch on and start-up time for trigger mode and start-up and break time must be set. Default is max. times of 15 seconds for start-up and 47 seconds for break time. With trigger bit the measurement is started.

Examples: Measurement of the 4 to 20 mA Sensors 1/ 2

Trigger Mode

- Write Reg. 17 for activating 4- 20 mA functionality and activate f.e. 2 sec. startup time with value: 8020H
- Write Reg. 18 with value: 8000H to trigger the measurement.
- Polling Reg. 18, when Reg. 18= 0000 then measurement is completed.
- Read out Register 6 & 7 for current values

Interval Mode

- Write Reg. 17 for activating 4- 20 mA functionality and activate f.e. 2 sec. startup- and 2 sec. for break- time with value: 8021H
- Write Reg. 18 with value: 8000H to trigger the interval
- Reg. 18 = 8000H when new measurement is started
- Polling Register 18, when Reg. 18= 0000H then measurement is just completed.
- Read out Reg. 6 & 7 for current values
- Stop Interval Reg. 17= 0000H

With an active functionality the error- handling is also active.

2.7 Passive Sensors

For the functionality passive sensors switch on control bit in register for measurements.
Please use a 22k NTC for connection to the box.
In 1 sec interval the temperatures are measured and stored in the registers 07H/ 08H.

With an active functionality the error- handling is also active.

3 Technical Data

Type		
Operating Voltage		AC/DC 24 V -10 %... +20 %, 0-60 Hz
Operating Power (without drives and sensors)		2 W
Max. power consumption with actuators and sensors		1050 mA
power consumption without actuators and sensors		< 60 mA
Automatic Baudrate Controller		4.800 to 115.200 bps
Switching current per output		2x 500 mA/ 2x 1.000 mA
Fuse		1x 800 mAT/ 1.000 mAT
Maximum MBCs of the RS-485 Interface		32
LED		Multi- color- LED
Storage temperature		-20 C bis +70 C
Ambient temperature		0 C bis +50°C
Degree of protection in one direction, cables down		>= IP54
Protection class		III
CE-conformity according to		EN 60730
Casing	Material	PC
	Colour	Lightgrey RAL 7035
Weight		240 g
Dimensions (width, height, depth)		125 x 36 x 95 mm

3.1 Power-supply: Boxes in series

The quantity of boxes in serial is limited because of max. 4 A over the M12 connectors and cables.
The power supply for the whole system must be protected with a 4 A fuse.

Actuators thermal: APO 46825
Actuators motoric: MPO 468x5

	Actuator 6 VA	Motoric AC	Motoric DC	Thermal AC/DC
Boxes in a serial	8	18	24	8

Pieces of boxes equipped with 2 actuators and 2 sensors.

3.2 Modbus- cable

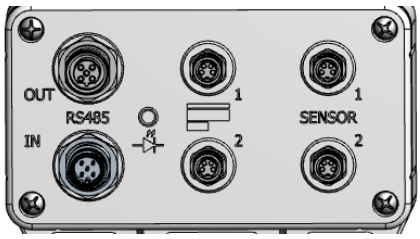
For the Modbus cables we recommend M12 - standard cable socket - plug with a minimum current load of 4 A.
If there is transmission interference due to EMC influences, we recommend the use of shielded Modbus cables.
The cable shielding is connected to PE and not to the operating voltage ground.

4 Installation notes

4.1 Installation positions

The OEM Modbus RTU- Converter: 24 V can be operated in all installation positions.

4.2 Electric Connection 24 V AC/DC

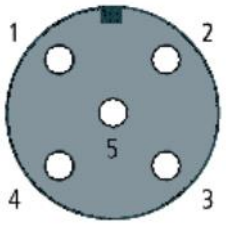


Connection line
With Standard M12 x 5wires cables

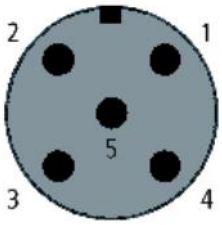
- Modbus in: M12 male, 5 poles
- Modbus out: M12 female, 5 poles
- Actuators: 2x M8 female, 4 poles
- Sensors: 2x M8 female, 4 poles
- Multi-color LED displays the status

Connections:

PIN	Modbus In/ Out
1	24 V, L2, GND
2	24 V, L1, +
3	Net Ground
4	Modbus D-
5	Modbus D+

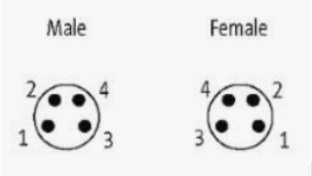


Buchse M12, 5-polig



Stecker M12, 5-polig

PIN	Drive 1/2
1	24 V, L1 +, black
2	Feedback- Signal 0- 10 V, yellow
3	Control Voltage 0- 10 V, red
4	24 V, L2 -, GND, blue



For the cable drives/sensors: Female icon looking to the backside of the connector!

PIN	Sensor 1/2
1	Active 4- 20 mA out
2	Active 4- 20 mA in
3	Passive Sensor (+12 V high- impedance)
4	GND/ L2