

AnaGate CAN FX2



User Manual

Analytica GmbH

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AnaGate CAN FX2: User Manual

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Abstract

This manual describes the modes of operation and interfaces of the *AnaGate CAN FX2*.

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Introduction

This document describes the functionality and features of the CAN FD-Ethernet gateway *AnaGate CAN FX2*.

This device is part of a product line, whose single device types mostly differ in the number of CAN interfaces and/or the device case. The differences are described by referring to a specific device in the series.

In this manual the term *AnaGate CAN Gateway* is uniformly used, if no specific model is addressed or it is not necessary to differentiate. Otherwise the full product name is used, such as *AnaGate CAN USB*, *AnaGate CAN uno*, *AnaGate CAN duo*, *AnaGate CAN quattro*, *AnaGate CAN X2*, *AnaGate CAN X4*, *AnaGate CAN X8*, *AnaGate CAN FX2*, *AnaGate CAN FX4*, *AnaGate CAN FZ8*, *AnaGate CAN FX8*, *AnaGate CAN FZ16*, *AnaGate CAN FZ16C4*, *AnaGate CAN F2*, *AnaGate CAN F4* or *AnaGate CAN F8*.

Chapter 1. Description

The *AnaGate CAN Gateway* connects a PC, an embedded device or other general devices to one or more CAN buses via the TCP/IP network protocol. It can function both as an active CAN bus participant and as a passive receiver.

For this purpose, the *AnaGate CAN FX2* provides an Ethernet interface and two electrically isolated CAN FD interfaces.

The *AnaGate CAN Gateway* is controlled and configured via a proprietary protocol based on TCP/IP. This protocol is described in detail (see [TCP-2010]). Free application libraries are available for devices with Windows or Linux operating systems. The entire range of functions of the individual devices can be integrated into application programs with these libraries.

In the *bridge mode*, the *AnaGate CAN Gateway* can connect two physically independent CAN networks via LAN/Ethernet (*LAN bridge mode*). This coupling allows the connection of separate CAN buses with different baud rates.



Note

The *AnaGate CAN duo*, *AnaGate CAN quattro*, *AnaGate CAN X2*, *AnaGate CAN X4*, *AnaGate CAN X8*, *AnaGate CAN FX2*, *AnaGate CAN FX4*, *AnaGate CAN FX8*, *AnaGate CAN F2*, *AnaGate CAN F4*, *AnaGate CAN F8*, *AnaGate CAN FZ8*, *AnaGate CAN FZ16* and *AnaGate CAN FZ16C4* (within a core unit) can also connect two internal CAN interfaces. The *AnaGate CAN uno* does not support this *internal bridge mode*.



Important

It is also possible to bridge a CAN FD network to a CAN network. However, it is important to note that CAN telegram data sent from CAN FD networks to CAN networks may be lost, since standard CAN supports only telegrams with a maximum of 8 data bytes.

1.1. Features

- The *AnaGate CAN FX2* can send and receive CAN/CAN FD messages via two independent CAN FD interfaces. The device can be controlled with a socket-compatible device (e.g. a PC or PLC).
- Each CAN FD interface can be operated individually with CAN 2.0 baud rates 20, 50, 62.5, 100, 125, 250, 500, 800 or 1000kbit/s and with CAN FD data baud rates 0.5, 1, 2, 4, 5 or 8Mbit/s. User defined baud rates are also possible.
- DIP switchable bus termination for each CAN FD interface. The bus termination cannot be set via software.
- The Power over Ethernet variant can alternatively be supplied via PoE/PoE+.
- Communication via a proprietary network protocol.
- Static or dynamic (DHCP) assignment of the IP address.

- Four analog inputs and four analog outputs are available, which can be accessed via Ethernet.
- Several simultaneous network connections (5x TCP and 1x UDP) are supported to each CAN FD interface.
- Coupling of two independent CAN networks via LAN bridge with two separate *AnaGate CAN Gateways*. All devices of the *AnaGate* product line, except for the *AnaGate CAN USB*, support this feature. CAN FD is only supported by the *AnaGate CAN F-series*.
- The internal bridge mode allows each CAN FD interface to be logically connected to one of the other CAN FD interfaces.

1.2. Specification

Technical aspect		Specification
System	Processor	Dual ARM Cortex A9 (1GHz)
	Memory	512MB RAM, 4GB eMMC Flash
	Operating system	Linux
Measurements	DIN rail casing	125mm x 127.5 mm x 51mm (WxLxH)
	Weight	approx. 250g
CAN bus	Baud rate	20 to 1000kbit/s (0.5 to 8Mbit/s CAN FD data baud rate), adjustable via software
	CAN controller	MCP2518FD
	CAN interface	2x ISO 11898-2, electrically isolated, CAN FD ISO or non-ISO
	Interface	2x pluggable clamp (4-pole, pitch 3.81mm) with CAN_H, CAN_L and GND
Analog IO	Inputs	4 (0-24V, $R_I \approx 500k\Omega$)
	Outputs ¹	4 (0.5V-min(24.5V; V_{Supply}), $I_{max}=250mA$)
LAN interface	Baud rate	10/100/1000 Mbps
	TCP/IP	Static or dynamic (DHCP) IP address
	Interface	RJ45 socket
Power supply	Voltage ²	$V_{Supply}=9-28V$ direct current, or optionally via PoE/PoE+
	Power consumption	about 5W (without USB or I/O devices)
Ambient temperatures	Storage	-40 .. 85 °C
	In operation	-20 .. 70 °C ³

¹Protected by a resettable fuse.

