FreeCon Active
PROFINET FO Repeater

IE-CDR-V14MSCPOF/VAPM-C-II

Weidmüller

Preface

The FreeCon Active PROFINET FO repeater from Weidmüller is a repeater for industrial PROFINET IRT applications. As well as its repeat and refresh functionality, it also has extensive options for fibre-optic cable diagnosis. With its robust IP65 metal housing, the FreeCon Active is perfect for ambitious applications in robot engineering.

Change log

Version	Date	Changes
1.1	28 August 2018	Second edition

Contact address

Weidmüller Interface GmbH & Co. KG
Postfach 3030
32720 Detmold
Klingenbergstraße 16
32758 Detmold, Germany
Telephone +49 (0) 5231 14-0
Fax +49 (0) 5231 14-2083
E-mail info@weidmueller.com
Internet www.weidmueller.com

Copyright notice

Contents

1. Safety information

1.1 Intended use

	**NOTE**
	The device is only intended for the applications described in the operating instructions. Any other usage is unauthorised and can lead to accidents or damage to the device. The unauthorised use of the product shall result in an immediate invalidation of any warranty and guarantee claims from the operator against the manufacturer.

	**WARNING: Hazard**
	Use of the selected product beyond the specifications or failure to comply with the operating instructions and warnings can lead to serious malfunctions, which could result in personal injury or damage to equipment.

1.2 Qualified personnel

These operating instructions have been written for trained and qualified personnel who are familiar with the valid regulations and standards applicable to the field of application.

1.3 Correctness of technical documentation

These operating instructions have been prepared with due care. Unless stipulated otherwise by law, no liability shall be accepted for the correctness and completeness of the data, figures and drawings. The General Terms and Conditions of Weidmüller shall apply in their current version.

We reserve the right to make changes.

1.4 CE marking

The product complies with the European Union (EU) directives and is therefore CE compliant. Weidmüller will provided the CE Declaration of Conformity on request.

1.5 Declaration of Conformity

The product complies with EMC Directive 2014/30/EU.

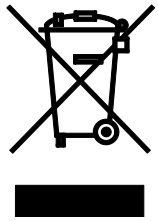
1.6 Recycling according to WEEE

B2B disposal

Dear Weidmüller Customer,

By purchasing our product, you have the option of returning the equipment to Weidmüller at the end of its service life.

.



The WEEE Directive (EU Directive 2002/96 EC) governs the collection and recycling of used electrical devices. In the B2B sector (Business to Business), as of 13 August 2005, manufacturers of electrical appliances are required to take back and recycle electrical appliances sold after this date. Electrical devices must no longer be disposed of through the "normal" waste disposal channels. Electrical devices must be separately recycled and disposed of.

All devices covered by this directive are marked with this logo.

What can we do for you?

Weidmüller offers you a way of returning your old device to us at no cost. Weidmüller will professionally recycle and dispose of your device in accordance with the current legislation.

What do you need to do?

Once your device has reached the end of its service life, simply send it by parcel service (in a box) to the Weidmüller subsidiary that supports you. We will then take care of all of the recycling and disposal activities.

You will not incur any costs or suffer any inconveniences.

2. Overview of the FreeCon Active FO PROFINET repeater

The FreeCon Active PROFINET FO repeater is used to provide additional cable lengths beyond the 50 m restriction for a POF segment. The signal is not only amplified, it is also treated to ensure optimum signal quality. Additional diagnostic functions also allow the fibre-optic cables used to be monitored.

It fulfils three important functions:

- Provision of important PROFINET diagnostic functions,
- Early notification that the robot cabling needs to be replaced,
- Extension of the maximum segment length for fibre-optic cables.

The device is connected via PushPull plug-in connectors in series with the power and FO cables. The extended diagnostic functions enable you to monitor the entire FO route and also give early warning if the cabling for a robot needs to be replaced. The figure below shows the integration of the FreeCon Active PROFINET FO repeater in a typical robotics application.

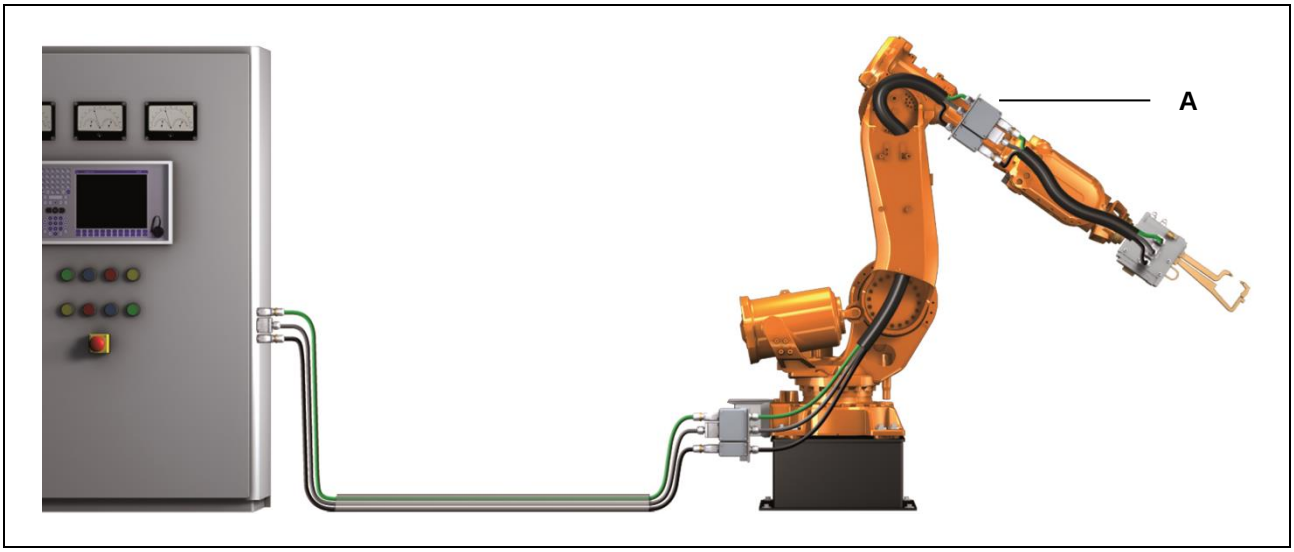


Figure 1 The FreeCon Active FO PROFINET repeater in a typical robotics application

A - Example: Weidmüller FreeCon Active PROFINET FO repeater mounted on the robot arm.

2.1 Electrical properties

The FreeCon Active PROFINET FO repeater typically consumes 150 mA current at 24 V DC. It works on an input voltage of between 18 and 30 V DC in a temperature range of -20 to 55°C. The maximum current on U_{S1} or U_{S2} must not exceed 16 A (see also Chapter 3.2 Power connection).

2.2 Internal CPU

The FreeCon Active PROFINET FO repeater is fitted with an NP40 processor and uses the HMS PROFINET protocol stack.

2.3 Mechanical characteristics

The device has dimensions of 112 mm x 53 mm x 130 mm. As shown in the figure below, it is fitted with two PushPull power ports and two PushPull FO data ports.

The FreeCon Active PROFINET FO repeater is not suitable for outdoor use.

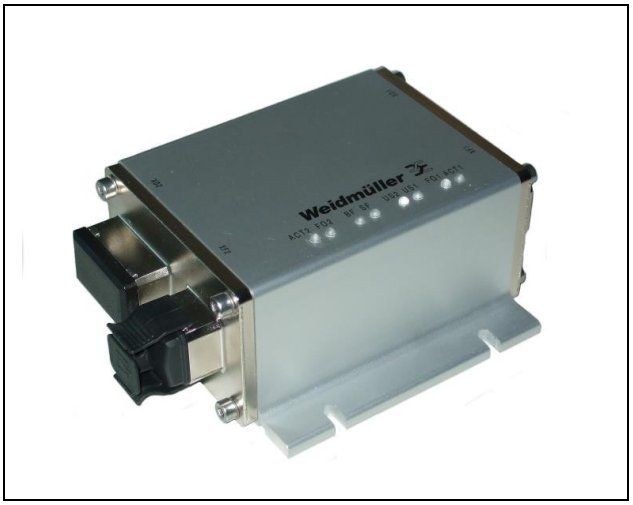


Figure 2 FreeCon Active FO PROFINET repeater

3. Installation and connections

3.1 Installation

The exact installation dimensions can be found in the diagram below. The FreeCon Active PROFINET FO repeater is mounted to a wall using four screws. Use the device as a template to draw the correct position of the four screws. We recommend using M4x10 mm or longer screws.

