



## User manual Gateway component Modbus TCP

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# 1 General Information

## 1.1 Disclaimer

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KUNBUS GmbH

Heerweg 15 C

73770 Denkendorf

Deutschland

[www.kunbus.de](http://www.kunbus.de)

## 1.2 Notes Regarding this User Manual

This user manual provides important technical information that can enable you as a user to integrate the Gateway into your applications and systems efficiently, safely and conveniently. It is intended for trained, qualified personnel, whose sound knowledge in the field of electronic circuits and expertise of Modbus TCP is assumed.

As an integral part of the module, the information provided here should be kept and made available to the user.

## 1.3 Validity

This document describes the application of the KUNBUS Gateway with the product number:

- PR100088, Release 03

## 1.4 Limitation of Liability

Warranty and liability claims will lapse if:

- the product has been used incorrectly,
- damage is due to non-observance of the operating manual,
- damage is caused by inadequately qualified personnel,
- damage is caused by technical modification to the product (e.g. soldering).

## 1.5 Customer Service

If you have any questions or suggestions concerning this product, please do not hesitate to contact us:

KUNBUS GmbH

Heerweg 15 C

73770 Denkendorf

Germany

+49 (0)711 3409 7077

support@kunbus.de

www.kunbus.de

## 2 Safe Use

### 2.1 Intended Use

The modular gateway component is part of a gateway that can be combined with another modular gateway component or a RevPi Core/Connect from KUNBUS as required.

The modular gateway component is designed to forward data from a specific protocol to a controller or other gateway component.

No other purpose is intended. If you do not use the device as intended, damage to property and personal injury may result.

### 2.2 User

The Gateway may only be assembled, installed and put into operation by trained, qualified personnel. Before assembly, it is absolutely essential that this documentation has been read carefully and understood. Expertise in the following fields is assumed:

- electronic circuits,
- basic knowledge of Modbus TCP,
- work in electrostatic protected areas,
- locally applicable rules and regulations for occupational safety.

### 2.3 Symbols

The symbols used have the following meaning:

#### DANGER

##### **Danger**

Always observe this information!

There is a safety hazard that can lead to serious injuries and death.

#### CAUTION

##### **Caution**

There is a safety hazard that can result in minor injuries and material damage.

#### NOTICE

##### **Note**

There is a safety hazard that can result in material damage.

## 2.4 Important safety instructions

### DANGER

#### **Danger of explosion**

The modular Gateway component do not meet the requirements of the ATEX directive. Therefore, they are not suitable for use in potentially explosive environments.

- Do not use the modular Gateway component in potentially explosive environments.

### CAUTION

#### **Electric shock**

Switch off all voltages before assembly/disassembly.

- Failure to observe this warning may result in personal injury.

### CAUTION

#### **The devices are „open equipment“ according to the Standard UL61010-2-201.**

To fulfill requirements for safe operation with regard to mechanical stability, flame retardation, stability, and protection against contact, the following alternative types of installation are specified:

- Installation in a suitable cabinet.
- Installation in a suitable enclosure.
- Installation in a suitable equipped, enclosed control room.

### NOTICE

#### **Incorrect connection of the power supply**

Using an unsuitable power supply can destroy your modules and connected devices.

- Use a power supply in the approved area for the base modules. The values for this can be found in the technical data of your base module.

### NOTICE

#### **Subsequent Modification**

Do not edit the modules afterwards.

Soldering can cause components to come loose, damaging or destroying the module.

- Note that the warranty expires due to technical modifications of the products.

## 2.5 Environmental Conditions

To prevent damage, only operate the RevPi module in an environment that corresponds to the operating conditions.

Suitable ambient conditions:

Operating temperature	-30 °C to +55 °C
Air humidity	93% (no condensation)

### NOTICE

**This device is designed for indoor use only.**

If you use the device outdoors, it may be destroyed.

→ Only use the device indoors.

## 2.6 Data safety

Please note that Gateway is not suitable for use in unprotected networks (e.g. the Internet).

Use Gateway in a secured network:

- Seal off your network so that no direct access via the Internet is allowed.
- Immediately change the default password for the web server. You can find out how to do this in the chapter "Changing the password". Select a secure new password.
- Check our website regularly for the latest software security alerts and updates for your product. Install the security updates provided by us.

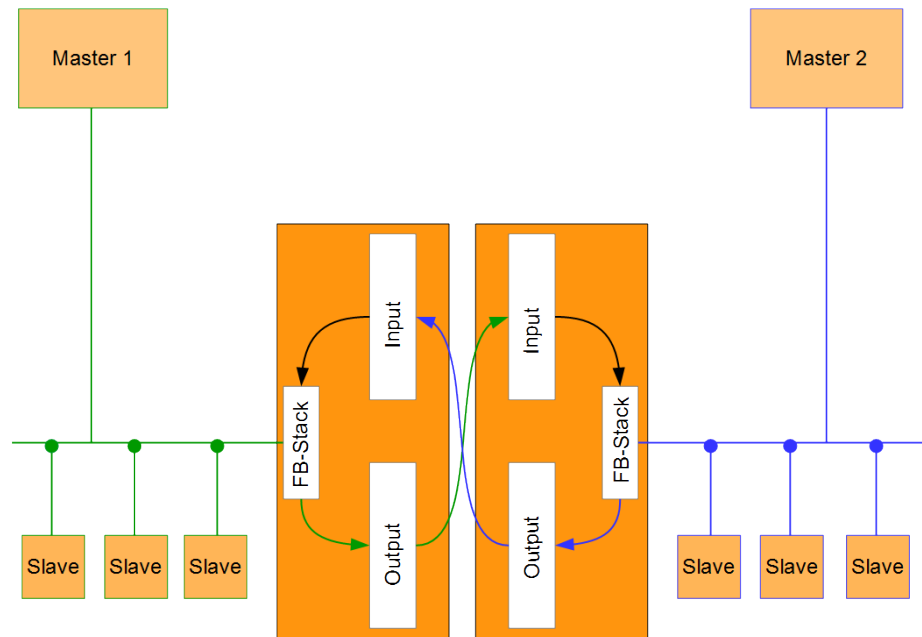
If you do not follow these instructions, it is possible that your module data may be manipulated.



