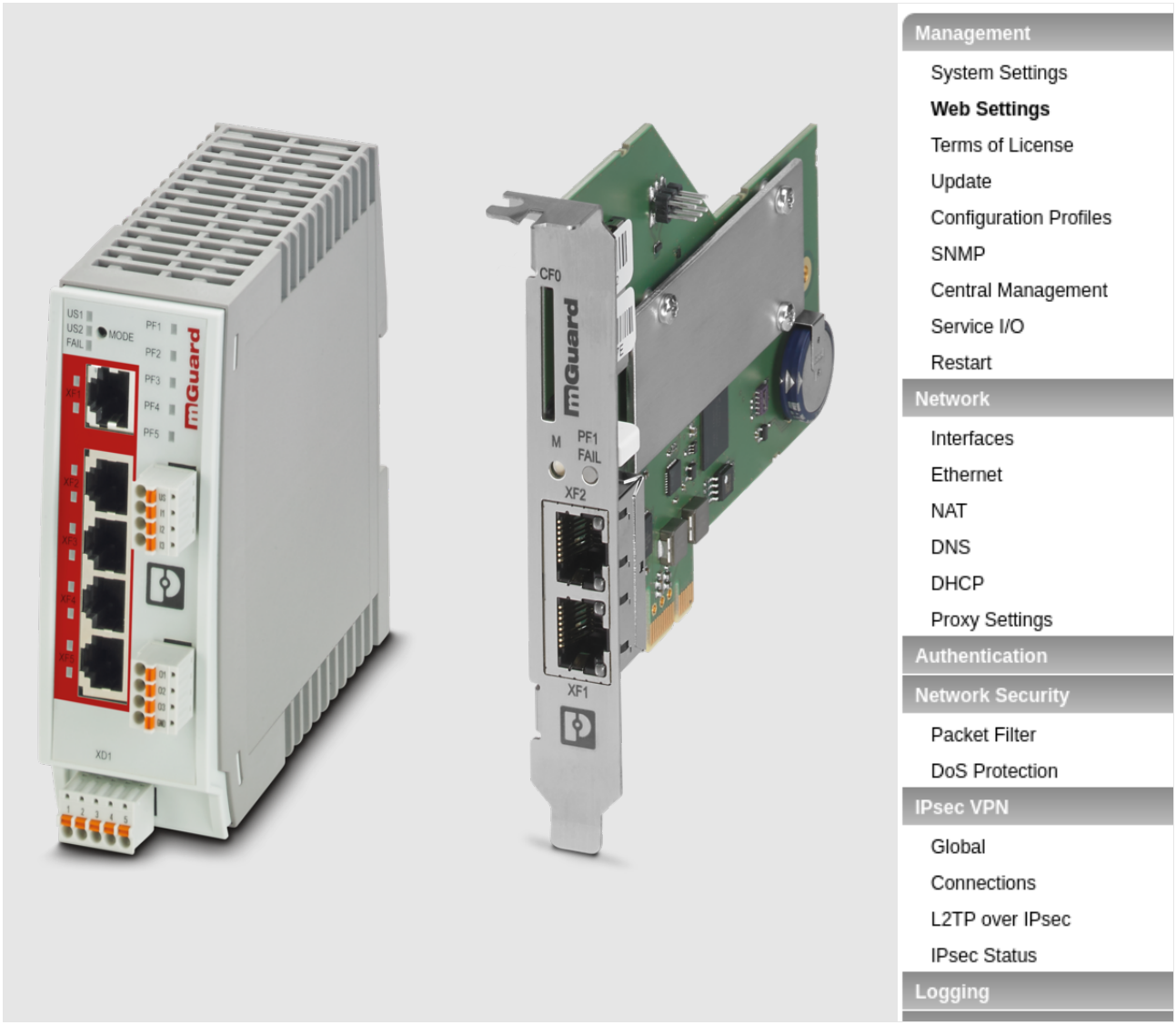


FL MGUARD 2000/4000 Web-based management mGuard 10.6.x

User manual

User manual

FL MGUARD 2000/4000 - Web-based management mGuard 10.6.x

UM EN FW MGUARD10, Revision 10 2026-01-29

This user manual is valid for

Designation	Item No.
FL MGUARD 2102	1357828
FL MGUARD 4302	1357840
FL MGUARD 4302/KX	1696708
FL MGUARD 2105	1357850
FL MGUARD 4305	1357875
FL MGUARD 4305/KX	1696779
FL MGUARD 4102 PCI	1441187
FL MGUARD 4102 PCIE	1357842

Firmware version: mGuard 10.6.x

Applicable documentation (available at phoenixcontact.com/product/<item number>):

Release Notes

mGuard 10.6.x Firmware – Release Notes

User Manual „Installation and startup“

UM EN HW FL MGUARD 2000/4000 – 110192_en_xx

User Manual „Generic Administration Interface - gaiconfig User Guide“:

UM EN GAICONFIG MGUARD10 – 110193_en_xx

User Manual „Installation, Configuration and Usage of the mGuard device manager (mdm)“:

UM EN MDM 1.18 – 111024_en_xx

User Manual „IEC 62443-4-2-compliant configuration of the FL MGUARD product family“:

UM EN MGUARD 62443-4-2 – 109049_en_xx

110191_en_10

Table of Contents

1 For your safety 9

1.1 Identification of warning notes 9
1.2 About this user manual 9
1.3 Qualification of users 9
1.4 Intended use 9
1.5 Modifications to the product 10
1.6 Safety notes 10
1.6.1 Safety notes for installation in zone 2 (only devices with Ex approval) ... 11
1.7 IT security 12
1.8 Latest security instructions for your product 14
1.9 Support 15

2 mGuard basics 17

2.1 Intended use of the device 17
2.2 New device platform FL MGUARD 2000/4000 17
2.2.1 Functions that are no longer supported 18
2.2.2 Newly added functions 19
2.2.3 Changed default settings 27
2.2.4 Changed variable values 29
2.2.5 Added functions that were already available on the old device platform 31
2.2.6 Migration of the device configuration 32
2.3 Basic properties 33
2.4 Typical application scenarios 36
2.4.1 Stealth mode (Plug-n-Protect) 36
2.4.2 Network router 37
2.4.3 DMZ 37
2.4.4 VPN gateway 38
2.4.5 WLAN via VPN 38
2.4.6 Resolving network conflicts 39

3 Configuration help 41

3.1 Secure encryption 41
3.2 Suitable web browsers 43
3.3 Number of concurrent sessions 43
3.4 User roles 44
3.5 Input help during configuration (system messages) 45
3.6 Using the web interface 46
3.7 CIDR (Classless Inter-Domain Routing) 49
3.8 Network example diagram 50

3.9 LED status indicator and blinking behavior 51

4 Management menu 53

4.1 Management >> System Settings 53
4.1.1 Host 53
4.1.2 Time and Date 56
4.1.3 Shell Access 62
4.1.4 E-Mail 76
4.2 Management >> Web Settings 80
4.2.1 General 80
4.2.2 Access 81
4.3 Management >> Terms of License 96
4.4 Management >> Update 97
4.4.1 Overview 97
4.4.2 Update 98
4.5 Management >> Configuration Profiles 101
4.5.1 Configuration Profiles 101
4.6 Management >> SNMP 109
4.6.1 Query 109
4.6.2 Trap 114
4.6.3 LLDP 120
4.7 Management >> Central Management 121
4.7.1 Configuration Pull 121
4.8 Management >> Service I/O 127
4.8.1 Service Contacts 129
4.8.2 Alarm Output 131
4.9 Management >> Restart 133
4.9.1 Restart 133

5 Network menu 135

5.1 Network >> Interfaces 135
5.1.1 Overview of "Router" network mode 137
5.1.2 Overview of "Stealth" network mode 138
5.1.3 General 142
5.1.4 External 146
5.1.5 Internal 148
5.1.6 DMZ 149
5.1.7 Stealth 151
5.2 Network >> Ethernet 154
5.2.1 MAU Settings 154
5.2.2 Multicast 156
5.2.3 Ethernet 158
5.3 Network >> NAT 159

5.3.1 Masquerading 159
5.3.2 IP and Port Forwarding 162
5.4 Network >> DNS 165
5.4.1 DNS server 165
5.4.2 DynDNS 169
5.5 Network >> DHCP 171
5.5.1 Internal/External DHCP 172
5.5.2 DMZ DHCP 176
5.6 Network >> Proxy Settings 179
5.6.1 HTTP(S) Proxy Settings 179
5.7 Network >> Dynamic Routing 180
5.7.1 OSPF 180
5.7.2 Distribution Settings 183

6 Authentication menu 185
6.1 Authentication >> Administrative Users 185
6.1.1 Passwords 185
6.1.2 RADIUS Filters 188
6.2 Authentication >> Firewall Users 190
6.2.1 Firewall Users 190
6.3 Authentication >> RADIUS 193
6.4 Authentication >> Certificates 197
6.4.1 Certificate Settings 202
6.4.2 Machine Certificates 204
6.4.3 CA Certificates 206
6.4.4 Remote Certificates 208
6.4.5 CRL 210

7 Network Security menu 213
7.1 Network Security >> Packet Filter 213
7.1.1 Incoming Rules 215
7.1.2 Outgoing Rules 218
7.1.3 DMZ 221
7.1.4 Rule Records 224
7.1.5 MAC Filtering 229
7.1.6 IP/Port Groups 231
7.1.7 Advanced 234
7.2 Network Security >> Firewall Assistant 240
7.2.1 Firewall Assistant 240
7.2.2 Alarms 243
7.3 Network Security >> Deep Packet Inspection 245
7.3.1 Modbus TCP 245
7.3.2 OPC Inspector 248

7.4 Network Security >> DoS Protection 250
7.4.1 Flood Protection 250
7.5 Network Security >> User Firewall 252
7.5.1 User Firewall Templates 252

8 IPsec VPN menu 257
8.1 IPsec VPN >> Global 257
8.1.1 Options 257
8.1.2 DynDNS Monitoring 265
8.2 IPsec VPN >> Connections 266
8.2.1 Connections (IKEv1 and IKEv2 beta) 269
8.2.2 General 273
8.2.3 Authentication 291
8.2.4 Firewall 299
8.2.5 IKE Options 303
8.2.6 General (IKEv2 beta) 309
8.2.7 Authentication (IKEv2 beta) 315
8.2.8 Firewall (IKEv2 beta) 322
8.2.9 IKE Options (IKEv2 beta) 326
8.3 IPsec VPN >> L2TP via IPsec 327
8.3.1 L2TP Server 327
8.4 IPsec VPN >> IPsec Status 329
8.4.1 IPsec Status 329
8.4.2 IPsec Status IKEv2 (beta) 331

9 OpenVPN Client menu 333
9.1 OpenVPN Client >> Connections 333
9.1.1 Connections 333
9.1.2 General 335
9.1.3 Tunnel Settings 337
9.1.4 Authentication 341
9.1.5 Firewall 344
9.1.6 NAT 348

10 Redundancy menu 353
10.1 Redundancy >> Firewall Redundancy 354
10.1.1 Redundancy 354
10.1.2 Connectivity Checks 359
10.2 Ring/Network Coupling 362
10.2.1 Ring/Network Coupling 362

11 Logging menu 363
11.1 Logging >> Settings 363

11.1.1 Settings 363
11.2 Logging >> Browse Local Logs 366
11.2.1 Log entry categories 368

12 Support menu 371
12.1 Support >> Advanced 371
12.1.1 Tools 371
12.1.2 Hardware 373
12.1.3 Snapshot 374
12.1.4 TCP Dump 375

13 Redundancy 377
13.1 Firewall redundancy 377
13.1.1 Components in firewall redundancy 378
13.1.2 Interaction of the firewall redundancy components 380
13.1.3 Firewall redundancy settings from previous versions 380
13.1.4 Requirements for firewall redundancy 380
13.1.5 Fail-over switching time 381
13.1.6 Error compensation through firewall redundancy 383
13.1.7 Handling firewall redundancy in extreme situations 384
13.1.8 Interaction with other devices 386
13.1.9 Limits of firewall redundancy 389

14 Glossary 391

15 Appendix 401
15.1 CGI interface 401
15.2 Command line tool „mg“ 402
15.3 LED status indicator and blinking behavior 403
15.3.1 Representation of system states 403

1 For your safety

Read this user manual carefully and keep it for future reference.

1.1 Identification of warning notes

This symbol together with the **NOTE** signal word warns the reader of actions that might cause property damage or a malfunction.

Here you will find additional information or detailed sources of information.

1.2 About this user manual

The following elements are used in this user manual:

Bold	Designations of operating elements, variable names or other accentuations
Italic	– Product, module or component designations (e.g., *tftpd64.exe*, *Config API*) – Foreign designations or proper names – Other accentuations
–	Unnumbered list
1.	Numbered list
•	Operating instructions
↳	Result of an operation

1.3 Qualification of users

The use of products described in this user manual is oriented exclusively to:

– Electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

– Qualified application programmers and software engineers. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

1.4 Intended use

– The devices of the FL MGUARD series are security routers for industrial use, with integrated stateful packet inspection firewall and VPN. They are suitable for distributed protection of production cells or individual machines against manipulation and for secure remote maintenance.

– The devices are not intended for private use. They may only be used and operated in the commercial or industrial sector.

1.5 Modifications to the product

Modifications to hardware and firmware of the device are not permitted.

Incorrect operation or modifications to the device can endanger your safety or damage the device. Do not repair the device yourself. If the device is defective, please contact Phoenix Contact.

1.6 Safety notes

To ensure correct operation and the safety of the environment and of personnel, the device must be installed, operated, and maintained correctly.

NOTE: Installation only by qualified personnel
Installation, startup and maintenance of the product may only be performed by qualified specialist staff who have been authorized for this by the system operator. An electrically skilled person is someone who, because of their professional training, skills, experience, and their knowledge of relevant standards, can assess any required operations and recognize any possible dangers. Specialist staff must read and understand this documentation and comply with instructions. Observe the national regulations in force for the operation, functional testing, repairs and maintenance of electronic devices.

NOTE: Risk of material damage due to incorrect wiring
Connect the network connections of the device to Ethernet installations only. Some telecommunications connections also use RJ45 jacks; these must not be connected to the RJ45 jacks of the device.

NOTE: Electrostatic discharge
The devices contain components that can be damaged or destroyed by electrostatic discharge. When handling the devices, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and EN 61340-5-2.

NOTE: Requirements for the power supply
The module is designed exclusively for operation with safety extra-low voltage (SELV/PELV). In redundant operation, both power supplies must satisfy the requirements of the safety extra-low voltage.

NOTE: Requirement for control cabinet/control box
DIN rail devices snap onto a DIN rail inside a control cabinet or control box. This control cabinet/box must meet the requirements of IEC/EN 62368-1 with respect to fire protection enclosure.

NOTE: Requirement for functional grounding
Mount the DIN rail devices on a grounded DIN rail. The module is grounded when it is snapped onto the DIN rail.

NOTE: Requirement for mounting location
The prescribed mounting position of DIN rail devices is vertical on a horizontally mounted DIN rail. To allow air to circulate freely, the vents must not be covered. A gap of 3 cm between the vents of the housing is recommended.

Do not open or modify the device. Do not repair the device yourself, but replace it with an equivalent device. Repairs may only be carried out by the manufacturer. The manufacturer is not liable for damage resulting from non-compliance.

The IP20 degree of protection (IEC 60529-0/EN 60529-0) of the device is intended for use in a clean and dry environment. Do not subject the device to mechanical and/or thermal loads that exceed the specified limits.

NOTE: Observe the following safety notes when using the device.

- If the equipment is used in a not specified manner, the protection provided by the equipment may be impaired.
- The external circuits intended to be connected to this device shall be galv. separated from mains supply or hazardous live voltage by reinforced or double insulation and meet the requirements of SELV/PELV (Class III) circuit of UL/CSA/IEC 61010-1, 2-201.
- Use Copper Conductors Only, AWG 24-16, 90 °C
- The modules have to be build-in the final safety enclosure, which has adequate rigidity according to UL 61010-1, 61010-2-201 and meets the requirements with respect to spread of fire.
- When installing and operating the device, the applicable regulations and safety directives (including national safety directives), as well as general technical regulations, must be observed.
- The technical data is provided in the packing slip and on the certificates (conformity assessment, additional approvals where applicable).
- To avoid overheating, do not expose the device to direct sunlight or other heat sources.
- Clean the device housing with a soft cloth. Do not use aggressive solvents.

1.6.1 Safety notes for installation in zone 2 (only devices with Ex approval)

– The category 3 device is designed for installation in Zone 2 potentially explosive areas. It meets the requirements of EN 60079-0 and EN 60079-7.
– The device is not designed for use in atmospheres with a danger of dust explosions.
– The configuration of the device using DIP switches, buttons, or other accessible switches on the device is only permitted outside of potentially explosive areas.
– Observe the specified conditions for use in potentially explosive areas. Install the device in a suitable, approved housing with at least IP54 degree of protection that meets the requirements of IEC/EN 60079-7 and GB/T 3836.1-2021. Also observe the requirements of IEC/EN 60079-14.
– Only devices which are designed for operation in Ex zone 2 and are suitable for the conditions at the installation location may be connected to the circuits in the Ex zone. In potentially explosive areas, only disconnect and connect cables, SFP modules and the SD card when the power is disconnected.
– Only use fault-free Ethernet cables with functioning latches.

- Plug-in connections (e.g., connector, SD card) must have a functional interlock (e.g., locking clip, screw connection). Insert the interlock and repair any damaged interlocks immediately. Make sure that all plug-in connections are inserted completely.
- The device must be stopped and immediately removed from the Ex area if it is damaged, was subject to an impermissible load, stored incorrectly or if it malfunctions.
- The ambient temperature inside the end user housing must be measured within 25 mm of the device and maintained.
- Only connect one cable per terminal point.
- The air pressure during operation is limited to 108 kPa.
- Electrical isolation, 500 V AC in accordance with EN/IEC 60079-7. Observe the limitations in the specific conditions of use.
- Surge protective devices discharge interference of <500 V_{rms} between the voltage supply connections and FE. Therefore disconnect the power supply connector prior to measuring insulation. Otherwise, inaccurate insulation measurements may occur. Reinsert the plug into the socket provided once insulation measurement has been completed.

1.7 IT security

You have to protect components, networks, and systems against unauthorized access and ensure the integrity of data. As a part of this, you must take organizational and technical measures to protect network-capable devices, solutions, and PC-based software.

The use of mGuard devices in a secure environment certified according to IEC 62443-4-2 requires a corresponding configuration of the mGuard device within a defined security context. Both are described in the user manual "IEC 62443-4-2-compliant configuration of the FL MGUARD product family" (UM EN MGUARD 62443-4-2 - 109049_en_xx).

Phoenix Contact strongly recommends using an Information Security Management System (ISMS) to manage all of the infrastructure-based, organizational, and personnel measures that are needed to ensure compliance with information security directives.

In addition, Phoenix Contact recommends taking at least the following measures into account (taking into account your respective applicable security context/security concept).

Furthermore, Phoenix Contact recommends that at minimum the following measures are taken into consideration.

More detailed information on the measures described is available on the following websites (last accessed on 2025-09-15; partly only available in German):

- bsi.bund.de/it-sik.html
- ics-cert.us-cert.gov/content/recommended-practices

Use the latest firmware version

Phoenix Contact regularly provides firmware updates. Any firmware updates available can be found on the product page for the respective device.

- Ensure that the firmware on all devices used is always up to date.
- Observe the Change Notes for the respective firmware version.
-
- Pay attention to the security advisories published on Phoenix Contact‘s Product Security Incident Response Team (PSIRT) website regarding any published vulnerabilities.

Use the latest documentation

Phoenix Contact regularly provides updates of the documentation which can be found on the product page for the respective device.

- Ensure that you always use the latest device related documentation.

Assure the integrity of downloaded files

Phoenix Contact provides checksums of files that can be downloaded on the product page for the respective device.

- To ensure that the downloaded firmware or update files as well as downloaded documentation have not been modified by third parties during the download, compare the SHA256 checksums of the files with the checksums specified on the corresponding product page (phoenixcontact.com/product/<item number>).

Use up-to-date security software

- Install security software on all PCs to detect and eliminate security risks such as viruses, trojans, and other malware.
- Ensure that the security software is always up to date and uses the latest databases.
- Use whitelist tools for monitoring the device context.
- Use an Intrusion-Detection system for checking the communication within your system.

Take Defense-in-Depth strategies into consideration when planning systems

It is not sufficient to take measures that have only been considered in isolation when protecting your components, networks, and systems. Defense-in-Depth strategies encompass several coordinated measures that include operators, integrators, and manufacturers.

- Take Defense-in-Depth strategies into consideration when planning systems.

Perform regular threat analyses

- To determine whether the measures you have taken still provide adequate protection for your components, networks, and systems, threat analyses should be performed regularly.
- Perform a threat analysis on a regular basis.

Deactivate unneeded communication channels

- Deactivate unnecessary communication channels (e.g., SNMP, FTP, BootP, DCP, etc.) on the components that you are using.

Do not integrate components and systems into public networks

- Avoid integrating your components and systems into public networks.
- If you have to access your components and systems via a public network, use a VPN (Virtual Private Network).

Restrict access rights

- Avoid unauthorized persons gaining physical access to the device. Accessing the hardware of the device could allow an attacker to manipulate the security functions.
- Restrict access rights for components, networks, and systems to those individuals for whom authorization is strictly necessary.
- Deactivate unused user accounts.

Secure access

- Change the default login information after initial startup.
- Use secure passwords reflecting the complexity and service life recommended in the latest guidelines.
- Change passwords in accordance with the rules applicable for their application.
- Use a password manager with randomly generated passwords.
- Wherever possible, use a central user administration system to simplify user management and login information management.

Use secure access paths for remote access

- Use secure access paths such as VPN (Virtual Private Network) or HTTPS for remote access.

Set up a firewall

- Set up a firewall to protect your networks and the components and systems integrated into them against external influences.
- Use a firewall to segment a network or to isolate a controller.

Activate security-relevant event logging

- Activate security-relevant event logging in accordance with the security directive and the legal requirements on data protection.
- Use the "Remote logging" function via an encrypted VPN tunnel to a syslog server.

Secure access to SD cards

Devices with SD cards require protection against unauthorized physical access. An SD card can be read with a conventional SD card reader at any time. If you do not protect the SD card against unauthorized physical access (such as by using a secure control cabinet), sensitive data is accessible to all.

- Ensure that unauthorized persons do not have access to the SD card.
- When destroying the SD card, ensure that the data cannot be retrieved.

1.8 Latest security instructions for your product

Product Security Incident Response Team (PSIRT)

The Phoenix Contact PSIRT is the central team for Phoenix Contact as well as for its subsidiaries, authorized to respond to potential security vulnerabilities, incidents and other security issues related to Phoenix Contact products, solutions as well as services.

Phoenix Contact PSIRT manages the disclosure, investigation internal coordination and publishes security advisories for confirmed vulnerabilities where mitigations/fixes are available.

The PSIRT website (phoenixcontact.com/psirt) is updated regularly. In addition, Phoenix Contact recommends subscribing to the PSIRT newsletter.

Anyone can submit information on potential security vulnerabilities to the Phoenix Contact PSIRT by e-mail.

1.9 Support

For additional information on the device as well as release notes, user assistance and software updates, visit: phoenixcontact.net/product/<item number>.

In the event of problems with your device or with operating your device, please contact your supplier.

To get help quickly in the event of an error, make a snapshot of the device configuration immediately when a device error occurs, if possible. You can then provide the snapshot to the support team.

The usage of snapshots is described in this user manual.

2 mGuard basics

2.1 Intended use of the device

- Industrial security router (model-dependent with built-in 3- or 4-port switch and DMZ port)
- Securing IP data connections in industrial automation networks (IACS).
- Protection against unauthorized access (stateful packet inspection firewall).
- Network segmentation and separation of critical systems.
- Secure remote maintenance via IPsec or OpenVPN connections.
- Compliance with the security requirements of the IEC 62443-4-2 standard (Security Level 2 or higher).
- Integral component of a Defense-in-Depth concept.

2.2 New device platform FL MGUARD 2000/4000

The FL MGUARD 2000/4000 series devices are gradually replacing the established Guard devices of the RS2000/RS4000 and PCI(E)4000 series.

The new devices with proven mGuard Security Technology are equipped with fast Gigabit Ethernet and are operated with the mGuard 10.x firmware version.

The devices are compatible with their predecessor models, can import existing configuration profiles (atv files), and can be configured via CGI and GAI interfaces.

The mGuard device manager (starting with version mdm 1.18.0) can be used to manage mGuard devices with firmware versions up to 10.6.x installed (see user manual "UM EN MDM 1.18" – 111024_en_xx).

Currently, some device functions from previous models cannot yet be supported on the new models (see Section 2.2.1).

2.2.1 Functions that are no longer supported

Certain functions of the old device platform are no longer supported on the new device platform.

Hardware

The new mGuard models of the FL MGUARD 2000/4000 series are offered without serial interface and without internal modem.

Firmware (functions)

Device functions that are not supported on the new device platform are listed in Table 2-1.

Table 2-1 Currently unsupported device functions

Functions currently not supported in the firmware mGuard 10.6.x
Network: Interfaces – PPPoE / PPTP – Secondary external interface
Network: Serial interface
Network: GRE tunnel (Generic Routing Encapsulation)
VPN redundancy
Quality of Services (QoS)
CIFS Integrity Monitoring
SEC-Stick
Update method „Online update“ (installation of package sets)

When transferring older device configurations to these new devices, care must therefore be taken to ensure that the functions described in Table 2-1 have been deactivated or reset to the default settings in the device configuration before export (see also Section 2.2.6).

2.2.2 Newly added functions

Variables have been added to the new device platform that are not available on the old device platform.

Table 2-2 Newly added functions / variables

New function / variable / value	New function / Impact of migration	Firmware
[Firewall Assistant] **Menu:** Network Security >> Firewall Assistant >> Firewall Assistant Network Security >> Firewall Assistant >> Alarms **Section:** Firewall Assistant Alarms (Firewall Assistant) **Variable:** Activate Firewall Assistant **GAI variable:** FWASSIST_ENABLE	Data traffic unintentionally rejected by the firewall can be easily identified and permitted through the automated creation of corresponding firewall rules. **Migration of older mGuard configurations** No effect.	**10.6.0**
[IPsec VPN connections] **Menu:** IPsec VPN >> Connections **Section:** Connections IKEv2 (beta) **Variable:** The variables in the "Connections IKEv2 (beta)" section represent a subsection of the variables that are already available in the "Connections" section. **GAI variable:** All GAI variables that contain the designation "IPSEC_CON".	**NOTE: Can only be used in productive environments after successful testing in the customer application.** Connections that are configured in the "Connections IKEv2 (beta)" section can also use the IKEv2 protocol in addition to the IKEv1 protocol. Support for the IKEv2 protocol for establishing VPN connections is currently in the beta phase and offers a limited range of functions. In productive use, IKEv2 connections should only be used after successful testing in the customer environment. In the IKEv2 connections, port 54500 is used to establish the connection, in deviation from the standard. Port 54500 must therefore also be configured on the remote side and must not be blocked by firewall settings. **Migration of older mGuard configurations** No effect. IPsec VPN connections that have already been configured remain unchanged.	**10.6.0**

Table 2-2 Newly added functions / variables [...]

New function / variable / value	New function / Impact of migration	Firmware
[Update] **Menu:** n/a **Section:** n/a **Variable:** n/a **GAI variable:** UPDATE_PASSWORD	A new user with the designation "update" is available. The "update" user is only authorized to perform firmware updates ("Local Update" or "Automatic Update"). The "update" user can be created and its password (update password) can be changed. In the current version, the user cannot be configured via the WBM, but only via the *Generic Administration Interface* (GAI) and the *mGuard device manager* (FL MGUARD DM UNLIMITED). **Migration of older mGuard configurations** No effects.	**10.6.0**
[Logging] **Menu:** n/a **Section:** n/a **Variable:** n/a **GAI variable:** n/a	Remote logging uses the Syslog Message Format, compliant with „RFC 5424 - Ch. 6“. **Migration of older mGuard configurations** No effects.	**10.6.0**

Table 2-2 Newly added functions / variables [...]

New function / variable / value	New function / Impact of migration	Firmware
[Pull Configuration / Configuration Pull Server] **Menu:** Administration >> Central Management >> Configuration Pull **Section:** Configuration Pull **Variable:** Server certificate **GAI variable:** GAI_PULL_HTTPS_CERT_REF	In addition to selecting a self-signed or root server certificate, the option "All installed certificates" can also be configured. This has the following advantage: During a planned replacement of the "Configuration Pull Server" certificate, the authentication of the server by the mGuard field devices can take place using either the "old" or the "new" server certificate. This is important if the corresponding server certificate of the field devices is or has been updated via a pull update. This is because the field devices sometimes do not maintain a permanent connection to the configuration pull server, which means that the server certificates are replaced on the field devices at different times. Updated and non-updated field devices can then access the configuration pull server, which uses the old certificate until further notice, regardless of the installed server certificate ("old" or "new"). Only after all mGuard field devices have either loaded the new server certificate from the configuration pull server or installed it in another way (e.g. SSH upload or import via WBM) the "old" server certificate can be replaced with the "new" server certificate on the configuration pull server. **Migration of older mGuard configurations** No effects. Already configured variable values are adopted.	**10.6.0**

Table 2-2 Newly added functions / variables [...]

New function / variable / value	New function / Impact of migration	Firmware
[Login via HTTPS/SSH] **Menu:** Administration >> System settings >> Host **Section:** System **Variable:** Control login via on/off switch (HTTPS/SSH) **GAI variable:** LOGIN_CONTROL	The login of users on the mGuard device can be controlled via a connected on/off switch (service contact), i.e. activated (permitted) or deactivated (prohibited). This applies to login via the HTTPS (WBM) and SSH (command line) interfaces. The login of the following users is not affected by the function and cannot be controlled via an on/off switch: – User "user" – Firewall user – SNMP users via the SNMP interface. **Migration of older mGuard configurations** No effects.	**10.6.0**
[Login of firewall users] **Menu:** Authentication >> Firewall Users >> Firewall Users **Section:** Users **Variable:** Enable/disable user firewall via on/off switch **GAI variable:** USERFW_CONTROL	The user firewall of the mGuard device can be controlled, i.e. activated or deactivated, via a connected on/off switch (service contact). If the login of firewall users is controlled by an on/off switch, firewall users can only log in and use the functions of the user firewall if the switch has been activated. **Migration of older mGuard configurations** No effect.	**10.6.0**
[SSH server] / [HTTPS-Server] **Menu:** Administration >> System Settings >> Shell Access **Menu:** Administration >> Web Settings >> Access **Section:** Shell >> Access **Section:** HTTPS Web Access **Variable:** Update SSH and HTTPS keys **GAI variable**: n/a	Algorithms that are considered insecure are generally no longer supported by the mGuard device. If an SSH/HTTPS client uses outdated and therefore insecure hashing and encryption algorithms, the connection may be rejected by the mGuard. The mGuard only supports a defined selection of secure hash and encryption algorithms. **Migration of older mGuard configurations** No effects. Under certain circumstances, some existing algorithms and SSH/HTTPS keys can initially continue to be used after a successful migration. However, newly created SSH/HTTPS keys only use the current algorithms.	**10.6.0**

Table 2-2 Newly added functions / variables [...]

New function / variable / value	New function / Impact of migration	Firmware
[SNMPv3] **Menu:** Administration >> SNMP >> Query **Section:** n/a **Variable:** n/a **GAI variable:** n/a	The MD5 and DES algorithms are no longer supported for newly created SNMP users. The SNMP server of the mGuard device generally only supports current encryption and hash algorithms that are considered secure. If a connection to the mGuard device is established via the SNMPv3 protocol, the hash algorithm SHA-1 (authentication) and the encryption algorithm AES must be used by the remote client. **Migration from older mGuard configurations** No effects. Already configured variable values are adopted. The MD5/DES algorithms are still used for SNMPv3 users that have already been created. As soon as new credentials are configured for an SNMPv3 user, only the SHA-1/AES algorithms are used.	**10.6.0**
[TCP-Dump] **Menu:** Support >> Advanced >> TCP Dump **Section:** TCP Dump **Variable** (Action): (1) Starting tcpdump (2) Stopping and downloading tcpdump	A packet analysis (*tcpdump*) can be used to analyze the content of network packets that are sent or received via a selected network interface. **Migration of older mGuard configurations** No effect.	**10.5.0**
[Logging] **Menu:** Logging >> Settings **Section**: Data protection **Variable**: Maximum retention period for log entries (0 = unlimited) **GAI variable**: LOGGING_MAX_DAYS	In order to comply with basic data protection requirements, it is possible to save log entries on the device only for a limited period of time. After a configurable storage period has expired, log entries will be deleted automatically from the device. **Migration of older mGuard configurations** No effect	**10.5.0**

Table 2-2 Newly added functions / variables [...]

New function / variable / value	New function / Impact of migration	Firmware
[Configuration profiles] **Menu**: Management >> Configuration Profiles **Section**: Configuration Profiles Signing **Variable**s: Enable signed configuration profiles Export certificate (machine certificate used to sign configuration profiles) Import certificate (certificate used to validate signature of configuration profiles) **GAI variables**: PROFILE_SECURE_ONLY PROFILE_EXPORT_CERT PROFILE_IMPORT_CERT	Configuration profiles can be signed using certificates. On devices configured accordingly, it is then only possible to upload configuration profiles to the device that have been signed with valid certificates. **Migration of older mGuard configurations** No effect	**10.5.0**
[OpenVPN Client] **Menu**: OpenVPN Client >> Connections >> Tunnel Settings **Section**: Data Encryption **Variable**: Encryption algorithm **GAI variable**: OPENVPN_CONNECTION.x.VPN_ENCRYPTION	**The "Blowfish" encryption algorithm is no longer supported.** A total of six AES encryption algorithms can be selected instead of the previous three: AES-128-GCM / AES-192-GCM / AES-256-GCM / AES-128-CBC / AES-192-CBC / AES-256-CBC **Migration of older mGuard configurations** After migrating a configuration from an older firmware version with the "Blowfish" encryption algorithm configured, the value of the variable is set to "AES-256-GCM". The following applies to all other algorithms: The value from the migrated configuration is adopted unchanged. The configured encryption algorithm will not be changed.	**10.5.0**

Table 2-2 Newly added functions / variables [...]

New function / variable / value	New function / Impact of migration	Firmware
[HTTPS access] **Menu**: Management >> Web Settings >> Access **Section**: HTTPS Web Access **Variable**: Lowest supported TLS version **GAI variable**: TLS_MIN_VERSION	Some functions of the mGuard device use TLS encryption, e.g.: – Web server (HTTPS access) – OpenVPN Client The used TLS version is negotiated between the remote peers. It is possible that a TLS version will be selected, that is no longer considered secure. To prevent this, it can be specified which TLS version will be accepted by the mGuard device as the lowest TLS version. Connections with lower TLS versions will be rejected by the mGuard device. Default: TLS 1.2 **Migration of older mGuard configurations** The variable will be configured with the value TLS 1.0/1.1. All TLS versions from TLS 1.0 are accepted by the mGuard device.	**10.5.0**
[Web access via HTTPS / Server certificate] **Menu**: Management >> Web Settings >> Access **Section**: HTTPS Web Access **Variable**: HTTPS server certificate **GAI variable**: HTTPS_SERVER_CERT_REF In previous firmware versions, the function was not officially available, but could be used as an unsupported expert function.	Instead of the self-signed web server certificate pre-installed on the mGuard device, a separate machine certificate can be uploaded to the device and used. The device can use this certificate to authenticate itself to requesting clients. The use of CA certificates in conjunction with a certificate chain of trust is possible. **Migration of older mGuard configurations** If an HTTPS server certificate is already in use, its use must be deactivated **before migrating the configuration or updating the device.** Command on the command line: `gaiconfig --set HTTPS_SERVER_CERT_REF ""` You can now perform the migration/update again and use the certificate again (if it is valid). If no HTTPS server certificate is used, the following applies: No effect.	**10.5.0**

Table 2-2 Newly added functions / variables [...]

New function / variable / value	New function / Impact of migration	Firmware
[Cellulink mode] **Menu**: Network >> Interfaces >> General **Section**: Network Status / Network Mode **Variable**: LINK mode **GAI variable**: ROUTER_MODE_LINK	The mGuard device can use the device "CELLULINK" available from Phoenix Contact to establish a mobile data connection to other networks or the Internet (e.g. via the 4G network). If Cellulink mode is activated, a hyperlink to the web-based management of the device "CELLULINK" is displayed in the WBM area of the mGuard device. **Migration of older mGuard configurations** No effect.	**10.5.0**
[OpenVPN Client] **Menu**: OpenVPN Client >> Connections >> Tunnel Settings **Section**: Data Encryption **Variable**: Hash algorithm (HMAC authentication) **GAI variable**: OPENVPN_CONNECTION.x.VPN_AUTH_HMAC	The hash function used to calculate the checksum can be configured. **Migration of older mGuard configurations** After migrating a configuration from an older firmware version, the value of the newly added variable is set to "SHA-1".	**10.4.0**
[Update Server] **Menu**: Management >> Update >> Update **Section**: Update Servers **Variable**: Server certificate **GAI variable**: PSM_REPOSITORIES.x.REMOTE_CERT_REF	To ensure that a secure HTTPS connection is established to the configured update server, a server certificate for the update server can be installed on the mGuard device. This can be used by the mGuard device to check the authenticity of the update server. **Migration of older mGuard configurations** After migrating a configuration from an older firmware version, the value of the newly added variable is set to "Ignore".	**10.3.0**
[Alarm Output] **Menu**: Management >> Service I/O >> Alarm Output **Section**: Operation Supervision **Variable**: Passwords not configured **GAI variable**: PASSWORD_CHECK	A configurable alarm "Passwords not configured" for default passwords that have not been changed (*admin/root)* has been added to the device. The alarm triggers the alarm output via I/Os and the corresponding FAIL LED. **Migration of older mGuard configurations** After migrating a configuration from an older firmware version, the value of the newly added variable is set to "Supervise".	**10.3.0**

2.2.3 Changed default settings

In a few cases, the default settings of existing variables on the old and new device platform differ.

Table 2-3 Changed default settings

Function	Changed default settings / Impact of migration	Firmware
[OpenVPN Client] **Menu**: OpenVPN Client >> Connections >> Tunnel Settings **Section**: Data Encryption **Variable**: Encryption algorithm **GAI variable**: OPENVPN_CONNECTION.x.VPN_ENCRYPTION	In the default settings, the encryption algorithm "AES-256-GCM" is used instead of "AES-256-CBC" as before. **Migration of older mGuard configurations** After migrating a configuration from an older firmware version with the "Blowfish" encryption algorithm configured, the value of the variable is set to "AES-256-GCM". The following applies to all other algorithms: The value from the migrated configuration is adopted unchanged. The configured encryption algorithm will not be changed.	**10.5.0**
[OpenVPN Client] **Menu**: OpenVPN Client >> Connections >> Tunnel Settings **Section**: Data Encryption **Variable**: Hash algorithm (HMAC authentication) **GAI variable**: OPENVPN_CONNECTION.x.VPN_AUTH_HMAC	In the default settings, the hash algorithm "SHA-256" is used instead of "SHA-1" as before. **Migration of older mGuard configurations** The value from the migrated configuration is adopted unchanged. The configured hash algorithm will not be changed.	**10.5.0**
[E-Mail] **Menu**: Management >> System Settings >> E-Mail **Section**: E-Mail **Variable**: Encryption mode for the e-mail server **GAI variable**: EMAIL_RELAY_TLS	In the default settings, the encryption algorithm "TLS Encryption" is used instead of "No encryption" as before. **Migration of older mGuard configurations** The value from the migrated configuration is adopted unchanged. The configured encryption mode will not be changed.	**10.5.0**

Table 2-3 Changed default settings

Function	Changed default settings / Impact of migration	Firmware
[Network Address Translation] **Menu**: Network >> NAT >> Masquerading **Section**: Network Address Translation/IP Masquerading **Variable**: Outgoing on interface / From IP	In default settings, a table row/rule with the following variable values is added: – Outgoing on interface: External – From IP: 0.0.0.0/0 IP masquerading is thus activated for all packets that are routed from the internal network (LAN) to the external network (WAN) (LAN --> WAN). **Migration of older mGuard configurations** The values from the migrated configuration are adopted unchanged. A new table row/rule will not be added.	**10.3.0**
[Network Settings] **Menu**: Network >> Interfaces >> General **Section**: Network Mode **Variable**: Network mode	All devices of the new device generation are delivered in the network mode "Router". The external WAN interface receives its IP configuration via DHCP. In the default setting, however, the firewall prevents remote access to the device via the WAN interface. The device can be accessed from the LAN network via the internal LAN interface under the network address 192.168.1.1/24. Devices connected to the LAN interface can obtain their IP configuration via the DHCP server of the mGuard device. **Migration of older mGuard configurations** The values from the migrated configuration are adopted unchanged. The configured network mode will not be changed.	**10.3.0**

2.2.4 Changed variable values

In a few cases, variable values are no longer available on the new device platform and are replaced by other values.

Table 2-4 Changed variable values

Function	Changed variable values / Impact of migration	Firmware
[OpenVPN Client] **Menu**: OpenVPN Client >> Connections >> Tunnel Settings **Section**: Data Encryption **Variable**: Encryption algorithm **GAI variable**: OPENVPN_CONNECTION.x.VPN_ENCRYPTION	**The "Blowfish" encryption algorithm is no longer supported.** A total of six AES encryption algorithms can be selected instead of the previous three: AES-128-GCM / AES-192-GCM / AES-256-GCM / AES-128-CBC / AES-192-CBC / AES-256-CBC **Migration of older mGuard configurations** After migrating a configuration from an older firmware version with the "Blowfish" encryption algorithm configured, the value of the variable is set to "AES-256-GCM". The following applies to all other algorithms: The value from the migrated configuration is adopted unchanged. The configured encryption algorithm will not be changed.	**10.5.0**

[Shell access]
Menu: Management >> System Settings >> Shell Access
Section: Maximum Number of Concurrent Sessions per Role
Variable: Admin / Netadmin / Audit
GAI variables:
SSH_ADMIN_LOGIN_ALLOWED_MAX
SSH_NETADMIN_LOGIN_ALLOWED_MAX
SSH_AUDIT_LOGIN_ALLOWED_MAX
	The "Maximum Number of Concurrent Sessions per Role" is limited to 10.
	Migration of older mGuard configurations
	– Applies to all configured values **<= 10**:
	  – The value from the migrated configuration is adopted unchanged. The configured maximum number of concurrent sessions per role will not be changed.
	– The following applies to configured values **> 10**:
	  – After the migration, the value of the variable "Maximum Number of Concurrent Sessions per Role" will be set to 10 in each case.
		10.5.0

Table 2-4 Changed variable values[...]

Function	Changed variable values / Impact of migration	Firmware
[Multicast] **Menu**: Network >> Ethernet >> Multicast **Section**: General Multicast Configuration **Variable**: IGMP snooping	To ensure that data in "Static multicast groups" is forwarded correctly to the configured ports, "IGMP snooping" must be activated **Migration of older mGuard configurations** After a migration, the value of the variable will be changed as follows: – **Enabled**: If "Static Multicast Groups" are configured. – **Enabled**: If "IGMP snooping" is enabled in the old configuration. – **Deactivated**: If no "Static Multicast Groups" are configured and "IGMP snooping" is deactivated in the old configuration.	**10.3.0**

2.2.5 Added functions that were already available on the old device platform

Variables that were already present on the old device platform but had been removed in the meantime were added again on the new device platform.

Table 2-5 Newly added functions / variables / variable values

New function / variable / value	New function / Impact of migration	Firmware
[Deep Packet Inspection / Modbus TCP] **Menu**: Network Security >> Deep packet Inspection >> Modbus TCP **Section**: Rule Records **Variable**: various **GAI variable**: MODBUS_RULESETS.x.FRIENDLY_NAME MODBUS_RULESETS.x.SET.y.MODBUS_FUNCTION_CODE MODBUS_RULESETS.x.SET.y.ADDRESS_RANGE MODBUS_RULESETS.x.SET.y.TARGET MODBUS_RULESETS.x.SET.y.COMMENT MODBUS_RULESETS.x.SET.y.LOG MODBUS_RULESETS.x.LOG_DEFAULT	The mGuard device can check packets of incoming and outgoing Modbus TCP connections (*Deep Packet Inspection*) and filter them if necessary. **Migration of older mGuard configurations** No effect. Already configured variable values will be adopted.	**10.5.0**
[Deep Packet Inspection / OPC Inspector] **Menu**: Network Security >> Deep packet Inspection >> OPC Inspector **Section**: OPC Inspector **Variable**: various **GAI variable**: IP_CONNTRACK_OPC IP_CONNTRACK_OPC_SANITY IP_CONNTRACK_OPC_TIMEOUT	Until now, the *OPC Classic* network protocol could only be used across firewalls if large port ranges were opened. Activating the *OPC Classic* function allows this network protocol to be used easily without having to configure the mGuard device's firewall in an insecure way. **Migration of older mGuard configurations** No effect. Already configured variable values will be adopted.	**10.5.0**
[Web access via HTTPS / Server certificate] **Menu**: Management >> Web Settings >> Access **Section**: HTTPS Web Access **Variable**: HTTPS server certificate **GAI variable**: HTTPS_SERVER_CERT_REF In previous firmware versions, the function was not officially available, but could be used as an unsupported expert function.	Instead of the self-signed web server certificate pre-installed on the mGuard device, a separate machine certificate can be uploaded to the device and used. The device can use this certificate to authenticate itself to requesting clients. The use of CA certificates in conjunction with a certificate chain of trust is possible.	**10.5.0**

Table 2-5 Newly added functions / variables / variable values[...]

New function / variable / value	New function / Impact of migration	Firmware
	Migration of older mGuard configurations If an HTTPS server certificate is already in use, its use must be deactivated **before migrating the configuration or updating the device.** Command on the command line: `gaiconfig --set HTTPS_SERVER_CERT_REF ""` You can now perform the migration/update again and use the certificate again (if it is valid). If no HTTPS server certificate is used, the following applies: No effect.	

2.2.6 Migration of the device configuration

Migrating the configuration of older mGuard devices can be done via web-based management (WBM) or via SD card (ECS).

Requirements

If device functions of the device whose configuration is to be migrated are not available on the new device, the variables must be reset to the default settings before the configuration on the old device is exported (see Table 2-1).

The exact procedure for device migration is described in document 111259_en_xx (AH EN MGUARD MIGRATE 10), available at phoenixcontact.com/product/1357875.

2.3 Basic properties

The mentioned properties are not guaranteed properties, as they are basically dependent on the respective device.

Unless otherwise stated, when the FL MGUARD 4302 and FL MGUARD 4305 devices are mentioned in this document, the 4302/KX and 4305/KX variants are also included.

Network features

- Stealth mode (Autodetect, Static, Multiple clients), Router mode (Static, DHCP)
- DMZ
- VLAN
- DHCP server/relay on the internal and external network interfaces
- DNS cache on the internal network interface
- Dynamic routing (OSPF)
- Administration via HTTPS and SSH
- LLDP
- MAU management
- SNMP

Firewall features

- Stateful packet inspection
- Anti-spoofing
- IP filter
- L2 filter (only in stealth mode)
- NAT with FTP, and IRC support (only in “Router” network mode)
- 1:1 NAT (only in “Router” network mode)
- Port forwarding (not in “Stealth” network mode)
- Individual firewall rules for different users (user firewall)
- Individual rule records as action (target) of firewall rules (apart from user firewall or VPN firewall)
- Deep Packet Inspection for Modbus TCP
- Protective device for PROFIsafe network cells (in accordance with IEC 61784-3-3).

VPN features (IPsec)

- Protocol: IPsec (tunnel and transport mode, XAuth/Mode Config)
- IPsec encryption with DES (56 bits), 3DES (168 bits), and AES (128, 192, 256 bits)
- Packet authentication: MD5, SHA-1, SHA-256, SHA-384, SHA-512
- Internet Key Exchange (IKEv1) with main and quick mode
- Authentication via:
  - Pre-shared key (PSK)
  - X.509v3 certificates with public key infrastructure (PKI) with certification authority (CA), optional certificate revocation list (CRL), and the option of filtering by subject

  or
  - Remote certificate, e.g., self-signed certificates
- Detection of changing peer IP addresses via DynDNS
- NAT traversal (NAT-T)
- Dead Peer Detection (DPD): detection of IPsec connection aborts
- IPsec/L2TP server: connection of IPsec/L2TP clients
- IPsec firewall and IPsec NAT
- Default route via VPN tunnel

- Data forwarding between VPNs (hub and spoke)
- Up to 250 active VPN tunnels (depending on the device)

VPN features (IPsec IKEv2 beta)

NOTE: In productive environments, IKEv2 connections should only be used after successful testing in the customer application.

Support for the IKEv2 protocol for establishing VPN connections is currently in the beta phase and offers a limited range of functions. In the IKEv2 connections, port 54500 is used to establish the connection, in deviation from the standard. Port 54500 must therefore also be configured on the remote side and must not be blocked by firewall settings.

Currently available range of functions (IKEv2 beta):

- Protocol: IPsec (tunnel mode)
- IPsec encryption: AES
- Packet authentication: SHA2
- Internet Key Exchange (IKEv1 and IKEv2)
- Authentication via
  - Pre-shared key (PSK)
  - X.509v3 certificates with public key infrastructure (PKI) with certification authority (CA), optional certificate revocation list (CRL), and the option of filtering by subject

  or
  - Remote certificate, e.g., self-signed certificates
- Detection of changing peer IP addresses via DynDNS
- Dead Peer Detection (DPD): detection of IPsec connection aborts
- IPsec/L2TP server: connection of IPsec/L2TP clients
- IPsec firewall
- Default route via VPN tunnel
- Data forwarding between VPNs (hub and spoke)
- Up to 10 active VPN tunnels

VPN features (OpenVPN)

- OpenVPN client
- OpenVPN encryption with AES (128, 192, 256 bits) (Block cipher modes: GCM and CBC)
- HMAC authentication: SHA-1, SHA-256, SHA-512
- Dead Peer Detection (DPD)
- Authentication via user identifier, password or X.509v3 certificate
- Detection of changing peer IP addresses via DynDNS
- OpenVPN firewall and 1:1 NAT
- Routes via VPN tunnels can be configured statically and learned dynamically
- Data forwarding between VPNs (hub and spoke)
- Up to 250 VPN tunnels

Additional features

- Remote Logging (Syslog Message Format compliant with RFC 5424 - Ch. 6)
- Administration using SNMP v1-v3 and mGuard device manager (FL MGUARD DM UNLIMITED)
- PKI support for HTTPS/SSH remote access
- Can act as an NTP and DNS server via the LAN interface
- Plug-n-Protect technology

– Compatible with *mGuard Secure Cloud* (mSC)

Support

In the event of problems with your mGuard, please contact your supplier.

For additional information on the device as well as release notes and software updates, visit: phoenixcontact.net/products/<item number>.

2.4 Typical application scenarios

This section describes various application scenarios for the mGuard.

- "Stealth mode (Plug-n-Protect)"
- "Network router"
- "DMZ" (Demilitarized Zone)
- "VPN gateway"
- "WLAN via VPN" tunnel
- "Resolving network conflicts"

2.4.1 Stealth mode (Plug-n-Protect)

In **stealth mode**, the mGuard can be positioned between an individual computer and the rest of the network. The three stealth modes "Automatic", "Static" and "Multiple clients" are available (see Section 5.1.2).

The settings (e.g., for firewall and VPN) can be made using a web browser under the URL https://1.1.1.1/.

No configuration modifications are required on the computer itself.

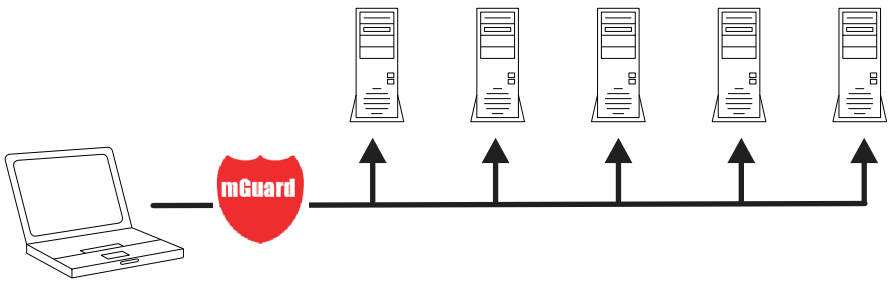


Figure 2-1 Stealth mode (Plug-n-Protect)

2.4.2 Network router

When used as a **network router**, the mGuard can provide the Internet connection for several computers and protect the company network with its firewall.

For computers in the Intranet, the mGuard must be specified as the default gateway.

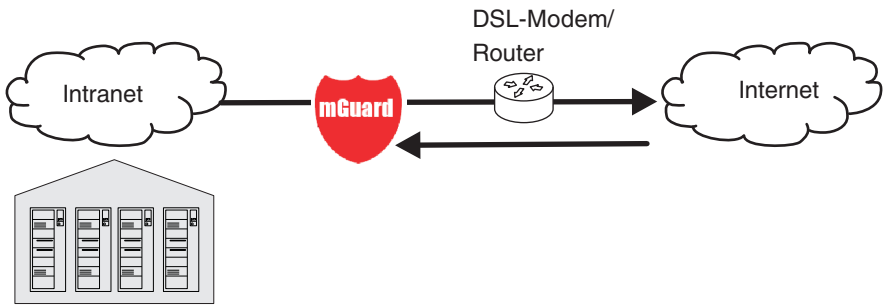


Figure 2-2 Network router

2.4.3 DMZ

A **DMZ** (demilitarized zone) is a protected network that is located between two other networks. For example, a company's website may be in the DMZ so that new pages can only be copied to the server from the Intranet via FTP. However, the pages can be read from the Internet via HTTP.

IP addresses within the DMZ can be public or private, and the mGuard, which is connected to the Internet, forwards the connections to private addresses within the DMZ by means of port forwarding.

A DMZ scenario can be established either between two mGuards (see Figure 2-3) or via a dedicated DMZ port of some mGuard devices, e. g. the FL MGUARD 4305.

The DMZ port is only supported in router mode and requires at least one IP address and a corresponding subnet mask. The DMZ does not support any VLANs.

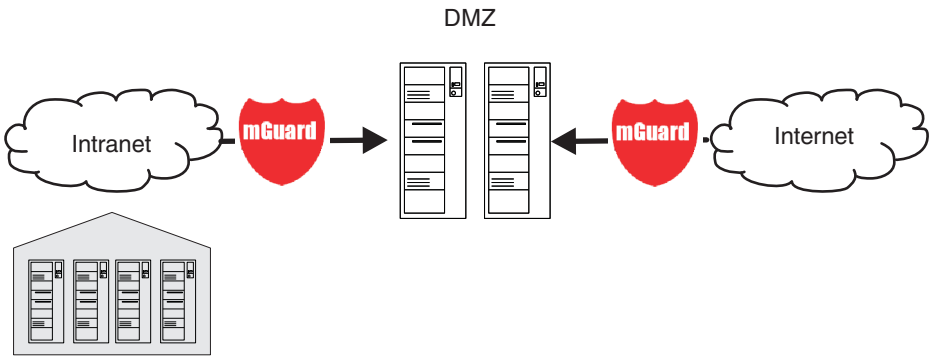


Figure 2-3 DMZ

2.4.4 VPN gateway

The **VPN gateway** provides company employees with encrypted access to the company network from home or when traveling. The mGuard performs the role of the VPN gateway.

IPsec-capable VPN client software must be installed on the external computers or failing that, the computer is equipped with an mGuard.

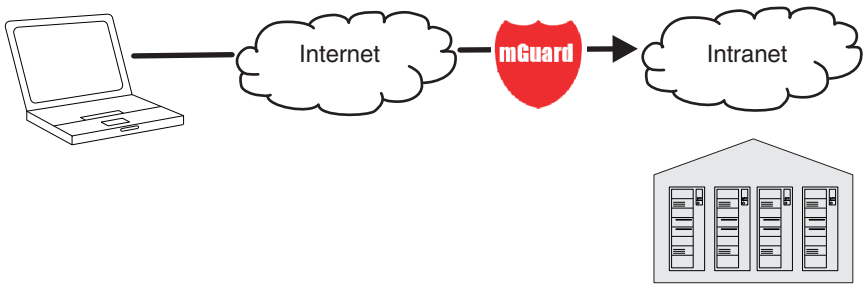


Figure 2-4 VPN gateway

2.4.5 WLAN via VPN

WLAN via VPN is used to connect two company buildings via a WLAN path protected using IPsec. The adjacent building should also be able to use the Internet connection of the main building.

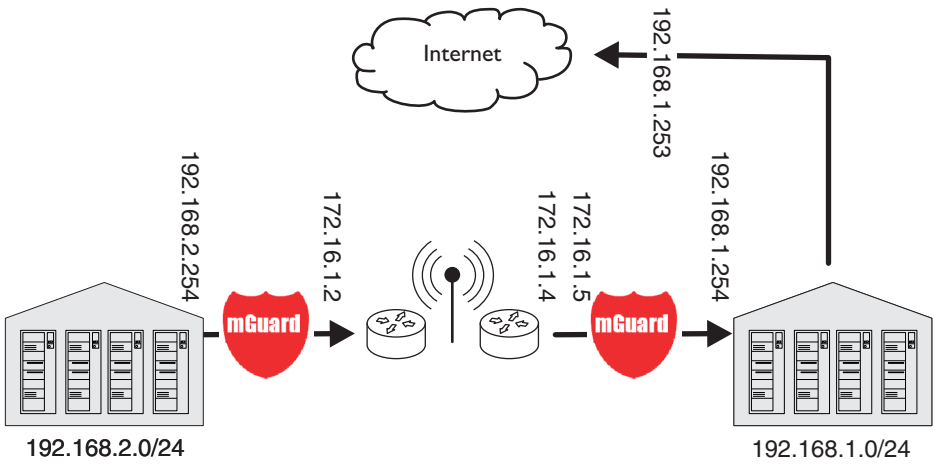


Figure 2-5 WLAN via VPN

In this example, the mGuards were set to *router* mode and a separate network with 172.16.1.x addresses was set up for the WLAN.

To provide the adjacent building with an Internet connection via the VPN, a default route is set up via the VPN:

Tunnel configuration in the adjacent building

Connection type	Tunnel (network <-> network)
Address of the local network	192.168.2.0/24
Address of the remote network	0.0.0.0/0

In the main building, the corresponding counterpart is configured:

Tunnel configuration in the main building

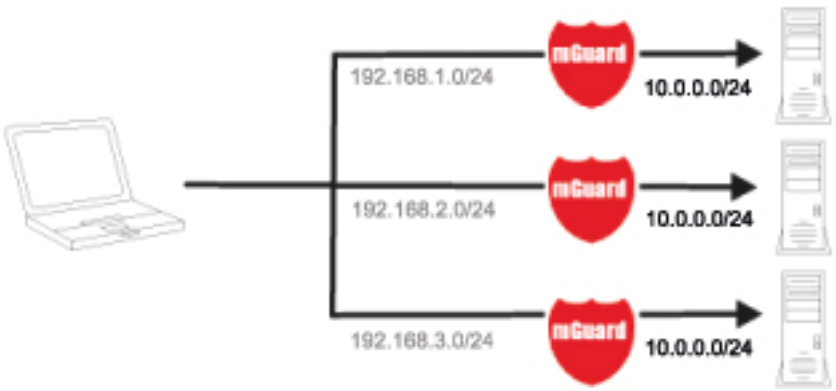
Connection type	Tunnel (network <-> network)
Local network	0.0.0.0
Address of the remote network	192.168.2.0/24

The default route of an mGuard usually uses the WAN port. However, in this case the Internet can be accessed via the LAN port:

Default gateway in the main building:

IP address of the default gateway	192.168.1.253

2.4.6 Resolving network conflicts



Resolving network conflicts

In the example, the networks on the right-hand side should be accessible to the network or computer on the left-hand side. However, for historical or technical reasons the networks on the right-hand side overlap.

The 1:1 NAT feature of the mGuard can be used to translate these networks to other networks, thereby resolving the conflict.

(1:1 NAT can be used in normal routing, in IPsec tunnels, and in OpenVPN connections.)

3 Configuration help

3.1 Secure encryption

The mGuard offers the option to use different encryption and hash algorithms.

Some of the available algorithms are outdated and no longer considered secure. They are therefore not recommended. However, they can still be selected and used for reasons of downward compatibility. In the WBM, outdated algorithms or unsecure settings are marked with an asterisk (*).

In the following areas of the mGuard, the user must ensure that secure encryption and hash algorithms are used:

– IPsec and OpenVPN connections
– Shell Access (SSH) and HTTPS Web Access (TLS/SSL)
– Access to an e-mail server

The secure use of encryption is explained in the following sections.

Further information can be found for example in the technical directive of the Federal office for information security: “BSI TR-02102 Cryptographic procedure: recommendations and key lengths”(last accessed on 2025-09-15).

Using secure encryption and hash algorithms

Phoenix Contact recommends using only the values and settings specified in Table 3-1 when configuring encryption and hash algorithms.

Table 3-1 Secure encrpytion and hash algorithms

Area / Protocol	Encryption	Hash / Checksum	Diffie Hellman / PFS
VPN – IPsec VPN			
IKE SA (Key Exchange)	The values are specified by the mGuard device and cannot be configured. The encryption and hash algorithms available and accepted by the device are described in Section 8.2. These algorithms are recommended by the BSI (BSI TR-02102) and considered secure according to the current state of the art.		
ISAKMP SA (Key Exchange)	AES-256	SHA-256, -384, -512	2048 bits or higher (see also Section 8.2)
IPsec SA (Data Exchange)	AES-256	SHA-256, -384, -512	
Perfect Forward Secrecy (PFS)			2048 bits or higher (see also Section 8.2)
VPN – OpenVPN			
Data Encryption	AES-256-GCM	SHA-256, -512	
E-Mail – SMTP			
Encryption mode for the e-mail server	TSL encryption , TLS encryption with StartTLS		
TLS-based encryption			
Lowest supported TLS version	TLS 1.3, TLS 1.2		

Use of secure SSH clients

Establishing encrypted SSH connections to the mGuard is initiated by the SSH client used.

If the SSH client uses outdated and therefore insecure hash and encryption algorithms, the connection may be rejected by the mGuard. The mGuard only supports a defined selection of secure hash and encryption algorithms.

Always use **Current SSH clients** (e.g. *PuTTY*), to avoid use of weak encryption algorithms.

Use of secure web browsers

Establishing encrypted HTTPS connections (TLS/SSL) to the mGuard is initiated by the web browser used. If the web browser uses outdated and thus insecure encryption algorithms, these are only accepted by the mGuard if they have been configured as the "Lowest supported TLS version“.

Always use **up to date web browsers** or HTTPS clients to avoid use of weak encryption algorithms.

Select the version TLS 1.2 or TLS 1.3 as the "Lowest supported TLS version" on the mGuard device.

Creation of secure X.509 certificates

X.509 certificates are generated using various software tools.

Always use **up to date program versions** of the software tools to avoid use of weak encryption algorithms when creating X.509 certificates.

When creating X.509 certificates, use **key lengths of at least 2048 bits** and secure **hash algorithms** (see also Table 3-1).

Use of X.509 certificates instead of Pre-Shared Keys (PSK)

Pre-shared key (PSK) authentication in VPN connections is considered insecure and should no longer be used. For security reasons, use X.509 certificates for authentication.

Use of Configuration Pull (*pull config*)

Select the version TLS 1.2 or TLS 1.3 as the "Lowest supported TLS version" on the mGuard device.

Use of Automatic Update

Select the version TLS 1.2 or TLS 1.3 as the "Lowest supported TLS version" on the mGuard device.

Use of CRL checking

Select the version TLS 1.2 or TLS 1.3 as the "Lowest supported TLS version" on the mGuard device.

3.2 Suitable web browsers

The device is configured via a graphic user interface in the web browser.

Always use **Current web browsers** to avoid use of weak encryption algorithms.

Current versions of the following web browsers are supported:

– Mozilla Firefox
– Google Chrome
– Microsoft Edge

3.3 Number of concurrent sessions

Concurrent login to the web-based management (WBM) of the device is limited to 10 web sessions (HTTPS). The limit applies to the *root, admin, audit*, *update,* and *netadmin* users. The number of concurrent logins of firewall users is not limited.

If 10 users are already logged in via the HTTPS protocol, i.e. if 10 parallel web sessions have been started, the device rejects the login of further users.

The limitation applies to logins via the HTTPS protocol, regardless of the web client used. This includes both web browsers and command line tools such as *cURL*.

For security reasons and to avoid blocking other users from logging in, users logged in via the HTTPS protocol (web browser, *cURL*, etc.) should always actively end their session after completing their activity and log out of the device.

The number of simultaneous SSH logins (SSH sessions) can be configured (see “Maximum number of concurrent sessions per role” on page 66).

Limitation of login attempts

In the event of a Denial of Service attack, services are intentionally made unable to function. To prevent this type of attack, the mGuard is provided with a throttle for different network requests.

This feature is used to count all the connections going out from one IP address and using a specific protocol. When a certain number of connection attempts is counted, the throttle becomes effective. The throttle is reset if there are no further connection attempts for 30 seconds.

The number of connection attempts that lead to activation of the throttle depends on the protocol used:

– 32 when using HTTPS
– 6 when using SSH, SNMP

3.4 User roles

root	User role without restrictions
admin	Administrator (local configuration changes)
netadmin	Administrator (local configuration changes) for mGuard devices that are generally configured via the mGuard device manager (mdm / FL MGUARD DM UNLIMITED).
update	User role for performing firmware updates
audit	Auditor/tester

The predefined users (*root*, *admin*, *netadmin, update, audit*) have different permissions.

– **Root:** The *root* user has unrestricted access to the mGuard. The number of concurrent HTTPS sessions is limited.
– **Admin:** The *admin* user has unrestricted functional access to the mGuard. The number of concurrent HTTPS sessions is limited. The number of simultaneous SSH sessions can be restricted.
– **Netadmin:** The *netadmin* user only has access to variables that have been assigned the value "local" via the mGuard device manager (mdm / FL MGUAR DM UNLIMITED). It has read-only access to all other variables. Passwords and private keys cannot be read by it.
– Changes to other variables (value not "local") are made in mdm and then uploaded to the device. To avoid conflicts between mdm and the *netadmin* user, a local variable can no longer be managed by the mdm.

  NOTE: Local changes to the configuration on devices that are administered via the mdm may only be made by the *netadmin* user. The *admin* and *root* users should no longer be used for configuration changes.

  Reason: If a user logs in with the role *admin* or *root* and changes one or more variables, all variables marked as "local" are **automatically** changed in such a way that they can no longer be changed by the *netadmin* user.
– **Update:** The update user is only authorized to perform firmware updates.
– **Audit:** The *audit* user only has read access to all functions.

By default, the *audit*, *update*, and *netadmin* user roles can only be activated via the mGuard device manager (FL MGUARD DM UNLIMITED) or the *Generic Administration Interface* (GAI).

3.5 Input help during configuration (system messages)

Modified or invalid entries are highlighted in color in the web interface.

System messages which explain why an entry is invalid, for example, are also displayed.

In order to support this, JavaScript must be enabled in the web browser used.

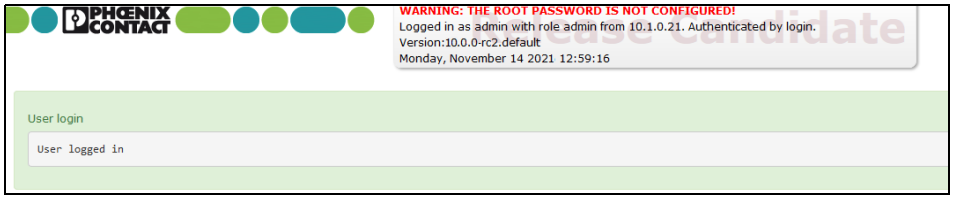


Figure 3-1 Example system message

– **Modified entries** are highlighted in **green** on the relevant page and in the associated menu item until the changes are applied or reset. In the case of tables, it is only indicated that a table row has been modified or removed; the modified value is not indicated.
– **Invalid entries** are highlighted in **red** on the relevant page and tab and in the associated menu item.

The modified or invalid entries remain highlighted even when you close a menu.

When necessary, information relating to the system and alarm messages are displayed at the top of the screen.

3.6 Using the web interface

You can click on the desired configuration via the menu on the left-hand side, e.g., “Management, Licensing”.

The page is then displayed in the main window – usually in the form of one or more tab pages – where settings can be made. If the page is organized into several tab pages, you can switch between them using the *tabs* at the top.

Working with tab pages

– You can make the desired entries on the corresponding tab page (see also “Working with sortable tables” on page 48).
– You can return to the previously accessed page by clicking on the **“Back”** button located at the bottom right of the page, if available.

Modifying values

If you modify the value of a variable on the web interface, the change will not be applied until you click on the **Save** icon. The variable name for the modified variable is then displayed in green.

In order to make it easier to trace the changes, the full menu path for the modified variable is also displayed in green: Menu >> Submenu >> Tab page >> Section >> Variable.

Entry of impermissible values

If you enter an impermissible value (e.g., an impermissible number in an IP address) and click on the **Save** icon, the relevant variable name is displayed in red and an error message is usually displayed.

In order to make it easier to trace the error, the full menu path for the modified variable is also displayed in red: Menu >> Submenu >> Tab page >> Section >> Variable.

Entry of a timeout

A timeout can be entered in three ways:

– In seconds [ss]
– In minutes and seconds [mm:ss]
– In hours, minutes, and seconds [hh:mm:ss]

The three possible values are each separated by a colon. If only one value is entered, it will be interpreted as seconds, two values as minutes and seconds, three values as hours, minutes and seconds. The values for minutes and seconds may be greater than 59. After the values have been applied, they will always be shown as [hh:mm:ss] regardless of the format they were entered in (if you enter 90:120 for example, it will be shown as 1:32:00).

Global icons

The following icons are located at the top of every page:

Logout

To **log out** after configuration access to the mGuard.

If the user does not log out, he/she is logged out automatically if there has been no further activity and the time period specified by the configuration has elapsed. Access can only be restored by logging in again.

Reset

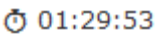
Reset to the original values. If you have entered values on one or more configuration pages and have not yet activated them (by clicking on **Save**), you can reset the modified values to the original values by clicking on **Reset**.

Save

To apply the settings on the device, you must click on **Save**.

Please note that changes made elsewhere (highlighted in green) will also be applied.

Session timeout



Displays the time remaining until the logged in user will be logged out of the web interface. Clicking on the time display resets the timeout time to the configured output value (see “Management >> Web Settings >> General” on page 80).

Online help

Link to the **online help** for the installed firmware version.

The online help can only be accessed when an Internet connection is established and the firewall is set accordingly.

Clicking on the icon opens the corresponding section of the mGuard firmware user manual for the page contents in a new tab/window of the web browser.

The mGuard firmware user manual is also available in a **PDF version** and can be downloaded on the corresponding product pages at phoenixcontact.net/products or help.mguard.com.

Working with sortable tables

Many settings are saved as data records. Accordingly, the adjustable parameters and their values are presented in the form of table rows. If multiple firewall rules are defined, these are queried starting from the top of the list of entries until an appropriate rule is found. Therefore, note the order of the entries, if necessary. The order can be changed by moving table rows up or down.

With tables you can:

– Insert rows to create a new data record with settings (e.g., the firewall settings for a specific connection)
– Move rows (i.e., re-sort them)
– Delete rows to delete the entire data record

Inserting rows

1. Click on the ⊕ **Insert Row** icon in the row below which a new row is to be inserted.
2. A new row is inserted below the selected row.
   The inserted row is displayed in green until the change has been applied.

Moving rows

1. Move the mouse pointer over the row number (seq.) of the row that you wish to move.
   The mouse pointer changes to a cross  .
2. Left-click in the desired row and hold down the mouse button.
   The row is deleted from the existing sequence.
3. With the mouse, move the selected row to the desired position.
   A border around the target row shows where the row will be inserted.
4. Release the mouse button.
5. The row is moved to the position marked with a box.

Deleting rows

1. Click on the 🗑 **Delete Row** icon in the row that you wish to delete.
2. Then click on the 💾 **Save** icon to apply the change.

3.7 CIDR (Classless Inter-Domain Routing)

IP netmasks and CIDR are methods of notation that combine several IP addresses to create a single address area. An area comprising consecutive addresses is handled like a network.

To specify an area of IP addresses for the mGuard, e.g., when configuring the firewall, it may be necessary to specify the address area in CIDR format. In the table below, the left-hand column shows the IP netmask, while the right-hand column shows the corresponding CIDR format.

IP netmask	Binary	CIDR
255.255.255.255	11111111 11111111 11111111 11111111	32
255.255.255.254	11111111 11111111 11111111 11111110	31
255.255.255.252	11111111 11111111 11111111 11111100	30
255.255.255.248	11111111 11111111 11111111 11111000	29
255.255.255.240	11111111 11111111 11111111 11110000	28
255.255.255.224	11111111 11111111 11111111 11100000	27
255.255.255.192	11111111 11111111 11111111 11000000	26
255.255.255.128	11111111 11111111 11111111 10000000	25
255.255.255.0	11111111 11111111 11111111 00000000	24
255.255.254.0	11111111 11111111 11111110 00000000	23
255.255.252.0	11111111 11111111 11111100 00000000	22
255.255.248.0	11111111 11111111 11111000 00000000	21
255.255.240.0	11111111 11111111 11110000 00000000	20
255.255.224.0	11111111 11111111 11100000 00000000	19
255.255.192.0	11111111 11111111 11000000 00000000	18
255.255.128.0	11111111 11111111 10000000 00000000	17
255.255.0.0	11111111 11111111 00000000 00000000	16
255.254.0.0	11111111 11111110 00000000 00000000	15
255.252.0.0	11111111 11111100 00000000 00000000	14
255.248.0.0	11111111 11111000 00000000 00000000	13
255.240.0.0	11111111 11110000 00000000 00000000	12
255.224.0.0	11111111 11100000 00000000 00000000	11
255.192.0.0	11111111 11000000 00000000 00000000	10
255.128.0.0	11111111 10000000 00000000 00000000	9
255.0.0.0	11111111 00000000 00000000 00000000	8
254.0.0.0	11111110 00000000 00000000 00000000	7
252.0.0.0	11111100 00000000 00000000 00000000	6
248.0.0.0	11111000 00000000 00000000 00000000	5
240.0.0.0	11110000 00000000 00000000 00000000	4
224.0.0.0	11100000 00000000 00000000 00000000	3
192.0.0.0	11000000 00000000 00000000 00000000	2
128.0.0.0	10000000 00000000 00000000 00000000	1

Example: 192.168.1.0/255.255.255.0 corresponds to CIDR: 192.168.1.0/24

3.8 Network example diagram

The following diagram shows how IP addresses can be distributed in a local network with subnetworks, which network addresses result from this, and how the details regarding additional internal routes may look for the mGuard.

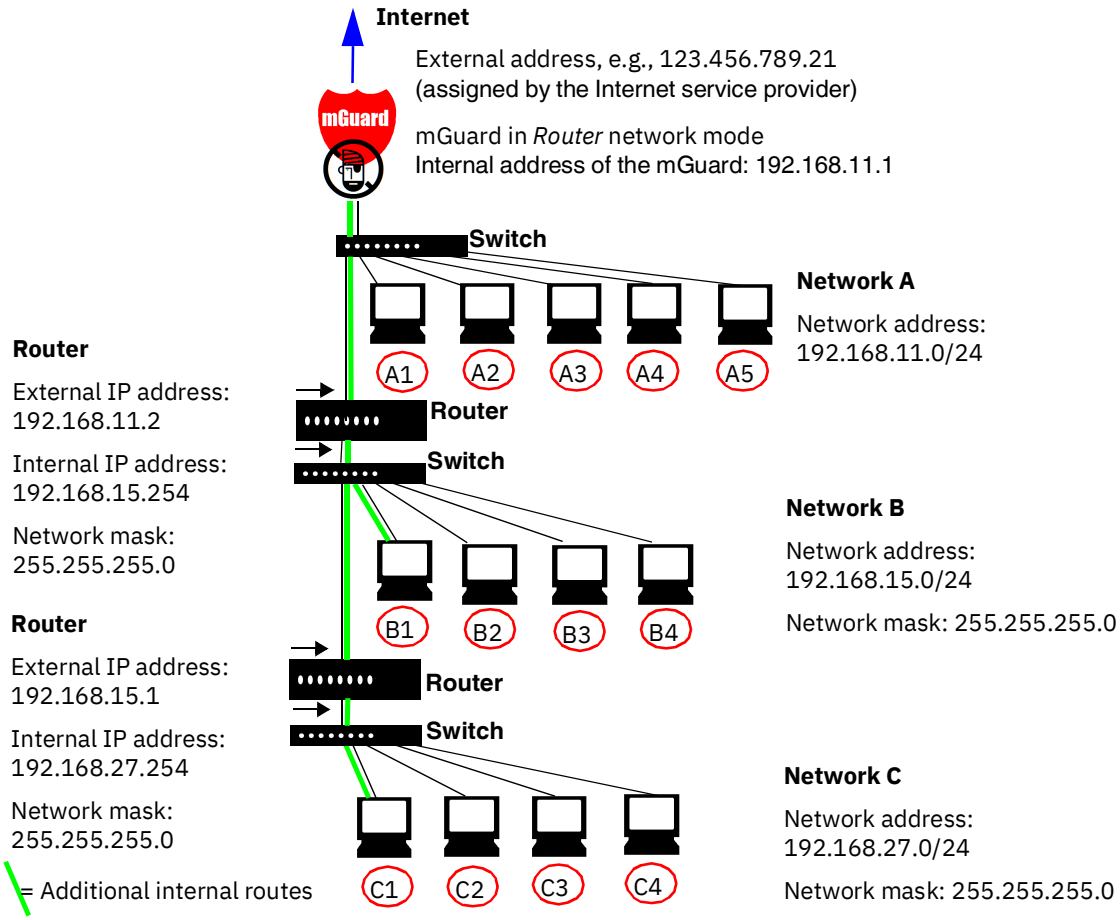


Table 3-2 Network example diagram

Network A	**Computer**	**A1**	**A2**	**A3**	**A4**	**A5**
	IP address	192.168.11.3	**192.168.11.4**	**192.168.11.5**	**192.168.11.6**	**192.168.11.7**
	Network mask	255.255.255.0	**255.255.255.0**	**255.255.255.0**	**255.255.255.0**	**255.255.255.0**

Table 3-2 Network example diagram[...]

Network B	**Computer**	**B1**	**B2**	**B3**	**B4**	**Additional internal routes** Network: 192.168.15.0/24 Gateway: 192.168.11.2 Network: 192.168.27.0/24 Gateway: 192.168.11.2
	IP address	192.168.15.2	**192.168.15.3**	**192.168.15.4**	**192.168.15.5**	
	Network mask	255.255.255.0	**255.255.255.0**	**255.255.255.0**	**255.255.255.0**	
Network C	**Computer**	**C**	**C2**	**C3**	**C4**	
	IP address	192.168.27.1	**192.168.27.2**	**192.168.27.3**	**192.168.27.4**	
	Network mask	255.255.255.0	**255.255.255.0**	**255.255.255.0**	**255.255.255.0**	

3.9 LED status indicator and blinking behavior

With the help of built-in LED diodes, mGuard devices indicate different system states. This can be status, alarm or error messages.

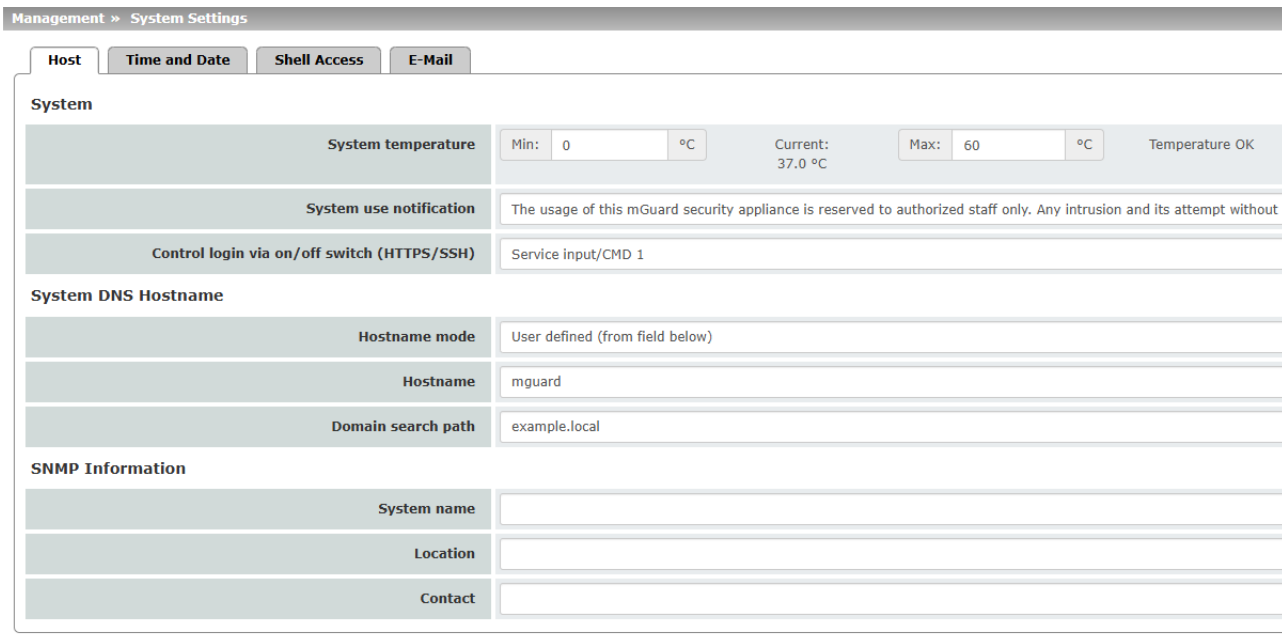
Detailed information on the LEDs can be found in the Appendix (see “LED status indicator and blinking behavior” on page 403).

4 Management menu

For security reasons, we recommend you change the default root and administrator passwords during initial configuration (see “Authentication >> Administrative Users” on page 185). A message informing you of this will continue to be displayed at the top of the page until the passwords are changed.

4.1 Management >> System Settings

4.1.1 Host

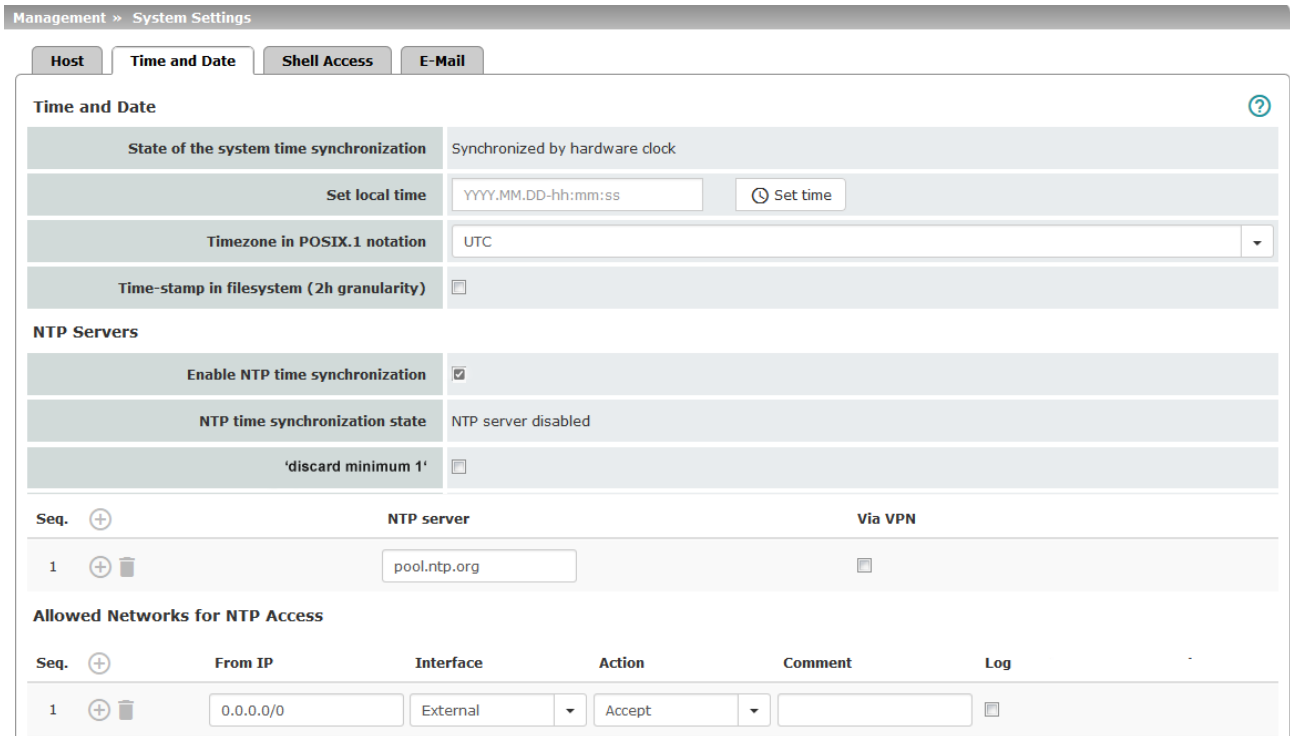


Management >> System Settings >> Host		
System	**Status of the Power supply 1/2**	State of both power supply units (model-dependent with redundant power supply)
	System temperature (°C)	An SNMP trap is triggered if the temperature exceeds or falls below the specified temperature range.

Management >> System Settings >> Host [...]		
	System use notification	Freely selectable text for a system use notification that is displayed before logging on at the mGuard device (maximum 1024 characters). Is displayed for: – Login per SSH login – Login via the web interface (web UI). The (repeated) display of the message can be disabled by the customer using a suitable SSH. **Default setting:** *The usage of this mGuard security appliance is reserved to authorized staff only. Any intrusion and its attempt without permission is illegal and strictly prohibited.*
	Control login via on/off switch (HTTPS/SSH)	**Service input CMD 1-3 (I 1-3)** User login via the HTTPS (WBM) and SSH (command line) interfaces can be activated (permitted) or deactivated (prohibited) via an on/off switch. If a connected switch is deactivated, it is not possible to log in via these interfaces. The login of the following users is not affected by the function and cannot be controlled via an on/off switch: – User "user" – Firewall user – SNMP user via the SNMP interface. **NOTE:** If no switch is connected to an assigned service contact, it is considered deactivated and it is not possible for users to log in. Existing sessions are retained until they are terminated by the user or by a timeout. The switch must be connected to one of the service contacts (I 1-3). "On/off switch" must be selected as the switch type for the service contact and not "Push-button" (see Section 4.8.1).

Management >> System Settings >> Host [...]		
System DNS Hostname	**Hostname mode**	You can assign a name to the mGuard using the *Hostname mode* and *Hostname* fields. This name is then displayed, for example, when logging in via SSH (see “Management >> System Settings” on page 53, “Shell Access” on page 62). Assigning names simplifies the administration of multiple mGuard devices. **User defined (from field below)** (Default) The name entered in the *Hostname* field is the name used for the mGuard. If the mGuard is running in *Stealth* mode, the “User defined” option must be selected under “Hostname mode”. **Provider defined (e.g., via DHCP)** If the selected network mode permits external setting of the host name, e.g., via DHCP, the name supplied by the provider is assigned to the mGuard.
	Hostname	If the “User defined” option is selected under *Hostname mode*, enter the name that should be assigned to the mGuard here.
	Domain search path	This option makes it easier for the user to enter a domain name. If the user enters the domain name in an abbreviated form, the mGuard completes the entry by appending the domain suffix that is defined here under “Domain search path”.
SNMP Information	**System name**	A name that can be freely assigned to the mGuard for administration purposes, e.g., “Hermes”, “Pluto”. (Under SNMP: sysName)
	Location	A description of the installation location that can be freely assigned, e.g., “Hall IV, Corridor 3”, “Control cabinet”. (Under SNMP: sysLocation)
	Contact	The name of the contact person responsible for the mGuard, ideally including the phone number. (Under SNMP: sysContact)

4.1.2 Time and Date



Set the time and date correctly. Otherwise, certain time-dependent activities cannot be started by the mGuard (see “Time-controlled activities” on page 57).

Management >> System Settings >> Time and Date

Time and Date

You can set the mGuard system time manually and assign the appropriate time zone or synchronize the system time using the NTP server of your choice.

Set the time and date correctly. Otherwise, certain time-dependent activities cannot be started by the mGuard (see “Time-controlled activities” on page 57).

Connected devices can use the mGuard as an NTP server.

Please note, that for security reasons the NTP version *NTP v1* is not supported by the mGuard.

Management >> System Settings >> Time and Date [...]

State of the system time

Indicates whether the mGuard system time has ever been synchronized with a valid time during mGuard runtime.

If the display indicates that the mGuard system time has not been synchronized, the mGuard does not perform any time-controlled activities.

Devices without built-in clock always start in “Not synchronized” mode. Devices with a built-in clock usually start in “Synchronized by hardware clock” mode.

The state of the clock only returns to “Not synchronized” if the firmware is reinstalled on the device or if the built-in clock has been disconnected from the power for too long.

Power supply of the built-in clock is ensured by the following components. The rechargeable battery lasts at least five days.

Time-controlled activities

– **Time-controlled pick-up of configuration from a configuration server:**
  This is the case when the *Time schedule* setting is selected under the *“Management >> Central Management”*, *Configuration Pull* menu item for the **Pull schedule** setting (see “Management >> Configuration Profiles” on page 101, “Configuration Pull” on page 121).
– **Acceptance of certificates when the system time has not yet been synchronized:**
  This is the case when the *Wait for synchronization of the system time* setting is selected under the “Authentication >> Certificates”,“Certificate Settings” menu item for the **Check the validity period of certificates and CRLs** option (see “Authentication >> Certificates” and“Certificate Settings” on page 202).

The system time can be set or synchronized by various events:

– **Synchronized by hardware clock**: the mGuard has a built-in clock which has been synchronized with the current time at least once. The display shows whether the clock is synchronized. A synchronized built-in clock ensures that the mGuard has a synchronized system time even after a restart.
– **Synchronized manually**: the administrator has defined the current time for the mGuard runtime by making a corresponding entry in the **“Set local time”** field.
– **Synchronized by file system time-stamp**: the administrator has set the **“Time-stamp in filesystem”** setting to *Yes*, and has either transmitted the current system time to the mGuard via NTP (see below under *NTP Servers*) or has entered it under **“Set local time”**. The system time of the mGuard is then synchronized using the time stamp after a restart (even if it has no built-in clock). The time might be set exactly again afterwards via NTP.
– **Synchronized by Network Time Protocol NTP**: the administrator has activated NTP time synchronization under **“NTP Servers”**, has entered the address of at least one NTP server, and the mGuard has established a connection with at least one of the specified NTP servers. If the network is working correctly, this occurs a few seconds after a restart. The display in the **“NTP time synchronization state”** field may only change to “Synchronized” much later (see the explanation below under **“NTP time synchronization state”**).

Management >> System Settings >> Time and Date [...]		
	Set local time	Here you can set the time for the mGuard, if no NTP server has been set up or the NTP server cannot be reached. The date and time are specified in the format YYYY.MM.DD-HH:MM:SS: YYYY Year MM Month DD Day HH Hour MM Minute SS Second
	Timezone in POSIX.1 notation	If a current local time (that differs from Greenwich Mean Time) is to be displayed as the *current system time*, you must enter the number of hours that your local time is ahead of or behind Greenwich Mean Time. You can select your location from the drop-down list (daylight savings time is usually automatically taken into consideration). Alternatively, you can set it manually as follows: **Example**: in Berlin, the time is one hour ahead of GMT. Therefore, enter: CET-1. In New York, the time is five hours behind Greenwich Mean Time. Therefore, enter: CET+5. The only important thing is the -1, -2 or +1, etc. value as only these values are evaluated – not the preceding letters. They can be “CET” or any other designation, such as “UTC”. If you wish to display Central European Time (e.g., for Germany) and have it automatically switch to/from daylight savings time, enter: CET-1CEST,M3.5.0,M10.5.0/3
	Time-stamp in filesystem	If this function is activated, the mGuard writes the current system time to its memory every two hours. If the mGuard is switched off and then on again, a time from this two-hour time slot is displayed, not a time on January 1, 2000.
NTP Servers	The mGuard can act as the NTP server for external computers (NTP = Network Time Protocol). In this case, the computers should be configured so that the address of the mGuard is specified as the NTP server address. By default, the NTP server of the mGuard device is disabled. After starting the NTP server, access is possible via the internal interface (LAN interface). Firewall rules can be used to enable or restrict access via all available interfaces. If the mGuard is operated in *Stealth* mode, the management IP address of the mGuard (if this is configured) must be used for the computers, or the IP address 1.1.1.1 must be entered as the local address of the mGuard. For the mGuard to act as the NTP server, it must obtain the current date and the current time from an NTP server (= time server). To do this, the address of at least one NTP server must be specified. This feature must also be activated.	

Management >> System Settings >> Time and Date [...]		
	Enable NTP time synchronization	If this function is activated, the mGuard obtains the date and time from one or more time server(s) and synchronizes itself with it or them. Initial time synchronization can take up to 15 minutes. During this time, the mGuard continuously compares the time data of the external time server and that of its own time so that this can be adjusted as accurately as possible. Only then can the mGuard act as the NTP server for the computers connected to its LAN interface and provide them with the system time. After initial time synchronization, the mGuard regularly compares the battery buffered system time with the time servers. Fine adjustment of the time is usually only made in the second range.
	NTP time synchronization state	Displays the current NTP status. Shows whether the NTP server running on the mGuard has been synchronized with the configured NTP servers to a sufficient degree of accuracy. If the system clock of the mGuard has never been synchronized prior to activation of NTP time synchronization, then synchronization can take up to 15 minutes. The NTP server still changes the mGuard system clock to the current time after a few seconds, as soon as it has successfully contacted one of the configured NTP servers. The system time of the mGuard is then regarded as synchronized. Fine adjustment of the time is usually only made in the second range.
	‘discard minimum 1‘	Enabling this option can improve time synchronization with some NTP clients, especially PLC systems. Additionally, the refresh interval on the PLC system should be increased to the maximum possible value (e.g. 86400 seconds).
	NTP server	Enter one or more time servers from which the mGuard should obtain the current time. If several time servers are specified, the mGuard will automatically connect to all of them to determine the current time.