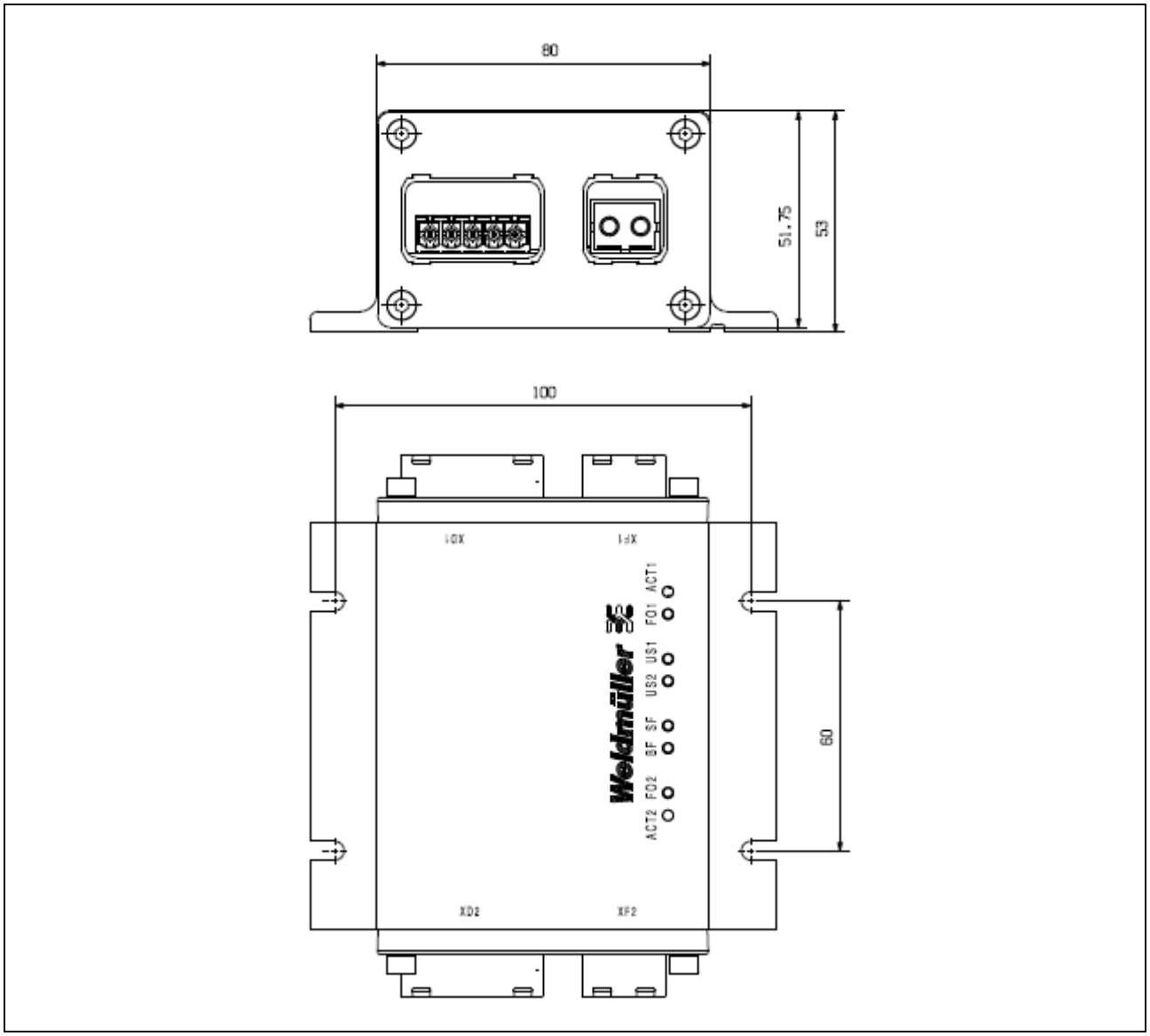
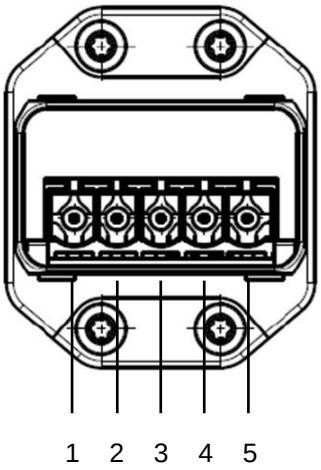


Figure 3 Installation dimensions

3.2 Power connection

	WARNING
	Safety takes priority! Calculate the maximum current generated in the individual wires. Note all relevant regulations governing the maximum permissible current for each wire cross-section. If the power exceeds the maximum permissible value, this may cause the wiring to overheat, which will cause serious damage to your devices and equipment.

Power port pin assignment (U_S1 / U_S2)



Pin assignment				
1	**2**	**3**	**4**	**5**
L1	N1	L2	N2	FE
U_S1_+	U_S1_-	U_S2_+	U_S2_-	FE

The FO cables for the FreeCon Active PROFINET FO repeater can be laid in a single cable conduit with the cables for the power supply. The cabling must be carried out in accordance with the PROFINET installation guidelines (can be viewed at www.profibus.com).

We recommend labelling the cables to all connected devices.

To connect the FreeCon Active PROFINET FO repeater, use the Weidmüller PushPull ***STEADY****TEC*® Power plug-in connectors IE-PS-VAPM-5P-2.5 (order number 2465440000).

Figure 4 The IE-PS-VAPM-5P-2.5 Power plug-in connector

Pin assignment for the Power plug-in connector:

1: L1 24 V DC (U_S1_+)

2: N1 0 V DC (U_S1_-)

3: L2 24 V DC (U_S2_+)

4: N2 0 V DC (U_S2_-)

5: Functional earth (FE)

The FreeCon Active PROFINET FO repeater is only powered via U_S1. U_S2 is fed through the device and only used as the power supply for other connected devices.

3.3 Data connection

The FreeCon Active PROFINET FO repeater has two 100Base-FX SCRJ Ethernet ports for polymer optical fibres (POF).

One of the two optical cables transfers data from Device I to Device II, the other optical cable transfers data from Device II to Device I for full duplex data transmission. Make sure that, as shown in the figure below, you connect the Tx port (transmit) on Device 1 to the Rx port (receive) on Device 2 and Rx port (receive) on Device 1 to the Tx port (transmit) on Device 2.

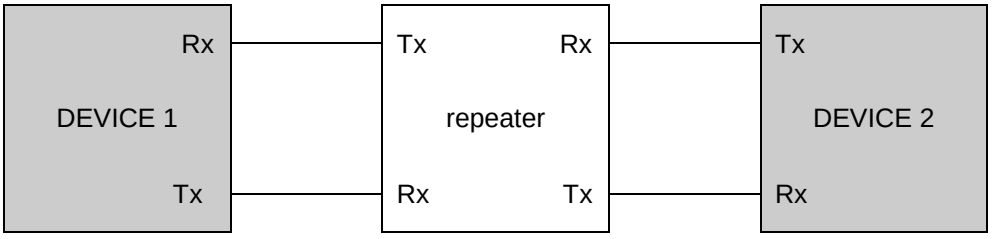
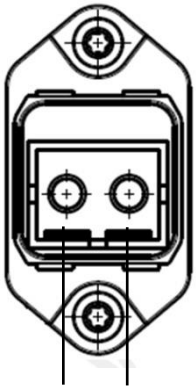


Figure 5 Rx to Tx cabling between the devices and the FreeCon Active PROFINET FO repeater

Data port



TX RX (transmit receive)

Use the Weidmüller PushPull ***STEADY****TEC*® data connector IE-PS-V14M-2SC-POF (order number 1191550000).

Figure 6 The IE-PS-V14M-2SC-POF data connector

	WARNING
	This is a Class 1 Laser / LED product. Never look directly into the laser beam, this could seriously damage your eyes.

3.4 Earthing

Proper earthing and cable laying is critical in order to minimise the effect of electromagnetic interference (EMI). The FreeCon Active PROFINET FO repeater is earthed via the functional earth on the power connector.

4. Setup and network configuration

The FreeCon Active PROFINET FO repeater can be configured and integrated into your system using one of the following access methods:

- PROFINET IO controller setup using GSDML file
- FreeCon CFG tool from Weidmüller

As soon as a valid IP address has been assigned, you can also access and configure the device via a web browser. Please note that the factory setting for the IP address is 0.0.0.0 in accordance with the PROFINET specification and therefore must be changed before you can access the FreeCon Active PROFINET FO repeater via a web browser.

The FreeCon Active PROFINET FO repeater must have a valid TCP/IP configuration in order to guarantee proper functioning in the network.

4.1 Setup using GSDML file

The FreeCon Active PROFINET FO repeater is generally installed in a system by integrating its GSDML file into the PLC configuration. The GSDML file and a BMP icon for the repeater are archived on the repeater itself (in the Fca-pir-pof.zip compressed file). As described in Section 4.3 below, these files can be downloaded via the repeater's web interface.

Make sure that the version saved on the FreeCon Active PROFINET FO repeater is up-to-date. The latest version of the GSDML file is available for download from the Weidmüller website www.weidmueller.com → Downloads → Software → Industrial Ethernet.