## 3 Overview

### 3.1 Functionality

The KUNBUS Gateway is a protocol converter. It allows communication between networks with different protocols.



*Illustration 1: Functionality as a slave*

A Gateway consists of 2 gateway components that master one specific protocol each. You can combine these gateway components as you wish. This design offers you a high degree of flexibility, since you can exchange the individual gateway components at any time. The following gateway components are currently available as slaves:

- CANopen
- DeviceNet
- EtherCAT
- EtherNet/IP
- Modbus RTU
- Modbus TCP
- POWERLINK
- PROFIBUS
- PROFINET
- Sercos III

The gateway component for DMX can be operated as a master or slave.

In addition, you can combine the gateway components with the RevPi Core.

## 3.2 Control Elements

Front view

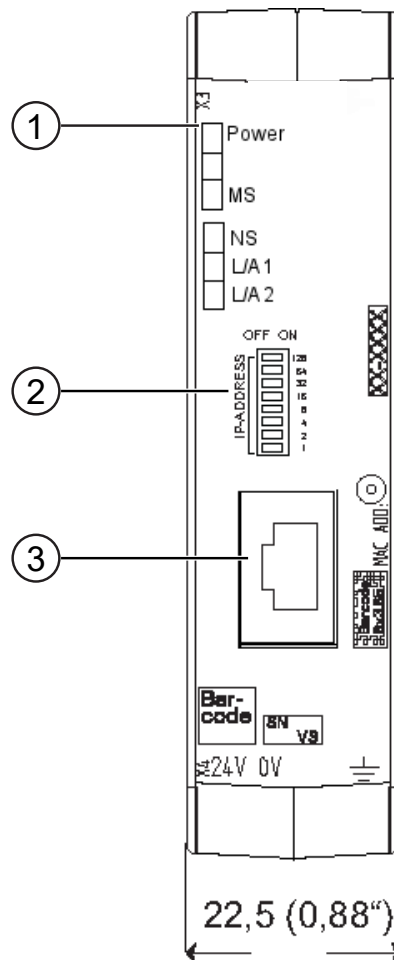


Illustration 2: Front view

1	Status LEDs
2	Coding switch 8-pin DIP switch for setting the IP address.
3	Fieldbus connection RJ45 socket for the connection to the fieldbus (2 sockets in all, s. figure top view)

Top view

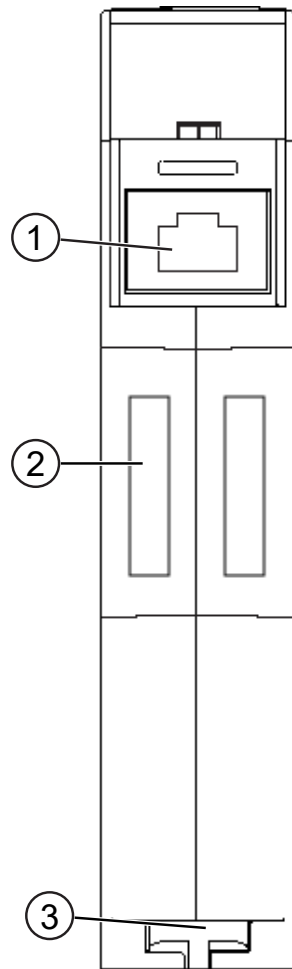
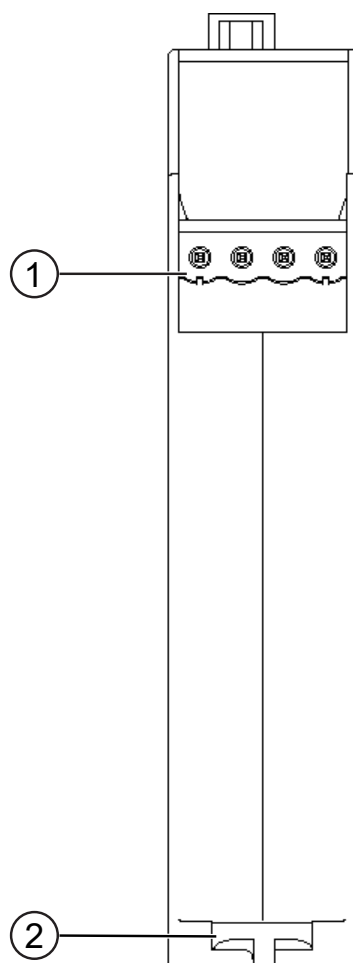


Illustration 3: Top view

1	Fieldbus connection RJ45 socket for the connection to the fieldbus (2 pcs. in total, see picture front view)
2	Interconnect ports for interconnecting the gateway components.
3	Locking clamps for securely attaching the gateway component to the DIN rail.

## Bottom view

*Illustration 4: Bottom view*

- |   |  |
|---|--|
| 1 | Mains connection<br>with 24 V supply voltage                                       |
| 2 | Locking clamps<br>for securely attaching the gateway component to the DIN<br>rail. |

### 3.3 Status LEDs

The signals of the status LEDs for Modbus TCP have the following meaning:

LED designation	Signal	Meaning
Power	off	Gateway component not running
	blinks, green	Initialization phase not yet completed
	on, green	Operational
	flashes, red	Correctable error (e.g. second gateway component missing)
	on, red	Serious error/defect in the gateway
MS	off	Gateway component is not running
	blinks, green	Configuration not completed
	on, green	Operation, gateway component runs without errors
NS	off	Gateway component is not running
	blinks, green	Standby mode, no data exchange via Modbus/TCP
	on, green	Connection is established, data is exchanged
L/A 1 + 2	off	No connection
	green	Connection to another device. No data exchange takes place.
	blinks, green	Connection established. Data exchange takes place.