Management >> System Settings >> Time and Date [...]

Via VPN

The NTP server's request is – **where possible** – carried out via a VPN tunnel (IPsec VPN or OpenVPN).

Prerequisite: A suitable VPN tunnel is available.

If no suitable VPN tunnel is available, traffic is always sent **unencrypted via the default gateway**.

A suitable VPN tunnel is available if the remote peer belongs to the remote network of a configured VPN tunnel and the mGuard has an internal IP address that belongs to the local network of the same VPN tunnel.

Please note:

For IPsec VPN connections, the "Via VPN" function must be activated so that the traffic is routed through a suitable IPsec VPN tunnel.

For OpenVPN connections, traffic is usually routed via a suitable OpenVPN tunnel even if the function is deactivated.

Allowed Networks for NTP access

(when "Enable NTP time synchronization" function is activated)

When the **Enable NTP time synchronization** function is activated, external devices can access the NTP server of the mGuard. By default, it can only be accessed via the internal interface (LAN interface).

NOTE: The device may be accessible via external networks.
Depending on the settings, the services of the device may be accessible via external networks or the internet. Make sure that access is only possible if it is desired. Otherwise, configure your network accordingly to prevent such access.

If no rules are set or if no rule applies, the following default settings apply:

– NTP access via *Internal* is permitted.
– NTP access via *External*, *DMZ* and *VPN* is denied.

Specify the monitoring options according to your requirements.

NOTE: If you want to deny access via *Internal*, you must implement this explicitly by means of corresponding firewall rules, for example, by specifying *Drop* as the action.

The table lists the firewall rules that have been set up. These apply for incoming data packets of an NTP access attempt. If multiple firewall rules are defined, these are queried starting from the top of the list of entries until an appropriate rule is found. This rule is then applied. If the list of rules contains further subsequent rules that could also apply, these rules are ignored.

Management >> System Settings >> Time and Date [...]

From IP

Enter the address of the computer or network from which access is permitted or forbidden in this field.

The following options are available:

– An IP address.
– To specify an address area, use CIDR format (see "CIDR (Classless Inter-Domain Routing)" on page 49).
– **0.0.0.0/0** means all addresses.

Interface

Internal / External / DMZ / VPN

Specifies to which interface the rule should apply.

If no rules are set or if no rule applies, the following default settings apply:

– NTP access via *Internal* is permitted.
– NTP access via *External*, *DMZ* and *VPN* is denied.

Specify the monitoring options according to your requirements.

NOTE: If you want to deny access via *Internal*, you must implement this explicitly by means of corresponding firewall rules, for example, by specifying *Drop* as the action.

Action

Accept means that the data packets may pass through.

Reject means that the data packets are sent back and the sender is informed of their rejection. (In *Stealth* mode, *Reject* has the same effect as *Drop*.)

Drop means that the data packets are not permitted to pass through. They are discarded, which means that the sender is not informed of their whereabouts.

Comment

Freely selectable comment for this rule.

Log

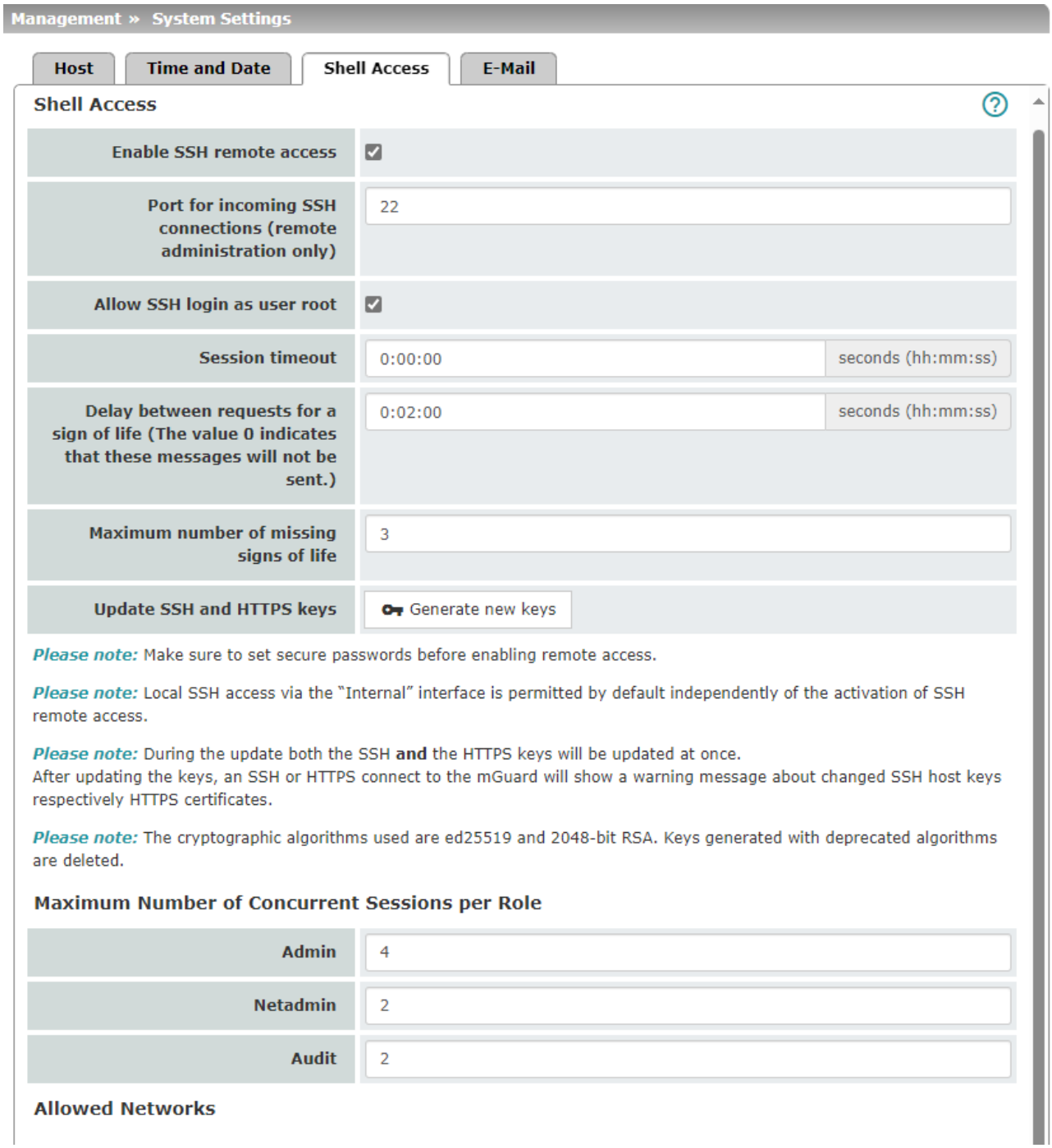
For each individual firewall rule, you can specify whether the use of the rule:

– Should be logged – activate *Log* function
– Should not be logged – deactivate *Log* function (default)

Log message (example):

2024-11-25_10:09:51.83909 firewall: fw-ntp-access-1-12e7d62f-6be7-1c6e-b8a6-000cbe00105c act=REJECT IN=eth0 MAC=d4:aa:62:b2:6d:62 SRC=192.168.1.55 DST=192.168.1.55 LEN=52 TOS=0x00 PREC=0x00 TTL=128 ID=47714 DF PROTO=TCP SPT=53379 DPT=22 SEQ=506303301 ACK=0 WINDOW=64240 SYN URGP=0 CTMARK=100030

4.1.3 Shell Access



The mGuard must not be simultaneously configured via web access, shell access or SNMP. Simultaneous configuration via the different access methods might lead to unexpected results.

Management >> System Settings >> Shell Access

Shell Access

You can configure the mGuard via the web interface or via the command line (shell). Access to the command line is via SSH.

Always use **Current SSH clients** (e.g. *PuTTY*), to avoid use of weak encryption algorithms.

If you need to make changes to the authentication procedure, you should subsequently restart the mGuard, in order to safely end existing sessions with no longer valid certifications or passwords.

When **SSH remote access** is activated, the mGuard can be configured **from remote computers** using the command line. **SSH remote access** is deactivated by default. It can be activated and restricted to selected networks.

NOTE: The device may be accessible via external networks.
Depending on the settings, the services of the device may be accessible via external networks or the internet. Make sure that access is only possible if it is desired. Otherwise, configure your network accordingly to prevent such access.

NOTE: Local SSH access via the interface *Internal* is permitted by default independently of the activation of SSH remote access.

In order to specify differentiated access options on the mGuard, the firewall rules must be defined accordingly (see “Allowed Networks” on page 67).

NOTE: If remote access is enabled, make sure that secure passwords are defined for *root* and *admin* users.

If you need to make changes to the password for *root* or *admin*, you should subsequently restart the mGuard, in order to safely end existing sessions with no longer valid certifications or passwords.

NOTE: If the “Control login via on/off switch (HTTPS/SSH)” function is used and the on/off switch is deactivated, it is no longer possible to log in via SSH (locally and via RADIUS server).

The login of the following users is not affected by this function and cannot be controlled via an on/off switch:

- User "user"
- Firewall user
- SNMP user via the SNMP interface.

Management >> System Settings >> Shell Access [...]

Enable SSH remote access

Activate the function to enable SSH remote access.

SSH access via the interface *Internal* (i.e., from the directly connected LAN or from the directly connected computer) is possible regardless of whether the function is enabled.

Following activation of the remote access, access is possible via the interfaces *Internal* and *VPN*.

The firewall rules for the available interfaces must be defined accordingly in order to specify differentiated access options on the mGuard (see "Allowed Networks" on page 67).

Enable SSH access as user root

Standard: enabled

If the function is activated, the user "*root*" can log onto the device via SSH access.

Port for incoming SSH connections (remote administration only)

(Only if SSH remote access is activated)

Default: 22

If this port number is changed, the new port number only applies for access via the *External, DMZ,* and *VPN* interface.

In Stealth mode, incoming traffic on the port specified is no longer forwarded to the client.

In Router mode with NAT or port forwarding, the port number set here has priority over the rules for port forwarding.

Port number 22 still applies for internal access.

The remote peer that implements remote access may have to specify the port number defined here during login.

Example:

If this mGuard can be accessed over the Internet via address 123.124.125.21 and default port number 22 has been specified for remote access, you may not need to enter this port number in the SSH client (e.g., *PuTTY* or OpenSSH) of the remote peer.

If a different port number has been set (e.g., 2222), this must be specified, e.g.: ssh -p 2222 123.124.125.21

Management >> System Settings >> Shell Access [...]		
	Session timeout	Specifies after what period of inactivity (in hh:mm:ss) the session is automatically terminated, i.e., automatic logout. When set to 0 (default setting), the session is not terminated automatically. The effect of the “Session timeout” setting is temporarily suspended if the processing of a shell command exceeds the number of seconds set. In contrast, the connection can also be aborted if it is no longer able to function correctly, see “Delay between requests for a sign of life” on page 65.
	Delay between requests for a sign of life	**Default: 120 seconds (00:02:00)** Values from 0 seconds to 1 hour can be set. Positive values indicate that the mGuard is sending a request to the peer within the encrypted SSH connection to find out whether it can still be accessed. This request is sent if no activity was detected from the peer for the specified number of seconds (e.g., due to network traffic within the encrypted connection). The value 0 means that no requests for a sign of life are sent. The value entered here relates to the functionality of the encrypted SSH connection. As long as it is working properly, the SSH connection is not terminated by the mGuard as a result of this setting, even when the user does not perform any actions during this time. As the number of concurrent sessions is limited, it is important to end expired sessions (see “Maximum number of concurrent sessions per role” on page 66). As the number of simultaneously open sessions is limited (see *“Maximum number of concurrent sessions per role” on page 66*), it is important to terminate sessions that have expired. Therefore, the request for a sign of life is preset to 120 seconds. If a maximum of three requests for a sign of life are issued, this causes an expired session to be detected and removed after six minutes. In previous versions, the preset was “0”. If it is important not to generate additional traffic, you can adjust the value. When “0” is set in combination with *Concurrent Session Limits*, subsequent access may be blocked if too many sessions are interrupted but not closed as a result of network errors. The entry can be in seconds [ss], minutes and seconds [mm:ss] or hours, minutes, and seconds [hh:mm:ss].

Management >> System Settings >> Shell Access [...]		
	Maximum number of missing signs of life	Specifies the maximum number of times a sign of life request to the peer may remain unanswered. For example, if a sign of life request should be made every 15 seconds and this value is set to 3, the SSH connection is deleted if a sign of life is still not detected after approximately 45 seconds.
	Update SSH and HTTPS keys	**Generate new keys** Keys created with an older firmware version (especially < 10.5) may be weak and should be renewed. • Click on this button to generate a new key. • Note the fingerprints of the new keys generated. • Log in via HTTPS and compare the certificate information provided by the web browser. The generated keys will no not be regenerated when updating to a new firmware version, but are retained. As of firmware version 10.6.0, the ECDSA NISTP 521 encryption algorithm is used to generate SSH keys.
Maximum number of concurrent sessions per role	You can limit the number of users (SSH sessions) who may access the mGuard command line simultaneously. The "*root*" user always has unrestricted access. The number of access instances (SSH sessions) for administrative user roles (*admin, netadmin, update, audit*) can be limited individually. The *netadmin* and *audit* authorization levels relate to access rights with the mGuard device manager (FL MGUARD DM UNLIMITED). The restriction does not affect existing sessions; it only affects newly established access instances. Approximately 0.5 MB of memory are required for each session.	
	Admin	2 to 10 (default: 4) At least two simultaneously permitted sessions are required for the "*admin*" role to prevent it from having its access blocked.
	Netadmin	0 to 10 (default: 2) When "0" is set, no session is permitted. The "*netadmin*" user is not necessarily used.
	Audit	0 to 10 (default: 2) When "0" is set, no session is permitted. The "*audit*" user is not necessarily used.
	Update	0 to 10 (default: 2) When "0" is set, no session is permitted. The "*update*" user is not necessarily used.

Management >> System Settings >> Shell Access [...]

Allowed Networks

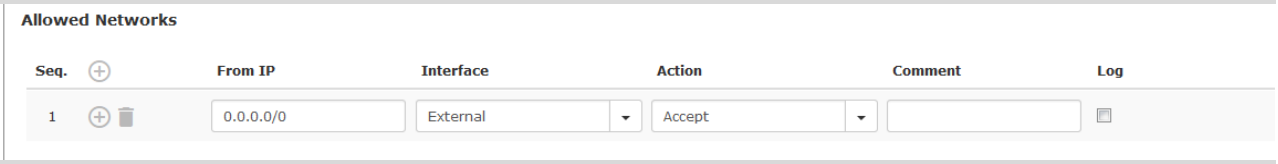
SSH access to the mGuard command line can be restricted to selected interfaces and networks by means of firewall rules.

The rules apply for incoming data packets and can be configured for all interfaces depending on the device.

1. The following applies to SSH remote access (*External* and *DMZ*):
   a) Access via the interfaces *External* and *DMZ* is always disabled if the **Enable SSH remote access** function is disabled.
   b) Access via the interfaces *External* and *DMZ* is also disabled if there is no firewall rule that explicitly allows access (Action = Accept).
   c) To allow access, you must both enable the **Enable SSH remote access** feature and configure a corresponding firewall rule for the interfaces *External* and *DMZ* (Action = Accept).
2. The following applies differently for the access via the LAN interface (*Internal*) and the VPN interface (*VPN*):
   a) Access via the interface *Internal* (LAN) is always allowed if it is not forbidden by an explicit firewall rule in this table (Action = Drop or Reject).
   a) Access via the interface *VPN* is allowed if the **Enable SSH remote access** function is enabled and if it is not forbidden by an explicit firewall rule in this table (Action = Drop or Reject).

If multiple firewall rules are defined, these are queried starting from the top of the list of entries until an appropriate rule is found. This rule is then applied. If the list of rules contains further subsequent rules that could also apply, these rules are ignored.

The following options are available:



From IP

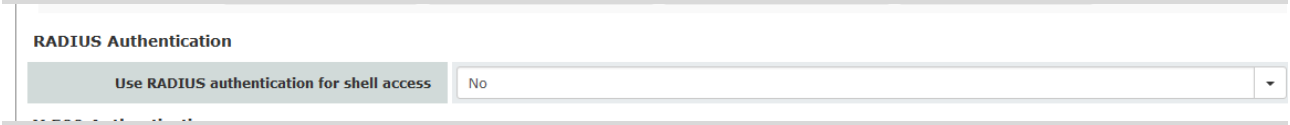
Enter the address of the computer or network from which access is permitted or forbidden in this field.

The following options are available:

IP address: **0.0.0.0/0** means all addresses. To specify an address area, use CIDR format, see "CIDR (Classless Inter-Domain Routing)" on page 49.

Management >> System Settings >> Shell Access [...]

	Interface	**Internal / External / DMZ / VPN** Specifies to which interface the rule should apply. If no rules are set or if no rule applies, the following default settings apply: – SSH access via *Internal* and *VPN* is permitted. – SSH access via *External* and *DMZ* is denied. Specify the access options according to your requirements. **NOTE:** If you want to deny access via *Internal* or *VPN*, you must implement this explicitly by means of corresponding firewall rules, for example, by specifying *Drop* as the action. **To prevent your own access being blocked**, you may have to permit access simultaneously via another interface explicitly with *Accept* before clicking on the **Save** button to activate the new setting. Otherwise, if your access is blocked, you must carry out the recovery procedure.
	Action	Options: – **Accept** means that the data packets may pass through. – **Reject** means that the data packets are sent back and the sender is informed of their rejection. (In *Stealth* mode, *Reject* has the same effect as *Drop*.) – **Drop** means that the data packets are not permitted to pass through. They are discarded, which means that the sender is not informed of their whereabouts.
	Comment	Freely selectable comment for this rule.
	Log	For each individual firewall rule, you can specify whether the use of the rule: – Should be logged – activate *Log* function – Should not be logged – deactivate *Log* function (default) Log message (example): 2024-11-25_10:09:51.83909 firewall: fw-ssh-access-1-12e7d62f-6be7-1c6e-b8a6-000cbe00105c act=REJECT IN=eth0 MAC=d4:aa:62:b2:6d:62 SRC=192.168.1.55 DST=192.168.1.55 LEN=52 TOS=0x00 PREC=0x00 TTL=128 ID=47714 DF PROTO=TCP SPT=53379 DPT=22 SEQ=506303301 ACK=0 WINDOW=64240 SYN URGP=0 CTMARK=100030
RADIUS authentication	Users can be authenticated via a RADIUS server when they log in. This also applies for users who want to access the mGuard via shell access using SSH. The password is checked locally in the case of predefined users *(root, admin, netadmin, update* and *audit*).	



Management >> System Settings >> Shell Access [...]

Use RADIUS authentication for shell access

If set to **No**, the passwords of users who log in via shell access are checked via the local database on the mGuard.

Select **Yes** for users to be authenticated via a RADIUS server. This also applies for users who want to access the mGuard via shell access using SSH. The password is only checked locally in the case of predefined users *(root, admin, netadmin, update, audit*).

The *netadmin* and *audit* authorization levels relate to access rights with the mGuard device manager (FL MGUARD DM UNLIMITED).

Under **"X.509 Authentication"**, if you set **"Enable X.509 certificates for SSH access"** to **Yes**, the X.509 authentication method can be used as an alternative. Which method is actually used by the user depends on how the user uses the SSH client.

If you need to make changes to the authentication procedure, you should subsequently restart the mGuard, in order to safely end existing sessions with no longer valid certifications or passwords.

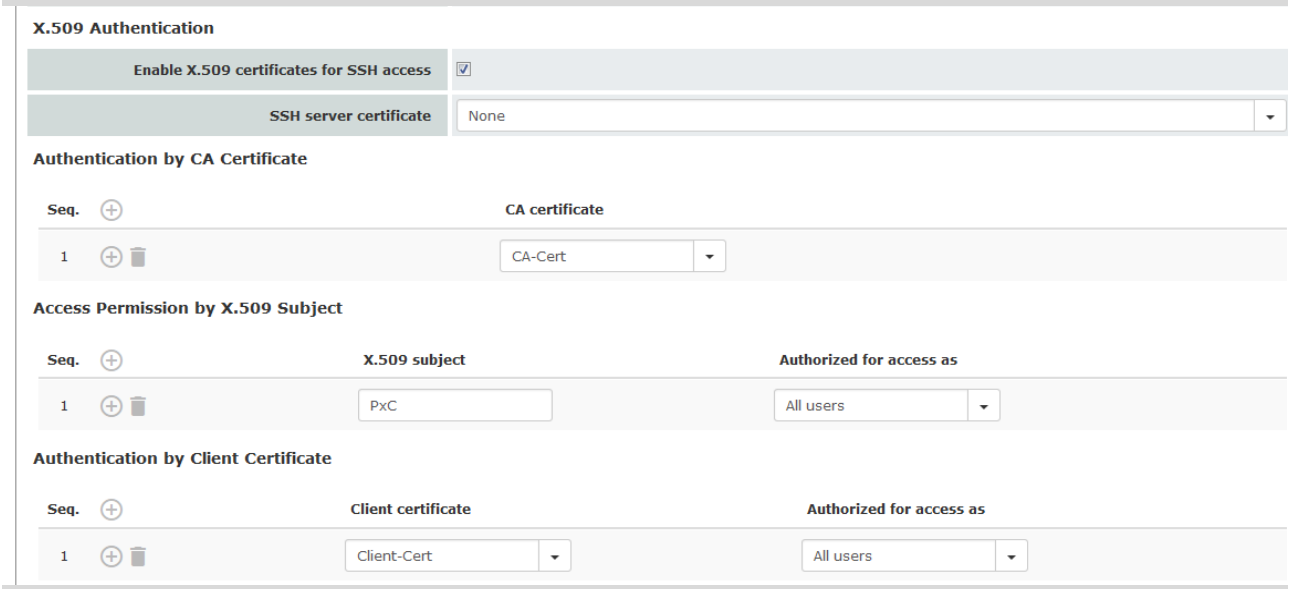
When setting up RADIUS authentication for the first time, select **Yes**.

You should only select **As only method for password authentication** if you are an experienced user, as doing so could result in all access to the mGuard being blocked.

If you do intend to use the **As only method for password authentication** option when setting up RADIUS authentication, we recommend that you create a "Customized Default Profile" which resets the authentication method.

The predefined users *(root, admin, netadmin, update,* and *audit)* are then no longer able to log into the mGuard via SSH.

Management >> System Settings >> Shell Access	
X.509 Authentication	**X.509 certificates for SSH clients** The mGuard supports the authentication of SSH clients using X.509 certificates. It is sufficient to configure CA certificates that are required for the establishment and validity check of a certificate chain. This certificate chain must exist between the CA certificate on the mGuard and the X.509 certificate shown to the SSH client (see "Shell Access" on page 62). If the validity period of the client certificate is checked by the mGuard (see "Certificate Settings" on page 202), new CA certificates must be configured on the mGuard at some point. This must take place before the SSH clients use their new client certificates. If CRL checking is activated (under "Authentication >> Certificates >> Certificate Settings"), one URL (where the corresponding CRL is available) must be maintained for each CA certificate. The URL and CRL must be published before the mGuard uses the CA certificates in order to confirm the validity of the certificates shown by the VPN partners. If you need to make changes to the authentication procedure, you should subsequently restart the mGuard, in order to safely end existing sessions with no longer valid certifications or passwords.



Management >> System Settings >> Shell Access [...]	
Enable X.509 certificates for SSH access	**If the function is deactivated**, then only conventional authentication methods (user name and password or private and public keys) are permitted, not the X.509 authentication method. **If the function is activated**, then the X.509 authentication method can be used in addition to conventional authentication methods (as also used when the function is deactivated). If the function is activated, the following must be specified: – How the mGuard authenticates itself to the SSH client according to X.509, see **SSH server certificate (1)** – How the mGuard authenticates the remote SSH client according to X.509, see **SSH server certificate (2)**
SSH server certificate (1)	**Specifies how the mGuard identifies itself to the SSH client.** Select one of the machine certificates from the selection list or the *None* entry. **None** When *None* is selected, the SSH server of the mGuard does not authenticate itself to the SSH client via the X.509 certificate. Instead, it uses a server key and thus behaves in the same way as older versions of the mGuard. If one of the machine certificates is selected, this is also offered to the SSH client. The client can then decide whether to use the conventional authentication method or the method according to X.509. The selection list contains the machine certificates that have been loaded on the mGuard under the *"Authentication >> Certificates"* menu item (see *page 197*).
SSH server certificate (2)	**Specifies how the mGuard authenticates the SSH client** The following definition relates to how the mGuard verifies the authenticity of the SSH client. The table below shows which certificates must be provided for the mGuard to authenticate the SSH client if the SSH client shows one of the following certificate types when a connection is established: – A certificate signed by a CA – A self-signed certificate For additional information about the table, see Section *"Authentication >> Certificates"* .

Authentication for SSH

The peer shows the following:	Certificate (specific to individual), **signed by CA**	Certificate (specific to individual), **self-signed**
The mGuard authenticates the peer using:		
	All CA certificates that form the chain to the root CA certificate together with the certificate shown by the peer PLUS (if required) Client certificates (remote certificates), **if** used as a filter	Client certificate (remote certificate)

According to this table, the certificates that must be provided are the ones the mGuard uses to authenticate the relevant SSH client.

The following instructions assume that the certificates have already been correctly installed on the mGuard (see *"Authentication >> Certificates"*).

If the use of revocation lists (CRL checking) is activated under the *"Authentication >> Certificates"*, *Certificate Settings* menu item, each certificate signed by a CA that is "shown" by SSH clients is checked for revocations.

Management >> System Settings >> Shell Access

Authentication by CA Certificate

This configuration is only necessary if the SSH client shows a certificate signed by a CA.

All CA certificates required by the mGuard to form the chain to the relevant root CA certificate with the certificates shown by the SSH client must be configured.

The selection list contains the CA certificates that have been loaded on the mGuard under the *"Authentication >> Certificates"* menu item.

If you need to make changes to the authentication procedure, you should subsequently restart the mGuard, in order to safely end existing sessions with no longer valid certifications or passwords.

Management >> System Settings >> Shell Access [...]

Access Permission by X.509 Subject

Enables a filter to be set in relation to the contents of the *Subject* field in the certificate shown by the SSH client. It is then possible to restrict or enable access for SSH clients, which the mGuard would accept in principle based on certificate checks:

– Restricted access to certain *subjects* (i.e., individuals) and/or to *subjects* that have certain attributes or
– Access enabled for all subjects (see glossary under *"Subject, certificate" on page 395*)

The *X.509 subject* field must not be empty.

Access enabled for all subjects (i.e., individuals):

An * (asterisk) in the *X.509 subject* field can be used to specify that all subject entries in the certificate shown by the SSH client are permitted. It is then no longer necessary to identify or define the subject in the certificate.

Restricted access to certain subjects (i.e., individuals) or to subjects that have certain attributes:

In the certificate, the certificate owner is specified in the *Subject* field. The entry is comprised of several attributes. These attributes are either expressed as an object identifier (e.g., 132.3.7.32.1) or, more commonly, as an abbreviation with a corresponding value.

Example: CN=John Smith, O=Smith and Co., C=US

If certain subject attributes have very specific values for the acceptance of the SSH client by the mGuard, then these must be specified accordingly. The values of the other freely selectable attributes are entered using the ***** (asterisk) wildcard.

Example: CN=*, O=*, C=US (with or without spaces between attributes)

In this example, the attribute "C=US" must be entered in the certificate under "Subject". It is only then that the mGuard would accept the certificate owner (subject) as a communication partner. The other attributes in the certificates to be filtered can have any value.

If a subject filter is set, the number (but not the order) of the specified attributes must correspond to that of the certificates for which the filter is to be used.
Please note that the filter is case-sensitive.

Several filters can be set and their sequence is irrelevant.

Management >> System Settings >> Shell Access [...]

Authorized for access as

All users / root / admin / netadmin / update / audit

Additional filter which specifies that the SSH client has to be authorized for a specific administration level in order to gain access.

When establishing a connection, the SSH client shows its certificate and also specifies the system user for which the SSH session is to be opened (*root, admin, netadmin, update, audit*). Access is only granted if the entries match those defined here.

Access for all listed system users is possible when *All users* is set.

The *netadmin* and *audit* setting options relate to access rights with the mGuard device manager (FL MGUARD DM UNLIMITED).

Authentication by Client Certificate

Configuration is required in the following cases:

– SSH clients each show a self-signed certificate.

– SSH clients each show a certificate signed by a CA. Filtering should take place: access is only granted to a user whose certificate copy is installed on the mGuard as the remote certificate and is provided to the mGuard in this table as the *Client certificate*.

  This filter is **not** subordinate to the *Subject* filter. It resides on the same level and is allocated a logical OR function with the *Subject* filter.

The entry in this field defines which client certificate (remote certificate) the mGuard should adopt in order to authenticate the peer (SSH client).

The client certificate can be selected from the selection list. The selection list contains the client certificates that have been loaded on the mGuard under the *"Authentication >> Certificates"* menu item.

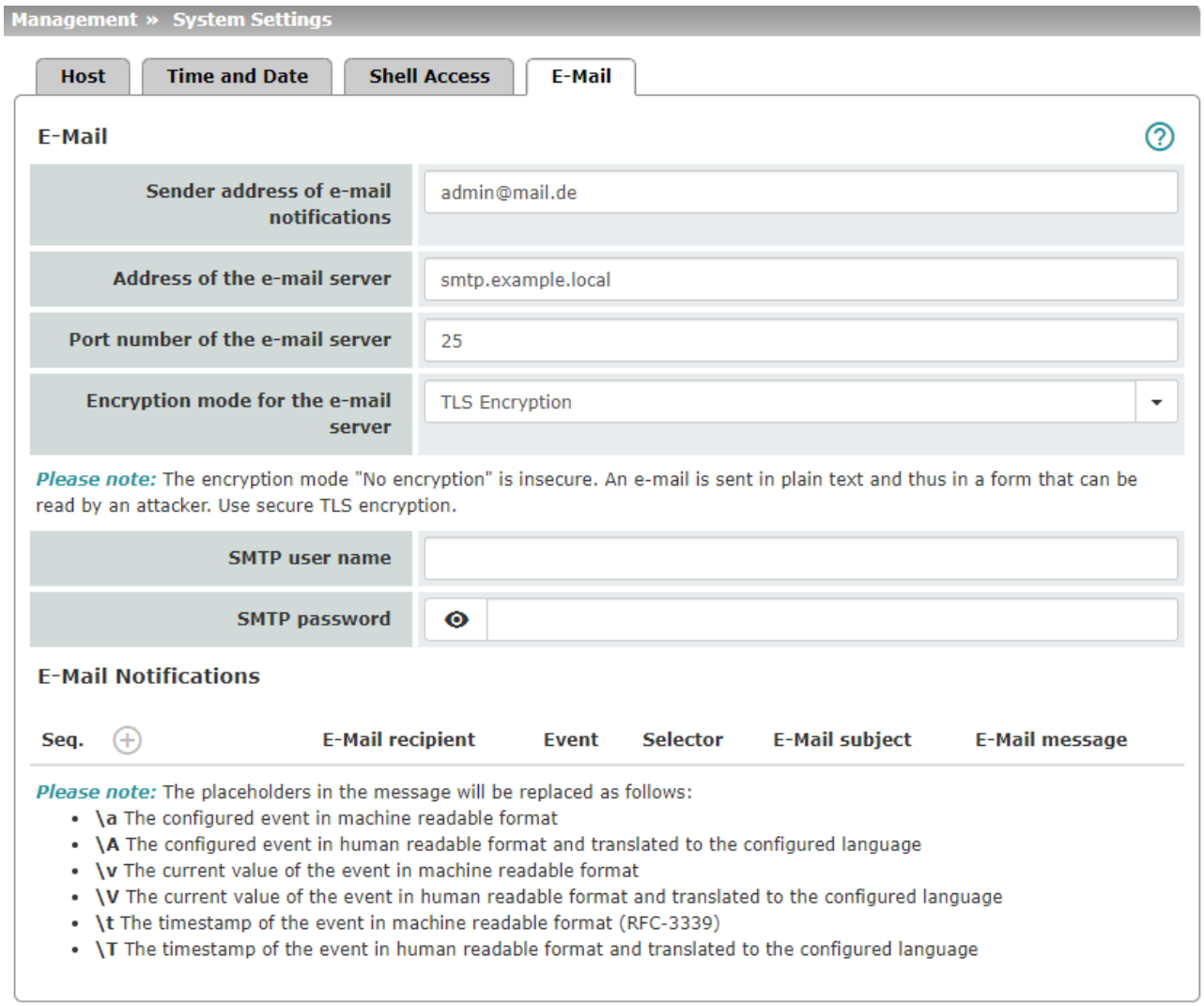
If you need to make changes to the authentication procedure, you should subsequently restart the mGuard, in order to safely end existing sessions with no longer valid certifications or passwords.

The client must use exactly this certificate to authenticate itself.

Further information from the certificate (validity period, issuer and subject) will not be considered during the examination.

Management >> System Settings >> Shell Access [...]		
	Authorized for access as	**All users / root / admin / netadmin / update / audit** Filter which specifies that the SSH client has to be authorized for a specific administration level in order to gain access. When establishing a connection, the SSH client shows its certificate and also specifies the system user for which the SSH session is to be opened (*root, admin, netadmin, update, audit*). Access is only granted if the entries match those defined here. Access for all listed system users is possible when *All users* is set. The *netadmin* and *audit* setting options relate to access rights with the mGuard device manager (FL MGUARD DM UNLIMITED).

4.1.4 E-Mail



Management >> System Settings >> E-Mail

E-mail
(Make sure that the e-mail settings for the mGuard are correctly configured)

You can configure the mGuard to send e-mails via an e-mail server. Should certain events occur, notifications in plain text or machine-readable format can be sent to recipients that can be freely selected.

Sender address of e-mail notifications	E-mail address which is displayed as the sender from mGuard.
Address of the e-mail server	Address of the e-mail server
Port number of the e-mail server	Port number of the e-mail server

Management >> System Settings >> E-Mail [...]		
	Encryption mode for the e-mail server	**No encryption* / TLS encryption (standard) / TLS encryption with StartTLS** Encryption mode for the e-mail server Some of the available algorithms are outdated and no longer considered secure. They are therefore not recommended. However, they can still be selected and used for reasons of downward compatibility. In the WBM, outdated algorithms or unsecure settings are marked with an asterisk (*). See “Using secure encryption and hash algorithms” on page 41
	SMTP user name	User identifier (login)
	SMTP password	Password for the e-mail server
E-Mail notifications	Any e-mail recipients can be linked to predefined events and a freely definable message. The list is processed from top to bottom.	
	E-Mail recipient	Specifies the e-mail address.
	Event	When the selected event occurs or the event is configured for the first time, the linked recipient address is selected and the event is sent to them as an e-mail. An e-mail message can also be stored and sent. Some of the events listed depend on the hardware used. A complete list of all events can be found under “Event table” on page 78.
	Selector	Configured VPN connections (IPsec VPN / OpenVPN) or firewall rule records that shall be monitored by e-mail can be selected.
	E-Mail subject	Text appears in the subject line of the e-mail The text is freely definable. You can use blocks from the event table which can be inserted as placeholders in plain text (\A and \V) or in machine-readable format (\a and \v). Time stamps in the form of a placeholder (\T or \t (machine readable)) can also be inserted.
	E-Mail message	Here you can enter the text that is sent as an e-mail. The text is freely definable. You can use blocks from the event table which can be inserted as placeholders in plain text (\A and \V) or in machine-readable format (\a and \v). Time stamps in the form of a placeholder can also be inserted in plain text (\T) or machine-readable format (\t).

Time stamp

Table 4-1 Time stamp examples

Plain text \T	Machine readable \t (according to RFC-3339)
Monday, April 22, 2016 13:22:36	2016-04-22T11:22:36+0200

Event table

Table 4-2 Event table

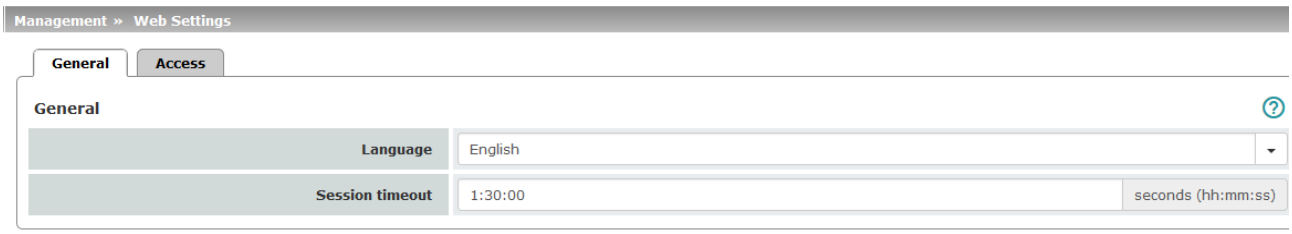
Plain text		Machine readable	
\A = event	\V = value	\a = event	\v = value
State of the ECS	Not present	/ecs/status	1
	Removed		2
	Present and in sync		3
	Not in sync		4
	Generic error		8
Connectivity check result of the external interface	Connectivity check succeeded	/redundancy/cc/int/ok	yes
	Connectivity check failed		no
Connectivity check result of the external interface	Connectivity check succeeded	/redundancy/cc/ext/ok	yes
	Connectivity check failed		no
State of the alarm output	Alarm output closed / high [OK]	/ihal/contact	close
	Alarm output is open / low [FAILURE]		open
Reason for activating the alarm output	No alarm	/ihal/contactreason	
	No network link on external interface		link_ext
	No network link on internal interface		link_int
	Power supply 1 out of order		psu1
	Power supply 2 out of order		psu2
	Board temperature exceeding configured bounds		temp
	No network link on XF2		link_swp0
	No network link on XF3		link_swp1
	No network link on XF4		link_swp2
	No network link on XF5		link_swp3
	No network link on DMZ		link_dmz
	Passwords not configured		password
State of the power supply 1	Power supply 1 working	/ihal/power/psu1	ok
	Power supply 1 out of order		fail
State of the power supply 2	Power supply 2 working	/ihal/power/psu2	ok
	Power supply 2 out of order		fail
State of the input/CMD 1 (I1)	Service input/CMD1 (I1) activated	/ihal/service/cmd1	on
	Service input/CMD1 (I1) deactivated		off

Table 4-2 Event table

Plain text		Machine readable	
\A = event	**\V = value**	**\a = event**	**\v = value**
State of the input/CMD 2 (I2)	Service input/CMD2 (I2) activated	/ihal/service/cmd2	on
	Service input/CMD2 (I2) deactivated		off
State of the input/CMD 3 (I3)	Service input/CMD3 (I3) activated	/ihal/service/cmd3	on
	Service input/CMD3 (I3) deactivated		off
Board temperature	Temperature OK	/ihal/temperature/board_alarm	ok
	Temperature too hot		hot
	Temperature too cold		cold
Status of redundancy	The redundancy controller starts up	/redundancy/status	booting
	No sufficient connectivity		faulty
	No sufficient connectivity and waiting for a component		faulty_waiting
	Synchronizing with active device		outdated
	Synchronizing with active device and waiting for a component		outdated_waiting
	On standby		on_standby
	On standby and waiting for a component		on_standby_waiting
	Becoming active		becomes_active
	Actively forwarding network traffic		active
	Actively forwarding network traffic and waiting for a component		active_waiting
IPsec VPN connection preparation state IKEv2 (beta)	Stopped	/ipsec/con/*/armed	no
	Started		yes
IPsec VPN connection preparation state	Stopped	/vpn/con/*/armed	no
	Started		yes
IPsec SA state of the VPN connection IKEv2 (beta)	No IPsec SAs established	/ipsec/con/*/ipsec	down
	Not all IPsec SAs established		some
	All IPsec SAs established		up
IPsec SA state of the VPN connection	No IPsec SAs established	/vpn/con/*/ipsec	down
	Not all IPsec SAs established		some
	All IPsec SAs established		up
Activation state of a firewall rule record	The state of the firewall rule records has changed	/fwrules/*/state	inactive
			active
OpenVPN connection activation state	Stopped	/openvpn/con/*/armed	no
	Started		yes
OpenVPN connection state	Down	/openvpn/con/*/state	down
	Established		up

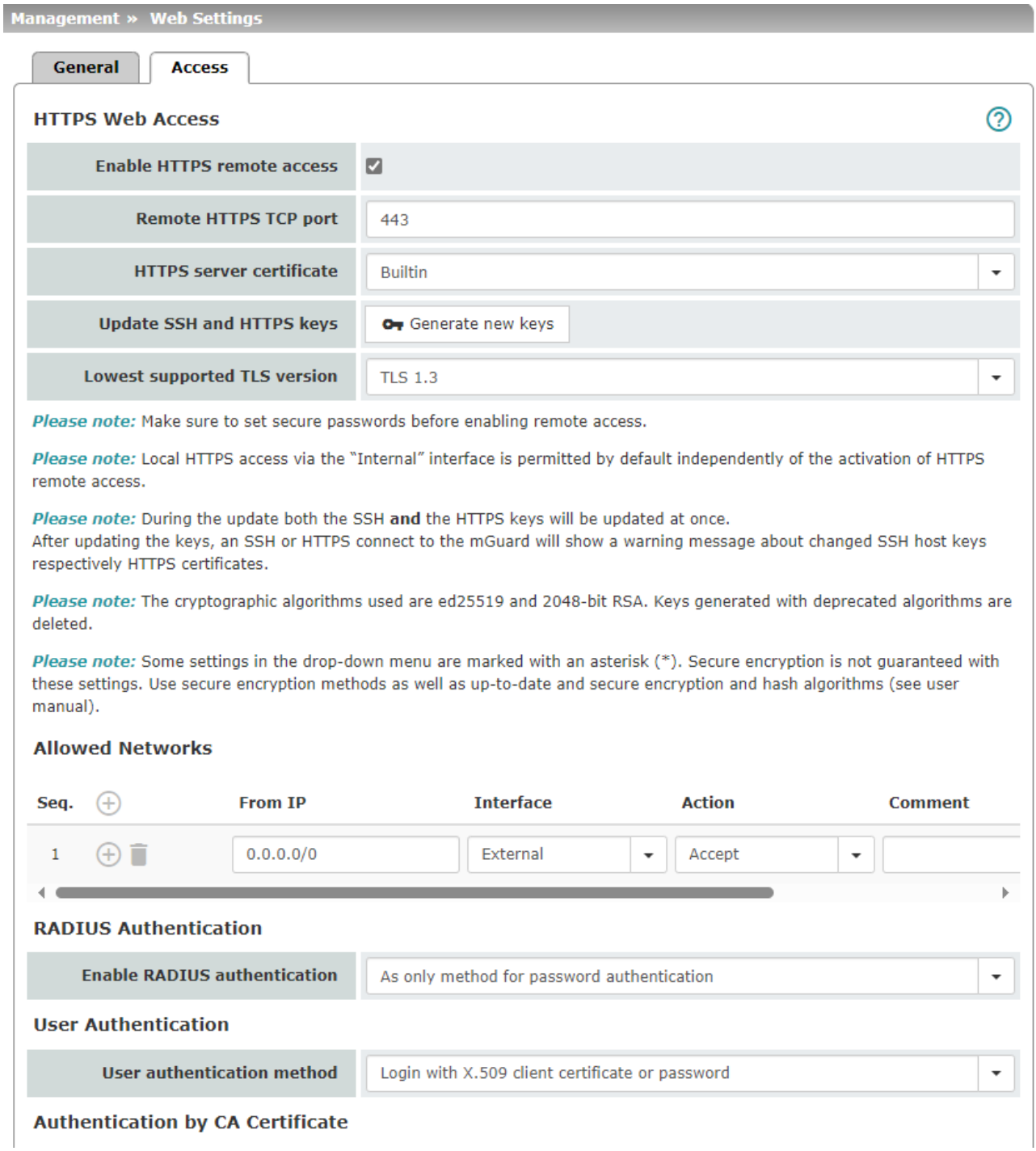
4.2 Management >> Web Settings

4.2.1 General



Management >> Web Settings >> General		
General	The number of concurrent user accesses (HTTPS sessions) for administrative user roles (root, admin, netadmin, update, audit) is limited to 10 in each case.	
	Language	If **Automatic** is selected in the list of languages, the device uses the language setting of the computer's web browser.
	Session timeout	Specifies the period of inactivity after which the user will be automatically logged out of the mGuard web interface. Possible values: 15 to 86400 seconds (= 24 hours) The entry can be in seconds [ss], minutes and seconds [mm:ss] or hours, minutes, and seconds [hh:mm:ss].

4.2.2 Access



The mGuard must not be simultaneously configured via web access, shell access or SNMP. Simultaneous configuration via the different access methods might lead to unexpected results.

Management >> Web Settings >> Access

HTTPS Web Access

When HTTPS remote access is activated, the mGuard can be configured **from remote computers** via its web interface. Access is via a web browser (e.g., Mozilla Firefox, Google Chrome, Microsoft Edge).

Always use **current web browsers** to avoid use of weak encryption algorithms.

If you need to make changes to the authentication procedure, you should subsequently restart the mGuard, in order to safely end existing sessions with no longer valid certifications or passwords.

HTTPS remote access is deactivated by default. Once activated it can be restricted to selected interfaces and networks.

NOTE: The device may be accessible via external networks.
Depending on the settings, the services of the device may be accessible via external networks or the internet. Make sure that access is only possible if it is desired. Otherwise, configure your network accordingly to prevent such access.

NOTE: Local HTTPS access via the interface *Internal* is permitted by default independently of the activation of HTTPS remote access.

In order to specify differentiated access options on the mGuard, the firewall rules must be defined accordingly (see “Allowed Networks” on page 86).

NOTE: If remote access is enabled, make sure that secure passwords are defined for *root* and *admin* users.

If you need to make changes to the password for *root* or *admin*, you should subsequently restart the mGuard, in order to safely end existing sessions with no longer valid certifications or passwords.

NOTE: If the “Control login via on/off switch (HTTPS/SSH)” function is used and the on/off switch is deactivated, it is no longer possible to log in via HTTPS (locally and via RADIUS server).

The login of the following users is not affected by this function and cannot be controlled via an on/off switch:

– User "user"
– Firewall user
– SNMP user via the SNMP interface.

Management >> Web Settings >> Access [...]

Enable HTTPS remote access

Activate the function to enable HTTPS remote access.

HTTPS access via the interface *Internal* (i.e., from the directly connected LAN or from the directly connected computer) is possible regardless of whether the function is enabled.

Following activation of the remote access, access is possible via the interfaces *Internal* and *VPN*.

The firewall rules for the available interfaces must be defined accordingly in order to specify differentiated access options on the mGuard (see "Allowed Networks" on page 86).

In addition, the authentication rules under **User authentication** must be set, if necessary.

Remote HTTPS TCP port

Default: 443

If this port number is changed, the new port number only applies for access via the *External, DMZ,* and *VPN* interface. Port number 443 still applies for internal access.

In Stealth mode, incoming traffic on the port specified is no longer forwarded to the client.

In Router mode with NAT or port forwarding, the port number set here has priority over the rules for port forwarding.

The remote peer that implements remote access may have to specify the port number defined here after the IP address when entering the address.

Example: if this mGuard can be accessed over the Internet via address 123.124.125.21 and port number 443 has been specified for remote access, you do not need to enter this port number after the address in the web browser of the remote peer.

If a different port number is used, it should be entered after the IP address, e.g.: https://123.124.125.21:442/

Management >> Web Settings >> Access [...]		
	HTTPS server certificate	**Predefined / <machine certificate>** **Predefined certificate** In the default setting, the mGuard device shows a pre-installed, self-signed web server certificate when a client (e.g. a web browser) contacts the web server of the device. This allows the client to verify the authenticity of the mGuard device. **Individual machine certificate (self-signed)** Instead of the pre-installed certificate, an individual, self-created machine certificate can be used to authenticate the web server. This certificate must first be uploaded to the mGuard device so that it can be selected in the drop-down list (see Section 6.4.2). Note the following: – If the certificate contains attributes of the type "*key usage*", these must contain the value "*digital signature*", "*key encipherment*" or "*key agreement*". – If the certificate contains attributes of the type "*extended key usage*", these must contain the value "*TLS web server authentication*". – If the certificate contains attributes of the type "*netscape certificate*" (not recommended), these must contain the value "*SSL server*". **Individual machine certificate (CA signed)** If the individual machine certificate was issued by a CA, the entire certificate chain, including the root CA certificate and all intermediate CA certificates, must be uploaded to the device (Authentication >> Certificates >> CA Certificates) so that a *chain of trust* can be formed (see Section 6.4.3 and "CA certificate"). The machine certificate must also be stored on the device (Authentication >> Certificates >> Machine Certificates). To authenticate the device, the client (e.g. web browser) uses the entire certificate chain. The client must trust the root CA certificate.

Management >> Web Settings >> Access [...]

Update SSH and HTTPS keys	**Generate new keys** Keys created with an older firmware version (especially < 10.5) may be weak and should be renewed. Keys that have been generated using an older firmware version might be weak and should be renewed. • Click on this button to generate a new key. • Note the fingerprints of the new keys generated. • Log in via HTTPS and compare the certificate information provided by the web browser. The generated keys will no not be regenerated when updating to a new firmware version, but are retained. As of firmware version 10.6.0, the ECDSA NISTP 521 encryption algorithm is used to generate SSH keys.
Lowest supported TLS version	**TLS 1.0/1.1*, TLS 1.2 (default), TLS 1.3** For security reasons, select version TLS 1.2 or TLS 1.3 as the "Lowest supported TLS version" to ensure secure TLS-encrypted connections (e.g. HTTPS connections to the device). In the WBM, outdated algorithms or unsecure settings are marked with an asterisk (*). See “Using secure encryption and hash algorithms” on page 41. The mGuard device supports TLS-encrypted connections to other remote peers. The connection can be established by the mGuard device itself (mGuard = Client) or by the remote peer (mGuard = Server). For TLS-encrypted connections, both remote peers must use the same and at least the "Lowest supported TLS version" selected here. If a client (e.g. a web browser that contacts the web server of the mGuard device) uses an outdated and therefore insecure TLS version, the connection request is only accepted by the mGuard device if it has been selected as the "Lowest supported TLS version". If the TLS version used by the client is lower than the version configured here, the connection will be rejected. NOTE: This restriction does not apply to TSL-encrypted connections that use TCP encapsulation/"Path Finder" (see “TCP encapsulation” on page 261). For reasons of downward compatibility, the TLS versions TLS 1.0/1.1 can always be used in these connections (and regardless of the lowest supported TLS version specified here).

Management >> Web Settings >> Access [...]

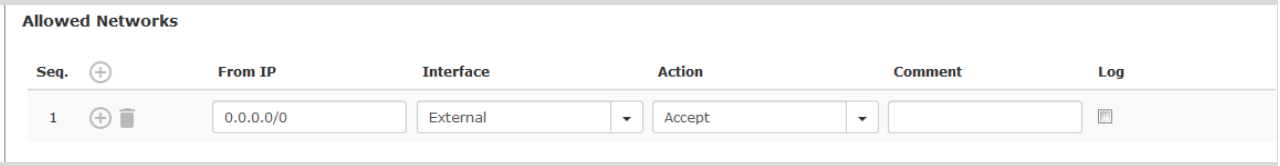
Allowed Networks

HTTPS access to the mGuard can be restricted to selected interfaces and networks by means of firewall rules.

1. The following applies to HTTPS remote access (*External* and *DMZ*):
   b) Access via the interfaces *External* and *DMZ* is always disabled if the **Enable HTTPS remote access** function is disabled.
   c) Access via the interfaces *External* and *DMZ* is also disabled if there is no firewall rule that explicitly allows access (Action = Accept).
   d) To allow access, you must both enable the **Enable HTTPS remote access** feature and configure a corresponding firewall rule for the interfaces *External* and *DMZ* (Action = Accept).
2. The following applies differently for the access via the LAN interface (*Internal*) and the VPN interface (*VPN*):
   a) Access via the interface *Internal* (LAN) is always allowed if it is not forbidden by an explicit firewall rule in this table (Action = Drop or Reject).
   a) Access via the interface *VPN* is allowed if the **Enable HTTPS remote access** function is enabled and if it is not forbidden by an explicit firewall rule in this table (Action = Drop or Reject).

If multiple firewall rules are defined, these are queried starting from the top of the list of entries until an appropriate rule is found. This rule is then applied. If the list of rules contains further subsequent rules that could also apply, these rules are ignored.

The following options are available:



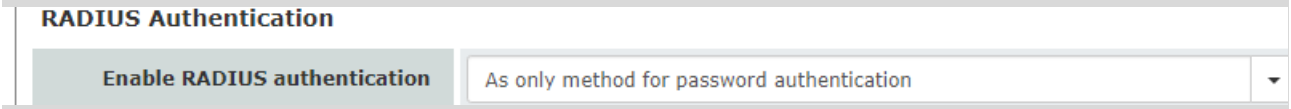
From IP

Enter the address of the computer or network from which access is permitted or forbidden in this field.

IP address: **0.0.0.0/0** means all addresses. To specify an address area, use CIDR format – see "CIDR (Classless Inter-Domain Routing)" on page 49.

Management >> Web Settings >> Access [...]

	Interface (This option varies depending on the device and licenses installed.)	**Internal / External / DMZ / VPN** Specifies to which interface the rule should apply. If no rules are set or if no rule applies, the following **default settings** apply: – HTTPS access via *Internal* and *VPN* is permitted. – HTTPS access via *External* and *DMZ* is denied. Specify the access options according to your requirements. If you want to deny access via *Internal* or *VPN*, you must implement this explicitly by means of corresponding firewall rules, for example, by specifying *Drop* as the action. **To prevent your own access being blocked**, you may have to permit access simultaneously via another interface explicitly with *Accept* before clicking on the **Save** button to activate the new setting. Otherwise, if your access is blocked, you must carry out the recovery procedure.
	Action	– **Accept** means that the data packets may pass through. – **Reject** means that the data packets are sent back and the sender is informed of their rejection. (In *Stealth* mode, *Reject* has the same effect as *Drop*.) – **Drop** means that the data packets are not permitted to pass through. They are discarded, which means that the sender is not informed of their whereabouts.
	Comment	**Freely selectable comment for this rule.**
	Log	For each individual firewall rule, you can specify whether the use of the rule: – Should be logged – activate *Log* function – Should not be logged – deactivate *Log* function (default) Log message (example): 2024-11-25_10:09:51.83909 firewall: fw-https-access-1-12e7d62f-6be7-1c6e-b8a6-000cbe00105c act=REJECT IN=eth0 MAC=d4:aa:62:b2:6d:62 SRC=192.168.1.55 DST=192.168.1.55 LEN=52 TOS=0x00 PREC=0x00 TTL=128 ID=47714 DF PROTO=TCP SPT=53379 DPT=22 SEQ=506303301 ACK=0 WINDOW=64240 SYN URGP=0 CTMARK=100030
RADIUS authentication	Users can be authenticated via a RADIUS server when they log in. The password is only checked locally in the case of predefined users *(root, admin, netadmin, update, audit,* and *user*).	



Management >> Web Settings >> Access [...]

Enable RADIUS authentication

Yes / No / As only method for password authentication

If the function is activated, the passwords of users who log in via HTTPS are checked via the local database.

The **"User authentication method"** can only be set to **"Login restricted to X.509 client certificate"** if **No** is selected.

Select **Yes** for users to be authenticated via the RADIUS server. The password is only checked locally in the case of predefined users (*root*, *admin*, *netadmin, update*, *audit,* and *user*).

If you need to make changes to the authentication procedure, you should subsequently restart the mGuard, in order to safely end existing sessions with no longer valid certifications or passwords.

The *netadmin* and *audit* authorization levels relate to access rights with the mGuard device manager (FL MGUARD DM UNLIMITED).

You should only select **As only method for password authentication** if you are an experienced user, as doing so could result in all access to the mGuard being blocked.

When setting up RADIUS authentication for the first time, select **Yes**.

If you do intend to use the **As only method for password authentication** option when setting up RADIUS authentication, we recommend that you create a "Customized Default Profile" which resets the authentication method.

If you have selected RADIUS authentication as the only method for checking the password, it may no longer be possible to access the mGuard. For example, this may be the case if you set up the wrong RADIUS server or convert the mGuard. The predefined users (*root*, *admin*, *netadmin, update*, *audit,* and *user*) are then no longer accepted.

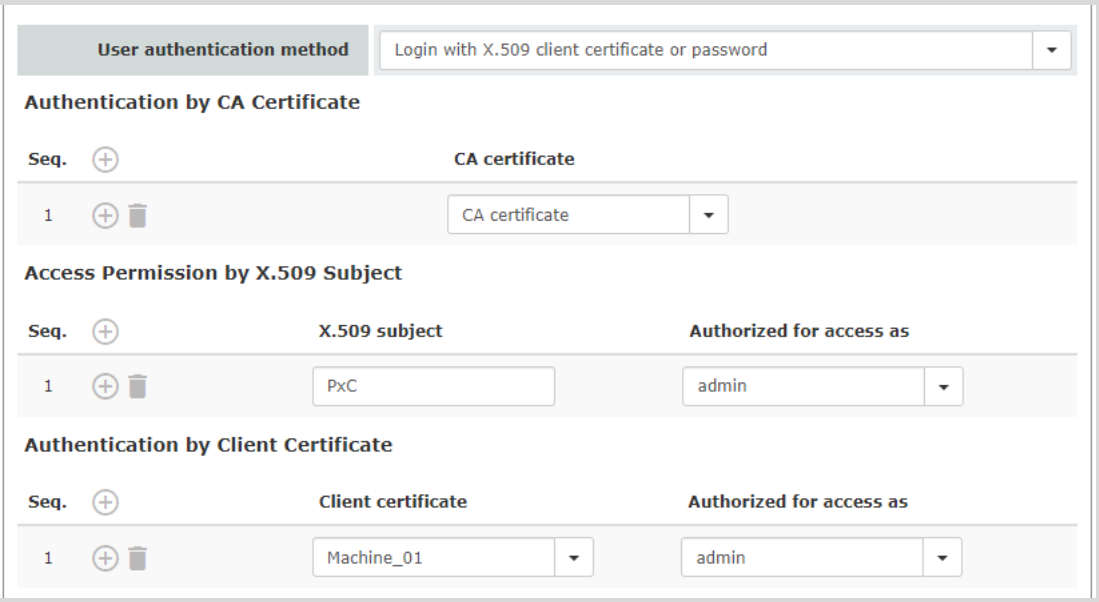
Management >> Web Settings >> Access

User Authentication

(This menu item is not part of the FL MGUARD 2000 functionality.)

You can specify whether the mGuard user authenticates their login with a password, an X.509 user certificate or a combination of the two.

If you need to make changes to the authentication procedure, you should subsequently restart the mGuard, in order to safely end existing sessions with no longer valid certifications or passwords.



Management >> Web Settings >> Access[...]		
Specifies how the local mGuard authenticates the remote peer	**User authentication method**	**Login with password** Specifies that the remote mGuard user must use a password to log into the mGuard. The password is specified under the *"Authentication >> Administrative Users"* menu (see *page 185*). The option of RADIUS authentication is also available (see page 193). If you need to make changes to the authentication procedure or change passwords, you should subsequently restart the mGuard in order to safely end existing sessions with no longer valid certifications or passwords. Depending on which user identifier is used to log in (user or administrator password), the user has the appropriate rights to operate and/or configure the mGuard accordingly. **Login with X.509 client certificate or password** User authentication is by means of login with a password (see above) or The user's web browser authenticates itself using an X.509 certificate and a corresponding private key. Additional details must be specified below. The use of either method depends on the web browser of the remote user. The second option is used when the web browser provides the mGuard with a certificate. **Login restricted to X.509 client certificate** The user's web browser must use an X.509 certificate and the corresponding private key to authenticate itself. Additional details must be specified here. Before enabling the *Login restricted to X.509 client certificate* option, you must first select and test the *Login with X.509 client certificate or password* option. Only switch to *Login restricted to X.509 client certificate* when you are sure that this setting works. **Otherwise your access could be blocked.** Always take this precautionary measure when modifying settings under **User Authentication**.

If the following **User authentication methods** are defined:

– *Login restricted to X.509 client certificate*
– *Login with X.509 client certificate or password*

You must then specify how the mGuard authenticates the remote user according to X.509.

The table below shows which certificates must be provided for the mGuard to authenticate the user (access via HTTPS) if the user or their web browser shows one of the following certificate types when a connection is established:

– A certificate signed by a CA
– A self-signed certificate

For additional information about the table, see “Authentication >> Certificates” on page 197.

X.509 authentication for HTTPS

The peer shows the following:	Certificate (specific to individual), **signed by CA**[1]	Certificate (specific to individual), **self-signed**
The mGuard authenticates the peer using:	⇕	⇕
	All CA certificates that form the chain to the root CA certificate together with the certificate shown by the peer PLUS (if required) Client certificates (remote certificates), **if** used as a filter	Client certificate (remote certificate)

[1] The peer can additionally provide sub-CA certificates. In this case, the mGuard can form the set union for creating the chain from the CA certificates provided and the self-configured CA certificates. The corresponding root certificate must always be available on the mGuard.

According to this table, the certificates that must be provided are the ones the mGuard uses to authenticate a remote user (access via HTTPS) or their web browser.

The following instructions assume that the certificates have already been correctly installed on the mGuard (see “Authentication >> Certificates” on page 197).

If the use of revocation lists (CRL checking) is activated under the “Authentication >> Certificates”, *Certificate Settings* menu item, each certificate signed by a CA that is “shown” by the HTTPS clients must be checked for revocations.

Management >> Web Settings >> Access

Authentication by CA Certificate

This configuration is only necessary if the user (access via HTTPS) shows a certificate signed by a CA.

If you need to make changes to the authentication procedure, you should subsequently restart the mGuard, in order to safely end existing sessions with no longer valid certifications or passwords.

All CA certificates required by the mGuard to form the chain to the relevant root CA certificate with the certificates shown by the user must be configured.

If the web browser of the remote user also provides CA certificates that contribute to forming the chain, then it is not necessary for these CA certificates to be installed on the mGuard and referenced at this point.

However, the corresponding root CA certificate must be installed on the mGuard and made available (referenced) at all times.

When selecting the CA certificates to be used or when changing the selection or the filter settings, you must first select and test the *Login with X.509 client certificate or password* option as the *User authentication method* before enabling the (new) setting.

Only switch to *Login restricted to X.509 client certificate* when you are sure that this setting works. **Otherwise your access could be blocked.**

Always take this precautionary measure when modifying settings under **User Authentication**.

Access Permission by X.509 Subject

Enables a filter to be set in relation to the contents of the *Subject* field in the certificate shown by the web browser/HTTPS client.

It is then possible to restrict or enable access for the web browser/HTTPS client, which the mGuard would accept in principle based on certificate checks:

– Restricted access to certain *subjects* (i.e., individuals) and/or to *subjects* that have certain attributes or
– Access enabled for all subjects (see glossary under "Subject, certificate" on page 395)

The *X.509 subject* field must not be left empty.

Management >> Web Settings >> Access [...]

Access enabled for all subjects (i.e., individuals):

An * (asterisk) in the *X.509 subject* field can be used to specify that all subject entries in the certificate shown by the web browser/HTTPS client are permitted. It is then no longer necessary to identify or define the subject in the certificate.

Restricted access to certain subjects (i.e., individuals) and/or to subjects that have certain attributes:

In the certificate, the certificate owner is specified in the *Subject* field. The entry is comprised of several attributes. These attributes are either expressed as an object identifier (e.g., 132.3.7.32.1) or, more commonly, as an abbreviation with a corresponding value.

Example: CN=John Smith, O=Smith and Co., C=US

If certain subject attributes have very specific values for the acceptance of the web browser by the mGuard, then these must be specified accordingly. The values of the other freely selectable attributes are entered using the ***** (asterisk) wildcard.

Example: CN=*, O=*, C=US (with or without spaces between attributes)

In this example, the attribute “C=US” must be entered in the certificate under “Subject”. It is only then that the mGuard would accept the certificate owner (subject) as a communication partner. The other attributes in the certificates to be filtered can have any value.

If a subject filter is set, the number (but not the order) of the specified attributes must correspond to that of the certificates for which the filter is to be used.

Please note that the filter is case-sensitive.

Several filters can be set and their sequence is irrelevant.

With HTTPS, the web browser of the accessing user does not specify which user or administrator rights it is using to log in. These access rights are assigned by setting filters here (under “Authorized for access as”).

This has the following result: if there are several filters that “let through” a certain user, then the first filter applies.

Management >> Web Settings >> Access [...]

The user is assigned the access rights as defined by this filter. This could differ from the access rights assigned to the user in the subsequent filters.

If client certificates are selected as the authentication method, then they have priority over the filter settings here.

Authorized for access as

root / admin / netadmin / update / audit / user

Specifies which user or administrator rights are granted to the remote user.

For a description of the *root, admin,* and user authorization levels, see “Authentication >> Administrative Users” on page 185.

The *netadmin* and *audit* authorization levels relate to access rights with the mGuard device manager (FL MGUARD DM UNLIMITED).

Authentication by Client Certificate

Configuration is required in the following cases:

– Remote users each show a self-signed certificate.
– Remote users each show a certificate signed by a CA. Filtering should take place: access is only granted to a user whose certificate copy is installed on the mGuard as the remote certificate and is provided to the mGuard in this table as the *Client certificate*.

  If used, this filter has priority over the *Subject* filter in the table above.

The entry in this field defines which remote certificate the mGuard should adopt in order to authenticate the peer (web browser of the remote user).

The client certificate can be selected from the selection list.

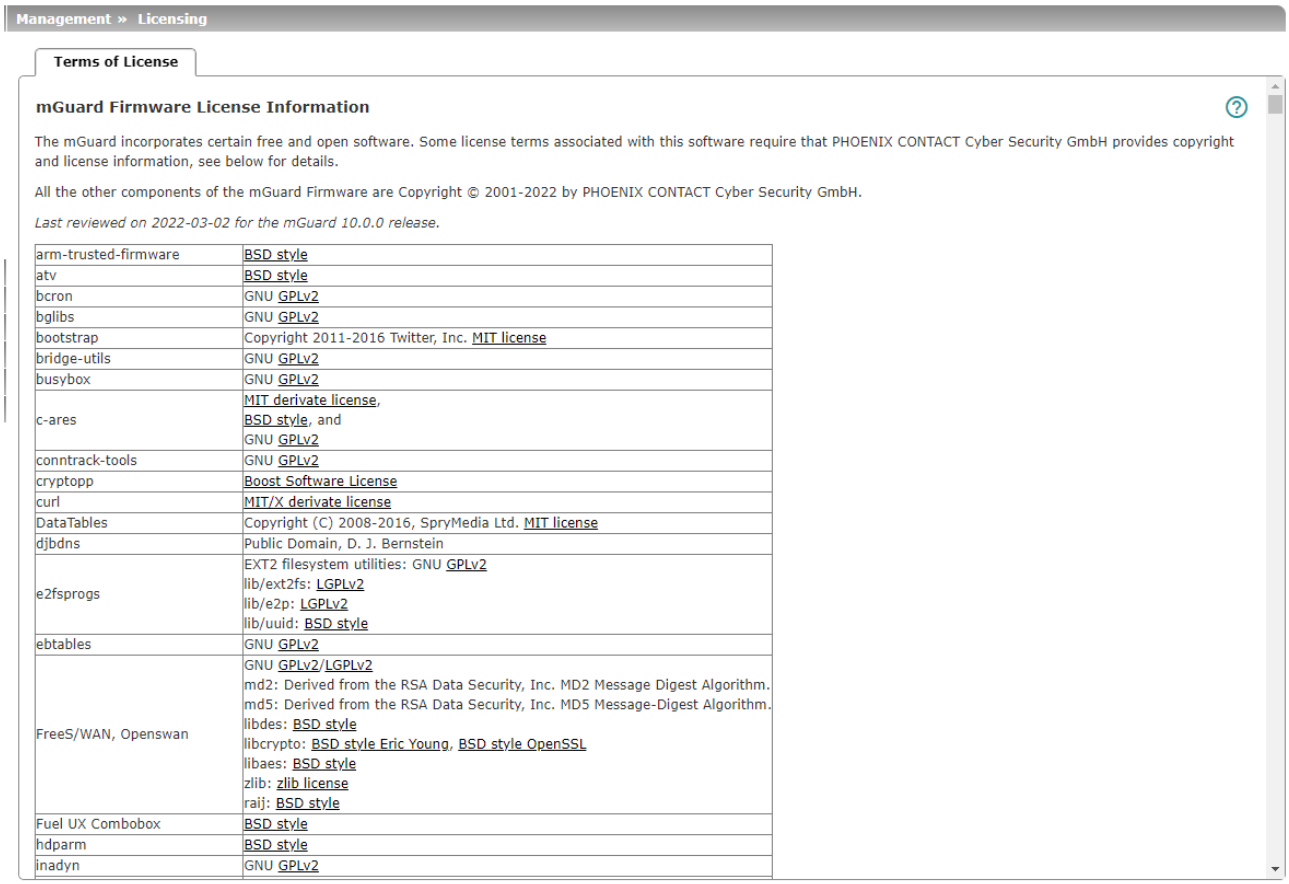
The selection list contains the client certificates that have been loaded on the mGuard under the "Authentication >> Certificates" menu item.

If you need to make changes to the authentication procedure, you should subsequently restart the mGuard, in order to safely end existing sessions with no longer valid certifications or passwords.

Management >> Web Settings >> Access [...]		
	Authorized for access as	**root / admin / netadmin / update / audit / user** Specifies which user or administrator rights are granted to the remote user. For a description of the *root, admin, and user* authorization levels, see “Authentication >> Administrative Users” on page 185. The *netadmin* and *audit* authorization levels relate to access rights with the mGuard device manager (FL MGUARD DM UNLIMITED).

4.3 Management >> Terms of License

Lists the licenses of the external software used on the mGuard. The software is usually open-source software (for the current list see also application note AH EN MGUARD3 MG10 LICENSES "License Information - Free and Open Source Software" (available in the PHOENIX CONTACT Web Shop e.g. at phoenixcontact.net/product/1357828).



arm-trusted-firmware	BSD style
atv	BSD style
bcron	GNU GPLv2
bglibs	GNU GPLv2
bootstrap	Copyright 2011-2016 Twitter, Inc. MIT license
bridge-utils	GNU GPLv2
busybox	GNU GPLv2
c-ares	MIT derivate license, BSD style, and GNU GPLv2
conntrack-tools	GNU GPLv2
cryptopp	Boost Software License
curl	MIT/X derivate license
DataTables	Copyright (C) 2008-2016, SpryMedia Ltd. MIT license
djbdns	Public Domain, D. J. Bernstein
e2fsprogs	EXT2 filesystem utilities: GNU GPLv2 lib/ext2fs: LGPLv2 lib/e2p: LGPLv2 lib/uuid: BSD style
ebtables	GNU GPLv2
FreeS/WAN, Openswan	GNU GPLv2/LGPLv2 md2: Derived from the RSA Data Security, Inc. MD2 Message Digest Algorithm. md5: Derived from the RSA Data Security, Inc. MD5 Message-Digest Algorithm. libdes: BSD style libcrypto: BSD style Eric Young, BSD style OpenSSL libaes: BSD style zlib: zlib license raij: BSD style
Fuel UX Combobox	BSD style
hdparm	BSD style
inadyn	GNU GPLv2

4.4 Management >> Update

Use the respective latest firmware version
Because security-relevant improvements are added to the product with each new firmware version, the latest firmware version should always be used.
Phoenix Contact regularly provides firmware updates. You will find these on the product page of the respective device (e.g., phoenixcontact.net/product/1357840).

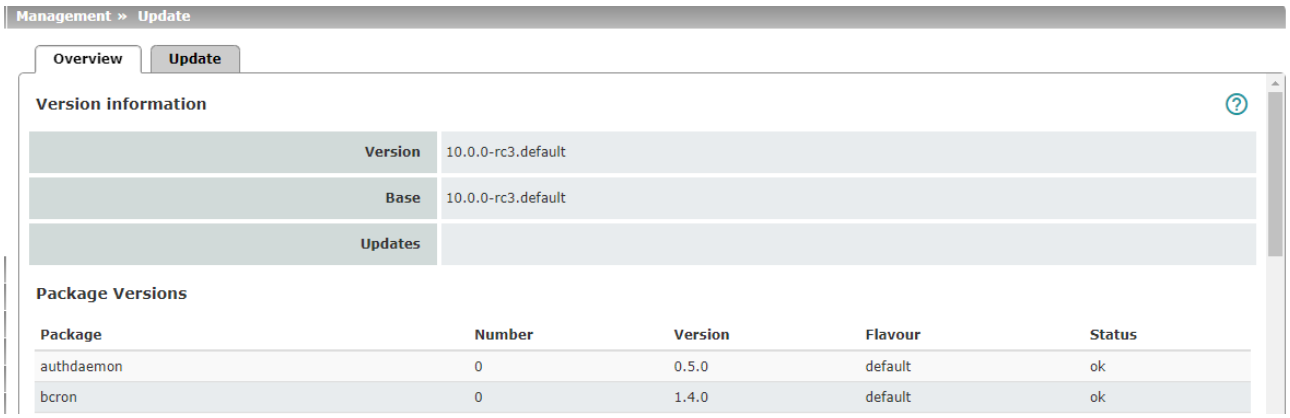
- Observe the Change Notes/Release Notes for the respective firmware version.
- Observe the security notes published on the Phoenix Contact Product Security Incident Response Team (PSIRT) website regarding any published vulnerabilities.

An update to firmware version 10.6.x is possible from firmware version 10.5.0.

NOTE: The device may be damaged if the update process is interrupted.
Do not switch the device off or interrupt the power supply to the device during the update process.

To ensure that the downloaded firmware or update file has not been modified by third parties during the download, you can compare the SHA256 checksum of the file with the checksum specified on the corresponding product page (phoenixcontact.com/product/<item number>).

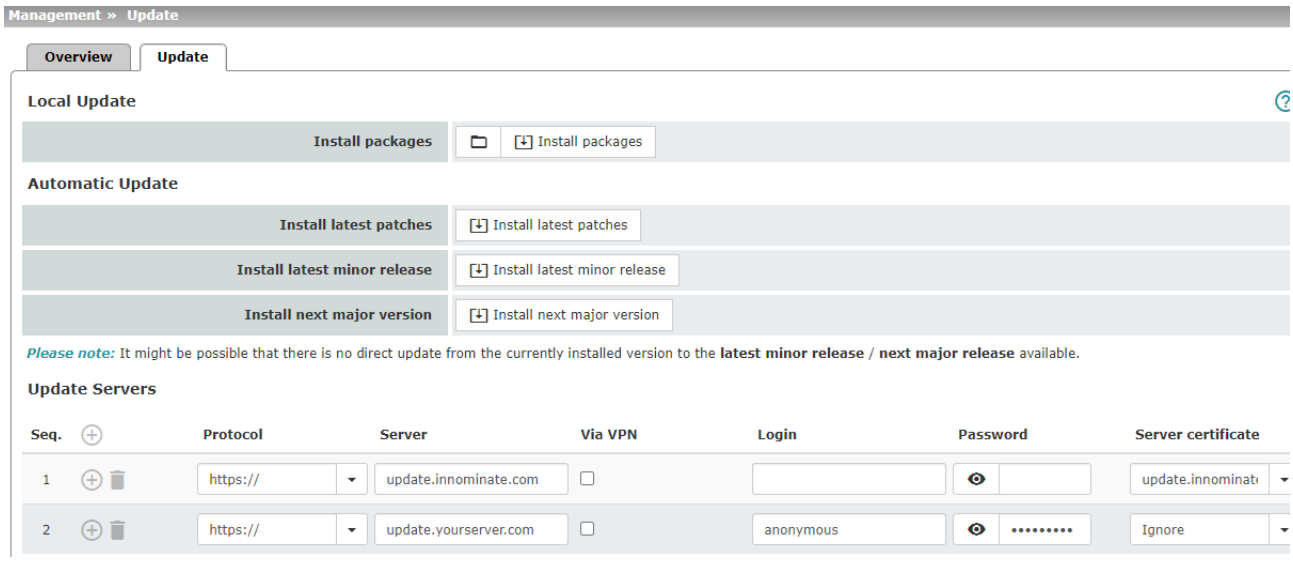
4.4.1 Overview



Management >> Update >> Overview		
Version information	Lists information about the firmware version of the mGuard.	
	Version	The current software version of the mGuard device.
	Base	The software version that was originally used to flash this device.
	Updates	List of updates that have been installed on the base.
Package Versions	Lists the individual software modules of the mGuard. This information may be needed if support is required.	

4.4.2 Update

NOTE: Never interrupt the power supply to the device during the update process! The device could be damaged.



Firmware updates with firewall redundancy enabled

NOTE: Only the inactive device of a redundancy pair can be updated.

Procedure

- Always update the inactive device of the redundancy pair first.
  This device will automatically become the active device after a successful update.
- Now, start the update for the other, now inactive, device.
- Check whether both devices have been successfully updated.

Updating the firmware

There are two options for performing a firmware update:

1. You have the current package set file on your computer (the file name ends with ".tar.gz") and you perform a local update.
2. The mGuard downloads a firmware update of your choice from the update server via the Internet and installs it.

Depending on the size of the update, the process may take several minutes.

The device restarts automatically after the update. If a manual restart is required, you will be notified by a message.

Management >> Update

Local Update

Install packages

To install the packages, proceed as follows:

- Click on the **No file selected** icon, select the file and open it.

  The file name of the update file depends on the device platform and the currently installed firmware version (see also **Application Note** AH EN MGUARD UPDATE - 108250_en_xx).

  Example: *update-10.{5-6)-10.6.0.default.aarch64.tar.gz*
- Then click on the **Install packages** button.

Automatic Update

Using the automatic update, the mGuard independently determines the required package set.

An automatic update via the configured update server can also be started on the command line (see "Command line tool „mg"" on page 402).

– Authorized users: *root*, *admin, update*

– Command: *mg update*, parameter: *major | minor | patches*

Successful implementation or any errors that occur will be documented in the log file: */var/log/psm-sanitize.*

Install latest patches

Patch releases resolve errors in previous versions and have a version number which only changes in the third digit position. Example: Version 10.0.**1** is a patch release for Version 10.0.**0**.

Install latest minor release

Minor and major releases supplement the mGuard with new properties or contain changes that affect the behavior of the mGuard.

Their version number changes in the first or second digit position. Example: Version 10.**1.0** is a minor release for Version 10.**0.1**.

Install next major version

Example: Version **11**.6.0 is a major release for Version **10**.1.0.

Update Servers

Specify from which servers an update may be performed.

The list of servers is processed from top to bottom until an available server is found. The order of the entries therefore also specifies their priority.

All configured update servers must provide the same updates.

It is not necessary to enter the login information (login + password) if the factory default update server (https://update.innominate.com) is used.

The following options are available:

Protocol

The update can be performed via HTTPS, HTTP, FTP or TFTP.

Server

Host name or IP address of the server that provides the update files.

Management >> Update [...]

Via VPN

The update server's request is – **where possible** – carried out via a VPN tunnel (IPsec VPN or OpenVPN).

Prerequisite: A suitable VPN tunnel is available.

If no suitable VPN tunnel is available, traffic is always sent **unencrypted via the default gateway**.

A suitable VPN tunnel is available if the remote peer belongs to the remote network of a configured VPN tunnel and the mGuard has an internal IP address that belongs to the local network of the same VPN tunnel.

Please note:

For IPsec VPN connections, the "Via VPN" function must be activated so that the traffic is routed through a suitable IPsec VPN tunnel.

For OpenVPN connections, traffic is usually routed via a suitable OpenVPN tunnel even if the function is deactivated.

Login

Login for the server.

Password

Password for login.

Server certificate

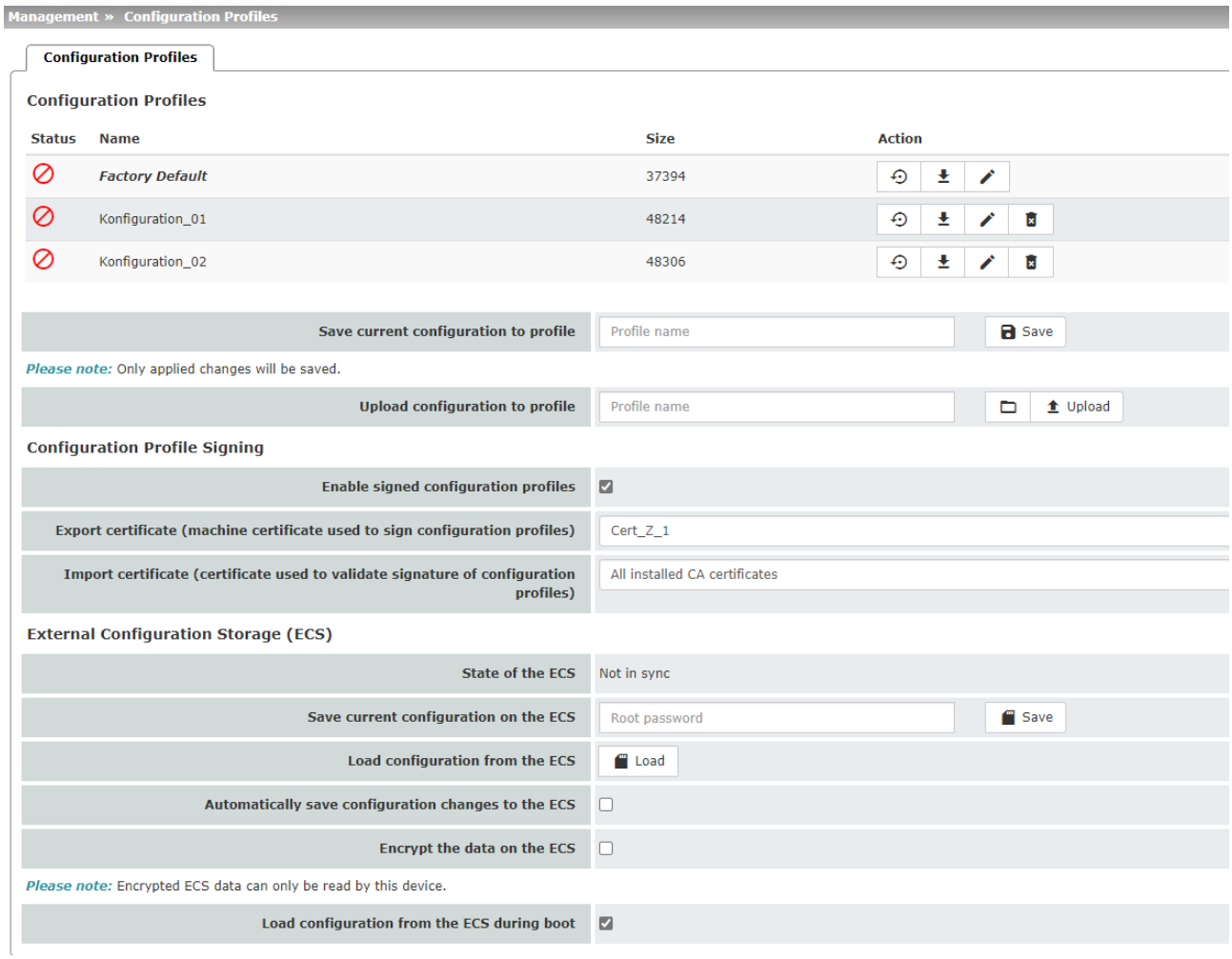
To ensure that a secure HTTPS connection is established to the configured update server, the corresponding server certificate of the update server must be checked by the mGuard device.

The update server is authenticated either via a corresponding remote certificate or via a CA certificate. The certificate must be uploaded to the mGuard device so that it can be selected for verification of the server certificate in the drop-down list (see Section 6.4.4, “Remote Certificates”und Section 6.4.3, “CA Certificates”).

If the "Ignore" option is selected, no check takes place.

4.5 Management >> Configuration Profiles

4.5.1 Configuration Profiles



You can save the settings of the mGuard as a configuration profile under any name on the mGuard. It is possible to create multiple configuration profiles. You can then switch between different profiles as required, for example, if the mGuard is used in different environments.

Furthermore, you can also save the configuration profiles as files on your configuration computer. Alternatively, these configuration files can be loaded onto the mGuard and activated.

Configuration profiles can be digitally signed using certificates. On appropriately configured devices, it is then only possible to upload configuration profiles to the device that have been signed with corresponding certificates.

In addition, you can restore the *Factory Default* settings at any time.

The devices also allow the configuration profiles to be stored on external configuration storage (ECS).

When a configuration profile is saved, the passwords used for authenticating administrative access to the mGuard (Root password, Admin password, SNMPv3 password) are not saved.

It is possible to load and activate a configuration profile that was created under an older firmware version. However, the reverse is not true – a configuration profile created under a newer firmware version should not be loaded and will be rejected.

Encrypted configuration memory (ECS)

Configuration profiles, stored on an ECS, can be encrypted and thus made associable for each device individually. This makes rollout easier.

You can save several mGuard configurations on an SD card and then use it to start up all mGuards. During the startup process, the mGuard finds the relevant valid configuration on the SD card. This is loaded, decrypted, and used as the valid configuration (see “Encrypt the data on the ECS” on page 107.)

Recovery procedure

Before performing the recovery procedure, the current device configuration is stored in a new configuration profile (“Recovery DATE”). Following the recovery procedure, the device starts with the default settings.

Following the recovery procedure, the configuration profile with the designation “Recovery DATE” appears in the list of configuration profiles and can be restored with or without changes.

Management >> Configuration Profiles

Configuration Profiles

At the top of the page there is a list of the configuration profiles that are stored on the mGuard, e.g., the *Factory Default* configuration profile. If any configuration profiles have been saved by the user (see below), they will be listed here.

Please note that the configuration profiles can be both unsigned and signed profiles (see “Configuration Profile Signing”).

Active configuration profile: the configuration profile that is currently enabled has an *Active* symbol at the start of the entry. If a configuration is modified in such a way that it corresponds to a stored configuration profile, the *Active* symbol appears next to it after the changes have been applied.

Configuration profiles that are stored on the mGuard can be:

– Enabled (Restore profile)
– Downloaded as an atv file on the connected configuration computer
– Viewed and edited (Edit profile)
– Deleted

Download configuration profile as an atv file

- Click on the name of the configuration profile in the list.

  The configuration profile is downloaded as an atv file and can be analyzed with a text editor.

Please note that the configuration profiles can be both unsigned and signed profiles (see “Configuration Profile Signing”).

Management >> Configuration Profiles [...]

View and edit configuration profile before restoring it (Edit profile)

- Click on the **Edit profile** icon to the right of the configuration profile name.
  The configuration profile is loaded, but not activated yet. All entries that contain changes to the configuration currently used are highlighted in green on the relevant page and in the associated menu path. The changes displayed can be applied as they are or with further modifications, or they can be discarded:
  – To apply the entries for the loaded profile (with further modifications, where applicable), click on the **Save** icon.
  – To discard all changes, click on the **Reset** icon.

Enable the factory default or a configuration profile saved on the mGuard by the user (Restore profile)

- Click on the **Restore profile** icon to the right of the configuration profile name.
  The corresponding configuration profile is restored without further inquiry and activated immediately.

Save configuration profile as a file on the configuration computer

- Click on the **Download profile** icon to the right of the configuration profile name.
- In the dialog box that is displayed, where appropriate specify the file name and storage location where the configuration profile is to be saved as a file. (The file name can be freely selected.)

Please note that the configuration profiles can be both unsigned and signed profiles (see “Configuration Profile Signing”).

Delete configuration profile

- Click on the **Delete profile** icon to the right of the configuration profile name.

The profile is deleted irrevocably without further inquiry.

The *Factory Default* profile cannot be deleted.

Save current configuration to profile

Save current configuration as a profile on the mGuard

- Enter the desired profile name in the *Profile name* field next to “Save current configuration to profile”.
- Click on the **Save** button.

The configuration profile is saved on the mGuard. The profile name appears in the list of configuration profiles stored on the mGuard.

Please note that the configuration profiles can be both unsigned and signed profiles (see “Configuration Profile Signing”).

Management >> Configuration Profiles [...]

	Upload configuration to profile	**Upload a configuration profile that has been saved to a file on the configuration computer** **Requirement**: a configuration profile has been saved on the configuration computer as a file according to the procedure described above. • Enter the desired profile name that is to be displayed in the *Profile name* field next to "**Upload configuration to profile**". • Click on the **No file selected** icon and select and open the relevant file in the dialog box that is displayed. • Click on the **Upload** button. The configuration profile is loaded on the mGuard, and the name assigned in step 1 appears in the list of profiles that are stored. Please note that the configuration profiles can be both unsigned and signed profiles (see "Configuration Profile Signing"). If the "Enable signed configuration profiles" function is activated, only signed configuration profiles can be uploaded to the device. In addition, one or more suitable certificates must be available to verify the signature of the configuration profile. Configuration profiles with settings that are actually identical may differ slightly in size (bytes) due to technical reasons. This behavior occurs when certain entries, e.g., date information, comments, permissions or firmware versions differ when the profile is created/applied.
Configuration Profile Signing	Configuration profiles can be signed using certificates. On devices configured accordingly, it is then only possible to upload configuration profiles to the device that have been signed with valid certificates. The system does not check whether the expiration date of a certificate has been exceeded or whether a used certificate has been withdrawn ("CRL" check). If no self-signed certificate is used to sign the profile, all intermediate certificates must also be installed as CA certificates on the mGuard device in addition to the corresponding root CA certificate (see Section 6.4.3). All necessary CA certificates must therefore be made available in order to form a *chain of trust* with the presented certificate (see also "CA certificates"). To sign configuration profiles manually, see document 111259_en_xx (AH EN MGUARD MIGRATE 10), available at phoenixcontact.com/product/1357875.	

Management >> Configuration Profiles [...]

Enable signed configuration profiles

If this function is activated,

– configurations that are saved as a configuration profile (**atv file**) or on an External Configuration Storage (**ECS**) are signed using an X.509 certificate,

– only signed configurations can be uploaded to the device.

The corresponding certificates must be uploaded to the mGuard device before the function is used (see section 6.4).

A machine certificate must be used to sign a configuration (see Section 6.4.2).

Either the same machine certificate or one or more CA certificates can be used to check an uploaded configuration.

If CA certificates are used, the machine certificate with which the configuration was signed must have been signed with the CA certificate and thus form a *chain of trust* with it (see Section 6.4.3 and "CA certificates").

If this function is deactivated, it is possible to upload unsigned and signed configurations without their signature being checked. This means that it is still possible to use unsigned configuration profiles on the device.

Export certificate (machine certificate used to sign configuration profiles)

None / <machine certificate>

The configuration is signed using a machine certificate.

The certificate(s) must first be uploaded to the mGuard device so that they can be selected in the drop-down list (see Section 6.4.2).

Import certificate (certificate used to validate signature of configuration profiles)

None / All installed CA certificates / <machine certificate> / <CA certificate>

The authenticity of the uploaded configuration is validated using a machine certificate or a CA certificate.

Machine certificate: The same machine certificate that has been used to sign the configuration must be selected for the validation.

CA certificate: At least one CA certificate that forms a *chain of trust* with the signing machine certificate must be selected for the verification. All installed CA certificates can also be selected.

The certificate(s) must first be uploaded to the mGuard device so that they can be selected in the drop-down list (see Section 6.4.2 and 6.4.3).

Management >> Configuration Profiles [...]

External Configuration Storage (ECS)

Configuration profiles stored on the mGuard can be exported to an SD card serving as an external configuration storage (ECS) from where they can be imported onto mGuard devices again.

Name of the exported file: *ECS.tgz*

Technical requirements of SD cards:

– FAT file system on the first partition

SD cards certified and approved by Phoenix Contact: see section „Accessories“ on the product pages at phoenixcontact.net/products

To import the file onto an mGuard device, the SD card must be inserted into the mGuard.

The configuration can be:

– Automatically loaded, decrypted, and used as the active configuration when the device is started
– Loaded and activated via the web interface

The configuration on the external storage medium also contains the encrypted passwords (hashed) for the users *root*, *admin*, *netadmin, update*, *audit*, and *user*, as well as for the SNMPv3 user. These passwords are also loaded when loading from an external storage medium.

State of the ECS

The current state is updated dynamically. (See "State of the ECS" in “Event table” on page 78).

Save current configuration on the ECS

When replacing the original device with a replacement device, the configuration profile of the original device can be applied using the ECS. To do so, the replacement device must still use “root” as the password for the “root” user.

If the root password on the replacement device is not “root”, this password must be entered in the **“Root password”** field. Click on the **Save** button to apply the entry.

Complex configurations, e.g. with a huge number of configured firewall rules and/or VPN connections, can lead to large configuration profiles.

If the function "Enable signed configuration profiles" is activated, the configuration on the ECS is signed with the selected machine certificate.

Load configuration from the ECS

If there is a configuration profile on an inserted or connected ECS storage medium, clicking on the **“Load”** button imports it to the mGuard where it is enabled as the active profile.

The loaded configuration profile does not appear in the list of configuration profiles stored on the mGuard.

If the function "Enable signed configuration profiles" is activated, the configuration on the ECS is signed with the selected machine certificate.

Management >> Configuration Profiles [...]

Automatically save configuration changes to the ECS

When the function is activated, the configuration changes are automatically saved to the ECS, i.e., the ECS always stores the profile currently used.

NOTE: Do not save any further configuration changes if storing the last configuration change on the ECS has not yet been successfully completed.

Further configuration changes that are made and applied during the current storage process will not be automatically saved on the ECS.

They may be lost if an "old" configuration is loaded from the ECS when booting the device.

The mGuard only uses the automatically stored configuration profiles on startup if the original password (“root”) is still set on the mGuard for the “root” user.

If the function "Enable signed configuration profiles" is activated, the configuration on the ECS is automatically signed with the selected machine certificate.