The GSDML file defines the parameters and configurable settings for the repeater. It is used by the PLC configuration software for the configuration and integration of the repeater into the whole system (compatible with SIMATIC STEP 7, version 7.5 or higher).

Before you access the extended diagnostic settings, you need to import the GSDML file and integrate it into your system topology. The necessary procedure depends on the PLC configuration software used.

4.2 Setup using Weidmüller FreeCon CFG

The FreeCon Active PROFINET FO repeater can also be configured using the "FreeCon CFG" software. This software, which you can download for free from the Weidmüller website, searches the Ethernet and displays all the FreeCon Active PROFINET FO repeaters found. The program can access the settings for all devices on the network via UDP on port 3250.

Carry out the following steps to run the service program:

1. Connect the PushPull Power plug-in connector to the power port on the FreeCon Active PROFINET FO repeater.
2. Connect the PushPull data push-in connector to the data port of the FreeCon Active PROFINET FO repeater.
3. Start "FreeCON CFG.exe" on your PC (the PC must be connected to the same network).
4. Click on the "Scan" button to search for Weidmüller devices.

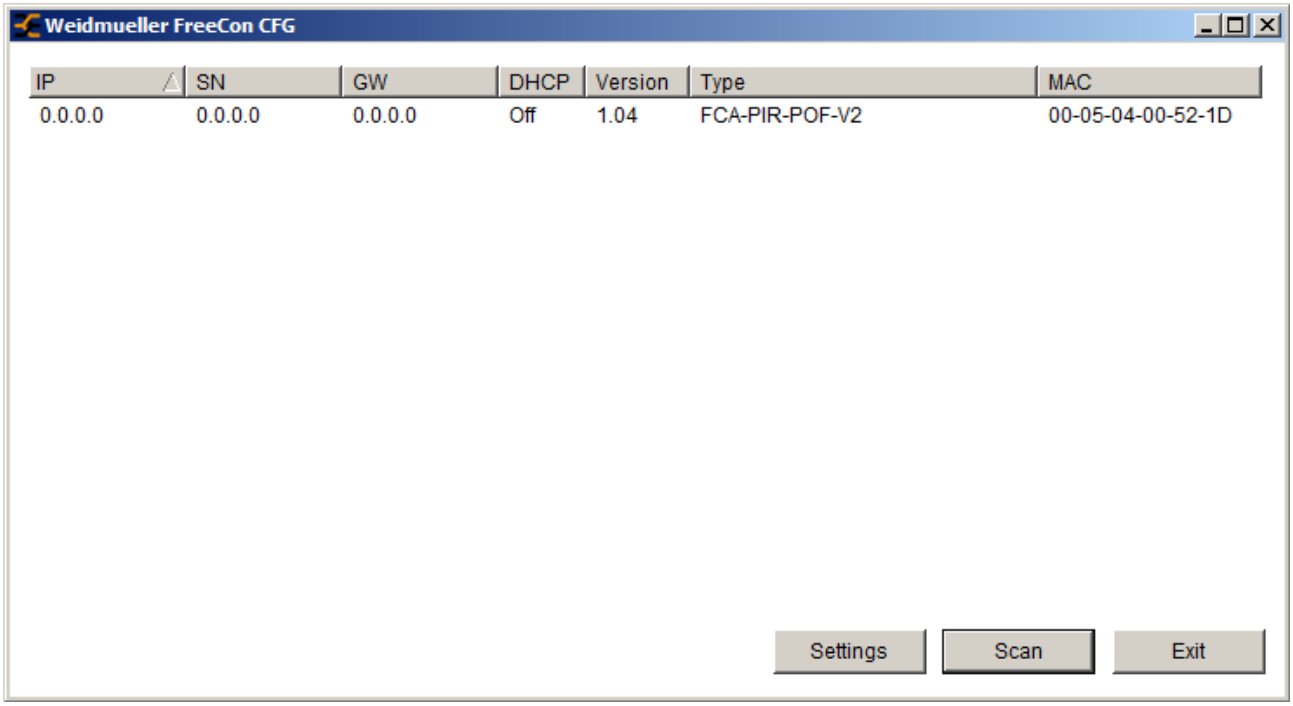


Figure 7 Search for Weidmüller devices in FreeCon CFG.

5 The repeater is shown in the list of devices detected as "FCA-PIR-POF". Double-click on the IP address to change it (the actual IP address may be different to that shown).

Depending on your network, you can either set a static IP address or select "DHCP on".

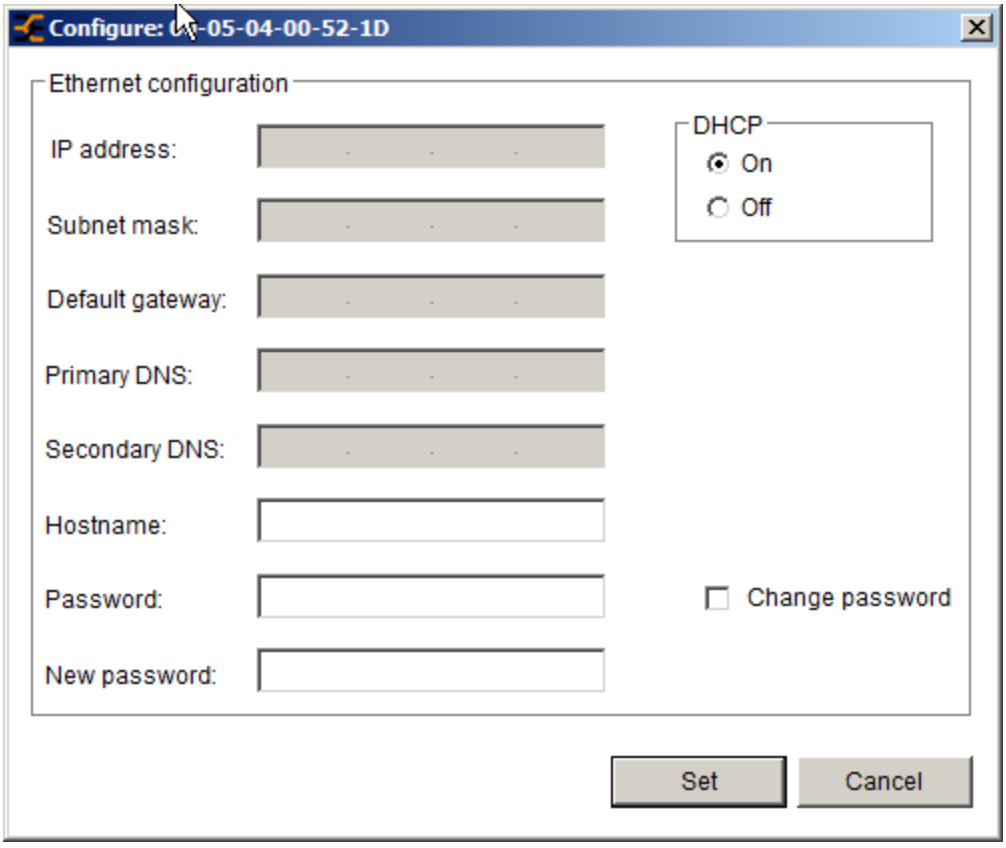


Figure 8 Configuring a new IP address in FreeCon CFG

6 Click on the "Set" button to apply the new settings.

7 Click on the "Scan" button again to display the values you have changed.

8 Right-click on the diagnostic repeater entry. This brings up a menu from which you can access the device web page or the configuration page, or run the PROFINET "Wink" function.