## 4 Installation

### 4.1 Preparations for Trouble-free Operation

In the following section we have compiled some general information for you that is important for trouble-free operation. If you are already acquainted with this topic, you can skip to the next section. There, you will learn about which conditions are necessary for installing the gateway.

#### Cable routing

Route your cables separately in cable groups. This will protect your gateway from any unintended electromagnetic interferences.

The following groups should be routed separately from each other:

Group	Line
A	Data and power supply lines for: DC voltage below 60 V AC voltage below 25 V
B	Data and power supply lines for: DC voltage between 60 V and 400 V AC voltage between 25 and 400 V
C	Power supply lines above 400 V

- You can route cables of the same group together in cable ducts or bundles.
- Cables of group A and B:
  - Route the groups in separate bundles or
  - in cable ducts at a minimum distance of 10 cm from each other.
- Cables of group C
  - Route the groups in separate bundles or
  - in cable ducts at a minimum distance of 50 cm from the other groups.

#### Shielding

Shield your cables. This will reduce any unintended electromagnetic interferences.

## Potential equalization

Potential differences occur when devices are connected to different earths. These potential differences cause malfunctions.

To prevent malfunctions, you have to route an equipotential equalization conductor.

When doing so, bear in mind the following points:

- Select an equipotential equalization conductor with low impedance.
- Select the following as a reference value for the cross-section of the potential equalization cable:
  - 16 mm<sup>2</sup> for potential equalization cables of up to 200 m in length
  - 25 mm<sup>2</sup> for potential equalization cables of more than 200 m in length
- Use potential equalization cables made of copper or galvanized steel.
- Connect potential equalization cables extensively with the earth rail.
- The smallest surfaces possible should be sandwiched between potential equalization cables and signal cables.

If the devices of the control system are connected by shielded signal cables that are earthed on both sides, the impedance must be 10% of the shielding impedance.

## 4.2 Requirements

The Gateway was designed for use in a control cabinet.

- ✓ The protection class of the control cabinet must be equivalent to at least IP54.
- ✓ For installation in the control cabinet you need a DIN rail 35 x 7.5 mm (EN50022).
  - Install the DIN rail horizontally in the control cabinet according to the manufacturers' specifications. When doing so, make sure that the Gateway is at a sufficient distance from other devices.

### NOTICE

**Your gateway could be damaged if temperatures are too high.**

- ➔ Make sure that the ambient temperature in the control cabinet is less than 60 °C.
- ➔ Keep the ventilation slots unobstructed. These must not be covered by cables etc.
- ➔ Maintain sufficient distance from other devices.

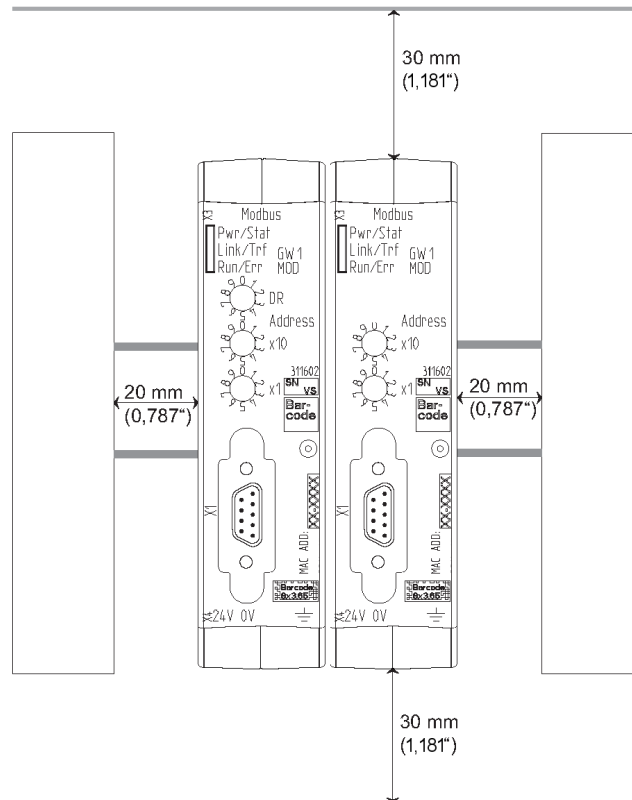


Illustration 5: Distances for installation

- Connect each gateway component individually to functional earth. When doing so, make sure that the power supplies of both gateway components have the same ground.
- ⇒ Your control cabinet now meets all requirements for installing the gateway.



## 4.3 Connecting Gateway Components

In order to attain a fully functional gateway, you have to interconnect both gateway components.

- Connect an interconnect port to each gateway component using the plug-in jumper provided.