Only configurations that have been signed with a valid certificate can then be loaded from the ECS.

Configuration changes are made even if the ECS is disconnected, full or defective. The corresponding error messages are displayed in the Logging menu (see “Logging >> Browse Local Logs” on page 366).

Activation of the new setting extends the response time of the user interface when changing any settings.

Encrypt the data on the ECS

When the function is activated, the configuration changes are encrypted and stored on an ECS. This makes mGuard rollout easier.

You can save several mGuard configurations on an SD card and then use it to start up all mGuards. During the startup process, the mGuard finds the relevant valid configuration on the configuration storage. This is loaded, decrypted, and used as the valid configuration.

Management >> Configuration Profiles [...]		
	Load configuration from the ECS during boot	When the function is activated, the ECS is accessed when booting the mGuard. The configuration profile is loaded from the ECS onto the mGuard, decrypted if necessary, and used as the valid configuration. If the function "Enable signed configuration profiles" is activated, the configuration on the ECS is signed with the selected machine certificate. The loaded configuration profile does not automatically appear in the list of configuration profiles stored on the mGuard.

4.6 Management >> SNMP

The mGuard must not be simultaneously configured via web access, shell access or SNMP. Simultaneous configuration via the different access methods might lead to unexpected results.

Unlike the SNMPv3 protocol, the older versions SNMPv1/SNMPv2 do not use authentication or encryption, and are therefore not considered to be secure.
The SNMPv1/2 protocol should only be used in a secure network environment that is entirely under the control of the operator.
SNMPv3 is not supported by all management consoles, however.

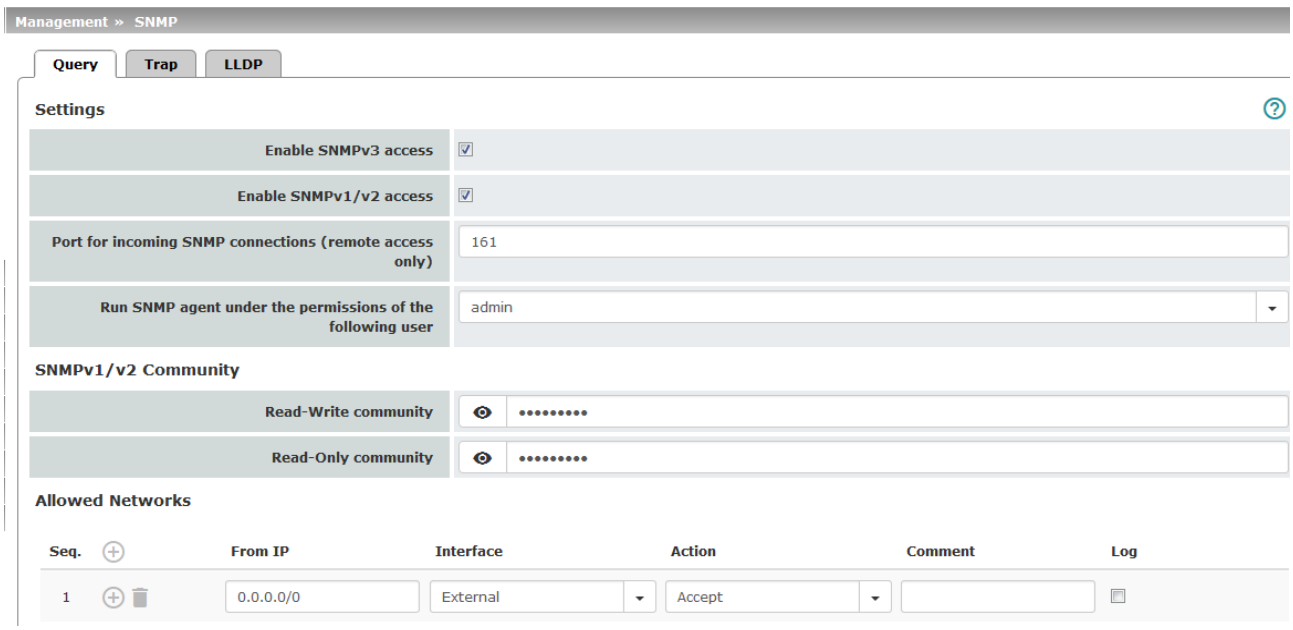
The Simple Network Management Protocol (SNMP) is primarily used in more complex networks to monitor or configure the state and operation of devices.

It is also possible to execute *Actions* on the mGuard using the SNMP protocol. Documentation of the actions that can be executed is available via the corresponding MIB file.

MIB file

To configure, monitor or control the mGuard via an SNMP client using the SNMP protocol, the corresponding MIB file must be imported into the SNMP client. MIB files are provided in a ZIP file together with the firmware or firmware updates. They can be downloaded from the manufacturer's website via the corresponding product pages: phoenixcontact.net/products.

4.6.1 Query



Processing an SNMP request may take more than one second. However, this value corresponds to the default timeout value of some SNMP management applications.

- If you experience timeout problems, set the timeout value of your management application to values between 3 and 5 seconds.

Management >> SNMP >> Query		
Settings	**Enable SNMPv3 access**	Activate the function if you wish to allow monitoring of the mGuard via SNMPv3. Following activation of the function, access is possible via *Internal* and *VPN*. The firewall rules for the available interfaces must be defined on this page under **Allowed Networks** in order to specify differentiated access and monitoring options on the mGuard. Access via SNMPv3 requires authentication with a user name and password. The default setting for the access data is as follows: **User name**: admin **Password**: SnmpAdmin (It is case-sensitive.) The SNMPv3 access data **user name** and **password** can be changed via the web interface, an ECS configuration, or a rollout script. Administration of SNMPv3 users via SNMPv3 USM is not possible. The changed user name and password can be saved on an **ECS** and restored from there. If the current configuration is saved in an **ATV configuration profile**, only the SNMPv3 user name and **not** the password is saved in the configuration profile. Archiving the profile does not change the SNMPv3s password currently on the mGuard. The addition of further SNMPv3 users is not currently supported. For newly created SNMP users, only the algorithms SHA1 and AES are supported and no longer MD5 and DES.
	Enable SNMPv1/v2 access	Activate the function if you wish to allow monitoring of the mGuard via SNMPv1/v2. You must also enter the login data under **SNMPv1/v2 Community**. Following activation of the function, access is possible via *Internal* and *VPN*. The firewall rules for the available interfaces must be defined on this page under **Allowed Networks** in order to specify differentiated access and monitoring options on the mGuard.

Management >> SNMP >> Query [...]		
	Port for incoming SNMP connections	Default: 161 If this port number is changed, the new port number only applies for access via the *External, DMZ,* and *VPN* interface. Port number 161 still applies for internal access. In Stealth mode, incoming traffic on the port specified is no longer forwarded to the client. In Router mode with NAT or port forwarding, the port number set here has priority over the rules for port forwarding. The remote peer that implements remote access may have to specify the port number defined here when entering the address.
	Run SNMP agent under the permissions of the following user	**admin / netadmin** Specifies which permissions are used to run the SNMP agent.
SNMPv3 access data	**User name**	Changes the currently assigned SNMPv3 user name.
	Password	Changes the currently assigned SNMPv3 password. The password can only be written but not read out (*write only*). The changed user name and password can be saved in an **ECS file** and restored from there. If the current configuration is saved in an **ATV configuration profile**, only the SNMPv3 user name, and **not** the password is taken on in the configuration profile. Archiving the profile does not change the SNMPv3s password currently on the mGuard.
SNMPv1/v2 Community	**Read-Write community**	Enter the required login data in this field.
	Read-Only community	Enter the required login data in this field.

Management >> SNMP >> Query [...]

Allowed Networks

Lists the firewall rules that have been set up. These apply for incoming data packets of an SNMP access attempt.

NOTE: The device may be accessible via external networks.
Depending on the settings, the services of the device may be accessible via external networks or the internet. Make sure that access is only possible if it is desired. Otherwise, configure your network accordingly to prevent such access.

If no rules are set or if no rule applies, the following default settings apply:

– SNMP access via *Internal* and *VPN* is permitted.
– SNMP access via *External* and *DMZ* is denied.

Specify the monitoring options according to your requirements.

NOTE: If you want to deny access via *Internal or VPN*, you must implement this explicitly by means of corresponding firewall rules, for example, by specifying *Drop* as the action.

The rules specified here only take effect if the **Enable SNMPv3 access** or **Enable SNMPv1/v2 access** function is activated.

If multiple firewall rules are defined, these are queried starting from the top of the list of entries until an appropriate rule is found. This rule is then applied. If the list of rules contains further subsequent rules that could also apply, these rules are ignored.

From IP

Enter the address of the computer or network from which access is permitted or forbidden in this field.

The following options are available:

– An IP address.
– To specify an address area, use CIDR format (see “CIDR (Classless Inter-Domain Routing)” on page 49).
– **0.0.0.0/0** means all addresses.

Interface

Internal / External / DMZ / VPN

Specifies to which interface the rule should apply.

If no rules are set or if no rule applies, the following default settings apply:

– SNMP access via *Internal* and *VPN* is permitted.
– SNMP access via *External* and *DMZ* is denied.

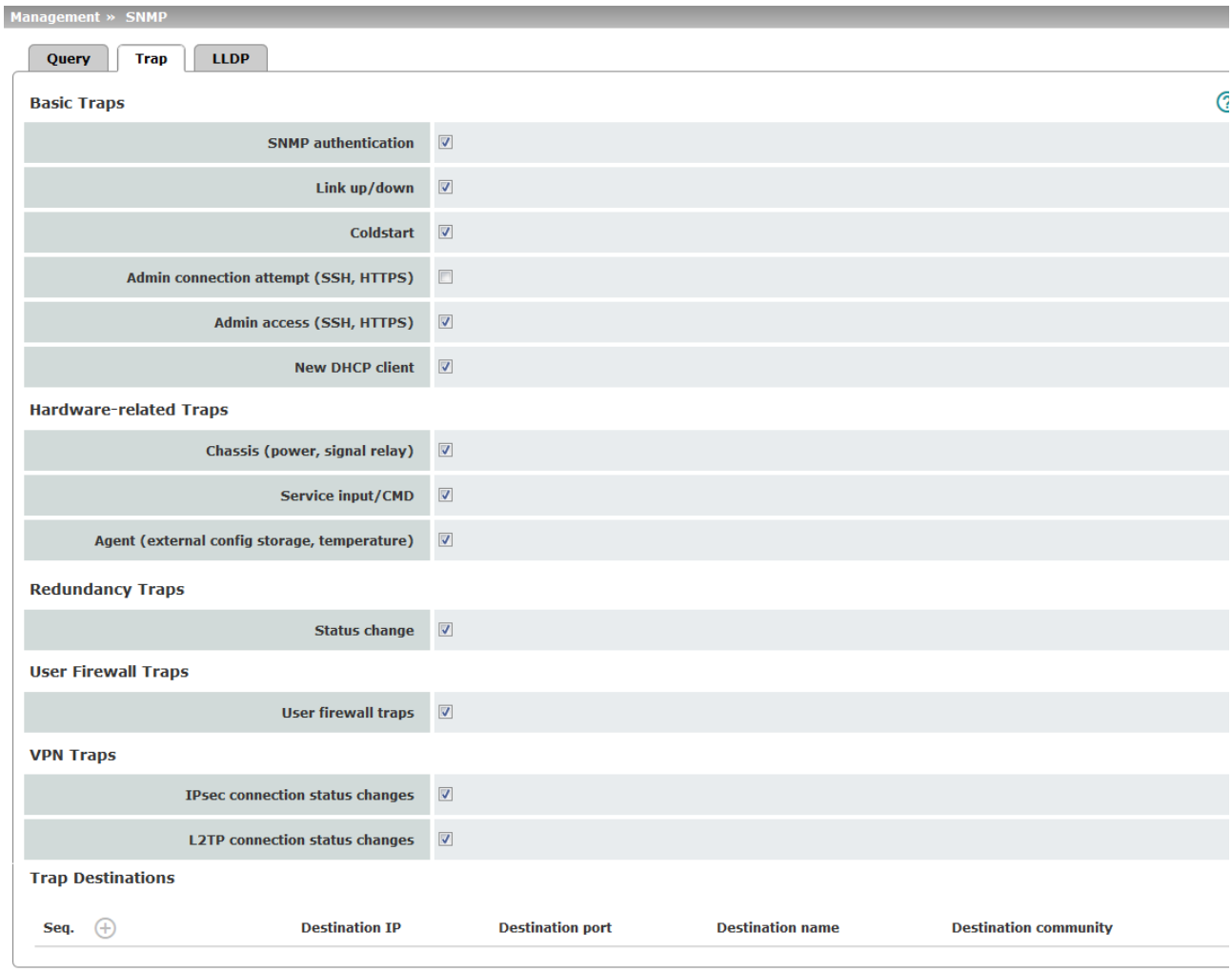
Specify the monitoring options according to your requirements.

NOTE: If you want to deny access via *Internal* or *VPN*, you must implement this explicitly by means of corresponding firewall rules, for example, by specifying *Drop* as the action.

Management >> SNMP >> Query [...]

Action	**Accept** means that the data packets may pass through. **Reject** means that the data packets are sent back and the sender is informed of their rejection. (In *Stealth* mode, *Reject* has the same effect as *Drop*.) **Drop** means that the data packets are not permitted to pass through. They are discarded, which means that the sender is not informed of their whereabouts.
Comment	Freely selectable comment for this rule.
Log	For each individual firewall rule, you can specify whether the use of the rule: – Should be logged – activate *Log* function – Should not be logged – deactivate *Log* function (default) Log message (example): 2024-11-25_10:09:51.83909 firewall: fw-snmp-access-1-12e7d62f-6be7-1c6e-b8a6-000cbe00105c act=REJECT IN=eth0 MAC=d4:aa:62:b2:6d:62 SRC=192.168.1.55 DST=192.168.1.55 LEN=52 TOS=0x00 PREC=0x00 TTL=128 ID=47714 DF PROTO=TCP SPT=53379 DPT=22 SEQ=506303301 ACK=0 WINDOW=64240 SYN URGP=0 CTMARK=100030

4.6.2 Trap



In certain cases, the mGuard can send SNMP traps. SNMP traps are only sent if the SNMP request is activated.

The traps correspond to SNMPv1. The trap information for each setting is listed below. A more detailed description can be found in the MIB that belongs to the mGuard.

If SNMP traps are sent to the peer via a VPN tunnel, the IP address of the peer must be located in the network that is specified as the **Remote** network in the definition of the VPN connection.

The internal IP address must be located in the network that is specified as **Local** in the definition of the VPN connection (see "IPsec VPN >> Connections >> Edit >> General").

– If the "IPsec VPN >> Connections >> Edit >> General", **Local** option is set to **1:1 NAT** (see page 285), the following applies:

  The internal IP address must be located in the specified local network.

– If the "IPsec VPN >> Connections >> Edit >> General", **Remote** option is set to **1:1 NAT** (see page 287), the following applies:

The IP address of the remote log server must be located in the network that is specified as **Remote** in the definition of the VPN connection.

Management >> SNMP >> Trap		
Basic Traps	**SNMP authentication**	**Trap description** – enterprise-oid : mGuardInfo – generic-trap : authenticationFailure – specific-trap : 0 Sent if an unauthorized station attempts to access the mGuard SNMP agent.
	Link up/down	**Trap description** – enterprise-oid : mGuardInfo – generic-trap : linkUp, linkDown – specific-trap : 0 Sent when the connection to a port is interrupted (linkDown) or restored (linkUp).
	Cold restart	**Trap description** – enterprise-oid : mGuardInfo – generic-trap : coldStart – specific-trap : 0 Is sent after a cold restart or warm start.
	Admin connection attempt (SSH, HTTPS)	Trap description – enterprise-oid : mGuard – generic-trap : enterpriseSpecific – specific-trap : mGuardHTTPSLoginTrap (1) – additional : mGuardHTTPSLastAccessIP Is sent if someone has tried successfully or unsuccessfully (e.g., using an incorrect password) to open an HTTPS session. The trap contains the IP address from which the attempt was issued. – enterprise-oid : mGuard – generic-trap : enterpriseSpecific – specific-trap : mGuardShellLoginTrap (2) – additional : mGuardShellLastAccessIP Is sent when someone opens the shell via SSH interface. The trap contains the IP address of the login request.
	Admin access (SSH, HTTPS)	Trap description – enterprise-oid : mGuard – generic-trap : enterpriseSpecific – specific-trap : mGuardTrapSSHLogin – additional : mGuardTResSSHUsername mGuardTResSSHRemoteIP Is sent when someone accesses the mGuard via SSH.

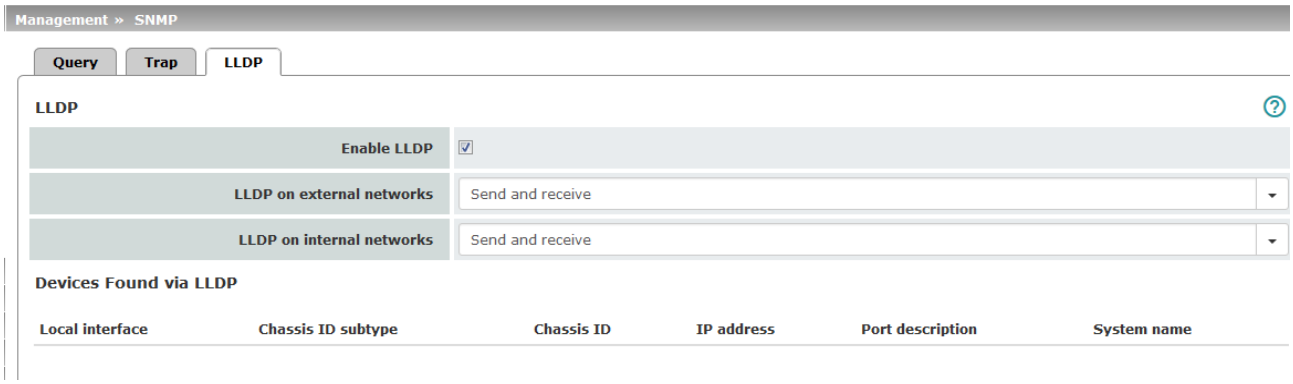
Management >> SNMP >> Trap [...]		
		– enterprise-oid : mGuard – generic-trap : enterpriseSpecific – specific-trap : mGuardTrapSSHLogout – additional : mGuardTResSSHUsername mGuardTResSSHRemoteIP Is sent when access to the mGuard via SSH is terminated.
	New DHCP client	Trap description – enterprise-oid : mGuard – generic-trap : enterpriseSpecific – specific-trap : 3 – additional : mGuardDHCPLastAccessMAC Is sent when a DHCP request is received from an unknown client.
Hardware-related Traps	**Chassis (power, signal relay)**	Trap description – enterprise-oid : mGuardTrapSenderIndustrial – generic-trap : enterpriseSpecific – specific-trap : mGuardTrapIndustrialPowerStatus (2) – additional : mGuardTrapIndustrialPowerStatus Sent when the system registers a power failure. – enterprise-oid : mGuardTrapSenderIndustrial – generic-trap : enterpriseSpecific – specific-trap : mGuardTrapSignalRelais (3) – additional : mGuardTResSignalRelaisState (mGuardTEsSignlalRelaisReason, mGuardTResSignal RelaisReasonIdx) Sent after the signal contact is changed and indicates the current status (0 = Off, 1 = On).
	Service input/CMD (Alternative designation for service input: „I“)	Trap description – enterprise-oid : mGuardTrapCMD – generic-trap : enterpriseSpecific – specific-trap : mGuardTrapCMDStateChange (1) – additional : mGuardCMDState Is sent if a service input/CMD is switched by a switch or button. A trap is sent during every switching procedure.

Management >> SNMP >> Trap [...]		
	Agent (external config storage, temperature)	Trap description – enterprise-oid : mGuardTrapIndustrial – generic-trap : enterpriseSpecific – specific-trap : mGuardTrapIndustrialTemperature (1) – additional : mGuardSystemTemperature, mGuardTrapIndustrialTempHiLimit, mGuardTrapIndustrialLowLimit Indicates the temperature in the event of the temperature exceeding the specified limit values. – enterprise-oid : mGuardTrapIndustrial – genericTrap : enterpriseSpecific – specific-trap : mGuardTrapAutoConfigAdapterState (4) – additional : mGuardTrapAutoConfigAdapter Change Is sent after access to the ECS.
Userfirewall traps (Not part of the FL MGUARD 2000 series.)	**Userfirewall traps**	Trap description – enterprise-oid : mGuardTrapUserFirewall – generic-trap : enterpriseSpecific – specific-trap : mGuardTrapUserFirewallLogin (1) – additional : mGuardTResUserFirewallUsername, mGuardTResUserFirewallSrcIP, mGuardTResUserFirewallAuthenticationMethod Is sent when a user logs into the user firewall. – enterprise-oid : mGuardTrapUserFirewall – generic-trap : enterpriseSpecific – specific-trap : mGuardTrapUserFirewallLogout (2) – additional : mGuardTResUserFirewallUsername, mGuardTResUserFirewallSrcIP, mGuardTResUserFirewallLogoutReason Is sent when a user logs out of the user firewall. – enterprise-oid : mGuardTrapUserFirewall – generic-trap : enterpriseSpecific – specific-trap : mGuardTrapUserFirewallAuthError TRAP-TYPE (3) – additional : mGuardTResUserFirewallUsername, mGuardTResUserFirewallSrcIP, mGuardTResUserFirewallAuthenticationMethod Is sent in the event of an authentication error.

Management >> SNMP >> Trap [...]		
Redundancy Traps (Not for devices of the FL MGUARD 2000 series)	**Status change**	**Trap description** – enterprise-oid : mGuardTrapRouterRedundancy – generic-trap : enterpriseSpecific – specific-trap : mGuardTrapRouterRedBackupDown – additional : mGuardTResRedundacyBackup-Down This trap is sent when the backup device (secondary mGuard) cannot be reached by the master device (primary mGuard). (The trap will only be sent if ICMP checks are activated.) – enterprise-oid : mGuardTrapRouterRedundancy – generic-trap : enterpriseSpecific – specific-trap : mGuardTrapRRedundancyStatus-Change – additional : mGuardRRedStateSSV, mGuardRRedStateACSummary, mGuardRRedStateCCSummary, mGuardRRedStateStateRepSummary Is sent when the status of the HA cluster has changed.
VPN Traps	**IPsec connection status changes** (Not valid for IPsec VPN connections „IKEv2 beta“)	Trap description – enterprise-oid : mGuardTrapVPN – genericTrap : enterpriseSpecific – specific-trap : mGuardTrapVPNIKEServerStatus (1) – additional : mGuardTResVPNStatus Is sent when the IPsec IKE server is started or stopped. – enterprise-oid : mGuardTrapVPN – genericTrap : enterpriseSpecific – specific-trap : mGuardTrapVPNIPsecConnStatus (2) – additional : mGuardTResVPNName, mGuardTResVPNIndex, mGuardTResVPNPeer, mGuardTResVPNStatus, mGuardTResVPNType, mGuardTResVPNLocal, mGuardTResVPNRemote Is sent when the status of an IPsec connection changes. – enterprise-oid : mGuard – generic-trap : enterpriseSpecific – specific-trap : mGuardTrapVPNIPsecConnStatus Is sent when a connection is established or aborted. It is not sent when the mGuard is about to accept a connection request for this connection.

Management >> SNMP >> Trap [...]		
	L2TP connection status changes	Trap description – enterprise-oid : mGuardTrapVPN – genericTrap : enterpriseSpecific – specific-trap : mGuardTrapVPNL2TPConnStatus (3) – additional : mGuardTResVPNName, mGuardTResVPNIndex, mGuardTResVPNPeer, mGuardTResVPNStatus, mGuardTResVPNLocal, mGuardTResVPNRemote Is sent when the status of an L2TP connection changes.
Trap Destinations	Traps can be sent to multiple destinations.	
	Destination IP	IP address to which the trap should be sent.
	Destination port	Default: 162 Destination port to which the trap should be sent.
	Destination name	Optional name for the destination. Does not affect the generated traps.
	Destination community	Name of the SNMP community to which the trap is assigned.

4.6.3 LLDP



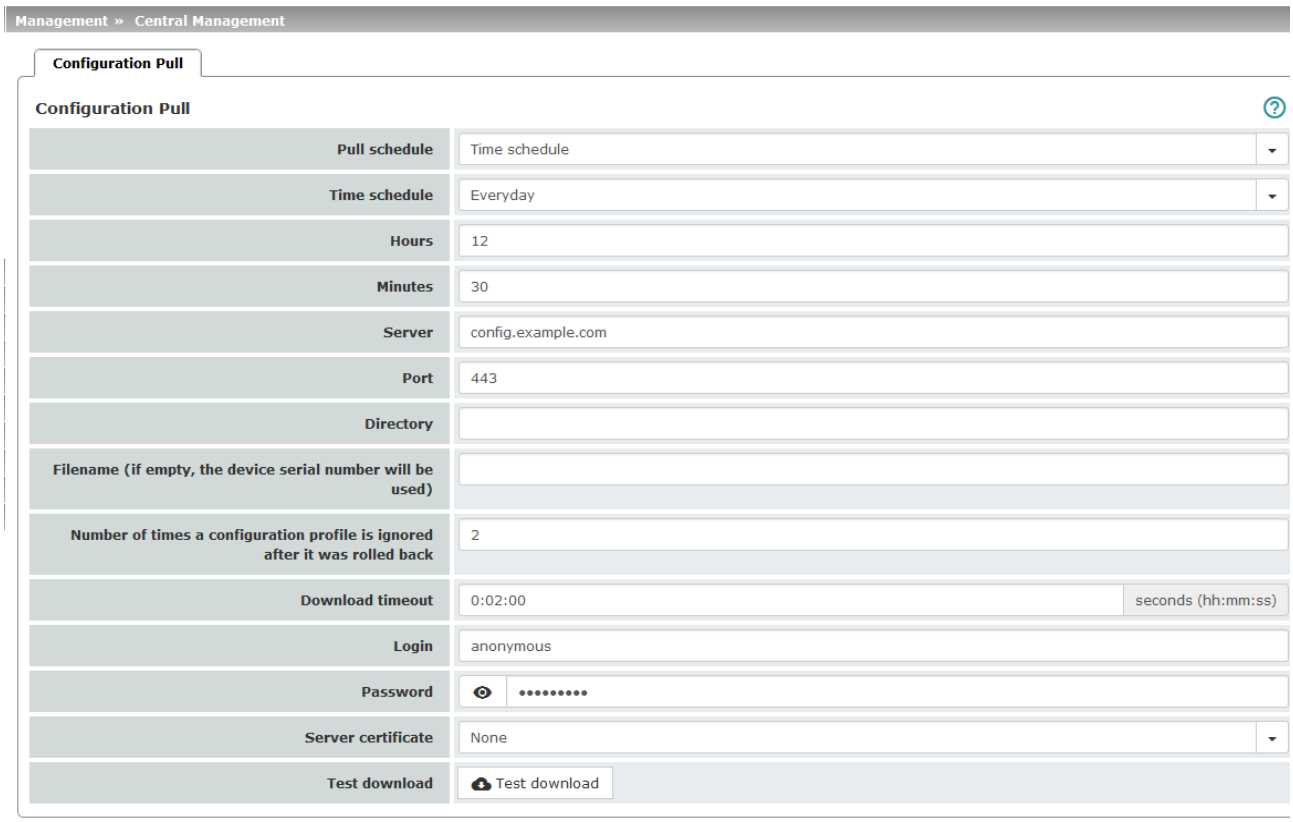
LLDP (Link Layer Discovery Protocol, IEEE 802.1AB/D13) uses suitable request methods to automatically obtain information about the network infrastructure. A system that uses LLDP can be configured so that it listens for or sends LLDP information. There are no requests for or responses to LLDP information.

As a transmitter, the mGuard periodically sends unsolicited multicasts to Ethernet level (Layer 2) in configured time intervals (typically ~30 s).

Management >> SNMP >> LLDP		
LLDP	**Enable LLDP**	The LLDP service or agent can be globally activated or deactivated here.
	LLDP on external networks	You can select whether the mGuard only **receives** or **sends and receives** LLDP information from external and/or internal networks.
	LLDP on internal networks	(See above)
Devices	**Devices Found via LLDP**	**Local interface** Local interface via which the device was found. **Chassis ID subtype** Unique chassis ID subtype of the computer found. **Chassis ID** A unique ID of the computer found; typically one of its MAC addresses. **IP address** IP address of the computer found. This can be used to perform administrative activities on the computer via SNMP. **Port description** A textual description of the network interface via which the computer was found. **System name** Host name of the computer found.

4.7 Management >> Central Management

4.7.1 Configuration Pull



The mGuard can retrieve new configuration profiles from an HTTPS server in adjustable time intervals, provided that the server makes them available to the mGuard as files (file extension: .atv). If the configuration provided differs from the current configuration of the mGuard, the available configuration is automatically downloaded and activated.

Management >> Central Management >> Configuration Pull		
Configuration Pull	**Schedule**	Here, specify whether (and if so, when and at what intervals) the mGuard should attempt to download and apply a new configuration from the server. To do this, open the selection list and select the desired value.  The following also applies for all time-based controls: the mGuard also attempts to download a new configuration from the server after every restart. When **Never** is selected, the mGuard makes no attempt to download a configuration from the server. When **Once at boot** is selected, the mGuard attempts to download a configuration from the server after every restart. When **Time schedule** is selected, a new field is shown below. In this field, specify whether the new configuration should be downloaded from the server daily or regularly on a certain weekday, and at what time. Time-controlled download of a new configuration is only possible if the system time has been synchronized (see "Management >> System Settings" on page 53, "Time and Date" on page 56). Time control sets the selected time based on the configured time zone. When **Every xx min/h** is selected, the mGuard attempts to download a configuration from the server at the specified time intervals.
	Server	IP address or host name of the server that provides the configurations.
	Port	Port via which the server can be accessed.
	Directory	The directory (folder) on the server where the configuration is located.
	File name	The name of the file in the directory defined above. If no file name is defined here, the serial number of the mGuard is used with file extension ".atv".
	Number of times a configuration profile is ignored after it was rolled back	Default: 2 After retrieving a new configuration, it is possible that the mGuard may no longer be accessible after applying the new configuration. It is then no longer possible to implement a new remote configuration to make corrections. In order to prevent this, the mGuard performs the following check:
	Procedure	
	As soon as the retrieved configuration is applied, the mGuard tries to connect to the configuration server again based on the new configuration. It then attempts to download the newly applied configuration profile again. If successful, the new configuration remains in effect.	

Management >> Central Management >> Configuration Pull [...]

If this check is unsuccessful for whatever reason, the mGuard assumes that the newly applied configuration profile is faulty. The mGuard remembers the MD5 total for identification purposes. The mGuard then performs a rollback.

Rollback means that the last (working) configuration is restored. This assumes that the new (non-functioning) configuration contains an instruction to perform a rollback if a newly loaded configuration profile is found to be faulty according to the checking procedure described above.

When the mGuard makes subsequent attempts to retrieve a new configuration profile periodically after the time defined in the **Pull schedule** field (and **Time schedule**) has elapsed, it will only accept the profile subject to the following selection criterion: the configuration profile provided **must differ** from the configuration profile previously identified as faulty for the mGuard and which resulted in the rollback.

(The mGuard checks the MD5 total stored for the old, faulty, and rejected configuration against the MD5 total of the new configuration profile offered.)

If this selection criterion is **met**, i.e., a newer configuration profile is offered, the mGuard retrieves this configuration profile, applies it, and checks it according to the procedure described above. It also disables the configuration profile by means of rollback if the check is unsuccessful.

If the selection criterion is **not met** (i.e., the same configuration profile is being offered), the selection criterion remains in force for all further cyclic requests for the period specified in the **Number of times...** field.

If the specified number of times elapses without a change of the configuration profile on the configuration server, the mGuard applies the unchanged new (“faulty”) configuration profile again, despite it being “faulty”. This is to rule out the possibility that external factors (e.g., network failure) may have resulted in the check being unsuccessful.

The mGuard then attempts to connect to the configuration server again based on the new configuration that has been reapplied. It then attempts to download the newly applied configuration profile again. If this is unsuccessful, another rollback is performed. The selection criterion is enforced again for the further cycles for loading a new configuration as often as is defined in the **Number of times...** field.

If the value in the **Number of times...** field is specified as **0**, the selection criterion (the offered configuration profile is ignored if it remains unchanged) will never be enforced. As a result, the second of the following objectives could then no longer be met.

This mechanism has the following objectives:

1. After applying a new configuration, it must be ensured that the mGuard can still be configured from a remote location.
2. When cycles are close together (e.g., **Pull schedule** = 15 minutes), the mGuard must be prevented from repeatedly testing a configuration profile that might be faulty at intervals that are too short. This can hinder or prevent external administrative access, as the mGuard might be too busy dealing with its own processes.
3. External factors (e.g., network failure) must be largely ruled out as a reason why the mGuard considers the new configuration to be faulty.

Management >> Central Management >> Configuration Pull [...]		
	Download timeout	Default: 2 minutes (00:02:00) Specifies the maximum timeout length (period of inactivity) when downloading the configuration file. The download is aborted if this time is exceeded. If and when a new download is attempted depends on the setting of Pull Schedule (see above). The entry can be in seconds [ss], minutes and seconds [mm:ss] or hours, minutes, and seconds [hh:mm:ss].
	Login	Login (user name) that the HTTPS server requests.
	Password	Password that the HTTPS server requests. The following special characters must **not** be used in the password: ' ` \ " $ [ ] ? * ; < > | & !
	Server certificate	The certificate that the mGuard uses to check the authenticity of the certificate “shown” by the configuration server. It prevents an incorrect configuration from an unauthorized server from being installed on the mGuard.

Management >> Central Management >> Configuration Pull [...]

The following may be specified here:

– A **self-signed certificate** of the configuration server or
– the **root certificate of the CA** (Certification Authority) that issued the server certificate (this applies if the configuration server's certificate is a certificate signed by a CA instead of a self-signed certificate) or
– the **All installed certificates** option must be selected.

The **All installed certificates** option should only be used if it is planned to replace the web server certificate of the configuration server.

The replacement of the server certificate on the configuration server also requires the replacement of the corresponding certificates on the mGuard field devices (using the configuration server).

As the certificates on the field devices are usually replaced at different times, it must be ensured for a limited period of time that the field devices can connect to the configuration server with both the old and the new certificate.

To do this, the required new certificates and the variable "**All installed certificates**" must be configured in the configuration offered on the configuration server. This configuration is downloaded from the field devices and applied.

Only after all mGuard field devices have either downloaded the new server certificate from the configuration server or installed it in another way (e.g. SSH upload or import via WBM), the old server certificate can be replaced with the new certificate on the configuration server.

The field devices should then be reassigned a configuration in which the new server certificate (self-signed or root certificate) is selected as the "Server certificate", as described above.

The **All installed certificates** setting should then no longer be used.

Management >> Central Management >> Configuration Pull [...]

If the stored configuration profiles also contain the private VPN key for the VPN connection(s) with PSK, the following conditions must be met:

– The password should consist of at least 30 random upper and lower case letters and numbers (to prevent unauthorized access).
– The HTTPS server should only grant access to the configuration of this individual mGuard using the login and password specified. Otherwise, users of other mGuard devices could access this individual device.

The IP address or the host name specified under Server must be the same as the server certificate's common name (CN).

Self-signed certificates should not use the “key-usage” extension.

To install a certificate, proceed as follows:

Requirement: the certificate file must be saved on the connected computer.

- Click on **Browse...** to select the file.
- Click on **Import**.

Download test

Click on the **Test download** button to test whether the specified parameters are correct without actually saving the modified parameters or activating the configuration profile.

The result of the test is displayed as a message at the top of the screen.

Ensure that the profile on the server does not contain unwanted variables starting with “GAI_PULL_”, as these overwrite the applied configuration.

4.8 Management >> Service I/O

The usage of firewall rule records is not possible on devices of the FL MGUARD 2000 series.

Service contacts (service I/Os) can be connected to several mGuard devices.

Connection of the service contacts is described in the user manual for the devices (see user manual UM EN HW FL MGUARD 2000/4000, available at phoenixcontact.com/product/1357828).

Input (I1–3 resp. CMD1–3) (COMBICON XG1)

You can select whether a push-button or an on/off switch has been connected to the inputs.

The following functions can be controlled or monitored via the service contact:

– VPN connections (IPsec VPN and OpenVPN)
– Firewall rule records
– User firewall
– User login (HTTPS, SSH)
  The user "user" as well as SNMP and firewall users are not affected.

In principle, one or more of the above functions can be switched via the corresponding switch/button (e.g. VPN connections/firewall rule records).

Both push-buttons and on/off switches are used

– to establish and terminate previously defined VPN connections,
– to activate/deactivate previously defined firewall rule sets.

The on/off switch is used exclusively

– to activate/deactivate the "User firewall" function,
– to activate/deactivate the user login via HTTPS/SSH.

It is possible to control several functions simultaneously.

The web interface (WBM) shows which functions are linked to the corresponding inputs.

Switching via push-button

- To switch on the selected functions (e. g. VPN connections/firewall rule records), press and hold the button for a few seconds and then release the button.
- To switch off the selected functions, press and hold the button for a few seconds and then release the button.

Switching via on/off switch

- To switch on the selected functions (e. g. user login, VPN connections/firewall rule records), set the switch to ON.
- To switch off the selected functions, set the switch to OFF.

Signal output (O1–2 resp. ACK1–2) (COMBICON XG2)

You can set whether to monitor specific VPN connections or firewall rule records.

A VPN connection or a firewall record can only be monitored via signal output O1/ACK1 if the Firewall Assistant is deactivated.

The PF3 (for O1) or PF4 (for O2) LEDs indicate whether the corresponding VPN connections have been established or the corresponding firewall rule records have been activated.

Alarm output (O3 resp. FAULT) (COMBICON XG2)

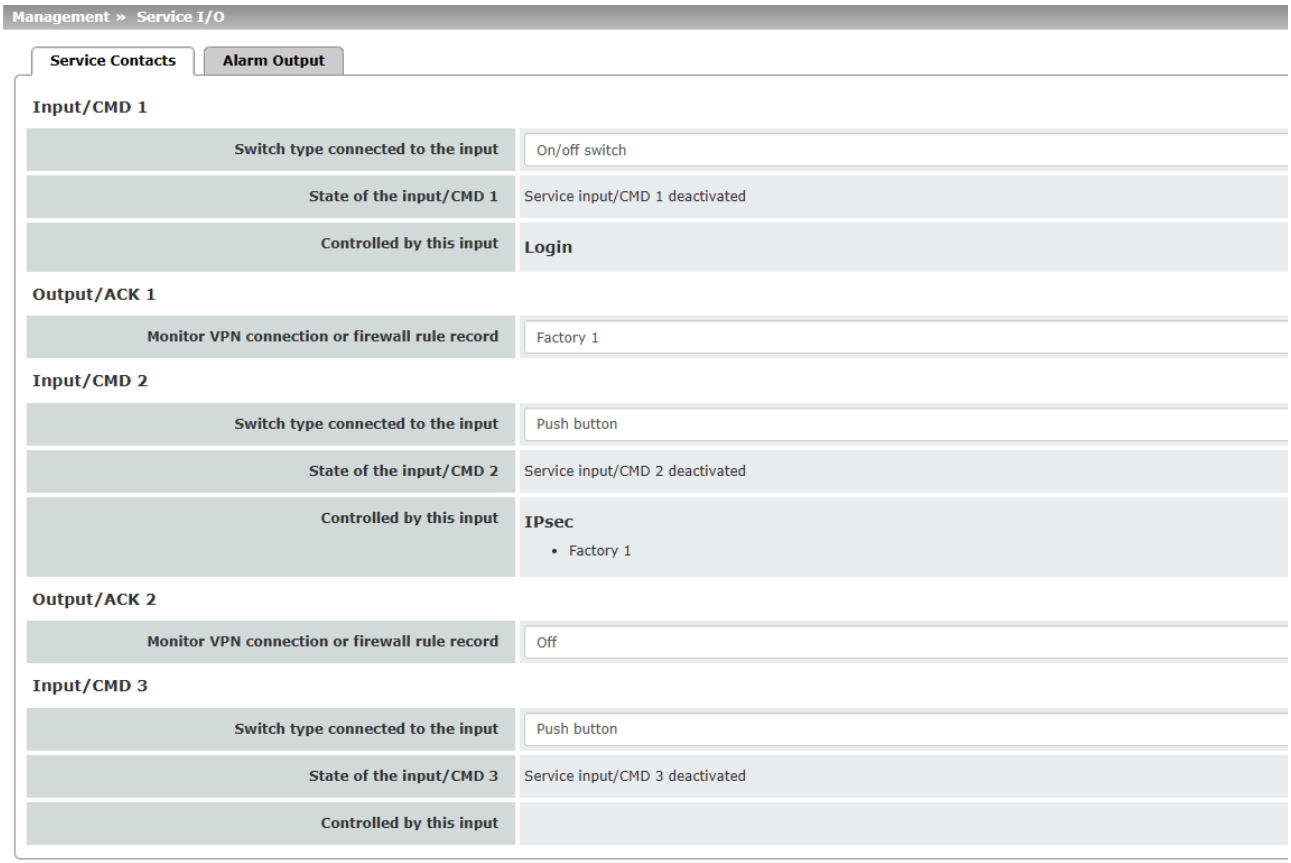
The alarm output O3 monitors the function of the mGuard and therefore enables remote diagnostics.

In case of DIN rail devices (but not in case of PCI cards), the LED FAIL lights up red if the alarm output changes to the low level due to an error (inverted control logic).

The following events can be reported by the O3 alarm output:

– Failure of the redundant power supply
– Unchanged administrator passwords (*admin/root*)
– Monitoring of the link status of the Ethernet connections
– Monitoring of the temperature state
– Monitoring of the connectivity state of redundancy

4.8.1 Service Contacts

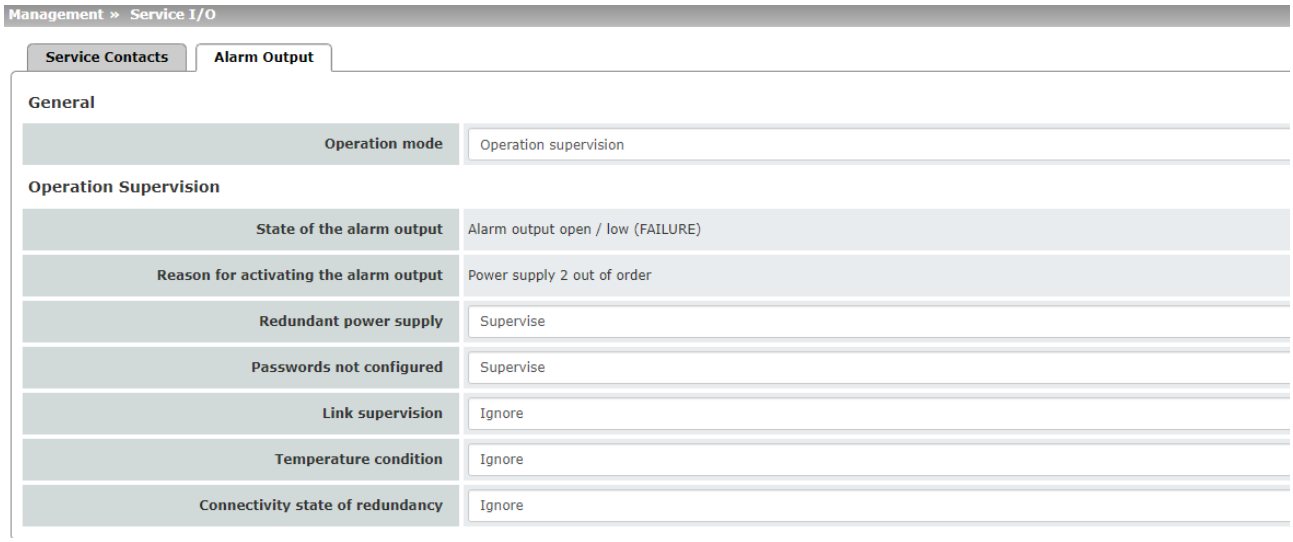


Management >> Service I/O >> Service Contacts

Input/CMD 1-3 (I1-3)	**Switch type connected to the input**	**Push-button / On/off switch** Select the type of switch connected.
	State of the input/CMD 1-3 (I1-3)	Displays the status of the corresponding input (service contact). Whether a function or which function is switched via the input is not displayed at this point. If no button/switch is connected to the service contact, it is considered deactivated.

Management >> Service I/O >> Service Contacts[...]		
	Controlled by this input	The mGuard has connections to which external push-buttons or an on/off switch can be connected. The push-button or on/off switch can be used – to start or stop configured VPN connections, – to activate or deactivate configured firewall rule records. Only the on/off switch can be used – to activate (permitted) or deactivate (prohibited) the login of users via the HTTPS and SSH interfaces. The user "user" as well as SNMP and firewall users are not affected. – To activate/deactivate the user firewall. The events that are controlled by the respective input can be configured here: 1. **IPsec VPN:** *"IPsec VPN >> Connections >> Edit >> General"* 2. **IPsec VPN:** *"IPsec VPN >> Connections IKEv2 (beta) >> Edit >> General"* 3. **OpenVPN:** *"OpenVPN Client >> Connections >> Edit >> General"* 4. **Firewall rule record:** *"Network Security >> Packet Filter >> Rule Records"* 5. **User firewall:** *"Authentication >> Firewall Users >> Firewall Users"* 6. **Login:** *"Management >> System Settings >> Host"*
Output/ACK 1-2 (O1-2)	**Monitor VPN connection or firewall rule record**	**Off / VPN connection / Firewall rule record** The mGuard has connections to which actuators (e.g. a signal lamp) can be connected. The state of the selected VPN connection or the selected firewall rule record is indicated via the associated signal contact (ACK output / O1-2).

4.8.2 Alarm Output



Management >> Service I/O >> Alarm Output		
General	**Operating mode**	**Operation supervision / Manual setting** The alarm output can be controlled automatically using **Operation supervision** (default) or **Manual setting**.
	Manual setting	**Closed / Open (Alarm)** The desired state of the alarm output (for operation supervision!) can be selected here: Please note: If the state is manually set to **Open (Alarm)**, the FAIL LED does not light up red (no alarm).
Operation Supervision (In case of FL MGUARD 4102 PCI(E), the status of the alarm output is not signaled via the FAIL LED).	**State fo the alarm output**	Displays the state of the alarm output. In addition, a message is displayed in the WBM at the top of the screen. For DIN rail devices (but not for PCI cards), the status of the alarm output is also signaled via the FAIL LED.
	Reason for activating the alarm output	The reason for activating the alarm output is displayed.
	Redundant power supply (Only FL MGUARD 4000)	If set to **Ignore**, the state of the power supply does not influence the alarm output. If set to **Supervise**, the alarm output is opened if either of the two supply voltages fails.
	Passwords not configured	Monitors whether the default administrator passwords for the *root* and *admin* users have been changed. If set to **Ignore**, the unchanged default passwords do not influence the alarm output. If set to **Supervise**, the alarm output is opened if the default passwords have not been changed.

Management >> Service I/O >> Alarm Output [...]		
	Link supervision	Monitoring of the link status of the Ethernet connections. If set to **Ignore**, the link status of the Ethernet connections does not influence the alarm output. If set to **Supervise**, the alarm output is opened if one link does not indicate connectivity. Set the links to be monitored under *"MAU Settings"* in the *"Link supervision"* menu.
	Temperature condition	The alarm output indicates overtemperature and undertemperature. The permissible range is set under *"System temperature (°C)"* in the *"Management >> System Settings >> Host"* menu. If set to **Ignore**, the temperature does not influence the signal contact. If set to **Supervise**, the alarm output is opened if the temperature is not within the permissible range.
	Connectivity state of redundancy	Only if the Redundancy function is used (see Section 13). If set to **Ignore**, the connectivity check does not influence the alarm output. If set to **Supervise**, the alarm output is opened if the connectivity check fails. This is regardless of whether the mGuard is active or in standby mode.

4.9 Management >> Restart

4.9.1 Restart

Management >> Restart >> Reboot		
Reboot	**Reboot**	Click on the “**Reboot**” button to restart (reboot) the mGuard. The device requires approx. 30 seconds to restart. A restart has the same effect as a temporary interruption to the power supply. The mGuard is switched off and back on again. A restart is required in the event of an error. It may also be required after a software update.

5 Network menu

5.1 Network >> Interfaces

The mGuard has the following interfaces with external access:

Device	**Ethernet:** – internal: LAN (Ports: XF2-4 or XF2-5) – external: WAN (Port: XF1) – DMZ: DMZ (Port: XF5)
FL MGUARD 2102	**LAN: 1** **WAN: 1**
FL MGUARD 4302 (KX)	**LAN: 1** **WAN: 1**
FL MGUARD 2105	**LAN: 4** **WAN: 1**
FL MGUARD 4305 (KX)	**LAN: 3** **WAN: 1** **DMZ: 1**
FL MGUARD 4102 PCI(E)	**LAN: 1** **WAN: 1**

The LAN port is connected to a stand-alone computer or the local network (internal). The WAN port is used to connect to the external network.

Network ports (Migration mGuard 8 --> mGuard 10)

Table 5-1 Mapping table (Network ports after the migration)

mGuard 8	**mGuard 10**	**mGuard 8** (Intern mit eingebautem Switch)	**mGuard 10** (Intern mit eingebautem Switch)
FL MGUARD 2000/4000			
WAN	XF1	(n/a)	(n/a)
LAN1	XF2	swp2	swp0
FL MGUARD 2105/4305			
LAN2	XF3	swp0	swp1
LAN3	XF4	swp1	swp2
FL MGUARD 2105			
LAN4	XF5	swp3	swp3
FL MGUARD 4305			
DMZ	XF5	swp4	dmz0
Nicht bei FL MGUARD 2105/FL MGUARD 4305			
LAN5	(n/a)	swp4	(n/a)

Connecting the network interface

The mGuard platforms have DTE interfaces. Connect the mGuards to the DTE interface using an Ethernet crossover cable. Here auto MDIX is permanently switched on, so it does not matter if the auto negotiation parameter is disabled.

MAC addresses

The MAC address of the WAN interface determined by the manufacturer is indicated on the type label of the device. The other MAC addresses (LAN/DMZ [optional]) can be calculated as follows:

– **WAN interface**: see type label.
– **LAN interface**: MAC address of the WAN interface incremented by 1 (**WAN + 1**).
  Devices with integrated switch: all switch ports use the same MAC address.
– **DMZ interface**: MAC address of the WAN interface incremented by 4 (**WAN + 4**).

Example:

– WAN: 00:a0:45:eb:28:9d
– LAN: 00:a0:45:eb:28:9e
– DMZ: 00:a0:45:eb:28:a1

5.1.1 Overview of "Router" network mode

Devices of the new device generation are configured with the following default settings: **Network mode "Router", Router mode "DHCP"**.

If the mGuard is in *Router* mode, it acts as the gateway between various subnetworks and has both an external interface (WAN port) and an internal interface (LAN port) with at least one IP address.

WAN port

The mGuard is connected to the Internet or other “external” parts of the LAN via its WAN port.

LAN port

The mGuard is connected to a local network or a stand-alone computer via its LAN port.

As in the other modes, firewall and VPN security functions are available (depending on the device).

If the mGuard is operated in *Router* mode, it must be set as the default gateway on the locally connected computers.

This means that the IP address of the mGuard LAN port must be specified as the default gateway address on these computers.

NAT should be activated if the mGuard is operated in *Router* mode and establishes the connection to the Internet (see “Network >> NAT” on page 159).

Only then can the computers in the connected local network access the Internet via the mGuard. If NAT is not activated, it is possible that only VPN connections can be used.

There are two router modes:

– Static
– DHCP

Router Mode: Static

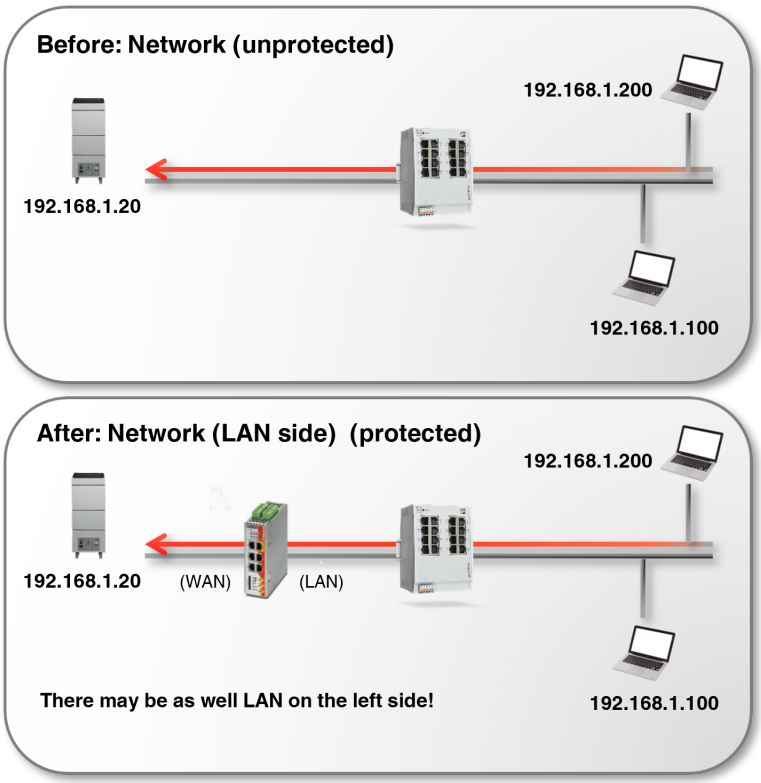
The external IP-settings are fixed.

Router Mode: DHCP

The external IP-settings are requested by the mGuard and assigned by an external DHCP server.

5.1.2 Overview of "Stealth" network mode

Stealth mode (Plug-n-Protect) is used to protect a stand-alone computer or a local network with the mGuard. Important: if the mGuard is in *Stealth* network mode, it is inserted into the existing network (see figure) without changing the existing network configuration of the connected devices.



The mGuard analyzes the network traffic and independently configures its network connection accordingly. It works transparently and therefore cannot be detected in the network without configured management IP address. Connected computers keep their network configuration and must not be reconfigured.

As in the other modes, firewall and VPN security functions are available (depending on the device).

In the factory default settings, network configurations that are sent from an external DHCP server are forwarded to the connected clients by the mGuard device.

In *Stealth* mode, the mGuard uses internal IP address 1.1.1.1. This can be accessed from the computer if the default gateway configured on the computer is accessible.

In the stealth configurations **"Autodetect"** and **"Static"** stealth configurations, a firewall installed on the computer must allow ICMP echo requests (ping) if the mGuard device is to provide services such as VPN, DNS, NTP, etc.

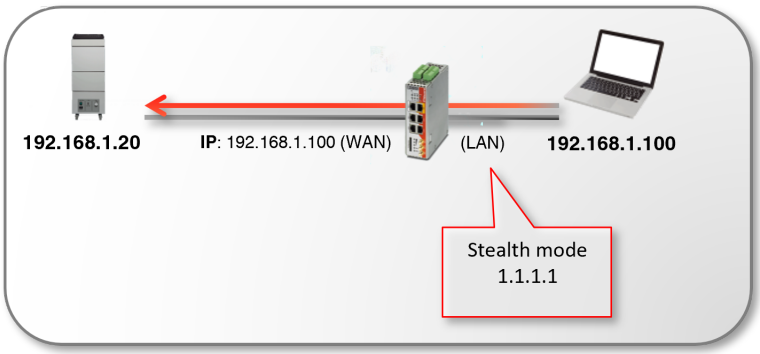
In the *Stealth* configurations **"Autodetect"** and **"Static"**, it is not possible to establish a VPN-connection originating from the internal client through the mGuard.

Stealth configurations

Autodetect

The mGuard analyzes the outgoing network traffic that passes through and configures its network connection accordingly. It operates transparently. No more than one network client to be protected may be connected to the internal LAN interface.

The mGuard receives its network configuration (IP address and MAC address) from the connected client (from the LAN network) when it generates data traffic through the mGuard for the first time. The mGuard continuously checks whether the client's IP has changed by analyzing the outgoing data packets.



If an IP address change is detected, the mGuard automatically adopts the new IP address and restarts the corresponding services.

Prerequisite:

The mGuard can be accessed from the locally connected network client (configuration computer) via the Stealth IP address 1.1.1.1 or via the configured management IP address (see below).

A default gateway must be configured on the network client.

To be able to use certain functions (e. g. „Automatic updates“ or establishing VPN connections), the mGuard device must also be able to make its own requests to external servers in stealth mode. However, these requests are only possible if the locally connected computer allows ping requests. Configure its security settings accordingly.

If a management IP is configured, the mGuard uses this IP as the sender address for connections that are initiated by the mGuard device itself (e.g. establishing a VPN connection or an online update). Network traffic originating from the connected client continues to receive the IP address of the client as the sender address.

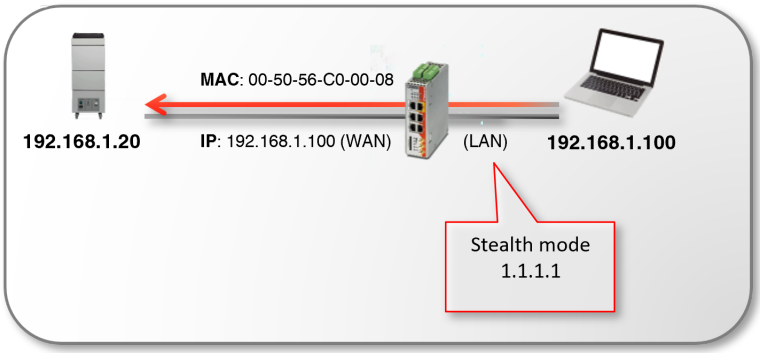
Static

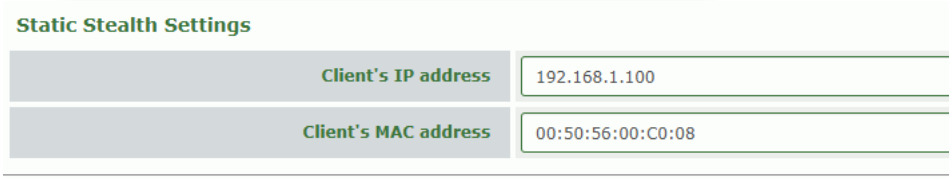
If the locally connected network client (LAN) does not generate any data traffic itself (e. g. server), no network traffic is routed through the mGuard. In this case the mGuard cannot adopt the network configuration from the connected client in the "Autodetect" stealth configuration.

The "Static" stealth configuration provides a remedy:

Even in this stealth configuration, no more than one network client to be protected may be connected to the internal LAN interface.

If the "Static" stealth configuration is selected, the "Client‘s IP address" and the "Client‘s MAC address" can be entered in configuration of the mGuard. This makes it possible for the client to be reached via the mGuard from the external network (WAN).





The mGuard can be accessed from the locally connected network client (configuration computer) via the Stealth IP address 1.1.1.1 or via the configured management IP address (see below).

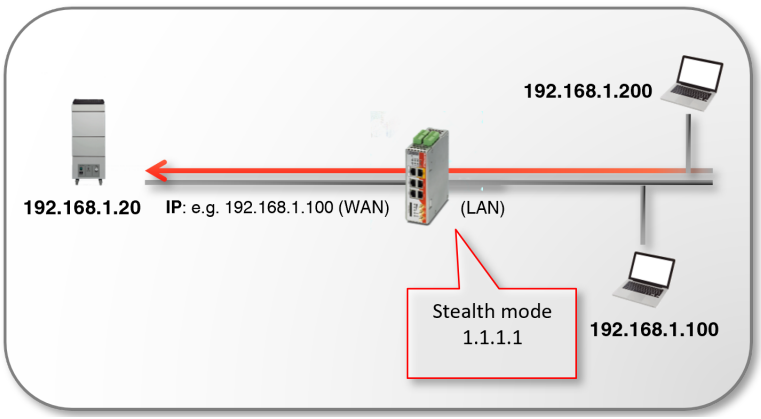
The IP address of the client must be configured. The mGuard will then automatically determine the MAC address of the client by sending an ARP request to the client.

If a management IP is configured, the mGuard uses this IP as the sender address for connections that are initiated by the mGuard device itself (e.g. establishing a VPN connection or an online update). Network traffic originating from the connected client continues to receive the IP address of the client as the sender address.

Multiple clients

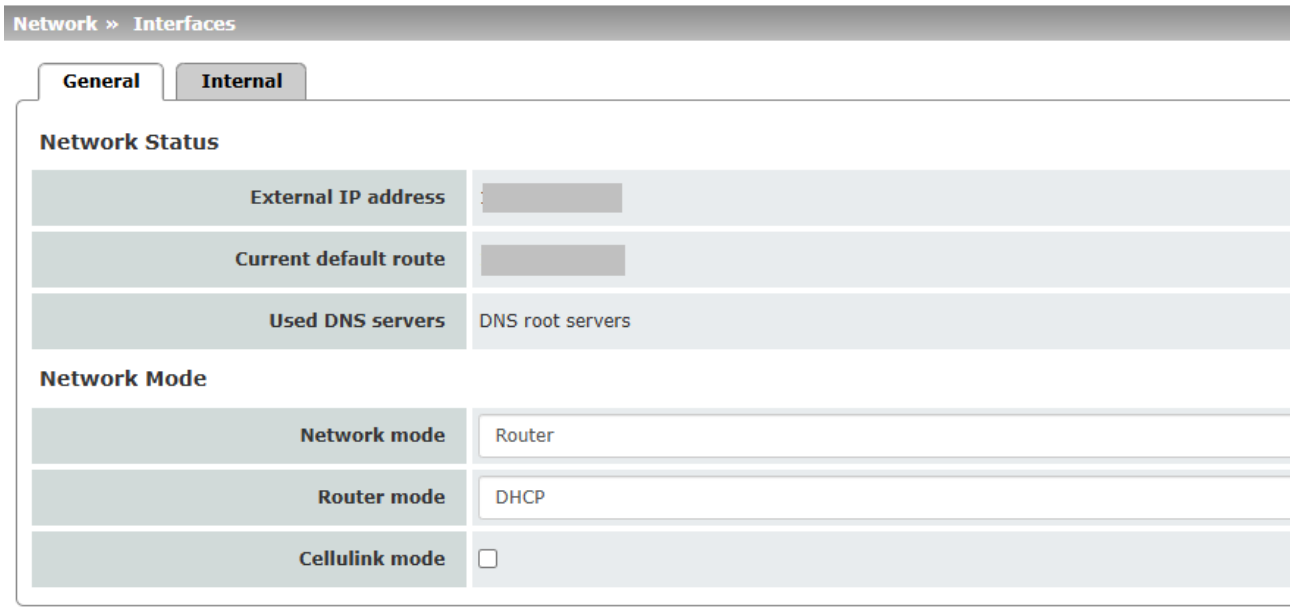
The "Multiple clients" stealth configuration is used to protect several connected clients without losing the advantage of the stealth function.

The "Multiple clients" stealth configuration works in the same way as the "Autodetect" stealth configuration. However, more than one computer can be connected to the LAN port (secure port) of the mGuard and therefore several IP addresses can be used on the LAN port.



For the further configuration of *Stealth* network mode, see “Stealth” on page 151.

5.1.3 General



Network >> Interfaces >> General		
Network Status	**External IP address**	Display only: the addresses via which the mGuard can be accessed by devices from the external network. They form the interface to other parts of the LAN or to the Internet. If the transition to the Internet takes place here, the IP addresses are usually assigned by the Internet service provider (ISP). If an IP address is assigned dynamically to the mGuard, the currently valid IP address can be found here. In *Stealth* mode, the mGuard adopts the address of the locally connected computer as its external IP.
	Current default route	Display only: the IP address that the mGuard uses to try to reach unknown networks is displayed here. If a default route has not been specified, the field is left empty.
	Used DNS servers	Display only: the names of the DNS servers used by the mGuard for name resolution are displayed here. This information can be useful, for example, if the mGuard is using the DNS servers assigned to it by the Internet service provider.

Network >> Interfaces >> General [...]		
	Cellulink connection	If the mGuard device is connected to the "CELLULINK" device via an interface, usually via its external WAN interface (XF1), and Cellulink mode is activated (see below), a hyperlink to the web-based management of the "CELLULINK" device is displayed. Clicking on the hyperlink opens the web-based management of the "CELLULINK" device, which can then be configured. To enable a connection to the "CELLULINK" device from the LAN network, the firewall and NAT rules of the mGuard device may need to be adapted.
Network mode	**Network mode**	**Router / Stealth** The mGuard must be set to the network mode that corresponds to its connection to the network. Depending on which network mode the mGuard is set to, the page will change together with its configuration parameters. See also: "Overview of "Router" network mode" on page 137 and "Overview of "Stealth" network mode" on page 138.
	Depending on the network mode selected and the mGuard device, different setting options are available on the web interface:	
	Router Mode (Only if "**Router**" network mode was selected)	**Static / DHCP** For a detailed description, see: – "Router Mode: Static" on page 137 – "Router Mode: DHCP" on page 137

Network >> Interfaces >> General [...]

Cellulink mode

(Only if network mode "**Router**" and router mode "**DHCP**" have been selected)

The mGuard device can use the "CELLULINK" device available from Phoenix Contact to establish a mobile data connection to other networks or the Internet (e.g. via the 4G network).

The mGuard device is usually connected to the "CELLULINK" device via its external WAN interface (XF1), which acts as the default gateway for the mGuard device.

If Cellulink mode is activated, a hyperlink to the web-based management of the "CELLULINK" device is displayed in the Network status area as "Cellulink connection" (see above).

Clicking on the hyperlink opens the web-based management of the "CELLULINK" device, which can then be configured.

To enable a connection to the "CELLULINK" device from the LAN network, the firewall and NAT rules of the mGuard device may need to be adapted.

Stealth configuration

(Only if "**Stealth**" network mode was selected)

Autodetect / Static / Multiple clients

Autodetect

The mGuard analyzes the network traffic and independently configures its network connection accordingly. It operates transparently.

For the use of certain functions (e.g. automatic updates, licence updates or establishment of VPN-connections), it is required that the mGuard makes its own requests of external servers, even in stealth mode.

These requests are only possible when the locally connected computer permits ping requests. Configure its security settings accordingly.

Static

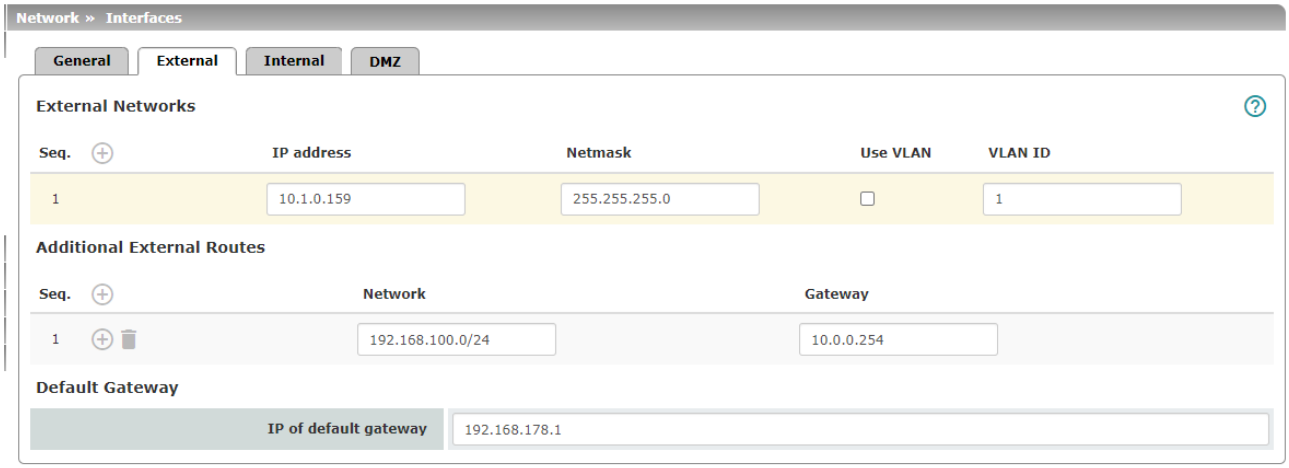
If the mGuard cannot analyze the network traffic, e.g., because the locally connected computer only receives data and does not send it, then ***Stealth configuration*** must be set to **Static**. In this case, further input fields are available for Static Stealth Configuration at the bottom of the page.

Multiple clients (default)

As with **Autodetect**, but it is possible to connect more than one computer to the LAN port (secure port) of the mGuard, meaning that multiple IP addresses can be used at the LAN port (secure port) of the mGuard.

Network >> Interfaces >> General [...]		
	Autodetect: ignore NetBIOS over TCP traffic on TCP port 139 (Only with **Autodetect** Stealth configuration)	If a Windows computer has more than one network card installed, it may alternate between the different IP addresses for the sender address in the data packets it sends. This applies to network packets that the computer sends to TCP port 139 (NetBIOS). As the mGuard determines the address of the computer from the sender address (and therefore the address via which the mGuard can be accessed), the mGuard would have to switch back and forth, and this would hinder operation considerably. To avoid this, activate the function if the mGuard has been connected to a computer that has these properties.

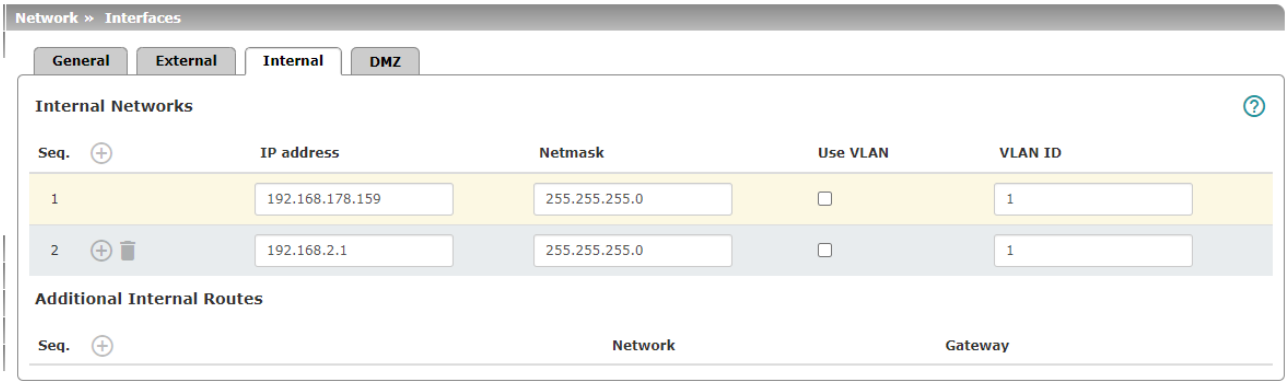
5.1.4 External



Network >> Interfaces >> External (network mode = "Router", router mode = "Static")		
External Networks	The addresses via which the mGuard can be accessed by external devices that are located behind the WAN port. If the transition to the Internet takes place here, the external IP address of the mGuard is assigned by the Internet service provider (ISP).	
	IP address	IP address via which the mGuard can be accessed via its WAN port.
	Netmask	The netmask of the network connected to the WAN port.
	Use VLAN	If the IP address should be within a VLAN, activate the function.
	VLAN ID	– A VLAN ID between 1 and 4095. – For an explanation of the term "VLAN", please refer to the glossary on page 398. – If you want to delete entries from the list, please note that the first entry cannot be deleted.
	OSPF area (Only if **OSPF** is activated)	Links the learned (DHCP) or configured (static) addresses/routes of the external network interface to an OSPF area (see "Network >> Dynamic Routing" on page 180).
Additional External Routes	In addition to the default route via the default gateway specified below, additional external routes can be specified.	
	Network	Specify the network in CIDR format (see "CIDR (Classless Inter-Domain Routing)" on page 49).
	Gateway	The gateway via which this network can be accessed. See also "Network example diagram" on page 50.

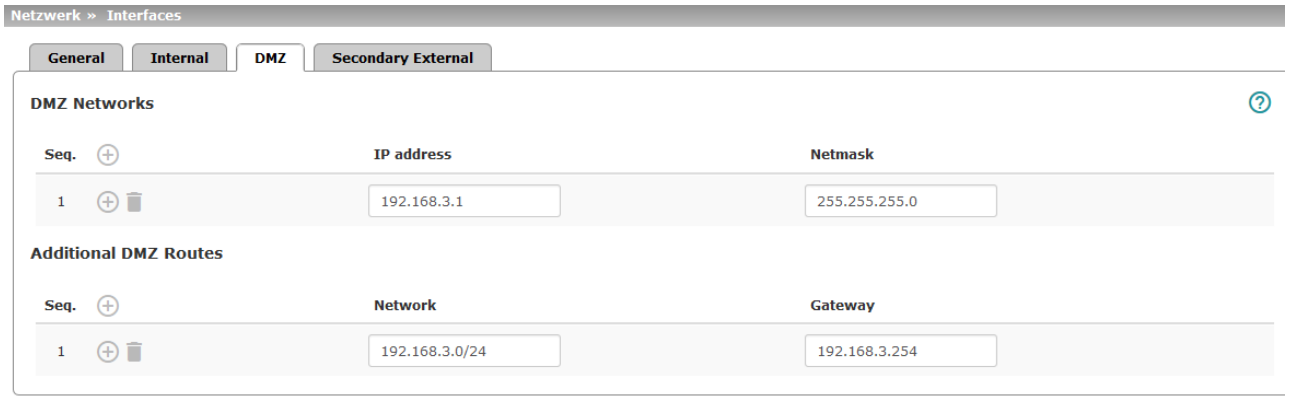
Network >> Interfaces >> External (network mode = "Router", router mode = "Static") [...]		
Default gateway	**IP of default gateway**	The IP address of a device in the local network (connected to the LAN port) or the IP address of a device in the external network (connected to the WAN port) can be specified here. If the mGuard is used within the LAN, the IP address of the default gateway is assigned by the network administrator. If the local network is not known to the external router, e.g., in the event of configuration via DHCP, specify your local network under “Network >> NAT” (see page 159).

5.1.5 Internal



Network >> Interfaces >> Internal (Network mode = "Router")		
Internal Networks	**IP address**	IP address under which the mGuard device shall be accessible from the locally connected network via its LAN port. The default settings in **Router** mode are as follows: – IP address: **192.168.1.1** – Netmask: **255.255.255.0** You can also specify other addresses via which the mGuard can be accessed by devices in the locally connected network. For example, this can be useful if the locally connected network is divided into subnetworks. Multiple devices in different subnetworks can then access the mGuard via different addresses.
	Netmask	The netmask of the network connected to the LAN port.
	Use VLAN	If the IP address should be within a VLAN, activate the function.
	VLAN ID	– A VLAN ID between 1 and 4095. – For an explanation of the term "VLAN", please refer to the glossary on page 398. – If you want to delete entries from the list, please note that the first entry cannot be deleted.
	OSPF area (Only if **OSPF** is activated)	Links the static addresses/routes of the internal network interface to an OSPF area (see "Network >> Dynamic Routing" on page 180).
Additional Internal Routes	Additional routes can be defined if further subnetworks are connected to the locally connected network.	
	Network	Specify the network in CIDR format (see "CIDR (Classless Inter-Domain Routing)" on page 49).
	Gateway	The gateway via which this network can be accessed. See also "Network example diagram" on page 50.

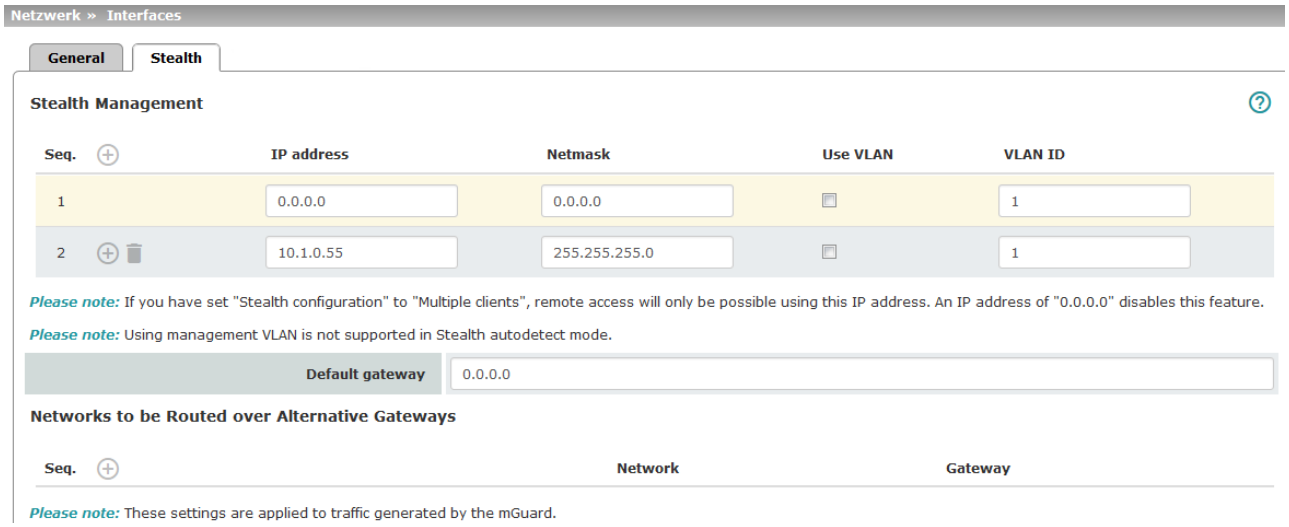
5.1.6 DMZ



Network >> Interfaces >> DMZ (Network mode = "Router")		
DMZ Networks (Only for FL MGUARD 4305)	**IP addresses**	IP address via which the mGuard can be accessed by devices in the network connected to the DMZ port. The DMZ port is only supported in router mode and requires at least one IP address and a corresponding subnet mask. The DMZ does not support any VLANs. In **"Router" network mode**, every newly added table line has default settings: – IP address: **192.168.3.1** – Netmask: **255.255.255.0** You can also specify other addresses via which the mGuard can be accessed by devices in the networks connected to the DMZ port. For example, this can be useful if the network connected to the DMZ port is divided into subnetworks. Multiple devices in different subnetworks can then access the mGuard via different addresses.
	IP address	IP address via which the mGuard can be accessed via its DMZ port. Default: 192.168.3.1
	Netmask	The netmask of the network connected to the DMZ port. Default: 255.255.255.0
	OSPF area (Only if **OSPF** is activated)	Links the static addresses/routes of the DMZ network interface to an OSPF area (see “Network >> Dynamic Routing” on page 180).
Additional DMZ Routes	Additional routes can be defined if further subnetworks are connected to the DMZ.	
	Network	Specify the network in CIDR format (see “CIDR (Classless Inter-Domain Routing)” on page 49). Default: 192.168.3.0/24

Network >> Interfaces >> DMZ (Network mode = "Router")[...]		
	Gateway	The gateway via which this network can be accessed. See also “Network example diagram” on page 50. Default: 192.168.3.254

5.1.7 Stealth



Network >> Interfaces >> Stealth (“Stealth” network mode)

Stealth Management

Additional Management IP addresses for the administration of the mGuard can be specified here.

If:

– The **Multiple clients** option is selected under *Stealth configuration*
– The client does not answer ARP requests
– No client is available

Remote access via HTTPS, SNMP, and SSH is **only** possible using this address.

With *static* Stealth configuration, the *Stealth Management IP Address* can always be accessed, even if the network card of the client PC has not been activated.

IP address

Management IP address via which the mGuard can be accessed and administered.

In Stealth mode "Autodetect" the following applies:

If a Management IP Address is assigned, the default gateway of the network in which the mGuard is located must be specified.

The IP address "0.0.0.0" deactivates the management IP address.

Change the management IP address first before specifying any additional addresses.

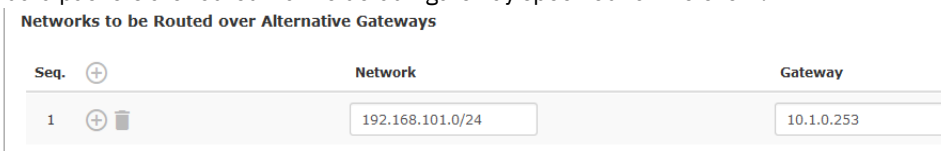
Netmask

The netmask of the IP address above.

Network >> Interfaces >> Stealth (“Stealth” network mode) [...]		
	Use VLAN	This option is valid only if you have set the „Stealth configuration“ option to „Multiple clients“. IP address and netmask of the VLAN port. If the IP address should be within a VLAN, activate the function.
	VLAN ID	This option only applies if you set the "Stealth configuration" option to "Multiple clients". – A VLAN ID between 1 and 4095. – An explanation can be found under “VLAN” on page 398. – If you want to delete entries from the list, please note that the first entry cannot be deleted. In Stealth mode “Multiple Clients“, the external DHCP server of the mGuard cannot be used if a VLAN ID is assigned as the management IP.
	Default gateway	The default gateway of the network where the mGuard is located. **In Stealth mode "Autodetect" the following applies:** If a Management IP Address is assigned, the default gateway of the network in which the mGuard is located must be specified.
Networks to be routed over alternative gateways	**Static routes**	In Stealth modes "Autodetect" and "Static", the mGuard adopts the default gateway of the computer connected to its LAN port. This does not apply if a management IP address is configured with the default gateway. Alternative routes can be specified for data packets destined for the WAN that have been created by the mGuard. These include for instance the packets from the following types of data traffic: – Download of certificate revocation lists (CRLs) – Download of a new configuration – Communication with an NTP server (for time synchronization) – Sending and receiving encrypted data packets from VPN connections – Requests to DNS servers – Log messages – Download of firmware updates – Download of configuration profiles from a central server (if configured) – SNMP traps

Network >> Interfaces >> Stealth (“Stealth” network mode) [...]

If this option is used, make the relevant entries afterwards. If it is not used, the affected data packets are routed via the default gateway specified for the client.



Network

Specify the network in CIDR format (see “CIDR (Classless Inter-Domain Routing)” on page 49).

Gateway

The gateway via which this network can be accessed.

The routes specified here are mandatory routes for data packets created by the mGuard. This setting has priority over other settings (see also “Network example diagram” on page 50).

Settings for Stealth mode (static)

(Only when "static" stealth configuration is selected)

Client‘s IP address

The IP address of the computer connected to the LAN port.

Client‘s MAC address

The physical address of the network card of the local computer to which the mGuard is connected.

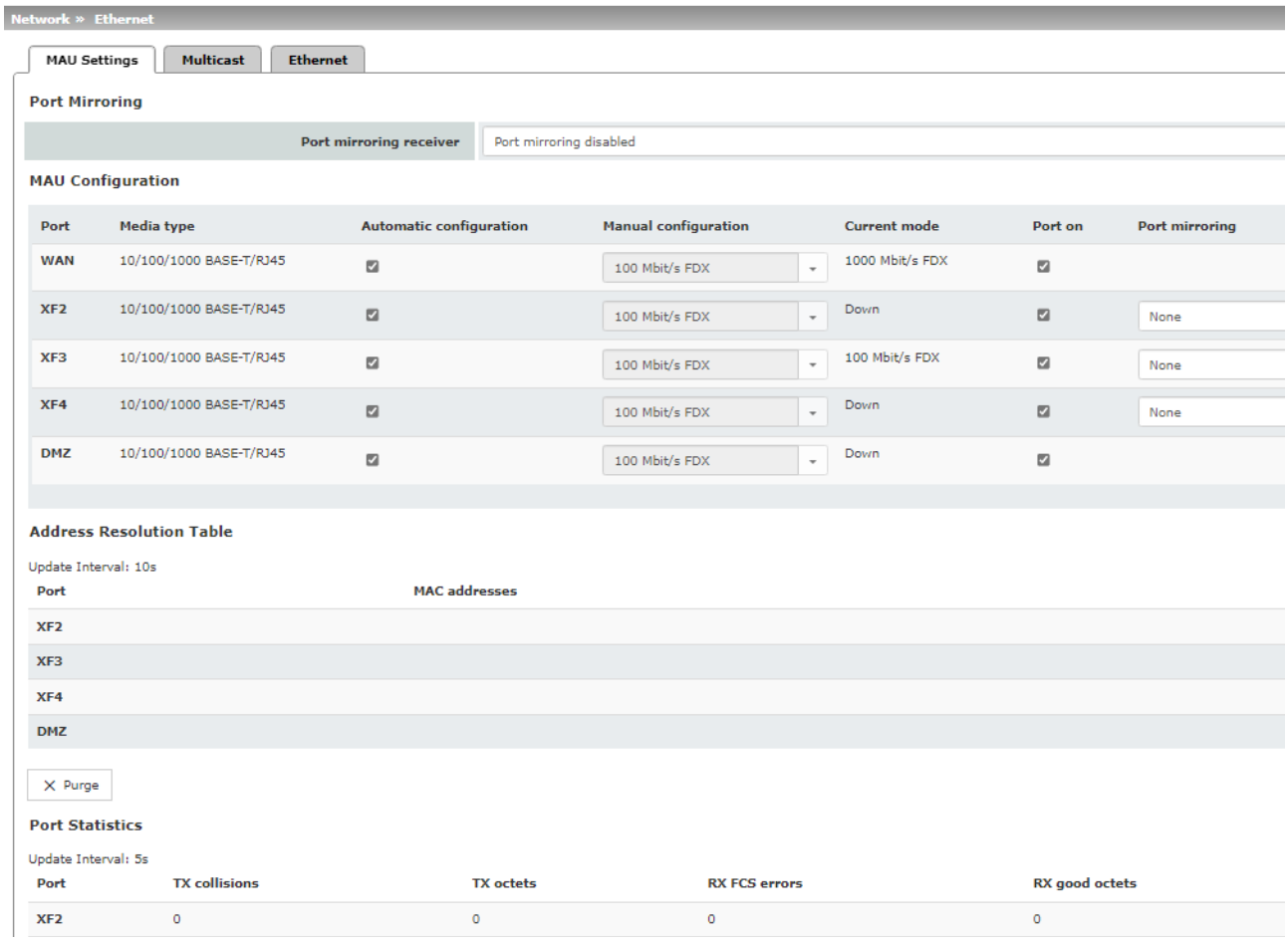
- The MAC address can be determined as follows:
  In DOS (Start, All Programs, Accessories, Command Prompt), enter the following command: ***ipconfig /all***

The MAC address does not necessarily have to be specified. The mGuard can automatically obtain the MAC address from the client. The MAC address 0:0:0:0:0:0 must be set in order to do this. Please note that the mGuard can only forward network packets to the client once the MAC address of the client has been determined.

If no *Stealth Management IP Address* or *Client MAC address* is configured in static Stealth mode, then DAD ARP requests are sent via the internal interface (see RFC 2131, "Dynamic Host Configuration Protocol", Section 4.4.1).

5.2 Network >> Ethernet

5.2.1 MAU Settings

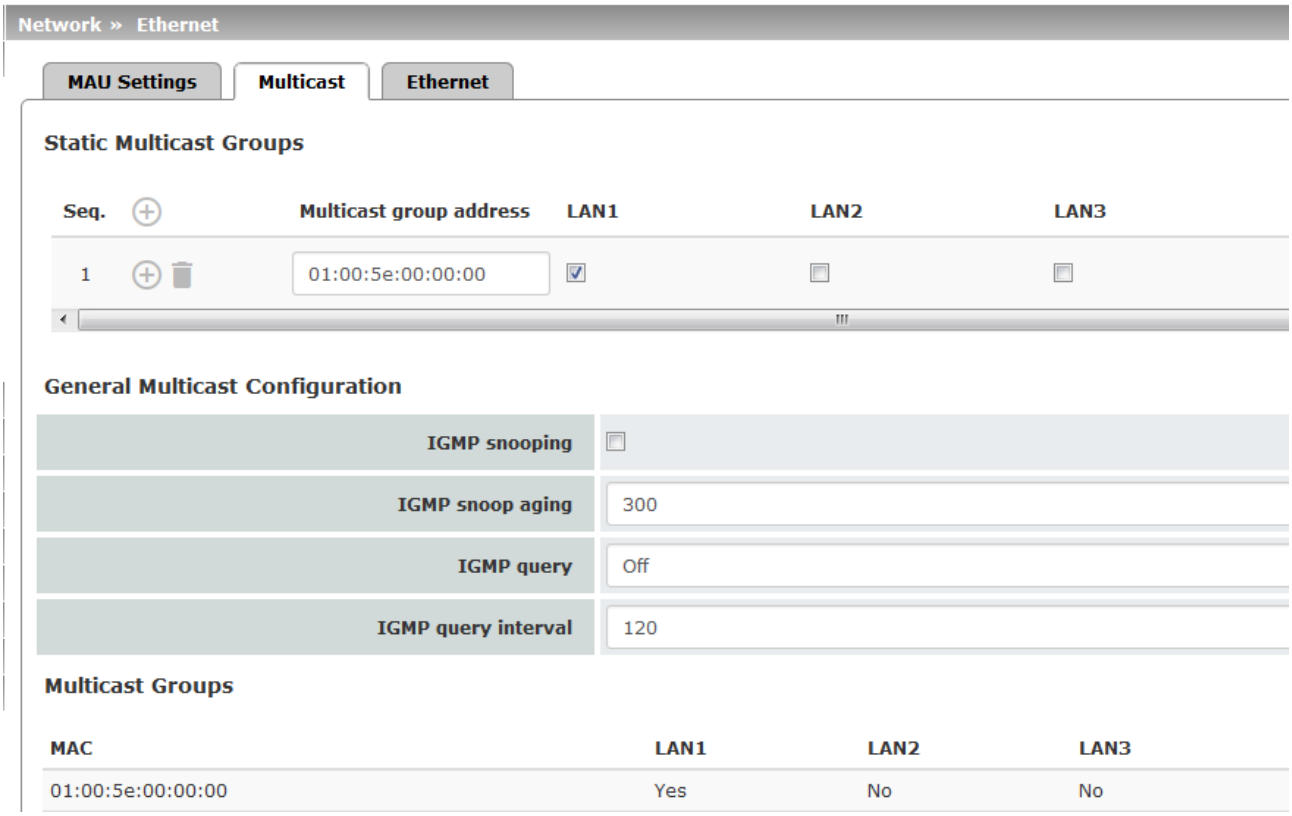


Network >> Ethernet >> MAU Settings		
Port Mirroring (Only for FL MGUARD 4305)	**Port mirroring receiver**	The integrated switch controls port mirroring in order to monitor the network traffic. Here, you can decide which ports you want to monitor. The switch then sends copies of data frames from the monitored ports to a selected port. The port mirroring function enables any frames to be forwarded to a specific recipient. You can select the receiver port or the mirroring of the incoming and outgoing frames from each switch port.
MAU Configuration	Configuration and status indication of the Ethernet connections:	
	Port	Name of the Ethernet connection to which the row refers.
	Media type	Media type of the Ethernet connection.

Network >> Ethernet >> MAU Settings [...]		
	Automatic configuration	**Activated**: tries to determine the required operating mode automatically. **Deactivated**: uses the operating mode specified in the “Manual configuration” column.
	Manual configuration	The desired operating mode when ***Automatic configuration*** is **deactivated**.
	Current mode	The current operating mode of the network connection.
	Port on	Switches the Ethernet connection on or off.
	Link supervision	Only visible when the "Management >> Service I/O >> Alarm Output" menu item „Link supervision“ is set to “Supervise”. If link supervision is active, the alarm output is opened if one link does not indicate connectivity.
	Port mirroring (Only for FL MGUARD 4305)	The port mirroring function enables any frames to be forwarded to a specific recipient. You can select the receiver port or the mirroring of the incoming and outgoing frames from each switch port.
Address Resolution Table (Only for FL MGUARD 4305)	**Port**	Name of the Ethernet connection to which the row refers.
	MAC addresses	Lists the MAC addresses of the connected Ethernet-capable devices. The switch can learn MAC addresses which belong to the ports of its connected Ethernet-capable devices. The contents of the list can be deleted by clicking on the “Purge” button.
Port Statistics (Only for FL MGUARD 4305)	A statistic is displayed for each physically accessible port of the integrated Managed Switch. The counter can be reset via the web interface or the following command: ***/Packages/mguard-api_0/mbin/action switch/reset-phy-counters***	
	Port	Name of the Ethernet connection to which the row refers.
	TX collisions	Number of errors while sending the data
	TX octets	Data volume sent
	RX FCS errors	Number of received frames with invalid checksum
	RX good octets	Volume of the valid data received

5.2.2 Multicast

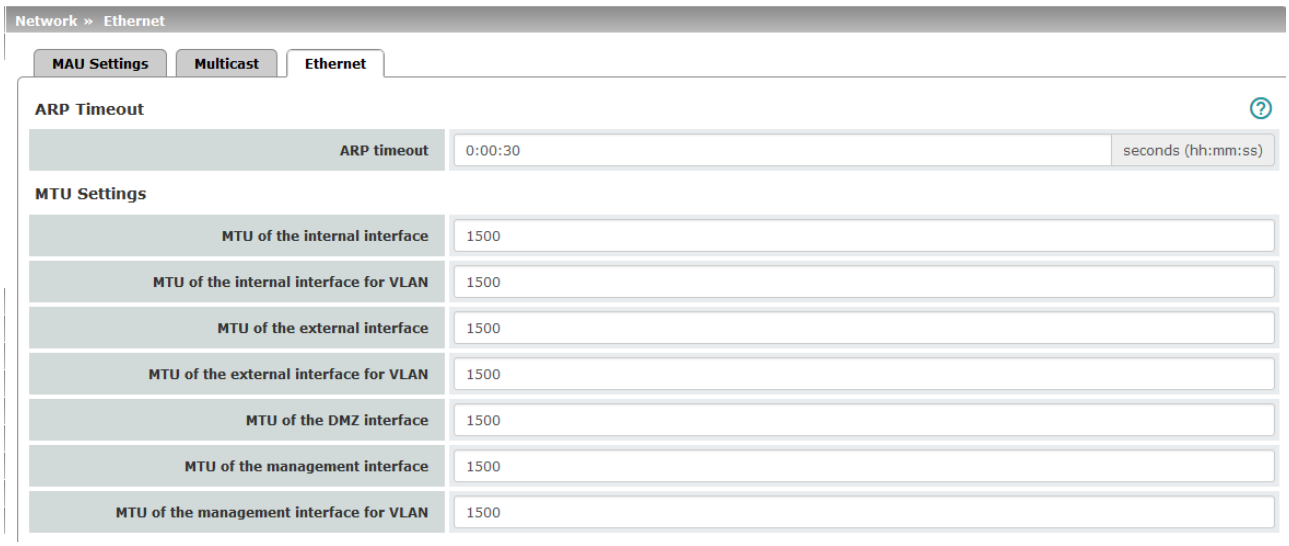
Only available with FL MGUARD 4305 and FL MGUARD 4305/KX.