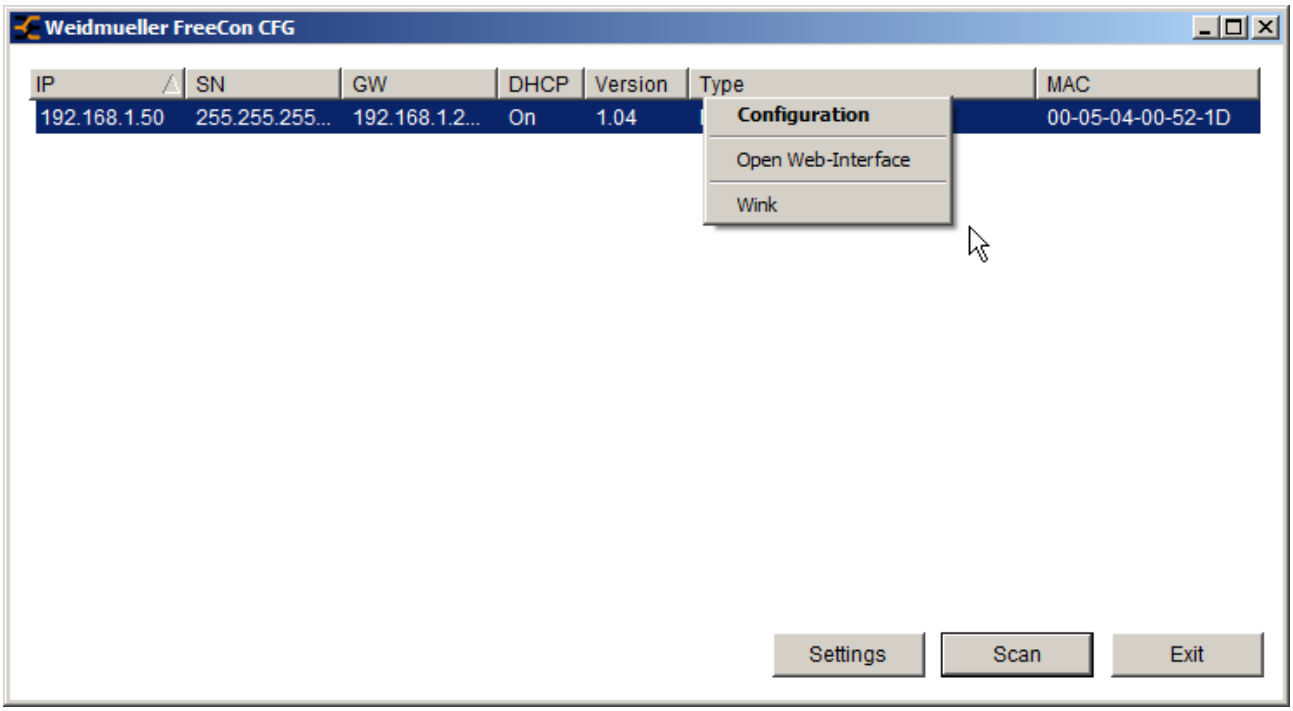


Figure 9 Options menu in FreeCon CFG

4.3 Using a web browser to access the device

Once the FreeCon Active PROFINET FO repeater has been configured using FreeCon CFG, the web server hosted on the repeater can be accessed via the assigned IP address. To do this, use a web browser installed on a PC in the same subnet. The web interface can be used to manually access the device properties (firmware version, serial number and MAC address) or to change the settings (IP, subnet mark or gateway addresses).

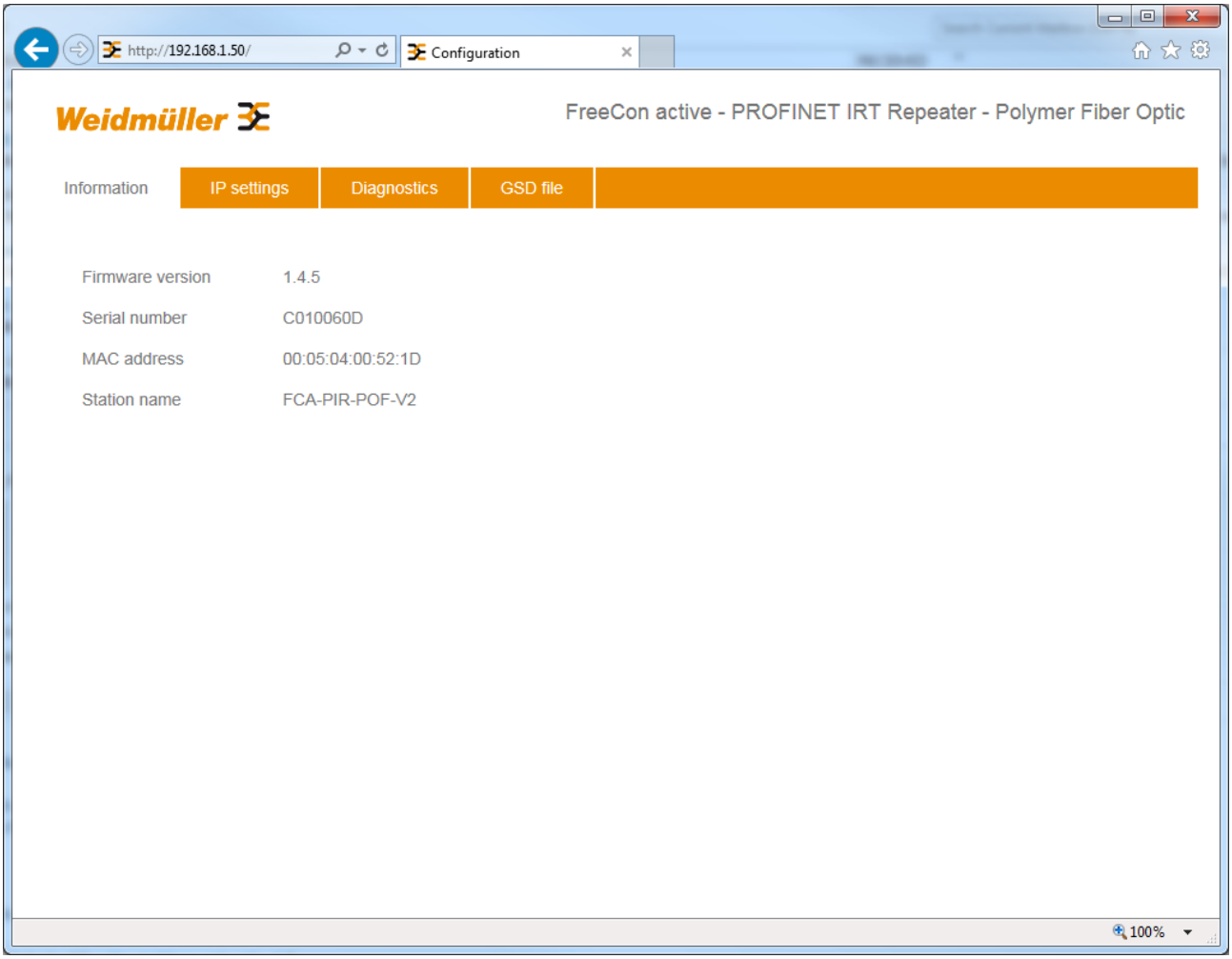


Figure 10 Properties of the FreeCon Active PROFINET FO repeater in the web browser view

The IP settings can be changed in the following screen.

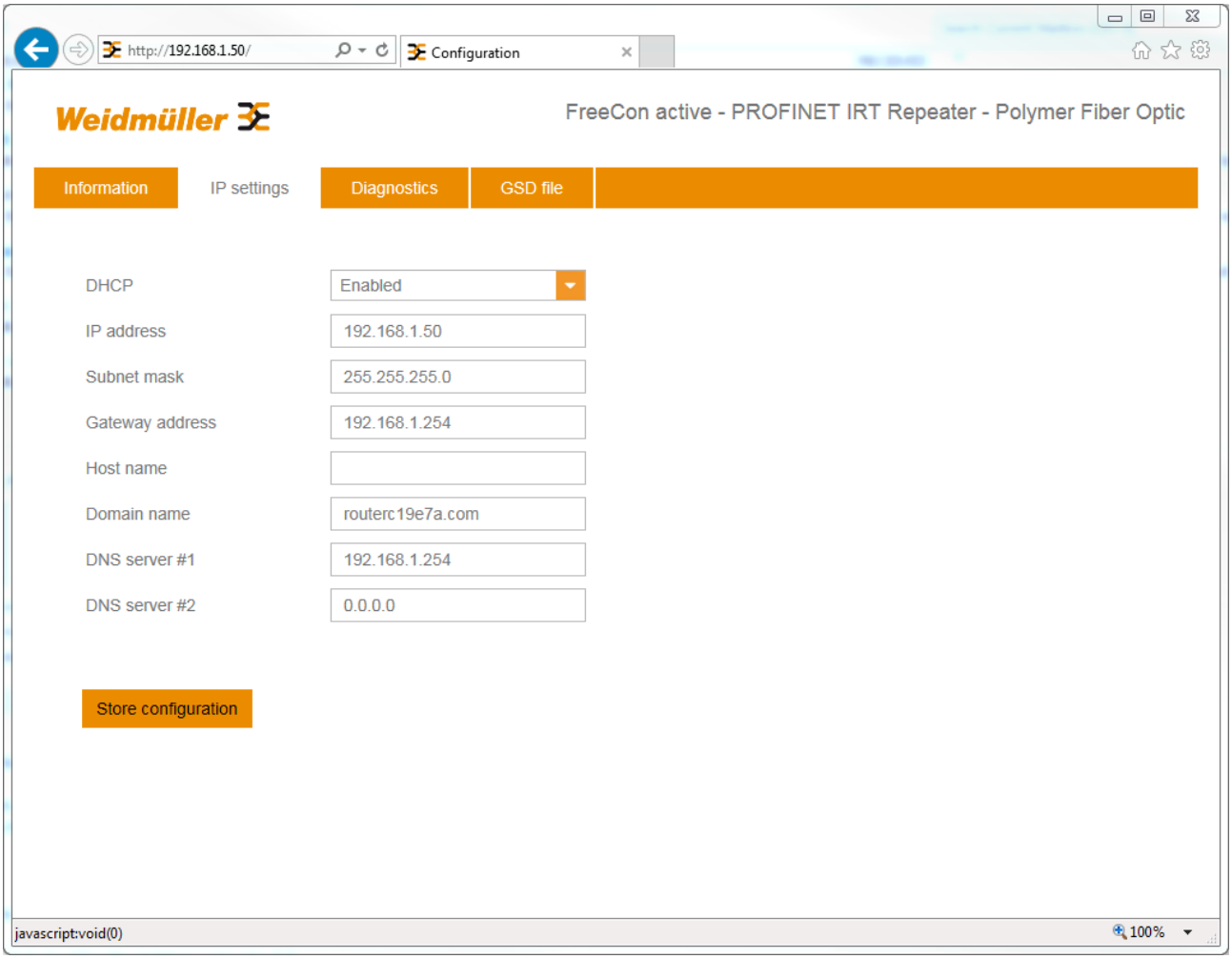


Figure 11 Configuring the FreeCon Active PROFINET FO repeater using a web browser