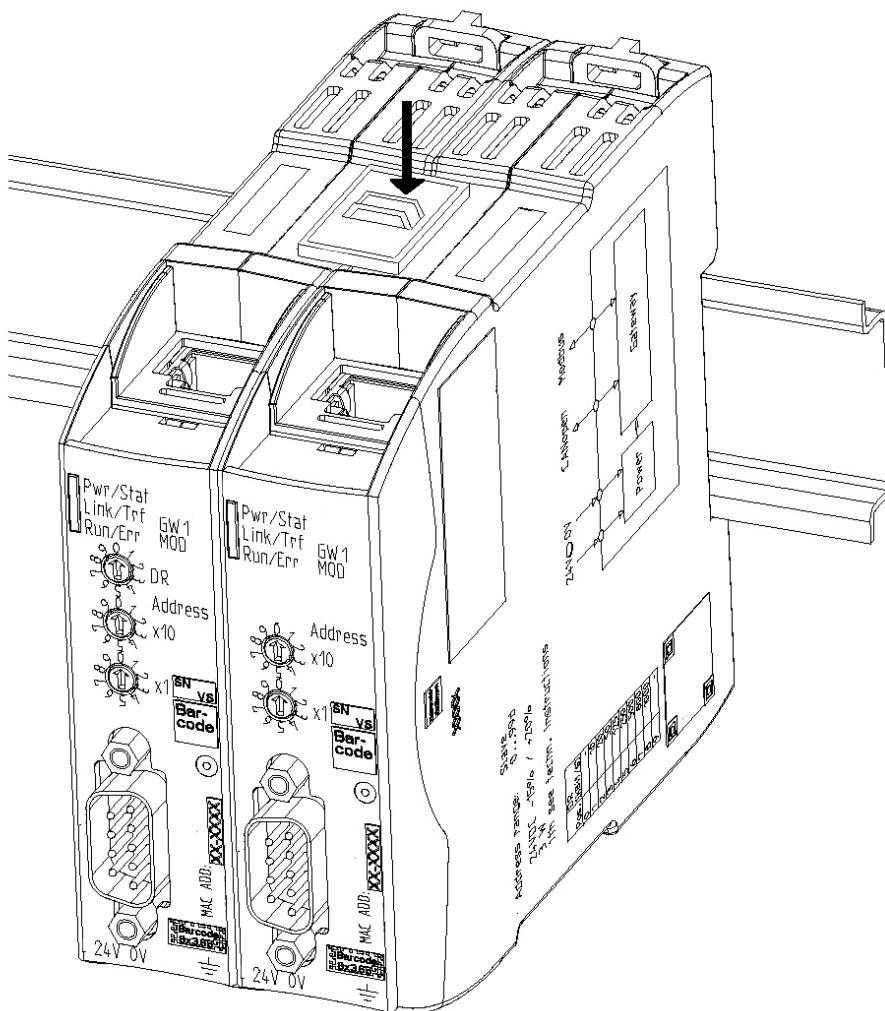


Illustration 6: Connecting gateway components

⇒ You can now install the gateway in the control cabinet.

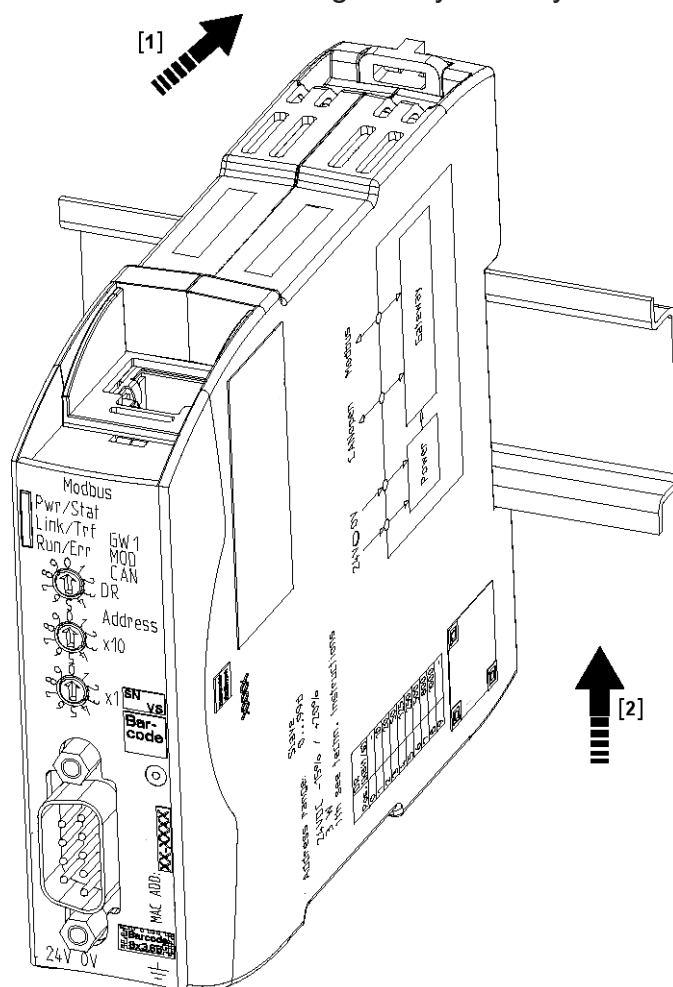
### NOTICE

**Only ever interconnect 2 gateway components.**

If you connect additional components, severe defects could result on all devices.

## 4.4 Installing a Gateway in the Control Cabinet

- Hold the raster element of the gateway on the DIN rail.
- Press down the locking elements towards the gateway.
- Make sure that the gateway is firmly attached to the DIN rail.



## 4.5 Connecting a Power Supply

To connect the gateway component to the power supply, you need a spring-loaded terminal (e.g. Metz-Connect SP995xxVBNC).

You have to connect each gateway component separately to a power supply. Never interconnect functional earth and GND, otherwise the galvanic isolation between gateway GND and fieldbus ground will be removed. Instead, connect the functional earth with low impedance to the potential equalization. You can then dispense with this connection if the shield of the fieldbus cable is connected to the potential equalization with lower impedance when entering the control cabinet.

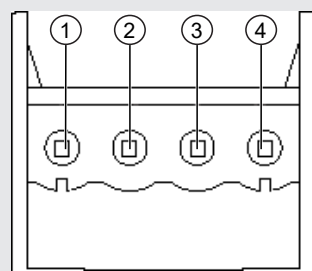
### NOTICE

#### Connect each of the two gateway components to the power supply

→ Ensure in particular that no potential differences occur between the GND pins (2).

Pin assignment:

Pin	Assignment
1	24 V for module supply
2	GND
3	Do not connect!
4	Functional earth



### NOTICE

#### Do not connect GND to PE

This connection could cause unintended malfunctions.

## 4.6 Connecting a Gateway to the Fieldbus

To connect the gateway component to Modbus TCP, you need Two RJ45 connectors.

The pin assignment complies with the Ethernet standard.

# 5 Configuration

## 5.1 Supported size of process data

The gateway component for Modbus TCP supports process data up to a length of 512 bytes per direction.

### NOTICE

**Bear in mind that the maximum length of the process data is always determined by the fieldbus with the shorter data length.**

## 5.2 Address Assignment

### Set IP address

With the 8-pole address switch you can set the IP address of the Gateways.

You can set values in binary format between 0-255.