Network >> Ethernet >> Multicast		
Static Multicast Groups	**Static Multicast Groups**	**Note**: For data to be correctly forwarded to the configured ports in Static Multicast Groups, "IGMP snooping" must be enabled (see below). Multicast is a technology which enables data to be sent to a group of recipients, without the transmitter having to send it multiple times. The data replication takes place through the distributor within the network. You can create a list of **multicast group addresses**. The data is forwarded to the configured ports (XF2 ... XF4).
General Multicast Configuration	**IGMP snooping** (Not active in network mode „Stealth“)	The switch uses IGMP snooping to guarantee that multicast data is only forwarded via ports which are intended for this use.
	IGMP snoop aging	Period, after which membership to the multicast group expires, in seconds.

Network >> Ethernet >> Multicast [...]		
	IGMP query	IGMP is used to join and leave a multicast group. Here, the IGMP version can be selected. IGMP version v1 (IGMPv1) is no longer supported. All devices of the new device generation exclusively support IGMP version v2 (IGMPv2).
	IGMP query interval	Interval in which IGMP queries are generated in seconds. If the interval is changed, new IGMP requests are generated only after the previously configured interval has expired.
Multicast Groups	Displays the multicast groups. The display contains all static entries and the dynamic entries which are discovered by IGMP snooping.	

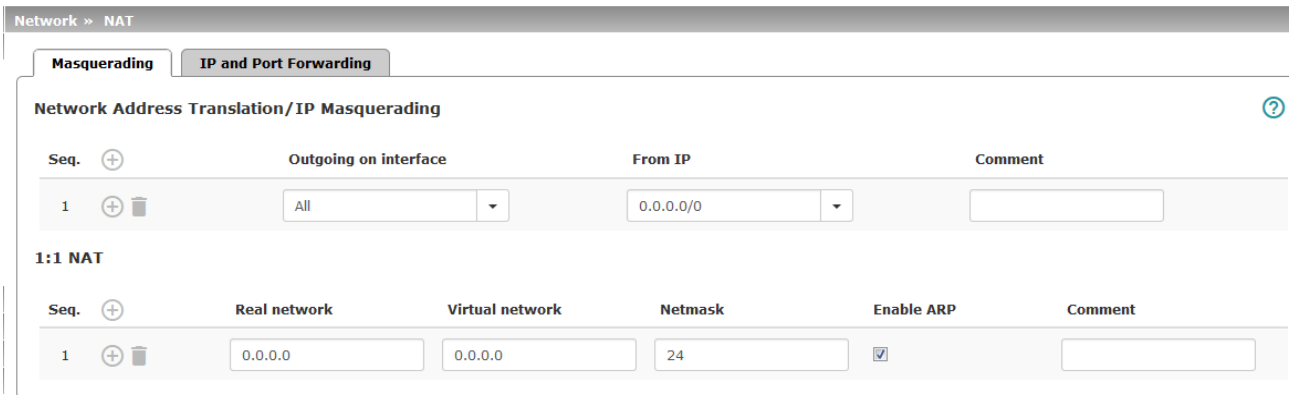
5.2.3 Ethernet



Network >> Ethernet >> Ethernet		
ARP Timeout	**ARP Timeout**	Service life of entries in the ARP table. The entry can be in seconds [ss], minutes and seconds [mm:ss] or hours, minutes, and seconds [hh:mm:ss]. MAC and IP addresses are assigned to each other in the ARP table.
The MTU settings	**MTU of the ... interface**	The maximum transfer unit (MTU) defines the maximum IP packet length that may be used for the relevant interface. Allowed values: 68 - 1500 The following applies for a VLAN interface: As VLAN packets contain 4 bytes more than those without VLAN, certain drivers may have problems processing these larger packets. Such problems can be solved by reducing the MTU to 1496.

5.3 Network >> NAT

5.3.1 Masquerading



Network >> NAT >> Masquerading

Network Address Translation/IP Masquerading

Lists the rules established for NAT (**N**etwork **A**ddress **T**ranslation).

For outgoing data packets, the device can rewrite the specified sender IP addresses from its internal network to its own external address, a technique referred to as NAT (Network Address Translation), see also NAT (Network Address Translation) in the glossary.

This method is used if the internal addresses cannot or should not be routed externally, e.g., because a private address area such as 192.168.x.x or the internal network structure should be hidden.

The method can also be used to hide external network structures from the internal devices. To do so, set the **Internal** option under **"Outgoing on interface"**. The **Internal** setting allows for communication between two separate IP networks where the IP devices have not configured a (useful) default route or differentiated routing settings (e.g., PLCs without the corresponding settings). The corresponding settings must be made under **"1:1 NAT"**.

This method is also referred to as *IP masquerading*.

Default setting: IP Masquerading is active for packets routed from the internal network (LAN) to the external network (WAN) (LAN --> WAN).

If multiple static IP addresses are used for the WAN port, the first IP address in the list is always used for IP masquerading.

These rules do not apply in Stealth mode.

Outgoing on interface

Internal / External / DMZ / All external

Specifies via which interface the data packets are sent so that the rule applies to them.

„All external“ refers to "External" for FL MGUARD 2000/4000 devices.

Network >> NAT >> Masquerading [...]

Masquerading is defined, which applies for network data flows in Router mode. These data flows are initiated so that they lead to a destination device which can be accessed over the selected network interface on the mGuard.

To do this, the mGuard replaces the IP address of the initiator with a suitable IP address of the selected network interface in all associated data packets. The effect is the same as for the other values of the same variables. The IP address of the initiator is hidden from the destination of the data flow. In particular, the destination does not require any routes in order to respond in a data flow of this type (not even a default route (default gateway)).

Set the firewall in order for the desired connections to be allowed. For incoming and outgoing rules, the source address must still correspond to the original sender if the firewall rules are used.

Please observe the outgoing rules when using the “External” settings (see “Outgoing Rules” on page 218).

Please observe the incoming rules when using the “Internal” setting (see “Incoming Rules” on page 215).

From IP

0.0.0.0/0 means that all internal IP addresses are subject to the NAT procedure. To specify an address area, use CIDR format (see “CIDR (Classless Inter-Domain Routing)” on page 49).

Name of IP groups, if defined. When a name is specified for an IP group, the host names, IP addresses, IP areas or networks saved under this name are taken into consideration (see “IP/Port Groups” on page 231).

If host names are used in IP groups, the mGuard must be configured so that the host name of a DNS server can be resolved in an IP address.

If a host name from an IP group cannot be resolved, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration.

Comment

Can be filled with appropriate comments.

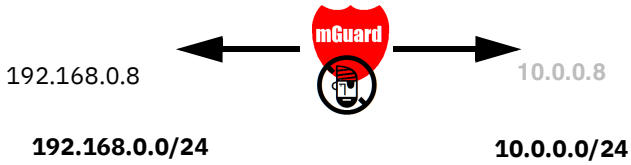
1:1 NAT

Lists the rules established for 1:1 NAT (Network Address Translation).

With 1:1 NAT, the sender IP addresses are exchanged so that each individual address is exchanged with another specific address, and is not exchanged with the same address for all data packets, as in IP masquerading. This enables the mGuard to mirror addresses from the real network to the virtual network.

Network >> NAT >> Masquerading [...]

Example: The mGuard is connected to network 192.168.0.0/24 via its LAN port and to network 10.0.0.0/24 via its WAN port. By using 1:1 NAT, the LAN computer with IP address 192.168.0.8 can be accessed via IP address 10.0.0.8 in the virtual network.



The mGuard claims the IP addresses entered for the “Virtual network” for the devices in its “Real network”. The mGuard returns ARP answers for all addresses from the specified “Virtual network” on behalf of the devices in the “Real network”.

The IP addresses entered under “Virtual network” must not be used. They must not be assigned to other devices or used in any way, as an IP address conflict would otherwise occur in the virtual network. This even applies when no device exists in the “Real network” for one or more IP addresses from the specified “Virtual network”.

Default setting: 1:1 NAT is not active.

1:1 NAT is only used in *Router* network mode.

Real network

The real IP address of the client that should be reachable from another network via the virtual IP address (depending on the scenario at LAN, WAN, or DMZ port).

One or more clients can be reachable depending on the network mask.

1:1-NAT is possible between all interfaces (LAN <–> WAN, LAN <–> DMZ, DMZ <–> WAN).

Virtual network

The virtual IP address with which the clients are reachable from the other network (depending on the scenario at LAN, WAN, or DMZ port).

The virtual IP-addresses must not be assigned and used by other clients.

1:1-NAT is possible between all interfaces (LAN <–> WAN, LAN <–> DMZ, DMZ <–> WAN).

Netmask

The netmask as a value between 1 and 32 for the local and external network address (see also “CIDR (Classless Inter-Domain Routing)” on page 49).

Enable ARP

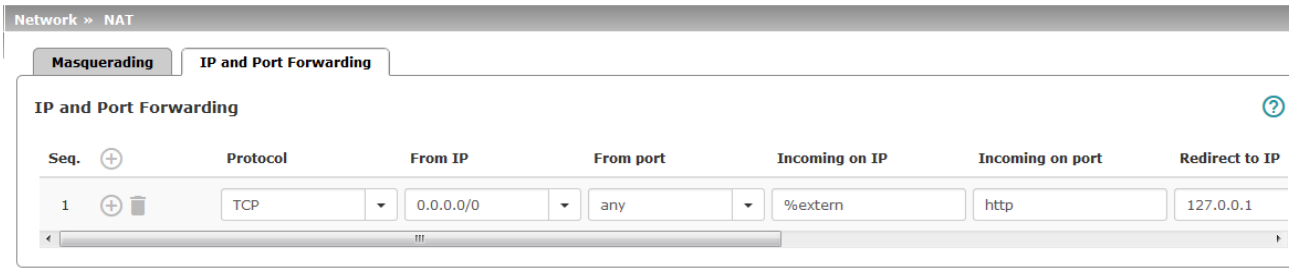
When the function is activated, ARP requests sent to the virtual network are answered on behalf of the mGuard. This means that hosts located in the real network can be accessed via their virtual address.

When the function is deactivated, ARP requests sent to the virtual network remain unanswered. This means that hosts in the real network cannot be accessed.

Comment

Can be filled with appropriate comments.

5.3.2 IP and Port Forwarding



Network >> NAT >> IP and Port Forwarding

IP and Port Forwarding

Lists the rules defined for port forwarding (DNAT = Destination NAT).

IP and port forwarding performs the following: the headers of incoming data packets from the external network, which are addressed to the external IP address (or one of the external IP addresses) of the mGuard and to a specific port of the mGuard, are re-written in order to forward them to a specific computer in the internal network and to a specific port on this computer. In other words, the IP address and port number in the header of incoming data packets are changed.

IP and port forwarding from the internal network behaves as described above.

The rules defined here have priority over the settings made under “Network Security >> Packet Filter >> Incoming Rules”.

IP and port forwarding cannot be used in *Stealth* network mode.

Protocol: TCP / UDP / GRE

Specify the protocol to which the rule should apply.

GRE

GRE protocol IP packets can be forwarded. However, only one GRE connection is supported at any given time. If more than one device sends GRE packets to the same external IP address, the mGuard may not be able to feed back reply packets correctly. We recommend only forwarding GRE packets from specific transmitters. These could be ones that have had a forwarding rule set up for their source address by entering the transmitter address in the “From IP” field, e.g., 193.194.195.196/32.

Network >> NAT >> IP and Port Forwarding [...]

From IP

The sender address for forwarding.

0.0.0.0/0 means all addresses. To specify an address area, use CIDR format (see “CIDR (Classless Inter-Domain Routing)” on page 49).

Name of IP groups, **if defined. When a name is specified for an IP group,** the host names, **IP addresses, IP areas or networks saved under this name are taken into consideration (see** “IP/Port Groups” on page 231**).**

If host names are used in IP groups, the mGuard must be configured so that the host name of a DNS server can be resolved in an IP address.

If a host name from an IP group cannot be resolved, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration.

From port

The sender port for forwarding.

any refers to any port.

Either the port number or the corresponding service name can be specified here, e.g., *pop3* for port 110 or *http* for port 80.

Name of port groups, if defined. When a name is specified for a port group, the ports or port ranges saved under this name are taken into consideration (see “IP/Port Groups” on page 231).

Incoming on IP

- Specify the external IP address (or one of the external IP addresses) of the mGuard here, **or**
- Specify the internal IP address (or one of the internal IP addresses) of the mGuard here, **or**
- Use the variable **%extern** (if the external IP address of the mGuard is changed dynamically so that the external IP address cannot be specified).

  If multiple static IP addresses are used for the WAN port, the **%extern** variable always refers to the first IP address in the list.

Incoming on port

The original destination port specified in the incoming data packets.

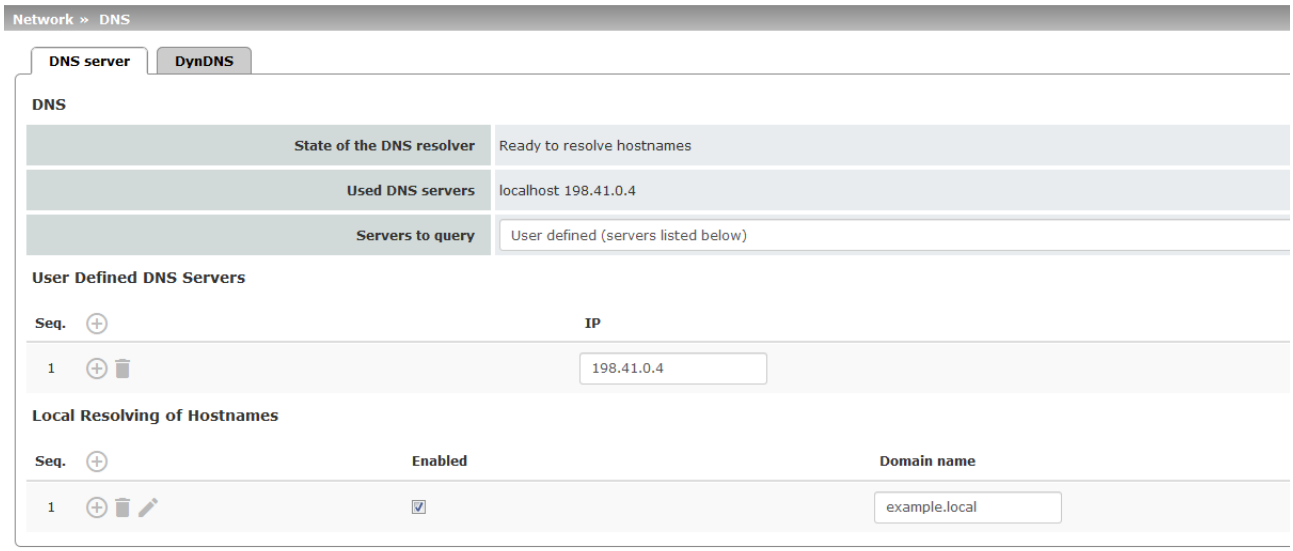
Either the port number or the corresponding service name can be specified here, e.g., *pop3* for port 110 or *http* for port 80.

This information is not relevant for the “GRE” protocol. It is ignored by the mGuard.

Network >> NAT >> IP and Port Forwarding [...]		
	Redirect to IP	The internal IP address to which the data packets should be forwarded and into which the original destination addresses are translated.
	Redirect to port	The port to which the data packets should be forwarded and into which the original port data is translated. Either the port number or the corresponding service name can be specified here, e.g., *pop3* for port 110 or *http* for port 80. This information is not relevant for the “GRE” protocol. It is ignored by the mGuard.
	Comment	Freely selectable comment for this rule.
	Log	For each individual port forwarding rule, you can specify whether the use of the rule: – Should be logged – activate *Log* function – Should not be logged – deactivate *Log* function (default)

5.4 Network >> DNS

5.4.1 DNS server



Network >> DNS >> DNS server	
DNS	If the mGuard is to initiate a connection to a peer on its own (e.g., to a VPN gateway or NTP server) and it is specified in the form of a host name (i.e., www.example.com), the mGuard must determine which IP address belongs to the host name. To do this, it connects to a domain name server (DNS) to query the corresponding IP address there. The IP address determined for the host name is stored in the cache so that it can be found directly (i.e., more quickly) for other host name resolutions. With the *Local resolving of hostnames* function, the mGuard can also be configured to respond to DNS requests for locally used host names itself by accessing an internal, previously configured directory. The locally connected clients can be configured (manually or via DHCP) so that the local address of the mGuard is used as the address of the DNS server to be used. If the mGuard is operated in *Stealth* mode, the management IP address of the mGuard (if this is configured) must be used for the clients, or the IP address 1.1.1.1 must be entered as the local address of the mGuard. **State of the DNS resolver** — Status of the host name resolution **Used DNS servers** — DNS servers for which the associated IP address was queried.

Network >> DNS >> DNS server [...]		
	Servers to query	**DNS root servers** Requests are sent to the root name servers on the Internet whose IP addresses are stored on the mGuard. These addresses rarely change. **Provider defined (i.e., via DHCP)** The DNS servers of the Internet service provider (ISP) that provide access to the Internet are used. Only select this setting if the mGuard operates in *Router* mode with DHCP. The setting can also be used if the mGuard is located in ***Stealth* mode** (*automatic*). In this case, the DNS server that the client uses can be recognized and taken on. **User defined (servers listed below)** If this setting is selected, the mGuard will connect to the DNS servers listed under *User defined DNS servers*.
User Defined DNS Servers (Only when **User-defined** is selected as root server)	The IP addresses of DNS servers can be entered in this list. If this should be used by the mGuard, select the "User defined (servers listed below)" option under **Servers to query**. As of firmware version 10.3.0, the following applies: The IP addresses that are already assigned to a network interface of the mGuard (External / Internal / DMZ) must not be used at this point. Updates and the import of profiles from older firmware versions that are configured accordingly are rejected.	
Local Resolving of Hostnames	You can configure multiple entries with assignment pairs of host names and IP addresses for various domain names. You have the option to define, change (edit), and delete assignment pairs of host names and IP addresses. You can also activate or deactivate the resolution of host names for a domain. In addition, you can delete a domain with all its assignment pairs.	

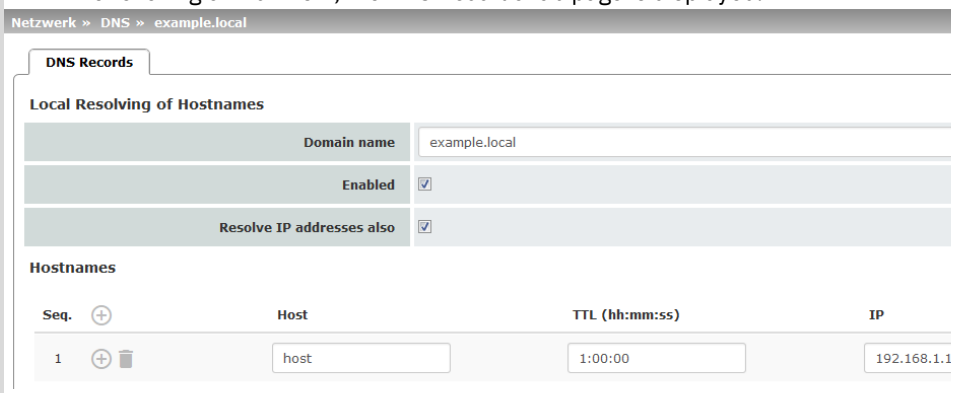
Network >> DNS >> DNS server [...]

Creating a table with assignment pairs for a domain:

- Open a new row and click on the **Edit Row** icon in this row.

Changing or deleting assignment pairs belonging to a domain:

- Click on the **Edit Row** icon in the relevant table row.
  After clicking on **Edit row**, the *DNS Records* tab page is displayed:



Domain name — The name can be freely assigned, but it must adhere to the rules for assigning domain names. It is assigned to every host name.

Enabled — Activates or deactivates the *Local Resolving of Hostnames* function for the domain specified in the “Domain name” field.

Resolve IP addresses also — **Deactivated:** the mGuard only resolves host names, i.e., it supplies the assigned IP address for host names.

Activated: as with “Deactivated”. It is also possible to determine the host names assigned to an IP address.

Hostnames — The table can have any number of entries.

> A host name may be assigned to multiple IP addresses. Multiple host names may be assigned to one IP address.

Host — Host name

TTL (hh:mm:ss) — **Default: 3600 seconds (1:00:00)**

Abbreviation for **T**ime **T**o **L**ive

Specifies how long called assignment pairs may be stored in the cache of the calling computer.

IP — The IP address assigned to the host name in this table row.

Example: Local Resolving of Hostnames

The “Local Resolving of Hostnames” function is used in the following scenario, for example:

A plant operates a number of identically structured machines, each one as a cell. The local networks of cells A, B, and C are each connected to the plant network via the Internet using the mGuard. Each cell contains multiple control elements, which can be addressed via their IP addresses. Different address areas are used for each cell.

A service technician should be able to use her/his notebook on site to connect to the local network for machine A, B or C and to communicate with the individual controllers. So that the technician does not have to know and enter the IP address for every single controller in machine A, B or C, host names are assigned to the IP addresses of the controllers in accordance with a standardized diagram that the service technician uses. The host names used for machines A, B, and C are identical, i.e., the controller for the packing machine in all three machines has the host name “pack”, for example. However, each machine is assigned an individual domain name, e.g., cell-a.example.com.

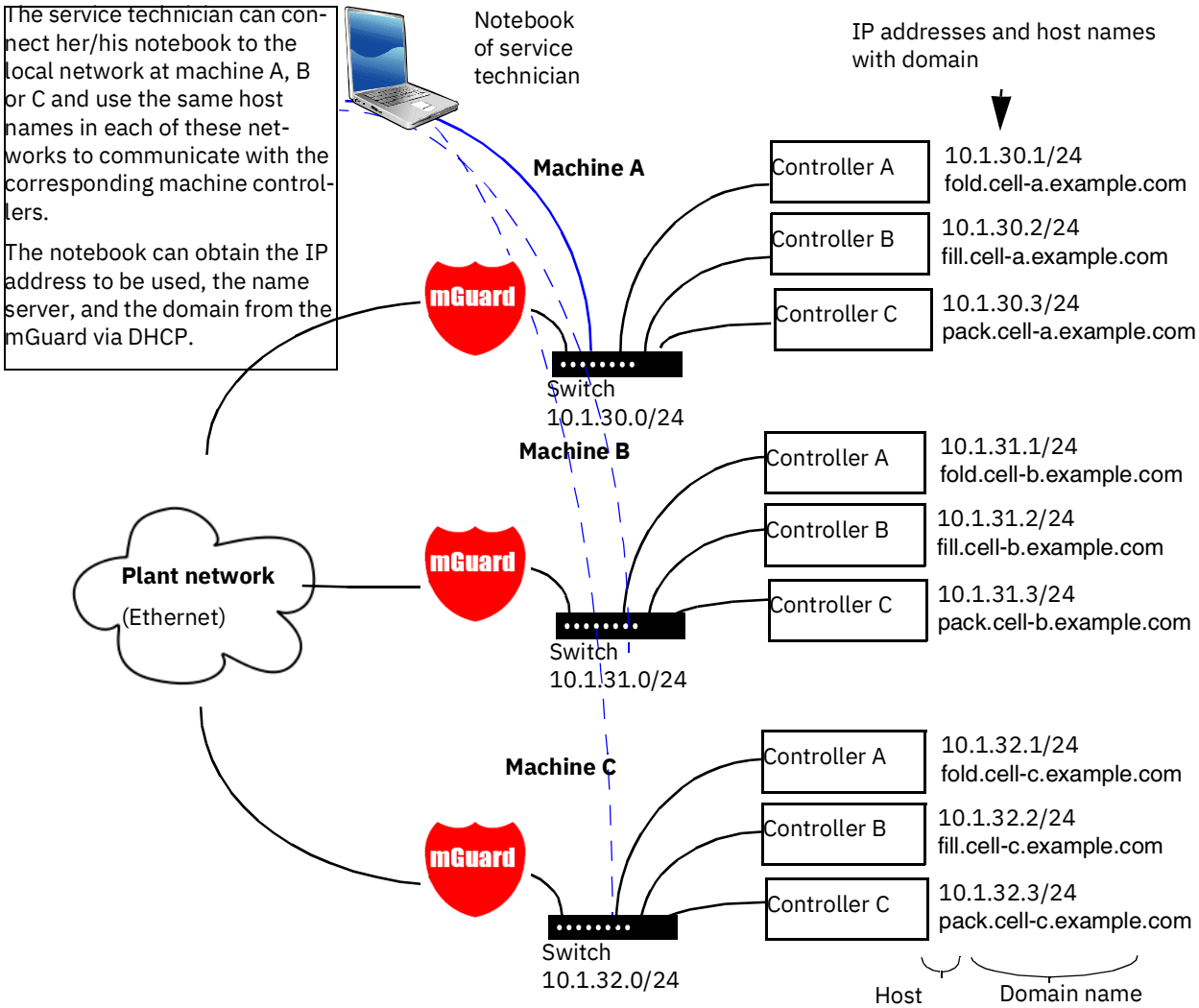
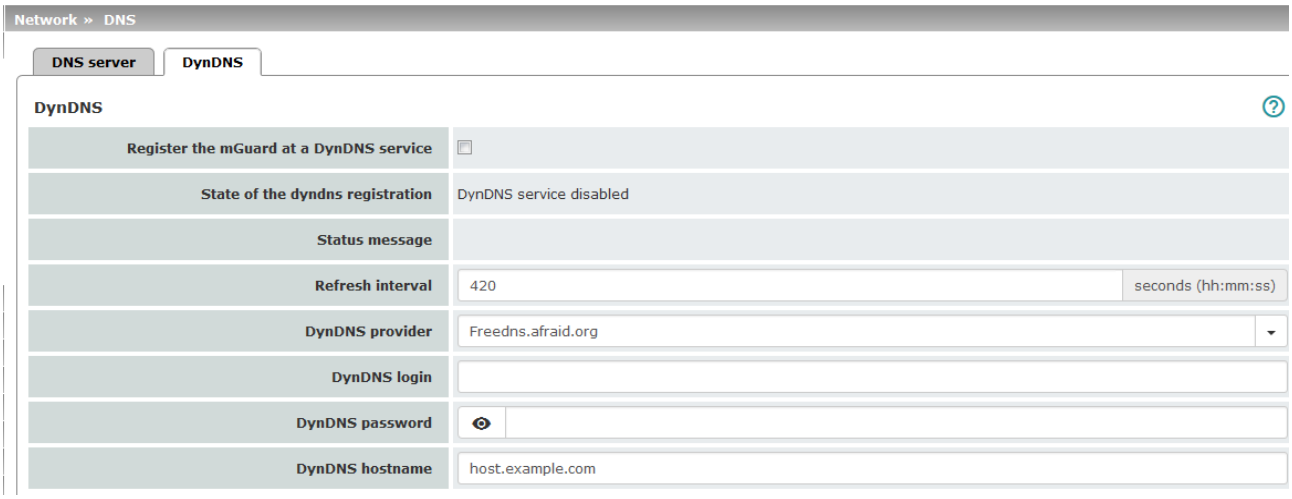


Figure 5-1 Local Resolving of Hostnames

5.4.2 DynDNS



Network >> DNS >> DynDNS

DynDNS

In order for a VPN connection to be established, at least one partner IP address must be known so that the partners can contact each other. This condition is not met if both participants are assigned IP addresses dynamically by their respective Internet service providers. In this case, a DynDNS service such as DynDNS.org or DNS4BIZ.com can be of assistance. With a DynDNS service, the currently valid IP address is registered under a fixed name.

If you have registered with one of the DynDNS services supported by the mGuard, you can enter the corresponding information in this dialog box.

Register the mGuard at a DynDNS service	Activate the function if you have registered with a DynDNS provider and if the mGuard is to use this service. The mGuard then reports its current IP address to the DynDNS service (i.e., the one assigned for its Internet connection by the Internet service provider).
State of the DynDNS registration	State of the DynDNS registration
Status message	Status message
Refresh Interval	Default: 420 (seconds). The mGuard informs the DynDNS service of its new IP address whenever the IP address of its Internet connection is changed. In addition, the device can also report its IP address at the interval specified here. This setting has no effect for some DynDNS providers, such as DynDNS.org, as too many updates can cause the account to be closed.
DynDNS provider	The providers in this list support the same protocol as the mGuard. Select the name of the provider with whom you are registered, e.g., DynDNS.org, TinyDynDNS, DNS4BIZ. If your provider is not in the list, select **DynDNS-compatible** and enter the server and port for this provider.

Network >> DNS >> DynDNS [...]		
	DynDNS server	Only visible when “DynDNS provider” is set to **DynDNS-compatible**. Name of the server for the DynDNS provider.
	DynDNS port	Only visible when “DynDNS provider” is set to **DynDNS-compatible**. Number of the port for the DynDNS provider.
	DynDNS login	Enter the user identifier assigned by the DynDNS provider here.
	DynDNS password	Enter the password assigned by the DynDNS provider here.
	DynDNS hostname	The host name selected for this mGuard at the DynDNS service, providing you use a DynDNS service and have entered the corresponding data above. The mGuard can then be accessed via this host name.

5.5 Network >> DHCP

The dynamic host configuration protocol (DHCP) can be used to automatically assign the network configuration set here to the computers connected directly to the mGuard.

You can specify the DHCP settings for the internal interface (LAN port) under **Internal DHCP** and the DHCP settings for the external interface (WAN port) under **External DHCP**. DHCP settings for the DMZ interface (DMZ port) can be made under **DMZ DHCP**.

In the default settings, the DHCP server of the mGuard device is activated by default for the LAN interface (port XF2-4 or XF2-5) (Internal DHCP).

This means that network clients connected via the LAN interface automatically receive their network configuration from the mGuard device if they have also activated DHCP.

The menu items **External DHCP** and **DMZ DHCP** are not part of the FL MGUARD 2000 series functionality.

The DHCP server also operates in *Stealth* mode.

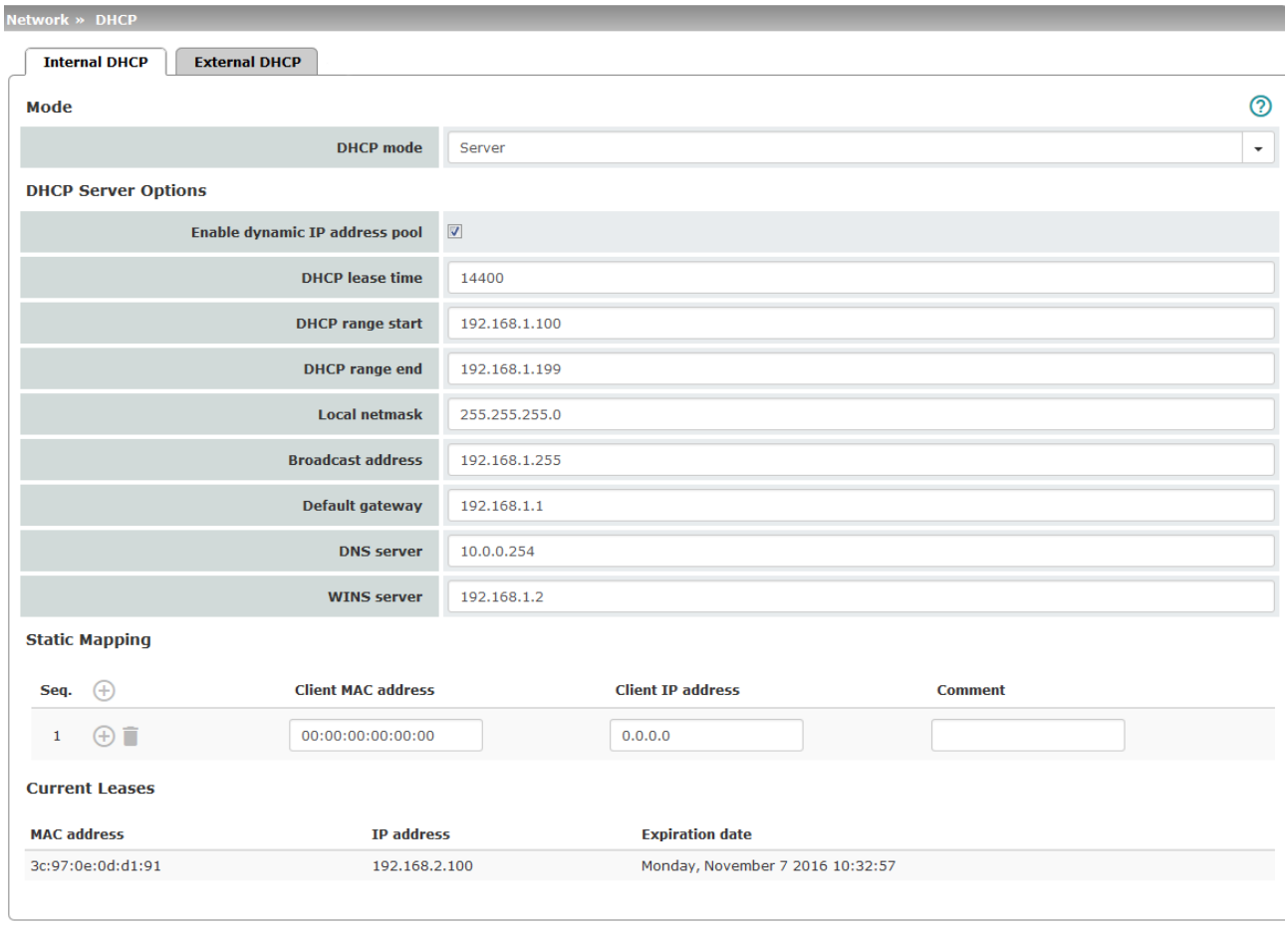
In multi-stealth mode, the external DHCP server of the mGuard cannot be used if a VLAN ID is assigned as the management IP.

IP configuration for Windows computers: when you start the DHCP server of the mGuard, you can configure the locally connected computers so that they obtain their IP configuration automatically from the mGuard via DHCP.

Please also refer to the chapter „Obtaining the IP setting per DHCP (Windows)“, in the user manual UM EN HW FL MGUARD 2000/4000, available at phoenixcontact.net/product/1357828).

5.5.1 Internal/External DHCP

The menu item **External DHCP** is not part of the FL MGUARD 2000 series functionality.



Network >> DHCP >> Internal DHCP

The settings for **Internal DHCP** and **External DHCP** are essentially identical and are not described separately in this section.

Network >> DHCP >> Internal DHCP[...]

Mode

DHCP mode

Disabled / Server / Relay

Set this option to **Server** if the mGuard is to operate as an independent DHCP server (default setting: Internal DHCP). The corresponding setting options are then displayed below on the tab page (see "DHCP mode: Server").

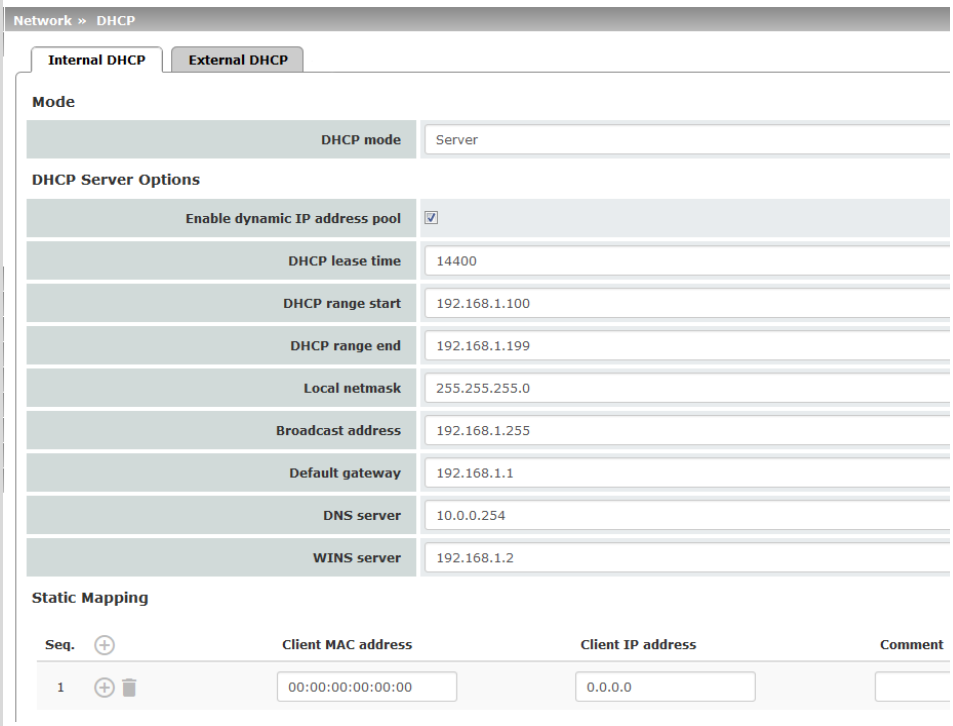
Set this option to **Relay** if the mGuard is to forward DHCP requests to another DHCP server. The corresponding setting options are then displayed below on the tab page (see "DHCP mode: Relay").

In mGuard *Stealth* mode, *Relay* DHCP mode is not supported. If the mGuard is in *Stealth* mode and *Relay* DHCP mode is selected, this setting will be ignored.
However, DHCP requests from the computer and the corresponding responses are forwarded due to the nature of Stealth mode.

If this option is set to **Disabled**, the mGuard does not answer any DHCP requests.

DHCP mode: Server

If DHCP mode is set to *Server*, the corresponding setting options are displayed below as follows.



Network >> DHCP >> Internal DHCP[...]		
DHCP Server Options	**Enable dynamic IP address pool:**	When the function is activated, the IP address pool specified under *DHCP range start* and *DHCP range end* is used (see below). Deactivate the function if only static assignments should be made using the MAC addresses (see below).
	DHCP lease time	Time in seconds for which the network configuration assigned to the computer is valid. The client should renew its assigned configuration shortly before this time expires. Otherwise it may be assigned to other computers.
	DHCP range start (With enabled dynamic IP address pool)	The start of the address area from which the DHCP server of the mGuard should assign IP addresses to locally connected computers.
	DHCP range end (With enabled dynamic IP address pool)	The end of the address area from which the DHCP server of the mGuard should assign IP addresses to locally connected computers.
	Local netmask	Specifies the netmask of the computers. Default: 255.255.255.0
	Broadcast address	Specifies the broadcast address of the computers.
	Default gateway	Specifies which IP address should be used by the computer as the default gateway. Usually this is the internal IP address of the mGuard.
	DNS server	Address of the server used by the computer to resolve host names in IP addresses via the Domain Name Service (DNS). If the DNS service of the mGuard is to be used, enter the internal IP address of the mGuard here.
	WINS server	Address of the server used by the computer to resolve host names in addresses via the Windows Internet Naming Service (WINS).
Static Mapping	**Client MAC address**	To find out the **MAC address** of your computer, proceed as follows: **Windows**: • Start **ipconfig /all** in a command prompt. The MAC address is displayed as the “Physical Address”. **Linux**: • Call **/sbin/ifconfig** or **ip link show** in a shell. The following options are available: – Client/computer MAC address (without spaces or hyphens) – Client IP address

Network >> DHCP >> Internal DHCP[...]

Client IP address

The static IP address of the computer to be assigned to the MAC address.

Static assignments take priority over the dynamic IP address pool.

Static assignments must not overlap with the dynamic IP address pool.

Do not use one IP address in multiple static assignments, otherwise this IP address will be assigned to multiple MAC addresses.

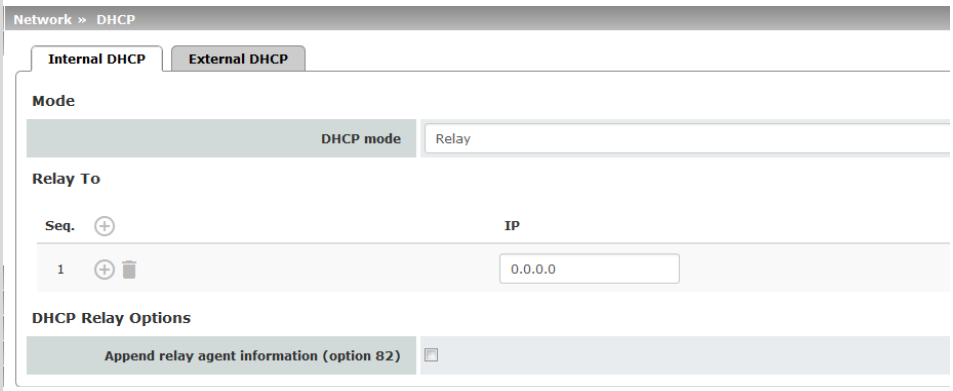
Only one DHCP server should be used per subnetwork.

Current Leases

The current leases assigned by the DHCP server are displayed with MAC address, IP address, and expiration date (timeout).

DHCP mode: Relay

If DHCP mode is set to *Relay*, the corresponding setting options are displayed below as follows.



DHCP Relay Options

In mGuard *Stealth* mode, *Relay* DHCP mode is not supported. If the mGuard is in *Stealth* mode and *Relay* DHCP mode is selected, this setting will be ignored. However, DHCP requests from the computer and the corresponding responses are forwarded due to the nature of *Stealth* mode.

DHCP servers to relay to

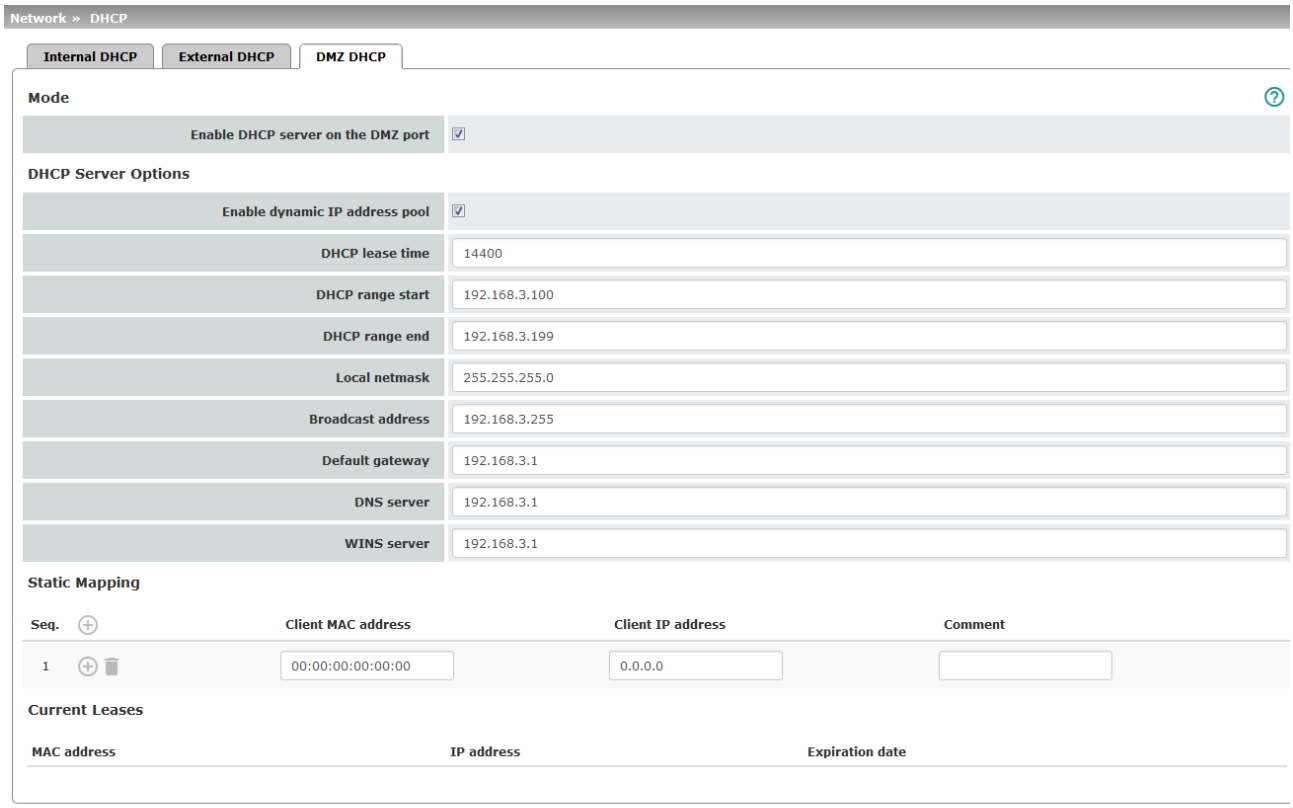
A list of one or more DHCP servers to which DHCP requests should be forwarded.

Append relay agent information (option 82)

When forwarding, additional information for the DHCP servers to which information is being forwarded can be appended according to RFC 3046.

5.5.2 DMZ DHCP

The menu item **DMZ DHCP** is not part of the FL MGUARD 2000 series functionality.



The DHCP server functionality of the mGuard is expanded on its DMZ interface (DMZ port). The mGuard can automatically assign a network configuration to clients connected to the DMZ port via the DHCP protocol.

Network >> DHCP >> DMZ DHCP		
Mode	**Enable DHCP server on the DMZ port**	Enables the DHCP server on the DMZ interface. If the function is disabled, the mGuard does not answer any DHCP queries on the DMZ interface.
DHCP Server Options	**Enable dynamic IP address pool:**	When the function is activated, the IP address pool specified under *DHCP range start* and *DHCP range end* is used (see below). Deactivate the function if only static assignments should be made using the MAC addresses (see below).
	DHCP lease time	Time in seconds for which the network configuration assigned to the computer is valid. The client should renew its assigned configuration shortly before this time expires. Otherwise it may be assigned to other computers.

Network >> DHCP >> DMZ DHCP[...]		
	DHCP range start (With enabled dynamic IP address pool)	The start of the address area from which the DHCP server of the mGuard should assign IP addresses to locally connected computers.
	DHCP range end (With enabled dynamic IP address pool)	The end of the address area from which the DHCP server of the mGuard should assign IP addresses to locally connected computers.
	Local netmask	Specifies the netmask of the computers. Default: 255.255.255.0
	Broadcast address	Specifies the broadcast address of the computers.
	Default gateway	Specifies which IP address should be used by the computer as the default gateway. Usually this is the internal IP address of the mGuard.
	DNS server	Address of the server used by the computer to resolve host names in IP addresses via the Domain Name Service (DNS). If the DNS service of the mGuard is to be used, enter the internal IP address of the mGuard here.
	WINS server	Address of the server used by the computer to resolve host names in addresses via the Windows Internet Naming Service (WINS).
Static Mapping	**Client MAC address**	To find out the **MAC address** of your computer, proceed as follows: **Windows**: • Start **ipconfig /all** in a command prompt. The MAC address is displayed as the “Physical Address”. **Linux**: • Call **/sbin/ifconfig** or **ip link show** in a shell. The following options are available: – Client/computer MAC address (without spaces or hyphens) – Client IP address

Network >> DHCP >> DMZ DHCP[...]		
	Client IP address	The static IP address of the computer to be assigned to the MAC address.  Static assignments take priority over the dynamic IP address pool.  Static assignments must not overlap with the dynamic IP address pool.  Do not use one IP address in multiple static assignments, otherwise this IP address will be assigned to multiple MAC addresses.  Only one DHCP server should be used per subnetwork.
Current Leases	The current leases assigned by the DHCP server are displayed with MAC address, IP address, and expiration date (timeout).	

5.6 Network >> Proxy Settings

5.6.1 HTTP(S) Proxy Settings

A proxy server can be specified here for the following activities performed by the mGuard itself:

– CRL download
– Firmware update
– Regular configuration profile retrieval from a central location

Network >> Proxy Settings >> HTTP(S) Proxy Settings		
The http(s) proxy settings	**Use proxy for HTTP and HTTPS**	When the function is activated, connections that use the HTTP or HTTPS protocol are transmitted via a proxy server whose address and port should also be specified. Connections that are transmitted in encapsulated form using the **VPN in TCP encapsulation** function are also routed via the proxy server (see “TCP encapsulation” on page 261). If the proxy server uses the "Digest" authentication method, VPN connections initiated by the mGuard device that use TCP encapsulation or „Path Finder“ cannot be established. Use "Basic" authentication on the proxy server instead.
	HTTP(S) proxy server	Host name or IP address of the proxy server.
	Port	Number of the port to be used, e.g., 3128.
Proxy Authentication	**Login**	User identifier (login) for proxy server login.
	Password	Password for proxy server login.

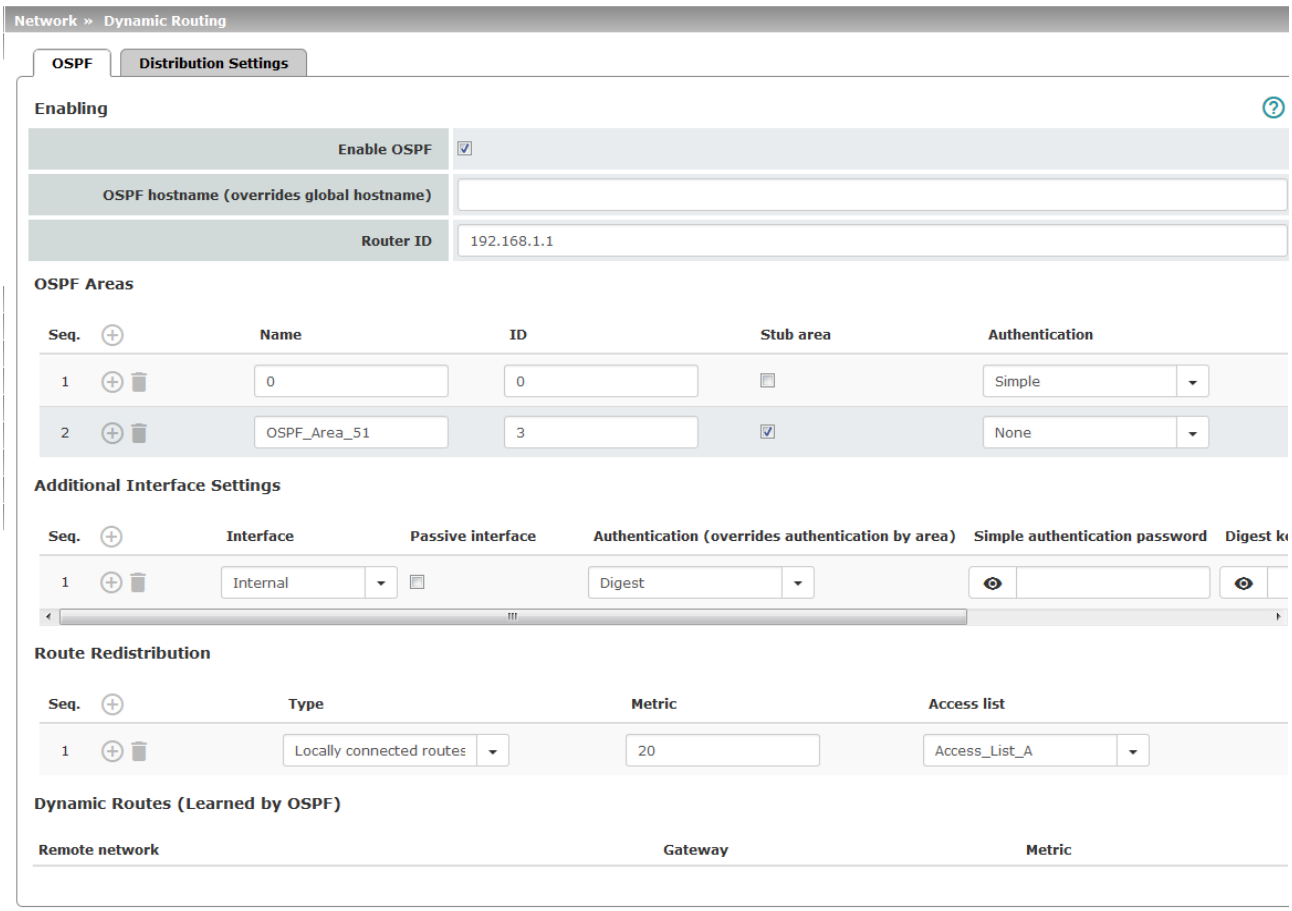
5.7 Network >> Dynamic Routing

In larger company networks, the use of dynamic routing protocols can make it easier for the network administrator to create and manage routes or even eliminate the need for this.

The **OSPF** (Open Shortest Path First) routing protocol allows participating routers to exchange and adapt the routes for transmitting IP packets in their autonomous network in real time (dynamically). The best route to each subnetwork is determined for all participating routers and entered in routing tables for the devices. Changes in the network topology are automatically sent to neighboring OSPF routers and eventually distributed by them to all participating OSPF routers.

This menu is only available when the mGuard is in “Router” network mode.

5.7.1 OSPF



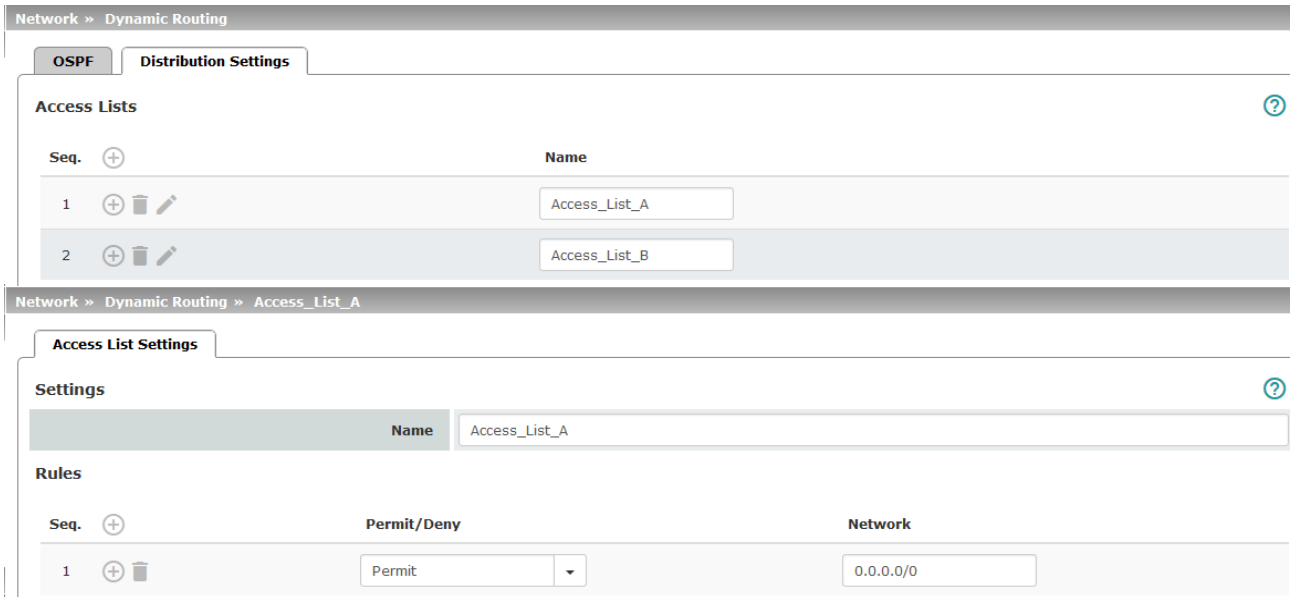
OSPF can be configured for internal, external, and DMZ interfaces. The support of OSPF via IPsec and GRE is currently not available.

Multiple OSPF areas can be configured in order to distribute local routes and learn external routes. The status of all learned routes is displayed in a table.

Network >> Dynamic Routing >> OSPF		
Activation	**Enable OSPF**	When the function is deactivated (default): OSPF is disabled on the device. When the function is activated: dynamic routing using the OSPF protocol is enabled on the device. New routes can be learned and distributed by neighboring OSPF routers.
	OSPF hostname	If an **OSPF hostname** is assigned here, this is communicated to the participating OSPF routers instead of the global host name.
	Router ID	The **Router ID** in the form of an IP address must be unique within the autonomous system. It can otherwise be freely selected and typically corresponds to the IP address of the WAN or LAN interface of the mGuard.
OSPF Areas	The autonomous system is segmented using **OSPF Areas**. The routes between OSPF routers are exchanged within an area. The mGuard can belong to one or more OSPF areas. Distribution between neighboring areas is also possible using the “Transition Area” (see below).	
	Name	The **Name** can be freely selected (default: ID). An OSPF router is clearly identified by its ID.
	ID	In general, the **ID** can be freely selected. If an OSPF area is assigned the ID 0, it becomes the “**Transition Area**”. This area is used to exchange routing information between two neighboring areas and then distribute it.
	Stub area	If the OSPF area is a stub area, activate the function.
	Authentication	None / Simple / Digest Authentication of the mGuard within the OSPF area can be performed using the “Simple” or “Digest” method. The corresponding passwords and digest keys are assigned for the allocated interfaces (see "Additional Interface Settings").
Additional Interface Settings	**Interface**	Internal / External / DMZ Selects the interface for which the settings apply. If no settings are made here, the default settings apply (i.e., OSPF is enabled for the interface and the passwords are not assigned).
	Passive interface	Default: deactivated When the function is deactivated, OSPF routes are learned and distributed by the interface. When the function is activated, no routes are learned or distributed.

Network >> Dynamic Routing >> OSPF		
	Authentication	None / Digest If **Digest** is selected, “Digest” is always used for authentication at the selected interface – regardless of the authentication method already assigned to an OSPF area. The authentication method (None / Simple / Digest) that has already been assigned to an **OSPF area** is therefore ignored and not used.
	Simple authentication password	Password for authentication of the OSPF router (for “Simple” authentication method)
	Digest key	Digest key for authentication of the OSPF router (for “Digest” authentication method)
	Digest key ID	Digest key ID for authentication of the OSPF router (for “Digest” authentication method) (1–255)
Route Redistribution	Statically entered routes in the kernel routing table can also be distributed using OSPF. Rules can be created for locally connected networks and networks that are reachable via a gateway. The networks whose routes are to be distributed using OSPF can be specified in “access lists” via the "Distribution Settings" . By default, an access list is not selected for locally connected networks and networks reachable via a gateway. This means that all corresponding routes in the kernel routing table are distributed using OSPF if a rule and the OSPF function are enabled.	
	Type	Locally connected routes / Remotely connected routes **Locally connected routes**: all local networks are distributed using OSPF, if OSPF is enabled. Distribution can be restricted by using access lists. **Remotely connected routes**: all external networks are distributed using OSPF. External networks include, for example, static as well as IPsec and OpenVPN remote networks. Distribution can be restricted by using access lists.
	Metric	Metric used to distribute the routes. Unit representing the quality of a connection when a specific route is used (depends on the bandwidth, hop count, costs, and MTU).
	Access list	Distributes the routes according to the selected access list (see "Distribution Settings"). If **None** is selected, all routes of the selected type are distributed.
Dynamic Routes (learned by OSPF)	The status of all routes learned using OSPF is displayed.	
	Remote network	Dynamically learned remote network.
	Gateway	Gateway to reach the remote network.
	Metric	Metric for the learned route.

5.7.2 Distribution Settings



Dynamic routes are automatically distributed using the OSPF protocol. For statically entered routes in the kernel routing table, it must be specified whether they should also be distributed using OSPF.

If a rule is selected for either the “Locally connected routes” or “Remotely connected routes” type, by default (Access List = None) all corresponding routes are distributed using OSPF if OSPF is enabled.

Rules can be created via Distribution Settings which determine the routes that are not learned dynamically that should be distributed using OSPF. These include:

– Locally configured networks (see “Network >> Interfaces” on page 135)
– Static routes entered as external, internal or DMZ networks (see “Network >> Interfaces” on page 135)
– Routes entered in the kernel routing table via OpenVPN (see “OpenVPN Client >> Connections” on page 333)

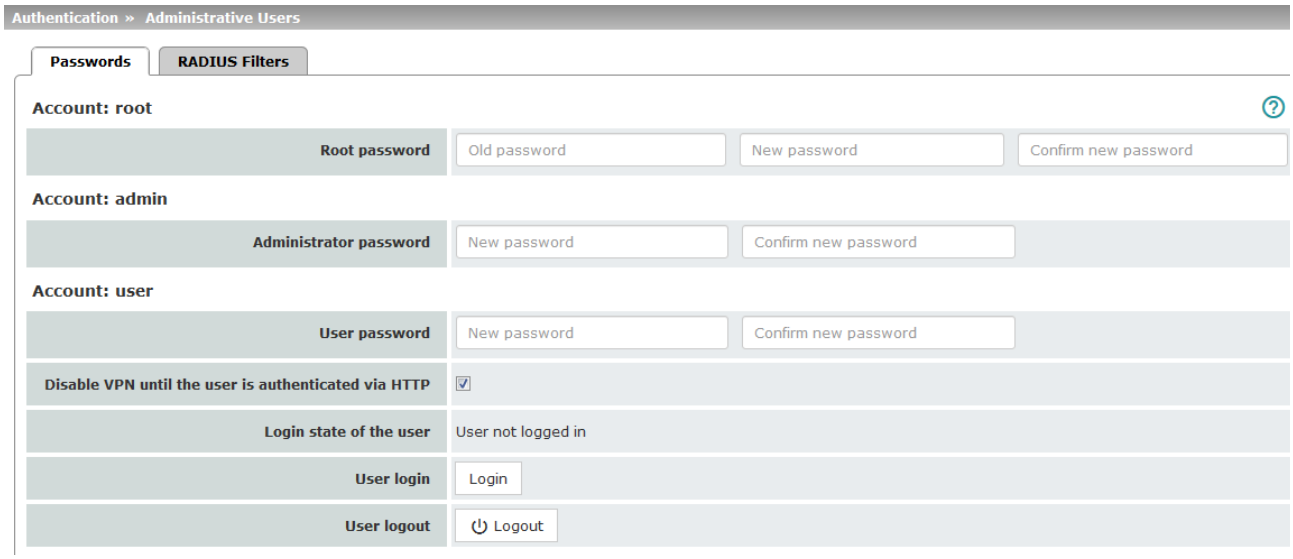
Network >> Dynamic Routing >> Distribution Settings >> Edit >> Access List Settings		
Settings	**Name**	The **Name** must be unique and must not be assigned more than once.
Rules	**Permit/Deny**	Lists the access list rules. These apply for routes that are not distributed dynamically using OSPF. **Permit** (default) means that the route to the entered network is distributed using OSPF. **Deny** means that the route to the entered network is not distributed using OSPF.
	Network	**Network** whose distribution is permitted or denied by rules.

6 Authentication menu

6.1 Authentication >> Administrative Users

NOTE: Change the administrator password during initial login
After logging in for the first time, immediately change the default administrator passwords for the users *root* and *admin*).

6.1.1 Passwords



Administrative Users refers to users who have the right (depending on their authorization level) to configure the mGuard (*root* and *administrator* authorization levels) or to use it (*user* authorization level).

Authentication >> Administrative Users >> Passwords

To log into the corresponding authorization level, the user must enter the password assigned to the relevant authorization level (*root*, *admin* or *user*).

NOTE: Use secure passwords!
Only create and use secure and complex passwords as described by the National Institute of Standards and Technology (NIST) (pages.nist.gov/800-63-4/sp800-63b.html).

If you change passwords, you should then restart the mGuard to securely end existing sessions with passwords that are no longer valid.

Authentication >> Administrative Users >> Passwords [...]		
Account: root	**Root password**	Grants full rights to all parameters of the mGuard. Background: only this authorization level allows unlimited access to the mGuard file system. User name (cannot be modified): **root** Default root password: **root** • To change the root password, enter the old password in the *Old password* field, then the new password in the next two fields.
Account: admin	**Administrator password**	Grants the rights required for the configuration options accessed via the web-based administrator interface. User name (cannot be modified): **admin** Default password: **mGuard**
Account: update (Not visible in WBM. Can only be configured via GAI and mdm.)	**Update password**	The "update" user is only authorized to perform a firmware update ("Local Update" or "Automatic Update"). A firmware update can be initiated by this user via WBM, GAI-Config or mdm. The user cannot be created and configured via the WBM, but only via the Generic Administration Interface (GAI) and the mGuard device manager (mdm). The user is created when a password is assigned for the first time. User name (cannot be changed): **update** Default password: **no password assigned**
Account: user	**User password**	There is no default user password. To set one, enter the desired password in both input fields.
	Disable VPN until the user is authenticated via HTTPS	If the function is activated and the user "user" is **not logged in**, all configured VPN connections (IPsec and OpenVPN) are permanently deactivated. If the function is activated and the user "user" is l**ogged in**, VPN connections can be started according to their configuration. To activate the function, the "user" user must log in via HTTPS on the mGuard login page using their password. The "user" user can also log in and log out in the WBM using the "User login" | **Login** button or "User logout" | **Logout** button (see below). If the device is restarted or the user "user" is logged out via WBM, all VPN connections are immediately deactivated until the user logs in again. Default setting: Deactivated
	Login state of the user	Displays whether the user is logged on or off.
	User login	To log in the user, click on the **Login** button.

Authentication >> Administrative Users >> Passwords [...]		
	User logout	To log out the user, click on the **Logout** button.

6.1.2 RADIUS Filters

Group names can be created here for administrative users whose password is checked using a RADIUS server when accessing the mGuard. Each of these groups can be assigned an administrative role.

If you change passwords or make changes to the authentication process, you should then restart the mGuard to securely end existing sessions with certificates or passwords that are no longer valid.

NOTE: Use secure passwords!
Only create and use secure and complex passwords as described by the National Institute of Standards and Technology (NIST) (pages.nist.gov/800-63-4/sp800-63b.html).

Authentication >> Administrative Users >> RADIUS Filters

The mGuard only checks passwords using RADIUS servers if you have activated RADIUS authentication:

– For shell access, see menu: *“Management >> System Settings >> Shell Access”*
– For web access, see menu: *“Management >> Web Settings >> Access”*

The RADIUS filters are searched consecutively. When the first match is found, access is granted with the corresponding role *(admin, netadmin, audit)*.

After a RADIUS server has checked and accepted a user's password, it sends the mGuard a list of filter IDs in its response.

These filter IDs are assigned to the user in a server database. They are used by the mGuard for assigning the group and therefore the authorization level as “admin”, “netadmin” or “audit”.

If authentication is successful, this is noted as part of the mGuard's logging process. The name of the RADIUS user and his role are recorded in log entries. The log messages may be forwarded to a remote server. For this, the access to the remove syslog server must be added and configured on the mGuard device (see Section 11, “Logging menu”).

The following actions of the RADIUS user are logged in the form of log entries (with the name and role of the RADIUS user):

– Login/logout of the RADIUS user
– Configuration changes by the RADIUS user
– All other actions performed by the RADIUS user
–

Authentication >> Administrative Users >> RADIUS Filters [...]		
RADIUS Filters for Administrative Access	**Group/Filter ID**	The group name may only be used once. Two lines must not have the same value. Responses from the RADIUS server with notification of successful authentication must have this group name in their filter ID attribute. Up to 50 characters are allowed (printable UTF-8 characters only) without spaces.
	Authorized for access as	Each group is assigned an administrative role. **admin:** Administrator (local configuration changes) **netadmin**: Administrator (local configuration changes) for mGuard devices that are administered via the mGuard device manager (mdm / FL MGUARD DM UNLIMITED). **update**: User to perform firmware updates **audit**: Auditor/Tester The *netadmin* and *audit* authorization levels relate to access rights with the mGuard device manager (FL MGUARD DM UNLIMITED).

6.2 Authentication >> Firewall Users

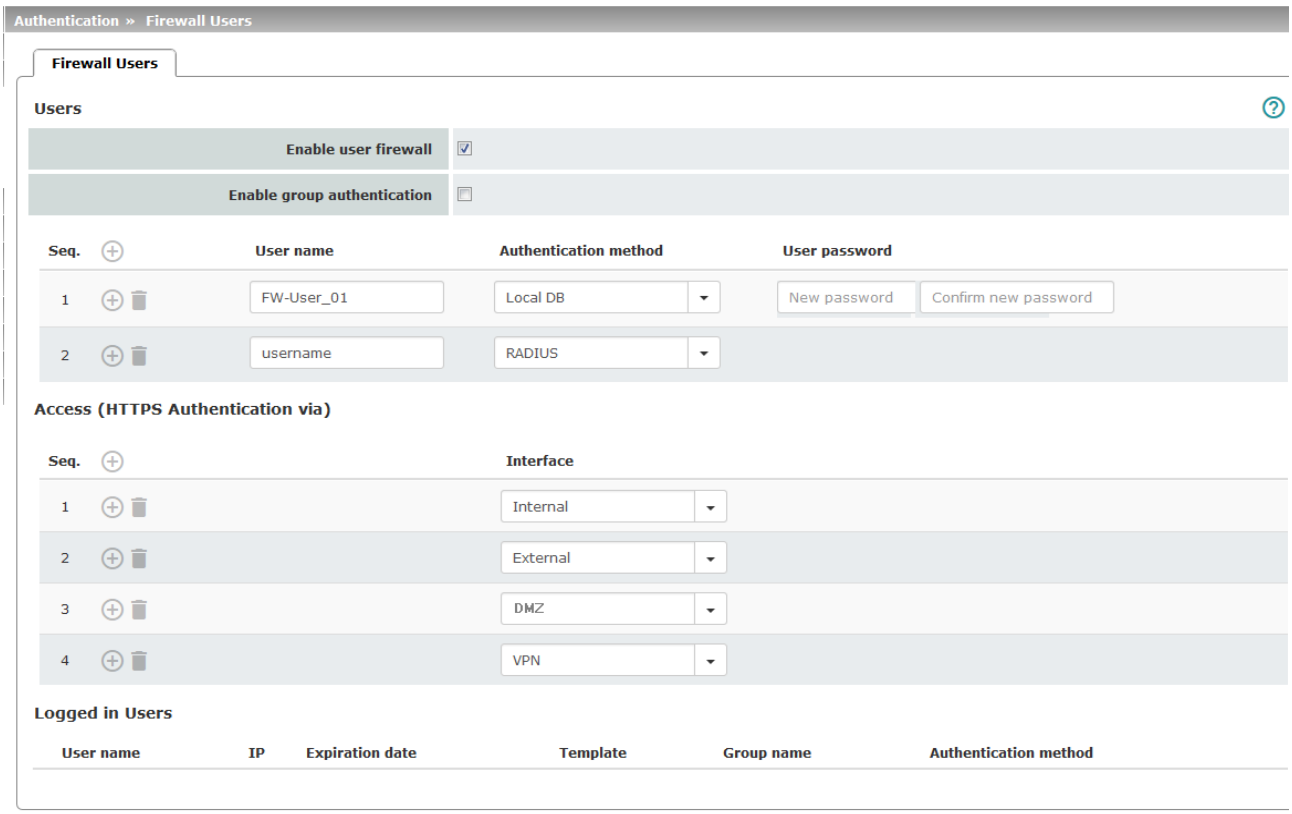
To prevent private surfing on the Internet, for example, every outgoing connection can be blocked under *"Network Security >> Packet Filter"*. VPN is not affected by this.

Under *"Network Security >> User Firewall"*, different firewall rules can be defined for certain users, e.g., all outgoing connections are permitted. This user firewall rule takes effect as soon as the relevant firewall user(s) (to whom this user firewall rule applies) has (or have) logged in, see *"Network Security >> User Firewall" on page 252*.

6.2.1 Firewall Users

This menu is **not** available on devices of the FL MGUARD 2000 series.

Concurrent administrative access via X.509 authentication and via login to the mGuard user firewall is not possible with the **"Safari" web browser**.



Authentication >> Firewall Users >> Firewall Users	
Users	Lists the firewall users by their assigned user identifier. Also specifies the authentication method.

Authentication >> Firewall Users >> Firewall Users [...]	
Enable user firewall	Under the *"Network Security >> User Firewall"* menu item, firewall rules can be defined and assigned to specific firewall users. When the user firewall is activated, the firewall rules assigned to the listed users are applied as soon as the corresponding user logs in.
Enable group authentication	When activated, the mGuard forwards login requests for unknown users to the RADIUS server. If successful, the response from the RADIUS server will contain a group name. The mGuard then enables user firewall templates containing this group name as the template user. The RADIUS server must be configured to deliver this group name in the "Access Accept" packet as a "Filter-ID=<group name>" attribute.
Enable/disable user firewall via on/off switch	**Service input CMD 1-3 (I 1-3)** The login of firewall users on the mGuard device can always be activated (permitted) or deactivated (prohibited) via an on/off switch. If the switch is deactivated, it is not possible for firewall users to log in. Firewall users who are already logged in are logged out when the user firewall is deactivated via the on/off switch. The switch must be connected to one of the service contacts (I 1-3). "On/off switch" must be selected as the switch type for the service contact and not "Push-button" (see Section 4.8.1). If no switch is connected to an assigned service contact, it is considered deactivated and it is not possible for firewall users to log in.
User name	Name specified by the user during login.
Authentication method	**Local DB**: when *Local DB* is selected, the password assigned to the user, and that the user must enter on login along with their *User name,* must be entered in the *User password* column. **RADIUS**: if *RADIUS* is selected, the user password can be stored on the RADIUS server. If you change passwords or make changes to authentication methods, you should then restart the mGuard to securely end existing sessions with certificate or passwords that are no longer valid.

Authentication >> Firewall Users >> Firewall Users [...]

User password

(Only if **Local DB** is selected as the authentication method.)

Assigned user password.

Use secure passwords!

Only create and use secure and complex passwords as described by the National Institute of Standards and Technology (NIST) (pages.nist.gov/800-63-4/sp800-63b.html).

Access (HTTPS Authentication via)

Specifies which mGuard interfaces can be used by firewall users to log into the mGuard.

HTTPS remote access must also be enabled in the "*"Management >> Web Settings"*" menu, if access does not take place via the **Internal** interface.

NOTE: For authentication via an external interface, please consider the following:

If a firewall user can log in via an "unsecure" interface and the user leaves the session without logging out correctly, the login session may remain open and could be misused by another unauthorized person.

An interface is "unsecure", for example, if a user logs in via the Internet from a location or a computer to which the IP address is assigned dynamically by the Internet service provider – this is usually the case for many Internet users. If such a connection is temporarily interrupted, e.g., because the user logged in is being assigned a different IP address, this user must log in again.

However, the old login session under the old IP address remains open. This login session could then be used by an intruder, who uses this "old" IP address of the authorized user and accesses the mGuard using this sender address. The same thing could also occur if an (authorized) firewall user forgets to log out at the end of a session.

This hazard of logging in via an "unsecure interface" is not completely eliminated, but the time is limited by setting the configured timeout for the user firewall template used. See "Timeout type" on page 254.

Interface

Internal / External / VPN

Specifies which mGuard interfaces can be used by firewall users to log into the mGuard. For the interface selected, web access via HTTPS must be enabled: **""Management >> Web Settings"" menu**, *Access* tab (see "Access" on page 81).

In *Stealth* network mode, both the **Internal** and **External** interfaces must be enabled so that firewall users can log into the mGuard.

(Two rows must be entered in the table for this.)

Authentication >> Firewall Users >> Firewall Users [...]	
Logged in Users	When the user firewall is activated, the status of logged in firewall users is displayed here. Selected users can be logged off by clicking on the ⊖ icon.

6.3 Authentication >> RADIUS

A RADIUS server is a central authentication server used by devices and services to check user passwords. The password is not known to these devices and services. Only one or a number of RADIUS servers know the password.

The RADIUS server also provides the device or service that a user wishes to access with further information about the user, e.g., the group to which the user belongs. In this way, all user settings can be managed centrally.

A list of RADIUS servers used by the mGuard is generated under Authentication >> RADIUS Servers. This list is also used when RADIUS authentication is activated for administrative access (SSH/HTTPS).

When RADIUS authentication is active, the login attempt of a non-predefined user (not: *root, admin, netadmin, audit* or *user*) is forwarded to all the RADIUS servers listed here. The first response received by the mGuard from one of the RADIUS servers determines whether or not the authentication attempt is successful.

If you change passwords or make changes to the authentication process, you should then restart the mGuard to securely end existing sessions with certificates or passwords that are no longer valid.

If the "Control login via on/off switch (HTTPS/SSH)" function is used and the on/off switch is deactivated, login via HTTPS/SSH and login and authentication of firewall users via a RADIUS server is no longer possible.

Authentication >> RADIUS		
RADIUS Servers	**RADIUS timeout**	Specifies the time (in seconds) the mGuard waits for a response from the RADIUS server. Default: 3 seconds.
	RADIUS retries	Specifies how many times requests to the RADIUS server are repeated after the RADIUS timeout time has elapsed. Default: 3.

Authentication >> RADIUS [...]		
	RADIUS NAS identifier	A NAS ID (NAS identifier) is sent with every RADIUS request, except when the field remains empty. All common characters on the keyboard can be used as the NAS ID. The NAS ID is a RADIUS attribute that can be used by the client to be identified by the RADIUS server. The NAS ID can be used instead of an IP address to identify the client. It must be unique within the range of the RADIUS server.
	Server	Name of the RADIUS server or its IP address. We recommend entering IP addresses as servers instead of names, where possible. Otherwise, the mGuard must first resolve the names before it can send authentication queries to the RADIUS server. This takes time when logging in. Also, it may not always be possible to perform authentication if name resolution fails, e.g., because the DNS is not available or the name was deleted from the DNS.

Authentication >> RADIUS [...]

Via VPN

The RADIUS server's request is – **where possible** – carried out via a VPN tunnel (IPsec VPN or OpenVPN).

Prerequisite: A suitable VPN tunnel is available.

If no suitable VPN tunnel is available, traffic is always sent **unencrypted via the default gateway**.

A suitable VPN tunnel is available if the remote peer belongs to the remote network of a configured VPN tunnel and the mGuard has an internal IP address that belongs to the local network of the same VPN tunnel.

Please note:

For IPsec VPN connections, the "Via VPN" function must be activated so that the traffic is routed through a suitable IPsec VPN tunnel.

For OpenVPN connections, traffic is usually routed via a suitable OpenVPN tunnel even if the function is deactivated.

When the **"Via VPN"** function is activated, the mGuard supports queries from a RADIUS server through its VPN connection. This happens automatically whenever the RADIUS server belongs to the remote network of a configured VPN tunnel and the mGuard has an internal IP address belonging to the local network of the same VPN tunnel. This makes the authentication query dependent on the availability of a VPN tunnel.

During configuration, ensure that the failure of a single VPN tunnel does not prevent administrative access to the mGuard.

Port

The port number used by the RADIUS server.

Authentication >> RADIUS [...]

Secret

RADIUS server password (secret)

This password must be the same as on the mGuard. The mGuard uses this password to exchange messages with the RADIUS server and to encrypt the user password. The RADIUS server password is not transmitted in the network.

The password is important for security since the mGuard can be rendered vulnerable to attack at this point if passwords are too weak. We recommend a password with at least 32 characters and several special characters. It must be changed on a regular basis.

If the RADIUS secret is discovered, an attacker can read the user password for the RADIUS authentication queries. An attacker can also falsify RADIUS responses and gain access to the mGuard if they know the user names. These user names are transmitted as plain text with the RADIUS request. The attacker can thus simulate RADIUS queries and thereby find out user names and the corresponding passwords.

Administrative access to the mGuard should remain possible while the RADIUS server password is being changed. Proceed as follows to ensure this:

- Set up the RADIUS server for the mGuard a second time with a new password.
- Also set this new password on the RADIUS server.
- On the mGuard, delete the line containing the old password.

6.4 Authentication >> Certificates

Authentication is a fundamental element of secure communication. The X.509 authentication method relies on certificates to ensure that the “correct” partners communicate with each other and that no “incorrect” partner is involved in communication. An “incorrect” communication partner is one who falsely identifies themselves as someone they are not (see glossary under “X.509 certificate” on page 397).

Certificate

A certificate is used as proof of the identity of the certificate owner. The relevant authorizing body in this case is the CA (certificate authority). The digital signature on the certificate is provided by the CA. By providing this signature, the CA confirms that the authorized certificate owner possesses a private key that corresponds to the public key in the certificate.

The name of the certificate issuer appears under **Issuer** on the certificate, while the name of the certificate owner appears under *Subject*.

Self-signed certificates

A self-signed certificate is one that is signed by the certificate owner and not by a CA. In self-signed certificates, the name of the certificate owner appears under both **Issuer** and *Subject*.

Basic constraint CA:FALSE

A self-signed certificate with the basic constraint "CA:FALSE" is rejected by the mGuard device during validation.

If you want to use such a certificate or create one yourself, you must ensure that the basic constraint "CA:FALSE" is not used.

Self-signed certificates are used if communication partners want to or must use the X.509 authentication method without having or using an official certificate. This type of authentication should only be used between communication partners that know and trust each other. Otherwise, from a security point of view, such certificates are as worthless as, for example, a home-made passport without the official stamp.

Certificates are shown to all communication partners (users or machines) during the connection process, providing the X.509 authentication method is used. In terms of the mGuard, this could apply to the following applications:

– Authentication of communication partners when establishing VPN connections using IPsec (see “IPsec VPN >> Connections” on page 266, “Authentication” on page 291).
– Authentication of communication partners when establishing VPN connections using OpenVPN (see “OpenVPN Client >> Connections” on page 333, “Authentication” on page 291).
– Management of the mGuard via SSH (shell access) (see “Management >> System Settings >> Host” on page 53, “Shell Access” on page 62).
– Management of the mGuard via HTTPS (see “Management >> Web Settings” on page 80, “Access” on page 81).

Certificate, machine certificate

Certificates can be used to identify (authenticate) oneself to others. The certificate used by the mGuard to identify itself to others shall be referred to as the “machine certificate” here, in line with Microsoft Windows terminology.

A “certificate”, “certificate specific to an individual” or “user certificate showing a person” is one used by operators to authenticate themselves to peers (e.g., an operator attempting to access the mGuard via HTTPS and a web browser for the purpose of remote

configuration). A certificate specific to an individual can also be saved on a chip card and then inserted by its owner in the card reader of their computer when prompted by a web browser during connection establishment, for example.

Remote certificate

A certificate is thus used by its owner (person or machine) as a form of ID in order to verify that they really are the individual they identify themselves as. As there are at least two communication partners, the process takes place alternately: partner A shows their certificate to their peer, partner B; partner B then shows their certificate to their peer, partner A.

Provision is made for the following so that A can accept the certificate shown by B, i.e., the certificate of their peer (thus allowing communication with B): A has previously received a copy of the certificate from B (e.g., by data carrier or e-mail) which B will use to identify itself to A. A can then verify that the certificate shown by B actually belongs to B by comparing it with this copy. With regard to the mGuard interface, the certificate copy given here by partner B to A is an example of a *remote certificate*.

For reciprocal authentication to take place, both partners must thus provide the other with a copy of their certificate in advance in order to identify themselves. A installs the copy of the certificate from B as its remote certificate. B then installs the copy of the certificate from A as its remote certificate.

Never provide the PKCS#12 file (file name extension: *.p12) as a copy of the certificate to the peer in order to use X.509 authentication for communication at a later time. The PKCS#12 file also contains the private key that must be kept secret and must not be given to a third party (see “Creation of certificates” on page 199).

To create a copy of a machine certificate imported in the mGuard, proceed as follows:

- On the “Machine Certificates” tab, click on the **Current Certificate File** button next to the *Download Certificate* row for the relevant machine certificate (see “Machine Certificates” on page 204).

CA certificates

The certificate shown by a peer can also be checked by the mGuard in a different way, i.e., not by consulting the locally installed remote certificate on the mGuard. To check the authenticity of possible peers in accordance with X.509, the method described below of consulting CA certificates can be used instead or as an additional measure, depending on the application.

CA certificates provide a way of checking whether the certificate shown by the peer is really signed by the CA specified in the peer's certificate.

A CA certificate is available as a file from the relevant CA (file name extension: *.cer, *.pem or *.crt). For example, this file may be available to download from the website of the relevant CA.

The mGuard can then check if the certificate shown by the peer is authentic using the CA certificates loaded on the mGuard. However, this requires all CA certificates to be made available to the mGuard in order to form a chain with the certificate shown by the peer. In addition to the CA certificate from the CA whose signature appears on the certificate shown by the peer to be checked, this also includes the CA certificate of the superordinate CA, and so forth, up to the root certificate (see glossary under “CA certificate” on page 391).

Authentication using CA certificates enables the number of possible peers to be extended without any increased management effort because it is not compulsory to install a remote certificate for each possible peer.

Creation of certificates

To create a certificate, a *private key* and the corresponding *public key* are required. Programs are available so that any user can create these keys. Similarly, a corresponding certificate with the corresponding *public key* can also be created, resulting in a self-signed certificate. (Additional information about self-creation can be downloaded from phoenixcontact.net/products. It is available in the download area in an application note entitled “How to obtain X.509 certificates”.)

A corresponding certificate signed by a CA must be requested from the CA.

In order for the private key to be imported into the mGuard with the corresponding certificate, these components must be packed into a PKCS#12 file (file name extension: *.p12).

Authentication methods

The mGuard uses two methods of X.509 authentication that are fundamentally different.

– The authentication of a peer is carried out based on the certificate and remote certificate. In this case, the remote certificate that is to be consulted must be specified for each individual connection, e.g., for VPN connections.
– The mGuard consults the CA certificates provided to check whether the certificate shown by the peer is authentic. This requires all CA certificates to be made available to the mGuard in order to form a chain with the certificate shown by the peer through to the root certificate.

“Available” means that the relevant CA certificates must be installed on the mGuard (see “CA Certificates” on page 206) and must also be referenced during the configuration of the relevant application (SSH, HTTPS, and VPN).

Whether both methods are used alternatively or in combination varies depending on the application (VPN, SSH, and HTTPS).

If you change passwords or make changes to the authentication process, you should then restart the mGuard to securely end existing sessions with certificates or passwords that are no longer valid.

Restrictions using the “Safari” web browser

Please note that during administrative access to the mGuard via an X.509 certificate using the **“Safari” web browser** all sub-CA certificates must be installed in the web browser's Trust Store.

Authentication for SSH

The peer shows the following:	Certificate (specific to individual), **signed by CA**	Certificate (specific to individual), **self-signed**
The mGuard authenticates the peer using:	⇕	⇕
	All CA certificates that form the chain to the root CA certificate together with the certificate shown by the peer PLUS (if required) Remote certificates, **if** used as a filter[1]	Remote certificate

1 (See “Management >> System Settings” on page 53, “Shell Access” on page 62)

Authentication for HTTPS

The peer shows the following:	Certificate (specific to individual), **signed by CA**[1]	Certificate (specific to individual), **self-signed**
The mGuard authenticates the peer using:	⇕	⇕
	All CA certificates that form the chain to the root CA certificate together with the certificate shown by the peer PLUS (if required) Remote certificates, **if** used as a filter[2]	Remote certificate

1 The peer can additionally provide sub-CA certificates. In this case, the mGuard can form the set union for creating the chain from the CA certificates provided and the self-configured CA certificates. The corresponding root CA certificate must always be available on the mGuard.

2 (See “Management >> Web Settings” on page 80, “Access” on page 81)

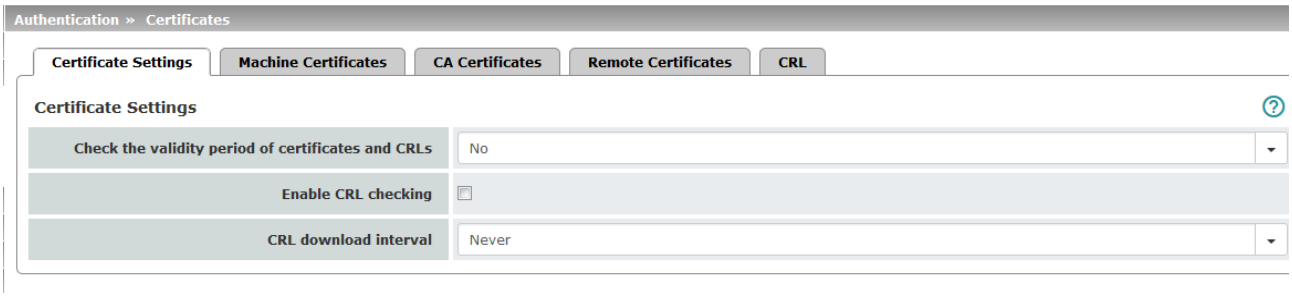
Authentication for VPN

The peer shows the following:	Machine certificate, **signed by CA**	Machine certificate, **self-signed**
The mGuard authenticates the peer using:		
	Remote certificate Or all CA certificates that form the chain to the root CA certificate together with the certificate shown by the peer	Remote certificate

NOTE: It is not sufficient to simply install the certificates to be used on the mGuard under *"Authentication >> Certificates"*. In addition, the certificate from the pool of certificates imported into the mGuard that is to be used must be referenced in the relevant applications (VPN, SSH, HTTPS).

The remote certificate for authentication of a VPN connection (or the tunnels of a VPN connection) is installed in the *"IPsec VPN >> Connections"* menu.

6.4.1 Certificate Settings



Authentication >> Certificates >> Certificate Settings

Certificate Settings

The settings made here relate to all certificates and certificate chains that are to be checked by the mGuard.

This generally excludes the following:

– Self-signed certificates from peers
– All remote certificates for VPN

Check the validity period of certificates and CRLs

Always

The validity period is always observed.

No

The validity period specified in certificates and CRLs is ignored by the mGuard.

Wait for synchronization of the system time

The validity period specified in certificates and CRLs is only observed by the mGuard if the current date and time are known to the mGuard:

– By means of the built-in clock
– By synchronizing the system clock (see “Time and Date” on page 56)

Until this point, all certificates to be checked are considered invalid for security reasons.

Authentication >> Certificates >> Certificate Settings [...]

Enable CRL checking

When **CRL checking is enabled**, the mGuard consults the CRL (certificate revocation list) and checks whether or not the certificates that are available to the mGuard are blocked.

CRLs are issued by the CAs and contain the serial numbers of blocked certificates, e.g., certificates that have been reported stolen.

On the **CRL** tab (see "CRL" on page 210), specify the origin of the revocation lists for the mGuard.

When CRL checking is enabled, a CRL must be configured for each **issuer** of certificates on the mGuard. Missing CRLs result in certificates being considered invalid.

Revocation lists are verified by the mGuard using an appropriate CA certificate. Therefore, all CA certificates that belong to a revocation list (all sub-CA certificates and the root certificate) must be imported on the mGuard. If the validity of a revocation list cannot be proven, it is ignored by the mGuard.

If the use of revocation lists is activated together with the consideration of validity periods, revocation lists are ignored if (based on the system time) their validity has expired or has not yet started.

After uploading a revocation list, up to 10 minutes can pass before VPN connections that use certificates for authentication are established.

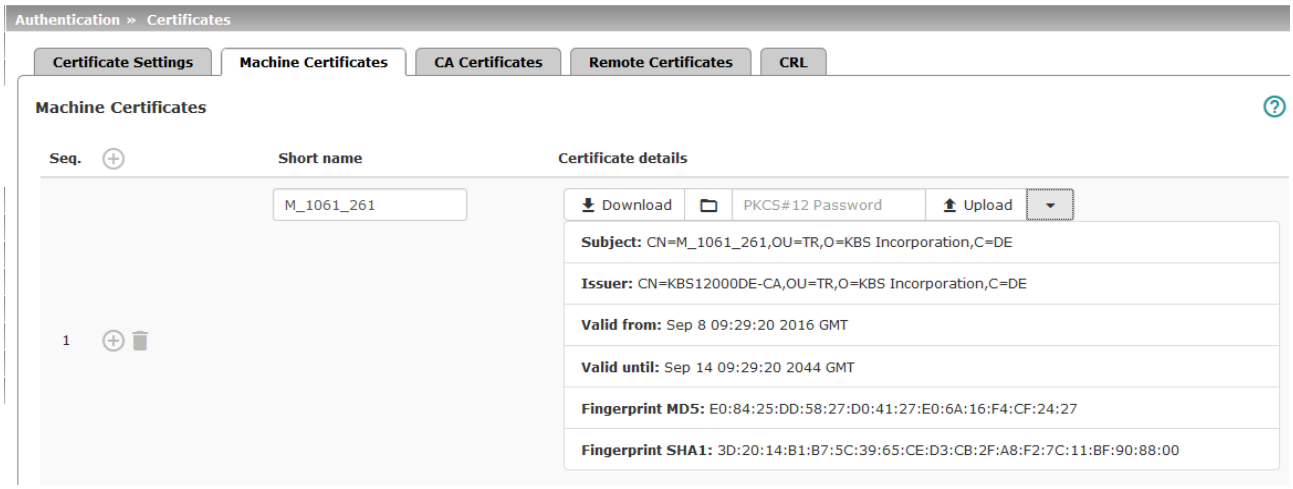
CRL download interval

If *CRL checking* is enabled (see above), select the time period in which the revocation lists should be downloaded and applied.

On the **CRL** tab (see "CRL" on page 210), specify the origin of the revocation lists for the mGuard.

If CRL checking is enabled, but CRL download is set to **Never**, the CRL must be manually loaded on the mGuard so that CRL checking can be performed.

6.4.2 Machine Certificates



The mGuard authenticates itself to the peer using a machine certificate loaded on the mGuard. The machine certificate acts as an ID card for the mGuard, which it shows to the relevant peer.

For a more detailed explanation, see “Authentication >> Certificates” on page 197.

By importing a PKCS#12 file, the mGuard is provided with a private key and the corresponding machine certificate. Multiple PKCS#12 files can be loaded on the mGuard, enabling the mGuard to show the desired self-signed or CA-signed machine certificate to the peer for various connections.

In order to use the machine certificate installed at this point, it must be referenced **additionally** during the configuration of applications (SSH, VPN) so that it can be used for the relevant connection or remote access type.

Example of imported machine certificates (see above).

Authentication >> Certificates >> Machine Certificates	
Machine Certificates	Shows the currently imported X.509 certificates that the mGuard uses to authenticate itself to peers, e.g., other VPN gateways.