The FreeCon Active PROFINET FO repeater must be switched off and restarted after clicking on the "STORE CONFIGURATION" button. The changes only become effective after a restart.

In order to download the GSD file, the "GSD File" page must be selected. After pressing "Download GSD file", a ZIP file containing the necessary files is downloaded.

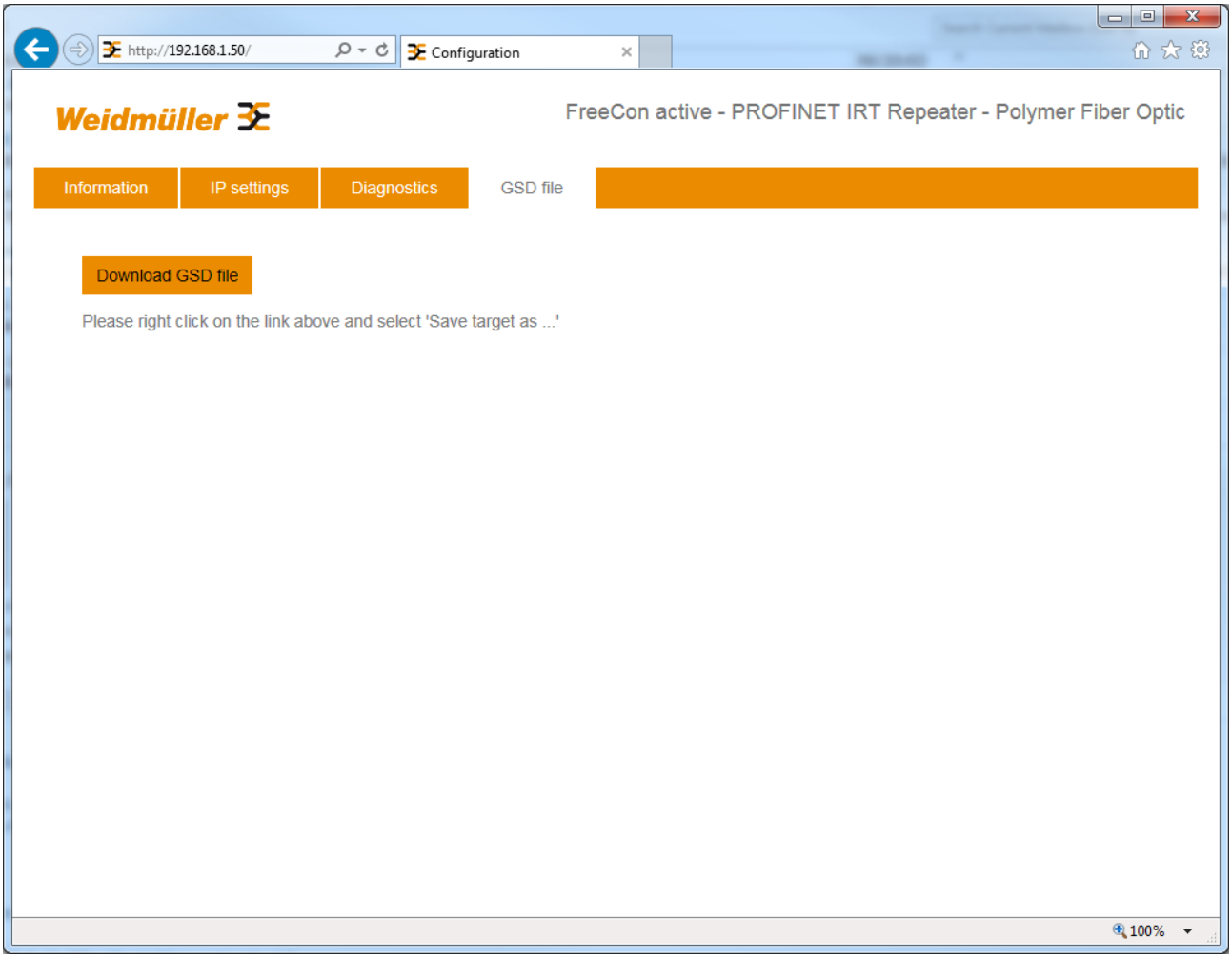


Figure 12 Downloading the GSDML file from the FreeCon Active PROFINET FO repeater

4.4 SNMP configuration

The FreeCon Active PROFINET FO repeater supports the Simple Network Management Protocol (SNMP) in accordance with the PROFINET standard and supports MIB-2. The repeater can be configured, monitored and administered remotely from a network management station. In order to access data from the device's Management Information Base (MIB), a message-based communications schema is used.

4.5 Discovery and basic Configuration Protocol (DCP)

The repeater offers full support for the PROFINET DCP protocol (a device detection and configuration protocol). This allows an I/O controller or supervisor to detect the FreeCon Active PROFINET FO repeater and change the IP settings.

4.6 Link Layer Discovery Protocol (LLDP)

LLDP provides information on which "partners" are connected to which Ethernet port. This information is saved in the LLDP MIB and can be read with SNMP.

4.7 Updating firmware

The repeater firmware can be updated by uploading a new firmware file. Updated firmware files are made available on the Weidmüller website.

The firmware file can be loaded onto the repeater directly via the built-in FTP server.

In order to establish an FTP connection to the repeater, first issue an IP address from your subnet, e.g. 192.168.1.101. (See Section 4.2)-

Use the "ftp *IP address*" command to establish an FTP connection to the FreeCon Active PROFINET FO repeater and confirm the user login (User + Password) by pressing *Enter.* The confirmation "*User logged in"* appears.

Switch to the "Firmware" directory using the "cd firmware" command.

Enter the command "put *filename*" to transfer the new firmware to the device.

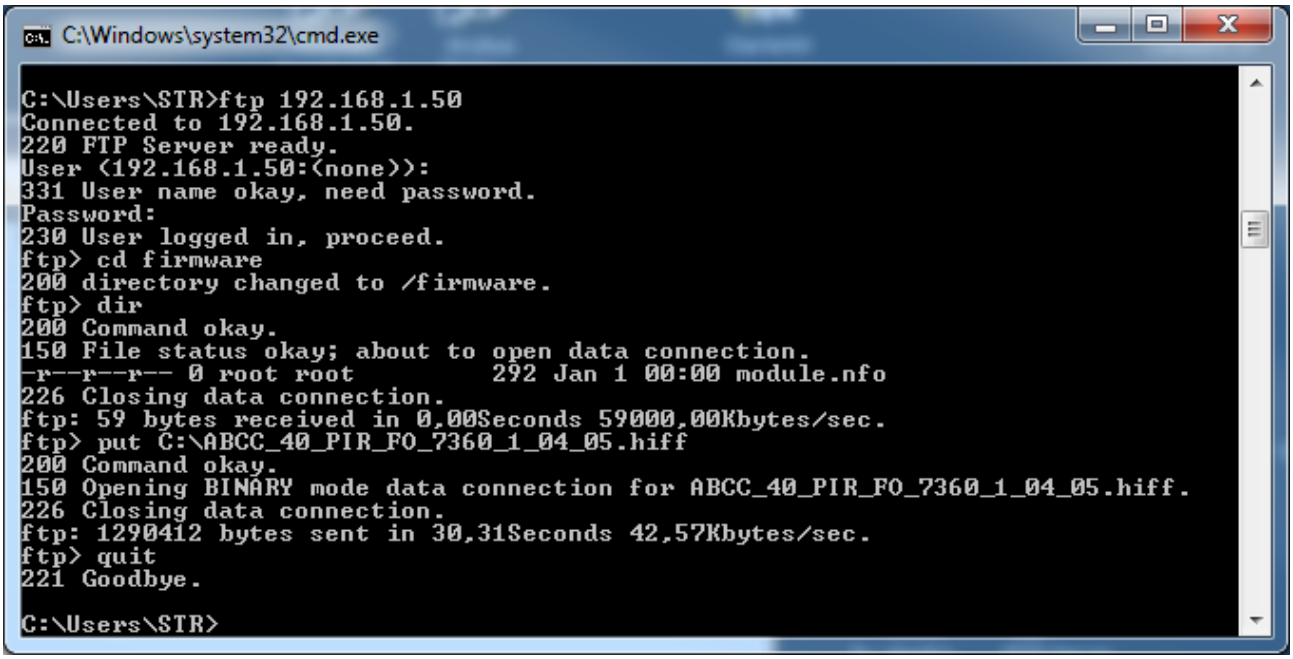


Figure 13 Transferring the firmware file via FTP

Once the data transmission is complete, disconnect the device briefly from the power supply. The update process begins after powering up.