Assign IP address manually:

- Stellen Sie eine beliebige Adresse zwischen 1-254 ein
  - ⇒ The gateway component uses the address 192.168.0.X , the Netork mask 255.255.255.0 and the Gateway 192.168.0.1
- Open the website **http://192.168.0.X**
- Log
 

Login	data	for	initial	in:
User:				logon:
Password: 1701				Admin
- Click on the "Change Configuration" button.
- Set the desired IP address.
- Confirm the entry with the "Apply" button."
- Set all address switches to "0".
- Restart the gateway component by switching it off and on again.
- ⇒ The set IP address is now used.

Get IP address from DHCP server

- Set the value "255" (all switches in the direction of the numbers) to activate the DHCP mode.
- ⇒ The IP address is automatically assigned by the DHCP server.

Setting the IP address via the master software

- Set the value to "0" (all switches to "Off").
  - ⇒ The gateway component uses the IP address that was last set via the software.
- You can change this IP address at any time via the Modbus/TCP protocol or the website.
- Restart the gateway component by switching it off and on again.
- ⇒ The set IP address is now used.

## 5.3 Configuration of Modbus TCP

### Modbus TCP - Addresses and access functions

#### Memory areas

Predefined memory areas are available for addressing the process data. Optionally, you can access the input and output data areas bit by bit (using coils) or word by word.

Register area for word by word access

Address area	Use	Access	Access type	Meaning
1 - 256	Input Register	Read Only	Holding/Input *	Values provided by the other gateway component
1025 - 1280	Output Register	Read/Write	Holding	Values that are delivered to the other gateway component.
4097/0x1001	Gateway-Status	Read Only	Holding	Displays the connection status to the other gateway component. 0x01 Initialization, hardware is checked. 0x02 Connection to the other gateway component is checked. 0x03 Other gateway component detected. 0x04 Communication to the other gateway component established.
4098/0x1002	Fieldbus status of the other gateway component.	Read Only	Holding	0x00 Fieldbus not connected. Make check all connections. 0x01 Fieldbus connected, no data communication. Check whether an IP address is set. 0x02 Gateway component configured, no data communication. 0x03 Cyclic data exchange.
4099/0x1003	IP address	Read/Write	Holding	IP address High Word
4100/0x1004	IP address	Read/Write	Holding	IP address Low Word
4101/0x1005	Network mask	Read/Write	Holding	Network mask High Word
4102/0x1006	Network mask	Read/Write	Holding	Network mask Low Word
4103/0x1007	Gateway address	Read/Write	Holding	Gateway address High Word
4104/0x1008	Gateway address	Read/Write	Holding	Gateway address Low Word

4105/0x1009	Max. number of Modbus/TCP connections	Read/Write	Holding	Displays the maximum number of Modbus/TCP connections that can be present at the same time. value range: 2-20
4106/0x100a	Current number of Modbus/TCP connections.	Read Only	Holding	Shows how many Modbus/TCP connections are currently available.
4107/0x101b	Write Timeout	Read/Write	Holding	The Write-Timeout function is active if this register contains a value > 0. It indicates the time interval at which at least one of the output registers must be written. As soon as the time has passed since the last write, all output registers are set to the default value 0..
4108/0x100c	Reset	Read/Write	Holding	Restarts the gateway component if 0x4b42 is written here.

\*Input and holding registers are not distinguished. They can be read via function code 0x04.

Register ranges for bitwise access:

Address area	Use	Access	Access type	Meaning
1 - 3840	Input Bits (Coil)	Read Only	Holding/Input*	Values that the other gateway component supplies.
16385 - 20224	Output Bits (Coil)	Read/Write	Holding	Values that are supplied to the other gateway component..

\*Input and Holding Register are not differentiated. They can be read using function code 0x04.

## Functions

You can access the data area of the gateway component using the following functions:

Function code	Use	Description	Max. size per telegram
0x01	Read data bit by bit	read coils	2000 Bit
0x02		read discrete inputs	
0x05	Write data bit by bit	write single coil	1 Bit
0x0f		write multiple coils	
0x03	Read data word by word	read holding registers	125 Words
0x04		read input registers	

0x06	Write data word by word	write single register	123 Words
0x10		write multiple registers	
0x16		mask write register	
0x17	Read and rite data word by word	read/write multiple registers	read 125 Words write 121 Words



## 6 Integrated servers

### 6.1 FTP-Server

The FTP server is necessary to update HTML files of the web server and to transfer firmware updates to the module.

You can access the FTP server from user level 2. The same credentials are valid as for the web server. The "Level" is defined in the file "password.xml". You can find out how to do this in the section „Logging on to the web server“.

Web server files

The files for the web server can be found in the subfolder "Web".

### 6.2 Webserver

The Gateway has a web server. You can call it from any browser.

#### Call Web Server

- Connect the Gateway with the PC.
  - Open your browser.
  - Enter IP address as URI (e. g.: <http://192.168.0.8>)
- ⇒ You can log in now.

#### Log on to web server

You can log on to the web server as an administrator or as a user.

The User may:

- Read process data of the Gateway.

Login data (default):

Username: User

Password: 1111

#### **The admin may:**

Login data (default):

- Username: Admin
- Password: 1701

## Create **user**

To be able to check and manage login data, you must create a file named "password.xml" in the main directory of the module.

Define the following 3 XML elements for each user in this file:

- <UserX>,
- <PasswordX>,
- <LevelX>.

Value	Comment
x	Represents a digit between 0 and 9. Assign a digit to each user. Make sure that the digit is not already used for another user.
User and Password	May consist of up to 20 characters each. Spaces are allowed. The user data must be encrypted (see next section).
Level	Defines the hierarchy of the users. You must enter a positive integer here. If this is at least 2, then the user is an "administrator".

## Encrypt user data

Protect your user data with these two security measures to protect your data from hacker attacks.