To import a (new) certificate, proceed as follows:

Importing a new machine certificate

Requirement:

The PKCS#12 file (file name extension: *.p12 or *.pfx) is saved on the connected computer.

Proceed as follows:

- Click on the **No file selected** icon to select the file.
- In the ***Password*** field, enter the password used to protect the private key of the PKCS#12 file.
- Click on the **Upload** icon.
  Once imported, you can view the details of the certificate by clicking on the **Details** button.
- Save the imported certificate by clicking on the **Save** icon.

Short name

When importing a machine certificate, the CN attribute from the certificate subject field is suggested as the short name here (providing the *Short name* field is empty at this point). This name can be adopted or another name can be chosen.

- A name must be assigned, whether it is the suggested one or another. Names must be unique and must not be assigned more than once.

Using the short name

During the configuration of:

– SSH (*"Management >> System Settings"*, *Shell Access* menu)
– HTTPS (*"Management >> Web Settings"*, *Access* menu)
– VPN connections (*"IPsec VPN >> Connections"* menu)

the certificates imported on the mGuard are provided in a selection list.

The certificates are displayed under the short name specified for each individual certificate on this page.

For this reason, name assignment is mandatory.

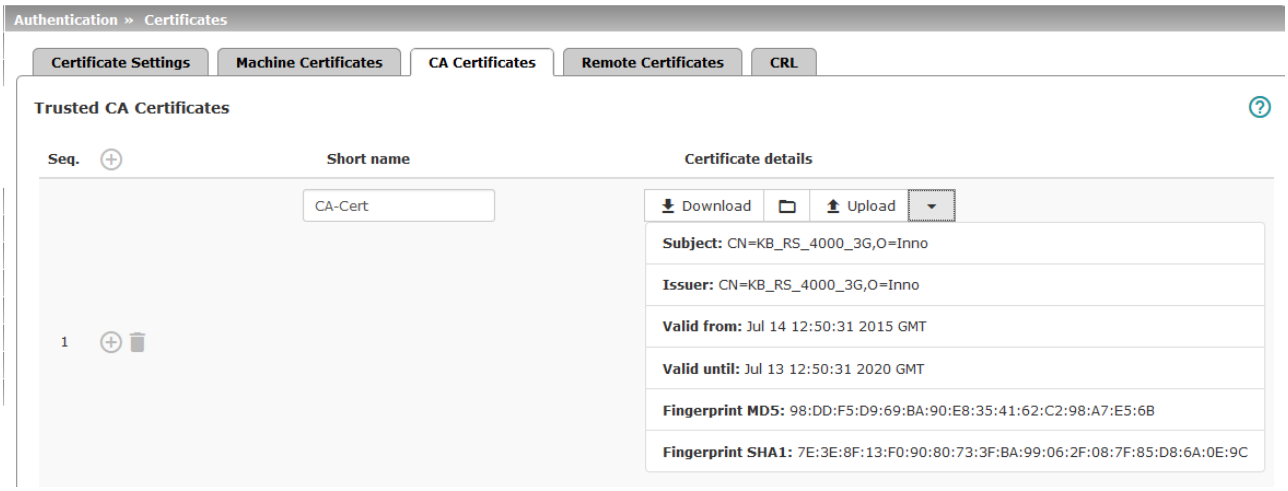
Creating and downloading a certificate copy

You can create and download a copy of the imported machine certificate (e.g., for the peer in order to authenticate the mGuard). This copy does not contain the private key and therefore does not pose a risk.

To do this, proceed as follows:

- Click on the **Download** icon in the row for the relevant machine certificate.
- Follow the instructions in the dialog boxes that are displayed.

6.4.3 CA Certificates



CA certificates are certificates issued by a certification authority (CA). CA certificates are used to check whether the certificates shown by peers are authentic.

The checking process is as follows: the certificate issuer (CA) is specified as the issuer in the certificate transmitted by the peer. These details can be verified using the local CA certificate from the same issuer. For a more detailed explanation, see “Authentication >> Certificates” on page 197.

Example of imported CA certificates (see above).

Authentication >> Certificates >> CA Certificates

Trusted CA Certificates — **Displays the current imported CA certificates.**

To import a (new) certificate, proceed as follows:

Importing a CA certificate

The file (file name extension: *.cer, *.pem or *.crt) is saved on the connected computer.

Proceed as follows:

- Click on the **No file selected** icon to select the file.
- Click on the **Upload** icon.
  Once imported, you can view the details of the certificate by clicking on the **Details** button.
- Save the imported certificate by clicking on the **Save** icon.

Short name

When importing a CA certificate, the CN attribute from the certificate subject field is suggested as the short name here (providing the Short name field is empty at this point). This name can be adopted or another name can be chosen.

- You must assign a name. The name must be unique.

Using the short name

During the configuration of:

– SSH (*“Management >> System Settings”*, *Shell Access* menu)
– HTTPS (*“Management >> Web Settings”*, *Access* menu)
– VPN connections (*“IPsec VPN >> Connections”* menu)

the certificates imported on the mGuard are provided in a selection list. The certificates are displayed under the short name specified for each certificate in this selection list. Name assignment is mandatory.

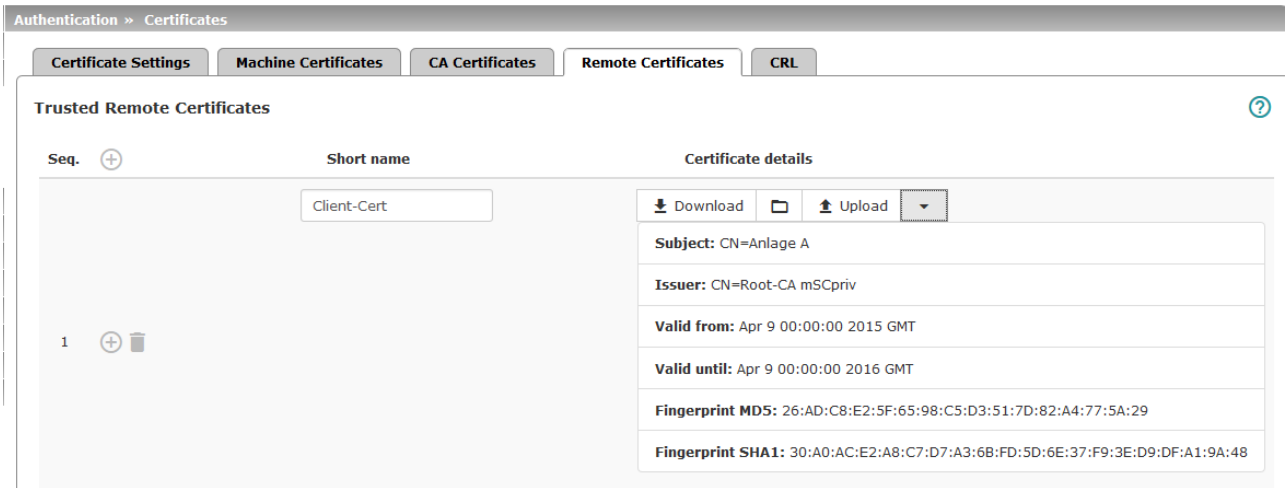
Creating and downloading a certificate copy

A copy can be created from the imported CA certificate and downloaded.

To do this, proceed as follows:

- Click on the **Download** icon in the row for the relevant CA certificate.
- Follow the instructions in the dialog boxes that are displayed.

6.4.4 Remote Certificates



A remote certificate is a copy of the certificate that is used by a peer to authenticate itself to the mGuard.

Remote certificates are files (file name extension: *.cer, *.pem or *.crt) received from the operators of possible peers by trustworthy means. You load these files on the mGuard so that reciprocal authentication can take place. The remote certificates of several possible peers can be loaded.

The remote certificate for authentication of a VPN connection (or the tunnels of a VPN connection) is installed in the *"IPsec VPN >> Connections"* menu.

For a more detailed explanation, see "Authentication >> Certificates" on page 197.

Example of imported remote certificates (see above)

Authentication >> Certificates >> Remote Certificates

Trusted Remote Certificates	Displays the current imported remote certificates.

Importing a new certificate

Requirement:

The file (file name extension: *.cer, *.pem or *.crt) is saved on the connected computer.

Proceed as follows:

- Click on the **No file selected** icon to select the file.
- Click on the **Upload** icon.
  Once imported, you can view the details of the certificate by clicking on the **Details** button.
- Save the imported certificate by clicking on the **Save** icon.

Short name

When importing a remote certificate, the CN attribute from the certificate subject field is suggested as the short name here (providing the *Short name* field is empty at this point). This name can be adopted or another name can be chosen.

- A name must be assigned, whether it is the suggested one or another. Names must be unique and must not be assigned more than once.

Using the short name

During the configuration of:

– SSH (*"Management >> System Settings"*, *Shell Access* menu)
– HTTPS (*"Management >> Web Settings"*, *Access* menu)

the certificates imported on the mGuard are provided in a selection list. The certificates are displayed under the short name specified for each certificate in this selection list. Name assignment is mandatory.

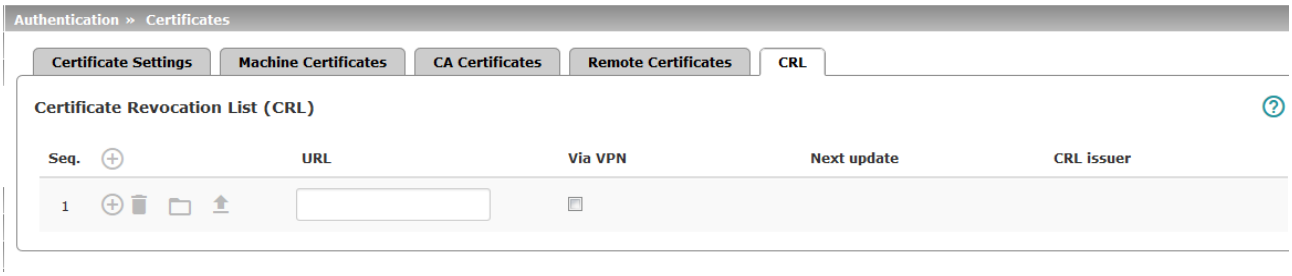
Creating and downloading a certificate copy

A copy can be created from the imported remote certificate and downloaded.

To do this, proceed as follows:

- Click on the **Download** icon in the row for the relevant remote certificate.
- Follow the instructions in the dialog boxes that are displayed.

6.4.5 CRL



Authentication >> Certificates >> CRL

Certificate Revocation List (CRL)

CRL stands for certificate revocation list.

The CRL is a list containing serial numbers of blocked certificates. This page is used for the configuration of sites from which the mGuard should download CRLs in order to use them.

Certificates are only checked for revocations if the **Enable CRL checking** function has been activated (see "Certificate Settings" on page 202).

A CRL with the same **issuer** name must be present for each **issuer** name specified in the certificates to be checked. If such a CRL is not present and CRL checking is enabled, the certificate is considered invalid.

After uploading a revocation list, up to 10 minutes can pass before VPN connections that use certificates for authentication are established.

URL

Specify the URL of the CA where CRL downloads are obtained if the CRL should be downloaded on a regular basis, as defined under **CRL download interval** on the *Certificate Settings* tab (see "Certificate Settings" on page 202).

Authentication >> Certificates >> CRL

Via VPN

The CRL download server's URL request is – **where possible** – carried out via a VPN tunnel (IPsec VPN or OpenVPN).

Prerequisite: A suitable VPN tunnel is available.

If no suitable VPN tunnel is available, traffic is always sent **unencrypted via the default gateway**.

A suitable VPN tunnel is available if the remote peer belongs to the remote network of a configured VPN tunnel and the mGuard has an internal IP address that belongs to the local network of the same VPN tunnel.

Please note:

For IPsec VPN connections, the "Via VPN" function must be activated so that the traffic is routed through a suitable IPsec VPN tunnel.

For OpenVPN connections, traffic is usually routed via a suitable OpenVPN tunnel even if the function is deactivated.

Next update

Information read directly from the CRL by the mGuard:

Time and date when the CA will next issue a new CRL.

This information is not influenced or considered by the CRL download interval.

CRL issuer

Information read directly from the CRL by the mGuard:

Shows the issuer of the relevant CRL.

Authentication >> Certificates >> CRL

Action: upload CRL file

If the CRL is available as a file, it can also be imported on the mGuard manually.

- Click on the **No file selected** icon and select the desired CRL file. Then click on the **Open** button.

If the icon is not shown, then after inserting a new table row, you must first click on the **Save** icon.

- Then click on the **Upload CRL file** icon to import the CRL file.
- Click on the **Save** icon to apply the changes.

An up-to-date CRL file must always be used. For this reason, it is not included in the mGuard configuration.

When exporting an mGuard configuration and then importing it to another mGuard, the CRL file must be uploaded again.

CRL files might be deleted during a firmware update. In this case, the mGuard downloads the CRL files from the specified URL again. Alternatively, they can also be uploaded manually.

7 Network Security menu

A reduced version of the menu is available on devices of the FL MGUARD 2000 series.

7.1 Network Security >> Packet Filter

The mGuard includes a *Stateful Packet Inspection Firewall*. The connection data of an active connection is recorded in a database (connection tracking). Rules therefore only have to be defined for one direction. This means that data from the other direction of the relevant connection, and only this data, is automatically allowed through.

A side effect is that existing connections are not aborted during reconfiguration, even if a corresponding new connection can no longer be established.

The firewall rules configured under **Network security >> Packet filter** are not used on IP packets which are directed to an mGuard IP address. They only apply to IP connections or IP traffic which passes through the mGuard.

Default firewall settings (standard)

– All incoming connections are discarded (excluding VPN).
– Data packets of all outgoing connections are allowed through.

The firewall rules here have an effect on the firewall that is permanently active, with the exception of:

– **VPN connections**. Individual firewall rules are defined for VPN connections (see “IPsec VPN >> Connections” on page 266, “Firewall” on page 299).
– **User firewall**. When a user logs in, for whom user firewall rules are defined, these rules take priority (see “Network Security >> User Firewall” on page 252), followed by the permanently active firewall rules.

If multiple firewall rules are defined, these are queried starting from the top of the list of entries until an appropriate rule is found. This rule is then applied. If the list of rules contains further subsequent rules that could also apply, these rules are ignored.

Firewall settings for devices from the FL MGUARD 2000 series

The devices of the FL MGUARD 2000 series have a simple firewall functionality.
The following functions are not supported:
– **Firewall** rule records cannot be configured.
– **MAC filters** cannot be configured.
– A **user firewall** cannot be configured.
– **Host names in IP-groups** cannot be used.
Caution: configuration profiles which include the corresponding settings cannot be imported.

Use of host names in IP groups (firewall rules)

Host names can also be specified in IP groups in addition to IP addresses, IP areas, and networks (DNS-based firewall rules). IP address resolution of host names is performed according to the DNS settings of the mGuard. This allows host names to be used in firewall groups via IP groups (see “IP/Port Groups” on page 231).

NOTE: When using host names, there is always the risk of an attacker manipulating or blocking DNS requests (i.e. *DNS spoofing*). You should therefore only configure trustworthy and secure DNS servers from your internal company network on the mGuard, so as to avoid these types of attacks.

For security reasons, IP groups that contain host names should not be used in firewall rules which execute “Drop” or “Reject” as the action.

If a host name from an IP group cannot be resolved, e.g., because a DNS server has not been configured or cannot be reached, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration.

PROFINET RT

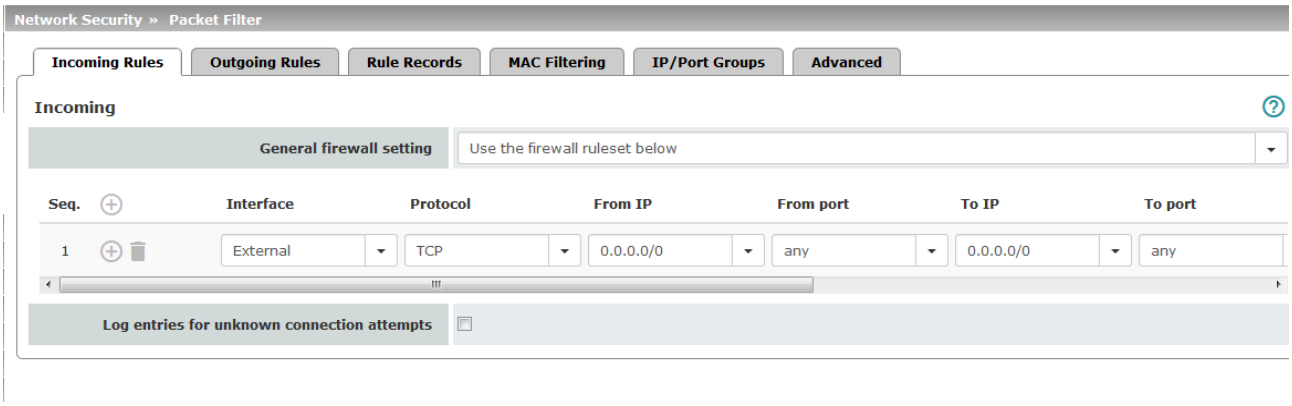
The hardware of the FL MGUARD 210X/410X/430X devices is designed in such a way that the WAN side (interface XF1) and the LAN side (interface XF2 or XF2-XF5) are securely separated from each other via the application processor.

In addition, the mGuard firmware 10.x is implemented in such a way that the transmission of Layer 2 datagrams such as PROFINET RT is excluded when using the "Router" network mode (default setting).

mGuard devices can therefore be used as a secure network boundary for PROFINET. They can be used as protective devices for PROFIsafe network cells in environments in which the uniqueness of the PROFIsafe addresses cannot be ensured.

The devices are used in accordance with the IEC 61784-3-3 standard (5.4.2 and 8.1.2).

7.1.1 Incoming Rules



Network Security >> Packet Filter >> Incoming Rules

Incoming

Lists the firewall rules that have been set up. They apply for incoming data connections that are initiated externally (WAN --> LAN).

Special firewall settings apply for the mGuard devices from the FL MGUARD 2000 series (see “Firewall settings for devices from the FL MGUARD 2000 series” on page 213).

In the default setting, all incoming connections (except VPN) are discarded.

If “*Use the firewall ruleset below*“ is selected as the **General firewall setting** and **no rule** has been set, the data packets of all incoming connections (excluding VPN) are dropped.

The DoS protection of the device is not available, if “*Accept all connections*“ is selected as the **General firewall setting** (see “Flood Protection” on page 250).

To provide DoS protection in this case, select the **General firewall setting** "*Use the firewall ruleset below*" and then create a firewall rule that accepts all connections.

General firewall setting

Accept all connections: the data packets of all incoming connections are allowed.

Drop all connections: the data packets of all incoming connections are discarded.

Accept Ping only: the data packets of all incoming connections are discarded, except for ping packets (ICMP). This setting allows all ping packets to pass through. The integrated protection against brute force attacks is not effective in this case.

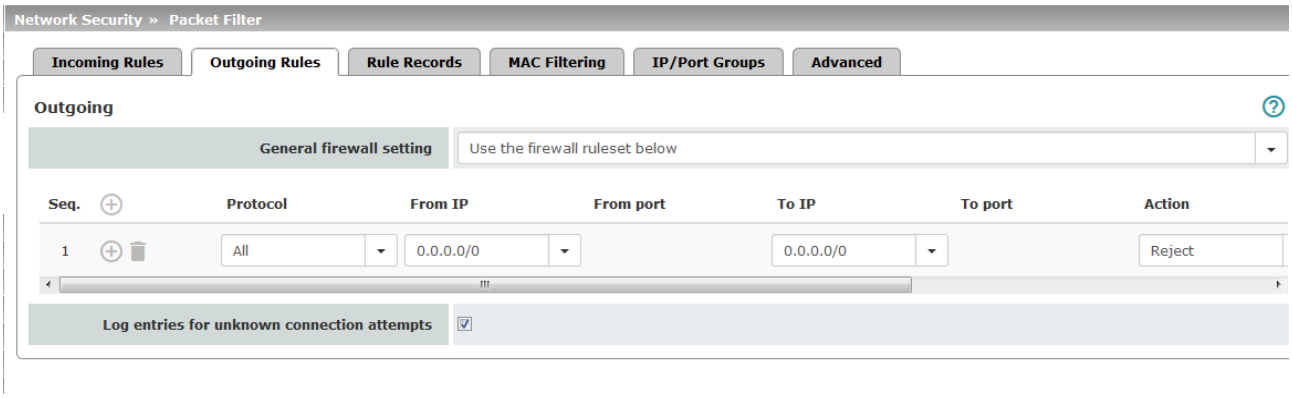
Use the firewall ruleset below: displays further setting options.

The following settings are only visible if “**Use the firewall ruleset below**” is set.

Network Security >> Packet Filter >> Incoming Rules [...]	
Interface	**External, All** Specifies via which interface the data packets are received so that the rule applies to them. On devices of the FL MGUARD 2000/4000 series, only the External interface is available.
Protocol	**All** means TCP, UDP, ICMP, GRE, and other IP protocols
From IP / To IP	**0.0.0.0/0** means all IP addresses. To specify an address area, use CIDR format (see "CIDR (Classless Inter-Domain Routing)" on page 49). **Name of IP groups**, if defined. When a name is specified for an IP group, the host names, IP addresses, IP areas or networks saved under this name are taken into consideration (see "IP/Port Groups" tab page). If host names are used in IP groups, the mGuard must be configured so that the host name of a DNS server can be resolved in an IP address. If a host name from an IP group cannot be resolved, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration. The use of host names in IP groups is not possible on mGuard devices of the FL MGUARD 2000 series.
From port / To port **(Only for TCP and UDP protocols)**	**any** refers to any port. **startport:endport** (e.g., 110:120) refers to a port range. Individual ports can be specified using the port number or the corresponding service name (e.g., 110 for pop3 or pop3 for 110). **Name of port groups**, if defined. When a name is specified for a port group, the ports or port ranges saved under this name are taken into consideration (see "IP/Port Groups" tab page).

Network Security >> Packet Filter >> Incoming Rules [...]	
Action	**Accept** means that the data packets may pass through. **Reject** means that the data packets are sent back and the sender is informed of their rejection. In Stealth mode, **Reject** has the same effect as **Drop**. **Drop** means that the data packets are not permitted to pass through. They are discarded, which means that the sender is not informed of their whereabouts. **Name of** rule records, if defined. When a rule record is selected, the firewall rules configured under this rule record take effect (see "Rule Records" on page 224). For security reasons, rule records that contain IP groups with host names should not be used in firewall rules which execute "Drop" or "Reject" as the action. The use of rule records is not possible on mGuard devices of the FL MGUARD 2000 series. **Name of Modbus TCP rule records**, if defined. When a Modbus TCP rule record is selected, the firewall rules configured under this rule record take effect (see Section 7.3.1).
Comment	Freely selectable comment for this rule.
Log	For each individual firewall rule, you can specify whether the use of the rule: – Should be logged – activate *Log* function – Should not be logged – deactivate *Log* function (default)
Log entries for unknown connection attempts	When the function is activated, all connection attempts that are not covered by the rules defined above are logged. (Default setting: **deactivated**)

7.1.2 Outgoing Rules



Network Security >> Packet Filter >> Outgoing Rules

Outgoing

Lists the firewall rules that have been set up.

They apply

b) for outgoing data connections that are initiated internally (LAN --> WAN),

c) for data connections initiated from one VLAN network on the LAN side to another VLAN network on the LAN side.

Special firewall settings apply for the mGuard devices from the FL MGUARD 2000 series (see “Firewall settings for devices from the FL MGUARD 2000 series” on page 213).

A rule is defined by default that allows all outgoing connections.

If “**Use the firewall ruleset below**” is selected and **no rule** has been set, the data packets of all outgoing connections (excluding VPN) are dropped.

General firewall setting

Accept all connections: the data packets of all outgoing connections are allowed.

Drop all connections: the data packets of all outgoing connections are discarded.

Accept Ping only: the data packets of all outgoing connections are discarded, except for ping packets (ICMP).

Use the firewall ruleset below: displays further setting options.

The following settings are only visible if “**Use the firewall ruleset below**” is set.

Protocol

All means TCP, UDP, ICMP, GRE, and other IP protocols

Network Security >> Packet Filter >> Outgoing Rules [...]

From IP / To IP

0.0.0.0/0 means all IP addresses. To specify an address area, use CIDR format (see "CIDR (Classless Inter-Domain Routing)" on page 49).

Name of IP groups, if defined. When a name is specified for an IP group, the host names, IP addresses, IP areas or networks saved under this name are taken into consideration (see "IP/Port Groups" tab page).

If host names are used in IP groups, the mGuard must be configured so that the host name of a DNS server can be resolved in an IP address.

If a host name from an IP group cannot be resolved, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration.

The use of host names in IP groups is not possible on mGuard devices of the FL MGUARD 2000 series.

From port / To port

(Only for TCP and UDP protocols)

any refers to any port.

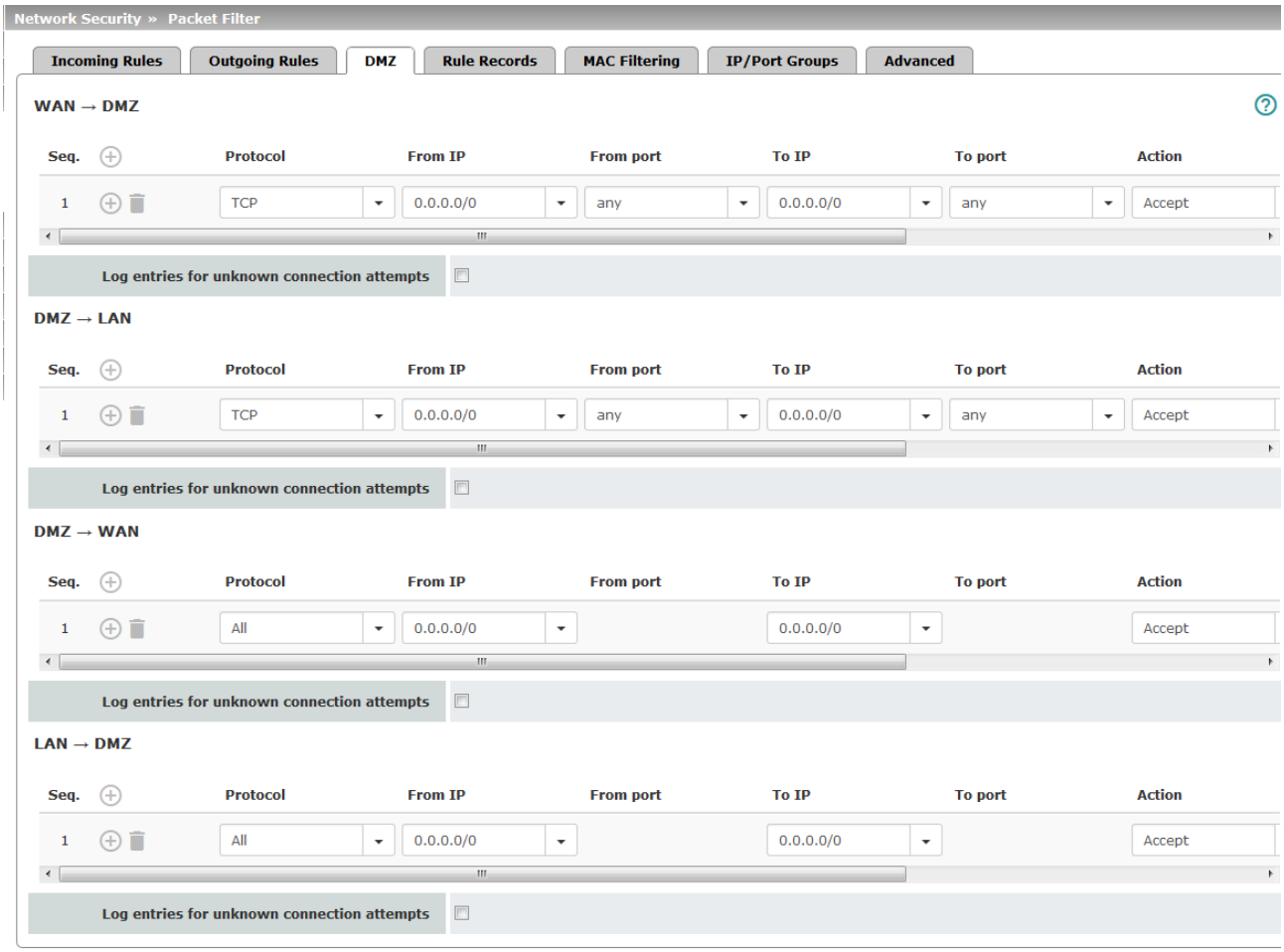
startport:endport (e.g., 110:120) refers to a port range.

Individual ports can be specified using the port number or the corresponding service name (e.g., 110 for pop3 or pop3 for 110).

Name of port groups, if defined. When a name is specified for a port group, the ports or port ranges saved under this name are taken into consideration (see "IP/Port Groups" tab page).

Network Security >> Packet Filter >> Outgoing Rules [...]	
Action	**Accept** means that the data packets may pass through. **Reject** means that the data packets are sent back and the sender is informed of their rejection. . In Stealth mode, **Reject** has the same effect as **Drop**. **Drop** means that the data packets are not permitted to pass through. They are discarded, which means that the sender is not informed of their whereabouts. **Name of** rule records, if defined. When a rule record is selected, the firewall rules configured under this rule record take effect (see "Rule Records" on page 224). For security reasons, rule records that contain IP groups with host names should not be used in firewall rules which execute "Drop" or "Reject" as the action. The use of rule records is not possible on mGuard devices of the FL MGUARD 2000 series. **Name of Modbus TCP rule records**, if defined. When a Modbus TCP rule record is selected, the firewall rules configured under this rule record take effect (see Section 7.3.1).
Comment	Freely selectable comment for this firewall rule.
Log	For each individual firewall rule, you can specify whether the use of the rule: – Should be logged – activate *Log* action – Should not be logged – deactivate *Log* action (default)
Log entries for unknown connection attempts	When the function is activated, all connection attempts that are not covered by the rules defined above are logged. (Default setting: **deactivated**)

7.1.3 DMZ

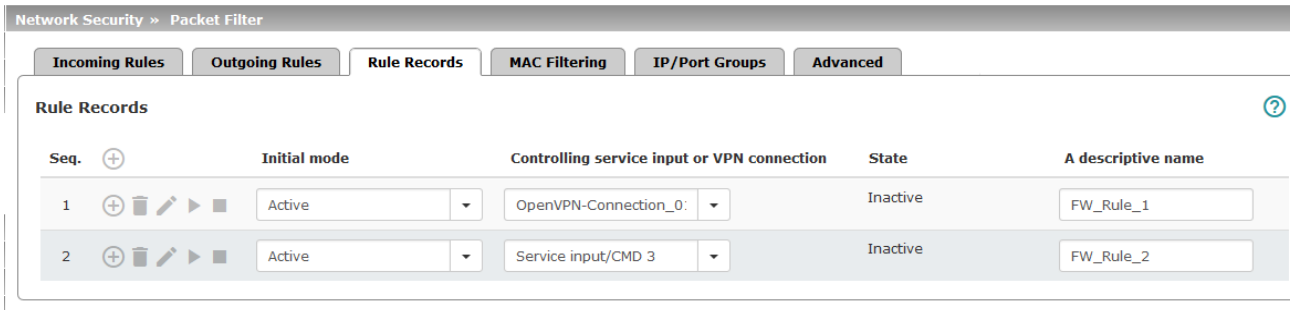


Network Security >> Packet Filter >> DMZ	
Firewall rules for the DMZ (Only for FL MGUARD 4305)	The DMZ can be protected against attacks from the internal network (LAN interface) and the external network (WAN interface) using a dedicated set of firewall rules. The settings are split into four possible directions of network traffic.
WAN → DMZ	If no rule has been set, the data packets of all incoming connections (excluding VPN) are dropped (default setting).
DMZ → LAN	If no rule has been set, the data packets of all outgoing connections (excluding VPN) are dropped (default setting).
DMZ → WAN	A rule is defined by default that allows all outgoing connections.
LAN → DMZ	A rule is defined by default that allows all incoming connections.

Network Security >> Packet Filter >> DMZ [...]		
	Protocol	**All** means TCP, UDP, ICMP, GRE, and other IP protocols
	From IP / To IP	**0.0.0.0/0** means all IP addresses. To specify an address area, use CIDR format (see Section 3.7, "CIDR (Classless Inter-Domain Routing)"). **Name of IP groups**, if defined. When a name is specified for an IP group, the host names, IP addresses, IP areas or networks saved under this name are taken into consideration (see "IP/Port Groups" tab page). If host names are used in IP groups, the mGuard must be configured so that the host name of a DNS server can be resolved in an IP address. If a host name from an IP group cannot be resolved, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration.
	From port / To port (Only for TCP and UDP protocols)	**any** refers to any port. **startport:endport** (e.g., 110:120) refers to a port range. Individual ports can be specified using the port number or the corresponding service name (e.g., 110 for pop3 or pop3 for 110). **Name of port groups**, if defined. When a name is specified for a port group, the ports or port ranges saved under this name are taken into consideration (see "IP/Port Groups" tab page).

Network Security >> Packet Filter >> DMZ [...]		
	Action	**Accept** means that the data packets may pass through. **Reject** means that the data packets are sent back and the sender is informed of their rejection. . In Stealth mode, **Reject** has the same effect as **Drop**. **Drop** means that the data packets are not permitted to pass through. They are discarded, which means that the sender is not informed of their whereabouts. **Name of** rule records, if defined. When a rule record is selected, the firewall rules configured under this rule record take effect (see "Rule Records" on page 224). For security reasons, rule records that contain IP groups with host names should not be used in firewall rules which execute "Drop" or "Reject" as the action. **Name of Modbus TCP rule records**, if defined. When a Modbus TCP rule record is selected, the firewall rules configured under this rule record take effect (see Section 7.3.1).
	Comment	Freely selectable comment for this rule.
	Log	For each individual firewall rule, you can specify whether the use of the rule: – Should be logged – activate *Log* action – Should not be logged – deactivate *Log* action (default)
	Log entries for unknown connection attempts	When the function is activated, all connection attempts that are not covered by the rules defined above are logged. (Default setting: **deactivated**)

7.1.4 Rule Records



Firewall rule records are used to combine firewall rules into one rule record. These can then be enabled or disabled together via the rule record.

A rule record – and thus all the firewall rules configured in it – could, for example, be controlled via an on/off switch or an established VPN connection (see “Management >> Service I/O” on page 127).

All VPN connections (IPsec and OpenVPN) can be used to control rule records.

Notes on the use of rule records that are only temporarily activated

In firewall rule records that are only temporarily activated (e.g. controlled by a switch), so-called "**Allow rules**" (Action = Accept) should always be used:

– The rule record is activated to allow the configured connections.
– The rule record is deactivated to block the configured connections.

"**Deny rules**" (Action = Reject/Drop) should not be used in temporarily activated rule records, since corresponding already existing data connections would not be automatically terminated with the activation of the rule record.

If a connection associated with a firewall rule record has been established and is continuously creating data traffic, deactivation of the firewall rule record might not interrupt this connection as expected.

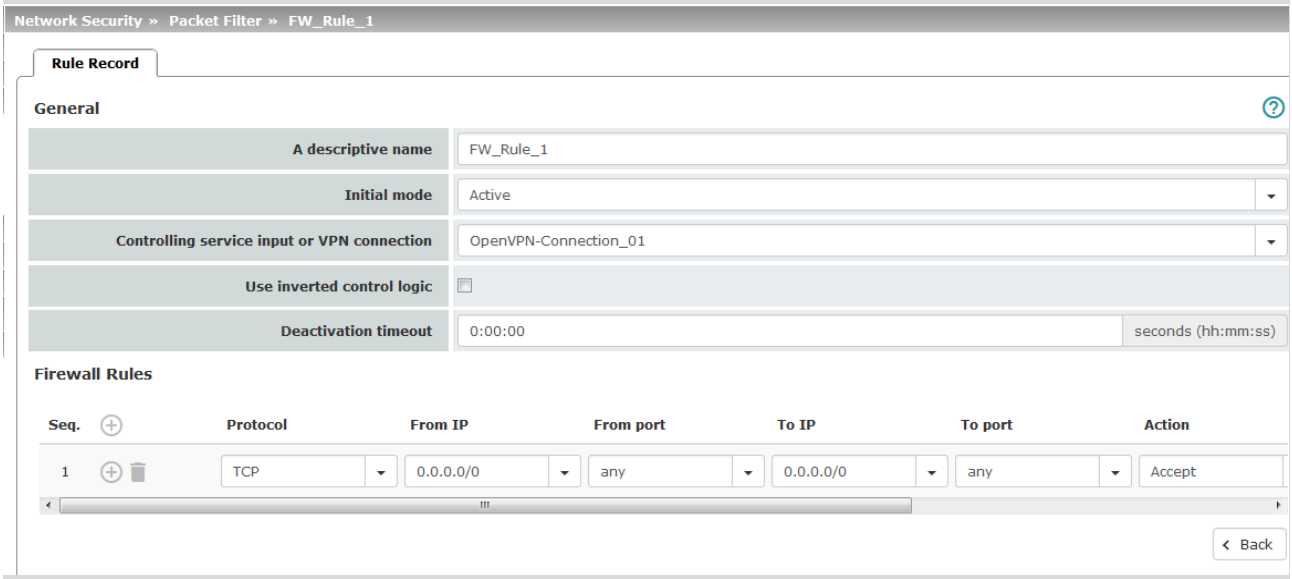
This happens because the (outgoing) response of a service on the LAN side creates an entry in the connection tracking table which enables a different (incoming) request from an external peer. This peer passes the firewall using the same parameters, however, it is not connected to the firewall rule record.

There are two ways to set up the mGuard so that it interrupts the associated connections when deactivating the firewall rule record.

– Activate the "Allow TCP connections upon SYN only" option under “Network Security >> Packet Filter >> Advanced”.
– In the firewall, block the outgoing connections that operate via the port that is the destination for the incoming connections.

If, for example, the firewall rule record enables incoming data traffic on port 22, an outgoing rule can be set up that deactivates any data traffic coming from port 22.

Network Security >> Packet Filter >> Rule Records		
Rule Records (This menu item is not part of the FL MGUARD 2000 series functionality.)	**Initial mode**	**Disabled / Active / Inactive** Determines the output state of the firewall rule record following a reconfiguration or restart. The “Active/Inactive” setting is only applicable if a push-button is connected. If the firewall rule records are controlled via a switch or VPN connection, they have priority. If set to “Disabled”, the firewall rule record cannot be dynamically enabled. The firewall rule record is retained but has no influence.
	Controlling service input or VPN connection	**Service input CMD 1-3 (I 1-3), VPN connection** The firewall rule record can be switched via a push-button/switch or via starting and stopping a VPN connection. ℹ The successful establishment of the VPN connection is not relevant for the activation of the rule record. ℹ The button/switch must be connected to one of the service contacts (CMD 1-3 / I 1-3).
	State	Indicates the current state.
	A descriptive name	The firewall rule record can be freely named/renamed.
	Activate / Inactivate rule record	**Activate / Inactivate** You can enable or disable the rule record by clicking on the ▶ **Activate** and ■ **Inactivate** icons.
Edit	The following tab page appears when you click on the ✎ **Edit Row** icon:	



Network Security >> Packet Filter >> Rule Records [...]		
General	**A descriptive name**	The firewall rule record can be freely named/renamed.
	Initial mode	**Disabled / Active / Inactive** Determines the output state of the firewall rule record following a reconfiguration or restart. The “Active/Inactive” setting is only applicable if a push-button is connected. If the firewall rule records are controlled via a switch or VPN connection, they have priority. If set to “Disabled”, the firewall rule record cannot be dynamically enabled. It is retained but has no influence.
	Controlling service input or VPN connection	**Service input CMD 1-3 (I1-3), VPN connection** The firewall rule record can be switched via a push-button/switch or via starting and stopping a VPN connection. [i] The successful establishment of the VPN connection is not relevant for the activation of the rule record. [i] The button/switch must be connected to one of the service contacts (CMD 1-3 / I 1-3).
	Use inverted control logic	Inverts the behavior of the connected push-button/switch or the controlling VPN connection. If the controlling service input is configured as an on/off switch, it can activate one firewall rule record while simultaneously deactivating another, for example. The same is true for the controlling VPN connections.
	Deactivation timeout	Activated firewall rule records are deactivated after this time has elapsed. 0 means the setting is disabled. Time in hh:mm:ss (1 day maximum) The entry can be in seconds [ss], minutes and seconds [mm:ss] or hours, minutes, and seconds [hh:mm:ss].
Firewall Rules	**Protocol**	**All** means TCP, UDP, ICMP, GRE, and other IP protocols.

Network Security >> Packet Filter >> Rule Records [...]

From IP

0.0.0.0/0 means all IP addresses. To specify an address area, use CIDR format (see "CIDR (Classless Inter-Domain Routing)" on page 49).

Name of IP groups, if defined. When a name is specified for an IP group, the host names, IP addresses, IP areas or networks saved under this name are taken into consideration (see "IP/Port Groups" tab page).

If host names are used in IP groups, the mGuard must be configured so that the host name of a DNS server can be resolved in an IP address.

If a host name from an IP group cannot be resolved, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration.

From port / To port

(Only for TCP and UDP protocols)

any refers to any port.

startport:endport (e.g., 110:120) refers to a port range.

Individual ports can be specified using the port number or the corresponding service name (e.g., 110 for pop3 or pop3 for 110).

Name of port groups, if defined. When a name is specified for a port group, the ports or port ranges saved under this name are taken into consideration (see "IP/Port Groups" tab page).

Action

Accept means that the data packets may pass through.

Reject means that the data packets are sent back and the sender is informed of their rejection.

In Stealth mode, **Reject** has the same effect as **Drop**.

Drop means that the data packets are not permitted to pass through. They are discarded, which means that the sender is not informed of their whereabouts.

Name of rule records, if defined. When a rule record is selected, the firewall rules configured under this rule record take effect (see "Rule Records" on page 224).

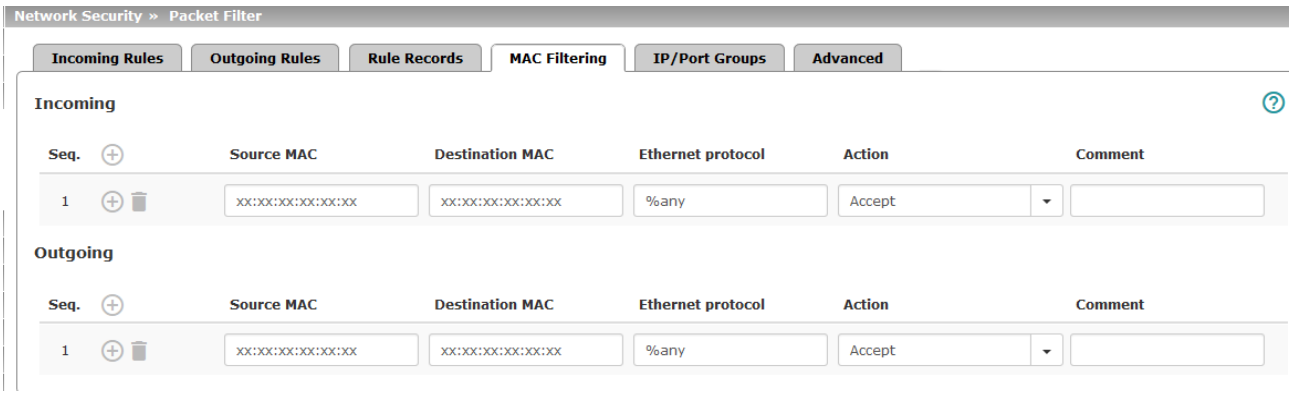
For security reasons, rule records that contain IP groups with host names should not be used in firewall rules which execute "Drop" or "Reject" as the action.

Name of Modbus TCP rule records, if defined.
When a Modbus TCP rule record is selected, the firewall rules configured under this rule record take effect (see Section 7.3.1).

Network Security >> Packet Filter >> Rule Records [...]		
	Comment	Freely selectable comment for this rule.
	Log	For each firewall rule, you can specify whether the use of the rule: – Should be logged – activate *Log* function – Should not be logged – deactivate *Log* function (default)

7.1.5 MAC Filtering

This menu item is not part of the FL MGUARD 2000 series functionality.
The incoming and outgoing rules only apply to the Network mode *Stealth*.



The “Incoming” MAC filter is applied to frames that the mGuard receives at the WAN interface. The “Outgoing” MAC filter is applied to frames that the mGuard receives at the LAN interface.

In *Stealth* mode, in addition to the packet filter (Layer 3/4) that filters data traffic, e.g., according to ICMP messages or TCP/UDP connections, a MAC filter (Layer 2) can also be set. A MAC filter (Layer 2) filters according to MAC addresses and Ethernet protocols.

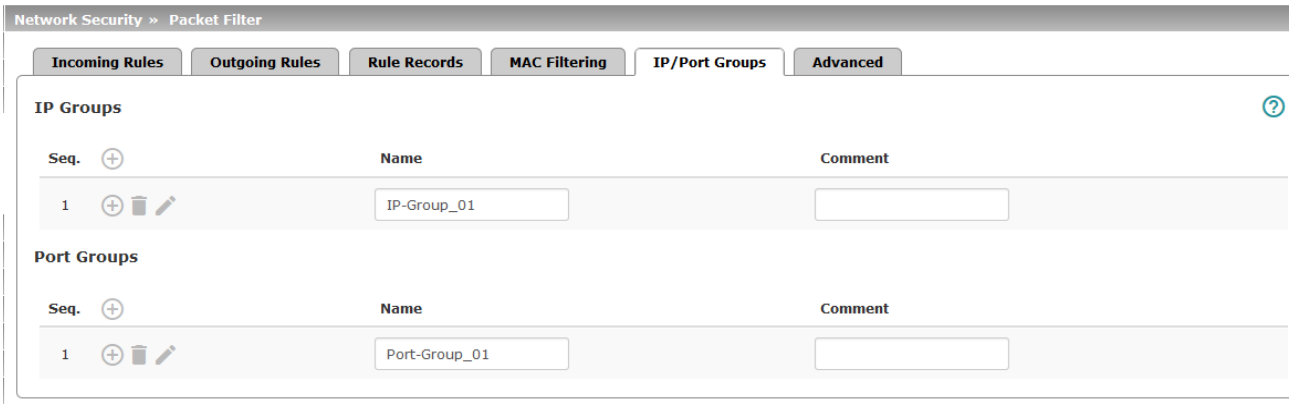
In contrast to the packet filter, the MAC filter is stateless. If rules are introduced, corresponding rules must also be created for the opposite direction.
If no rules are set, all ARP and IP packets are allowed to pass through.

When setting MAC filter rules, please note the information displayed on the screen. The rules defined here have priority over packet filter rules. The MAC filter does not support logging.

Network Security >> Packet Filter >> MAC Filtering		
Incoming	**Source MAC**	xx:xx:xx:xx:xx:xx stands for all MAC addresses.
	Destination MAC	xx:xx:xx:xx:xx:xx stands for all MAC addresses. ff:ff:ff:ff:ff:ff stands for the broadcast MAC address to which all ARP requests are sent, for example.
	Ethernet protocol	**%any** stands for all Ethernet protocols. Additional protocols can be specified in name or hexadecimal format, for example: – IPv4 or 0800 – ARP or 0806
	Action	**Accept** means that the data packets may pass through. **Drop** means that the data packets are not permitted to pass through (they are dropped).
	Comment	Freely selectable comment for this rule.

Network Security >> Packet Filter >> MAC Filtering [...]	
Outgoing	The explanation provided under “Incoming” also applies to “Outgoing”.

7.1.6 IP/Port Groups



IP and port groups enable the easy creation and management of firewall and NAT rules in complex network structures.

Host names, IP addresses, IP areas, and networks can be grouped in IP groups and identified by a name. Likewise, ports or port ranges can be grouped in port groups.

If a firewall or NAT rule is created, instead of IP addresses/IP areas or ports/port ranges, the IP or port groups can be selected directly in the corresponding fields and assigned the rule.

NOTE: Ineffective firewall rules due to empty IP or port groups

Do not use empty IP or port groups, i.e. created groups in which no values are configured. Firewall rules that refer to empty IP or port groups are ineffective.

NOTE: When using host names, there is always the risk of an attacker manipulating or blocking DNS requests (i.e. *DNS spoofing*). You should therefore only configure trustworthy and secure DNS servers from your internal company network on the mGuard, so as to avoid these types of attacks.

For security reasons, IP groups that contain host names should not be used in firewall rules which execute “Drop” or “Reject” as the action.

Use of hostnames

Address resolution of hostnames is performed according to the DNS settings of the mGuard (see “Network >> DNS” on page 165).

If a host name can be resolved in several IP addresses, all IP addresses returned by the DNS server are taken into consideration.

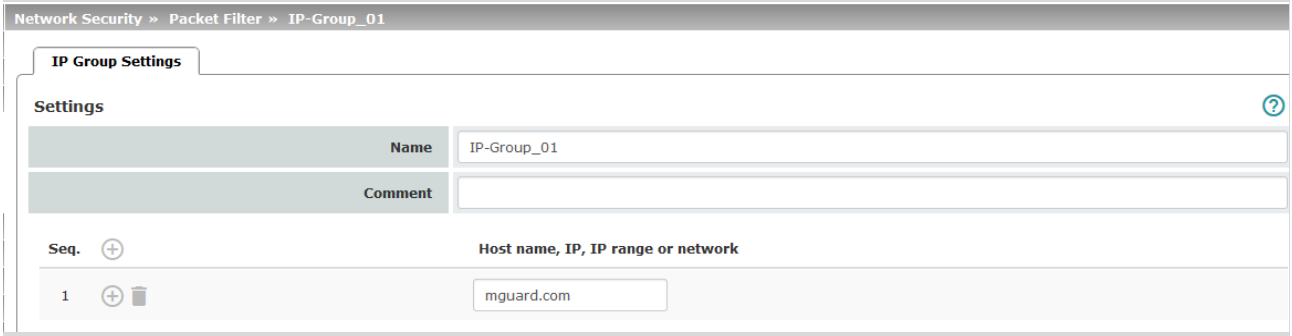
If a host name from an IP group cannot be resolved, e.g., because a DNS server has not been configured or cannot be reached, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration.

If a DNS server resolves a resolved host name with another IP address after the TTL has elapsed, an existing connection to the original IP address is **not aborted**.

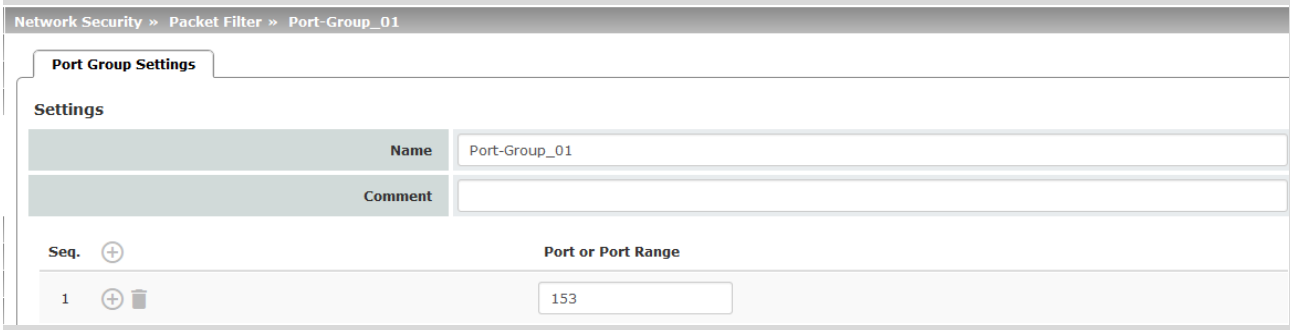
mGuard devices of the FL MGUARD 2000 series

The use of host names in IP groups is not supported by mGuard devices of the FL MGUARD 2000 series.

Network Security >> Packet Filter >> IP/Port Groups		
IP Groups	**Name**	The IP group can be freely named/renamed.
	Comment	Freely selectable comment for this group/rule.
Edit	The following tab page appears when you click on the **Edit Row** icon:	



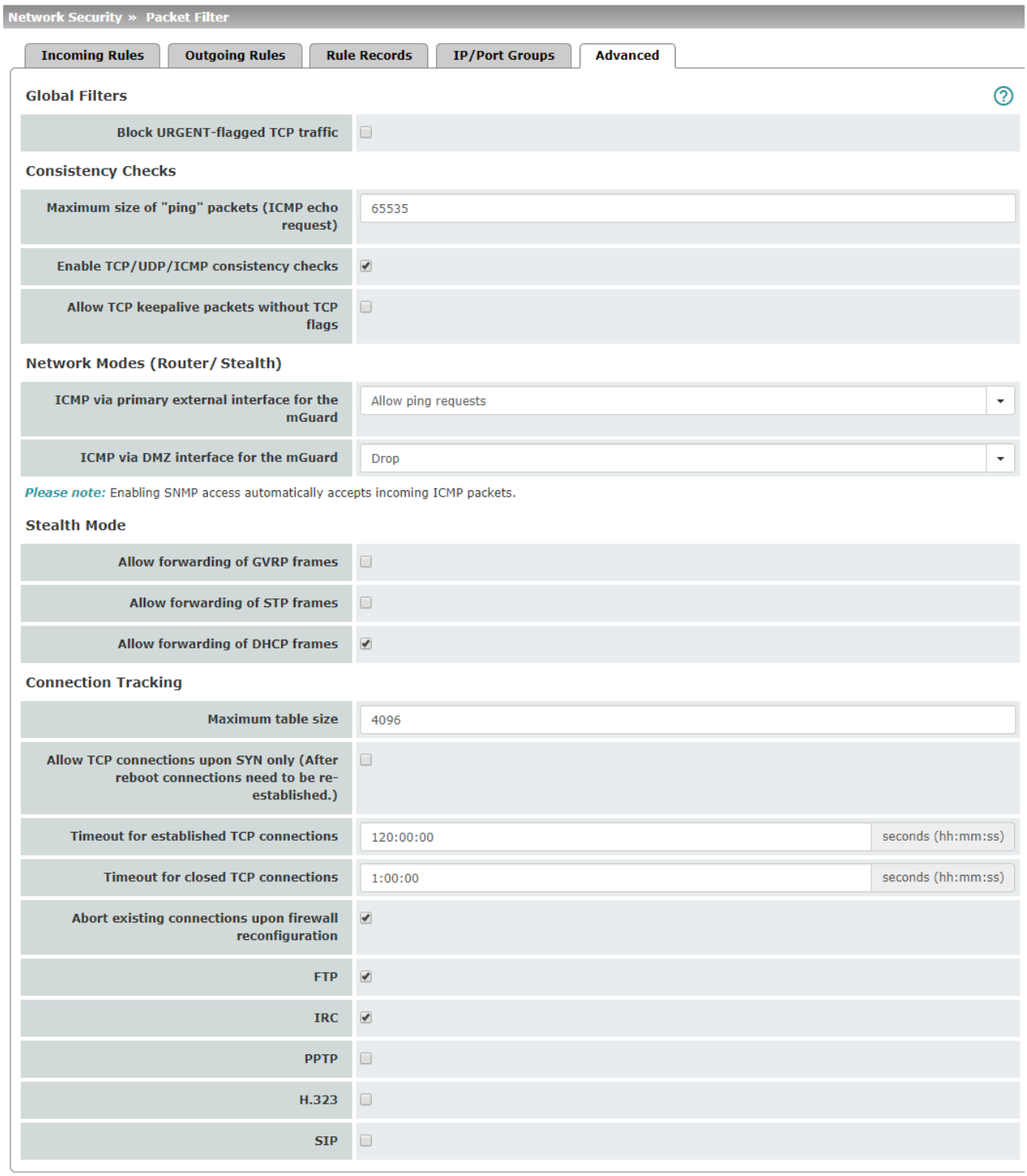
IP Group Settings	**Name**	The IP group can be freely named/renamed.
	Comment	Freely selectable comment for this group/rule.
	Host name, IP, IP range or network	The entries (max. 4096) can specify a host name (e.g., mguard.com), an IP address (e.g., 192.168.3.1), an IP address area (e.g., 192.168.3.1-192.168.3.10) or a network in CIDR format (e.g., 192.168.1.0/24).
		Using more than 200 host names in IP groups is not supported.
		When using host names, there is always the risk of an attacker manipulating or blocking DNS requests (i.e. *DNS spoofing*). You should therefore only configure trustworthy and secure DNS servers from your internal company network on the mGuard, so as to avoid these types of attacks.
Port groups	**Name**	The port group can be freely named/renamed.
	Comment	Freely selectable comment for this group/rule.
Edit	The following tab page appears when you click on the **Edit Row** icon:	



Network Security >> Packet Filter >> IP/Port Groups [...]		
Port Group Settings	**Name**	The port group can be freely named/renamed.
	Comment	Freely selectable comment for this group/rule.
	Port or Port Range	The entries (max. 4096) can specify a port (e.g., pop3 or 110) or a port range (e.g., 110:120 or 110-120).

7.1.7 Advanced

The following settings affect the basic behavior of the firewall.



Network Security >> Packet Filter >> Advanced		
Global Filters (This menu item is not part of the FL MGUARD 2000 series functionality.)	**Block URGENT-flagged TCP traffic**	When the function is activated, packets with the URGENT flag set in the TCP header are blocked: – In network mode "*Router*", the connections over which corresponding packets are sent are terminated. – In network mode "*Stealth*", the corresponding packets are dropped. TCP packets with the URGENT flag set that are routed through a VPN tunnel are also blocked.
Consistency Checks (This menu item is not part of the FL MGUARD 2000 series functionality.)	**Maximum size of "ping" packets (ICMP echo request)**	Refers to the length of the entire packet including the header. The packet length is normally 64 bytes, but it can be larger. If oversized packets are to be blocked (to prevent bottlenecks), a maximum value can be specified. This value should be more than 64 bytes in order to not block normal ICMP echo requests.
	Enable TCP/UDP/ICMP consistency checks	When the function is **activated** (default) , the mGuard performs a range of tests to check for incorrect checksums, packet sizes, etc. and drops packets that fail these tests.
	Allow TCP keepalive packets without TCP flags	TCP packets without flags set in their TCP header are normally rejected by firewalls. At least one type of Siemens controller with older firmware sends TCP keepalive packets without TCP flags set. These are therefore discarded as invalid by the mGuard. When the **function is activated**, forwarding of TCP packets where no TCP flags are set in the header is enabled. This only applies when TCP packets of this type are sent within an existing TCP connection established in the regular way. TCP packets without TCP flags do not result in a new entry in the connection table (see "Connection Tracking" on page 237). If the connection is already established when the mGuard is restarted, the corresponding packets are still rejected and connection problems can be observed as long as no packets with flags belonging to the connection are sent. These settings affect all the TCP packets without flags. **Activation** of this function therefore weakens the security functions provided by the mGuard.

Network Security >> Packet Filter >> Advanced [...]		
Network Modes (Router/PPTP/PPPoE)	**ICMP via primary external interface for the mGuard**	This option can be used to control the behavior of the mGuard when ICMP messages are received from the external network via the primary external interface.
	ICMP via DMZ for the mGuard	 Regardless of the setting specified here, incoming ICMP packets are always accepted if SNMP access is activated. **Drop**: all ICMP messages to all IP addresses of the mGuard are dropped. **Allow ping requests**: only ping messages (ICMP type 8) to all IP addresses of the mGuard are accepted. **Allow all ICMPs**: all types of ICMP messages to all IP addresses of the mGuard are accepted.
Stealth Mode	**Allow forwarding of GVRP frames**	The GARP VLAN Registration Protocol (GVRP) is used by GVRP-capable switches to exchange configuration information. When the **function is activated**, GVRP packets are allowed to pass through the mGuard in *Stealth* mode.
	Allow forwarding of STP frames	The Spanning Tree Protocol (STP) (802.1d) is used by bridges and switches to detect and allow for loops in the cabling. When the **function is activated**, STP packets are allowed to pass through the mGuard in *Stealth* mode.
	Allow forwarding of DHCP frames	When the **function is activated** (default), the client is allowed to obtain an IP address via DHCP – regardless of the firewall rules for outgoing data traffic.

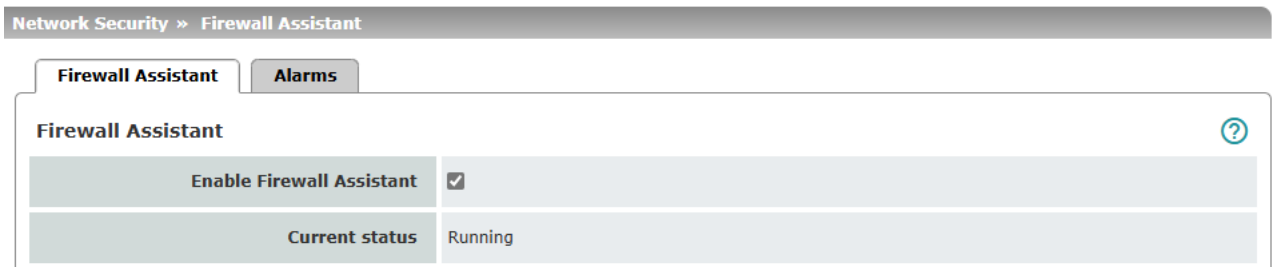
Network Security >> Packet Filter >> Advanced [...]		
Connection Tracking	**Maximum table size**	This entry specifies an upper limit. This is set to a value that can never be reached during normal practical operation. However, it can be easily reached in the event of attacks, thus providing additional protection. If there are special requirements in your operating environment, this value can be increased. Connections established from the mGuard are also counted. This value must therefore not be set too low, as this will otherwise cause malfunctions.
	Allow TCP connections upon SYN only	SYN is a special data packet used in TCP/IP connection establishment that marks the beginning of the connection establishment process. **Function deactivated** (**default**): the mGuard also allows connections where the beginning has not been registered. This means that the mGuard can perform a restart when a connection is present without interrupting the connection. **Function activated**: the mGuard must have registered the SYN packet of an existing connection. Otherwise, the connection is aborted. If the mGuard performs a restart while a connection is present, this connection is interrupted. Attacks on and the hijacking of existing connections are thus prevented.
	Timeout for established TCP connections	If a TCP connection is not used during the time period specified here, the connection data is deleted. A connection translated by NAT (not 1:1 NAT) must then be reestablished. If the "Allow TCP connections upon SYN only" function has been activated, all expired connections must be reestablished. Default setting: 120 hours (120:00:00) The entry can be in seconds [ss], minutes and seconds [mm:ss] or hours, minutes, and seconds [hh:mm:ss].
	Timeout for closed TCP connections	The timeout specifies how long the mGuard keeps a TCP-connection open when one side ends the connection with a "FIN packet", but the peer has not yet confirmed this. Default setting: 1 hour (1:00:00) The entry can be in seconds [ss], minutes and seconds [mm:ss] or hours, minutes, and seconds [hh:mm:ss].

Network Security >> Packet Filter >> Advanced [...]		
	Abort existing connections upon firewall reconfiguration	When the **function is activated** (default), the existing connections are reset if the following applies: – If the "Allow TCP connections upon SYN only" function has been activated and – The firewall rules have been adjusted or – If the function is activated (even without changing the firewall rules) After changing the firewall rules, the mGuard behaves in the same way as after a restart. However, this only applies to the forwarded connections. Existing TCP connections are interrupted, even if they are allowed according to the new firewall rules. Connections to the device are not affected, even if the firewall rules have been changed for remote access. When the **function is not activated**, the connections remain, even if the firewall rules changed would not allow them or would abort them.
	FTP	If an outgoing connection is established to call data for the FTP protocol, two methods of data transmission can be used: 1. With “active FTP”, the called server establishes an additional counter-connection to the caller in order to transmit data over this connection. 2. With “passive FTP”, the client establishes this additional connection to the server for data transmission. „FTP“ must be **activated** (default) so that additional connections can pass through the firewall.
	IRC	Similar to FTP: for IRC chat over the Internet to work properly, incoming connections must be allowed following active connection establishment. IRC must be **activated** (default) in order for these connections to pass through the firewall.
	PPTP	**Default: deactivated** Must be **activated** if VPN connections are to be established using PPTP from local computers to external computers without the aid of the mGuard. Must be **activated** if GRE packets are to be forwarded from the internal area to the external area.
	H.323	**Default: deactivated** Protocol used to establish communication sessions between two or more devices. Used for audio-visual transmission. This protocol is older than SIP.

Network Security >> Packet Filter >> Advanced [...]		
	SIP	**Default: deactivated** SIP (Session Initiation Protocol) is used to establish communication sessions between two or more devices. Often used in IP telephony. When the **function is activated**, it is possible for the mGuard to track the SIP and add any necessary firewall rules dynamically if further communication channels are established to the same session. When NAT is also activated, one or more locally connected computers can communicate with external computers by SIP via the mGuard.

7.2 Network Security >> Firewall Assistant

7.2.1 Firewall Assistant



Data traffic unintentionally rejected by the firewall can be easily identified and permitted through the automated creation of corresponding firewall rules.

NOTE: Firewall is partially deactivated
When using the Firewall Assistant, data packets that are not detected by any of the already configured firewall rules will not be discarded, as is normally the case, but instead will be forwarded.

Prerequisite

1. There must be no final rule in the existing firewall table that rejects all data traffic. Otherwise, no alarms and therefore no new firewall rules could be generated using the Firewall Assistant.
2. The Firewall Assistant cannot be activated if a firewall user is logged on.
3. The Firewall Assistant cannot be activated if a VPN connection or a firewall rule set is being monitored via signal output O1/ACK 1.

Important notes

1. The following applies in stealth mode: If the "Allow forwarding of DHCP frames" function is activated (default setting in „Network Security >> Packet Filter >> Advanced“), incoming data packets on port 68 are not captured by the Firewall Assistant and are therefore not entered in the alarm table.
2. If the "Block URGENT-flagged TCP traffic" function is activated (in „Network Security >> Packet Filter >> Advanced“), related data packets are not captured by the Firewall Assistant and are therefore not entered in the alarm table.
3. Do not change the network mode after you have started the Firewall Assistant (e.g. from *Router mode* to *Stealth mode*). The analysis of the data traffic would otherwise be stopped.
4. Firewall rules in referenced firewall rule records are only taken into account if the corresponding rule record is activated (status = active).

Network Security >> Firewall Assistant >> Firewall Assistant

Firewall Assistant

When the Firewall Assistant is enabled, the data traffic routed through the device is analyzed by the firewall:

- If a previously configured firewall rule applies to a data packet, the rule is applied to the packet **as normal** (Accept, Reject, or Drop).
- If none of the configured rules apply to a data packet, the packet is not discarded, **as is usually the case**, but forwarded. In addition:
  - An entry is created in the "Alarms (Firewall Assistant)" table, which can be analyzed by the user and converted into a firewall rule (see "Alarms (Firewall Assistant)".
  - The "PF2" LED of the device lights up red.
  - The "O1" signal output on the "XG2" COMBICON connector of the device switches to high level. (If a signal light is connected, it would light up in this case.)

Signaling via LED and signal output is only provided for DIN rail devices.

Enable Firewall Assistant

If you enable the check box and apply the change, the Firewall Assistant will be enabled.

NOTE: Firewall is partially deactivated
Data packets that are not detected by any of the already configured firewall rules will not be discarded, as is normally the case, but instead will be forwarded.

The data traffic passed through is analyzed.

Data traffic to which none of the existing firewall rules are applied creates a new entry in the "Alarms (Firewall Assistant)" table.

End monitoring / deactivate Firewall Assistant

The monitoring of data traffic continues until either

- the Firewall Assistant is disabled via the check box (disabling must be accepted by clicking on the icon),
- the device is restarted or
- the maximum number of entries has been reached (limit = 2000 entries).

NOTE: Data traffic to which none of the existing firewall rules are applied continues to pass through the firewall until the Firewall Assistant is disabled via the checkbox.

1. Deactivation via checkbox:

The Firewall Assistant is terminated (status = stopped). All entries in the "Alarms (Firewall Assistant)" table are deleted. Signaling by the "PF2" LED and the "O1" signal output is stopped.

Network Security >> Firewall Assistant >> Firewall Assistant

2. Restart:

The Firewall Assistant is only disabled temporarily during the restart. All entries in the "Alarms (Firewall Assistant)" table are deleted. Signaling by the "PF2" LED and the "O1" signal output is stopped.

After the restart, the Firewall Assistant and thus the generation of alarms is reactivated (status = running).

3. Maximum number of entries reached (limit)

Once the limit has been reached, no more new alarms will be entered in the "Alarms (Firewall Assistant)" table. However, the Firewall Assistant is not disabled (status = running).

All existing entries are retained and can be converted into firewall rules until the Firewall Assistant is permanently disabled via checkbox or temporarily disabled by restarting the device.

The signaling by the LED "PF2" and the signal output "O1" remains.

NOTE: Data traffic not fully captured

If the limit of 2000 entries is reached, no new entries are added to the table. It can then be assumed that the alarms captured in the table are incomplete.

To create further alarms in this case, proceed as follows:

- Add all desired entries to your firewall ruleset.
- Then disable the Firewall Assistant.

↪ All entries in the "Alarms (Firewall Assistant)" table will be deleted.

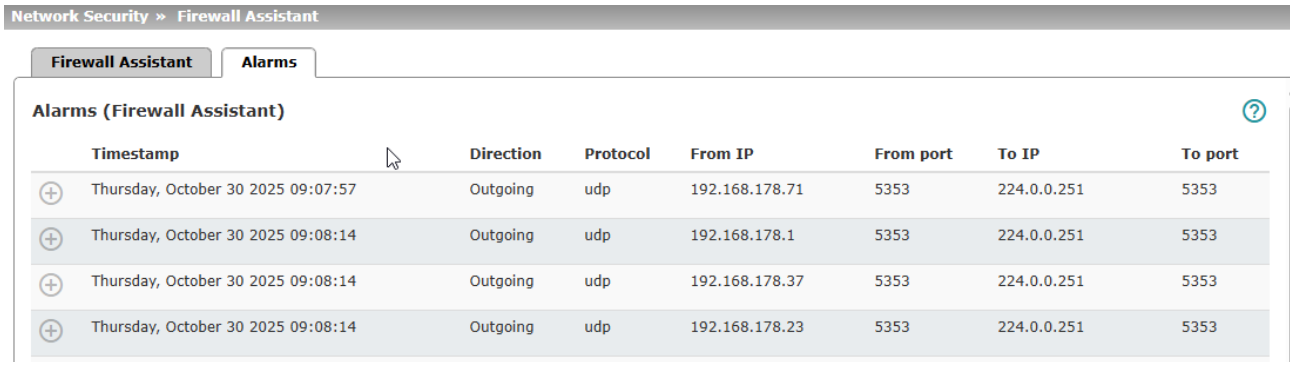
- Restart the Firewall Assistant to create new alarms.

Current status

Current status of the Firewall Assistant:

– Stopped
– Running
– Failed

7.2.2 Alarms



Network Security >> Firewall Assistant >> Alarms

Alarms (Firewall Assistant)

The entries created by the Firewall Assistant are entered chronologically in the table.

Entries in the "Alarms (Firewall Assistant)" table can be selected and automatically added as a new firewall rule at the end of the existing firewall tables (Incoming Rules / Outgoing Rules) (see Section 7.1.1 and 7.1.2).

The newly added rules would then allow the respective data traffic in the future (Action = Accept). To activate the inserted rules, they must first be accepted by clicking on the icon .

NOTE: Limit reached at 2000 entries
If the limit is reached, no new entries are added to the table. It can then be assumed that the alarms captured in the table are incomplete.

The following table entries are generated from the analyzed data traffic:

Time stamp	Time at which the entry was generated by the relevant data traffic. The time is displayed according to the configured time zone.
Direction	Direction in which the data packet was routed/sent by the device. WAN >> LAN (incoming) or LAN >> WAN (outgoing).
Protocol	Network protocol that was used for the transmission of the data packet. The **TCP, UDP, ICMP, GRE** and **ESP** protocols are adopted. The value **All** is entered for all other protocols.
From IP	Source (IP address) from which the data packet was sent.
From port	Source port from which the data packet was sent.
To IP	Destination (IP address) to which the data packet was sent.
To port	Destination port to which the data packet was sent. No entry means that no destination port was specified in the data packet (e.g. ICMP data packets).

Network Security >> Firewall Assistant >> Alarms

Creating new firewall rules from alarm entries

Proceed as follows to create new firewall rules based on alarm entries:

- Check the table entries (alarms).
- Identify the entries that you would like to adopt as new firewall rules, taking your security requirements into account.
- Click on the icon ⊕ to transfer a rule to the corresponding firewall table (Incoming Rules or Outgoing Rules).

↪ The firewall rule is added at the end of the corresponding firewall table.
The comment field of the inserted rule contains the following entry:
"Firewall Assistant (<time stamp of inserted rule>)"

- Transfer further rules, if necessary.
- Change to the menu „Network Security >> Packet Filter >> Incoming Rules or Outgoing Rules“.
- Check the existing and newly added rules and their order and adjust them if necessary.
- Click on the 💾 icon to apply the changes.

↪ The newly added firewall rules are active and immediately allow the corresponding data traffic.

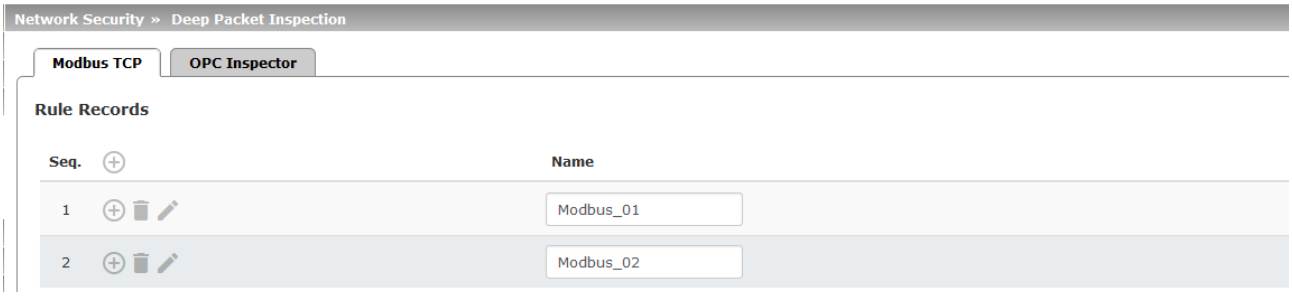
NOTE: Disable the Firewall Assistant after you have finalized your firewall rules. This will stop monitoring and all entries in the "Alarms (Firewall Assistant)" table will be deleted.

NOTE: If the Firewall Assistant remains enabled, data packets that are not detected by any of the already configured firewall rules will not be discarded as usual, but forwarded instead.

7.3 Network Security >> Deep Packet Inspection

This menu is **not** available on devices of the FL MGUARD 2000 series.

7.3.1 Modbus TCP



The Modbus protocol is often used to integrate automation devices in industrial applications. It enables process data to be exchanged between Modbus controllers regardless of the network structure. Modbus is a client/server protocol.

The TCP/IP version of the protocol is used to transmit data in industrial Ethernet: **Modbus TCP**. Access to specific device data is controlled via the Modbus TCP protocol using **function codes**.

Reserved TCP port 502 is usually used for transmission via the Modbus TCP protocol.

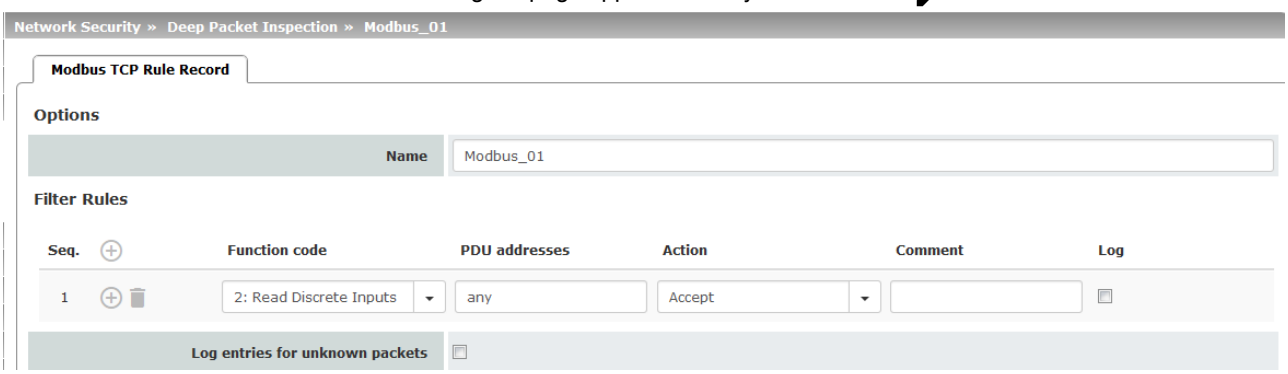
Deep Packet Inspection (DPI)

The mGuard can inspect packets of incoming and outgoing Modbus TCP connections (*Deep Packet Inspection*) and filter them if required. The user data of incoming packets is inspected. Responses to filtered requests are not subject to further DPI.

Packets which use specific function codes can be “dropped” or “accepted” via defined rules.

If a TCP packet contains more than one *Protocol Data Unit* (PDU), the packet is always discarded.

The following tab page appears when you click on the **Edit Row** icon:



Network Security >> Deep Packet Inspection >> Modbus TCP >> Rule Records >> Edit

Modbus TCP rule record

The rules for filtering Modbus TCP packets are configured in rule records. These rule records can be used in the following firewall tables if “TCP” is selected as the protocol: general packet filter / DMZ / Psec VPN / OpenVPN.

If a firewall rule uses a Modbus TCP rule record, data traffic is not possible via an affected connection which does not use the Modbus protocol.

If the mGuard is unable to determine whether a Modbus packet is an incoming or outgoing packet, the packet is discarded.

This is the case, for example, if the status of connection tracking has been deleted after connection establishment and the mGuard has therefore not registered the SYN packet of the existing connection.

Options

Name

A descriptive name

Filter Rules

Function code

1 - 255 / Name of the function code / any

Function codes in Modbus TCP connections indicate the purpose of data transmission, i.e., which operation is to be performed by the server (slave) based on the request from the client (master).

You can select the function code from the drop-down list or enter it directly in the input field.

PDU addresses

(Only displayed for certain function codes)

0 - 65535 / any

Various addresses can be assigned to certain function codes (as PDU addresses based on 0). This setting can either be an individual PDU address (e.g., 47015) or an address area (e.g., 47010:47020).

The PDU address area for incoming packets can either be **partially or fully** in the specified address area for the filter rule.

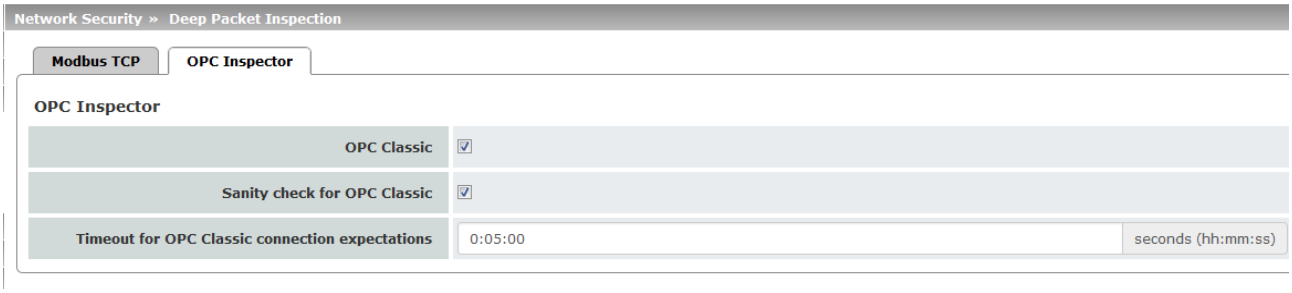
The **action (Drop or Accept)** performed by the rule determines when the rule applies:

1. **Drop rule**: if “Drop” is selected as the action, the rule (i.e., that the packet will be discarded) applies if **at least one address** in the packet is in the specified address area. It also applies if the packet contains further addresses that are not in the specified address area.
2. **Accept rule**: if “Accept” is selected as the action, the rule (i.e., that the packet will be accepted) applies if **all addresses** in the packet are in the specified address area.

An individual address is interpreted as an area in line with the behavior described above.

Network Security >> Deep Packet Inspection >> Modbus TCP >> Rule Records >> Edit		
	Action	**Accept** means that the data packets may pass through. **Drop** means that the data packets are not permitted to pass through. They are discarded, rendering the TCP connection unusable. It therefore cannot be used for further data transmission. A new TCP connection must be established for subsequent Modbus requests. If multiple rules are defined, these are queried starting from the top of the list of entries until an appropriate rule is found. This rule is then applied. If the list of rules contains further subsequent rules that could also apply, these rules are ignored. If no rule applies, the packet is discarded.
	Comment	Freely selectable comment for this rule.
	Log	For each individual Modbus TCP filter, you can specify whether the use of the rule: – Should be logged – activate *Log* action – Should not be logged – deactivate *Log* action (default)
	Log entries for unknown packets	When the function is activated, the packets that are not covered by any of the created filter rules are logged.

7.3.2 OPC Inspector



Network Security >> Deep Packet Inspection >> OPC Inspector

OPC Inspector

Until now, the *OPC Classic* network protocol could only be used across firewalls if large port ranges were opened. Activating the *OPC Classic* function allows this network protocol to be used easily without having to configure the mGuard device's firewall in an insecure way.

When the OPC Classic function is activated, the OPC packets are monitored. The TCP ports that are negotiated within the first open connection are recognized and opened for OPC packets. If no OPC packets are sent via these ports within a configurable timeout, they are closed again.

If the OPC validity check is activated, only OPC packets may be sent via OPC Classic port 135.

OPC Classic

With OPC Classic, communication always starts via TCP port 135. The client and server then negotiate one or more additional connections on new ports. To enable these connections, in the past all ports of an interconnected firewall had to be open. If OPC Classic is activated, it is enough to only enable TCP port 135 for a client/server pair using the firewall rules.

The mGuard inspects the user data of the packets (Deep Packet Inspection). It checks in the user data sent via this port whether a new connection has been negotiated, and opens the negotiated port. To do so, communication between the client and the server on port 135 must be enabled in both directions.

The functionality of OPC Classic is also supported for the NAT methods *IP Masquerading* and *1:1 NAT*.

Sanity check for OPC Classic

If Sanity check for OPC Classic is activated, only OPC packets may be transmitted via OPC Classic port 135 (TCP) and the newly negotiated ports.

Network Security >> Deep Packet Inspection >> OPC Inspector		
	Timeout for OPC Classic connection expectations	Configures the timeout (in seconds) during which OPC traffic is expected. An existing OPC connection may negotiate another connection on a new port. If "Sanity check for OPC Classic" is activated, these connections must only be OPC connections. The mGuard creates a new dynamic firewall rule if it detects in OPC traffic that a new OPC connection should be established. The dynamic firewall rule immediately accepts new OPC connections with the negotiated parameters. If the timeout for the dynamic firewall expires, the rule is deleted. New connections with these parameters are then no longer accepted. Already established connections are not closed.

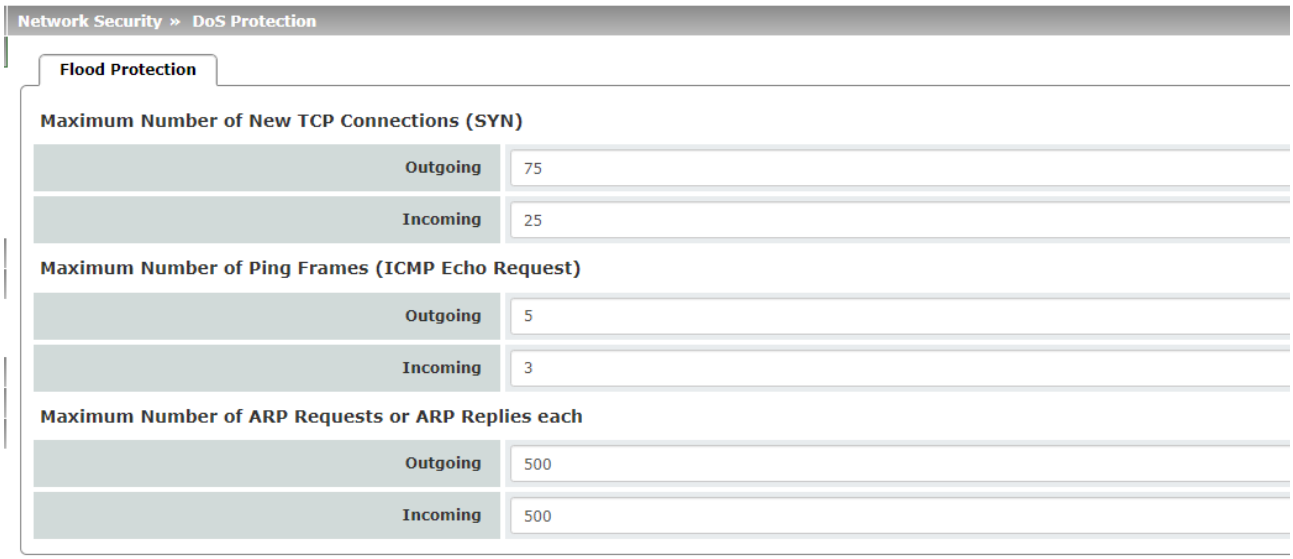
7.4 Network Security >> DoS Protection

This menu is **not** available on devices of the FL MGUARD 2000 series.

7.4.1 Flood Protection

This menu is **not** available on devices of the FL MGUARD 2000 series.

NOTE: Firewall setting affects DoS protection
The DoS protection of the device is not available, if in the menu **Network Security >> Packet Filter >> Incoming Rules** "*Accept all connections*" is selected as the **General firewall setting** (see "Incoming Rules" on page 215).
To provide DoS protection in this case, select the **General firewall setting** "*Use the firewall ruleset below*" and then create a firewall rule that accepts all connections.



Network Security >> DoS Protection >> Flood Protection		
Maximum number of new TCP connections (SYN)	**Incoming/Outgoing**	Outgoing: default setting: 75 Incoming: default setting: 25 Maximum values for the number of incoming and outgoing TCP connections allowed per second. They are set to a value that can never be reached during normal practical operation. However, they can be easily reached in the event of attacks, thus providing additional protection. If there are special requirements in your operating environment, these values can be increased.

Network Security >> DoS Protection >> Flood Protection [...]		
Maximum number of ping frames (ICMP echo request)	**Incoming/Outgoing**	Outgoing: default setting: 5 Incoming: default setting: 3 Maximum values for the number of incoming and outgoing “ping” packets allowed per second. They are set to a value that can never be reached during normal practical operation. However, they can be easily reached in the event of attacks, thus providing additional protection. If there are special requirements in your operating environment, these values can be increased. The value **0** means that no “ping” packets are allowed through or in.
Maximum number of ARP requests or ARP replies each (Only in "Stealth" network mode)	**Incoming/Outgoing**	Default setting: 500 Maximum values for the number of incoming and outgoing ARP requests or replies allowed per second. They are set to a value that can never be reached during normal practical operation. However, they can be easily reached in the event of attacks, thus providing additional protection. If there are special requirements in your operating environment, these values can be increased.

7.5 Network Security >> User Firewall

This menu is **not** available on devices of the FL MGUARD 2000 series.

The user firewall is used exclusively by firewall users, i.e., users who are registered as firewall users (see “Authentication >> Firewall Users” on page 190).

Each firewall user can be assigned a set of firewall rules, also referred to as a template.

If a user firewall template or a firewall rule of a template is added, changed, deleted or disabled, this immediately affects all firewall users who are logged in.

Existing connections are interrupted. One exception is changing user firewall rules if the function *"Abort existing connections upon firewall reconfiguration"* is deactivated under **“Network Security >> Packet Filter >> Advanced”**. In this case, a network connection that exists due to a previously permitted rule is not interrupted.

If a firewall ruleset (template) is disabled, affected logged in firewall users still appear as *logged in*. However, the firewall rules from the **disabled** template no longer apply to them.

If a firewall ruleset (template) is **disabled** and then **enabled** again, affected logged in firewall users must first log out and then log in again to reactivate the firewall rules from the template for themselves.

7.5.1 User Firewall Templates

All defined user firewall templates are listed here. A template can consist of several firewall rules. A template can be assigned to several users.

Defining a new template:

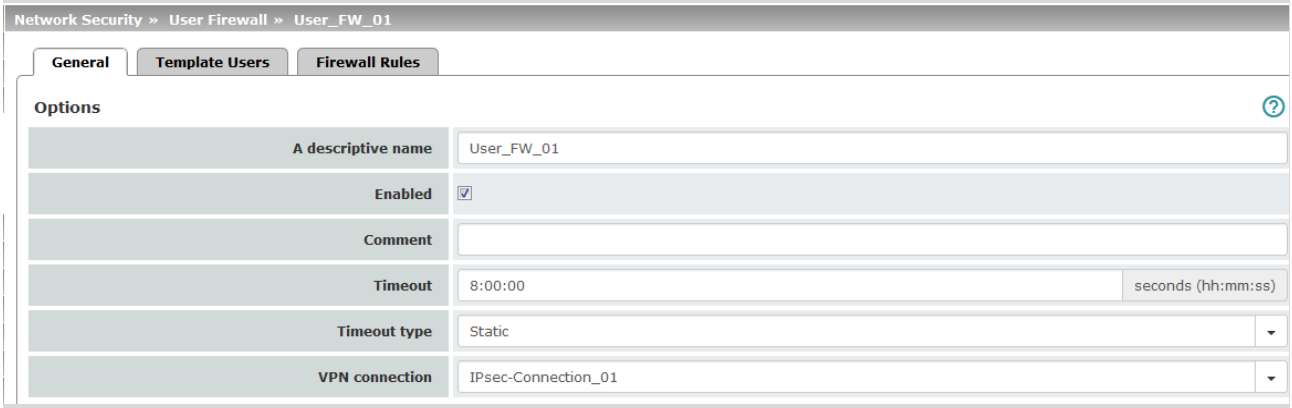
- In the template table, click on the ⊕ **Insert Row** icon to add a new table row.
- Click on the ✎ **Edit Row** icon.

Editing a template:

- Click on the ✎ **Edit Row** icon in the relevant row.

Network Security >> User Firewall >> User Firewall Templates		
	Enabled	Activates/deactivates the relevant template.
	A descriptive name	The name of the template. The name is specified when the template is created.
General	The following tab page appears when you click on the ✎ **Edit Row** icon:	

Network Security >> User Firewall >> User Firewall Templates [...]



Options

A descriptive name

The user firewall template can be freely named/renamed.

Enabled

When the function is activated, the user firewall template becomes active as soon as firewall users log into the mGuard who are listed on the *Template Users* tab page (see below) and who have been assigned this template. It does not matter from which computer and under what IP address the user logs in. The assignment of the firewall rules to a user is based on the authentication data that the user enters during login (user name, password).

Comment

Optional explanatory text.

Timeout

Default: 8 hours (8:00:00)

Specifies the time at which point the firewall rules are deactivated. If the user session lasts longer than the timeout time specified here, the user has to log in again.

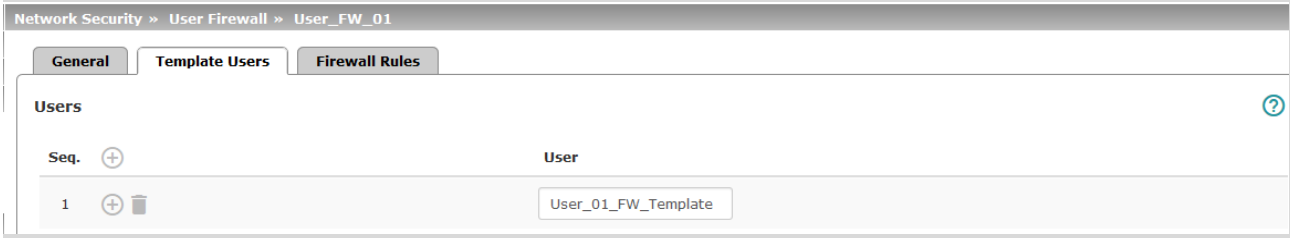
The entry can be in seconds [ss], minutes and seconds [mm:ss] or hours, minutes, and seconds [hh:mm:ss].

Network Security >> User Firewall >> User Firewall Templates [...]		
	Timeout type	**Static / Dynamic** With a **static timeout**, users are logged out automatically as soon as the set timeout time has elapsed. With **dynamic timeout**, users are logged out automatically after all the connections have been closed by the user or have expired on the mGuard, and the set timeout time has **subsequently** elapsed. An mGuard connection is considered to have expired if no more data is sent for this connection over the following periods. Connection expiration period after non-usage: – TCP: 5 days (this value can be set, see "Timeout for established TCP connections" on page 237). 120 seconds are added after closing the connection. (These 120 seconds also apply to connections closed by the user.) – UDP: 30 seconds after data traffic in one direction; 180 seconds after data traffic in both directions – ICMP: 30 seconds – Others: 10 minutes
	VPN connection	Specifies the VPN connection for which this user firewall rule is valid. This requires existing remote access through the VPN tunnel to the web interface.

Network Security >> User Firewall >> User Firewall Templates >> Edit > ...

Template Users

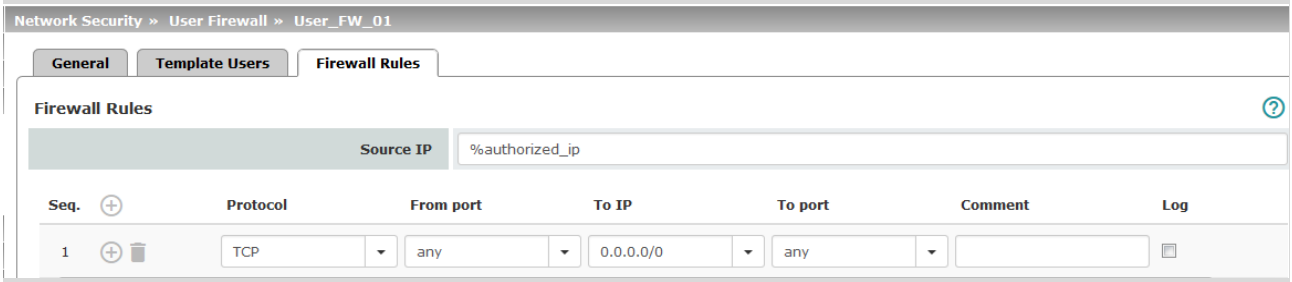
Specify the names of the users here. The names must correspond to those that have been defined under the “Authentication >> Firewall Users” menu (see page 190).