NOTE

The testing and **updating of the firmware in the FreeCon Active PROFINET FO repeater can take up to 2 minutes.** During this time, the SD LED flashes alternately in green and red. Never disconnect the power supply while you are installing new firmware.

After successful installation, the FreeCon Active PROFINET FO repeater normally restarts automatically and is still available at its old IP address.

However, in exceptional cases, it may be necessary to disconnect the device briefly from the power supply after completing the firmware update. In this case, the SF LED remains unlit after the firmware update. In this case, the IP address settings are deleted and the device must be reconfigured as described in Section 4.2.

A detailed description of the firmware update can be found in the download area at www.weidmueller.com.

5. Advanced diagnostics functions

The FreeCon Active PROFINET FO repeater measures and reports temperature, supply voltage, optical performance reserves (amplitude margin) and performance budget. These values are generally accessed via the controller software. They are also directly accessible via the web server on the FreeCon Active PROFINET FO repeater.

5.1 PLC integration

The diagnostic information can be processed by PROFINET IO-compliant controllers. The integration of the FreeCon Active PROFINET FO repeater in SIMATIC STEP 7 is shown here as an example.

Once you have created a new project including a controller, you can add a PROFINET IO system.

Figure 13 Step 7 - Adding a PROFINET IO system

Now add the Ethernet network for the repeater and other hardware components by right-clicking on the "Insert Object..." menu option. Alternatively, you can work with the hardware catalogue.

Figure 14 Configuring PROFINET IO subscribers

The next thing to do is to issue the components with IP addresses and device names so that they can be addressed in the PROFINET IO network.

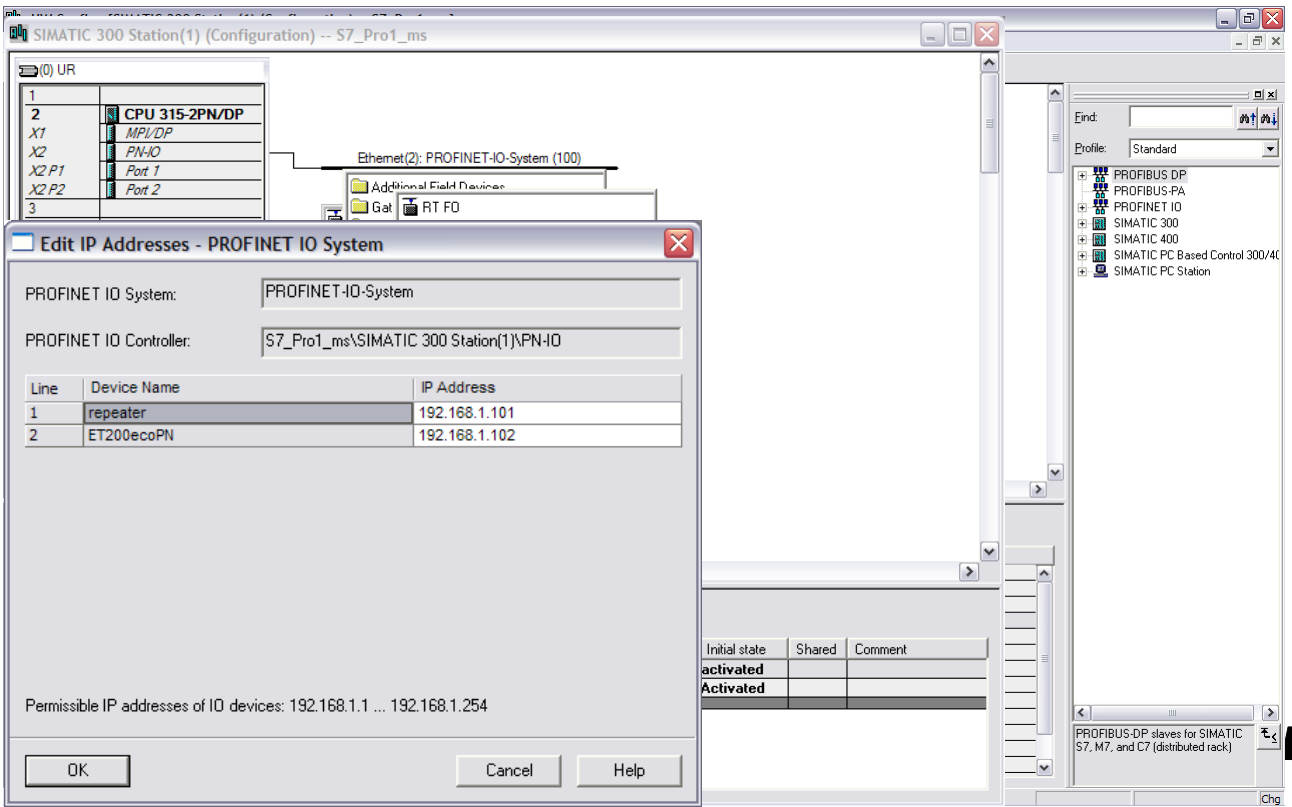


Figure 15 Issuing IP addresses

The property dialogue of the PROFINET IO subscriber takes you to the device name input screen:

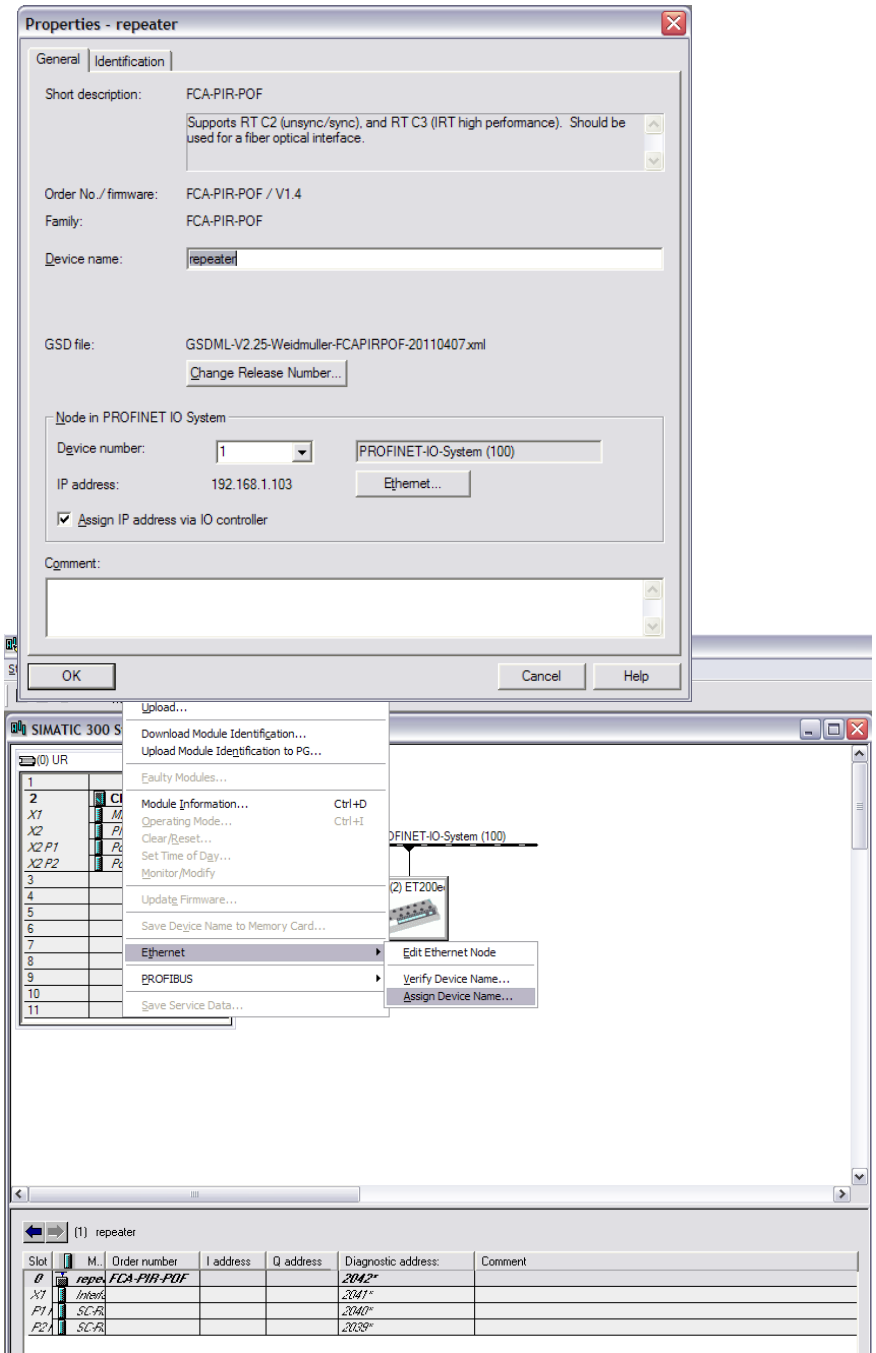


Figure 16 Adjusting the device name in the properties dialog

Figure 17 Issuing device names

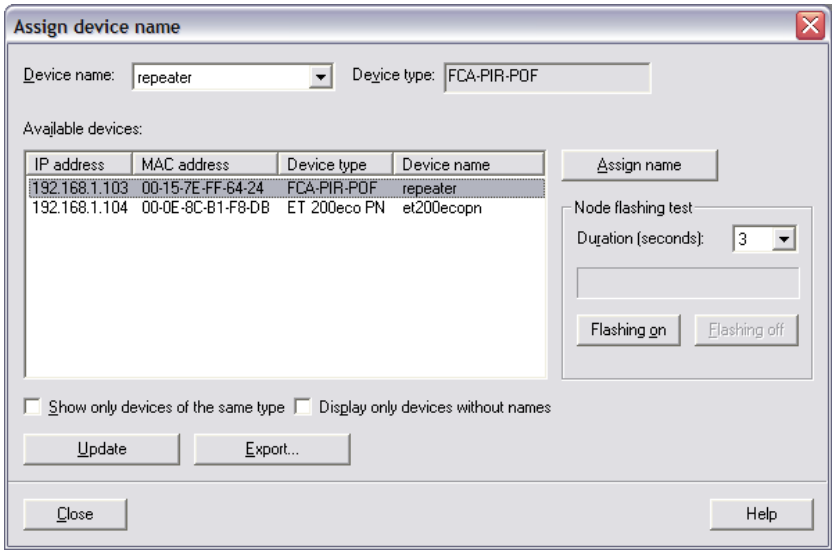


Figure 18 Assigning device names

Now load the project to the controller and start it up. If the PROFINET IO network is correctly configured, neither the red BF nor the red SF LED is lit on the FreeCon Active PROFINET FO repeater.

You can view the diagnosis information for the individual ports on the FreeCon Active PROFINET FO repeater in Step 7 under Module Information.

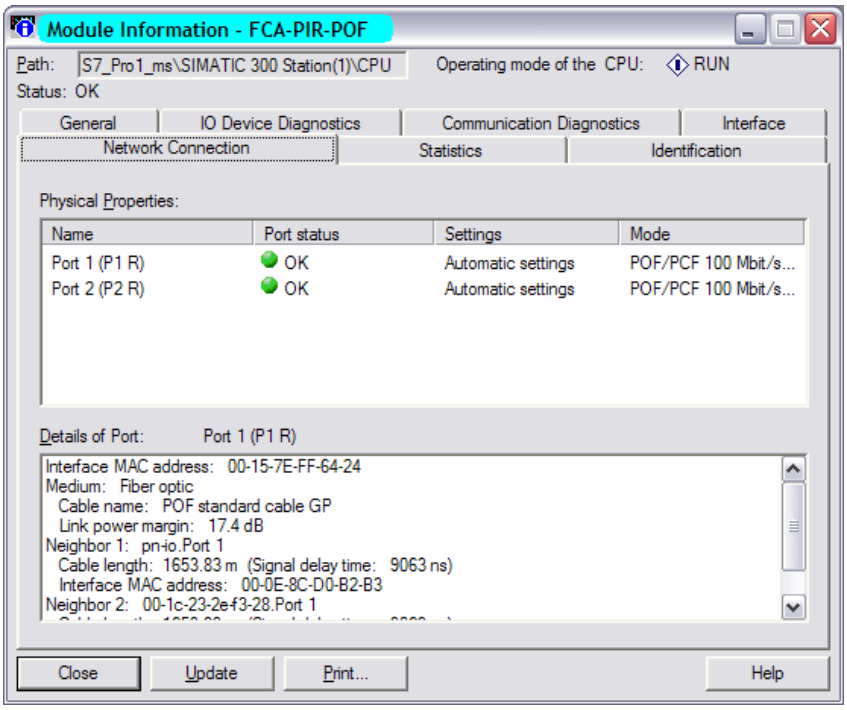


Figure 19 Step 7 Configuration

5.2 Web browser diagnosis

You can establish a connection to the web server on the FreeCon Active PROFINET FO repeater in order to access the diagnostic values. In the browser window, enter the IP address assigned to the FreeCon Active PROFINET FO repeater and navigate to the diagnosis page. The following diagnosis screen is displayed:

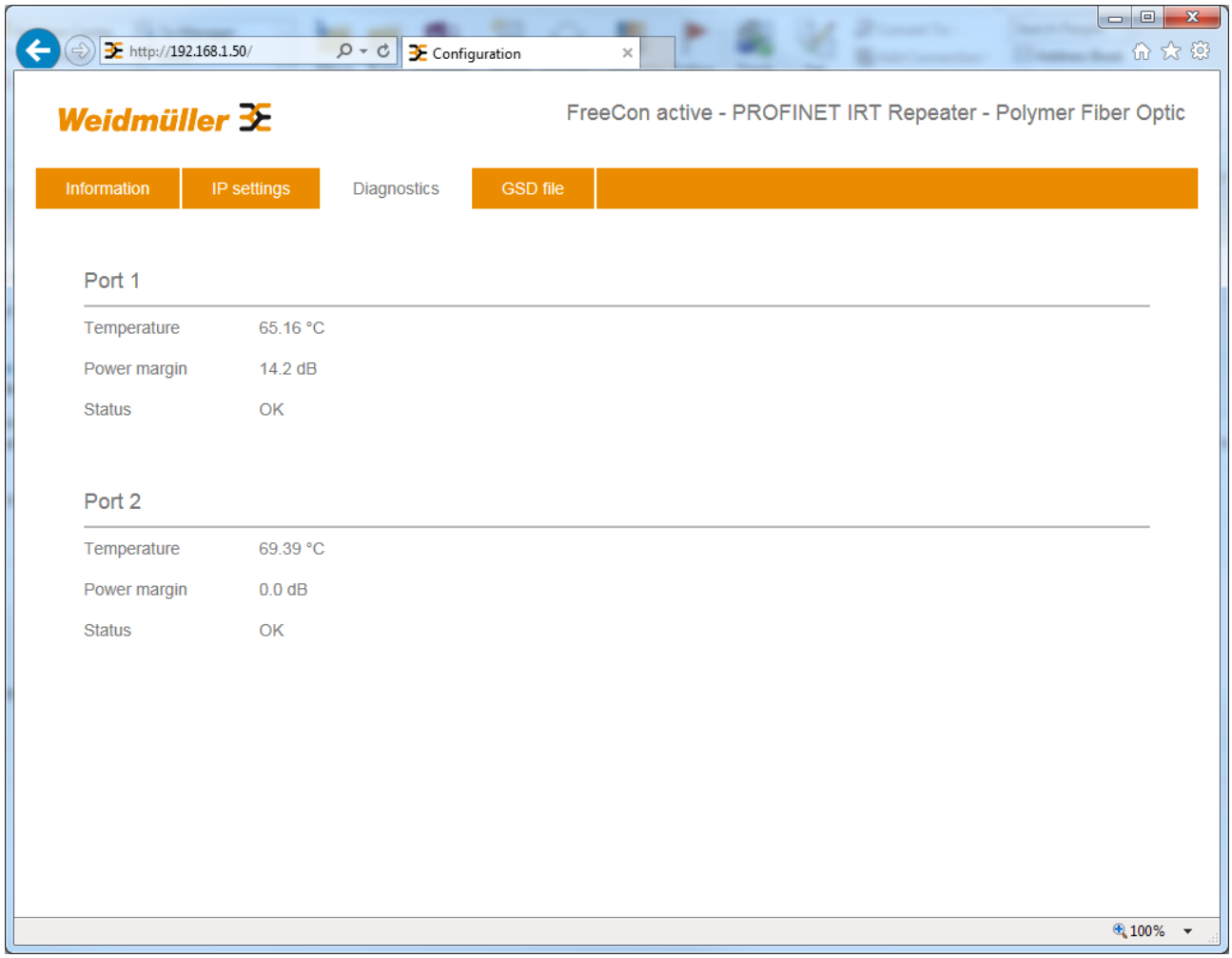


Figure 20 Diagnosis screen in the browser

Temperature	Temperature - this displays the current temperature of the two FO transceivers.
Power margin	Power reserve - The difference in dB between the optical power received and the minimum optical power required to balance out distance loses and still guarantee the minimum requirements at the input to the receiver. The power reserve is displayed for both FO transceivers.
Status	Status of connection

6. Status and maintenance

6.1 LED displays

The device has eight LEDs on the top. Their function is described in the table below.