- Add a "salt value" to the user name and password. In this case, the salt is a static value that is added to the user data:
  - For users: KB
  - For passwords: EM
- Generate a hash value from the combination of the user name and salt. You can use any MD5 generator to do this. (e. g.: <https://www.md5hashgenerator.com/>)

Example with the default values:

Login values	Input value in the MD5 generator	Hashvalue
User	UserKB	42fca17d0fd125a5f584e805c15a760b
1111	1111EM	a4d922aaeab65a306124046ac6918380
Admin	AdminKB	76276cf-b7e48f3964e7d2d1c99d8937f
1701	1701EM	605301ba4bd8-fa9f53bf58b0c2d27236

- Use the hash values as the entry for the user data:

Example for a „password.xml“:

```
<?xml version="1.0" encoding="UTF-8"?>
<Passwords>
<User0>42fca17d0fd125a5f584e805c15a760b</User0>
<Password0>a4d922aaeab65a306124046ac6918380</
Password0>
<Level0>1</Level0>
<User1>76276cfb7e48f3964e7d2d1c99d8937f</User1>
<Password1>605301ba4bd8fa9f53bf58b0c2d27236</Password1>
<Level1>3</Level1>
</Passwords>
```

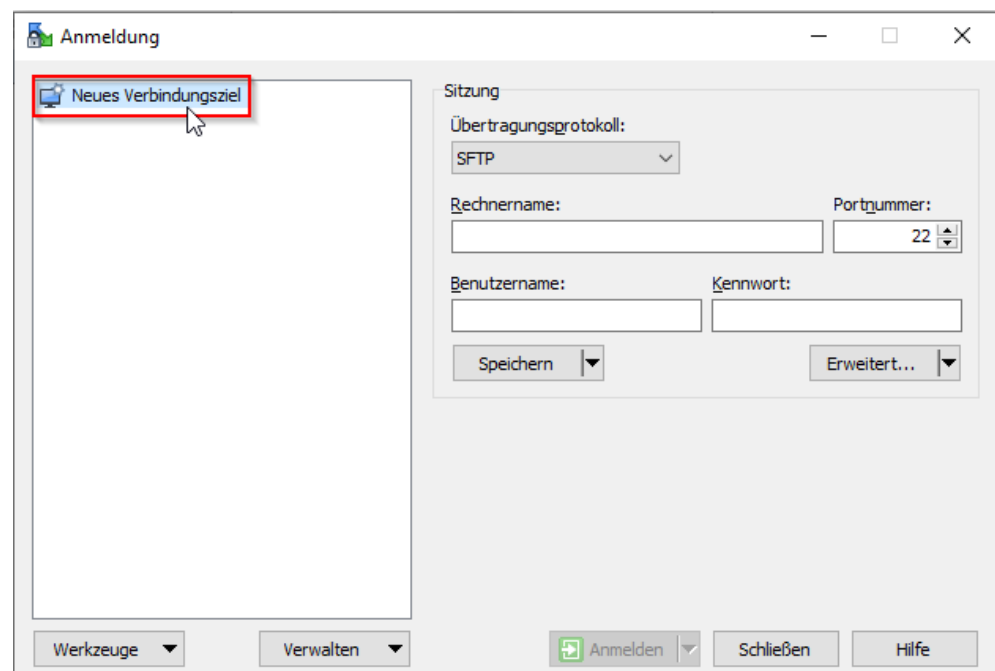
**Tip! All users can change the password directly in the web server.**

## 6.3 Installing Firmware Update

The following pages describe how to install a firmware update on a gateway component with a web server. We use the program "WinSCP" for this purpose: However, you can also use another FTP program for this purpose..

### Conditions:

- ✓ Your gateway is on your network.
- ✓ The network interface is correctly configured.
- ✓ You have installed an FTP program on your PC.
  - Open your FTP program.
  - Click on "New connection destination"..



- Enter the following values:

Transmission protocol	FTP
Computer name	IP address of the gateway component. The following address is used on delivery: 192.168.0.8
Port number	22
User name	Username for the web server. The following user name is used on delivery: "Admin"

## Password

Password for the web server.

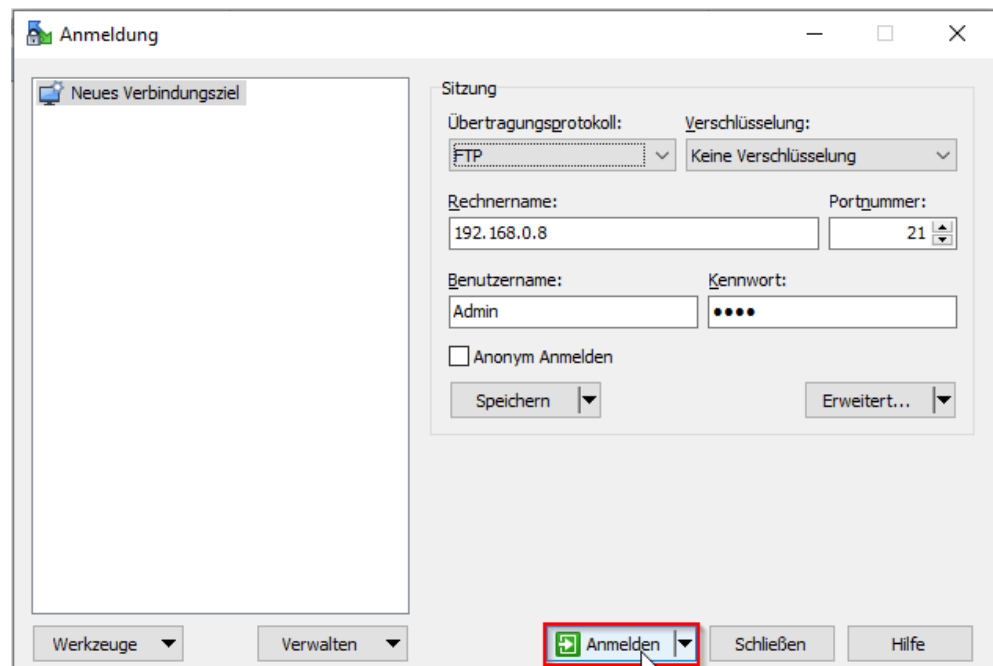
The following password is used on delivery: „1701“

For reasons of data security, we recommend that you change your password as quickly as possible and do not continue to use the stored values. You can change your password via the web server.