Firewall Rules

Firewall rules for the user firewall templates.

When the template is configured with **dynamic timeout** approved UDPs and other network packets (excluding ICMP), reset the dynamic timeout to the initial value.



Source IP

IP address from which connections are allowed to be established. If this should be the address from which the user logged into the mGuard, the placeholder “%authorized_ip” should be used.

If multiple firewall rules are defined, these are queried starting from the top of the list of entries until an appropriate rule is found. This rule is then applied. If the list of rules contains further subsequent rules that could also apply, these rules are ignored.

Protocol

All means TCP, UDP, ICMP, GRE, and other IP protocols.

From port / To port

(Only for TCP and UDP protocols)

any refers to any port.

startport:endport (e.g., 110:120) > port range.

Individual ports can be specified using the port number or the corresponding service name (e.g., 110 for pop3 or pop3 for 110).

Name of port groups, if defined. When a name is specified for a port group, the ports or port ranges saved under this name are taken into consideration (see “IP/Port Groups” on page 231).

Network Security >> User Firewall >> User Firewall Templates >> Edit > ... [...]

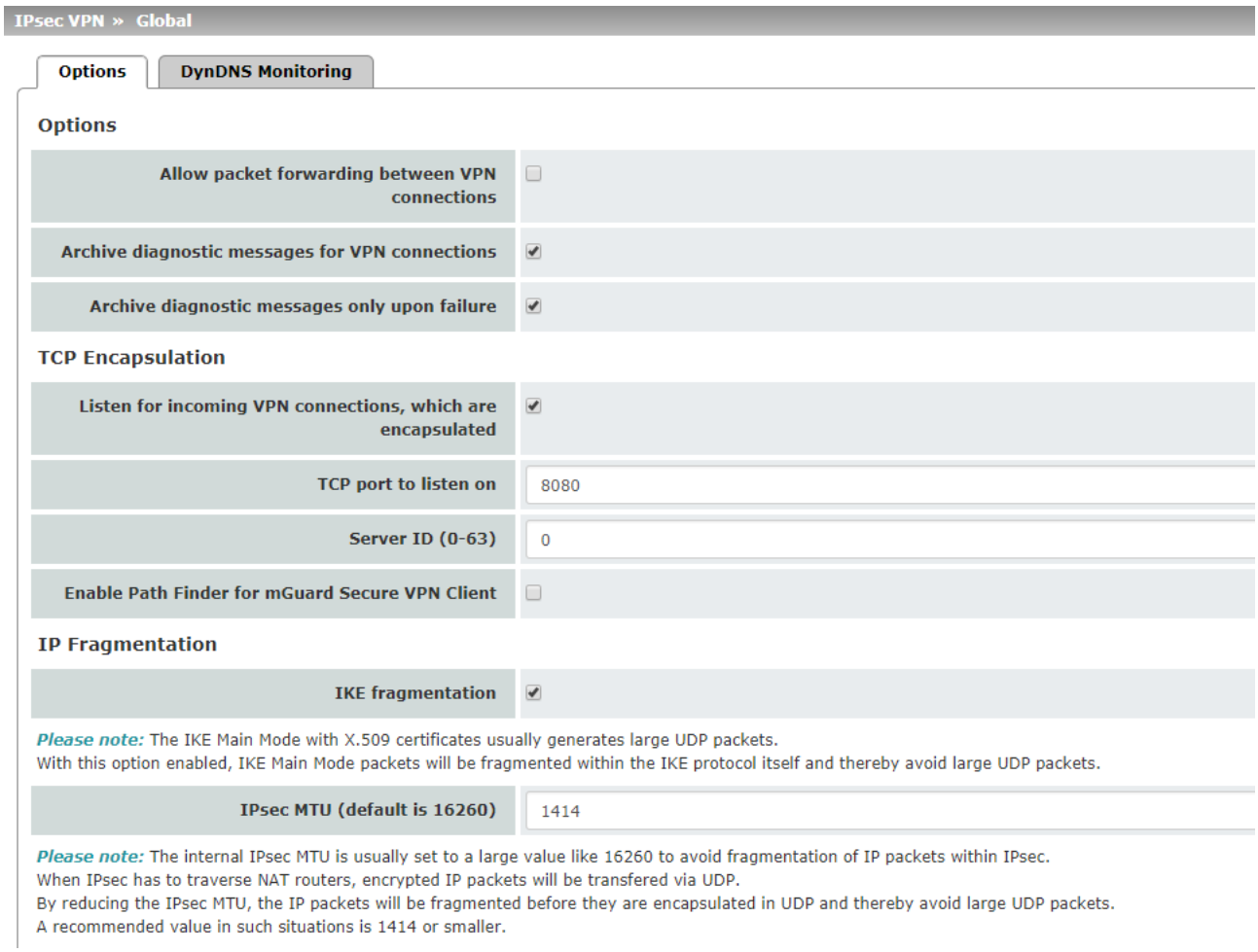
To IP	**0.0.0.0/0** means all IP addresses. To specify an address area, use CIDR format (see "CIDR (Classless Inter-Domain Routing)" on page 49). **Name of IP groups**, if defined. When a name is specified for an IP group, the host names, IP addresses, IP areas or networks saved under this name are taken into consideration (see "IP/Port Groups" on page 231). If host names are used in IP groups, the mGuard must be configured so that the host name of a DNS server can be resolved in an IP address. If a host name from an IP group cannot be resolved, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration.
Comment	Freely selectable comment for this rule.
Log	For each firewall rule, you can specify whether the use of the rule: – Should be logged – activate *Log* function – Should not be logged – deactivate *Log* function (default)

8 IPsec VPN menu

8.1 IPsec VPN >> Global

Does not work with connections of the type "Connections IKEv2 (beta)".

8.1.1 Options



IPsec VPN >> Global >> Options

Options

Does **not** work with connections of the type "Connections IKEv2 (beta)".

Allow packet forwarding between VPN connections

(Not for devices of the FL MGUARD 2000 series)

This function is only required on an mGuard communicating between two different VPN peers.

To enable communication between two VPN peers, the local network of the communicating mGuard must be configured so that the remote networks containing the VPN peers are included. The opposite setup (local and remote network swapped round) must also be implemented for the VPN peers (see “Remote NAT for IPsec tunnel connections” on page 287).

The function is not supported in *Stealth* network mode.

When the **function is deactivated** (default): VPN connections exist separately. There is no packet forwarding between the configured VPN connections.

When the **function is activated**: “hub and spoke” feature enabled: acting as a control center, the mGuard diverts VPN connections to several branches that can then also communicate with each other.

The setting is also valid for OpenVPN connections.

With a star VPN connection topology, mGuard peers can also exchange data with one another. In this case, it is recommended that the local mGuard consults CA certificates for the authentication of peers (see “Authentication” on page 291).

In the case of “hub and spoke”, 1:1 NAT of the peer is not supported.

IPsec VPN >> Global >> Options [...]		
	Archive diagnostic messages for VPN connections	**Function deactivated (default)** If errors occur when establishing VPN connections, the mGuard logging function can be used to find the source of the error based on corresponding entries (see *"Logging >> Browse Local Logs"* menu item). This option for error diagnostics is used as standard. If it is sufficient, you can deactivate the function at this point. **Function activated** If the option of diagnosing VPN connection problems using the mGuard logging function is too impractical or insufficient, select this option. This may be the case if the following conditions apply: – In certain application environments, e.g., when the mGuard is "operated" by means of a machine controller via the CMD contact, the option for a user to view the mGuard log file via the web-based user interface of the mGuard may not be available at all. – When used remotely, it is possible that a VPN connection error can only be diagnosed after the mGuard is temporarily disconnected from its power source – which causes all the log entries to be deleted. – The relevant log entries of the mGuard that could be useful may be deleted because the mGuard regularly deletes older log entries on account of its limited memory capacity. – If an mGuard is being used as the central VPN peer, e.g., in a remote maintenance center as the gateway for the VPN connections of numerous machines, the messages regarding activity on the various VPN connections are logged in the same data stream. The resulting logging volume makes it time-consuming to find the information relevant to one error. After archiving is enabled, relevant log entries about the operations involved in establishing VPN connections are archived in the non-volatile memory of the mGuard if the connections are established as follows: – Via the CMD contact – Via the "Start" icon on the web interface – Via the CGI interface nph-vpn.cgi using the "synup" command (see application note: "How to use the CGI Interface"). (Application notes are available in the download area of phoenixcontact.net/products.) – Archived log entries are not affected by a restart. They can be downloaded as part of the support snapshot (*"Hardware"* menu item). A snapshot provides your supplier's support team with additional options for more efficient troubleshooting than would be possible without archiving.

IPsec VPN >> Global >> Options [...]		
	Archive diagnostic messages only upon failure (Only when **Archiving** is activated)	If only log entries generated for failed connection attempts are to be archived, activate the function. When the function is deactivated, all log entries will be archived.

TCP encapsulation

This function is used to encapsulate data packets to be transmitted via a VPN connection in TCP packets. Without this encapsulation, under certain circumstances it is possible for VPN connections that important data packets belonging to the VPN connection may not be correctly transmitted due to interconnected NAT routers, firewalls or proxy servers, for example.

Firewalls, for example, may be set up to prevent any data packets of the UDP protocol from passing through or (incorrectly implemented) NAT routers may not manage the port numbers correctly for UDP packets.

TCP encapsulation avoids these problems because the packets belonging to the relevant VPN connection are encapsulated in TCP packets, i.e., they are hidden so that only TCP packets appear for the network infrastructure.

The mGuard may receive VPN connections encapsulated in TCP, even when it is positioned behind a NAT gateway in the network and thus cannot be reached by the VPN peer under its primary external IP address. To do this, the NAT gateway must forward the corresponding TCP port to the mGuard (see "Listen for incoming VPN connections, which are encapsulated" on page 263).

Please note the following information:

TCP encapsulation can only be used if an mGuard is used on both sides of the VPN tunnel. The "Path Finder" function also works with the mGuard Secure VPN Client. The function must be activated on both sides of the connection (server and client).

TCP encapsulation only works if one of the two sides is waiting for connections ("Connection initiation" = **wait**) and **%any** is specified as the "Address of the remote site's VPN gateway".

TCP encapsulated VPN connections can only be established against the primary external or internal IP address of the mGuard that is waiting for the connection.

TCP encapsulation should only be used if required, because connections are slowed down by the significant increase in the data packet overhead and by the correspondingly longer processing times.

If the mGuard is configured to use a proxy for HTTP and HTTPS in the *"Network >> Proxy Settings"* menu item, then this proxy is also used for VPN connections that use TCP encapsulation.

TCP encapsulation supports the *basic authentication* and *NTLM* authentication methods for the proxy.

For the TCP encapsulation to work through an HTTP proxy, the proxy must be named explicitly in the proxy settings (*"Network >> Proxy Settings"* menu item) (i.e., it must not be a transparent proxy) and this proxy must also understand and permit the HTTP method CONNECT.

TCP encapsulation does not work in conjunction with authentication via pre-shared key (PSK).

TCP encapsulation does not work with connections of the type "Connections IKEv2 (beta)".

TCP encapsulation with enabled “Path Finder” function

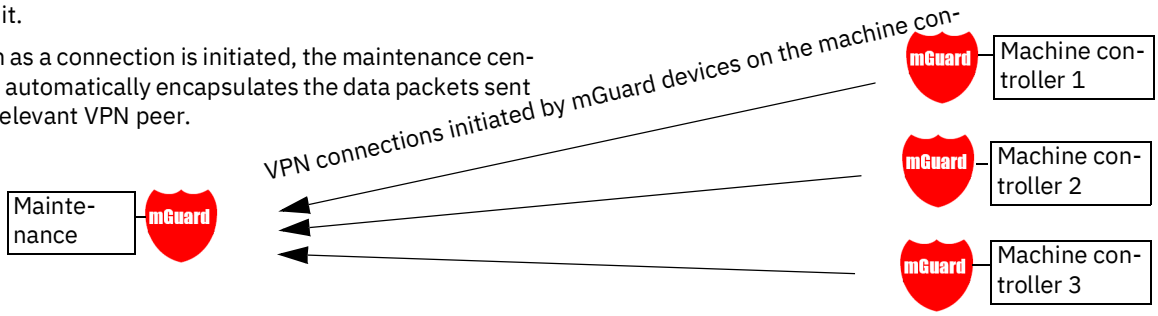
TCP encapsulation with enabled “Path Finder” function improves the behavior of the standard TCP encapsulation described above.

When the connection has been newly set up and no reverse compatibility is required, the Path Finder function should be used.

If a VPN connection is started by the mGuard Secure VPN Client, which is positioned behind a proxy server or a firewall, the “Path Finder” function must be enabled in the mGuard Secure VPN Client as well as in the mGuard (server). The data packets to be transmitted via the VPN connection are encapsulated in TCP packets (see “TCP encapsulation” on page 261).

As devices in the TCP encapsulation, the mGuard devices for the machine controllers initiate VPN data traffic to the maintenance center and encapsulate the data packets sent to it.

As soon as a connection is initiated, the maintenance center also automatically encapsulates the data packets sent to the relevant VPN peer.



Maintenance center mGuard

Required basic settings

- **IPsec VPN >> Global >> Options**:
  - Listen for incoming VPN connections, which are encapsulated: **activated**
- **IPsec VPN >> Connections >> General**:
  - Address of the remote site's VPN gateway: **%any**
  - Connection startup: **Wait**

mGuard **devices on machine controllers**

Required basic settings

- **IPsec VPN >> Global >> Options**:
  - Listen for incoming VPN connections, which are encapsulated: **deactivated**
- **IPsec VPN >> Connections >> General**:
  - Address of the remote site's VPN gateway: **fixed IP address or host name**
  - Connection startup: **Initiate** or **Initiate on traffic**
  - Encapsulate the VPN traffic in TCP: **TCP encapsulation or Path Finder**

Figure 8-1 TCP encapsulation in an application scenario with a maintenance center and machines maintained remotely via VPN connections

IPsec VPN >> Global >> Options

TCP encapsulation

Does **not** work with connections of the type "Connections IKEv2 (beta)".

Listen for incoming VPN connections, which are encapsulated

Default setting: **deactivated**

Only activate this function if the TCP encapsulation function is used. Only then can the mGuard allow connection establishment with encapsulated packets.

For technical reasons, the RAM requirements increase with each interface that is used to listen out for VPN connections encapsulated in TCP. If multiple interfaces need to be used for listening, then the device must have at least 64 Mbytes of RAM.

The interfaces to be used for listening are determined by the mGuard according to the settings on the active VPN connections that have “%any” configured as the peer. The decisive setting is specified under “Interface to use for gateway setting %any”.

TCP port to listen on

(For TCP encapsulation)

Default: 8080

Number of the TCP port where the encapsulated data packets to be received arrive. The port number specified here must be the same as the one specified for the mGuard of the peer as the **TCP port of the server, which accepts the encapsulated connection** (*“IPsec VPN >> Connections”* menu item, Edit, *General* tab page).

The following restriction applies:

The port to be used for listening must not be identical to:

– A port that is being used for remote access (SSH, HTTPS or SEC-Stick)
– The port which is used for listening with enabled *Path Finder* function

Server ID (0-63)

(For TCP encapsulation)

The default value **0** does not usually have to be changed. The numbers are used to differentiate between different control centers.

A different number is only to be used in the following scenario: an mGuard connected upstream of a machine must establish connections to two or more different maintenance centers and their mGuard devices with TCP encapsulation enabled.

Enable Path Finder for mGuard Secure VPN Client

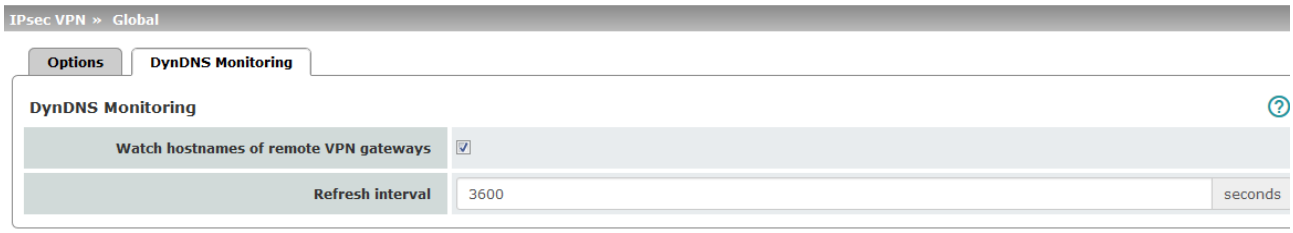
Default setting: **deactivated**

Only activate this function if the mGuard should accept a VPN connection from an mGuard Secure VPN Client that is positioned behind a proxy server or a firewall.

The “Path Finder” function must also be enabled in the mGuard Secure VPN Client.

IPsec VPN >> Global >> Options [...]		
	TCP port to listen on (For Path Finder)	**Default: 443** Number of the TCP port where the encapsulated data packets to be received arrive. The port number specified here must be the same as the one specified for the VPN client of the peer as the **TCP port of the server**, which accepts the encapsulated connection. The **mGuard Secure VPN Client** always uses port 443 as the destination port. It is when the port is overwritten by a firewall between the mGuard Secure VPN Client and the mGuard that the port in the mGuard has to be changed. **The following restriction applies:** The port to be used for listening must not be identical to: – A port that is being used for remote access (SSH, HTTPS or SEC-Stick) – The port which is used for listening with enabled *TCP encapsulation* function
IP Fragmentation Does **not** work with connections of the type "Connections IKEv2 (beta)".	**IKE fragmentation**	UDP packets can be oversized if an IPsec connection is established between the participating devices via IKE and certificates are exchanged. Some routers are not capable of forwarding large UDP packets if they are fragmented over the transmission path (e.g., via DSL in 1500-byte segments). Some faulty devices forward the first fragment only, resulting in connection failure. If two mGuard devices communicate with each other, it is possible to ensure at the outset that only small UDP packets are to be transmitted. This prevents packets from being fragmented during transmission, which can result in incorrect routing by some routers. If you want to use this option, activate the function. When the function is activated, the setting only takes effect if the peer is an mGuard with firmware Version 5.1.0 or later installed. In all other cases, the setting has no effect, negative or otherwise.
	IPsec MTU (default is 16260)	The option for avoiding oversized IKE data packets, which cannot be routed correctly on the transmission path by faulty routers, can also be applied for IPsec data packets. In order to remain below the upper limit of 1500 bytes often set by DSL, it is recommended that a value of 1414 (bytes) be set. This also allows enough space for additional headers. If you want to use this option, specify a value lower than the default setting.

8.1.2 DynDNS Monitoring



For an explanation of DynDNS, see “DynDNS” on page 169.

IPsec VPN >> Global >> Options		
DynDNS Monitoring Does **not** work with connections of the type "Connections IKEv2 (beta)".	**Watch hostnames of remote VPN gateways**	If the mGuard has the address of a VPN peer in the form of a host name (see “Defining a new VPN connection/VPN connection tunnel” on page 270) and this host name is registered with a DynDNS service, then the mGuard can check the relevant DynDNS at regular intervals to determine whether any changes have occurred. If so, the VPN connection will be established to the new IP address.
	Refresh interval	Default: 300 seconds

8.2 IPsec VPN >> Connections

NOTE: IKEv2 VPN connections can only be used in productive environments after successful testing in the customer application.

Connections that are configured in the "Connections IKEv2 (beta)" section can also use the IKEv2 protocol in addition to the IKEv1 protocol.

Support for the IKEv2 protocol for establishing VPN connections is currently in the beta phase and offers a limited range of functions.

In productive use, IKEv2 connections should only be used after successful testing in the customer environment.

In the IKEv2 connections, port 54500 is used to establish the connection, in deviation from the standard. Port 54500 must therefore also be configured on the remote side and must not be blocked by firewall settings.

To ensure compatibility with remote peers, older mGuard devices and firmware versions that use the IKEv1 protocol, the IPsec VPN connections must be created in different tables:

1. **"Connections" table**: Connections in this table use the IKEv1 protocol and are compatible with older mGuard devices and firmware versions (**recommended**).
2. **"Connections IKEv2 (beta)" table**: Connections in this table use the IKEv2 protocol for key exchange (**must be tested before productive use**).

Requirements for a VPN connection

A general requirement for a VPN connection is that the IP addresses of the VPN partners are known and can be accessed.

- mGuard devices provided in stealth network mode are preset to the “multiple clients” stealth configuration. In this mode, you need to configure a management IP address and default gateway if you want to use VPN connections (see “Default gateway” on page 152). Alternatively, you can select a different stealth configuration than the “multiple clients” configuration or use another network mode.
- VPN connections can currently only be used if firewall redundancy is deactivated on the device.
- In order for the IPsec connections configured in both tables to be established successfully, the VPN peer must support IPsec with the following configurations:

IPsec connections in the "Connections" table

  - Authentication via pre-shared key (PSK) or X.509 certificates
  - ESP
  - Diffie-Hellman group (2, 5 and 14 – 18)
  - DES, 3DES or AES encryption
  - MD5- and SHA hash algorithms
  - Tunnel or transport mode
  - XAuth and Mode Config
  - Quick mode
  - Main Mode and Aggressive Mode
  - SA lifetime (1 second to 24 hours)
- If the peer is positioned downstream of a NAT router, the peer must support NAT traversal (NAT-T). Alternatively, the NAT router must know the IPsec protocol (IPsec/VPN passthrough). For technical reasons, only IPsec tunnel connections are supported in both cases.

– Authentication using “Pre-shared key” in Aggressive mode is not supported when using “XAuth”/“Mode Config”. If, e.g., a connection from the iOS or Android client to the mGuard server is created, the authentication must take place via certificate.

Encryption and hash algorithms

Some of the available algorithms are outdated and no longer considered secure. They are therefore not recommended. However, they can still be selected and used for reasons of downward compatibility. In the WBM, outdated algorithms or unsecure settings are marked with an asterisk (*).

NOTE: Use secure encryption and hash algorithms (see “Using secure encryption and hash algorithms” on page 41).

IPsec connections in the "Connections IKEv2 (beta)" table

The mGuard 10.6.0 firmware still has a limited range of functions:

– ESP
– Authentication via pre-shared key (PSK) or X.509 certificates
– AES encryption
– SHA2 hash algorithms
– Perfect Forward Secrecy (PFS) activated
– Tunnel mode

Encryption and hash algorithms: The related settings for the IKE options cannot be configured by the user.

The mGuard device uses **only** the following algorithms recommended by the BSI and considered secure according to the current state of the art (see BSI TR-0210, last accessed on 2025-09-15).

Encryption algorithms:

– ENCR_AES_GCM_16 - aes128gcm16/aes256gcm16
– ENCR_AES_GCM_12 - aes128gcm12/aes256gcm12
– ENCR_AES_CCM_16 - aes128ccm16/aes256ccm16
– ENCR_AES_CCM_12 - aes128ccm12/aes256ccm12
– ENCR_AES_CTR - aes128ctr/aes256ctr
– ENCR_AES_CBC - aes128/aes256

Functions for key generation (PRF - pseudo-random function)

– PRF_HMAC_SHA2_512 - prfsha512
– PRF_HMAC_SHA2_384 - prfsha384
– PRF_HMAC_SHA2_256 - prfsha256
– PRF_AES128_CMAC - prfaescmac
– PRF_AES128_XCBC - prfaesxcbc

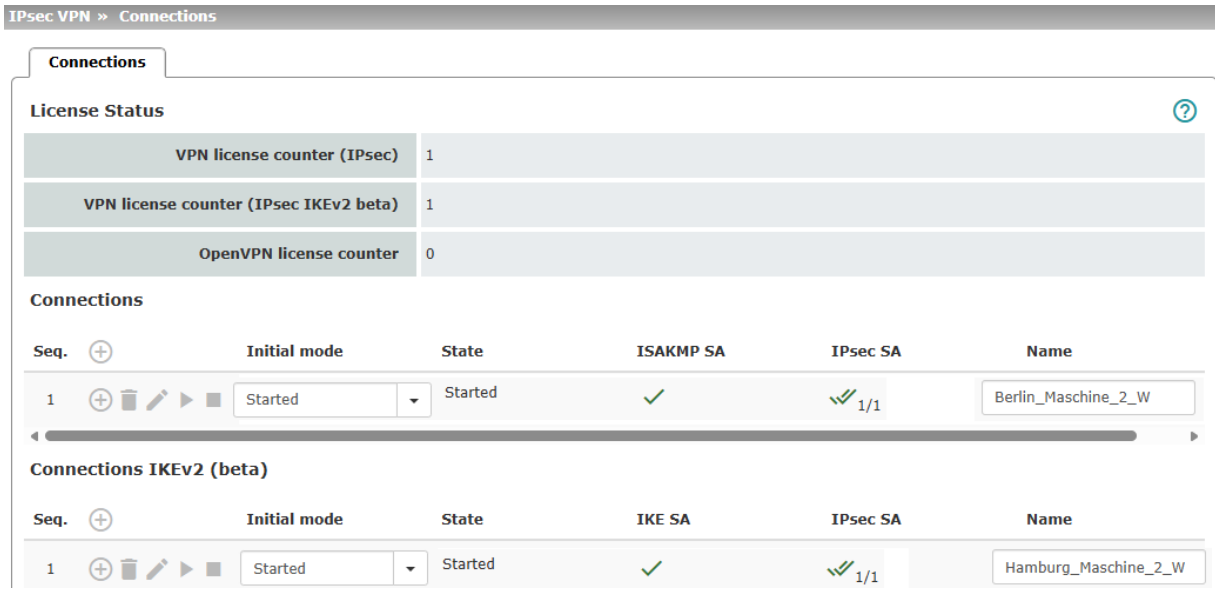
Checksums (hashes)

– AUTH_HMAC_SHA2_512_256 - sha512
– AUTH_HMAC_SHA2_384_192 - sha384
– AUTH_HMAC_SHA2_256_128 - sha256

Diffie-Hellman groups

– brainpoolP512r1 - ecp512bp
– brainpoolP384r1 - ecp384bp
– brainpoolP256r1 - ecp256bp
– 521-bit random ECP group - ecp521
– 384-bit random ECP group - ecp384
– 256-bit random ECP group - ecp256
– 4096-bit MODP group - modp4096
– 3072-bit MODP group - modp3072

8.2.1 Connections (IKEv1 and IKEv2 beta)



List of all the VPN connections that have been defined.

Each connection name listed here can refer to an individual VPN connection or a group of VPN connection tunnels. You have the option of defining several tunnels under the transport and/or tunnel settings of the relevant entry.

You also have the option of defining new VPN connections, activating and deactivating VPN connections, changing (editing) the VPN connection or connection group properties, and deleting connections.

Connections that are configured in the "Connections IKEv2 (beta)" section can also use the IKEv2 protocol in addition to the IKEv1 protocol.

NOTE: IKEv2 VPN connections can only be used in productive environments after successful testing in the customer application.

Support for the IKEv2 protocol for establishing VPN connections is currently in the beta phase and offers a limited range of functions.

In the IKEv2 connections, port 54500 is used to establish the connection, in deviation from the standard. Port 54500 must therefore also be configured on the remote side and must not be blocked by firewall settings.

To ensure compatibility with remote peers, older mGuard devices and firmware versions that use the IKEv1 protocol, the IPsec VPN connections must be created in different tables:

1. **"Connections" table**: Connections in this table use the IKEv1 protocol and are compatible with older mGuard devices and firmware versions (**recommended**).
2. **"Connections IKEv2 (beta)" table**: Connections in this table use the IKEv2 protocol for key exchange (**must be tested before productive use**).

In the "Connections IKEv2 (beta)" table, the maximum number of configurable VPN connections is limited to 10.

IPsec VPN >> Connections / IPsec VPN >> Connections IKEv2 (beta)		
License Status	**VPN license counter (IPsec)**	Number of remote peers that have currently established a VPN connection via the IPsec protocol (IKEv1).
	VPN license counter (IPsec IKEv2 beta)	Number of remote peers that have currently established a VPN connection via the IPsec protocol (IKEv2 beta).
	OpenVPN license counter	Number of remote peers to which a VPN connection is currently established using the OpenVPN protocol.
Connections / Connections IKEv2 (beta)	**Initial mode**	**Disabled / Stopped / Started** The "**Disabled**" setting deactivates the VPN connection permanently; it cannot be started or stopped. The "**Started**" and "**Stopped**" settings determine the state of the VPN connection after restarting/booting the mGuard (e.g., after an interruption in the power supply). VPN connections that are not deactivated can be started or stopped via icons on the web interface, a switch, a push-button, data traffic or the script nph-vpn.cgi.
	State	Indicates the current activation state of the IPsec VPN connection.
	ISAKMP SA (Only in the "Connections" table)	Indicates whether or not the corresponding ISAKMP SA has been established.
	IKE SA (Only in the "Connections IKEv2 (beta)" table)	Indicates whether or not the corresponding IKE SA has been established.
	IPsec SA	Indicates how many of the configured tunnels are established. The number of established tunnels may be higher than the number of configured tunnels, if the "Tunnel Group" function is used.
	Name	Name of the VPN connection

Connections / Connections IKEv2 (beta)

Defining a new VPN connection/VPN connection tunnel

- In the connection table, click on the ⊕ **Insert Row** icon to add a new table row.
- Click on the ✎ **Edit Row** icon.

Editing a VPN connection/VPN connection tunnel

- Click on the ✎ **Edit Row** icon in the relevant row.

URL for starting, stopping, querying the status of a VPN connection

The following URL can be used to start and stop VPN connections that are in "**Started**" or "**Stopped**" initial mode or to query their connection status:

Example

ℹ Each call of a CGI command creates a separate HTTPS session that is not automatically terminated. A maximum of 10 simultaneous HTTPS sessions are possible. Phoenix Contact recommends using session cookies and CSRF tokens to execute commands in the same session.

Create session cookie and CSRF token:

curl -k -c session_cookie -d '["admin", "admin", "mGuard"]' https://192.168.1.1/?cmd=login

csrf=$(curl -k -b session_cookie https://192.168.1.1/?cmd=dev-info | jq -r .csrf_token)

IKEv1 connections

Without session cookie:

curl --insecure "https://admin:mGuard@192.168.1.1/nph-vpn.cgi?name=Berlin&cmd=up“

curl --insecure "https://admin:mGuard@192.168.1.1/nph-vpn.cgi?name=Berlin&cmd=down“

curl --insecure "https://admin:mGuard@192.168.1.1/nph-vpn.cgi?name=Berlin&cmd=status“

Using cookies:

curl -k -b session_cookie -H "X-CSRF-Token: $csrf" -X POST ‘https://192.168.1.1/?cmd=action&action=vpn/start&name=Berlin'

curl -k -b session_cookie -H "X-CSRF-Token: $csrf" -X POST ‘https://192.168.1.1/?cmd=action&action=vpn/stop&name=Berlin'

IKEv2 connections (beta)

Using cookies:

curl -k -b session_cookie -H "X-CSRF-Token: $csrf" -X POST ‘https://192.168.1.1/?cmd=action&action=vpn/ipsec-start&name=Berlin_IKEv2'

curl -k -b session_cookie -H "X-CSRF-Token: $csrf" -X POST ‘https://192.168.1.1/?cmd=action&action=vpn/ipsec-stop&name=Berlin_IKEv2'

Using the command line tool *wget* is not supported.

The admin password and the name that an action relates to may only contain the following characters:

– Letters: A - Z, a - z
– Numbers: 0 - 9
– Characters: - . _ ~

Other characters, such as a space or question mark, must be encoded accordingly (see “Encoding of special characters (URL encoding)” on page 401).

The option **--insecure** or **-k** (*curl*) ensures that the HTTPS certificate on the mGuard does not undergo any further checking.

A command like this relates to all connection tunnels that are grouped together under the respective name (in this example, *Berlin*). This is the name that is listed under *“IPsec VPN >> Connections >> Edit >> General”* as *"A descriptive name for the connection"* . In the event of ambiguity, the URL call only affects the first entry in the list of connections.

It is not possible to communicate with the individual tunnels of a VPN connection. If individual tunnels are deactivated, they are not started. Starting and stopping in this way therefore has no effect on the settings of the individual tunnels (see “Transport and Tunnel Settings” on page 281).

If the status of a VPN connection is queried using the URL specified above, then the following responses can be expected:

Table 8-1 Status of a VPN connection

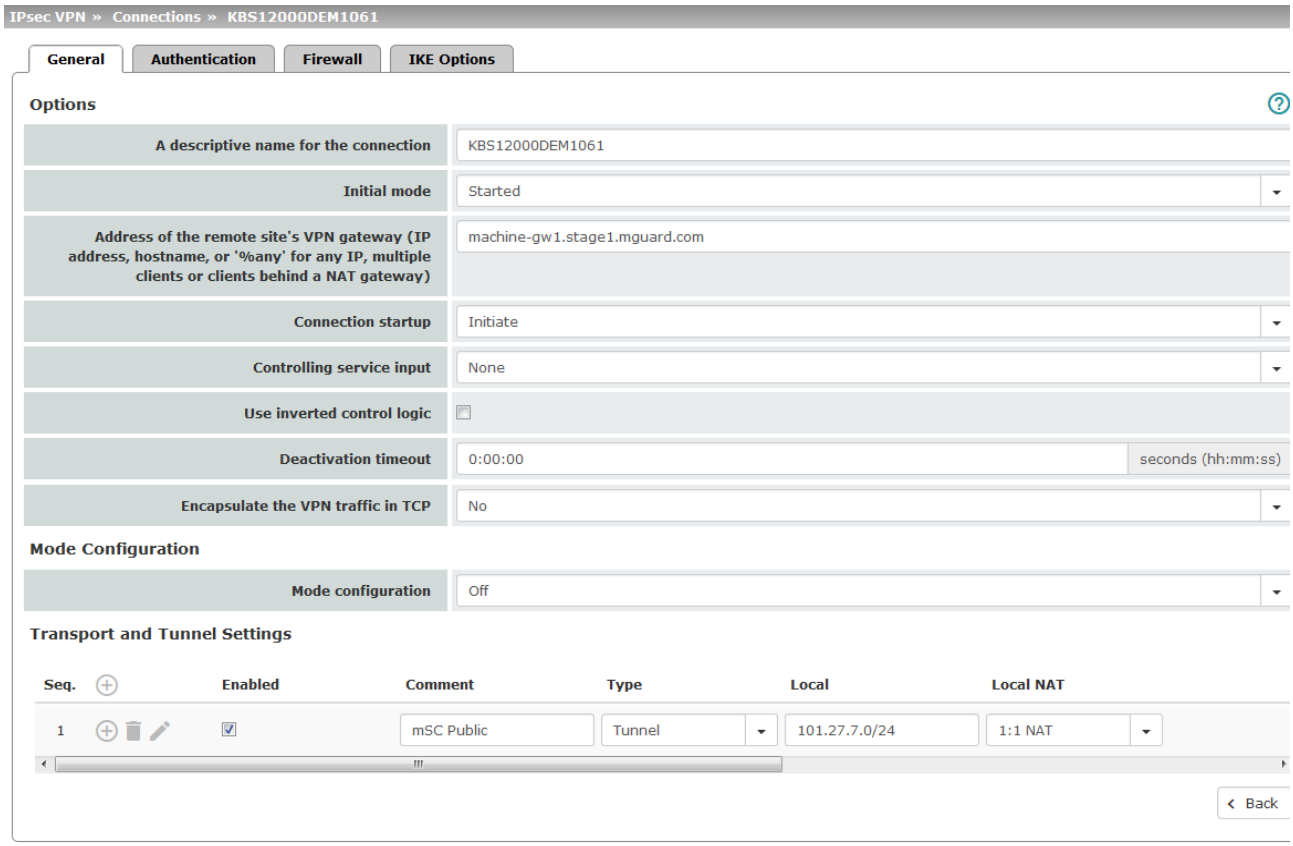
Response	Indicates
unknown	A VPN connection with this name does not exist.
void	The connection is inactive due to an error, e.g., the external network is down or the host name of the peer could not be resolved in an IP address (DNS). The response “void” is also issued by the CGI interface, even if no error occurred. If, for example, the VPN connection is deactivated according to the configuration (**No** set in column) and has not been enabled temporarily using the CGI interface or CMD contact („I“ contact).
ready	The connection is ready to establish tunnels or allow incoming queries regarding tunnel setup.
active	At least one tunnel has already been established for the connection.

Defining a VPN connection/VPN connection tunnel

Depending on the network mode of the mGuard, the following page appears after clicking on the **Edit Row** icon.

8.2.2 General

Only valid for IPsec VPN connections in the „Connections“ table.



IPsec VPN >> Connections >> Edit >> General		
Options	**A descriptive name for the connection**	The connection can be freely named/renamed. If several connection tunnels are defined under **“”**, then this name applies to the entire set of VPN connection tunnels grouped under this name. Similarities between VPN connection tunnels: – Same authentication method, as specified on the *Authentication* tab page (see “Authentication” on page 291) – Same firewall settings – Same IKE options set

IPsec VPN >> Connections >> Edit >> General[...]		
	Initial mode	**Disabled / Stopped / Started** The “**Disabled**” setting deactivates the VPN connection permanently; it cannot be started or stopped. The “**Started**” and “**Stopped**” settings determine the status of the VPN connection after restarting/booting the mGuard (e.g., after an interruption in the power supply). VPN connections that are not deactivated can be started or stopped via icons on the web interface, a switch, a push-button, data traffic or the script nph-vpn.cgi.
	Address of the remote site's VPN gateway	An IP address, host name or **%any** for several peers or peers downstream of a NAT router.

Address of the remote site's VPN gateway

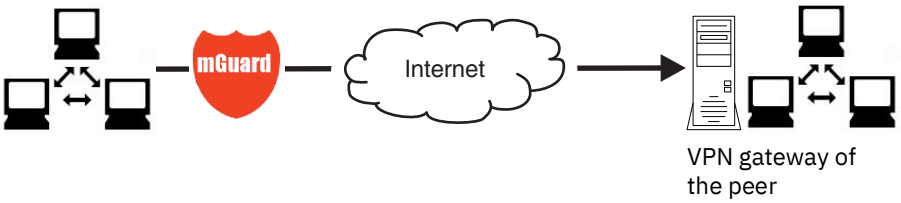


Figure 8-2 The address of the transition to the private network where the remote communication partner is located.

– If the mGuard should actively initiate and establish the connection to the remote peer, specify the IP address or host name of the peer here.
– If the VPN gateway of the peer does not have a fixed and known IP address, the DynDNS service (see glossary) can be used to simulate a fixed and known address.
– If the mGuard should be ready to allow a connection to the local mGuard that was actively initiated and established by a remote peer with any IP address, specify **%any**.
  This setting should also be selected for a VPN star configuration if the mGuard is connected to the control center.
  The mGuard can then be “called” by a remote peer if this peer has been dynamically assigned its IP address (by the Internet service provider), i.e., it has an IP address that changes. In this scenario, you may only specify an IP address if the remote “calling” peer also has a fixed and known IP address.

%any can only be used together with the authentication method using X.509 certificates.

If locally stored CA certificates are to be used to authenticate the peer, the address of the remote site's VPN gateway can be specified explicitly (by means of an IP address or host name) or by **%any**. If it is specified using an explicit address (and not by “%any”), then a VPN identifier (see “VPN Identifier” on page 294) must be specified.

%any must be selected if the peer is located downstream of a NAT gateway. Otherwise, the renegotiation of new connection keys will fail on initial contact.

If **TCP encapsulation** is used (see “TCP encapsulation” on page 261): a fixed IP address or a host name must be specified if this mGuard is to initiate the VPN connection and encapsulate the VPN data traffic.

If this mGuard is installed upstream of a maintenance center to which multiple remote mGuard devices establish VPN connections and transmit encapsulated data packets, **%any** must be specified for the VPN gateway of the peer.

IPsec VPN >> Connections >> Edit >> General		
Options	**Address of the remote site's VPN gateway**	IP address, host name or “%any” for any IP addresses, several peers or peers downstream of a NAT router.
	Interface to use for gateway setting %any (If the value %any was specified for “Address of the remote site's VPN gateway”)	**Internal, External, DMZ. Implicitly chosen by the IP address specified to the right** Selection of the **Internal** option is not permitted in Stealth mode. This interface setting is only considered when “%any” is entered as the address of the remote site's VPN gateway. In this case, the interface of the mGuard through which it answers and permits requests for the establishment of this VPN connection is set here. The VPN connection can be established through the LAN and WAN port in all Stealth modes when **External** is selected. The interface setting allows encrypted communication to take place over a specific interface for VPN peers without a known IP address. If an IP address or host name is entered for the peer, then this is used for the implicit assignment to an interface. The mGuard can be used as a “single-leg router” in Router mode when **Internal** is selected, as both encrypted and decrypted VPN traffic for this VPN connection is transferred over the internal interface. IKE and IPsec data traffic is only possible through the primary IP address of the individual assigned interface. This also applies to VPN connections with a specific peer. **DMZ** can only be selected in Router mode. Here, VPN connections can be established to hosts in the DMZ and IP packets can be routed from the DMZ in a VPN connection. **Implicitly chosen by the IP address below** This function can only be selected in "Static" router mode. In this case, an IP address is used instead of a dedicated interface.
	IP address to use for gateway setting %any (If the setting "Implicitly chosen by the IP address specified below" has been selected for "Interface used for the gateway setting %any").	An IP address is used instead of a dedicated interface.

IPsec VPN >> Connections >> Edit >> General[...]

Connection startup	**Initiate / Initiate on traffic / Wait** **Initiate** The mGuard initiates the connection to the peer. The fixed IP address of the peer or its name must be entered in the *Address of the remote site's VPN gateway* field (see above). **Initiate on traffic** The connection is initiated automatically when the mGuard sees that the connection should be used. (Can be selected for all operating modes of the mGuard (*Stealth, Router*, etc.)) If one peer is initiated on data traffic, **Wait** or **Initiate** must be selected for the other peer. **Wait** The mGuard is ready to allow the connection to the mGuard that a remote peer actively initiates and establishes. If **%any** is entered under *Address of the remote site's VPN gateway*, **Wait** must be selected.
Controlling service input	**None / Service input CMD 1-3 (I 1-3)** The VPN connection can be switched via a connected push-button/switch. The push-button/switch must be connected to one of the service contacts (CMD 1-3 / I 1-3). If starting and stopping the VPN connection via the CMD contact is enabled, only the CMD contact is authorized to do this. However, if a push-button is connected to the CMD contact (instead of a switch – see below), the connection can also be established and released using the CGI script command nph-vpn.cgi, which has the same rights.
Use inverted control logic	Inverts the behavior of the connected switch. If the switching service input is configured as an on/off switch, it can activate one VPN connection while simultaneously deactivating another which uses inverted logic, for example.

IPsec VPN >> Connections >> Edit >> General[...]		
	Deactivation timeout	Time, after which the VPN connection is stopped, if it has been started via switch, push-button, nph-vpn.cgi or the web interface. The timeout starts on transition to the “Started” state. After the timeout has elapsed, the connection remains in the “Stopped” state until it is restarted. **Exception: “Initiate on traffic”** A connection initiated (established) by data traffic is released after the timeout has elapsed, but remains in the “Started” state. The timeout only starts once there is no more data traffic. The VPN connection is established again when data traffic resumes. Time in hours, minutes and/or seconds (00:00:00 to 720:00:00, around 1 month). The entry can be in seconds [ss], minutes and seconds [mm:ss] or hours, minutes, and seconds [hh:mm:ss]. 0 means the setting is disabled.

	Encapsulate the VPN traffic in TCP	**No / TCP encapsulation / Path Finder (default: No)**
		
		If the **TCP encapsulation** function is used (see “TCP encapsulation” on page 261), only set this option to TCP encapsulation if the mGuard is to encapsulate its own outgoing data traffic for the VPN connection it initiated. In this case, the number of the port where the peer receives the encapsulated data packets must also be specified.
		
		TPC encapsulation can also be used with the “**Path Finder**” function (see “TCP encapsulation with enabled “Path Finder” function” on page 262). In this case, only set this option to **Path Finder** if the peer also supports the “Path Finder” function. The number of the port where the peer receives the encapsulated data packets must then also be specified.
		
		TCP-encapsulated or Path Finder connections do not use the UDP protocol and the standard UDP ports 500 and 4500 to send the data. Instead, the encrypted data (using the IKE protocol and the ESP extension) will be sent encapsulated via a TCP connection.
		
		Connection startup setting when using TCP encapsulation/Path Finder
		
		– If the mGuard is to establish a VPN connection to a maintenance center and encapsulate the data traffic there:
		  – “Initiate” or “Initiate on traffic” must be specified.
		– If the mGuard is installed at a maintenance center to which mGuard devices establish a VPN connection:
		  – “Wait” must be specified.

IPsec VPN >> Connections >> Edit >> General[...]		
	TCP-Port of the server, which accepts the encapsulated connection (Only visible if “Encapsulate the VPN traffic in TCP” is set to **TCP encapsulation** or **Path Finder**.)	**Default: 8080** Number of the port where the encapsulated data packets are received by the peer. The port number specified here must be the same as the one specified for the mGuard of the peer under TCP port to listen on (“IPsec VPN >> Global >> Options” menu item).
Mode Configuration	The mGuard supports the "Extended Authentication" authentication method (XAuth) and the frequently required "Mode Config" protocol extension including "Split Tunneling“ as the server and as the client (including iOS and Android-support). Network settings and DNS and WINS configurations are communicated to the IPsec client by the IPsec server.	
	Mode configuration	**Off / Server / Client (default: Off)** In order to communicate via an IPsec VPN connection as the server or client with peers that require “**XAuth**” and “**Mode Config**”, select “Server” or “Client”. **Off**: do not use “Mode Config”. **Server**: communicate the IPsec network configuration to the peer. **Client**: accept and apply the IPsec network configuration communicated by the peer. “Mode Config” cannot be used in “VPN Aggressive Mode” (“Aggressive Mode (insecure)” on page 298).
	Settings as server Allows clients that require “XAuth” and “Mode Config” (e.g., Apple iPad) to establish an IPsec VPN connection to the mGuard. The remote clients receive the necessary values for configuring the connection (local and remote network) from the mGuard. If a connection is to be established by the iOS client, a certificate must be used for authentication. The certificate name (CN) and the “Subject Alternative Name“ of the mGuard achine Certificate must be identical to the IP address (or hostname/DNS name) that the iOS client uses to establish a VPN connection with the mGuard device (see "Authentication >> Certificates").	

IPsec VPN >> Connections >> Edit >> General[...]

Local

Fixed / From table below

Fixed: the local network on the server side is manually set and fixed and must also be set manually on the client side (on the remote client).

From table below: the local network(s) on the server side is/are communicated to the remote client using the split tunneling extension.

Entry in CIDR format (see “CIDR (Classless Inter-Domain Routing)” on page 49).

Local IP network

(If “Fixed” was selected)

Local network at the server end in CIDR format.

Networks

(If “From table below” was selected)

Local network at the server end in CIDR format.

Remote

From pool below / From table below

From pool below

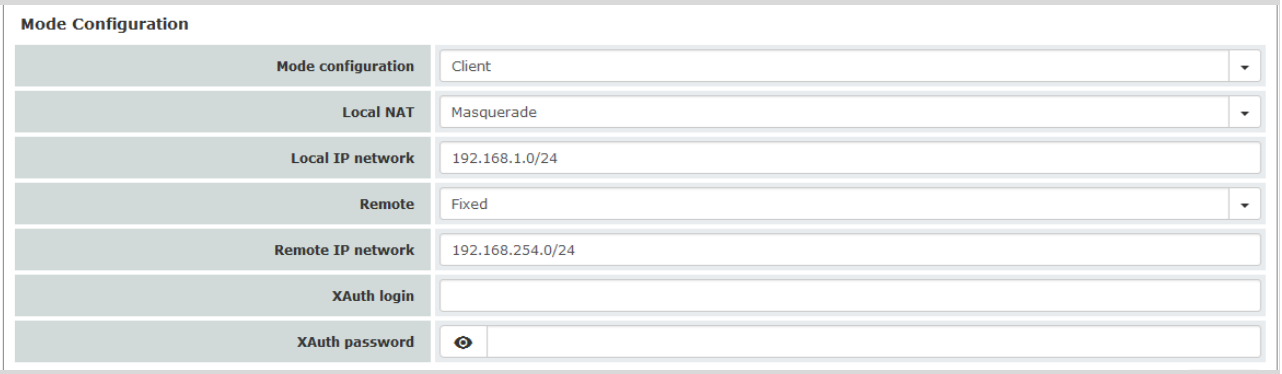
The server dynamically selects IP networks for the peer from the specified pool according to the selected tranche size.

From table below

(This function can only be used if an mGuard is used at the peer.)

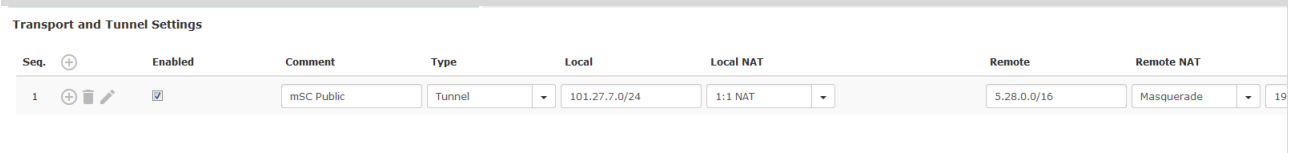
The IP networks of the peer are communicated to the remote client using the split tunneling extension.

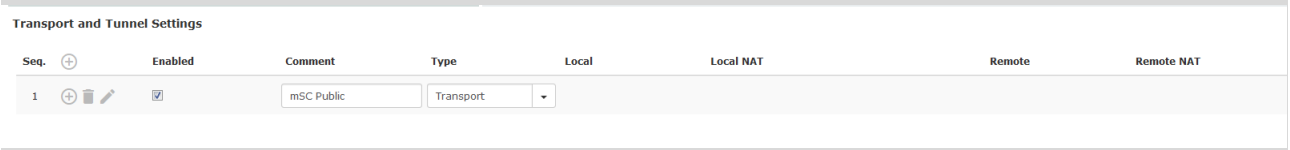
IPsec VPN >> Connections >> Edit >> General[...]	
Remote IP network pool **(If “From pool” was selected)**	Network pool from which IP networks for the peer are selected, in CIDR format.
Tranches of size (network size between 0 and 32) **(If “From pool” was selected)**	Section sizes which determine the size of the IP networks which can be taken from the network pool for the peer.
Networks (If “From table below” was selected)	IP networks for the peer in CIDR format.
1st and 2nd DNS server for the peer	Address of a DNS server which is communicated to the peer. The setting 0.0.0.0 means “no address”.
1st and 2nd WINS server for the peer	Address of a WINS server which is communicated to the peer. The setting 0.0.0.0 means “no address”.
Settings as client	
Allows the mGuard to establish an IPsec VPN connection to servers that require “XAuth” and “Mode Config”. As an option, the mGuard receives the necessary values (IP address/IP network) for configuring the connection (local and remote network) from the remote server of the peer.	



Local NAT (Not active in Stealth modes “Autodetect” and “Static”)	**No NAT / Masquerade** **No NAT** Local IP addresses selected by the server can use the tunnel. **Masquerade** The mGuard can masquerade its local network. To do this, the local network must be specified in CIDR format (see “CIDR (Classless Inter-Domain Routing)” on page 49).
Local IP network	IP network at the local interface of the client that is masqueraded.

IPsec VPN >> Connections >> Edit >> General[...]		
	Remote	**Fixed / From Server** **Fixed**: the local network on the client side is manually set and fixed and must also be set manually on the server side (on the remote server). **From Server**: the remote network(s) on the server side is/are communicated to the local client using the split tunneling extension. If the remote server does not use split tunneling, 0.0.0.0/0 is used.
	Remote IP network **(If "Fixed" was selected)**	The network of the remote server in CIDR format.
	XAuth login	Some remote servers require an XAuth user name (login) and an XAuth password in order to authenticate the client.
	XAuth password	Corresponding XAuth password
Transport and Tunnel Settings		





	Enabled	Specify whether the connection tunnel should be active or not.
	Comment	Freely selectable comment text. Can be left empty.

IPsec VPN >> Connections >> Edit >> General[...]		
	Type	The following can be selected: – Tunnel (network ↔ network) – Transport (host ↔ host) **Tunnel (network ↔ network)** This connection type is suitable in all cases and is also the most secure. In this mode, the IP datagrams to be transmitted are completely encrypted and are, with a new header, transmitted to the VPN gateway of the peer – the "tunnel end". The transmitted datagrams are then decrypted and the original datagrams are restored. These are then forwarded to the destination computer. If the default route (0.0.0.0/0) is entered as the peer, the rules specified under "Network >> NAT >> IP and Port Forwarding" are given priority. This ensures that incoming connections to the WAN interface of the mGuard can continue using port forwarding. In this case, this data is not transmitted via VPN. **Transport (host ↔ host)** For this type of connection, only the data of the IP packets is encrypted. The IP header information remains unencrypted. When you switch to *Transport*, the following fields (apart from Protocol) are hidden as these parameters are omitted.
	Local (For "Tunnel" connection type)	Define the network areas for both tunnel ends under **Local** and **Remote**. **Local:** here, specify the address of the network or computer which is connected locally to the mGuard.
	Remote (For "Tunnel" connection type)	**Remote:** here, specify the address of the network or computer which is located downstream of the remote VPN gateway.
	The virtual IP which will be used by the client in Stealth mode (Only if Stealth network mode is selected: "Autodetect" or "Static"). (For "Tunnel" connection type)	The virtual IP which will be used by the client in Stealth mode**.**

IPsec VPN >> Connections >> Edit >> General[...]

Local NAT

(For “Tunnel” connection type)

No NAT / 1:1 NAT / Masquerade

It is possible to translate the IP addresses of devices located at the respective end of the VPN tunnel.

No NAT: NAT is not performed.

With **1:1 NAT**, the IP addresses of devices at the local end of the tunnel are exchanged so that each individual address is translated into another specific address.

You must click on the **Edit Row** icon in order to specify 1:1 NAT rules for local devices.

With **Masquerade**, the IP addresses of devices at the local end of the tunnel are exchanged with an IP address that is identical for all devices.

Remote NAT

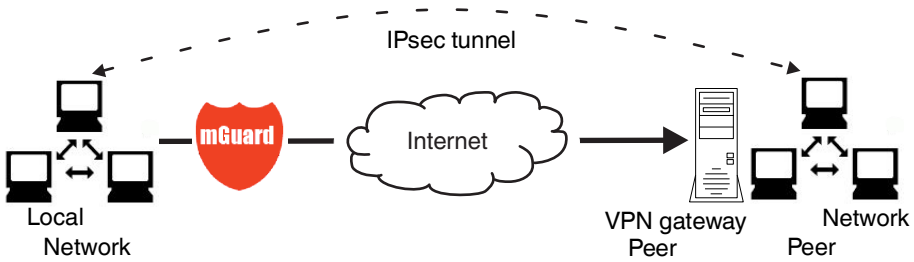
(For “Tunnel” connection type)

No NAT / 1:1 NAT / Masquerade

No NAT: NAT is not performed.

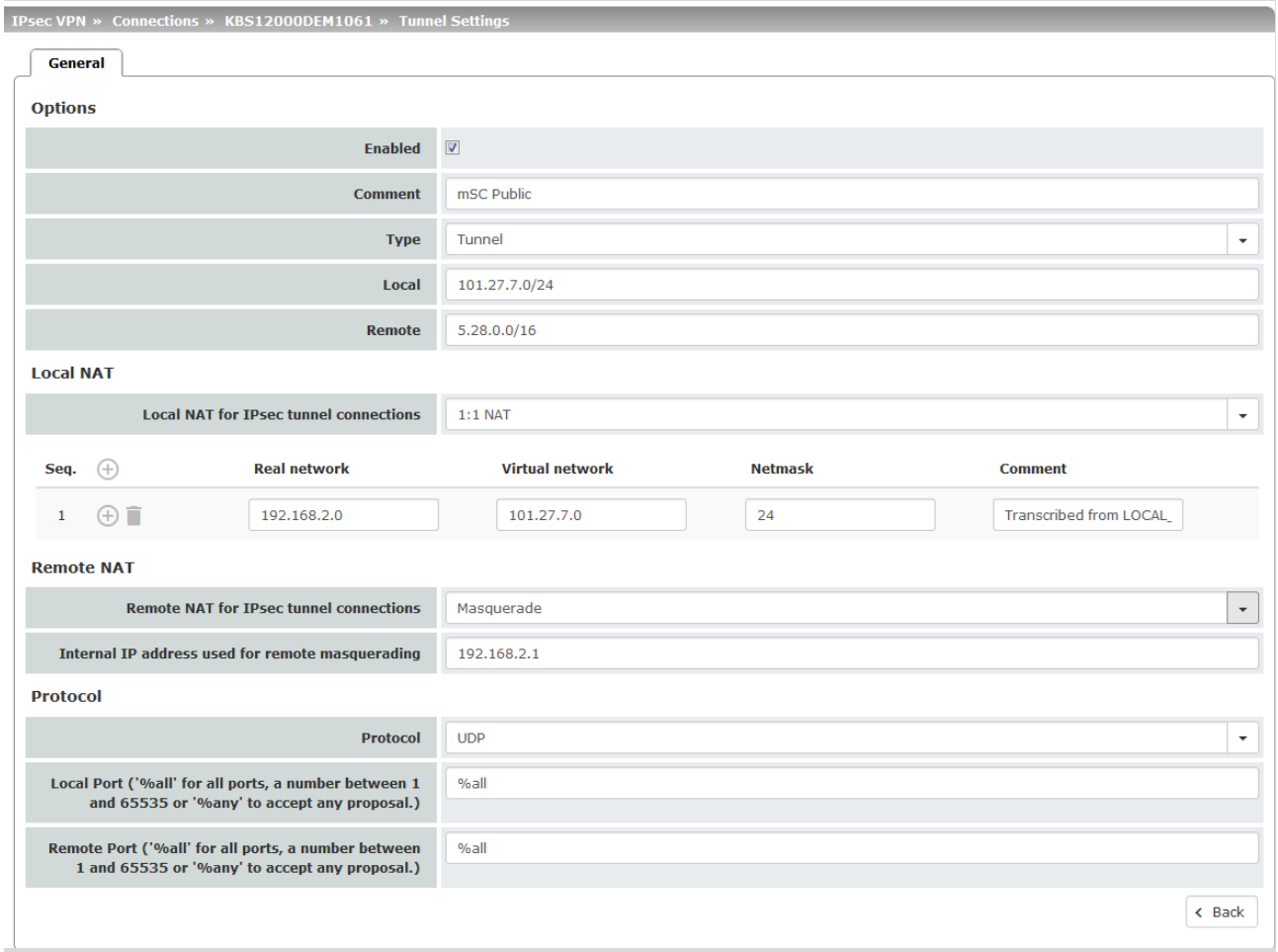
With **1:1 NAT**, the IP addresses of devices of the tunnel peer are exchanged so that each individual address is translated into another specific address.

With **Masquerade**, the IP addresses of devices of the peer are exchanged with an IP address that is identical for all devices.



Click on the **Edit Row** icon to make further settings. The “IPsec VPN >> Connections >> Transport and Tunnel Settings >> General” window opens.

IPsec VPN >> Connections >> Edit >> General[...]



Options	**Transport and Tunnel Settings (Edit)**	
	Enabled	Specify whether the connection tunnel should be active or not.
	Comment	Freely selectable comment text. Can be left empty.

IPsec VPN >> Connections >> Edit >> General[...]		
	Type	The following can be selected: – Tunnel (network ↔ network) – Transport (host ↔ host) **Tunnel (network ↔ network)** This connection type is suitable in all cases and is also the most secure. In this mode, the IP datagrams to be transmitted are completely encrypted and are, with a new header, transmitted to the VPN gateway of the peer – the "tunnel end". The transmitted datagrams are then decrypted and the original datagrams are restored. These are then forwarded to the destination computer. If the default route (0.0.0.0/0) is entered as the peer, the rules specified under "Network >> NAT >> IP and Port Forwarding" are given priority. This ensures that incoming connections to the WAN interface of the mGuard can continue using port forwarding. In this case, this data is not transmitted via VPN. **Transport (host ↔ host)** For this type of connection, only the data of the IP packets is encrypted. The IP header information remains unencrypted. When you switch to *Transport*, the following fields (apart from Protocol) are hidden as these parameters are omitted.
	Local (For "Tunnel" connection type)	Define the network areas for both tunnel ends under **Local** and **Remote**. **Local:** here, specify the address of the network or computer which is connected locally to the mGuard.
	Remote (For "Tunnel" connection type)	**Remote:** here, specify the address of the network or computer which is located downstream of the remote VPN gateway.
Local NAT	**Local NAT for IPsec tunnel connections** (For "Tunnel" connection type)	**No NAT / 1:1 NAT / Masquerade** It is possible to translate the IP addresses of devices located at the respective end of the VPN tunnel. **No NAT**: NAT is not performed. With **1:1 NAT**, the IP addresses of devices at the local end of the tunnel are exchanged so that each individual address is translated into another specific address. With **Masquerade**, the IP addresses of devices at the local end of the tunnel are exchanged with an IP address that is identical for all devices.

IPsec VPN >> Connections >> Edit >> General[...]

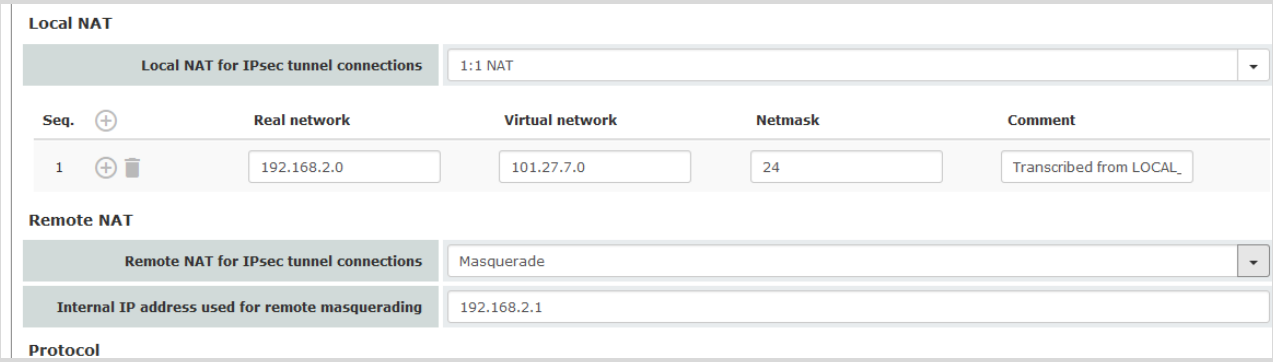
If local devices transmit data packets, only those data packets are considered which:

– Are actually encrypted by the mGuard (the mGuard only forwards packets via the VPN tunnel if they originate from a trustworthy source).
– Originate from a source address within the network which is defined here.
– Have their destination address in the *Remote* network if 1:1 NAT is not set there for the peer.

The data packets of local devices are assigned a source address according to the address set under *Local* and are transmitted via the VPN tunnel.

You can specify 1:1 NAT rules for each VPN tunnel for local devices. In this way, an IP area that is distributed over a wide network can be gathered and sent through a narrow tunnel.

Local 1:1 NAT networks must be specified in ascending order, beginning with the smallest network up to the largest network.



Real network — Configures the “From IP” address for 1:1 NAT.

Virtual network — Configures the translated IP address for 1:1 NAT.

Netmask — The netmask as a value between 1 and 32 for the real and virtual network address (see also “CIDR (Classless Inter-Domain Routing)” on page 49).

Comment — Can be filled with appropriate comments.

Internal network address for local masquerading
(When “Masquerade” is selected)

If local devices transmit data packets, only those data packets are considered which:

– Are actually encrypted by the mGuard (the mGuard only forwards packets via the VPN tunnel if they originate from a trustworthy source).
– Originate from a source address within the network which is defined here.
– Have their destination address in the *Remote* network if 1:1 NAT is not set for the *Remote* NAT.

IPsec VPN >> Connections >> Edit >> General[...]		
		Only one IP address (subnet mask /32) is permitted as the VPN network for this setting. The network to be masqueraded is translated to this IP address. The data packets are then transmitted via the VPN tunnel. Masquerading changes the source address (and source port). The original addresses are recorded in an entry in the Conntrack table. Where response packets are received via the VPN tunnel and there is a matching entry in the Conntrack table, these packets have their destination address (and destination port) written back to them.
Remote NAT	Remote NAT for IPsec tunnel connections (For "Tunnel" connection type)	**No NAT / 1:1 NAT / Masquerade** It is possible to translate the IP addresses of devices located at the respective end of the VPN tunnel. With **Remote 1:1 NAT**, the IP addresses of devices of the tunnel peer are exchanged so that each individual address is translated into another specific address. With **Masquerade** set for the peer network, the IP addresses of devices of the peer are exchanged with an IP address that is identical for all devices.
	Network address for 1:1 NAT (For selection "1:1-NAT")	If local devices transmit data packets, only those data packets are considered which: – Are actually encrypted by the mGuard (the mGuard only forwards packets via the VPN tunnel if they originate from a trustworthy source). – Have a source address within the network which is defined here under Local. The data packets are assigned a destination address from the network that is set under Remote. If necessary, the source address is also replaced (see Local). The data packets are then transmitted via the VPN tunnel.
	Internal IP address used for remote masquerading (When "Masquerade" is selected)	Only one IP address (subnet mask /32) is permitted as the VPN network for this setting. The network to be masqueraded is translated to this IP address. The data packets are then transmitted via the VPN tunnel. Masquerading changes the source address (and source port). The original addresses are recorded in an entry in the Conntrack table. Where response packets are received via the VPN tunnel and there is a matching entry in the Conntrack table, these packets have their destination address (and destination port) written back to them.

IPsec VPN >> Connections >> Edit >> General[...]		
Protocol	**Protocol**	**All** means TCP, UDP, ICMP, and other IP protocols **Local port (only for TCP/UDP)**: number of the port to be used. Select “%all” for all ports, a number between 1 and 65535 or “%any” to leave the decision to the client. **Remote port (only for TCP/UDP)**: number of the port to be used. Select “%all” for all ports, a number between 1 and 65535 or “%any” to leave the decision to the client.
Dynamic Routing	**Add kernel route to remote network to allow OSPF route redistribution** (Only if “OSPF“ is activated)	When the function is activated, a kernel route to the remote network (peer) is added in order to enable distribution by means of OSPF.

Tunnel setting IPsec/L2TP

If clients should connect via the mGuard by IPsec/L2TP, activate the L2TP server and make the following entries in the fields specified below:

- **Type**: Transport
- **Protocol**: UDP
- **Local:** %all
- **Remote:** %all
- **PFS**: No (“Perfect Forward Secrecy (PFS)” on page 306)

Specifying a default route over the VPN

Address 0.0.0.0/0 specifies a *default route over the VPN*.

With this address, all data traffic where no other tunnel or route exists is routed through this VPN tunnel.

A default route over the VPN should only be specified for a single tunnel.

In *Stealth* mode, a *default route over the VPN* cannot be used.

Option of tunnel groups

The "Tunnel groups" option no longer limits the number of established tunnels, but instead the number of connected remote stations (VPN peers). If several tunnels are established to a peer, only one peer is counted, which is an improvement over the old model.

If *Address of the remote site's VPN gateway* is specified as **%any**, there may be many mGuard devices or many networks on the remote side.

A very large address area is then specified in the **Remote** field for the local mGuard. A part of this address area is used on the remote mGuard devices for the network specified for each of them under **Local**.

This is illustrated as follows: the entries in the **Local** and **Remote** fields for the local and remote mGuard devices could be made as follows:

Local mGuard			Remote **mGuard A**	
Local	Remote		Local	Remote
10.0.0.0/8	10.0.0.0/8	>	10.1.7.0/24	10.0.0.0/8
			Remote **mGuard B**	
			Local	Remote
		>	10.3.9.0/24	10.0.0.0/8
			etc.	

In this way, by configuring a single tunnel, you can establish connections for a number of peers.

Masquerade

Can only be used for *Tunnel* VPN type.

Example

A control center has one VPN tunnel each for a large number of branches. One local network with numerous computers is installed in each of the branches, and these computers are connected to the control center via the relevant VPN tunnel. In this case, the address area could be too small to include all the computers at the various VPN tunnel ends.

Masquerading solves this problem:

The computers connected in the network of a branch appear under a single IP address by means of masquerading for the VPN gateway of the control center. In addition, this enables the local networks in the various branches to all use the same network address locally. Only the branch can establish VPN connections to the control center.

Network address for masquerading

Specify the IP address area for which masquerading is used.

The sender address in the data packets sent by a computer via the VPN connection is only replaced by the address specified in the **Local** field (see above) if this computer has an IP address from this address area.

The address specified in the **Local** field must have the netmask “/32” to ensure that only one IP address is signified.

Masquerade can be used in the following network modes: Router and Stealth (only “Multiple clients” in Stealth mode).

For IP connections via a VPN connection with active masquerading, the firewall rules for outgoing data in the VPN connection are used for the original source address of the connection.

1:1 NAT

Can only be used for *Tunnel* VPN type.

With 1:1 NAT in VPN, it is still possible to enter the network addresses actually used to specify the tunnel beginning and end, independently of the tunnel parameters agreed with the peer:

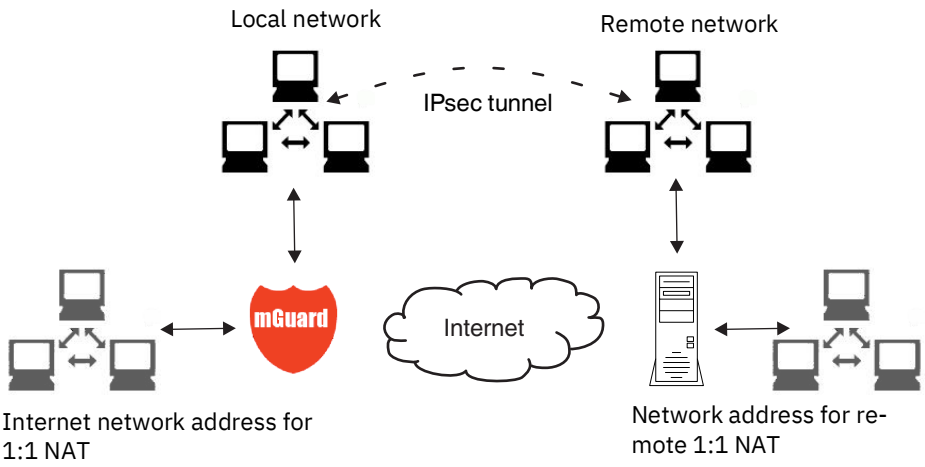
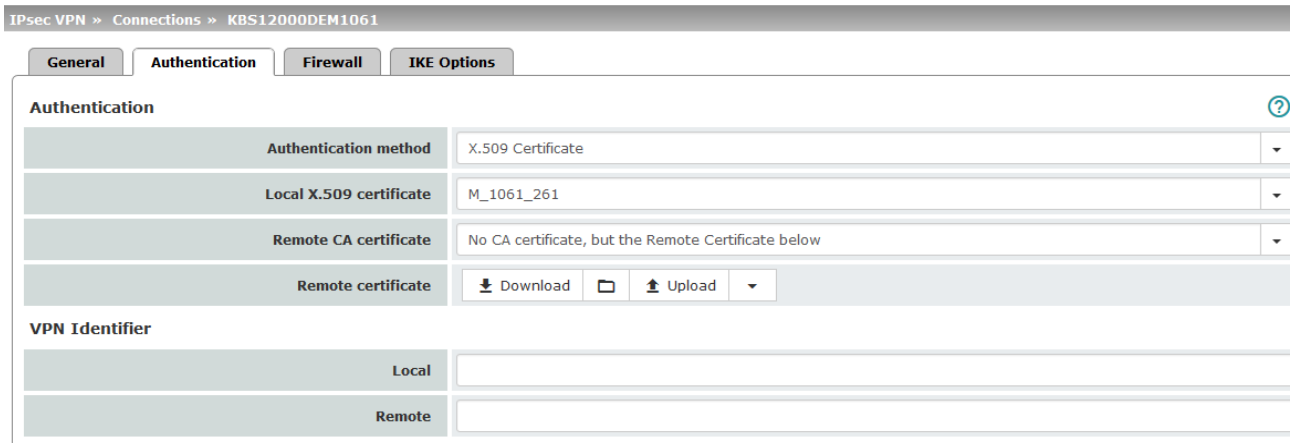


Figure 8-3 1:1 NAT

8.2.3 Authentication



IPsec VPN >> Connections >> Edit >> Authentication

Authentication

Authentication method

There are two options:

– X.509 Certificate (default setting)
– Pre-shared key (PSK)

CAUTION: Insecure PSK authentication
Pre-shared key (PSK) authentication is considered insecure and should no longer be used. For security reasons, use X.509 certificates for authentication.

The page contains different setting options depending on the method chosen.

Authentication method: X.509 Certificate

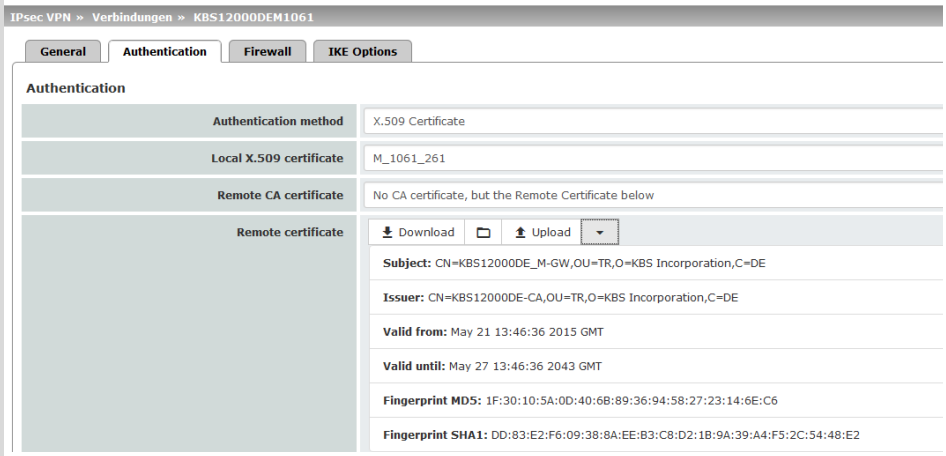
This method is supported by most modern IPsec implementations. With this option, each VPN device has a secret private key and a public key in the form of an X.509 certificate, which contains further information about the certificate's owner and the certification authority (CA).

The following must be specified:

– How the mGuard authenticates itself to the peer
– How the mGuard authenticates the remote peer

IPsec VPN >> Connections >> Edit >> Authentication

How the mGuard authenticates itself to the peer



Local X.509 certificate

(Authentication method: "X.509 Certificate")

Specifies which machine certificate the mGuard uses as authentication to the VPN peer.

Select one of the machine certificates from the selection list.

The selection list contains the machine certificates that have been loaded on the mGuard under the *"Authentication >> Certificates"* menu item.

If *None* is displayed, a certificate must be installed first. *None* must not be left in place, as this results in no X.509 authentication.

How the mGuard authenticates the remote peer

The following definition relates to how the mGuard verifies the authenticity of the VPN remote peer.

The table below shows which certificates must be provided for the mGuard to authenticate the VPN peer if the VPN peer shows one of the following certificate types when a connection is established:

– A machine certificate signed by a CA
– A self-signed machine certificate

Remote CA certificate

The following selection options are available:

– Signed by any trusted CA
– No CA certificate, but the Remote Certificate below
– Name of a CA certificate if available

Remote certificate

(For authentication using remote certificate)

You can upload the remote certificate. The certificate is selected and stored in the list of remote certificates (see "Remote Certificates" on page 208).

For additional information about the table, see “Authentication >> Certificates” on page 197.

Authentication for VPN

The peer shows the following:	Machine certificate, **signed by CA**	Machine certificate, **self-signed**
The mGuard authenticates the peer using:		
	Remote certificate Or all CA certificates that form the chain to the root CA certificate together with the certificate shown by the peer	Remote certificate

According to this table, the certificates that must be provided are the ones the mGuard uses to authenticate the relevant VPN peer.

Requirements

The following instructions assume that the certificates have already been correctly installed on the mGuard (see *“Authentication >> Certificates” on page 197*, apart from the remote certificate).

If the use of revocation lists (CRL checking) is activated under the *“Authentication >> Certificates”, Certificate Settings* menu item, each certificate signed by a CA that is “shown” by the VPN peer is checked for revocations.

However, an existing VPN connection is not immediately terminated by a withdrawn certificate if the CRL update is being performed during the existing VPN connection. Nevertheless, it is no longer possible to exchange keys again (*rekeying*) or restart the VPN connection.

Remote CA certificate

Self-signed machine certificate

If the VPN peer authenticates itself with a **self-signed** machine certificate:

- Select the following entry from the selection list:
  “No CA certificate, but the Remote Certificate below”
- Install the remote certificate under *Remote certificate* (see “Installing the remote certificate” on page 294).

It is not possible to reference a remote certificate loaded under the *“Authentication >> Certificates”* menu item.

Machine certificate signed by the CA

If the VPN peer authenticates itself with a machine certificate **signed by a CA**:

It is possible to authenticate the machine certificate shown by the peer as follows:

– Using CA certificates
– Using the corresponding remote certificate

Authentication using a CA certificate:

Only the CA certificate from the CA that signed the certificate shown by the VPN peer should be referenced here (selection from list). The additional CA certificates that form the chain to the root CA certificate together with the certificate shown by the peer must be installed on the mGuard under the *“Authentication >> Certificates”* menu item.

The selection list contains all CA certificates that have been loaded on the mGuard under the *"Authentication >> Certificates"* menu item.

The other option is *"Signed by any trusted CA"*.

With this setting, all VPN peers are accepted, providing they log in with a signed CA certificate issued by a recognized certification authority (CA). The CA is recognized if the relevant CA certificate and all other CA certificates have been loaded on the mGuard. These then form the chain to the root certificate together with the certificates shown.

Authentication using the corresponding remote certificate:

- Select the following entry from the selection list:
  "*No CA certificate, but the Remote Certificate below*"
- Install the remote certificate under *Remote certificate* (see "Installing the remote certificate" on page 294).

It is not possible to reference a remote certificate loaded under the *"Authentication >> Certificates"* menu item.

Installing the remote certificate

The remote certificate must be configured if the VPN peer is to be authenticated using a remote certificate.

To import a certificate, proceed as follows:

Requirement

The certificate file (file name extension: *.pem, *.cer or *.crt) is saved on the connected computer.

- **No file selected...** click to select the file
- Click on **Upload**.
  The contents of the certificate file are then displayed.

IPsec VPN >> Connections >> Edit >> Authentication	
VPN Identifier	**Authentication method: CA certificate** The following explanation applies if the VPN peer is authenticated using CA certificates. VPN gateways use the VPN identifier to detect which configurations belong to the same VPN connection. **If the mGuard consults CA certificates to authenticate a VPN peer, then it is possible to use the VPN identifier as a filter.** • Make a corresponding entry in the *Remote* field.

IPsec VPN >> Connections >> Edit >> Authentication [...]		
	Local	Default: empty field The local VPN identifier can be used to specify the name the mGuard uses to identify itself to the peer. It must match the data in the machine certificate of the mGuard. **Valid values:** – Empty, i.e., no entry (default). The “Subject” entry (previously *Distinguished Name*) in the machine certificate is then used. – The “Subject” entry in the machine certificate. – One of the *Subject Alternative Names*, if they are listed in the certificate. If the certificate contains *Subject Alternative Names*, these are specified under “Valid values:”. These can include IP addresses, host names with “@” prefix or e-mail addresses.
	Remote	Specifies what must be entered as a subject in the machine certificate of the VPN peer for the mGuard to accept this VPN peer as a communication partner. It is then possible to restrict or enable access by VPN peers, which the mGuard would accept in principle based on certificate checks, as follows: – Restricted access to certain *subjects* (i.e., machines) and/or to *subjects* that have certain attributes or – Access enabled for all *subjects* (See “Subject, certificate” on page 395.) “Distinguished Name” was previously used instead of “Subject”.

IPsec VPN >> Connections >> Edit >> Authentication [...]

Access enabled for all subjects:

If the *Remote* field is left empty, then any subject entries are permitted in the machine certificate shown by the VPN peer. It is then no longer necessary to identify or define the subject in the certificate.

Restricted access to certain subjects:

In the certificate, the certificate owner is specified in the *Subject* field. The entry is comprised of several attributes. These attributes are either expressed as an object identifier (e.g., 132.3.7.32.1) or, more commonly, as an abbreviation with a corresponding value.

Example: CN=VPN endpoint 01, O=Smith and Co., C=US

If certain subject attributes have very specific values for the acceptance of the VPN peer by the mGuard, then these must be specified accordingly. The values of the other freely selectable attributes are entered using the ***** (asterisk) wildcard.

Example: CN=*, O=Smith and Co., C=US (with or without spaces between attributes)

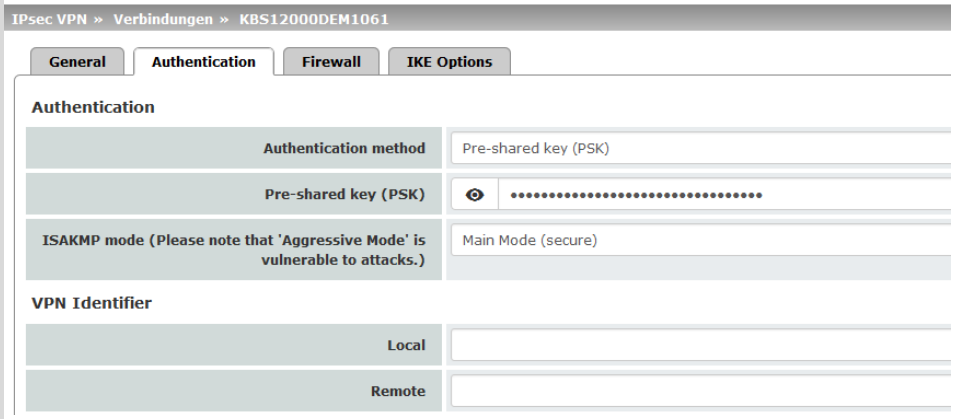
In this example, the attributes “O=Smith and Co.” and “C=US” should be entered in the certificate that is shown under “Subject”. It is only then that the mGuard would accept the certificate owner (subject) as a communication partner. The other attributes in the certificates to be filtered can have any value.

Please note the following when setting a subject filter:The number and the order of the attributes must correspond to that of the certificates for which the filter is used. Please note this is case-sensitive.

IPsec VPN >> Connections >> Edit >> Authentication [...]

Authentication

Authentication method: Pre-shared key (PSK)



This method is mainly supported by older IPsec implementations. In this case, both sides of the VPN authenticate themselves using the same PSK.

NOTE: Insecure authentication method
Pre-shared key (PSK) authentication is considered insecure and should no longer be used. For security reasons, use X.509 certificates for authentication.

To make the agreed key available to the mGuard, proceed as follows:

- Enter the agreed string in the **Pre-shared key (PSK)** input field.

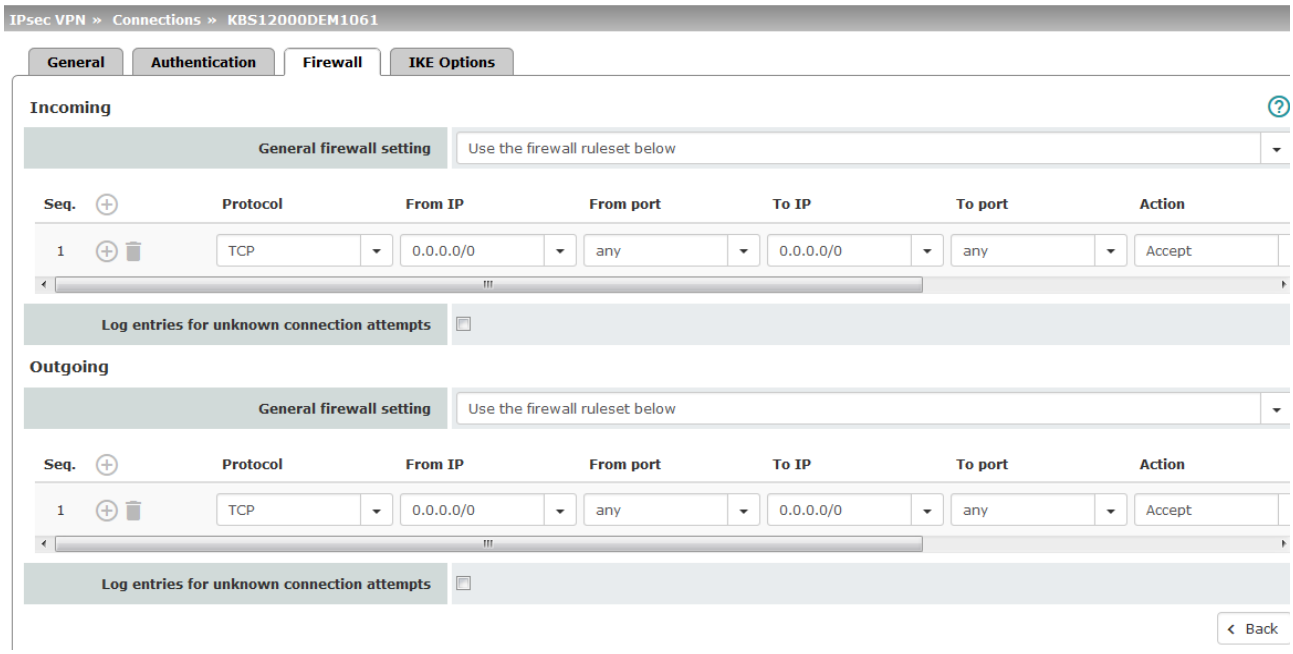
Use secure passwords reflecting the complexity and service life recommended in the latest guidelines (see Section 1.7, “IT security”).

When PSK is used together with the "Aggressive Mode (insecure)" setting, a fixed Diffie-Hellman algorithm must be selected under IKE Options for the initiator of the connection.

When PSK is used together with the "Aggressive Mode (insecure)" setting, all Diffie-Hellman algorithms should be selected under IKE Options for the responder of the connection.
When using a fixed Diffie-Hellman algorithm, it must be the same for all connections using the "Aggressive Mode (insecure)" setting.

IPsec VPN >> Connections >> Edit >> Authentication [...]		
	ISAKMP mode	**Main Mode (secure)** In Main Mode, the party wishing to establish the connection (initiator) and the responder negotiate an ISAKMP SA. We recommend using certificates in Main Mode. **Aggressive Mode (insecure)** Encryption for Aggressive Mode is not as secure as for Main Mode. The use of this mode can be justified if the responder does not know the initiator's address in advance, and both parties wish to use pre-shared keys for authentication. Another reason may be to achieve faster connection establishment when the responder's credentials are already known, e.g., an employee wishing to access the company network. Requirement: – Cannot be used together with the redundancy function. – The same mode must be used between peers. – Aggressive mode is not supported in conjunction with XAuth/Mode Config. – If two VPN clients downstream of the same NAT gateway establish the same connection to a VPN gateway, they must use the same PSK. VPN connections in Aggressive Mode and with PSK authentication, which are to be implemented by means of a NAT gateway, must use unique VPN identifiers on both the client and the gateway.
VPN Identifier	VPN gateways use the *VPN Identifier* to detect which configurations belong to the same VPN connection. The following entries are valid for PSK: – Empty (IP address used by default) – An IP address – A host name with “@” prefix (e.g., “@vpn1138.example.com”) – An e-mail address (e.g., “piepiorra@example.com”)	

8.2.4 Firewall



Incoming/outgoing firewall

While the settings made under the *Network Security* menu item only relate to non-VPN connections (see above under “Network Security menu” on page 213), the settings here only relate to the VPN connection defined on these tab pages.

If multiple VPN connections have been defined, you can restrict the outgoing or incoming access individually for each connection. Any attempts to bypass these restrictions can be logged.

By default, the VPN firewall is set to allow all connections for this VPN connection.
However, the extended firewall settings defined and explained above apply independently for each individual VPN connection (see “Network Security menu” on page 213, “Network Security >> Packet Filter” on page 213, “Advanced” on page 234).

If multiple firewall rules are defined, these are queried starting from the top of the list of entries until an appropriate rule is found. This rule is then applied. If the list of rules contains further subsequent rules that could also apply, these rules are ignored.

In *Stealth* mode, the actual IP address used by the client should be used in the firewall rules, or it should be left at 0.0.0.0/0, as only one client can be addressed through the tunnel.

If the **Allow packet forwarding between VPN connections** function is **activated** on the **Global** tab page, the rules under **Incoming** are used for the incoming data packets to the mGuard, and the rules under **Outgoing** are applied to the outgoing data packets.

If the outgoing data packets are included in the same connection definition (for a defined VPN connection group), then the firewall rules for **Incoming** and **Outgoing** for the same connection definition are used.

If a different VPN connection definition applies to the outgoing data packets, the firewall rules for **Outgoing** for this other connection definition are used.

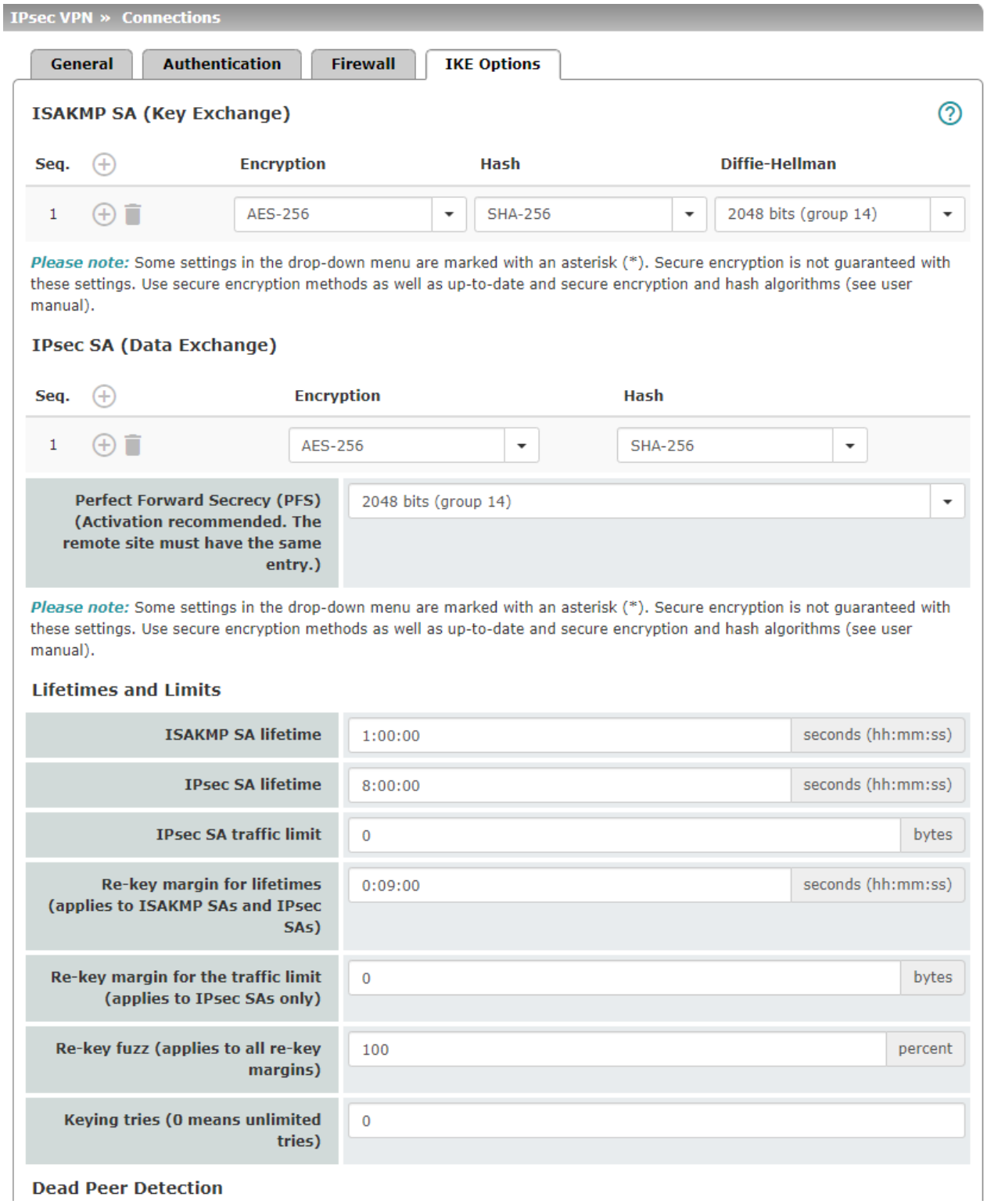
If the mGuard has been configured to forward SSH connection packets (e.g., by permitting a SEC-Stick hub & spoke connection), existing VPN firewall rules are not applied. This means, for example, that packets of an SSH connection are sent through a VPN tunnel despite the fact that this is prohibited by its firewall rules.

IPsec VPN >> Connections >> Edit >> Firewall		
Incoming	**General firewall setting**	**Accept all incoming connections**: the data packets of all incoming connections are allowed. **Drop all incoming connections**: the data packets of all incoming connections are discarded. **Accept Ping only:** the data packets of all incoming connections are discarded, except for ping packets (ICMP). **Use the firewall ruleset below**: displays further setting options.
	The following settings are only visible if "**Use the firewall ruleset below**" is set.	