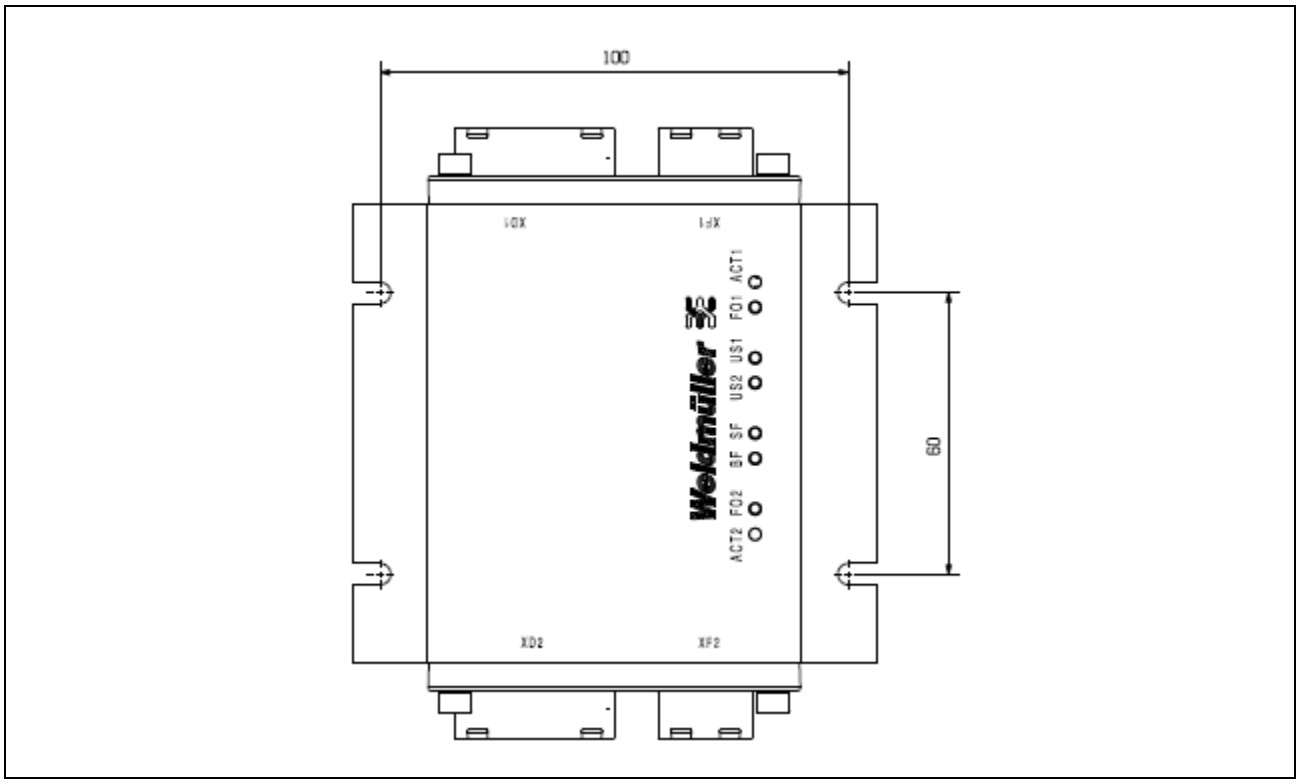


Figure 21 The eight LEDs on the FreeCon Active PROFINET FO repeater

6.1.1 Link1 and Link2 LEDs

These LEDs show the connection status of the FO transfer conductors to ports 1 (FO1) and 2 (FO2).

Colour	Status	Meaning
Green	On (continuous)	100 Mbps connection to TP port is active and transmission is OK.
Green	Off	No connection, *or* Fibre-optic receiver power (RX) outside authorised range (PROFINET IO Controller function activated).

If one of the FO LEDs is not lit, check whether the relevant port is connected to another subscriber and whether the fibre-optic cable is properly connected (with the right polarity).

6.1.2 Act1 and Act2 LEDs

These LEDs show activity on the FO transmission conductors at ports 1 (FO1) and 2 (FO2).

Colour	Status	Meaning
Yellow	Off (continuous)	No activity
Yellow	Flashing at 1 Hz	PROFINET IO activity or Flash/Blink identification

6.1.3 LEDs U_{S1} und U_{S2}

These two LEDs are controlled by the hardware as follows.

Colour	Status	Meaning
Green	On	Current input U_S1 (L1) or U_S2 (L2) is supplied with current.
	Off	Current input U_S1 (L1) or. U_S2 (L2) is not supplied with current, or the voltage is below 18 V.

6.1.4 SF LED

This LED indicates a system failure or fault.

Colour	Status	Meaning
---	Off	No power supply or device not powered up
Green	On	Status OK
Green	Flashing	Diagnosis event active
Red	On	One or more of the following faults: - FO transceiver faulty. - No connection with I/O controller. - Damping reserve < 2 dB
Red/green	Flashing alternately	Firmware update in progress

6.1.5 BF LED

This LED indicates a bus failure.

Colour	Status	Meaning
---	Off	Not connected to PROFINET IO controller
Green	On	Connection to PROFINET IO controller (normally the PLC) is established IO controller in "RUN" status
Green	Flashing, 1x	Connection to PROFINET IO controller (normally the PLC) is established IO controller in "STOP" status or "IO data bad"
Red	On	Error
Red	Flashing, 1x	Station name not set
Red	Flashing, 2x	IP address not set
Red	Flashing, 3x	Expected identification does not correspond to real identification

If the SF LED flashes red or goes out, check the following:

- The FO cables are properly connected
- The damping reserve must be > 2 db
- The station name is entered correctly.
- The IP address is set correctly (if it is not determined by the PROFINET IO controller).
- The hardware is correctly configured.

7. Technical data

Function	
Fibre-optic interface	Two 100 BaseFX POF Ports (PROFINET PushPull V14 push-in connector, SCRJ)

100BaseFX Plastic Optical Fibre (POF)	
Wavelength	650 nm
Max. transmission	-2 dBm
Min. transmission	-8.5 dBm
Min. Receive sensitivity	-23 dBm
Link budget	15 dB
Typical distances	50 m (if using P980/1000 POF cable (160 dB/km))

Power supply	
Input voltage	18 - 30 V DC
Current consumption	0.15 A / 24 V DC on U_{S1}
Power connection	PushPull Power plug-in connector
Reverse polarity protection	Yes
Max. current U_S1	16 A
Max. current U_S2	16 A
Mechanical specifications	
Base material for the housing	Aluminium profile, cover painted with zinc diecast
Degree of protection	IP65
Dimensions	112 mm x 53 mm x 130 mm
Weight	725 g without plug-in connector
Type of mounting	Wall mounting with four M4 screws (10 mm or longer)

Environmental conditions	
Ambient temperature (operational)	-20 °C…+55 °C
Storage temperature	-40 °C…+70 ℃
Relative ambient air humidity	Operation: 100% Storage/transport: 5...95%, no condensation

Approvals	
Safety	UL 1863
Emissions	EN 61000-6-4 Class A
ESD	EN61000-4-2 Level 3
RF	EN61000-4-3 Level 3
Burst	EN61000-4-4 Level 3
Surge	EN61000-4-5 Level 3
CRFI	EN61000-4-6 Level 3
Impact	IEC 60068-2-27
Hammer	IEC 60068-2-75
Vibration	IEC 60068-2-6

8. Warranty:

For this product, Weidmüller provides a guarantee in accordance with the guarantee terms and conditions in the general terms and conditions of sale of the Weidmüller company from which you bought the product. Weidmüller guarantees that product faults which existed on delivery will be repaired free of charge, or that Weidmüller will provide a new, fully-functioning product to replace the faulty product free of charge. If there are no specific written assurances about the system and its functionality in this catalogue/this product description, Weidmüller accepts no liability for compatibility with specific systems or suitability for specific applications. If acceptable in the law, damages and compensation of expenses regardless of the legal grounds are excluded, in particular for the breach of duties arising from contractual obligations and tort. In addition, the general conditions of sale are also applicable along with the expressly granted liability commitments of the Weidmüller company that sold you the products.