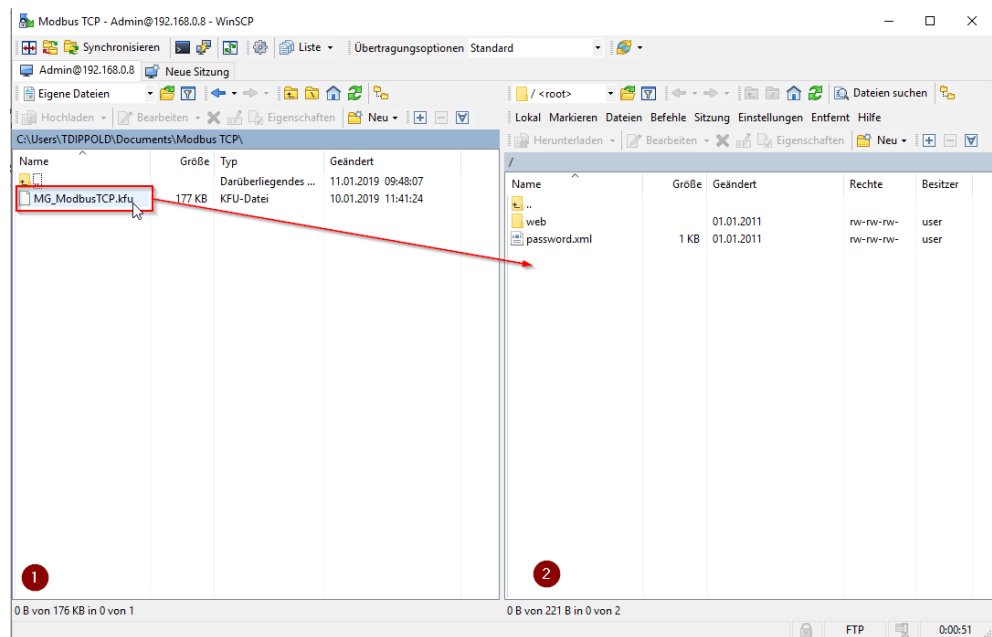
## Safe

You can optionally save these settings. This allows you to access the gateway component more quickly via FTP in the future.

- Click on "Login"



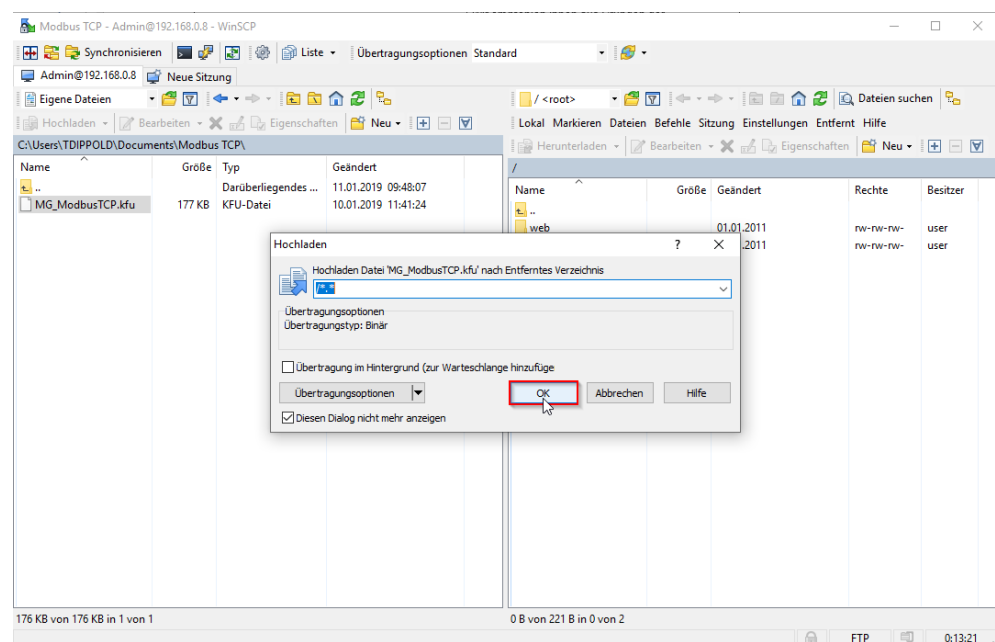
- Select in the kfu file from your local resources (window 1).



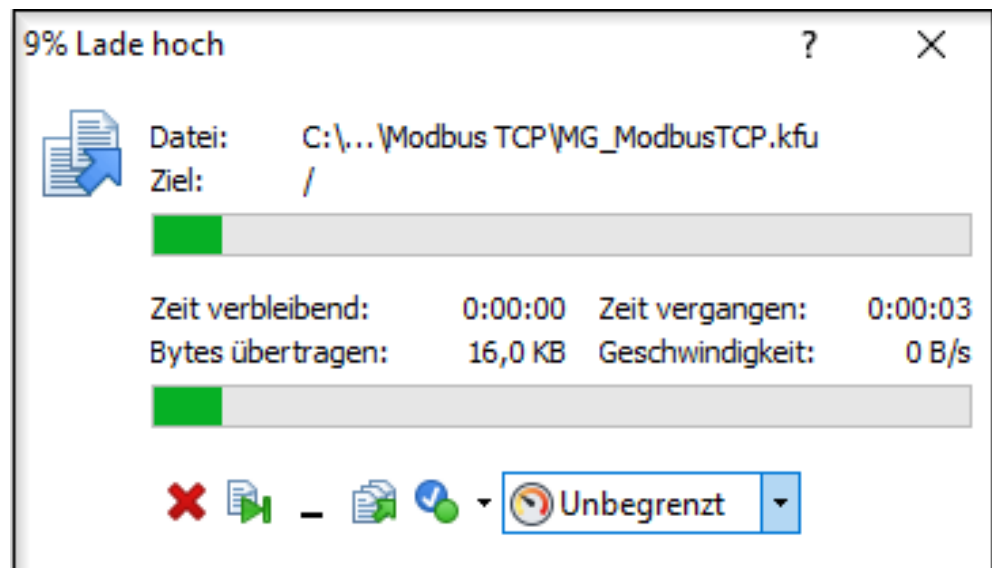
- Drag and drop the kfu file into the root directory of your gateway component (window 2).