IPsec VPN >> Connections >> Edit >> Firewall	
Protocol	**All** means TCP, UDP, ICMP, GRE, and other IP protocols.
From IP/To IP	**0.0.0.0/0** means all IP addresses. To specify an address area, use CIDR format (see "CIDR (Classless Inter-Domain Routing)" on page 49). **Name of IP groups,** if defined. When a name is specified for an IP group, the host names, IP addresses, IP areas or networks saved under this name are taken into consideration (see "IP/Port Groups" on page 231). If host names are used in IP groups, the mGuard must be configured so that the host name of a DNS server can be resolved in an IP address. If a host name from an IP group cannot be resolved, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration. The use of host names in IP groups is not possible on mGuard devices of the FL MGUARD 2000 series. **Incoming**: – From IP: IP address in the VPN tunnel – To IP: 1:1 NAT address or the actual address **Outgoing**: – From IP: 1:1 NAT address or the actual address – To IP: IP address in the VPN tunnel
From port / To port **(Only for TCP and UDP protocols)**	**any** refers to any port. **startport:endport** (e.g., 110:120) refers to a port range. Individual ports can be specified using the port number or the corresponding service name (e.g., 110 for pop3 or pop3 for 110). **Name of port groups**, if defined. When a name is specified for a port group, the ports or port ranges saved under this name are taken into consideration (see "IP/Port Groups" on page 231).

IPsec VPN >> Connections >> Edit >> Firewall		
	Action	**Accept** means that the data packets may pass through. **Reject** means that the data packets are sent back and the sender is informed of their rejection. (In *Stealth* mode, Reject has the same effect as Drop.) **Drop** means that the data packets are not permitted to pass through. They are discarded, which means that the sender is not informed of their whereabouts. **Name of** rule records, if defined. When a name is specified for rule records, the firewall rules configured under this name take effect (see “Rule Records” on page 224 tab page). For security reasons, rule records that contain IP groups with host names should not be used in firewall rules which execute “Drop” or “Reject” as the action. The use of rule records is not possible on mGuard devices of the FL MGUARD 2000 series. **Name of Modbus TCP rule records**, if defined. When a Modbus TCP rule record is selected, the firewall rules configured under this rule record take effect (see Section 7.3.1).
	Comment	Freely selectable comment for this rule.
	Log	For each individual firewall rule, you can specify whether the use of the rule: – Should be logged – activate *Log* function – Should not be logged – deactivate *Log* function (default)
	Log entries for unknown connection attempts	When the function is activated, all connection attempts that are not covered by the rules defined above are logged.
Outgoing	The explanation provided under “Incoming” also applies to “Outgoing”.	

8.2.5 IKE Options



IPsec VPN >> Connections >> Edit >> IKE Options

ISAKMP SA (Key Exchange)

Algorithms

(This preference list starts with the most preferred pair of algorithms.)

Use secure algorithms

Some of the available algorithms are outdated and no longer considered secure. They are therefore not recommended. However, they can still be selected and used for reasons of downward compatibility. In the WBM, outdated algorithms or unsecure settings are marked with an asterisk (*).

See “Using secure encryption and hash algorithms” on page 41.

Decide on which encryption method should be used with the administrator of the peer.

Encryption **DES*, 3DES*, AES-128*, AES-192*, AES-256 (default)**

Use secure algorithms

Some of the available algorithms are outdated and no longer considered secure. They are therefore not recommended. However, they can still be selected and used for reasons of downward compatibility. In the WBM, outdated algorithms or unsecure settings are marked with an asterisk (*).

See “Using secure encryption and hash algorithms” on page 41.

The following applies in principle: the longer the encryption length (in Bits) which uses an encryption algorithm (stated by the appended number), the more secure it is.

The longer the key, the more time-consuming the encryption procedure. However, this does not affect the mGuard as it uses a hardware-based encryption technique. Nevertheless, this aspect may be of significance for the peer.

IPsec VPN >> Connections >> Edit >> IKE Options		
	Checksum	**MD5*, SHA-1*, SHA-256 (default), SHA-384, SHA-512** Leave this set to *All algorithms*. It is then of no consequence whether the peer works with MD5, SHA-1, SHA-256, SHA-384 or SHA-512. **Use secure algorithms** Some of the available algorithms are outdated and no longer considered secure. They are therefore not recommended. However, they can still be selected and used for reasons of downward compatibility. In the WBM, outdated algorithms or unsecure settings are marked with an asterisk (*). See “Using secure encryption and hash algorithms” on page 41.
	Diffie-Hellman	The Diffie-Hellman key exchange method is not available for all the algorithms. The bit depth for the encryption can be set here. **Use secure algorithms** Some of the available algorithms are outdated and no longer considered secure. They are therefore not recommended. However, they can still be selected and used for reasons of downward compatibility. In the WBM, outdated algorithms or unsecure settings are marked with an asterisk (*). See “Using secure encryption and hash algorithms” on page 41.
IPsec SA (Data Exchange)		In contrast to *ISAKMP SA (Key Exchange)* (see above), the procedure for data exchange is defined here. It does not necessarily have to differ from the procedure defined for key exchange. The algorithm designated as “Null” does not contain encryption.

IPsec VPN >> Connections >> Edit >> IKE Options

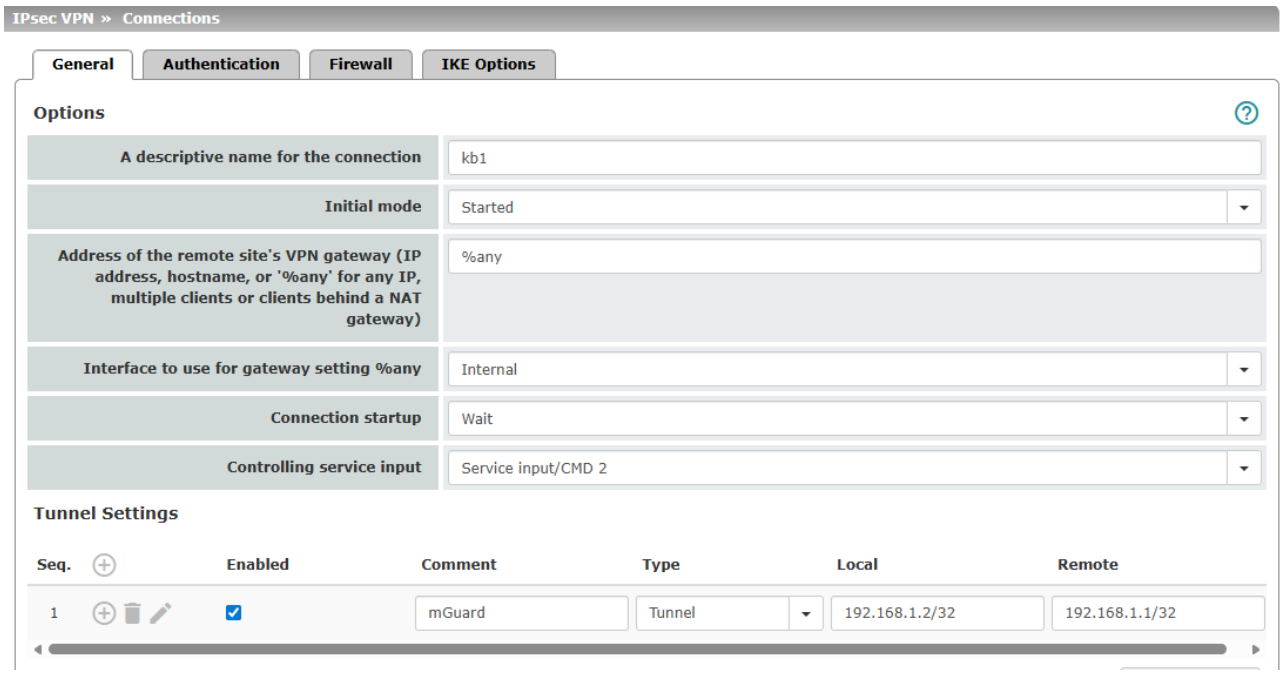
	Algorithms	See above: ISAKMP SA (Key Exchange). If the data exchange shall occur without encryption, the entry "Null" must be selected in the drop-down menu "Encryption". **Use secure algorithms** Some of the available algorithms are outdated and no longer considered secure. They are therefore not recommended. However, they can still be selected and used for reasons of downward compatibility. In the WBM, outdated algorithms or unsecure settings are marked with an asterisk (*). See “Using secure encryption and hash algorithms” on page 41.
	Perfect Forward Secrecy (PFS)	Method for providing increased security during data transmission. With IPsec, the keys for data exchange are renewed at defined intervals. With PFS, new random numbers are negotiated with the peer instead of being derived from previously agreed random numbers. The peer must have the same entry. For security reasons, Phoenix Contact recommends activating PFS with a key length of at least 2048 bits. **Use secure algorithms** Some of the available algorithms are outdated and no longer considered secure. They are therefore not recommended. However, they can still be selected and used for reasons of downward compatibility. In the WBM, outdated algorithms or unsecure settings are marked with an asterisk (*). See “Using secure encryption and hash algorithms” on page 41. If the remote peer supports PFS, select a key length of at least **2048 bits** if possible for security reasons. Selecting **Yes*** could result in a lower key length being used. Set *Perfect Forward Secrecy (PFS)* to **No*** if the peer is an IPsec/L2TP client.
Lifetimes and Limits		The keys of an IPsec connection are renewed at defined intervals in order to increase the difficulty of an attack on an IPsec connection.

IPsec VPN >> Connections >> Edit >> IKE Options		
	ISAKMP SA lifetime	Lifetime in seconds (hh:mm:ss) of the keys agreed for ISAKMP SA. Default setting: 3600 seconds (1 hour). The maximum permitted lifetime is 86400 seconds (24 hours).
	IPsec SA lifetime	Lifetime in seconds (hh:mm:ss) of the keys agreed for IPsec SA. Default setting: 28800 seconds (8 hours). The maximum permitted lifetime is 86400 seconds (24 hours).
	IPsec SA traffic limit	0 to 2147483647 bytes The value 0 indicates that there is no traffic limit for the IPsec SAs on this VPN connection. All other values indicate the maximum number of bytes which are encrypted by the IPsec SA for this VPN connection (Hard Limit).
	Re-key margin for lifetimes	Applies to ISAKMP SAs and IPsec SAs. Minimum duration before the old key expires and during which a new key should be created. Default setting: 540 seconds (9 minutes).
	Re-key margin for the traffic limit	Only applies to IPsec SAs. The value 0 indicates that the traffic limit is not used. 0 must be set here when 0 is also set under *IPsec SA traffic limit*. If a value above 0 is entered, then a new limit is calculated from two values. The number of bytes entered here is subtracted from the value specified under *IPsec SA traffic limit* (i.e., the *Hard Limit*). The calculated value is then known as the *Soft Limit*. This specifies the number of bytes which must be encrypted for a new key to be negotiated for the IPsec SA. A further amount is subtracted when a re-key fuzz (see below) above 0 is entered. This is a percentage of the re-key margin. The percentage is entered under Re-key fuzz. The re-key margin value must be lower than the *Hard Limit*. It must be significantly lower when a *Re-key fuzz* is also added. If the *IPsec SA lifetime* is reached earlier, the *Soft Limit* is ignored.
	Re-key fuzz	Maximum percentage by which the *Re-key margin* should be randomly increased. This is used to delay key exchange on machines with multiple VPN connections. Default setting: 100 percent.
	Keying tries	Number of attempts to negotiate new keys with the peer. The value 0 results in unlimited attempts for connections initiated by the mGuard, otherwise it results in 5 attempts.

IPsec VPN >> Connections >> Edit >> IKE Options		
Dead Peer Detection	If the peer supports the Dead Peer Detection (DPD) protocol, the relevant peers can detect whether or not the IPsec connection is still active and whether it needs to be established again.	
	Delay between requests for a sign of life	Duration in seconds after which *DPD Keep Alive* requests should be transmitted. These requests test whether the peer is still available. Default setting: 30 seconds (00:00:30).
	Timeout for absent sign of life after which peer is assumed dead	Duration in seconds after which the connection to the peer should be declared dead if there has been no response to the *Keep Alive* requests. Default setting: 120 seconds (00:02:00).  If the mGuard finds that a connection is dead, it responds according to the setting under **Connection startup** (see definition of this VPN connection under **Connection startup** on the *General* tab page).

8.2.6 General (IKEv2 beta)

Only valid for IPsec VPN connections in the „Connections IKEv2 (beta)“ table.



IPsec VPN >> Connections IKEv2 (beta) >> Edit >> General

Options	**A descriptive name for the connection**	The connection can be freely named/renamed. If several connection tunnels are defined under **“”**, then this name applies to the entire set of VPN connection tunnels grouped under this name. Similarities between VPN connection tunnels: – Same authentication method, as specified on the *Authentication* tab page (see “Authentication” on page 291) – Same firewall settings – Same IKE options set
	Initial mode	**Disabled / Stopped / Started** The “**Disabled**” setting deactivates the VPN connection permanently; it cannot be started or stopped. The “**Started**” and “**Stopped**” settings determine the status of the VPN connection after restarting/booting the mGuard (e.g., after an interruption in the power supply). VPN connections that are not deactivated can be started or stopped via icons on the web interface, a switch, a push-button, data traffic or the script nph-vpn.cgi.

IPsec VPN >> Connections IKEv2 (beta) >> Edit >> General[...]		
	Address of the remote site's VPN gateway	IP address, host name or “%any” for any IP addresses, several peers or peers downstream of a NAT router.
	Interface to use for gateway setting %any (If the value %any was specified for “Address of the remote site's VPN gateway”)	**Internal, External, DMZ. Implicitly chosen by the IP address specified to the right** Selection of the **Internal** option is not permitted in Stealth mode. This interface setting is only considered when “%any” is entered as the address of the remote site's VPN gateway. In this case, the interface of the mGuard through which it answers and permits requests for the establishment of this VPN connection is set here. The VPN connection can be established through the LAN and WAN port in all Stealth modes when **External** is selected. The interface setting allows encrypted communication to take place over a specific interface for VPN peers without a known IP address. If an IP address or host name is entered for the peer, then this is used for the implicit assignment to an interface. The mGuard can be used as a “single-leg router” in Router mode when **Internal** is selected, as both encrypted and decrypted VPN traffic for this VPN connection is transferred over the internal interface. IKE and IPsec data traffic is only possible through the primary IP address of the individual assigned interface. This also applies to VPN connections with a specific peer. **DMZ** can only be selected in Router mode. Here, VPN connections can be established to hosts in the DMZ and IP packets can be routed from the DMZ in a VPN connection. **Implicitly chosen by the IP address below** This function can only be selected in "Static" router mode. In this case, an IP address is used instead of a dedicated interface.
	IP address to use for gateway setting %any (If the setting "Implicitly chosen by the IP address specified below" has been selected for "Interface used for the gateway setting %any").	An IP address is used instead of a dedicated interface.

IPsec VPN >> Connections IKEv2 (beta) >> Edit >> General[...]

Connection startup

Initiate / Initiate on traffic / Wait

Initiate

The mGuard initiates the connection to the peer. The fixed IP address of the peer or its name must be entered in the *Address of the remote site's VPN gateway* field (see above).

Initiate on traffic

The connection is initiated automatically when the mGuard sees that the connection should be used.

(Can be selected for all operating modes of the mGuard (*Stealth, Router*, etc.))

If one peer is initiated on data traffic, **Wait** or **Initiate** must be selected for the other peer.

Wait

The mGuard is ready to allow the connection to the mGuard that a remote peer actively initiates and establishes.

If **%any** is entered under *Address of the remote site's VPN gateway*, **Wait** must be selected.

Controlling service input

None / Service input CMD 1-3 (I 1-3)

The VPN connection can be switched via a connected push-button/switch.

The push-button/switch must be connected to one of the service contacts (CMD 1-3 / I 1-3).

If starting and stopping the VPN connection via the CMD contact is enabled, only the CMD contact is authorized to do this.

However, if a push-button is connected to the CMD contact (instead of a switch – see below), the connection can also be established and released using the CGI script command nph-vpn.cgi, which has the same rights.

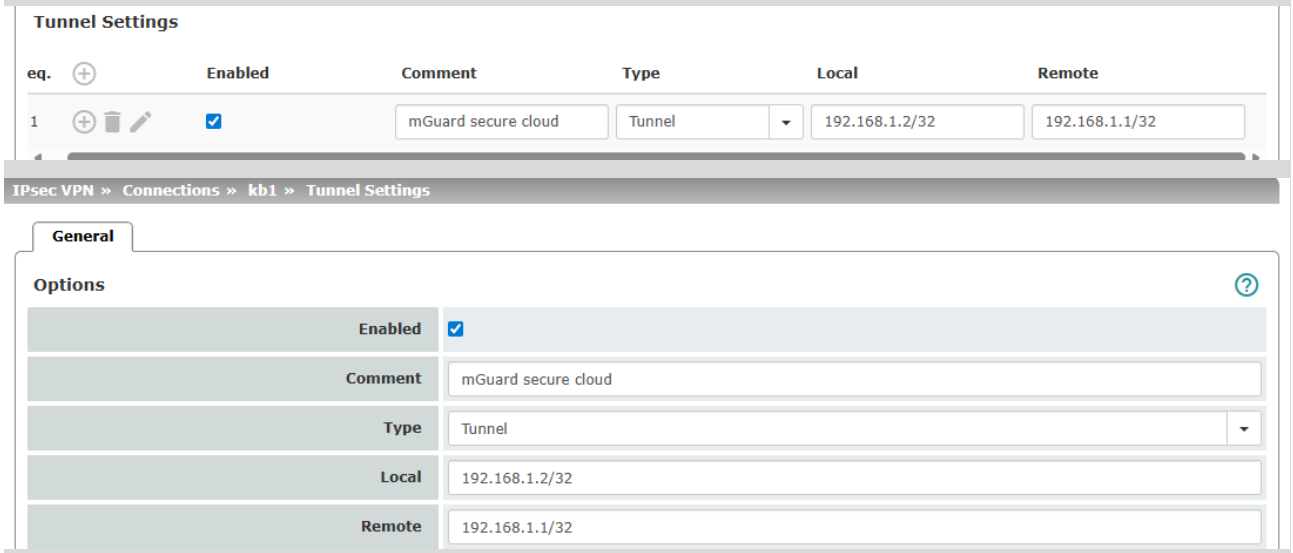
Use inverted control logic

Inverts the behavior of the connected switch.

If the switching service input is configured as an on/off switch, it can activate one VPN connection while simultaneously deactivating another which uses inverted logic, for example.

IPsec VPN >> Connections IKEv2 (beta) >> Edit >> General[...]

Tunnel Settings



Enabled

Specify whether the connection tunnel should be active or not.

Comment

Freely selectable comment text. Can be left empty.

Type

The following can be selected:

– Tunnel (network ↔ network)

Tunnel (network ↔ network)

This connection type is suitable in all cases and is also the most secure. In this mode, the IP datagrams to be transmitted are completely encrypted and are, with a new header, transmitted to the VPN gateway of the peer – the “tunnel end”. The transmitted datagrams are then decrypted and the original datagrams are restored. These are then forwarded to the destination computer.

If the default route (0.0.0.0/0) is entered as the peer, the rules specified under “Network >> NAT >> IP and Port Forwarding” are given priority.

This ensures that incoming connections to the WAN interface of the mGuard can continue using port forwarding. In this case, this data is not transmitted via VPN.

IPsec VPN >> Connections IKEv2 (beta) >> Edit >> General[...]

Local	Define the network areas for both tunnel ends under **Local** and **Remote**. **Local:** here, specify the address of the network or computer which is connected locally to the mGuard.
Remote	**Remote:** here, specify the address of the network or computer which is located downstream of the remote VPN gateway.
The virtual IP which will be used by the client in Stealth mode (Only if "Stealth" network mode is selected: Autodetect or Static).	The virtual IP which will be used by the client in Stealth mode**.**

The use of the virtual IP address is not possible or only possible to a limited extent:

In this case, the virtual IP address **must** match the IP address of the network client. Regardless of whether it was configured statically or assigned dynamically via DHCP.

Specifying a default route over the VPN

Address 0.0.0.0/0 specifies a *default route over the VPN*.

With this address, all data traffic where no other tunnel or route exists is routed through this VPN tunnel.

A default route over the VPN should only be specified for a single tunnel.

In *Stealth* mode, a *default route over the VPN* cannot be used.

Option of tunnel groups

The "Tunnel groups" option no longer limits the number of established tunnels, but instead the number of connected remote stations (VPN peers). If several tunnels are established to a peer, only one peer is counted, which is an improvement over the old model.

If *Address of the remote site's VPN gateway* is specified as **%any**, there may be many mGuard devices or many networks on the remote side.

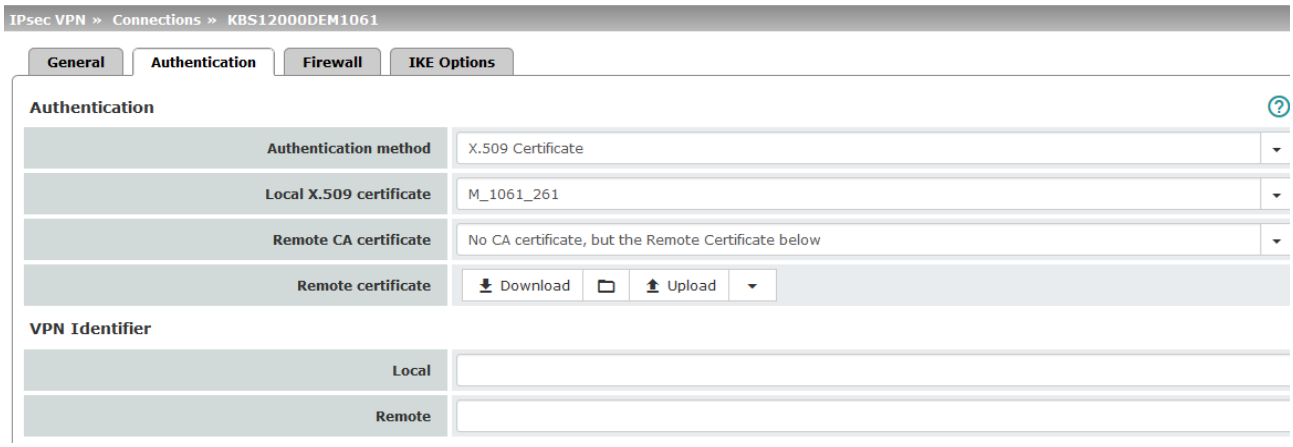
A very large address area is then specified in the **Remote** field for the local mGuard. A part of this address area is used on the remote mGuard devices for the network specified for each of them under **Local**.

This is illustrated as follows: the entries in the **Local** and **Remote** fields for the local and remote mGuard devices could be made as follows:

Local mGuard			Remote **mGuard A**	
Local	Remote		Local	Remote
10.0.0.0/8	10.0.0.0/8	>	10.1.7.0/24	10.0.0.0/8
			Remote **mGuard B**	
			Local	Remote
		>	10.3.9.0/24	10.0.0.0/8
			etc.	

In this way, by configuring a single tunnel, you can establish connections for a number of peers.

8.2.7 Authentication (IKEv2 beta)



IPsec VPN >> Connections IKEv2 (beta) >> Edit >> Authentication

Authentication

Authentication method

There are two options:

– X.509 Certificate (default setting)
– Pre-shared key (PSK)

CAUTION: Insecure PSK authentication
Pre-shared key (PSK) authentication is considered insecure and should no longer be used. For security reasons, use X.509 certificates for authentication.

The page contains different setting options depending on the method chosen.

Authentication method: X.509 Certificate

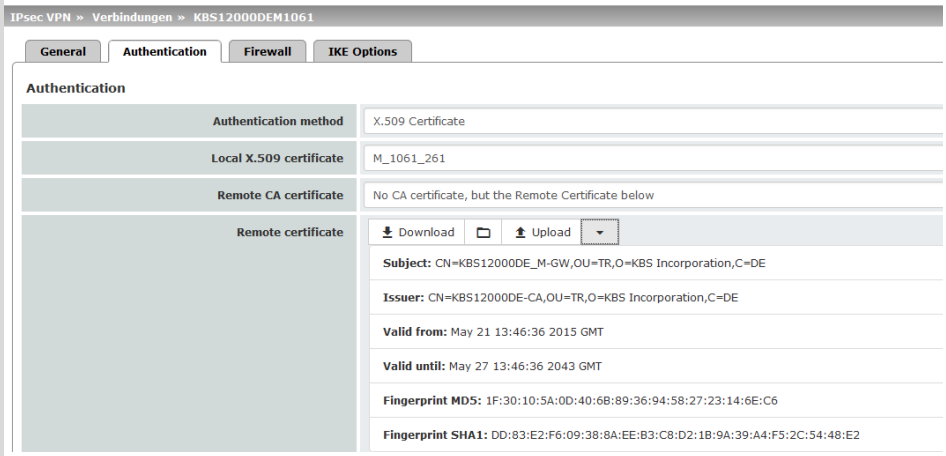
This method is supported by most modern IPsec implementations. With this option, each VPN device has a secret private key and a public key in the form of an X.509 certificate, which contains further information about the certificate's owner and the certification authority (CA).

The following must be specified:

– How the mGuard authenticates itself to the peer
– How the mGuard authenticates the remote peer

IPsec VPN >> Connections IKEv2 (beta) >> Edit >> Authentication

How the mGuard authenticates itself to the peer



Local X.509 certificate

(Authentication method: "X.509 Certificate")

Specifies which machine certificate the mGuard uses as authentication to the VPN peer.

Select one of the machine certificates from the selection list.

The selection list contains the machine certificates that have been loaded on the mGuard under the *"Authentication >> Certificates"* menu item.

If *None* is displayed, a certificate must be installed first. *None* must not be left in place, as this results in no X.509 authentication.

How the mGuard authenticates the remote peer

The following definition relates to how the mGuard verifies the authenticity of the VPN remote peer.

The table below shows which certificates must be provided for the mGuard to authenticate the VPN peer if the VPN peer shows one of the following certificate types when a connection is established:

– A machine certificate signed by a CA
– A self-signed machine certificate

Remote CA certificate

The following selection options are available:

– Signed by any trusted CA
– No CA certificate, but the Remote Certificate below
– Name of a CA certificate if available

Remote certificate

(For authentication using remote certificate)

You can upload the remote certificate. The certificate is selected and stored in the list of remote certificates (see "Remote Certificates" on page 208).

For additional information about the table, see “Authentication >> Certificates” on page 197.

Authentication for VPN

The peer shows the following:	Machine certificate, **signed by CA**	Machine certificate, **self-signed**
The mGuard authenticates the peer using:		
	Remote certificate Or all CA certificates that form the chain to the root CA certificate together with the certificate shown by the peer	Remote certificate

According to this table, the certificates that must be provided are the ones the mGuard uses to authenticate the relevant VPN peer.

Requirements

The following instructions assume that the certificates have already been correctly installed on the mGuard (see *“Authentication >> Certificates” on page 197*, apart from the remote certificate).

If the use of revocation lists (CRL checking) is activated under the *“Authentication >> Certificates”, Certificate Settings* menu item, each certificate signed by a CA that is “shown” by the VPN peer is checked for revocations.

However, an existing VPN connection is not immediately terminated by a withdrawn certificate if the CRL update is being performed during the existing VPN connection. Nevertheless, it is no longer possible to exchange keys again (*rekeying*) or restart the VPN connection.

Remote CA certificate

Self-signed machine certificate

If the VPN peer authenticates itself with a **self-signed** machine certificate:

- Select the following entry from the selection list:
  “No CA certificate, but the Remote Certificate below”
- Install the remote certificate under *Remote certificate* (see “Installing the remote certificate” on page 294).

It is not possible to reference a remote certificate loaded under the *“Authentication >> Certificates”* menu item.

Machine certificate signed by the CA

If the VPN peer authenticates itself with a machine certificate **signed by a CA**:

It is possible to authenticate the machine certificate shown by the peer as follows:

– Using CA certificates
– Using the corresponding remote certificate

Authentication using a CA certificate:

Only the CA certificate from the CA that signed the certificate shown by the VPN peer should be referenced here (selection from list). The additional CA certificates that form the chain to the root CA certificate together with the certificate shown by the peer must be installed on the mGuard under the *“Authentication >> Certificates”* menu item.

The selection list contains all CA certificates that have been loaded on the mGuard under the *"Authentication >> Certificates"* menu item.

The other option is *"Signed by any trusted CA"*.

With this setting, all VPN peers are accepted, providing they log in with a signed CA certificate issued by a recognized certification authority (CA). The CA is recognized if the relevant CA certificate and all other CA certificates have been loaded on the mGuard. These then form the chain to the root certificate together with the certificates shown.

Authentication using the corresponding remote certificate:

- Select the following entry from the selection list:
  "*No CA certificate, but the Remote Certificate below*"
- Install the remote certificate under *Remote certificate* (see "Installing the remote certificate" on page 294).

It is not possible to reference a remote certificate loaded under the *"Authentication >> Certificates"* menu item.

Installing the remote certificate

The remote certificate must be configured if the VPN peer is to be authenticated using a remote certificate.

To import a certificate, proceed as follows:

Requirement

The certificate file (file name extension: *.pem, *.cer or *.crt) is saved on the connected computer.

- **No file selected...** click to select the file
- Click on **Upload**.
  The contents of the certificate file are then displayed.

IPsec VPN >> Connections IKEv2 (beta) >> Edit >> Authentication	
VPN Identifier	**Authentication method: CA certificate** The following explanation applies if the VPN peer is authenticated using CA certificates. VPN gateways use the VPN identifier to detect which configurations belong to the same VPN connection. **If the mGuard consults CA certificates to authenticate a VPN peer, then it is possible to use the VPN identifier as a filter.** • Make a corresponding entry in the *Remote* field.

IPsec VPN >> Connections IKEv2 (beta) >> Edit >> Authentication[...]

Local

Default: empty field

The local VPN identifier can be used to specify the name the mGuard uses to identify itself to the peer. It must match the data in the machine certificate of the mGuard.

Valid values:

- Empty, i.e., no entry (default). The “Subject” entry (previously *Distinguished Name*) in the machine certificate is then used.
- The “Subject” entry in the machine certificate.
- One of the *Subject Alternative Names*, if they are listed in the certificate. If the certificate contains *Subject Alternative Names*, these are specified under “Valid values:”. These can include IP addresses, host names with “@” prefix or e-mail addresses.

Remote

Specifies what must be entered as a subject in the machine certificate of the VPN peer for the mGuard to accept this VPN peer as a communication partner.

It is then possible to restrict or enable access by VPN peers, which the mGuard would accept in principle based on certificate checks, as follows:

- Restricted access to certain *subjects* (i.e., machines) and/or to *subjects* that have certain attributes or
- Access enabled for all *subjects*

(See “Subject, certificate” on page 395.)

“Distinguished Name” was previously used instead of “Subject”.

IPsec VPN >> Connections IKEv2 (beta) >> Edit >> Authentication[...]

Access enabled for all subjects:

If the *Remote* field is left empty, then any subject entries are permitted in the machine certificate shown by the VPN peer. It is then no longer necessary to identify or define the subject in the certificate.

Restricted access to certain subjects:

In the certificate, the certificate owner is specified in the *Subject* field. The entry is comprised of several attributes. These attributes are either expressed as an object identifier (e.g., 132.3.7.32.1) or, more commonly, as an abbreviation with a corresponding value.

Example: CN=VPN endpoint 01, O=Smith and Co., C=US

If certain subject attributes have very specific values for the acceptance of the VPN peer by the mGuard, then these must be specified accordingly. The values of the other freely selectable attributes are entered using the ***** (asterisk) wildcard.

Example: CN=*, O=Smith and Co., C=US (with or without spaces between attributes)

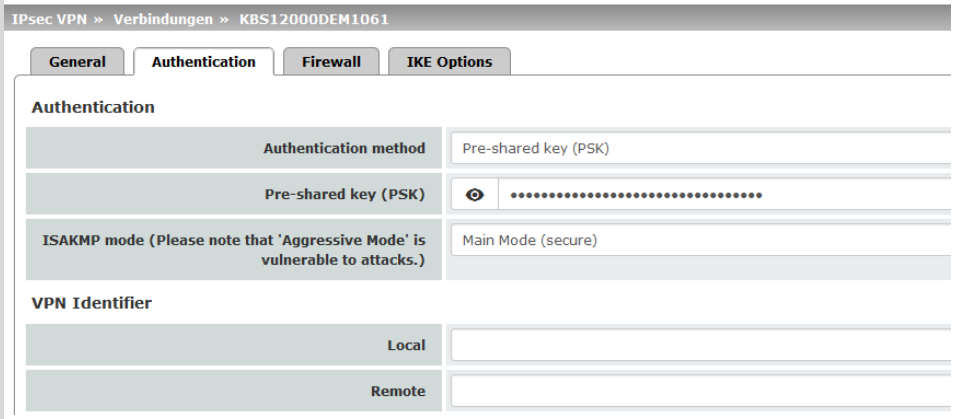
In this example, the attributes “O=Smith and Co.” and “C=US” should be entered in the certificate that is shown under “Subject”. It is only then that the mGuard would accept the certificate owner (subject) as a communication partner. The other attributes in the certificates to be filtered can have any value.

Please note the following when setting a subject filter:The number and the order of the attributes must correspond to that of the certificates for which the filter is used. Please note this is case-sensitive.

IPsec VPN >> Connections IKEv2 (beta) >> Edit >> Authentication[...]

Authentication

Authentication method: Pre-shared key (PSK)



This method is mainly supported by older IPsec implementations. In this case, both sides of the VPN authenticate themselves using the same PSK.

NOTE: Insecure authentication method
Pre-shared key (PSK) authentication is considered insecure and should no longer be used. For security reasons, use X.509 certificates for authentication.

To make the agreed key available to the mGuard, proceed as follows:

- Enter the agreed string in the **Pre-shared key (PSK)** input field.

Use secure passwords reflecting the complexity and service life recommended in the latest guidelines (see Section 1.7, “IT security”).

When PSK is used together with the "Aggressive Mode (insecure)" setting, a fixed Diffie-Hellman algorithm must be selected under IKE Options for the initiator of the connection.

When PSK is used together with the "Aggressive Mode (insecure)" setting, all Diffie-Hellman algorithms should be selected under IKE Options for the responder of the connection.
When using a fixed Diffie-Hellman algorithm, it must be the same for all connections using the "Aggressive Mode (insecure)" setting.

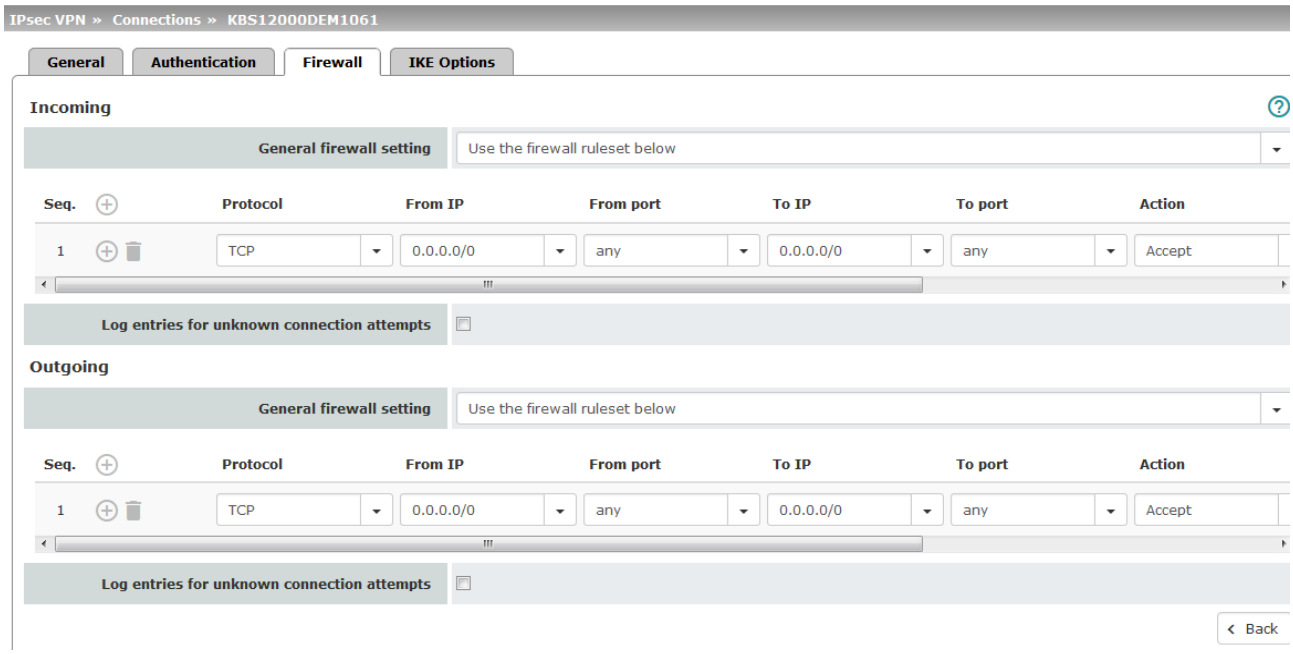
VPN Identifier

VPN gateways use the *VPN Identifier* to detect which configurations belong to the same VPN connection.

The following entries are valid for PSK:

– Empty (IP address used by default)
– An IP address
– A host name with “@” prefix (e.g., “@vpn1138.example.com”)
– An e-mail address (e.g., “piepiorra@example.com”)

8.2.8 Firewall (IKEv2 beta)



Incoming/outgoing firewall

While the settings made under the *Network Security* menu item only relate to non-VPN connections (see above under "Network Security menu" on page 213), the settings here only relate to the VPN connection defined on these tab pages.

If multiple VPN connections have been defined, you can restrict the outgoing or incoming access individually for each connection. Any attempts to bypass these restrictions can be logged.

By default, the VPN firewall is set to allow all connections for this VPN connection.
However, the extended firewall settings defined and explained above apply independently for each individual VPN connection (see "Network Security menu" on page 213, "Network Security >> Packet Filter" on page 213, "Advanced" on page 234).

If multiple firewall rules are defined, these are queried starting from the top of the list of entries until an appropriate rule is found. This rule is then applied. If the list of rules contains further subsequent rules that could also apply, these rules are ignored.

In *Stealth* mode, the actual IP address used by the client should be used in the firewall rules, or it should be left at 0.0.0.0/0, as only one client can be addressed through the tunnel.

If the **Allow packet forwarding between VPN connections** function is **activated** on the **Global** tab page, the rules under **Incoming** are used for the incoming data packets to the mGuard, and the rules under **Outgoing** are applied to the outgoing data packets.

If the outgoing data packets are included in the same connection definition (for a defined VPN connection group), then the firewall rules for **Incoming** and **Outgoing** for the same connection definition are used.

If a different VPN connection definition applies to the outgoing data packets, the firewall rules for **Outgoing** for this other connection definition are used.

If the mGuard has been configured to forward SSH connection packets (e.g., by permitting a SEC-Stick hub & spoke connection), existing VPN firewall rules are not applied. This means, for example, that packets of an SSH connection are sent through a VPN tunnel despite the fact that this is prohibited by its firewall rules.

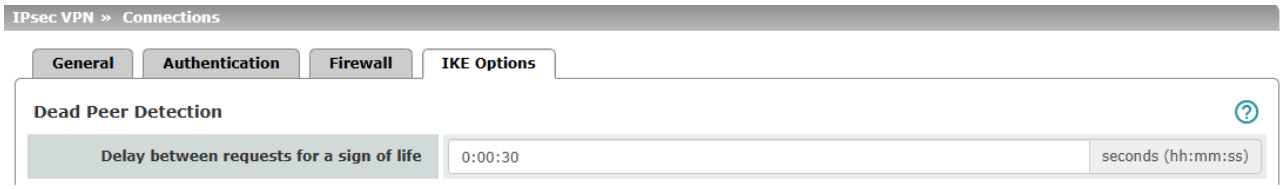
IPsec VPN >> Connections IKEv2 (beta) >> Edit >> Firewall		
Incoming	**General firewall setting**	**Accept all incoming connections**: the data packets of all incoming connections are allowed. **Drop all incoming connections**: the data packets of all incoming connections are discarded. **Accept Ping only:** the data packets of all incoming connections are discarded, except for ping packets (ICMP). **Use the firewall ruleset below**: displays further setting options.
	The following settings are only visible if "**Use the firewall ruleset below**" is set.	

IPsec VPN >> Connections IKEv2 (beta) >> Edit >> Firewall

Protocol	**All** means TCP, UDP, ICMP, GRE, and other IP protocols.
From IP/To IP	**0.0.0.0/0** means all IP addresses. To specify an address area, use CIDR format (see "CIDR (Classless Inter-Domain Routing)" on page 49). **Name of IP groups,** if defined. When a name is specified for an IP group, the host names, IP addresses, IP areas or networks saved under this name are taken into consideration (see "IP/Port Groups" on page 231). If host names are used in IP groups, the mGuard must be configured so that the host name of a DNS server can be resolved in an IP address. If a host name from an IP group cannot be resolved, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration. The use of host names in IP groups is not possible on mGuard devices of the FL MGUARD 2000 series. **Incoming**: – From IP: IP address in the VPN tunnel – To IP: 1:1 NAT address or the actual address **Outgoing**: – From IP: 1:1 NAT address or the actual address – To IP: IP address in the VPN tunnel
From port / To port **(Only for TCP and UDP protocols)**	**any** refers to any port. **startport:endport** (e.g., 110:120) refers to a port range. Individual ports can be specified using the port number or the corresponding service name (e.g., 110 for pop3 or pop3 for 110). **Name of port groups**, if defined. When a name is specified for a port group, the ports or port ranges saved under this name are taken into consideration (see "IP/Port Groups" on page 231).

IPsec VPN >> Connections IKEv2 (beta) >> Edit >> Firewall		
	Action	**Accept** means that the data packets may pass through. **Reject** means that the data packets are sent back and the sender is informed of their rejection. (In *Stealth* mode, Reject has the same effect as Drop.) **Drop** means that the data packets are not permitted to pass through. They are discarded, which means that the sender is not informed of their whereabouts. **Name of** rule records, if defined. When a name is specified for rule records, the firewall rules configured under this name take effect (see “Rule Records” on page 224 tab page). For security reasons, rule records that contain IP groups with host names should not be used in firewall rules which execute “Drop” or “Reject” as the action. The use of rule records is not possible on mGuard devices of the FL MGUARD 2000 series. **Name of Modbus TCP rule records**, if defined. When a Modbus TCP rule record is selected, the firewall rules configured under this rule record take effect (see Section 7.3.1).
	Comment	Freely selectable comment for this rule.
	Log	For each individual firewall rule, you can specify whether the use of the rule: – Should be logged – activate *Log* function – Should not be logged – deactivate *Log* function (default)
	Log entries for unknown connection attempts	When the function is activated, all connection attempts that are not covered by the rules defined above are logged.
Outgoing	The explanation provided under “Incoming” also applies to “Outgoing”.	

8.2.9 IKE Options (IKEv2 beta)



IPsec VPN >> Connections IKEv2 (beta) >> Edit >> IKE Options

Dead Peer Detection	**Encryption and hash algorithms:** Unlike with IKEv1 connections, settings for the IKE options for IKEv2 connections cannot be configured by the user. In this case, the mGuard device **only** uses the encryption and hash algorithms specified in Section 8.2, “IPsec VPN >> Connections”. If the peer supports the Dead Peer Detection (DPD) protocol, the relevant peers can detect whether or not the IPsec connection is still active and whether it needs to be established again.	
	Delay between requests for a sign of life	Duration in seconds after which *DPD Keep Alive* requests should be transmitted. These requests test whether the peer is still available. Default setting: 30 seconds (00:00:30).

8.3 IPsec VPN >> L2TP via IPsec

These settings do not apply in Stealth mode.
It is not possible to use the MD5 algorithm under Windows 7. The MD5 algorithm must be replaced by SHA-1.

Allows VPN connections to the mGuard to be established using the IPsec/L2TP protocol.

In doing so, the L2TP protocol is driven using an IPsec transport connection in order to establish a tunnel connection to a Point-to-Point Protocol (PPP). Clients are automatically assigned IP addresses by the PPP.

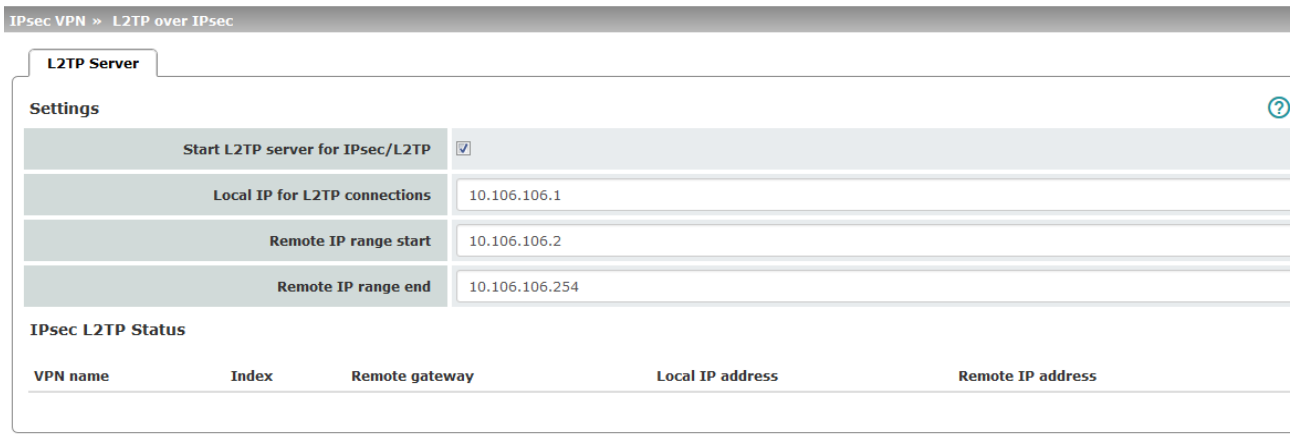
In order to use IPsec/L2TP, the L2TP server must be activated and one or more IPsec connections with the following properties must be defined:

- **Type**: Transport
- **Protocol**: UDP
- **Local:** %all
- **Remote:** %all
- **PFS**: No

See

- “IPsec VPN >> Connections >> Edit >> General” on page 273
- “IPsec VPN >> Connections >> Edit >> IKE Options”, “Perfect Forward Secrecy (PFS)” on page 306

8.3.1 L2TP Server

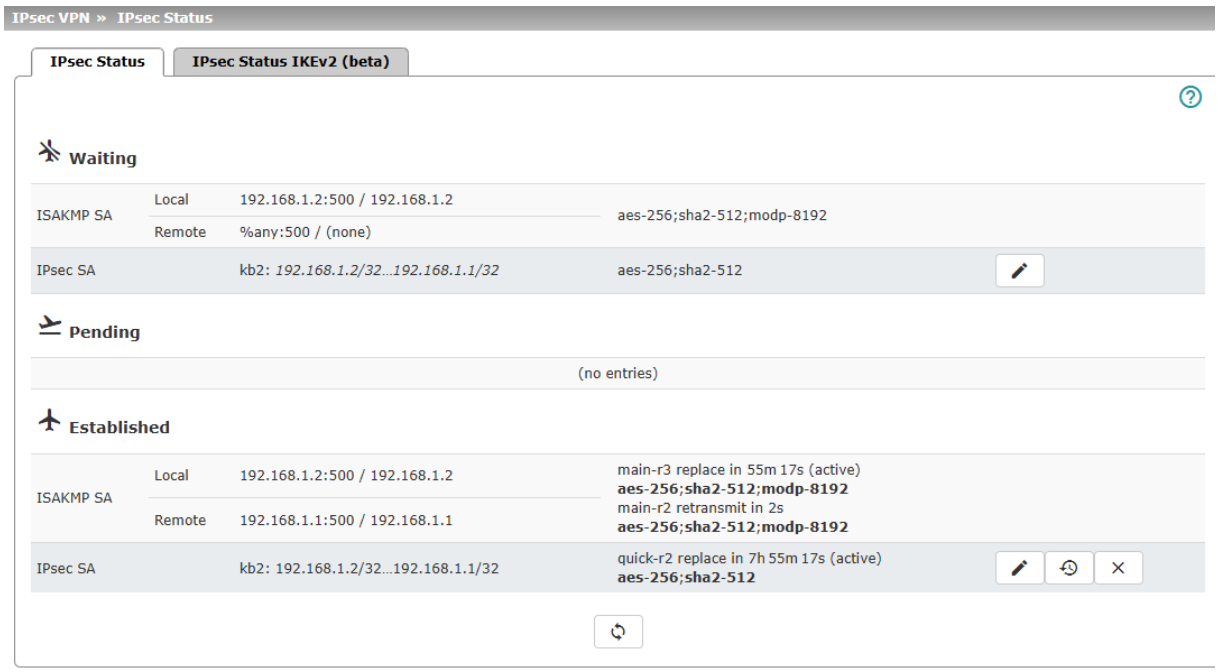


IPsec VPN >> L2TP over IPsec >> L2TP Server		
Settings	**Start L2TP server for IPsec/L2TP**	If you want to enable IPsec/L2TP connections, activate the function. It is then possible to establish L2TP connections to the mGuard via IPsec, which dynamically assign IP addresses to the clients within the VPN.
	Local IP for L2TP connections	If set as shown in the screenshot above, the mGuard will inform the peer that its address is 10.106.106.1.

IPsec VPN >> L2TP over IPsec >> L2TP Server		
	Remote IP range start/end	If set as shown in the screenshot above, the mGuard will assign the peer an IP address between 10.106.106.2 and 10.106.106.254.
	Status	Displays information about the L2TP status if this connection type has been selected.

8.4 IPsec VPN >> IPsec Status

8.4.1 IPsec Status



Displays information about the current status of the configured IPsec connections.

Waiting: displays all VPN connections that have not yet been established which will be started by means of initiation on data traffic or which are waiting for a connection to be established.

Pending: displays all VPN connections that are currently attempting to establish a connection.

The ISAKMP SA has been established and authentication of the connections was completed successfully. If the connection remains in “connection establishment” status the other parameters may not match: does the connection type (Tunnel, Transport) correspond? If “Tunnel” is selected, do the network areas match on both sides?

Established: displays all VPN connections that have successfully established a connection.

The VPN connection has been successfully established and can be used. However, if this is not possible, the VPN gateway of the peer is causing problems. In this case, deactivate and reactivate the connection to reestablish the connection.

Icons

Reload To update the displayed data, click on the **Reload** icon.

Restart To disconnect and restart a VPN connection (all instances and tunnels), click on the corresponding **Restart** icon.

Edit To reconfigure a VPN connection, click on the corresponding **Edit rows** icon.

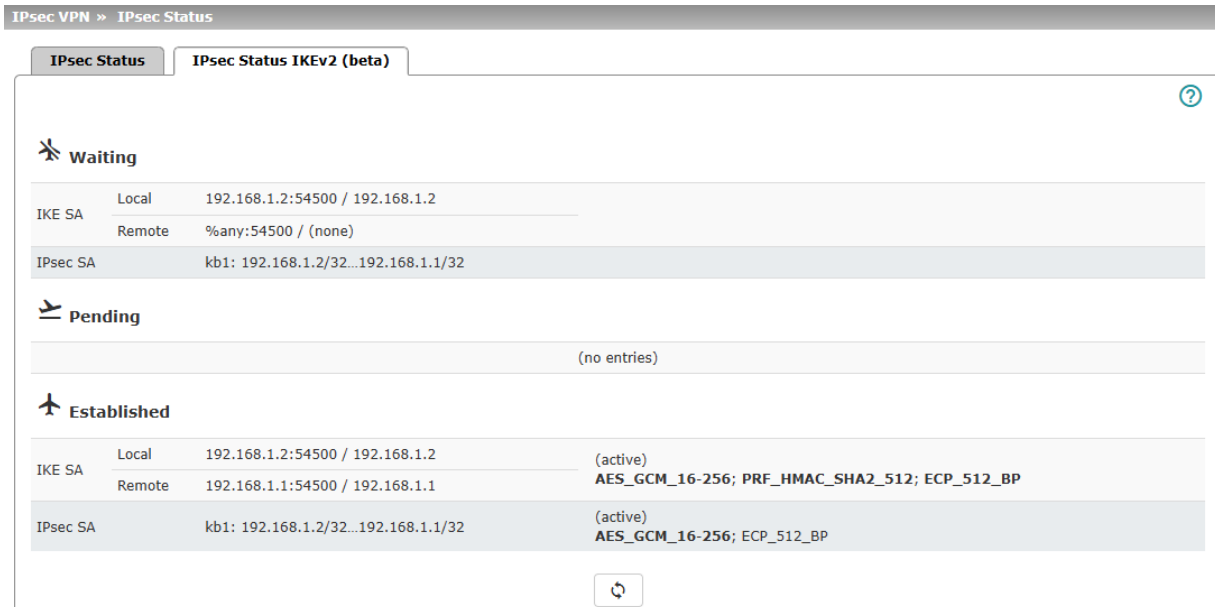
Clear To terminate one instance / tunnel of a VPN connection, click on the corresponding **Clear** icon.

Connection, ISAKMP SA Status, IPsec SA Status

ISAKMP SA	**Local**	– Local IP address – Local port – ID = subject of an X.509 certificate	State, lifetime, and encryption algorithm for the connection (bold = active)
	Remote	– Remote IP address – Local port – VPN Identifier (e. g. subject of an X.509 certificate)	
IPsec SA		– Name of the connection – Local networks ... Remote networks	State, lifetime, and encryption algorithm for the connection (bold = active)

In the event of problems, it is recommended that you check the VPN logs of the peer to which the connection was established. This is because detailed error messages are not forwarded to the initiating computer for security reasons.

8.4.2 IPsec Status IKEv2 (beta)



Displays information about the current status of the configured IPsec connections.

Waiting: displays all VPN connections that have not yet been established which will be started by means of initiation on data traffic or which are waiting for a connection to be established.

Pending: displays all VPN connections that are currently attempting to establish a connection.

The IKE SA has been established and the authentication of the connections was successful. If the connection remains in the "Pending" status, other parameters may not be correct. (For example, do the network areas on both sides of the tunnel connection match?)

Established: displays all VPN connections that have successfully established a connection.

The VPN connection has been successfully established and can be used. However, if this is not possible, the VPN gateway of the peer is causing problems. In this case, deactivate and reactivate the connection to reestablish the connection.

Connection, IKE SA Status, IPsec SA Status

IKE SA	**Local**	– Local IP address – Local port – ID = subject of an X.509 certificate	State, lifetime, and encryption algorithm for the connection (bold = active)
	Remote	– Remote IP address – Local port – VPN Identifier (e. g. subject of an X.509 certificate)	
IPsec SA		– Name of the connection – Local networks ... Remote networks	State, lifetime, and encryption algorithm for the connection (bold = active)

In the event of problems, it is recommended that you check the VPN logs of the peer to which the connection was established. This is because detailed error messages are not forwarded to the initiating computer for security reasons.

9 OpenVPN Client menu

9.1 OpenVPN Client >> Connections

With OpenVPN, an encrypted VPN connection can be established between the mGuard as the OpenVPN client and a peer (OpenVPN server). The OpenSSL library is used for encryption and authentication. Data is transported using the TCP or UDP protocols.

The OpenVPN client supports the following TLS versions: TLS 1.0, TLS 1.1, TLS 1.2, and TLS 1.3.

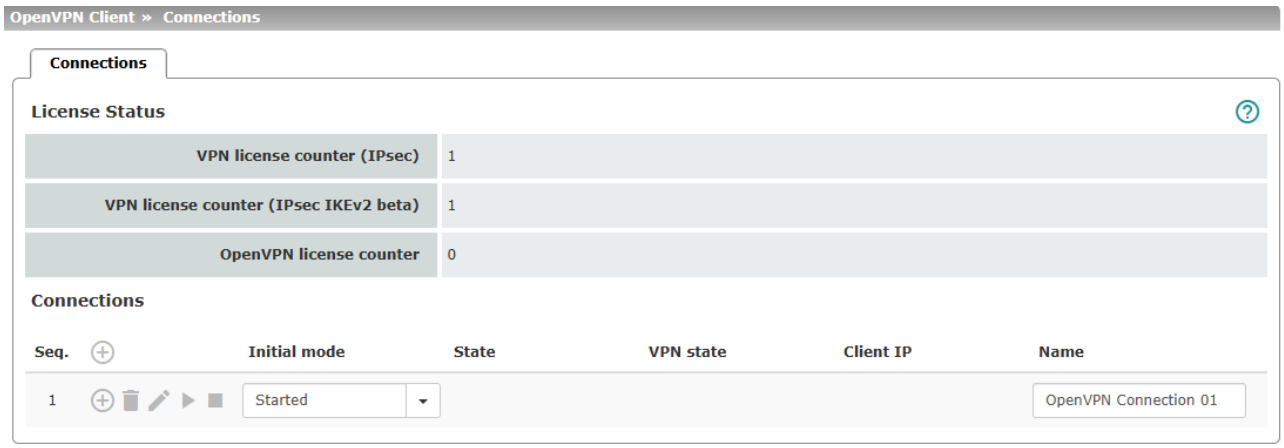
For security reasons, select versions TLS 1.2 or 1.3 as the “Lowest supported TLS version” to ensure secure TLS-encrypted connections.

Requirements for a VPN connection

A general requirement for a VPN connection is that the IP addresses of the VPN peers are known and can be accessed.

- mGuard devices provided in stealth network mode are preset to the “multiple clients” stealth configuration. In this mode, you need to configure a management IP address and default gateway if you want to use VPN connections (see “Default gateway” on page 152). Alternatively, you can select a different stealth configuration than the “multiple clients” configuration or use another network mode.
- In order to successfully establish an OpenVPN connection, the VPN peer must support the OpenVPN protocol as the OpenVPN server.

9.1.1 Connections



Lists all the VPN connections that have been defined.

Each connection name listed here can refer to an individual VPN connection. You also have the option of defining new VPN connections, activating and deactivating VPN connections, changing (editing) the VPN connection properties, and deleting connections.

OpenVPN Client >> Connections		
License Status	**VPN license counter (IPsec)**	Number of remote peers that have currently established a VPN connection via the IPsec protocol (IKEv1).

OpenVPN Client >> Connections[...]		
	VPN license counter (IPsec IKEv2 beta)	Number of remote peers that have currently established a VPN connection via the IPsec protocol (IKEv2 beta).
	OpenVPN license counter	Number of peers to which a VPN connection is currently established using the OpenVPN protocol.

OpenVPN Client >> Connections		
Connections	**Initial mode**	**Disabled / Stopped / Started** The “**Disabled**” setting deactivates the VPN connection permanently; it cannot be started or stopped. The “**Started**” and “**Stopped**” settings determine the status of the VPN connection after restarting/booting the mGuard (e.g., after an interruption in the power supply). VPN connections that are not disabled can be started or stopped via icons on the web interface, via text message, a switch or a push-button.
	State	Indicates the current activation state of the OpenVPN connection.
	VPN state	Indicates whether or not the corresponding OpenVPN connection has been established.
	Client IP	IP address of the OpenVPN interface.
	Name	Name of the VPN connection

Connections

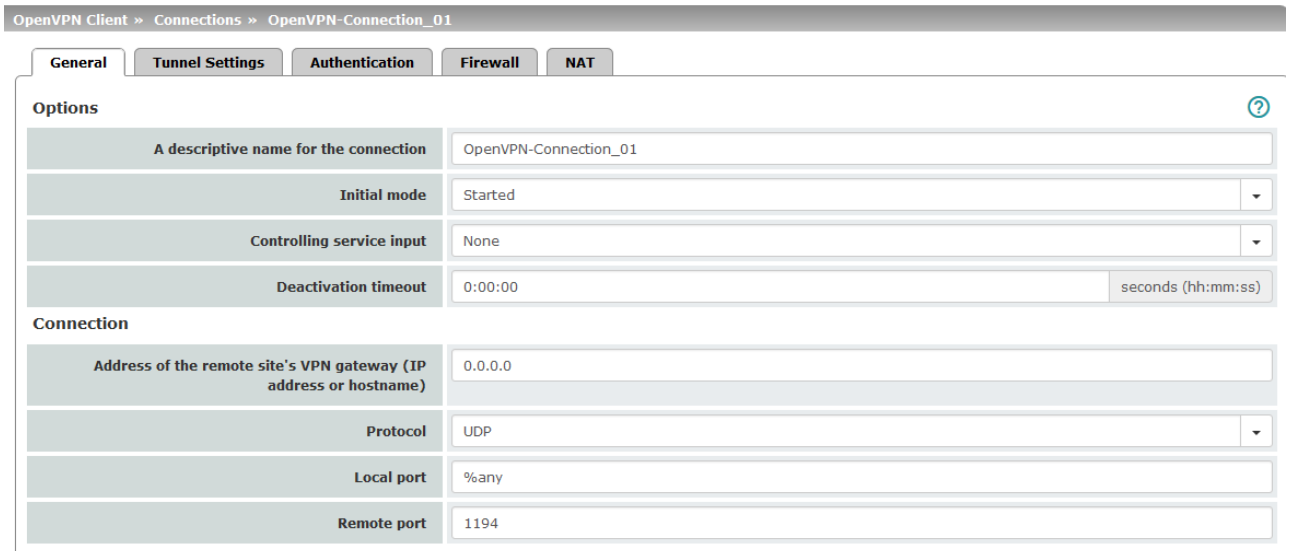
Defining a new VPN connection

- In the connection table, click on the ⊕ **Insert Row** icon to add a new table row.
- Click on the ✎ **Edit Row** icon.

Editing a VPN connection

Click on the ✎ **Edit Row** icon in the relevant row.

9.1.2 General



OpenVPN Client >> Connections >> Edit >> General

Options

A descriptive name for the connection

The connection can be freely named/renamed.

Initial mode

Disabled / Stopped / Started

The “**Disabled**” setting deactivates the VPN connection permanently; it cannot be started or stopped.

The “**Started**” and “**Stopped**” settings determine the status of the VPN connection after restarting/booting the mGuard (e.g., after an interruption in the power supply).

VPN connections that are not disabled can be started or stopped via icons on the web interface, via text message, a switch or a push-button.

Controlling service input

None / Service input CMD 1-3 (I 1-3)

The VPN connection can be switched via a connected push-button/switch.

The push-button/switch must be connected to one of the service contacts (CMD 1-3).

If starting and stopping the VPN connection via the CMD contact is enabled, only the CMD contact is authorized to do this.

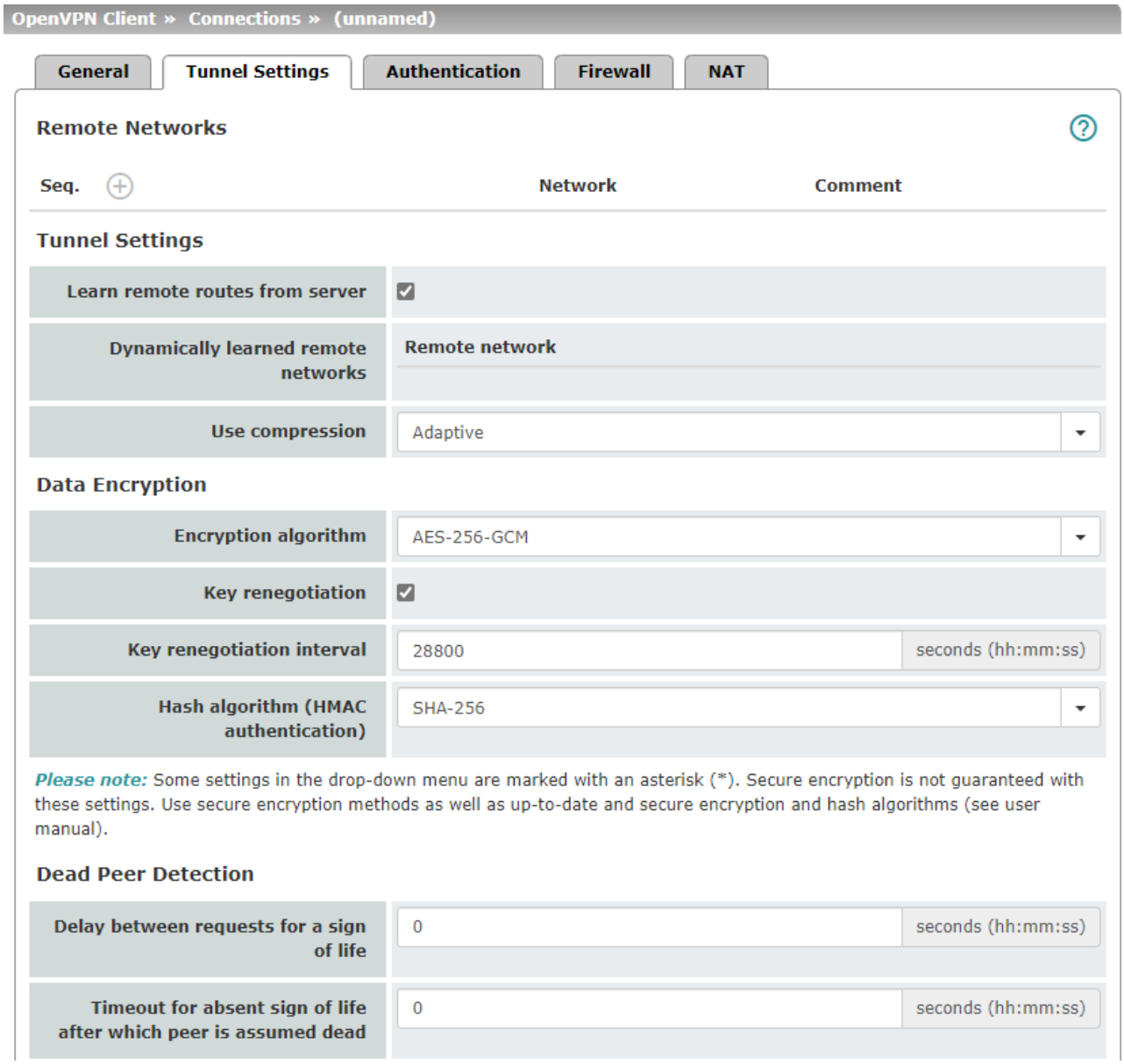
Use inverted control logic

Inverts the behavior of the connected switch.

If the switching service input is configured as an on/off switch, it can activate one VPN connection while simultaneously deactivating another which uses inverted logic, for example.

	Deactivation timeout	Time, after which the VPN connection is stopped, if it has been started via switch, push-button or the web interface. The timeout starts on transition to the “Started” state. After the timeout has elapsed, the connection remains in the “Stopped” state until it is restarted. Time in hours, minutes and/or seconds (00:00:00 to 720:00:00, around 1 month). The entry can be in seconds [ss], minutes and seconds [mm:ss] or hours, minutes, and seconds [hh:mm:ss]. 0 means the setting is disabled.
Connection	**Address of the remote site's VPN gateway**	**IP address or host name of the VPN gateway of the peer**
	Protocol	**TCP / UDP** The network protocol used by the OpenVPN server must likewise be selected here in the mGuard.
	Local port	The port of the local OpenVPN client from which the connection to an OpenVPN server is initiated. Values: 1 - 65535; default: %any (selection left to the peer)
	Remote port	Port on the remote OpenVPN server that should respond to requests from the OpenVPN client. Values: 1 - 65535; default: 1194

9.1.3 Tunnel Settings



OpenVPN Client >> Connections >> Edit >> Tunnel Settings		
Remote Networks	**Network**	Addresses of networks that are located behind the OpenVPN server (VPN gateway of the peer) (CIDR format).
	Comment	Optional comment text.

Tunnel Settings	**Learn remote routes from server**	When the **function is activated** (default), remote networks are automatically learned from the server if the server is configured accordingly. The routes to remote networks are only known to the mGuard if the corresponding VPN connection is established. If this VPN connection is not in place, network traffic will not be blocked to the relevant IP addresses, instead it will be possible to send network traffic unencrypted via a different interface. In this case, the appropriate firewall rules must be set. Routes to remote networks behind the OpenVPN server can also be overwritten on other interfaces by higher priority routes, e.g., if there are routes with a smaller destination network. If, for example, 10.0.0.0/8 is a route via the OpenVPN interface and 10.1.0.0/16 is a route via the external interface, network traffic will be sent unencrypted to IP address 10.1.0.1 via the external interface. When the **function is deactivated**, the statically entered routes will be used.
	Dynamically learned remote networks	Dynamically learned remote networks are displayed.
	Use compression	**Yes** / **No** / **Adaptive** / **Disabled** You can select whether compression should always be applied, should never be applied or should be applied adaptively (adapted according to the type of traffic). The option **Disabled** disables compression completely by disabling the use of *liblzo* resp. *comp-lzo*. Note that the server and client must use the same compression settings. This applies in particular to the use of *iblzo* resp. *comp-lzo*.

Data Encryption	**Encryption algorithm**	**AES-128-CBC* / AES-192-CBC* / AES-256-CBC / AES-128-GCM* / AES-192-GCM* / AES-256-GCM (Standard)** Decide on which encryption algorithm should be used with the administrator of the peer. **Use secure algorithms** Some of the available algorithms are outdated and no longer considered secure. They are therefore not recommended. However, they can still be selected and used for reasons of downward compatibility. In the WBM, outdated algorithms or unsecure settings are marked with an asterisk (*). See “Using secure encryption and hash algorithms” on page 41. The following generally applies: the longer the key length (in bits) used by an encryption algorithm (specified by the appended number), the more secure it is. The longer the key, the more time-consuming the encryption procedure.
	Hash algorithm (HMAC authentication)	**SHA-1*, SHA-256 (default), SHA-512** Hash algorithm for calculating the checksum used to secure the encrypted OpenVPN connection between the OpenVPN server and mGuard client. **Use secure algorithms** Some of the available algorithms are outdated and no longer considered secure. They are therefore not recommended. However, they can still be selected and used for reasons of downward compatibility. In the WBM, outdated algorithms or unsecure settings are marked with an asterisk (*). See “Using secure encryption and hash algorithms” on page 41.
	Key renegotiation	When the **function is activated** (default), the mGuard will attempt to negotiate a new key when the old one expires.
	Key renegotiation interval	Duration after which the validity of the current key expires and a new key is negotiated between the server and client. Time in hh:mm:ss (default: 8 h)
Dead Peer Detection	If the peer supports Dead Peer Detection, the relevant partners can detect whether the OpenVPN connection is still active or whether it needs to be established again.	

Delay between requests for a sign of life

Duration after which DPD Keep Alive requests should be transmitted. These requests test whether the peer is still available.

Time in hh:mm:ss

Default: 00:00:00 (DPD is disabled)

Timeout for absent sign of life after which peer is assumed dead

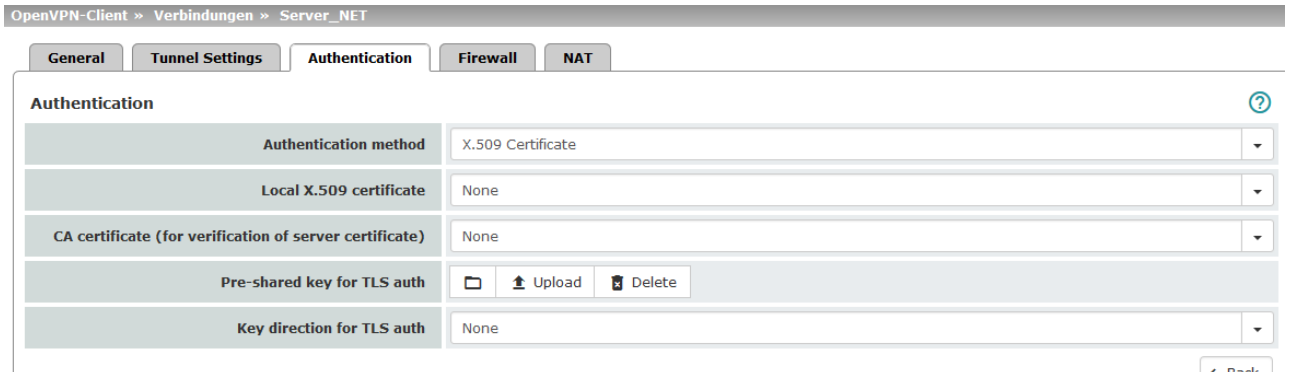
Duration after which the connection to the peer should be declared dead if there has been no response to the Keep Alive requests.

Time in hh:mm:ss

If there is no response, the connection is initiated again by the mGuard.

Default: 00:00:00 (DPD is disabled)

9.1.4 Authentication



OpenVPN Client >> Connections >> Edit >> Authentication

Authentication

Authentication method

There are three ways in which the mGuard can authenticate itself as an OpenVPN client to the OpenVPN server:

– X.509 Certificate (default)
– Login/password
– X.509 Certificate + login/password

The page contains different setting options depending on the method chosen.

Login

Authentication method: Login/Password

User identifier (login) that the mGuard uses to authenticate itself to the OpenVPN server.

Password

Agreed password that is used together with a user identifier (login) for authentication.

To achieve adequate security, the string should consist of around 30 randomly selected characters, and should include upper and lower case characters and digits.

Authentication method: X.509 Certificate

Each VPN device has a secret private key and a public key in the form of an X.509 certificate, which contains further information about the certificate's owner and the certification authority (CA).

The following must be specified:

– How the mGuard authenticates itself to the peer
– How the mGuard authenticates the remote peer

OpenVPN Client >> Connections >> Edit >> Authentication

Local X.509 certificate

Specifies which machine certificate the mGuard uses as authentication to the VPN peer.

Select one of the machine certificates from the selection list.

The selection list contains the machine certificates that have been loaded on the mGuard under the *"Authentication >> Certificates"* menu item.

If *None* is displayed, a certificate must be installed first. *None* must not be left in place, as this results in no X.509 authentication.

CA certificate (for verification of server certificate)

Only the CA certificate from the certification authority (CA) that signed the certificate shown by the VPN peer (OpenVPN server) should be referenced here (selection from list).

Verification with a CA certificate is also required if the "Login/Password" authentication method is selected.

The additional CA certificates that form the chain to the root CA certificate together with the certificate shown by the peer must then be imported into the mGuard under the "Authentication >> Certificates" menu item.

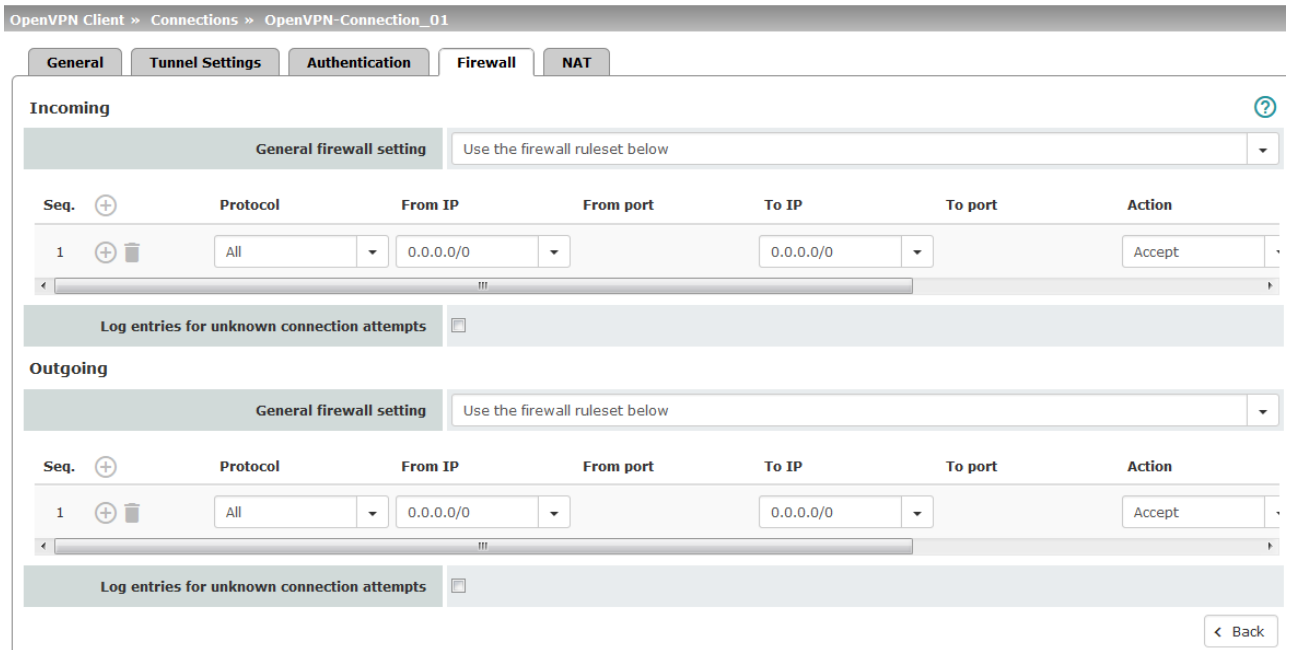
If *None* is displayed, a certificate must be imported first. *None* must not be left in place, as this results in no authentication of the VPN server.

The selection list contains all CA certificates that have been imported into the mGuard under the "Authentication >> Certificates" menu item.

With this setting, all VPN peers are accepted, providing they log in with a signed CA certificate issued by a recognized certification authority (CA). The CA is recognized if the relevant CA certificate and all other CA certificates have been loaded on the mGuard. These then form the chain to the root certificate together with the certificates shown.

OpenVPN Client >> Connections >> Edit >> Authentication		
	Pre-shared key for TLS auth	To increase security (e.g., prevent DoS attacks), authentication of the OpenVPN connection can also be protected via pre-shared keys (TLS-PSK). To do so, first a static PSK file (e.g., *ta.key*) must be created and installed and activated on both OpenVPN peers (server and client). The PSK file can: – be created by the OpenVPN server **or** – consist of any file (8 – 2048 bytes). If the file is generated by the server, the key direction can also be selected (see below). To activate TLS authentication, a PSK file must be selected using the 🗀 icon and uploaded using the **Upload** button. To deactivate TLS authentication, the file must be deleted using the **Delete** button. The **Delete** button is always visible, i.e., even if no PSK file has been uploaded or an uploaded PSK file has been deleted.
	Key direction for TLS auth	**None / 0 / 1** **None** Must be selected if the PSK file was **not** generated by the OpenVPN server. **0 and 1** Can be selected if the PSK file was generated by the OpenVPN server. The selection on the client and server side must be complementary (0 <–>1 or 1 <–> 0) or identical (None <–> None). If the settings are incorrect, the connection will not be established and a log entry will be generated.

9.1.5 Firewall



Incoming/outgoing firewall

While the settings made under the *Network Security* menu item only relate to non-VPN connections (see above under “Network Security menu” on page 213), the settings here only relate to the VPN connection defined on these tabs.

If multiple VPN connections have been defined, you can restrict the outgoing or incoming access individually for each connection. Any attempts to bypass these restrictions can be logged.

By default, the VPN firewall is set to allow all connections for this VPN connection.
However, the extended firewall settings defined and explained above apply independently for each individual VPN connection (see “Network Security menu” on page 213, “Network Security >> Packet Filter” on page 213, “Advanced” on page 234).

If multiple firewall rules are defined, these are queried starting from the top of the list of entries until an appropriate rule is found. This rule is then applied. If the list of rules contains further subsequent rules that could also apply, these rules are ignored.

In *Single Stealth* mode, the actual IP address used by the client should be used in the firewall rules, or it should be left at 0.0.0.0/0, as only one client can be addressed through the tunnel.

If the **Allow packet forwarding between VPN connections** function is activated on the *Options* tab under the *IPsec VPN >> Global* menu item, the rules under **Incoming** are used for the incoming data packets to the mGuard, and the rules under **Outgoing** are applied to the outgoing data packets. This applies for OpenVPN connections as well as for IPsec connections.

If the outgoing data packets are included in the same connection definition, then the firewall rules for **Incoming** and **Outgoing** for the same connection definition are used.

If a different VPN connection definition applies to the outgoing data packets, the firewall rules for **Outgoing** for this other connection definition are used.

If the mGuard has been configured to forward SSH connection packets (e.g., by permitting a SEC-Stick hub & spoke connection), existing VPN firewall rules are not applied. This means, for example, that packets of an SSH connection are sent through a VPN tunnel despite the fact that this is prohibited by its firewall rules.

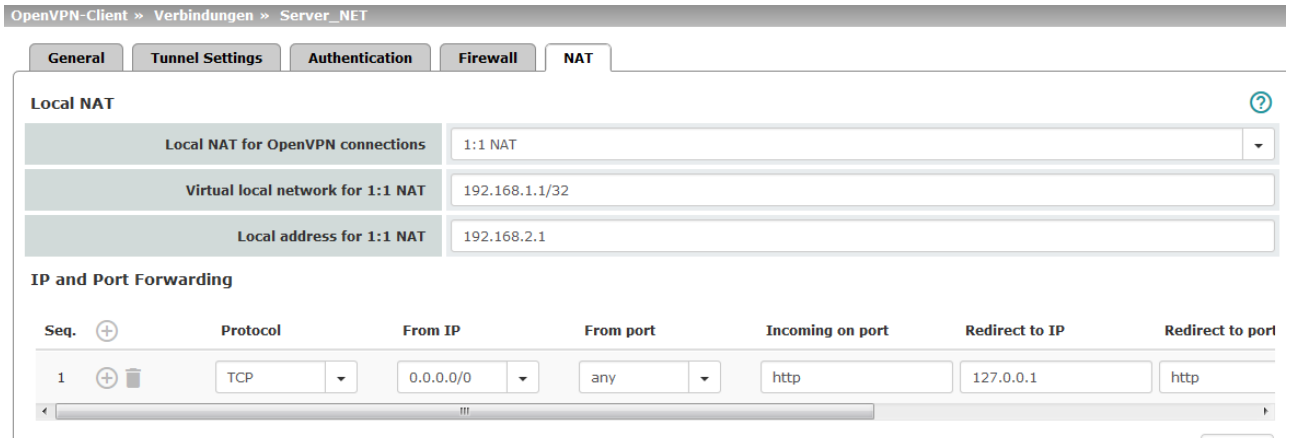
OpenVPN Client >> Connections >> Edit >> Firewall		
Incoming	**General firewall setting**	**Accept all incoming connections**: the data packets of all incoming connections are allowed. **Drop all incoming connections**: the data packets of all incoming connections are discarded. **Accept Ping only:** the data packets of all incoming connections are discarded, except for ping packets (ICMP). **Use the firewall ruleset below**: displays further setting options.
	The following settings are only visible if "**Use the firewall ruleset below**" is set.	

OpenVPN Client >> Connections >> Edit >> Firewall

Protocol	**All** means TCP, UDP, ICMP, GRE, and other IP protocols.
From IP/To IP	**0.0.0.0/0** means all IP addresses. To specify an address area, use CIDR format (see "CIDR (Classless Inter-Domain Routing)" on page 49). **Name of IP groups**, if defined. When a name is specified for an IP group, the host names, IP addresses, IP areas or networks saved under this name are taken into consideration (see "IP/Port Groups" on page 231). If host names are used in IP groups, the mGuard must be configured so that the host name of a DNS server can be resolved in an IP address. If a host name from an IP group cannot be resolved, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration. On mGuard devices from the FL MGUARD 2000 series, it is not possible to use host names in IP groups. **Incoming**: – From IP: IP address in the VPN tunnel – To IP: 1:1 NAT address or the actual address **Outgoing**: – From IP: 1:1 NAT address or the actual address – To IP: IP address in the VPN tunnel
From port / To port **(Only for TCP and UDP protocols)**	**any** refers to any port. **startport:endport** (e.g., 110:120) refers to a port range. Individual ports can be specified using the port number or the corresponding service name (e.g., 110 for pop3 or pop3 for 110). **Name of port groups**, if defined. When a name is specified for a port group, the ports or port ranges saved under this name are taken into consideration (see "IP/Port Groups" on page 231).

OpenVPN Client >> Connections >> Edit >> Firewall		
	Action	**Accept** means that the data packets may pass through. **Reject** means that the data packets are sent back and the sender is informed of their rejection. (In *Stealth* mode, Reject has the same effect as Drop.) **Drop** means that the data packets are not permitted to pass through. They are discarded, which means that the sender is not informed of their whereabouts. **Name of** rule records, if defined. When a name is specified for rule records, the firewall rules configured under this name take effect (see "Rule Records" tab). For security reasons, rule records that contain IP groups with host names should not be used in firewall rules which execute "Drop" or "Reject" as the action. On mGuard devices from the FL MGUARD 2000 series, it is not possible to use rule records. **Name of Modbus TCP rule records**, if defined. When a Modbus TCP rule record is selected, the firewall rules configured under this rule record take effect (see Section 7.3.1).
	Comment	Freely selectable comment for this rule.
	Log	For each individual firewall rule, you can specify whether the use of the rule: – Should be logged – activate *Log* function – Should not be logged – deactivate *Log* function (default)
	Log entries for unknown connection attempts	When the function is activated, all connection attempts that are not covered by the rules defined above are logged.
Outgoing	The explanation provided under "Incoming" also applies to "Outgoing".	

9.1.6 NAT



The IP address (OpenVPN client IP address) that the mGuard uses as the OpenVPN client is assigned to it by the OpenVPN server of the peer.

If NAT is not used, the local networks of the mGuard, from which the OpenVPN connection should be used, must be statically configured in the OpenVPN server. It is therefore recommended that you use NAT, i.e., that local routes (local IP addresses within the private address area) are rewritten to the OpenVPN client IP address so that devices in the local network can use the OpenVPN connection.

OpenVPN Client >> Connections >> Edit >> NAT

Local NAT

For outgoing data packets, the device can rewrite the specified sender IP addresses from its internal network to its OpenVPN client IP address, a technique referred to as NAT (Network Address Translation).

This method is used if the internal addresses cannot or should not be routed externally, e.g., because a private address area such as 192.168.x.x or the internal network structure should be hidden.

In the **default setting (0.0.0.0/0)**, all networks positioned behind the mGuard are masqueraded and can use the OpenVPN connection.

Local NAT for OpenVPN connections

No NAT / 1:1 NAT / Masquerade

It is possible to translate the IP addresses of devices located at the local end of the OpenVPN tunnel, (e.g., behind the mGuard).

No NAT: NAT is not performed.

With **1:1 NAT**, the IP addresses of devices at the local end of the tunnel are exchanged so that each individual address is translated into another specific address.

With **Masquerade**, the IP addresses of devices at the local end of the tunnel are exchanged with an IP address that is identical for all devices.

OpenVPN Client >> Connections >> Edit >> NAT

	Virtual local network for 1:1 NAT **(When "1:1 NAT" was selected)**	Configures the virtual IP address area to which the actual local IP addresses are translated when 1:1 NAT is used. The netmask specified in CIDR format also applies to the Local address for *1:1-NAT* (see below). If the function **Allow packet forwarding between VPN connections** was activated under *IPsec VPN >> Global >> Options*, use of the virtual local network addresses in other OpenVPN connections is not supported.
	Local address for 1:1-NAT **(When "1:1 NAT" was selected)**	Configures the local IP address area from which IP addresses are translated into the virtual IP addresses through the use of 1:1-NAT in the *Virtual local network for 1:1-NAT* defined above (see above). The netmask specified for the *Virtual local network for 1:1-NAT* applies (see above).
	Network (When "Masquerading" was selected)	Internal networks whose device IP addresses are translated into the OpenVPN client IP address. **0.0.0.0/0** means that all internal IP addresses are subject to the NAT procedure. To specify an address area, use CIDR format (see "CIDR (Classless Inter-Domain Routing)" on page 49). The masquerading of remote networks can be configured under *Network >> NAT >> Masquerading* (see "Masquerading" on page 159). When the **Local NAT/Masquerading** function is used, IP and port forwarding must also be used (see below) in order to access devices in the local network of the mGuard from the remote network.
	Comment	Freely selectable comment for this rule.
IP and Port Forwarding	Lists the rules defined for IP and port forwarding (DNAT = Destination NAT). IP and port forwarding (**DNAT**) performs the following: the headers of incoming data packets from the OpenVPN tunnel, which are addressed to the OpenVPN client IP address of the mGuard and to a specific port of the mGuard, are rewritten in order to forward them to a specific computer in the internal network and to a specific port on this computer. In other words, the IP address and port number in the header of incoming data packets are changed. If port forwarding is used, the packets pass through the mGuard firewall without taking into consideration the rules configured under *"Network Security >> Packet Filter >> Incoming Rules"*.	

OpenVPN Client >> Connections >> Edit >> NAT

Protocol: TCP / UDP / GRE

Specify the protocol to which the rule should apply (**TCP** / **UDP** / **GRE**).

GRE protocol IP packets can be forwarded. However, only one GRE connection is supported at any given time. If more than one device sends GRE packets to the same external IP address, the mGuard may not be able to feed back reply packets correctly.

We recommend only forwarding GRE packets from specific transmitters. These could be ones that have had a forwarding rule set up for their source address by entering the transmitter address in the “From IP” field, e.g., 193.194.195.196/32.

From IP

The sender address for forwarding.

0.0.0.0/0 means all addresses. To specify an address area, use CIDR format (see “CIDR (Classless Inter-Domain Routing)” on page 49).

Name of IP groups, if defined. When a name is specified for an IP group, the host names, IP addresses, IP areas or networks saved under this name are taken into consideration (see “IP/Port Groups” on page 231).

If host names are used in IP groups, the mGuard must be configured so that the host name of a DNS server can be resolved in an IP address.

If a host name from an IP group cannot be resolved, this host will not be taken into consideration for the rule. Further entries in the IP group are not affected by this and are taken into consideration.

From port

The sender port for forwarding.

any refers to any port.

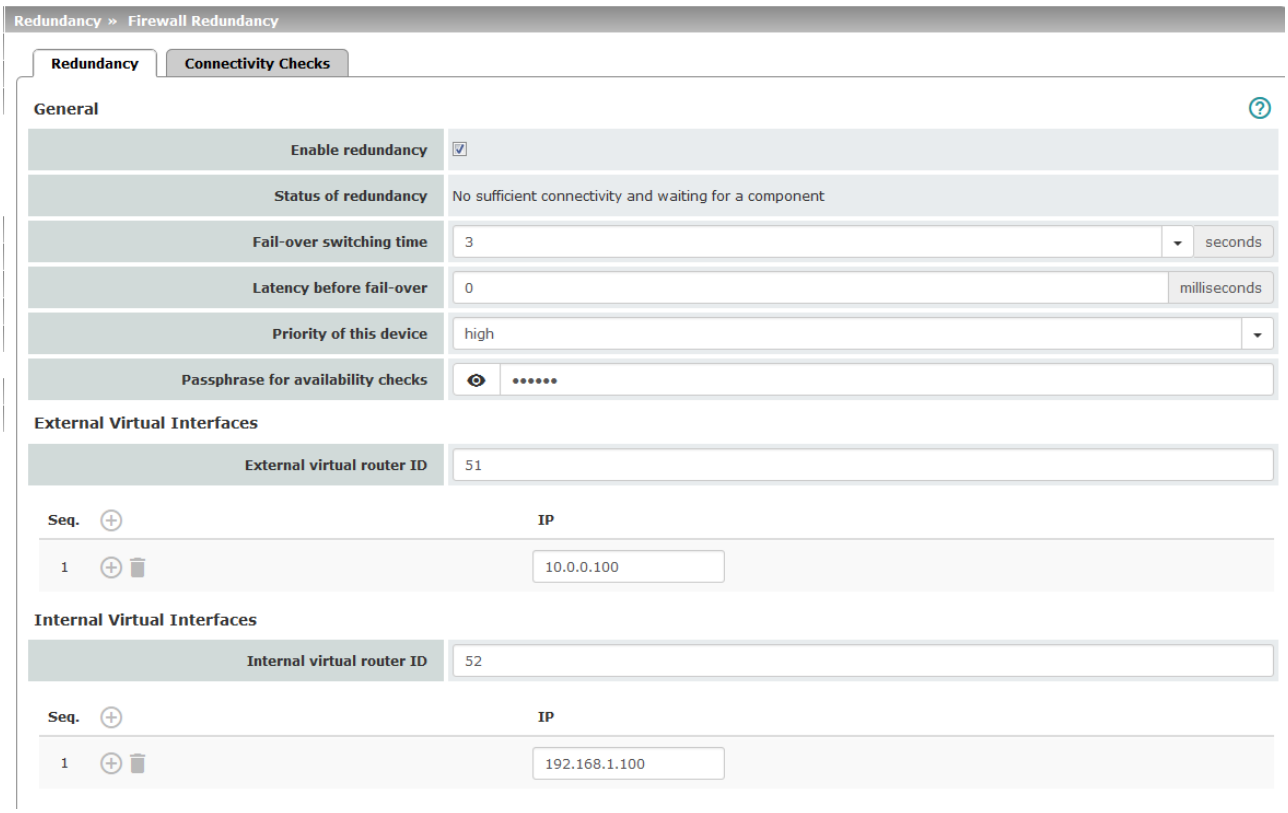
Either the port number or the corresponding service name can be specified here, e.g., *pop3* for port 110 or *http* for port 80.

Name of port groups, if defined. When a name is specified for a port group, the ports or port ranges saved under this name are taken into consideration (see “IP/Port Groups” on page 231).

OpenVPN Client >> Connections >> Edit >> NAT		
	Incoming on port	The original destination port specified in the incoming data packets. Either the port number or the corresponding service name can be specified here, e.g., *pop3* for port 110 or *http* for port 80. This information is not relevant for the “GRE” protocol. It is ignored by the mGuard.
	Redirect to IP	The internal IP address to which the data packets should be forwarded and into which the original destination addresses are translated.
	Redirect to port	Internal port to which the data packets should be forwarded and into which the original port is translated.
	Comment	Freely selectable comment for this rule.
	Log	For each individual port forwarding rule, you can specify whether the use of the rule: – Should be logged – activate *Log* function – Should not be logged – deactivate *Log* function (default)

10 Redundancy menu

	Firewall redundancy can currently only be enabled if no VPN connections are configured on the device.
	The firewall redundancy functions are **not** available on the devices of the FL MGUARD 2000 series.
	Redundancy is described in detail in Section 13, “Redundancy”.
	To use the redundancy function, the same firmware must be installed on both mGuard devices.
	When the redundancy function is activated, VLAN cannot be used in Stealth mode.



10.1 Redundancy >> Firewall Redundancy

10.1.1 Redundancy

Redundancy >> Firewall Redundancy >> Redundancy		
General	**Enable redundancy**	**Deactivated** (default): firewall redundancy is disabled. **Activated**: firewall redundancy is enabled.
	Status of redundancy	Shows the current status.
	Fail-over switching time	Maximum time that is allowed to elapse in the event of errors before switching to the other mGuard device .
	Latency before fail-over	**0 ... 10,000 milliseconds, default: 0** Time the redundancy system ignores an error. The connectivity and availability checks ignore an error unless it is still present after the time set here has elapsed.
	Priority of this device	**high/low** Specifies the priority associated with the presence notifications (CARP). Set the priority to **high** on the mGuard device that you want to be active. The device on standby is set to **low**. Both devices in a redundancy pair may either be set to different priorities or to **high** priority. . Never set **both** mGuard devices in a redundancy pair to **low** priority.

Redundancy >> Firewall Redundancy >> Redundancy

Passphrase for availability checks

On an mGuard device which is part of a redundancy pair, checks are constantly performed to determine whether an active mGuard is available and whether it should remain active. A variation of the CARP (Common Address Redundancy Protocol) is used here.

CARP uses SHA-1 HMAC encryption together with a password. This password must be set so it is the same for both mGuard devices. It is used for encryption and is never transmitted in plain text.

The password is important for security since the mGuard device is vulnerable at this point. We recommend a password with at least 20 characters and several special characters (printable UTF-8 characters). It must be changed on a regular basis.

When changing the password, proceed as follows:

Set the new password on both mGuard devices. It does not matter which order you do this in but the same password must be used in both cases. If you inadvertently enter an incorrect password, follow the instructions under "How to proceed in the event of an incorrect password" on page 356.

As soon as a redundancy pair has been assigned a new password, it automatically negotiates when it can switch to the new password without interruption.

If one device fails while the password is being changed, the following scenarios apply:

- Password replacement has been started on all mGuard devices and then interrupted because of a network error, for example. This scenario is rectified automatically.
- Password replacement has been started on all mGuard devices. However, one mGuard then fails and must be replaced.
- Password replacement has been started but not performed on all mGuard devices because they have failed. Password replacement must be started as soon as a faulty mGuard is back online. If an mGuard device has been replaced, it must first be configured with the old password before it is connected.

Redundancy >> Firewall Redundancy >> Redundancy

How to proceed in the event of an incorrect password

If you have inadvertently entered an incorrect password on an mGuard device, proceed as follows.

If you can still remember the old password, proceed as follows:

- Reconfigure the device on which the incorrect password was entered so that it uses the old password.
- Wait until the device indicates that the old password is being used.
- Then enter the correct password.

If you have forgotten the old password, proceed as follows:

- Check whether you can read the old password from the other device.
- If the other deivce is disabled or missing, you can simply enter the correct new password on the active device on which you inadvertently set the incorrect password. Make sure that the other device is assigned the same password before operating it again.
- If the other device is already using the new password, you must make sure that the device with the incorrect password is not active or able to be activated, e.g., by removing the cable at the LAN or WAN interface.

  In the case of remote access, you can enter a destination for the connectivity check that will not respond. Prior to provoking this type of error, check that there is no redundancy error on any of the mGuard devices. One device must be active and the other must be on standby. If necessary, rectify any errors displayed and only then use this method. After that, follow these steps:
  - Replace the incorrect password with a different one.
  - Enter this password on the active device too.
  - Restart the device that is not active. You can do this, for example, by reconnecting the Ethernet cable or restoring the old settings for the connectivity check.

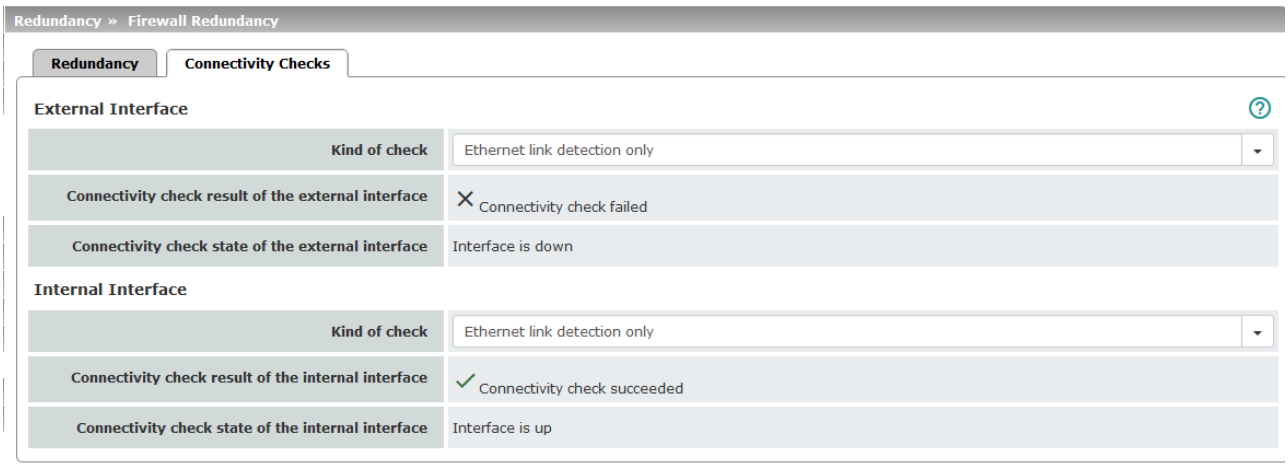
External Virtual Interfaces	**External virtual router ID**	1, 2, 3, ... 255 (default: 51) Only in Router network mode. This ID is sent by the redundancy pair with each presence notification (CARP) via the external interface and is used to identify the redundancy pair. This ID must be the same for both mGuard devices. It is used to differentiate the redundancy pair from other redundancy pairs that are connected to the same Ethernet segment via their external interface. Please note that CARP uses the same protocol and port as VRRP (Virtual Router Redundancy Protocol). The ID set here must be different to the IDs on other devices which use VRRP or CARP and are located in the same Ethernet segment.

Redundancy >> Firewall Redundancy >> Redundancy		
	External virtual IP addresses (IP)	Default: 10.0.0.100 Only in Router network mode. These are IP addresses which are shared by both mGuard devices as virtual IP addresses of the external interface. These IP addresses must be the same for both mGuard devices. These addresses are used as a gateway for explicit static routes for devices located in the same Ethernet segment as the external network interface of the mGuard device. The active mGuard device can receive ICMP requests via this IP address. It responds to these ICMP requests according to the menu settings under *"Network Security >> Packet Filter >> Advanced"*. No network masks or VLAN IDs are set up for the virtual IP addresses as these attributes are defined by the real external IP address. For each virtual IP address, a real IP address must be configured whose IP network accommodates the virtual address. The mGuard device transmits the network mask and VLAN setting from the real external IP address to the corresponding virtual IP address. The applied VLAN settings determine whether standard MTU settings or VLAN MTU settings are used for the virtual IP address. Firewall redundancy cannot function correctly if a real IP address and network mask are not available.
Internal Virtual Interfaces	**Internal virtual router ID**	1, 2, 3, ... 255 (default: 52) Only in Router network mode. This ID is sent by the redundancy pair with each presence notification (CARP) via the external and internal interface and is used to identify the redundancy pair. This ID must be set so it is the same for both mGuard devices. It is used to differentiate the redundancy pair from other Ethernet devices that are connected to the same Ethernet segment via their external/internal interface. Please note that CARP uses the same protocol and port as VRRP (Virtual Router Redundancy Protocol). The ID set here must be different to the IDs on other devices which use VRRP or CARP and are located in the same Ethernet segment.

Redundancy >> Firewall Redundancy >> Redundancy		
	Internal virtual IP addresses (IP)	As described under *"External virtual IP addresses (IP)"*, but with two exceptions. Under **Internal virtual IP addresses (IP)**, IP addresses are defined for devices which belong to the internal Ethernet segment. These devices must use the IP address as their default gateway. These addresses can be used as a DNS or NTP server when the mGuard device is configured as a server for the protocols. For each virtual IP address, a real IP address must be configured whose IP network accommodates the virtual address. The response to ICMP requests with internal virtual IP addresses is independent from the settings made under *"Network Security >> Packet Filter >> Advanced"*.

10.1.2 Connectivity Checks

Each device in a redundancy pair is continuously checked to see whether there is a connection on the internal and external network interface via which network packets can be forwarded.
As the redundancy feature is not applicable on the DMZ interface, network connections via an existing DMZ interface will not be checked.



Targets can be configured for the internal and external interface in the connectivity check. It is important that these targets are actually connected to the specified interface. An ICMP echo reply cannot be received by an external interface when the corresponding target is connected to the internal interface (and vice versa). When the static routes are changed, the targets may easily not be checked properly.

Redundancy >> Firewall Redundancy >> Connectivity Checks		
External Interface	**Kind of check**	Specifies whether a connectivity check is performed on the external interface, and if so, how. If **Ethernet link detection only** is selected, then only the state of the Ethernet connection is checked. If **at least one target must respond** is selected, it does not matter whether the ICMP echo request is answered by the primary or secondary target. The request is only sent to the secondary target if the primary target did not provide a suitable response. In this way, configurations can be supported where the devices are only provided with ICMP echo requests if required. If **all targets of one set must respond** is selected, then both targets must respond. If a secondary target is not specified, then only the primary target must respond.
	Connectivity check result of the external interface	Indicates whether the connectivity check was successful (green check mark).

Redundancy >> Firewall Redundancy >> Connectivity Checks		
	Connectivity check state of the external interface	Indicates the status of the connectivity check.
Primary External Targets (for ICMP echo requests) (Not available when **Ethernet link detection only** is selected.)	**IP**	This is an unsorted list of IP addresses used as targets for ICMP echo requests. We recommend using the IP addresses of routers, especially the IP addresses of default gateways or the real IP address of the other mGuard device. Default: 10.0.0.30, 10.0.0.31 (for new addresses) Each set of targets for state synchronization can contain a maximum of ten targets.
Secondary External Targets (for ICMP echo requests) (Not available when **Ethernet link detection only** is selected.)	**IP**	(See above) Only used if the primary targets check has failed. Failure of a secondary target is not detected in normal operation. Default: 10.0.0.30, 10.0.0.31 (for new addresses) Each set of targets for state synchronization can contain a maximum of ten targets.
Internal Interface	**Kind of check**	Specifies whether a connectivity check is performed on the internal interface, and if so, how. If **Ethernet link detection only** is selected, then only the state of the Ethernet connection is checked. The Ethernet link cannot be checked on devices with an internal switch. If **at least one target must respond** is selected, it does not matter whether the ICMP echo request is answered by the primary or secondary target. The request is only sent to the secondary target if the primary target did not provide a suitable response. In this way, configurations can be supported where the devices are only provided with ICMP echo requests if required. If **all targets of one set must respond** is selected, then both targets must respond. If a secondary target is not specified, then only the primary target must respond.
	Connectivity check result of the internal interface	Indicates whether the connectivity check was successful (green check mark).
	Connectivity check state of the internal interface	Indicates the status of the connectivity check.

Redundancy >> Firewall Redundancy >> Connectivity Checks	
Primary Internal Targets (for ICMP echo requests) (Not available when **Ethernet link detection only** is selected.)	(See above) Default: 192.168.1.30, 192.168.1.31 (for new addresses)
Secondary Internal Targets (for ICMP echo requests) (Not available when **Ethernet link detection only** is selected.)	(See above) Default: 192.168.1.30, 192.168.1.31 (for new addresses)

10.2 Ring/Network Coupling

Not available on devices of the FL MGUARD 2000 series and on devices with built-in switch (FL MGUARD 4305).

10.2.1 Ring/Network Coupling

Redundancy >> Firewall Redundancy >> Ring/Network Coupling		
Settings	**Enable ring/network coupling/dual homing**	When activated, the status of the Ethernet connection is transmitted from one port to another in Stealth mode. This means that interruptions in the network can be traced easily.
	Redundancy port	Internal / External **Internal**: if the connection is lost/established on the LAN port, the WAN port is also disabled/enabled. **External**: if the connection is lost/established on the WAN port, the LAN port is also disabled/enabled.

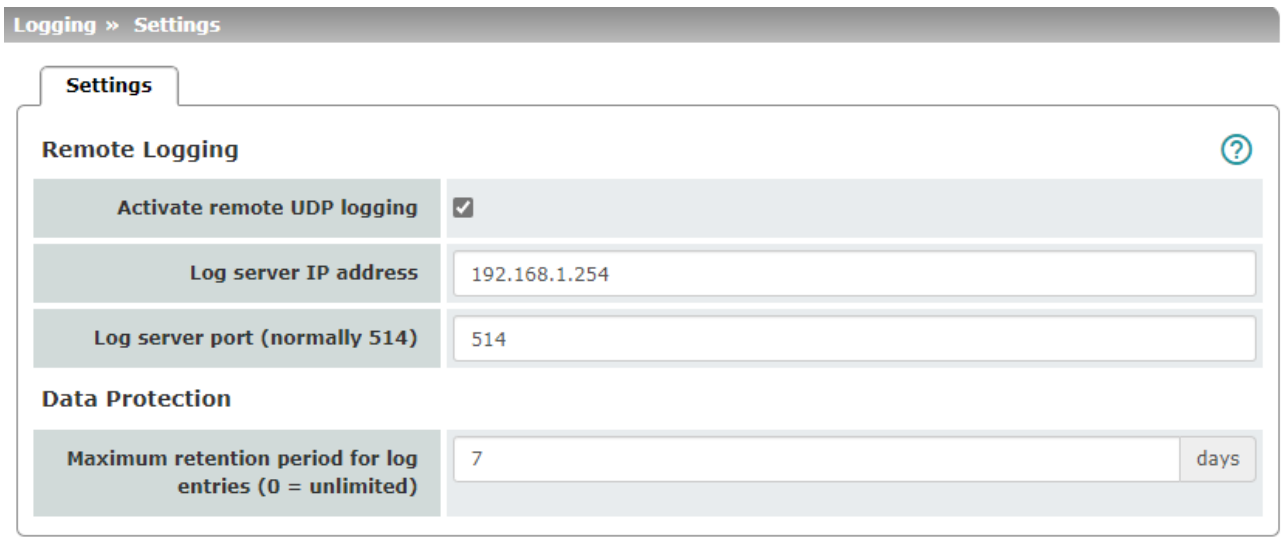
11 Logging menu

Logging refers to the recording of event messages, e.g., regarding settings that have been made, the application of firewall rules, errors, etc.

Log entries are recorded in various categories and can be sorted and displayed according to these categories (see “Logging >> Browse Local Logs” on page 366).

11.1 Logging >> Settings

11.1.1 Settings



All log entries are recorded in the RAM of the mGuard by default. Once the maximum memory space for log entries has been used up, the oldest log entries are automatically overwritten by new entries. In addition, all log entries are deleted when the mGuard is switched off.

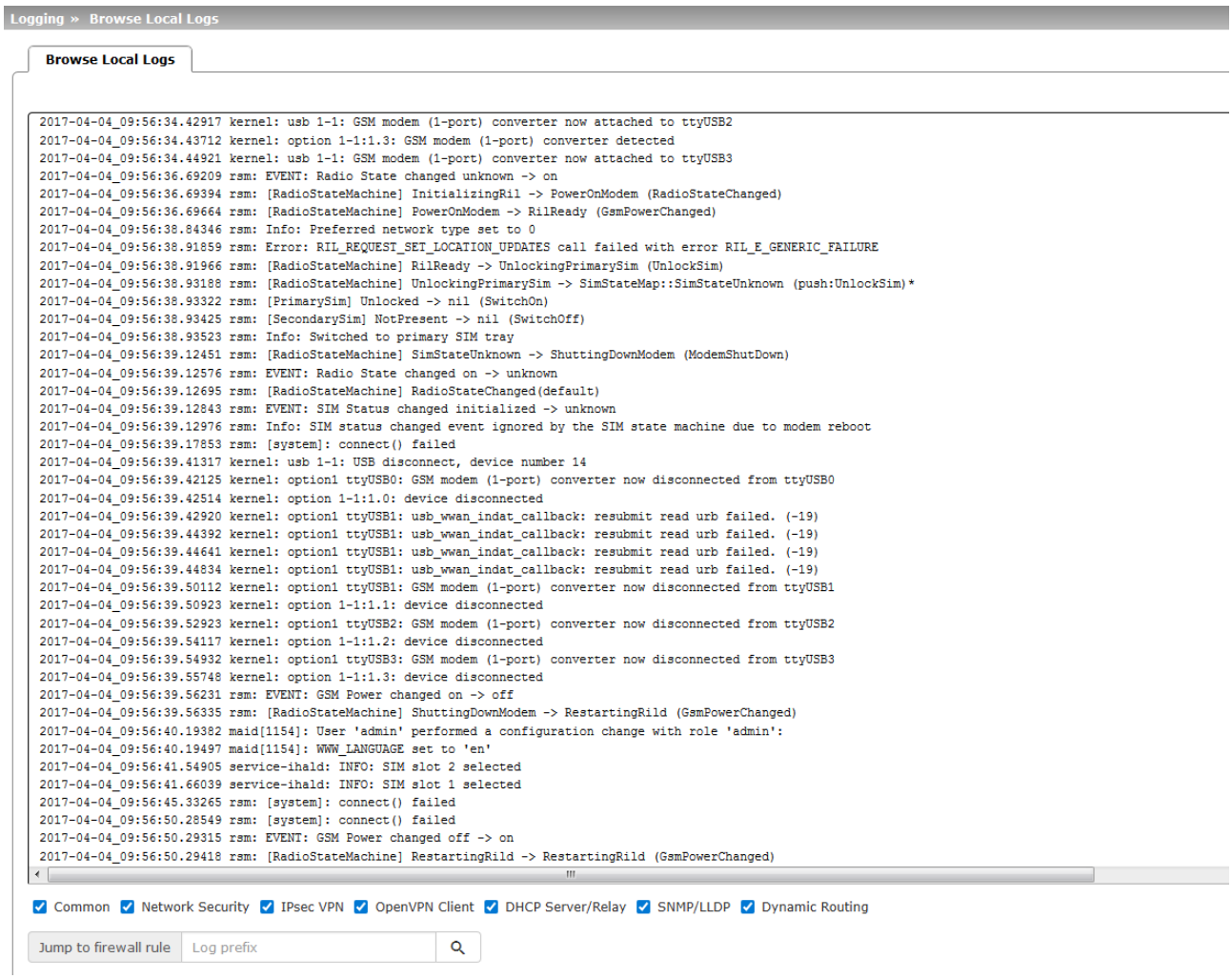
To prevent this, log entries can be transmitted to an external computer (remote server). This is particularly useful if you wish to manage the logs of multiple mGuard devices centrally.

Logging >> Settings	
Remote Logging	The log entries can be transferred to an external log server (syslog server) using the remote logging function. Syslog Message Format compliant with RFC 5424 - Ch. 6. To check on the external log server whether log entries are transmitted regularly, an "UPTIME" log entry is created approximately every 30 minutes and sent to the syslog server. The log entry shows the current uptime of the mGuard device. Example: 2024-12-25_08:20:00.90770 uptime-audit: -------- UPTIME: 29 min --------

Logging >> Settings [...]		
	Activate remote UDP logging	If you want all log entries to be transmitted to the external log server (specified below), activate the function.
	Log server IP address	Specify the IP address of the log server to which the log entries should be transmitted via UDP. An IP address must be specified, not a host name. This function does not support name resolution because it might not be possible to make log entries if a DNS server fails.
	Log server port	Specify the port of the log server to which the log entries should be transmitted via UDP. Default: 514
		If log messages should be transmitted to a remote server via a VPN tunnel, the IP address of the remote server must be located in the network that is specified as the **Remote** network in the definition of the VPN connection. The internal IP address must be located in the network that is specified as **Local** in the definition of the VPN connection (see "IPsec VPN >> Connections >> Edit >> General").
		– If the "IPsec VPN >> Connections >> Edit >> General", **Local** option is set to **1:1 NAT** (see page 285), the following applies: The internal IP address must be located in the specified local network. – If the "IPsec VPN >> Connections >> Edit >> General", **Remote** option is set to **1:1 NAT** (see page 287), the following applies: The IP address of the remote log server must be located in the network that is specified as **Remote** in the definition of the VPN connection.
Data Protection	Log entries may contain personal data. In order to comply with basic data protection requirements, it is possible to store log entries on the device only for a limited period of time. After a configurable retention period has expired, log entries are automatically deleted from the device. Log entries that are also transferred to an external log server (*syslog* server) are only deleted locally on the device after the storage period has expired. Data protection-compliant storage of the transferred log entries must therefore also be ensured on the external log server.	

Logging >> Settings [...]		
	Maximum retention period for log entries (0 = unlimited)	**Default: 0 (no limit)** Specifies the **maximum number of days** after which a locally stored log entry is deleted on the device. The value 0 (default setting) means that there is no maximum retention period for the deletion of log entries. Please note that, for technical reasons, log entries may be deleted before the configured retention period has expired. The following generally applies: If the maximum storage space for log files on the device is exhausted, the oldest log entries are automatically overwritten by new ones. If the device is restarted, all log entries are deleted. Log entries that are transferred to an external log server (remote logging) must be deleted separately. Maximum retention period: 365 days

11.2 Logging >> Browse Local Logs



mGuard devices have different functions depending on the model. Depending on the available functions, the log entries can be filtered by category so that only the intended log entries are visible in the WBM.

To display one or more categories, enable the check boxes for the desired categories. The log entries are continuously updated according to the selection.

To pause or continue the continuous updating of the log entries, click on the ⏸ **Pause** or ▶ **Continue** button.

Access to log entries

The log entries can be accessed in various ways.

Table 11-1 Viewing log entries

mGuard	UDP	Web interface (web UI)
/var/log/dhclient	No	Common
/var/log/dhcp-ext	No	DHCP Server/Relay
/var/log/dhcp-int	No	DHCP Server/Relay
/var/log/dhcp-dmz	No	DHCP Server/Relay
/var/log/dnscache	No	No
/var/log/dynrouting	socklog	Dynamic Routing
/var/log/firestarter	svlogd	IPsec VPN
/var/log/firewall	svlogd	Network Security
/var/log/fwrulesetd	socklog	Network Security
/var/log/https	No	No
/var/log/ipsec	socklog	IPsec VPN
/var/log/l2tp	No	IPsec VPN
/var/log/lldpd	No	SNMP/LLDP
/var/log/maid	No	Common
/var/log/main	socklog	Common
/var/log/maitrigger	No	No
/var/log/openvpn	socklog	OpenVPN Client
/var/log/pluto	svlogd	IPsec VPN
/var/log/charon	svlogd	IPsec VPN IKEv2 (beta)
/var/log/psm-sanitize	No	Common
/var/log/pullconfig	socklog	Common
/var/log/redundancy	socklog	Common
/var/log/snmp	No	SNMP/LLDP
/var/log/tinydns	No	Common
/var/log/userfwd	socklog	Network Security

11.2.1 Log entry categories

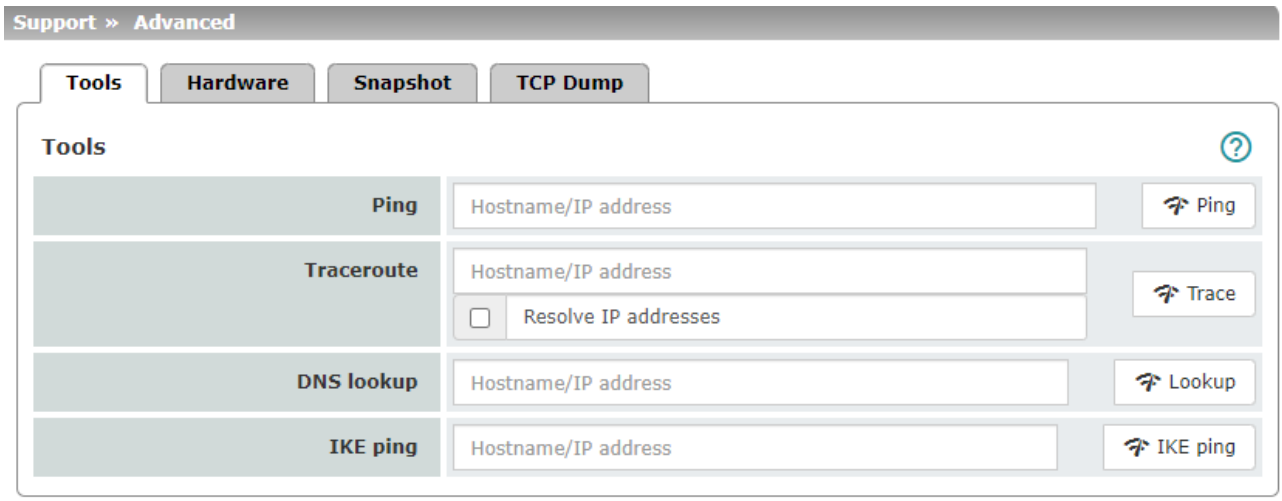
Logging >> Browse Local Logs >> Categories	
General	Log entries that cannot be assigned to other categories. Examples (without time stamp): **HTTPS (Login/Logout)** – Webinterface: Failed login for '*******' role '*******' from 192.168.1.55 by Web – Webinterface: Accepted login for 'user1' role 'admin' from 192.168.1.55 by Web – Webinterface: Logout for 'user1' role 'admin' from 192.168.1.55 by timeout **SSH (Login)** – sshd[28296]: Accepted password for admin from 192.168.1.55 port 49248 ssh2 – inno-sshlimitd: accepting new connection at fd 6 – inno-sshlimitd: allow session 1 of maximum 4 for role admin (class 1) at fd 6 – ssh[28472]: session start for user 'admin' **Action** – maid[12138]: User 'user1' performed a configuration change with role 'admin': – maid[12138]: NTP_ENABLE set to 'no'
Network Security / Firewall	Logged events are shown here if the logging of events was selected when defining the firewall rules (Log = enabled). **Log ID and number for tracing errors** Log entries that relate to the firewall rules listed below have a log ID and number. This log ID and number can be used to trace the firewall rule to which the corresponding log entry relates and that led to the corresponding event. **Firewall rules and their log ID** – Packet filters: "Network Security >> Packet Filter >> Incoming Rules" menu "Network Security >> Packet Filter >> Outgoing Rules" menu Log ID: ***fw-incoming*** or ***fw-outgoing*** – Firewall rules for VPN connections: "IPsec VPN >> Connections >> Edit >> Firewall" menu, Incoming/Outgoing Log ID: ***fw-vpn-in*** or ***fw-vpn-out*** – Firewall rules for OpenVPN connections: "OpenVPN Client >> Connections >> Edit >> Firewall" menu, Incoming/Outgoing Log ID: ***fw-openvpn-in*** or ***fw-openvpn-out*** "OpenVPN Client >> Connections >> Edit >> NAT" menu Log ID: ***fw-openvpn-portfw*** – Firewall rules for web access to the mGuard via HTTPS: "Management >> Web Settings >> Access" menu Log ID: ***fw-https-access***

Logging >> Browse Local Logs >> Categories	
	– Firewall rules for access to the mGuard via SNMP: "Management >> SNMP >> Query" menu Log ID: ***fw-snmp-access*** – Firewall rules for SSH remote access to the mGuard: "Management >> System Settings >> Shell Access" menu Log ID: ***fw-ssh-access*** – Firewall rules for access to the mGuard via NTP: "Management >> System Settings >> Time and Date" menu Log ID: ***fw-ntp-access*** – Firewall rules for the user firewall: "Network Security >> User Firewall" menu, Firewall Rules Log ID: ***ufw-*** – Rules for NAT, port forwarding: "Network >> NAT >> IP and Port Forwarding" menu Log ID: ***fw-portforwarding***
	Searching for firewall rules based on a network security log As of mGuard firmware version 8.6.0, firewall log entries in the list are highlighted in blue and provided with a hyperlink. A click on the firewall log entry, e. g. *fw-https-access-1-1ec2c133-dca1-1231-bfa5-000cbe01010a* opens the configuration page (menu >> submenu >> tab) with the firewall rule that caused the log entry.
IPsec VPN	Lists all IPsec VPN events (both IPsec VPN and IPsec VPN IKEv2 (beta)). The format corresponds to standard Linux format. There are special evaluation programs that present information from the logged data in a more easily readable format.
OpenVPN	Lists all OpenVPN events.
DHCP Server/Relay	Messages fraom the services that can be configured under "Network >> DHCP".
SNMP/LLDP	Messages from the services that can be configured under "Management >> SNMP".

12 Support menu

12.1 Support >> Advanced

12.1.1 Tools

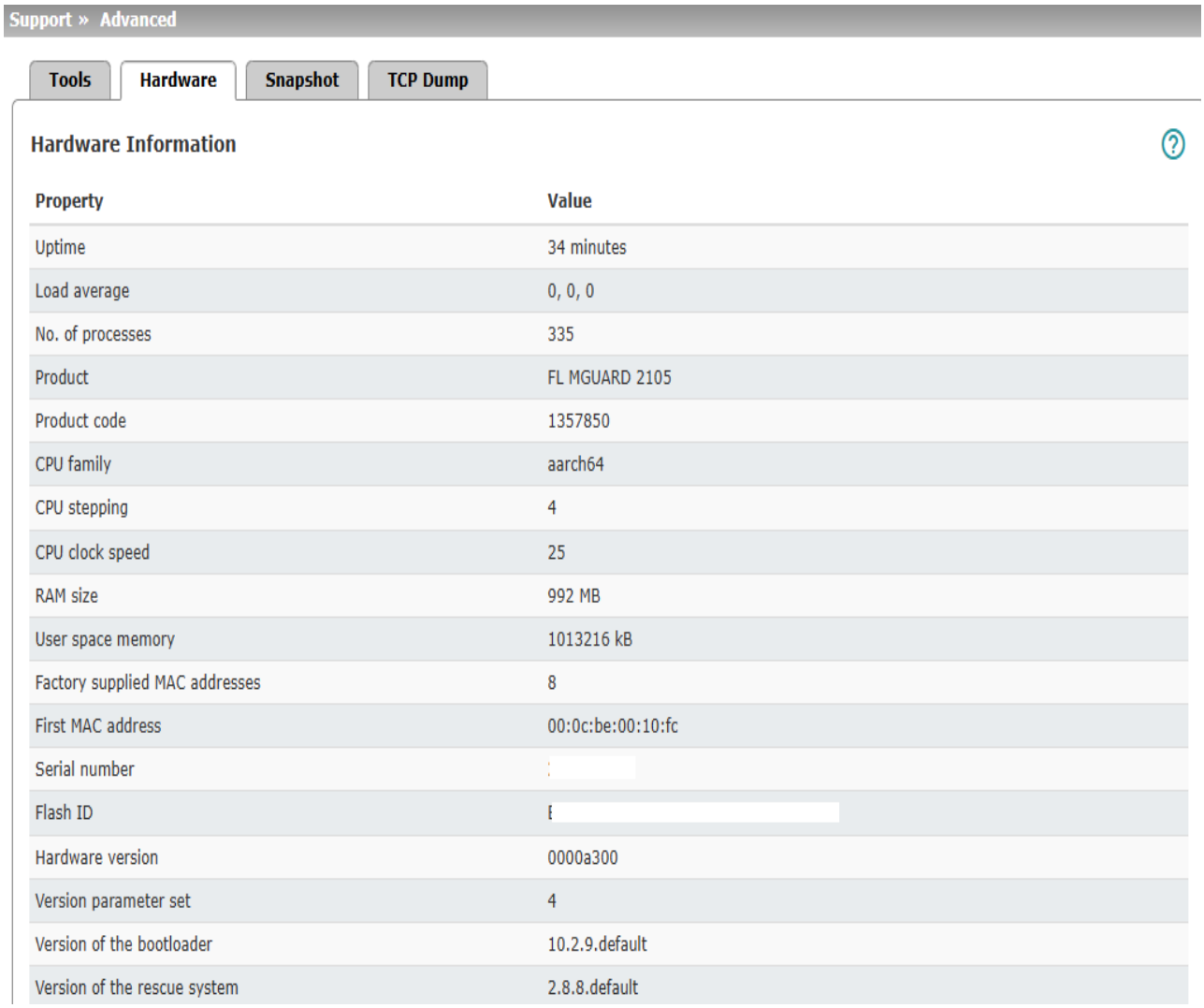


Support >> Advanced >> Tools	
Ping	**Aim**: to check whether a peer can be reached via a network. **Procedure**: • Enter the IP address or host name of the peer in the **Hostname/IP Address** field. Then click on the **Ping** button. A corresponding message is then displayed.
Traceroute	**Aim**: to determine which intermediate points or routers are located on the connection path to a peer. **Procedure**: • Enter the host name or IP address of the peer whose route is to be determined in the **Hostname/IP Address** field. • If the points on the route are to be output with IP addresses instead of host names (if applicable), activate the **Do not resolve IP addresses to hostnames** check box (check mark). • Then click on the **Trace** button. A corresponding message is then displayed.
DNS lookup	**Aim**: to determine which host name belongs to a specific IP address or which IP address belongs to a specific host name. **Procedure**: • Enter the IP address or host name in the **Hostname** field. • Click on the **Lookup** button. The response, which is determined by the mGuard according to the DNS configuration, is then returned.

Support >> Advanced >> Tools	
IKE ping	**Aim**: to determine whether the VPN software for a VPN gateway is able to establish a VPN connection, or whether a firewall prevents this, for example. **Procedure**: • Enter the name or IP address of the VPN gateway in the **Hostname/IP Address** field. • Click on the **IKE ping** button. • A corresponding message is then displayed.

12.1.2 Hardware

This page lists various hardware properties of the mGuard.



Property	Value
Uptime	34 minutes
Load average	0, 0, 0
No. of processes	335
Product	FL MGUARD 2105
Product code	1357850
CPU family	aarch64
CPU stepping	4
CPU clock speed	25
RAM size	992 MB
User space memory	1013216 kB
Factory supplied MAC addresses	8
First MAC address	00:0c:be:00:10:fc
Serial number	
Flash ID	
Hardware version	0000a300
Version parameter set	4
Version of the bootloader	10.2.9.default
Version of the rescue system	2.8.8.default

MAC addresses

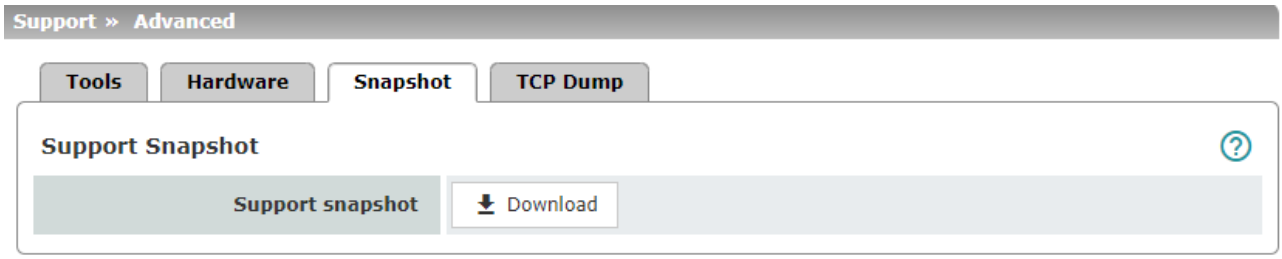
The MAC address of the WAN interface determined by the manufacturer is indicated on the type label of the device. The other MAC addresses (LAN/DMZ [optional]) can be calculated as follows:

- **WAN interface**: see type label.
- **LAN interface**: MAC address of the WAN interface incremented by 1 (**WAN + 1**).
  Devices with integrated switch: all switch ports use the same MAC address.
- **DMZ interface**: MAC address of the WAN interface incremented by 4 (**WAN + 4**).

Example:

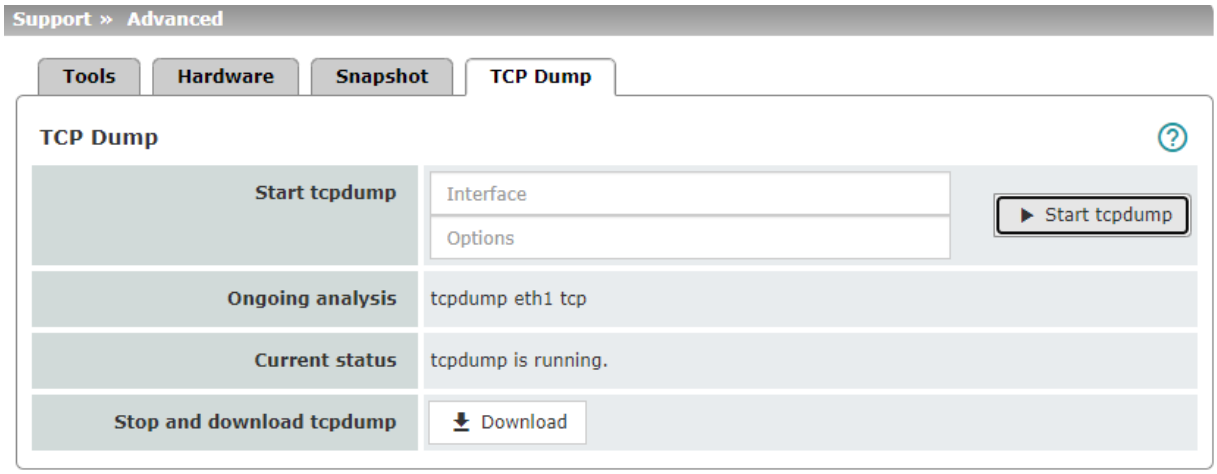
- WAN: 00:a0:45:eb:28:9d
- LAN: 00:a0:45:eb:28:9e
- DMZ: 00:a0:45:eb:28:a1

12.1.3 Snapshot



Support >> Advanced >> Snapshot		
Support Snapshot	**Support snapshot**	Creates a compressed file (in tar.gz format) containing all current configuration settings that could be relevant for error diagnostics. This file does not contain any private information such as private machine certificates or passwords. However, any pre-shared keys of VPN connections are contained in the snapshots. To create a **Support snapshot** or **Support snapshot with persistent logs**, proceed as follows: • Click on the **Download** button. • Save the file (under the name **snapshot-YYYY.MM.DD-hh.mm.ss.tar.gz** or **snapshot-all-YYYY.MM.DD-hh.mm.ss.tar.gz**). Provide the file to the support team of your supplier, if required.

12.1.4 TCP Dump



Support >> Advanced >> Snapshot

TCP Dump

A packet analysis (*tcpdump*) can be used to analyze the content of network packets that are sent or received via a selected network interface. Filter options are used to determine which network packets are analyzed.

The result of the analysis is saved in a file (**.tar.gz*), downloaded and deleted on the device.

If the file (**.tar.gz)* exceeds a size of 50 MB, the process *tcpdump* is automatically stopped. The file is saved on the device and can then be downloaded. Once the file has been downloaded, it is deleted from the device.

Start tcpdump

Interface

Only data packets that are sent or received via the selected network interface will be analyzed.

- WAN interface (XF1):
  - **eth0**
- LAN interface (XF2-4 or 2-5):
  - **eth1** (XF2 FL MGUARD 2102/4302/4102 only)
  - **br0** (network mode *Stealth* only)
  - **swp0** (XF2 FL MGUARD 2105/4305 only)
  - **swp1** (XF3 FL MGUARD 2105/4305 only)
  - **swp2** (XF4 FL MGUARD 2105/4305 only)
  - **swp3** (XF5 FL MGUARD 2105 only)
- DMZ interface (XF5):
  - **dmz0** (XF5 FL MGUARD 4305 only)

br0 is the software bridge in stealth mode, which combines all ports (with the exception of dmz0, as a DMZ is not available in this network mode).

For FL MGUARD 2105/4305 devices, eth1 acts as a software bridge that combines all switch ports (with the exception of dmz0).

Support >> Advanced >> Snapshot

	Options By specifying options, the packet analysis can be restricted to a selection of the elements listed below. Options can be linked via the logical operators "and, or, not". Example: *tcp and net 192.168.1.0/24 and not port 443* Available options: – **tcp**: TCP protocol – **udp**: UDP protocol – **arp**: ARP protocol – **icmp**: ICMP protocol – **esp**: ESP protocol – **host <ip>**: IPv4 address – **port <1-65535>**:Network port (port number or service name) – **net <nw_cidr>**: Network (in CIDR format, e.g. 192.168.1.0/24) – **and, or, not**: Logical operators **"start tcpdump" button** • Click on the "Start tcpdump" button to start an analysis.
Ongoing analysis	During a running analysis: shows for which interface and with which options *tcpdump* is being executed.
Current status	Shows the status of the analysis.
Stop and download tcpdump	**"Download" button** • Click on the **Download** button, – to stop a running analysis and download the data or – to download data that has been saved on the device after an automatically stopped analysis. The recorded package contents are summarized in a file (**.tar.gz*) and automatically downloaded from the device. The file is then deleted from the device. The time at which the file was downloaded is specified in the file name as follows: <YYYY.MM.DD-hh.mm.ss> Example: tcpdump-2024.06.10-09.47.54.tar.gz

13 Redundancy

The firewall redundancy functions are **not** available on the devices of the FL MGUARD 2000 series.

Each device in a redundancy pair is continuously checked to see whether there is a connection on the internal and external network interface via which network packets can be forwarded.

As the redundancy feature is not applicable on the DMZ interface, network connections via an existing DMZ interface will not be checked.

There are several different ways of compensating for errors using the mGuard so that an existing connection is not interrupted.

– **Firewall redundancy:** two identical mGuard devices can be combined to form a redundancy pair, meaning one takes over the functions of the other if an error occurs.
– **Ring/network coupling**: in ring/network coupling, another method is used. Parts of a network are designed as redundant. In the event of errors, the alternative path is selected.

13.1 Firewall redundancy

Using firewall redundancy, it is possible to combine two identical mGuard devices into a redundancy pair pair (single virtual router). One mGuard takes over the functions of the other if an error occurs. Both mGuard devices run synchronously, meaning an existing connection is not interrupted when the device is switched.

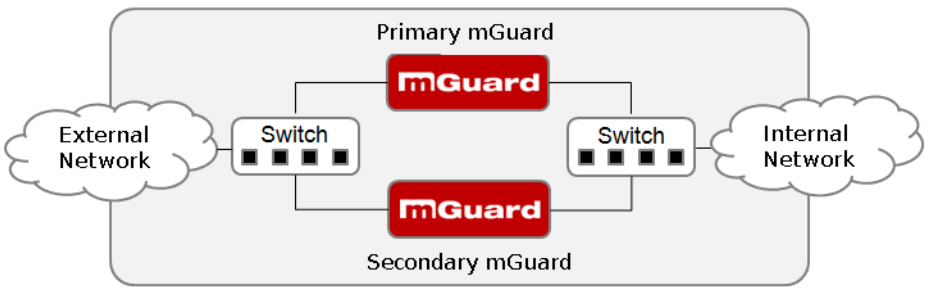


Figure 13-1 Firewall redundancy (example)

Basic requirements for firewall redundancy

– Only identical mGuard devices can be used together in a redundancy pair.
– In Router network mode, firewall redundancy is only supported with “Static” Router mode.
– In Stealth network mode, firewall redundancy is only supported when stealth configuration is set to “Multiple clients”.
– For further restrictions, see “Requirements for firewall redundancy” on page 380 and “Limits of firewall redundancy” on page 389.

13.1.1 Components in firewall redundancy

Firewall redundancy is comprised of several components:

– **Connectivity check**
  Checks whether the necessary network connections have been established.
– **Availability check**
  Checks whether an active mGuard is available and whether this should remain active.
– **State synchronization of the firewall**
  The mGuard on standby receives a copy of the current firewall database state.
– **Virtual network interface**
  Provides virtual IP addresses and MAC addresses that can be used by other devices as routes and default gateways.
– **State monitoring**
  Coordinates all components.
– **Status indicator**
  Shows the user the state of the mGuard.

Connectivity check

Each device in a redundancy pair is continuously checked to see whether there is a connection on the internal and external network interface via which network packets can be forwarded.

As the redundancy feature is not applicable on the DMZ interface, network connections via an existing DMZ interface will not be checked.

Each mGuard checks its own internal and external network interfaces independently of each other. Both interfaces are tested for a continuous connection. This connection must be in place, otherwise the connectivity check will fail.

ICMP echo requests can also be sent (optional). The ICMP echo requests can be set via the *"Redundancy >> Firewall Redundancy >> Connectivity Checks"* menu.

Availability check

On each mGuard in a redundancy pair, checks are also constantly performed to determine whether an active mGuard is available and whether it should remain active. A variation of the CARP (Common Address Redundancy Protocol) is used here.

The active mGuard constantly sends presence notifications via its internal and external network interface while both mGuard devices listen. If a dedicated Ethernet link for state synchronization of the firewall is available, the presence notification is also sent via this link. In this case, the presence notification for the external network interface can also be suppressed.

The availability check fails if an mGuard does not receive any presence notifications within a certain time. The check also fails if an mGuard receives presence notifications with a lower priority than its own.

The data is always transmitted via the physical network interface and never via the virtual network interface.

State synchronization

The mGuard on standby receives a copy of the state of the mGuard that is currently active.

This includes a database containing the forwarded network connections. This database is filled and updated constantly by the forwarded network packets. The unencryptted data of the state is transmitted via the physical LAN interface and never via the virtual network interface.

NOTE: Unencrypted data transfer

The data from the connection tracking table of the firewall of the redundancy pair is transmitted unencrpyted over the LAN network.

Use the redundancy function only in a secure network environment where the LAN network is fully under the control of the operator.

To keep internal data traffic to a minimum, a VLAN can be configured to store the synchronization data in a separate multicast and broadcast domain.

Virtual IP addresses

Each mGuard is configured with virtual IP addresses. The number of virtual IP addresses depends on the network mode used. Both mGuard devices in a redundancy pair must be assigned the same virtual IP addresses. The virtual IP addresses are required by the mGuard to establish virtual network interfaces.

Two virtual IP addresses are required in Router network mode, while others can be created. One virtual IP address is required for the external network interface and the other for the internal network interface.

These IP addresses are used as a gateway for routing devices located in the external or internal LAN. In this way, the devices can benefit from the high availability resulting from the use of both redundant mGuard devices.

The redundancy pair automatically defines MAC addresses for the virtual network interface. These MAC addresses are identical for the redundancy pair. In Router network mode, both mGuard devices share a MAC address for the virtual network interface connected to the external and internal Ethernet segment.

In Router network mode, the mGuard devices support forwarding of special UDP/TCP ports from a virtual IP address to other IP addresses, provided the other IP addresses can be reached by the mGuard. In addition, the mGuard also masks data with virtual IP addresses when masquerading rules are set up.

State monitoring

State monitoring is used to determine whether the mGuard is active, on standby or has an error. Each mGuard determines its own state independently, based on the information provided by other components. State monitoring ensures that two mGuard devices are not active at the same time.

Status indicator

The status indicator contains detailed information on the firewall redundancy state. A summary of the state can be called via the *“Redundancy >> Firewall Redundancy >> Redundancy”* or *“Redundancy >> Firewall Redundancy >> Connectivity Checks”* menu.

13.1.2 Interaction of the firewall redundancy components

During operation, the components work together as follows: both mGuard devices perform ongoing connectivity checks for both of their network interfaces (internal and external). In addition, an ongoing availability check is performed. Each mGuard listens continuously for presence notifications (CARP) and the active mGuard also sends them.

Based on the information from the connectivity and availability checks, the state monitoring function is made aware of the state of the mGuard devices. State monitoring ensures that the active mGuard mirrors its data to the other mGuard (state synchronization).

13.1.3 Firewall redundancy settings from previous versions

Existing configuration profiles for firmware Version 6.1.x (and earlier) can be imported with certain restrictions. For more information, please contact Phoenix Contact.

13.1.4 Requirements for firewall redundancy

- To use the redundancy function, **both mGuard devices** must have the same firmware.
- Each set of targets for the connectivity check can contain more than ten targets. (A fail-over time cannot be guaranteed without an upper limit.)
  "Redundancy >> Firewall Redundancy >> Redundancy"
  - >> "External Interface" >> "Primary External Targets (for ICMP echo requests)"
  - >> "External Interface" >> "Secondary External Targets (for ICMP echo requests)"
  - >> "Internal Interface" >> "Primary External Targets (for ICMP echo requests)"
  - >> "Internal Interface" >> "Secondary External Targets (for ICMP echo requests)"

  If "**at least one target must respond**" or "**all targets of one set must respond**" is selected under "External Interface" >> "Kind of check", then "External Interface" >> "Primary External Targets (for ICMP echo requests)" must not be empty. This also applies to the internal interface.
- In **Router network mode**, at least one external and one internal virtual IP address must be set. A virtual IP address cannot be listed twice.

13.1.5 Fail-over switching time

The mGuard calculates the intervals for the connectivity check and availability check automatically according to the variables under **Fail-over switching time**.

Connectivity check

The factors which define the intervals for the connectivity check are specified in Table 13-1.

64 byte ICMP echo requests are sent for the connectivity check. They are sent on Layer 3 of the Internet protocol. When VLAN is not used, 18 bytes for the MAC header and checksum are added to this with Ethernet on Layer 2. The ICMP echo reply is the same size.

The bandwidth is also shown in Table 13-1. This takes into account the values specified for a single target and adds up the bytes for the ICMP echo request and reply.

The timeout on the mGuard following transmission includes the following:

– The time required by the mGuard to transmit an ICMP echo reply. If other data traffic is expected, half duplex mode is not suitable here.
– The time required for the transmission of the ICMP echo request to a target. Consider the latency during periods of high capacity utilization. This applies especially when routers forward the request. The actual latency may be twice the value of the configured latency in unfavorable circumstances (connectivity check error).
– The time required on each target for processing the request and transmitting the reply to the Ethernet layer. Please note that full duplex mode is also used here.
– The time for transmission of the ICMP echo reply to the mGuard.

Table 13-1 Frequency of the ICMP echo requests

Fail-over switching time	ICMP echo requests per target	Timeout on the mGuard after transmission	Bandwidth per target
1 s	10 per second	100 ms	6560 bps
3 s	$3.\overline{3}$ per second	300 ms	2187 bps
10 s	1 per second	1 s	656 bps

If secondary targets are configured, then additional ICMP echo requests may occasionally be sent to these targets. This must be taken into account when calculating the ICMP echo request rate.

The timeout for a single ICMP echo request is displayed in Table 13-1. This does not indicate how many of the responses can be missed before the connectivity check fails. The check tolerates a negative result for one of two back-to-back intervals.

Availability check

Presence notifications (CARP) are up to 76 bytes in size on Layer 3 of the Internet protocol. When VLAN is not used, 18 bytes for the MAC header and checksum are added to this with Ethernet on Layer 2. The ICMP echo reply is the same size.

Table 13-2 shows the maximum frequency at which the presence notifications (CARP) are sent from the active mGuard. It also shows the bandwidth used in the process. The frequency depends on the mGuard priority and the *"Fail-over switching time"*.

Table 13-2 also shows the maximum latency tolerated by the mGuard for the network that is used to transmit the presence notifications (CARP). If this latency is exceeded, the redundancy pair can exhibit undefined behavior.

Table 13-2 Frequency of the presence notifications (CARP)

Fail-over switching time	Presence notifications (CARP) per second		Maximum latency	Bandwidth on Layer 2 for high priority
	High priority	Low priority		
1 s	50 per second	25 per second	20 ms	37600 bps
3 s	16.6 per second	8.3 per second	60 ms	12533 bps
10 s	5 per second	2.5 per second	200 ms	3760 bps

13.1.6 Error compensation through firewall redundancy

Firewall redundancy is used to compensate for hardware failures.

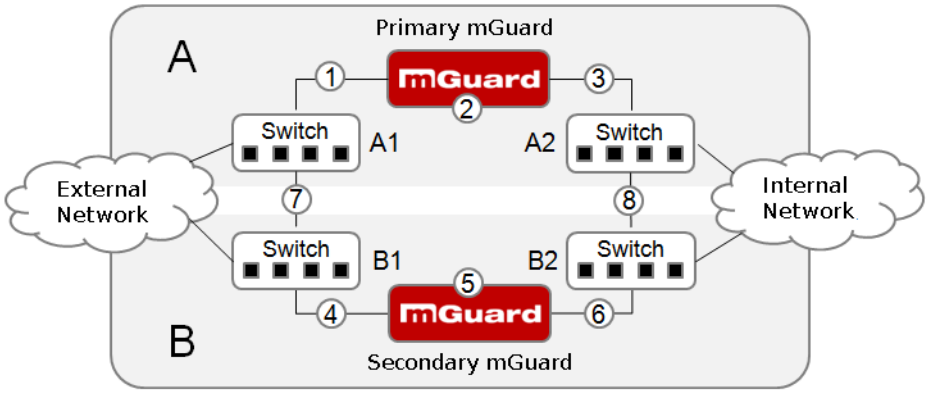


Figure 13-2 Possible error locations (1 ... 8)

Figure 13-2 shows a diagram containing various error locations (not related to the network mode).

Each of the mGuard devices in a redundancy pair is located in a different area (A and B). The mGuard in area A is connected to switch A1 through its external Ethernet interface and to switch A2 through its internal Ethernet interface. mGuard B is connected accordingly to switches B1 and B2. In this way, the switches and mGuard devices connect an external Ethernet network to an internal Ethernet network. The connection is established by forwarding network packets (in Router network mode).

Firewall redundancy compensates for errors shown in Figure 13-2 if only one occurs at any given time. If two errors occur simultaneously, they are only compensated if they occur in the same area (A or B).

For example, if one of the mGuard devices fails completely due to a power outage, then this is detected. A connection failure is compensated if the connection fails completely or partially. When the connectivity check is set correctly, a faulty connection caused by the loss of data packets or an excessive latency is detected and compensated. Without the connectivity check, the mGuard cannot determine which area caused the error.

A connection failure between switches on a network side (internal/external) is not compensated for (7 and 8 in Figure 13-2).

13.1.7 Handling firewall redundancy in extreme situations

The situations described here only occur rarely.

Restoration in the event of a network lobotomy

A network lobotomy occurs if a redundancy pair is separated into two mGuard devices operating independently of one another. In this case, each mGuard deals with its own tracking information as the two mGuard devices can no longer communicate via Layer 2. A network lobotomy can be triggered by a rare and unfortunate combination of network settings, network failures, and firewall redundancy settings.

Each mGuard is active during a network lobotomy. The following occurs after the network lobotomy has been rectified: if the mGuard devices have different priorities, the device with the higher priority becomes active and the other switches to standby mode. If both mGuard devices have the same priority, an identifier sent with the presence notifications (CARP) determines which mGuard becomes active.

Both mGuard devices manage their own firewall state during the network lobotomy. The active mGuard retains its state. Connections on the other mGuard, which were established during the lobotomy, are dropped.

Fail-over when establishing complex connections

Complex connections are network protocols which are based on different IP connections. One example of this is the FTP protocol. In the case of FTP, the client establishes a control channel for a TCP connection. The server is then expected to open another TCP connection over which the client can then transmit data. The data channel on port 20 of the server is set up while the control channel on port 21 of the server is being established.

If the relevant connection tracking function is activated on the mGuard (see “Advanced” on page 234), complex connections of this type are tracked. In this case, the administrator only needs to create a firewall rule on the mGuard which allows the client to establish a control channel to the FTP server. The mGuard enables the server to establish a data channel automatically, regardless of whether the firewall rules allow for this.

The tracking of complex connections is part of the firewall state synchronization process. However, to keep the latency short, the mGuard forwards the network packets independently of the firewall state synchronization update that has been triggered by the network packets themselves.

Therefore, it may be the case for a very brief period that a state change for the complex connection is not forwarded to the mGuard on standby if the active mGuard fails. In this case, tracking of the connection from the mGuard which is active after the fail-over is not continued correctly. This cannot be corrected by the mGuard. The data link is then reset or interrupted.

Fail-over when establishing semi-unidirectional connections

A semi-unidirectional connection refers to a single IP connection (such as UDP connections) where the data only travels in one direction after the connection is established with a bidirectional handshake.

The data flows from the responder to the initiator. The initiator only sends data packets at the very start.

The following applies only to certain protocols which are based on UDP. Data always flows in both directions on TCP connections.

If the firewall of the mGuard is set up to only accept data packets from the initiator, the firewall accepts all related responses per se. This happens regardless of whether or not a relevant firewall rule is available.

A scenario is conceivable in which the mGuard allows the initiating data packet to pass through and then fails before the relevant connection entry has been made in the other mGuard. The other mGuard may then reject the responses as soon as it becomes the active mGuard.

The mGuard cannot correct this situation due to the single-sided connection. As a countermeasure, the firewall can be configured so that the connection can be established in both directions. This is normally already handled via the protocol layer and no additional assignment is required.

Loss of data packets during state synchronization

If data packets are lost during state synchronization, this is detected automatically by the mGuard, which then requests the active mGuard to send the data again.

This request must be answered within a certain time, otherwise the mGuard on standby is assigned the “outdated” state and asks the active mGuard for a complete copy of all state information.

The response time is calculated automatically from the fail-over switching time. This is longer than the time for presence notifications (CARP), but shorter than the upper limit of the fail-over switching time.

Loss of presence notifications (CARP) during transmission

A one-off loss of presence notifications (CARP) is tolerated by the mGuard, but it does not tolerate the loss of subsequent presence notifications (CARP). This applies to the availability check on each individual network interface, even when these are checked simultaneously. It is therefore very unlikely that the availability check will fail as a result of a very brief network interruption.

Loss of ICMP echo requests/replies during transmission

ICMP echo requests or replies are important for the connectivity check. Losses are always observed, but are tolerated under certain circumstances.

The following measures can be used to increase the tolerance level for ICMP echo requests.

– Select **at least one target must respond** under **Kind of check** in the *“Redundancy >> Firewall Redundancy >> Connectivity Checks”* menu.
– Also define a secondary set of targets here. The tolerance level for the loss of ICMP echo requests can be further increased by entering the targets of unreliable connections under both sets (primary and secondary) or listing them several times within a set.

Restoring the primary mGuard following a failure

If a redundancy pair is defined with different priorities, the secondary mGuard becomes active if the connection fails. The primary mGuard becomes active again after the failure has been rectified. The secondary mGuard receives a presence notification (CARP) and returns to standby mode.

State synchronization

If the primary mGuard becomes active again after a failure of the internal network connection, it may contain an obsolete copy of the firewall database. This database must, therefore, be updated before the connection is reestablished. The primary mGuard ensures that it receives an up-to-date copy before becoming active.

13.1.8 Interaction with other devices

Virtual and real IP addresses

With firewall redundancy in Router network mode, the mGuard uses real IP addresses to communicate with other network devices.

Virtual IP addresses are used in the following two cases:

– Virtual IP addresses are used when establishing and operating VPN connections.
– If DNS and NTP services are used according to the configuration, they are offered to internal virtual IP addresses.

The use of real (management) IP addresses is especially important for the connectivity check and availability check. Therefore, the real (management) IP address must be configured so that the mGuard can establish the required connections.

The following are examples of how and why mGuard communication takes place:

– Communication with NTP servers to synchronize the time
– Communication with DNS servers to resolve host names (especially those from VPN partners)
– To register its IP address with a DynDNS service
– To send SNMP traps
– To forward log messages to a SysLog server
– To download a CRL from an HTTP(S) server
– To authenticate a user via a RADIUS server
– To download a configuration profile via an HTTPS server
– To download a firmware update from an HTTPS server

With firewall redundancy in Router network mode, devices connected to the same LAN segment as the redundancy pair must use their respective virtual IP addresses as gateways for their routes. If these devices were to use the actual IP address of either of the mGuard devices, this would work until that particular mGuard failed. However, the other mGuard would then not be able to take over.

Targets for the connectivity check

If a target is set for ICMP echo requests as part of the connectivity check, these requests must be answered within a certain time, even if the network is busy with other data. The network path between the redundancy pair and these targets must be set so that it is also able to forward the ICMP responses when under heavy load. Otherwise, the connectivity check for an mGuard could erroneously fail.

Targets can be configured for the internal and external interface in the connectivity check (see “Connectivity Checks” on page 359). It is important that these targets are actually connected to the specified interface. An ICMP echo reply cannot be received by an external interface when the target is connected to the internal interface (and vice versa). When the static routes are changed, it is easy to forget to adjust the configuration of the targets accordingly.

The targets for the connectivity check should be well thought out. Without a connectivity check, all it takes are two errors for a network lobotomy to occur.

A network lobotomy is prevented if the targets for both mGuard devices are identical and all targets have to answer the request. However, the disadvantage of this method is that the connectivity check fails more often if one of the targets does not offer high availability.

In **Router network mode**, we recommend defining a high-availability device as the target on the external interface. This can be the default gateway for the redundancy pair (e.g., a virtual router comprised of two independent devices). In this case, either no targets or a selection of targets should be defined on the internal interface.

Please also note the following information when using a virtual router consisting of two independent devices as the default gateway for a redundancy pair. If these devices use VRRP to synchronize their virtual IP, then a network lobotomy could split the virtual IP of this router into two identical copies. These routers could use a dynamic routing protocol and only one may be selected for the data flows of the network being monitored by the mGuard. Only this router should keep the virtual IP. Otherwise, you can define targets which are accessible via this route in the connectivity check. In this case, the virtual IP address of the router would not be a sensible target.

Redundancy group

Several redundancy pairs can be connected within a LAN segment (redundancy group). You define a value as an identifier (using the router ID) for each virtual instance of the redundancy pair. As long as these identifiers are different, the redundancy pairs do not come into conflict with each other.

Data traffic

In the event of a high **latency** in a network used for state synchronization updates or a serious data loss on this network, the mGuard on standby is assigned the “outdated” state. This does not occur, however, as long as no more than two back-to-back updates are lost. This is because the mGuard on standby automatically requests a repeat of the update. The latency requirements are the same as those detailed under “Fail-over switching time” on page 381.

Sufficient bandwidth

The data traffic generated as a result of the connectivity check, availability check, and state synchronization uses bandwidth in the network. The connectivity check also generates complicated calculations. There are several ways to limit this or stop it completely.

If the impact on other devices is unacceptable:

- The connectivity check must either be deactivated, or must only relate to the actual IP address of the other **mGuard**.
- The data traffic generated by the availability check and state synchronization must be moved to a separate VLAN.
- Switches must be used which allow separation of the VLANs.

13.1.9 Limits of firewall redundancy

- In **Router network mode**, firewall redundancy is only supported with “Static” mode.
- Access to the mGuard via the HTTPS, SNMP, and SSH **management protocols** is only possible with a real IP address from each mGuard. Attempts to access virtual addresses are rejected.
- The following **features cannot be used** with firewall redundancy.
  - A DHCP server
  - A DHCP relay
  - A user firewall
- The **redundancy pair must have the same configuration**. Take this into account when making the following settings:
  - NAT settings (masquerading, port forwarding, and 1:1 NAT)
  - Flood protection
  - Packet filter (firewall rules, MAC filter, advanced settings)
- Some network connections may be interrupted following a **network lobotomy**. (See “Restoration in the event of a network lobotomy” on page 384.)
- After a fail-over, **semi-unidirectional or complex connections** that were established in the second before the fail-over may be interrupted. (See “Fail-over when establishing complex connections” on page 384 and “Fail-over when establishing semi-unidirectional connections” on page 384.)
- State synchronization does not replicate the connection tracking entries for **ICMP echo requests** forwarded by the mGuard. Therefore, ICMP echo replies can be dropped according to the firewall rules if they only reach the mGuard after the fail-over is completed. Please note that ICMP echo replies are not suitable for measuring the fail-over switching time.
- **Masquerading** involves hiding the transmitter behind the first virtual IP address or the first internal IP address. This is different to masquerading on the mGuard without firewall redundancy. When firewall redundancy is not activated, the external or internal IP address hiding the transmitter is specified in a routing table.

14 Glossary

Asymmetrical encryption

In asymmetrical encryption, data is encrypted with one key and decrypted with a second key. Both keys are suitable for encryption and decryption. One of the keys is kept secret by its owner (private key), while the other is made available to the public (public key), i.e., to potential communication partners.

A message encrypted with the public key can only be decrypted and read by a recipient in possession of the associated private key. A message encrypted with the private key can be decrypted by any recipient in possession of the associated public key. Encryption using the private key shows that the message actually originated from the owner of the associated public key. Therefore, the expression “digital signature” is also often used.

However, asymmetrical encryption methods such as RSA are both slow and susceptible to certain types of attack. As a result, they are often combined with some form of symmetrical encryption (?“Symmetrical encryption” on page 398). On the other hand, concepts are available enabling the complex additional administration of symmetrical keys to be avoided.

DES/3DES

The encryption algorithms **DES** and **3DES** are no longer regarded as secure and should not be used where possible. The use of **AES** encryption algorithms is recommended as an alternative.

For reasons of backwards compatibility, the DES and 3DES encryption algorithms can continue to be used. For more information, see “Using secure encryption and hash algorithms” on page 41.

This symmetrical encryption algorithm (?“Symmetrical encryption” on page 398) was developed by IBM and checked by the NSA. DES was specified in 1977 by the American National Bureau of Standards (the predecessor of the National Institute of Standards and Technology (NIST)) as the standard for American governmental institutions. As this was the very first standardized encryption algorithm, it quickly won acceptance in industrial circles, both inside and outside America.

DES uses a 56-bit key length, which is no longer considered secure as the available processing power of computers has greatly increased since 1977.

3DES is a version of DES. It uses keys that are three times as long, i.e., 168 bits in length. Still considered to be secure today, 3DES is included in the IPsec standard, for example.

AES

AES (Advanced Encryption Standard) has been developed by NIST (National Institute of Standards and Technology) over the course of many years of cooperation with industry. This symmetrical encryption standard has been developed to replace the earlier DES standard. AES specifies three different key lengths (128, 192, and 256 bits).

In 1997, NIST started the AES initiative and published its conditions for the algorithm. From the many proposed encryption algorithms, NIST selected a total of five algorithms for closer examination – MARS, RC6, Rijndael, Serpent, and Twofish. In October 2000, the Rijndael algorithm was adopted as the encryption algorithm.

CA certificate

How trustworthy is a certificate and the issuing CA (certification authority)? (? “X.509 certificate” on page 397) A CA certificate can be consulted in order to check a certificate bearing this CA's signature. This check only makes sense if there is little doubt that the CA certificate originates from an authentic source (i.e., is authentic). In the event of doubt, the CA certificate itself can be checked. If (as is usually the case) the certificate is

a sub-CA certificate (i.e., a CA certificate issued by a sub-certification authority), then the CA certificate of the superordinate CA can be used to check the CA certificate of the subordinate instance. If a superordinate CA certificate is in turn subordinate to another superordinate CA, then its CA certificate can be used to check the CA certificate of the subordinate instance, etc. This “chain of trust” continues down to the root instance (the root CA or certification authority). The root CA's CA file is necessarily self-signed, since this instance is the highest available and is ultimately the basis of trust. No-one else can certify that this instance is actually the instance in question. A root CA therefore is a state or a state-controlled organization.

The mGuard can use its imported CA certificates to check the authenticity of certificates shown by peers. In the case of VPN connections, for example, peers can only be authenticated using CA certificates. This requires all CA certificates to be installed on the mGuard in order to form a chain with the certificate shown by the peer. In addition to the CA certificate from the CA whose signature appears on the certificate shown by the VPN partner to be checked, this also includes the CA certificate of the superordinate CA, and so forth, up to the root certificate. The more meticulously this “chain of trust” is checked in order to authenticate a peer, the higher the level of security will be.

Client/server

In a client/server environment, a server is a program or computer which accepts and responds to queries from client programs or client computers.

In data communication, the computer establishing a connection to a server (or host) is also called a client. In other words, the client is the calling computer and the server (or host) is the computer called.

Datagram

In IP transmission protocols, data is sent in the form of data packets. These are known as IP datagrams. An IP datagram is structured as follows

IP header	TCP, UDP, ESP, etc. header	Data (payload)

The IP header contains:

– The IP address of the sender (source IP address)
– The IP address of the recipient (destination IP address)
– The protocol number of the protocol on the superordinate protocol layer (according to the OSI layer model)
– The IP header checksum used to check the integrity of the received header

The TCP/UDP header contains the following information:

– The port of the sender (source port)
– The port of the recipient (destination port)
– A checksum covering the TCP header and some information from the IP header (including source and destination IP address)

Default route

If a computer is connected to a network, the operating system creates a routing table internally. The table lists the IP addresses that the operating system has identified based on the connected computers and the routes available at that time. Accordingly, the routing table contains the possible routes (destinations) for sending IP packets. If IP packets are to be sent, the computer's operating system compares the IP addresses stated in the IP packets with the entries in the routing table in order to determine the correct route.

If a router is connected to the computer and its internal IP address (i.e., the IP address of the router's LAN port) has been relayed to the operating system as the default gateway (in the network card's TCP/IP configuration), then this IP address is used as the destination if all other IP addresses in the routing table are not suitable. In this case, the IP ad-

dress of the router specifies the default route because all IP packets whose IP address has no counterpart in the routing table (i.e., cannot find a route) are directed to this gateway.

DynDNS provider

Also known as *Dynamic DNS provider*. Every computer connected to the Internet has an IP address (IP = Internet Protocol). If the computer accesses the Internet via a dial-up modem, ISDN or ADSL, its Internet service provider will assign it a dynamic IP address. In other words, the address changes for each online session. Even if a computer is online 24 hours a day without interruption (e.g., flat-rate), the IP address will change during the session.

If this computer needs to be accessible via the Internet, it must have an address that is known to the remote peer. This is the only way to establish a connection to the computer. However, if the address of the computer changes constantly, this will not be possible. This problem can be avoided if the operator of the computer has an account with a DynDNS provider (DNS = Domain Name Server).

In this case, the operator can set a host name with this provider via which the computer should be accessible, e.g., www.example.com. The DynDNS provider also provides a small program that must be installed and run on the computer concerned. Every time a new Internet session is launched on the local computer, this tool sends the IP address used by the computer to the DynDNS provider. The domain name server registers the current assignment of the host name to the IP address and also informs the other domain name servers on the Internet accordingly.

If a remote computer now wishes to establish a connection to a computer that is registered with the DynDNS provider, then the remote computer can use the host name of the computer as the address. This establishes a connection to the responsible DNS in order to look up the IP address that is currently registered for this host name. The corresponding IP address is sent back from the DNS to the remote computer, which can then use it as the destination address. This now leads directly to the desired computer.

In principle, all Internet addresses are based on this procedure: first, a connection to a DNS is established in order to determine the IP address assigned to the host name. Once this has been accomplished, the “looked up” IP address is used to set up a connection to the required peer, which could be any site on the Internet.

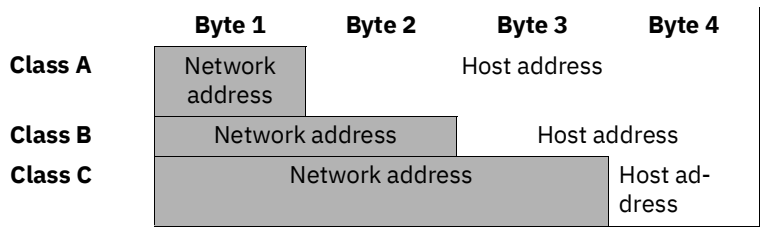
IP address

Every host or router on the Internet/Intranet has its own unique IP address (IP = Internet Protocol). An IP address is 32 bits (4 bytes) long and is written as four numbers (each between 0 and 255), which are separated by a dot.

An IP address consists of two parts: the network address and the host address.

Network address	Host address

All network hosts have the same network address, but different host addresses. The two parts of the address differ in length depending on the size of the respective network (networks are categorized as Class A, B or C).



The first byte of the IP address determines whether the IP address of a network device belongs to Class A, B or C. The following is specified:

	Value of byte 1	Bytes for the network address	Bytes for the host address
Class A	1 - 126	1	3
Class B	128 - 191	2	2
Class C	192 - 223	3	1

Based on the above figures, the number of Class A networks worldwide is limited to 126. Each of these networks can have a maximum of 256 x 256 x 256 hosts (3 bytes of address area). There can be 64 x 256 Class B networks and each of these networks can have up to 65,536 hosts (2 bytes of address area: 256 x 256). There can be 32 x 256 x 256 Class C networks and each of these networks can have up to 256 hosts (1 byte of address area).

Subnet mask

Normally, a company network with access to the Internet is only officially assigned a single IP address, e.g., 128.111.10.21. The first byte of this example address indicates that this company network is a Class B network; in other words, the last two bytes are free to be used for host addressing. Accordingly, an address area for up to 65,536 possible hosts (256 x 256) can be computed.

Such a huge network is not practical and generates a need for subnetworks to be built. The subnet mask is used here. Like an IP address, the mask is 4 bytes long. The bytes representing the network address are each assigned the value 255. The primary purpose of doing this is to enable a portion of the host address area to be “borrowed” and used for addressing subnetworks. For example, if the subnet mask 255.255.255.0 is used on a Class B network (2 bytes for the network address, 2 bytes for the host address), the third byte, which was actually intended for host addressing, can now be used for subnetwork addressing. This computes to potential support for 256 subnetworks, each with 256 hosts.

IPsec

IP security (IPsec) is a standard that uses encryption to verify the authenticity of the sender and to ensure the confidentiality and integrity of the data in IP datagrams (? “Datagram” on page 392). The components of IPsec are the Authentication Header (AH), the Encapsulating Security Payload (ESP), the Security Association (SA), and the Internet Key Exchange (IKE).

At the start of the session, the systems involved in communication must determine which technique should be used and the implications of this choice, e.g., *Transport Mode* or *Tunnel Mode*.

In *Transport Mode*, an IPsec header is inserted between the IP header and the TCP or UDP header respectively in each IP datagram. Since the IP header remains unchanged, this mode is only suitable for host-to-host connections.

In *Tunnel mode*, an IPsec header and a new IP header are prefixed to the entire IP datagram. This means the original datagram is encrypted in its entirety and stored in the payload of the new datagram.

Tunnel Mode is used in VPN applications: the devices at the ends of the tunnel ensure that the datagrams are encrypted/decrypted along the tunnel; in other words, the actual datagrams are completely protected during transfer over a public network.

Subject, certificate

In a certificate, confirmation is provided by a certification authority (CA) that the certificate does actually belong to its owner. This is done by confirming specific owner properties. Furthermore, the certificate owner must possess the private key that matches the public key in the certificate. (→ "X.509 certificate" on page 397).

Example

```
Certificate:
  Data:
    Version: 3 (0x2)
    Serial Number: 1 (0x1)
    Signature Algorithm: md5WithRSAEncryption
    Issuer: C=XY, ST=Austria, L=Graz, O=TrustMe Ltd, OU=Certificate Authority, CN=CA/Email=ca@trustme.dom
    Validity
      Not Before: Oct 29 17:39:10 2000 GMT
→   Subject: CN=anywhere.com,E=doctrans.de,C=DE,ST=Hamburg,L=Hamburg,O=Phoenix Contact,OU=Security
    Subject Public Key Info:
      Public Key Algorithm: rsaEncryption
      RSA Public Key: (1024 bit)
        Modulus (1024 bit):
          00:c4:40:4c:6e:14:1b:61:36:84:24:b2:61:c0:b5:
          d7:e4:7a:a5:4b:94:ef:d9:5e:43:7f:c1:64:80:fd:
          9f:50:41:6b:70:73:80:48:90:f3:58:bf:f0:4c:b9:
          90:32:81:59:18:16:3f:19:f4:5f:11:68:36:85:f6:
          1c:a9:af:fa:a9:a8:7b:44:85:79:b5:f1:20:d3:25:
          7d:1c:de:68:15:0c:b6:bc:59:46:0a:d8:99:4e:07:
          50:0a:5d:83:61:d4:db:c9:7d:c3:2e:eb:0a:8f:62:
          8f:7e:00:e1:37:67:3f:36:d5:04:38:44:44:77:e9:
          f0:b4:95:f5:f9:34:9f:f8:43
        Exponent: 65537 (0x10001)
    X509v3 extensions:
      X509v3 Subject Alternative Name:
        email:xyz@anywhere.com
      Netscape Comment:
        mod_ssl generated test server certificate
      Netscape Cert Type:
        SSL Server
  Signature Algorithm: md5WithRSAEncryption
    12:ed:f7:b3:5e:a0:93:3f:a0:1d:60:cb:47:19:7d:15:59:9b:
    3b:2c:a8:a3:6a:03:43:d0:85:d3:86:86:2f:e3:aa:79:39:e7:
    82:20:ed:f4:11:85:a3:41:5e:5c:8d:36:a2:71:b6:6a:08:f9:
    cc:1e:da:c4:78:05:75:8f:9b:10:f0:15:f0:9e:67:a0:4e:a1:
    4d:3f:16:4c:9b:19:56:6a:f2:af:89:54:52:4a:06:34:42:0d:
    d5:40:25:6b:b0:c0:a2:03:18:cd:d1:07:20:b6:e5:c5:1e:21:
    44:e7:c5:09:d2:d5:94:9d:6c:13:07:2f:3b:7c:4c:64:90:bf:
    ff:8e
```

The *subject distinguished name* (or *subject* for short) uniquely identifies the certificate owner. The entry consists of several components. These are called attributes (see the example certificate above). The following table contains a list of possible attributes. The sequence of attributes in an X.509 certificate can vary.

Table 14-1 X.509 certificate

Abbreviation	Name	Explanation
CN	Common name	Identifies the person or object to whom or which the certificate belongs. Example: CN=server1
E	E-mail address	Specifies the e-mail address of the certificate owner.
OU	Organizational unit	Specifies the department within an organization or company. Example: OU=Development
O	Organization	Indicates the organization or company. Example: O=Phoenix Contact

Table 14-1 X.509 certificate

Abbreviation	Name	Explanation
L	Locality	Indicates the location Example: L=Hamburg
ST	State	Specifies the state or county. Example: ST=Bavaria
C	Country	Two-letter code that specifies the country. (Germany=DE) Example: C=DE

A filter can be set for the subject (i.e., the certificate owner) during VPN connections and remote service access to the mGuard using SSH or HTTPS. This would ensure that only certificates from peers that have certain attributes in the subject line are accepted.

NAT (Network Address Translation)

Network Address Translation (NAT) (also known as *IP masquerading*) “hides” an entire network behind a single device, known as a NAT router. If you communicate externally via a NAT router, the internal computers in the local network and their IP addresses remain hidden. The remote communication partner will only see the NAT router with its IP address.

In order to allow internal computers to communicate directly with external computers (on the Internet), the NAT router must modify the IP datagrams that are sent from internal computers to remote partners and received by internal computers from remote partners.

If an IP datagram is sent from the internal network to a remote partner, the NAT router modifies the UDP and TCP headers of the datagram, replacing the source IP address and source port with its own official IP address and a previously unused port. For this purpose, the NAT router uses a table in which the original values are listed together with the corresponding new ones.

When a response datagram is received, the NAT router uses the specified destination port to recognize that the datagram is intended for an internal computer. Using the table, the NAT router replaces the destination IP address and port before forwarding the datagram via the internal network.

Port number

A port number is assigned to each device in UDP and TCP protocol-based communication. This number makes it possible to differentiate between multiple UDP or TCP connections between two computers and use them simultaneously.

Certain port numbers are reserved for specific purposes. For example, HTTP connections are usually assigned to TCP port 80 and POP3 connections to TCP port 110.

Proxy

A proxy is an intermediary service. A web proxy (e.g., Squid) is often connected upstream of a large network. For example, if 100 employees access a certain website frequently over a web proxy, then the proxy only loads the relevant web pages from the server once and then distributes them as needed among the employees. Remote web traffic is reduced, which saves money.

PPPoE

Acronym for **P**oint-to-**P**oint **P**rotocol **o**ver **E**thernet. A protocol based on the PPP and Ethernet standards. PPPoE is a specification defining how to connect users to the Internet via Ethernet using a shared broadband medium such as DSL, wireless LAN or a cable modem.

PPTP

Acronym for **P**oint-to-**P**oint **T**unneling **P**rotocol. This protocol was developed by Microsoft and U.S. Robotics, among others, for secure data transfer between two VPN nodes (? VPN) via a public network.

Router

A router is a device that is connected to different IP networks and communicates between them. To do this, the router has an interface for each network connected to it. A router must find the correct path to the destination for incoming data and define the appropriate interface for forwarding it. To do this, it takes data from a local routing table listing assignments between available networks and router connections (or intermediate stations).

Trap

SNMP (Simple Network Management Protocol) is often used alongside other protocols, in particular on large networks. This UDP-based protocol is used for central administration of network devices. For example, the configuration of a device can be requested using the GET command and changed using the SET command; the requested network device must simply be SNMP-compatible.

An SNMP-compatible device can also send SNMP messages (e.g., should unexpected events occur). Messages of this type are known as SNMP traps.

X.509 certificate

A type of “seal” that certifies the authenticity of a public key (? asymmetrical encryption) and the associated data.

It is possible to use certification to enable the user of the public key (used to encrypt the data) to ensure that the received public key is indeed from its actual issuer (and thus from the instance that should later receive the data). A *certification authority* (CA) certifies the authenticity of the public key and the associated link between the identity of the issuer and its key. The certification authority verifies authenticity in accordance with its rules (for example, it may require the issuer of the public key to appear before it in person). After successful authentication, the CA adds its (digital) signature to the public key. This results in a certificate.

An X.509(v3) certificate thus consists of a public key, information about the key owner (the Distinguished Name (DN)), authorized use, etc., and the signature of the CA (? Subject, certificate).

The signature is created as follows: the CA creates an individual bitstring from the bitstring of the public key, owner information, and other data. This bitstring can be up to 160 bits in length and is known as the HASH value. The CA then encrypts this with its own private key and then adds it to the certificate. The encryption with the CA's private key proves the authenticity of the certificate (i.e., the encrypted HASH string is the CA's digital signature). If the certificate data is tampered with, then this HASH value will no longer be correct and the certificate will be rendered worthless.

The HASH value is also known as the fingerprint. Since it is encrypted with the CA's private key, anyone who has the corresponding public key can decrypt the bitstring and thus verify the authenticity of the fingerprint or signature.

The involvement of a certification authority means that it is not necessary for key owners to know each other. They only need to know the certification authority involved in the process. The additional key information also simplifies administration of the key.

X.509 certificates are used for e-mail encryption with S/MIME or IPsec, for example.

Protocol, transmission protocol

Devices that communicate with each other must follow the same rules. They have to “speak the same language”. Rules and standards of this kind are called protocols or transmission protocols. Some of the more frequently used protocols are IP, TCP, PPP, HTTP, and SMTP.

Service provider

Service providers are companies or institutions that enable users to access the Internet or online services.

Spoofing, anti-spoofing

In Internet terminology, spoofing means supplying a false address. Using this false Internet address, a user can create the illusion of being an authorized user.

Anti-spoofing is the term for mechanisms that detect or prevent spoofing.

Symmetrical encryption

In symmetrical encryption, the same key is used to encrypt and decrypt data. Two examples of symmetrical encryption algorithms are DES and AES. They are fast, but also increasingly difficult to administrate as the number of users increases.

TCP/IP (Transmission Control Protocol/Internet Protocol)

Network protocols used to connect two computers on the Internet.

IP is the base protocol.

UDP is based on IP and sends individual packets. The packets may reach the recipient in a different order than that in which they were sent or they may even be lost.

TCP is used for connection security and ensures, for example, that data packets are forwarded to the application in the correct order.

UDP and TCP add port numbers between 1 and 65535 to the IP addresses. These distinguish the various services offered by the protocols.

A number of additional protocols are based on UDP and TCP. These include HTTP (Hyper Text Transfer Protocol), HTTPS (Secure Hyper Text Transfer Protocol), SMTP (Simple Mail Transfer Protocol), POP3 (Post Office Protocol, Version 3), and DNS (Domain Name Service).

ICMP is based on IP and contains control messages.

SMTP is an e-mail protocol based on TCP.

IKE is an IPsec protocol based on UDP.

ESP is an IPsec protocol based on IP.

On a Windows PC, the WINSOCK.DLL (or WSOCK32.DLL) handles the processing of both protocols.

(→ “Datagram” on page 392)

VLAN

A VLAN (Virtual Local Area Network) divides a physical network into several independent logical networks, which exist in parallel.

Devices on different VLANs can only access devices within their own VLAN. Accordingly, assignment to a VLAN is no longer defined by the network topology alone, but also by the configured VLAN ID.

VLAN settings can be used as optional settings for each IP. A VLAN is identified by its VLAN ID (1-4094). All devices with the same VLAN ID belong to the same VLAN and can communicate with one another.

The Ethernet packet for a VLAN (according to IEEE 802.1Q) is extended by 4 bytes, with 12 bits available for recording the VLAN ID. VLAN IDs “0” and “4095” are reserved and cannot be used for VLAN identification.

VPN (Virtual Private Network)

A **V**irtual **P**rivate **N**etwork (VPN) connects several separate private networks (subnetworks) via a public network (e.g., the Internet) to form a single common network. A cryptographic protocol is used to ensure confidentiality and authenticity. A VPN is therefore an inexpensive alternative to using permanent lines for building a nationwide company network.

15 Appendix

15.1 CGI interface

The additional HTTPS interfaces *nph-vpn.cgi*, *nph-diag.cgi, nph-status.cgi* and *nph-action.cgi* are implemented as CGI (**C**ommon **G**ateway **I**nterface) scripts.

For more information on using the CGI interfaces, see *mGuard Application Notes* (UM EN MGUARD APPNOTES), available at phoenixcontact.net/products or help.mguard.com.

When executing the CGI scrips *nph-vpn.cgi*, *nph-diag.cgi, nph-status.cgi* and *nph-action.cgi*, only the following characters may be used in user names, passwords, and other user-defined names (for example, the name of a VPN connection):

– Letters: A - Z, a - z
– Digits: 0 - 9
– Special characters: - . _ ~

If other special characters, such as "space" or the "question mark", are used, they must be encoded accordingly (URL encoding).

Each call of a CGI command creates a separate HTTPS session that is not automatically terminated. A maximum of 10 simultaneous HTTPS sessions are possible. Phoenix Contact recommends using session cookies and CSRF tokens to execute commands in the same session.

Examples:

curl -k -b session_cookie -H "X-CSRF-Token: $csrf" -X POST 'https://192.168.1.1/?cmd=action&action=vpn/start&name=Berlin'

curl --insecure "https://admin:mGuard@192.168.1.1/nph-action.cgi?action=tools%2Ftcpdump-start&interface=eth1"

The option ***-k*** or **--insecure** (*curl*) ensures that the HTTPS certificate on the mGuard does not undergo any further checking.

Table 15-1 Encoding of special characters (URL encoding)

(Space)	!	"	#	$	%	&	'	(	)	*	+
%20	%21	%22	%23	%24	%25	%26	%27	%28	%29	%2A	%2B

,	/	:	;	=	?	@	[	\	]	{	|	}
%2C	%2F	%3A	%3B	%3D	%3F	%40	%5B	%5C	%5D	%7B	%7C	%7D

15.2 Command line tool „mg“

The following commands can be executed on the command line of the mGuard by the users **root** and **admin**.

Table 15-2 Command line tool “mg“

Command	Parameter	Description
mg update	*patches*	An automatic online update will be started. The required package set will be determined automatically by the mGuard (see“Automatic Update” on page 99). **Patch-Releases** resolve errors in previous versions and have a version number which only changes in the third digit position.
	minor	**Minor- und major releases** supplement the mGuard with new properties or contain changes that affect the behavior of the mGuard. Their version number changes in the first or second digit position.
	major	
mg status	*/network/dns-servers*	**Used DNS server** Names of the DNS servers used by the mGuard for name resolution.
	/network/if-state/ext1/gw	**Current default route** The IP address that the mGuard uses to try to reach unknown networks.
	/network/if-state/ext1/ip	**External IP address** The addresses via which the mGuard can be accessed by devices from the external network. In *Stealth* mode, the mGuard adopts the address of the locally connected computer as its external IP.
	/network/if-state/ext1/net-mask	**Net mask of the external IP address.**

15.3 LED status indicator and blinking behavior

15.3.1 Representation of system states

The system states (status, alarm or error messages), which are displayed by the LED's lighting and blinking behavior, are shown in Table 15-3.

Table 15-3 System states represented by lighting and blinking behavior of the LEDs

PF1 (green)	PF2 (green)	PF3 (green)	PF4 (green)	PF5 (ERR) (red)	FAIL (FAULT) (red)	Description of the system state
Operational						
Heart-beat						The system status is OK. The PF1 LED is blinking in the rhythm "heartbeat".
System start						
Heart-beat				ON (~20 sec)	ON (~20 sec)	The system is booting. All LEDs of the Ethernet ports (LNK/ACT and SPD) briefly light up red/green. All PF LEDs (PF1-5) briefly light up orange. The PF1 LED is blinking in the rhythm "heartbeat".
Heart-beat				Blink 500/500	ON	The device failed to start after an integrity check of the file system. The file system is damaged or has been manipulated. The device can only be put back into operation with a rescue flash.
Heart-beat	ON (orange) (3 sec)					ECS: The configuration was successfully loaded and applied from the ECS.
Update						
				Blink 500/500		Bootloader replacement failed due to hardware error.
				Blink 500/500		Another severe error has happened.
Operation Supervision / Alarm output						
Heart-beat					ON	No connectivity on WAN interface (link supervision configurable on device)
Heart-beat					ON	No connectivity on LAN interface (link supervision configurable on device)
Heart-beat					ON	Power supply 1 or 2 failed (alarm configurable on device)
Heart-beat					ON	Temperature too high / low (alarm configurable on device)
Heart-beat					ON	(Redundancy) Connectivity check failed (alarm configurable on device)

Table 15-3 System states represented by lighting and blinking behavior of the LEDs

PF1 (green)	PF2 (green)	PF3 (green)	PF4 (green)	PF5 (ERR) (red)	FAIL (FAULT) (red)	Description of the system state
Heart-beat					ON	Administrator passwords not configured (alarm configurable on device)
Controllable VPN connections/firewall rule records (via service contacts)						
Heart-beat		Blink				**Service contact O1**: The VPN connection switched via service contact O1 will be established.
Heart-beat		ON				**Service contact O1**: The VPN connection switched via service contact O1 was successfully established. OR **Service contact O1**: The firewall rule record switched via service contact O1 was successfully activated .
Heart-beat			Blink			**Service contact O2**: The VPN connection switched via service contact O2 will be established.
Heart-beat			ON			**Service contact O2**: The VPN connection switched via service contact O2 was successfully established. OR **Service contact O2**: The firewall rule record switched via the service contact O2 was successfully activated.
External Configuration Storage (ECS)						
Heart-beat	ON (orange) (3 sec)					ECS: The configuration was successfully loaded and applied from the ECS.
Heart-beat				ON (3 sec)		ECS: The ECS is incompatible.
Heart-beat				ON (3 sec)		ECS: The capacity of the ECS is exhausted.
Heart-beat				ON (3 sec)		ECS: The root password from the ECS does not match.
Heart-beat				ON (3 sec)		ECS: Failed to load the configuration from the ECS.
Heart-beat				ON (3 sec)		ECS: Failed to save the configuration to the ECS.
Recovery procedure						
Heart-beat				ON (2 sec)		RECOVERY: The recovery procedure failed.
ON (2 sec)						RECOVERY: The recovery procedure succeeded.

Table 15-3 System states represented by lighting and blinking behavior of the LEDs

PF1 (green)	PF2 (green)	PF3 (green)	PF4 (green)	PF5 (ERR) (red)	FAIL (FAULT) (red)	Description of the system state
Flash procedure						
ON					ON	FLASH PROCEDURE: The flash procedure has been started. Please wait.
Running light	Running light	Running light			ON	FLASH PROCEDURE: The flash procedure is currently executed.
Blink 50/800	Blink 50/800	Blink 50/800			ON	FLASH PROCEDURE: The flash procedure succeeded.
				Blink 50/100 (5 sec)		FLASH PROCEDURE WARNING: Replacing the rescue system. Do not power off. When the blinking stops, the replacement of the rescue system is over.
				ON		FLASH PROCEDURE: The flash procedure failed.
				ON		FLASH PROCEDURE: The DHCP/BOOTP requests failed.
				ON		FLASH PROCEDURE: Mounting the data storage device failed.
				ON		FLASH PROCEDURE: Erasing the file system partition failed.
				ON		FLASH PROCEDURE: Failed to load the firmware image.
				ON		FLASH PROCEDURE: The signature of the firmware image is not valid.
				ON		FLASH PROCEDURE: Failed to load the install script.
				ON		FLASH PROCEDURE: The signature of the install script is not valid.
				ON		FLASH PROCEDURE: The rollout script failed.

Please observe the following notes

General terms and conditions of use for technical documentation

Phoenix Contact reserves the right to alter, correct, and/or improve the technical documentation and the products described in the technical documentation at its own discretion and without giving prior notice, insofar as this is reasonable for the user. The same applies to any technical changes that serve the purpose of technical progress.

The receipt of technical documentation (in particular user documentation) does not constitute any further duty on the part of Phoenix Contact to furnish information on modifications to products and/or technical documentation. You are responsible to verify the suitability and intended use of the products in your specific application, in particular with regard to observing the applicable standards and regulations. All information made available in the technical data is supplied without any accompanying guarantee, whether expressly mentioned, implied or tacitly assumed.

In general, the provisions of the current standard Terms and Conditions of Phoenix Contact apply exclusively, in particular as concerns any warranty liability.

Phoenix Contact reserves the right to register its own intellectual property rights for the product identifications of Phoenix Contact products that are used here. Registration of such intellectual property rights by third parties is prohibited.

Other product identifications may be afforded legal protection, even where they may not be indicated as such.

How to contact us

Internet

Up-to-date information on Phoenix Contact products and our Terms and Conditions can be found on the Internet at:
phoenixcontact.com

Make sure you always use the latest documentation.
It can be downloaded at:
phoenixcontact.net/products

Subsidiaries

If there are any problems that cannot be solved using the documentation, please contact your Phoenix Contact subsidiary.
Subsidiary contact information is available at phoenixcontact.com.

Published by

PHOENIX CONTACT GmbH & Co. KG
Flachsmarktstraße 8
32825 Blomberg
GERMANY

PHOENIX CONTACT Development and Manufacturing, Inc.
586 Fulling Mill Road
Middletown, PA 17057
USA

Should you have any suggestions or recommendations for improvement of the contents and layout of our manuals, please send your comments to:
tecdoc@phoenixcontact.com

Phoenix Contact GmbH & Co. KG
Flachsmarktstraße 8
32825 Blomberg, Germany
Phone: +49 5235 3-00
Fax: +49 5235 3-41200
Email: info@phoenixcontact.com
phoenixcontact.com

110191_en_10
Item No. –10