The following window opens:

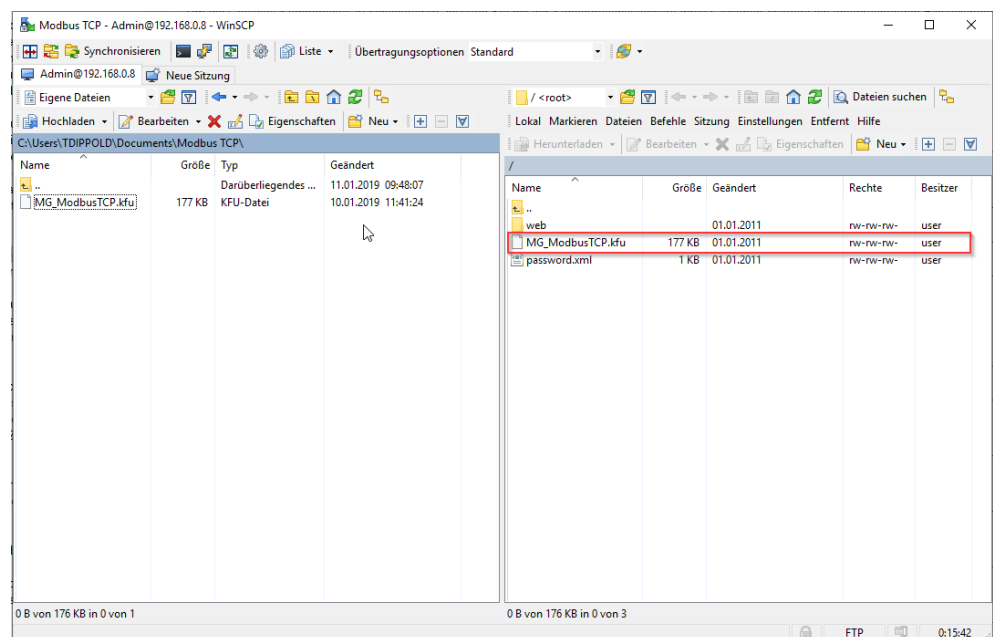
- Click on ok.



The update file will now be copied.



After successful copying, the file appears in the root directory of the gateway component..



- Restart the gateway component.

- Log on to the web server.

Here you can check whether the software version has changed.

**KUNBUS-GW Modbus TCP**

ModbusTCP Input and Output  
ModbusTCP Input and Output  
ModbusTCP Input and Output  
ModbusTCP Input and Output

Modbus Register 0x0001 - 0x0010 and 0x0401 - 0x0410  
Modbus Register 0x0011 - 0x0020 and 0x0411 - 0x0420  
Modbus Register 0x0021 - 0x0030 and 0x0421 - 0x0430  
Modbus Register 0x0031 - 0x0040 and 0x0431 - 0x0440

**Configuration**

Serial number	2859
Software Version	1.1.13166
MAC Address	C8:3E:A7:01:00:6A
IP address	192.168.0.8
Subnet mask	255.255.255.0
Gateway	192.168.0.1
DHCP	<input type="checkbox"/> active

Change Configuration

Change Password

Reboot



## 7 Technical Data

### Dimensions

Width	22.5 mm
Height	96 mm
Depth	110.4 mm
Weight	90 g

### Electrical data

Power supply	24VDC -15%/ +20%; 1,5W
Power consumption during operation (cyclical data exchange)	100 mA
Source of Supply	The device may only be supplied from circuits that comply with Class 2 or Safety Extra Low Voltage (SELV) according to Class 9.4 of UL 61010-1.
Status display	LED

### Environmental conditions

Ambient temperature	0 – 60 °C
Storage temperature	- 25 – 60 °C
Humidity	93% (at 40 °C)
Condensing	Not allowed
Protection class	
Control cabinet	IP54
Housing	IP20
Terminal area	IP20

### Assembly data

DIN rail	35 x 7.5 mm
Height	96 mm
Depth	110.4 mm

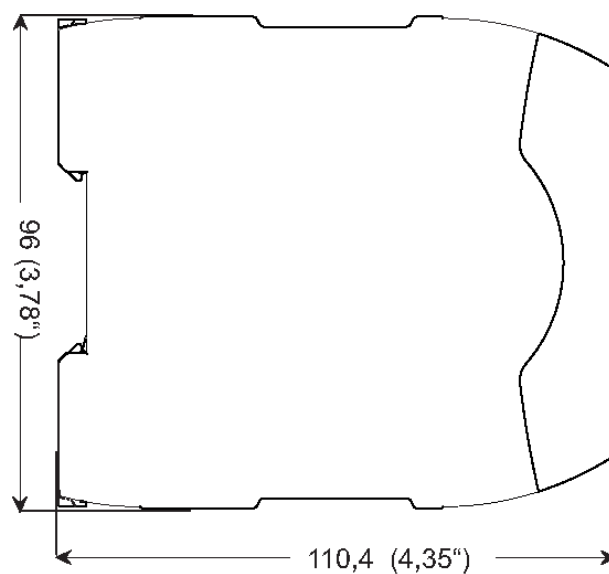


Illustration 7: Side dimensions

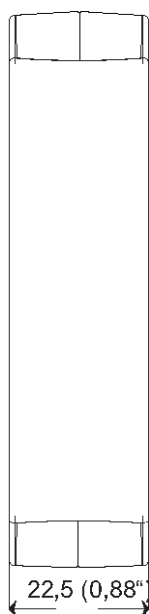


Illustration 8: Front dimensions