²The integrated resettable fuse resets at 1250mA (25°C). If high ambient temperatures are expected, a sufficiently high V_{Supply} must be provided (see Section 2.1, "Initial installation").

³After triggering the overtemperature protection, any further communication is disabled (except error codes from CANOpenDevice/OP_ANAGATE_CAN_OPEN_REQ) and the device must be power cycled.

Table 1.1. Technical data, AnaGate CAN FX2

1.3. Scope of delivery

The *AnaGate CAN Gateway* is supplied with the following components:

- 1x AnaGate CAN FX2
- 2x 4 pole plug connector with screw terminals for analog IO
- 1x 2 pole plug connector with screw terminals for external power supply
- 2x 4 pole plug connector with screw terminals for CAN interface

1.4. Interfaces and connections

1.4.1. AnaGate CAN FX2

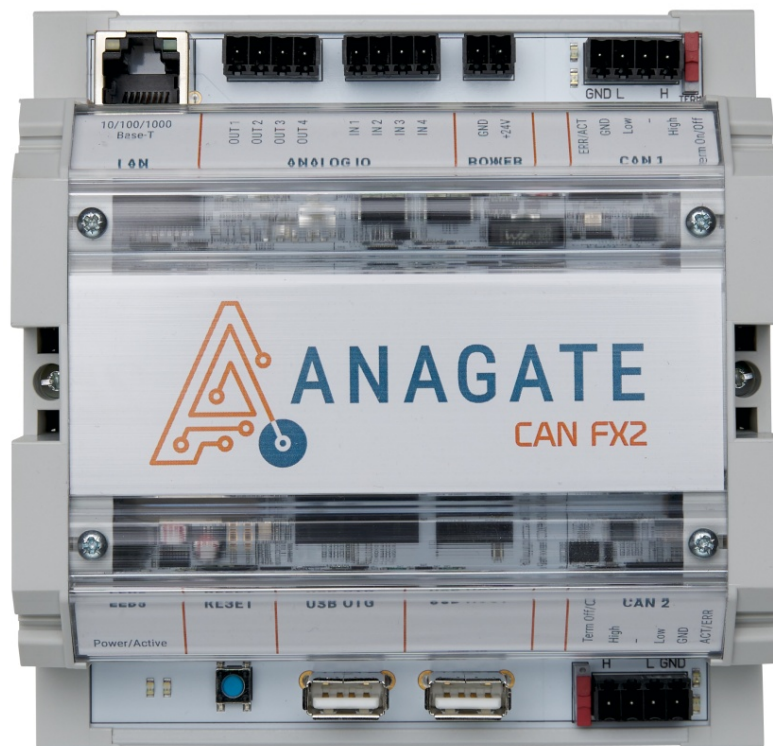


Figure 1.1. Top view AnaGate CAN FX2

The upper connector row of the *AnaGate CAN FX2* features the following connectors and LEDs (from left to right):

LAN

Via the RJ45 socket the *AnaGate CAN Gateway* is connected with the Ethernet. The device can be connected to a network component like a hub or a switch. For a direct connection to a PC, a crossover network cable has to be used. Devices with the optional PoE/PoE+ feature can use this socket for the power supply, if they are connected to a PoE/PoE+ capable network component.

Analog IO	The <i>AnaGate CAN Gateway</i> has 4 analog inputs and 4 analog outputs ¹ . The IOs are not electrically isolated from the device and are supplied by the external power supply (see Section 2.10, "Analog IO").
Power supply	The two pole clamping socket can be used to connect an external power supply. The integrated resettable fuse resets at 1250mA (25°C). If high ambient temperatures are expected, a sufficiently high V_{Supply} must be provided (see Section 2.1, "Initial installation").
CAN 1	<p>ACT LED This green LED lights up when sending and receiving CAN messages.</p> <p>ERR LED This red LED lights up during startup or if at least one error counter exceeds the limit value of 95 for the warning status.</p> <p>CAN 4 pole clamping socket to connect the CAN bus.</p>

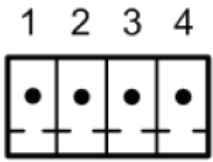
Pin	Description	
1	GND	
2	CAN_L	
3	not connected	
4	CAN_H	

Table 1.2. Pin out, CAN socket, upper connector strip

Term	This switch enables or disables the integrated CAN bus termination for the respective CAN port. The bus termination cannot be set via software.
------	---

The lower connector row features the following connectors and LEDs (from left to right):

Power LED	This LED lights up constantly green, when the power supply is stable.
Active LED	During an IP output or a factory reset, this LED flashes yellow (see Section 2.11, "Factory reset").
Reset	Pushing this button resets the <i>AnaGate CAN Gateway</i> to factory settings (see Section 2.11, "Factory reset").
USB OTG, USB Host	Two USB 2.0 interfaces(1x OTG, 1x Host) are available for future extensions or customer specific solutions.
CAN 2	<p>Term This switch enables or disables the integrated CAN bus termination for the respective CAN port. The bus termination cannot be set via software.</p> <p>CAN 4 pole clamping socket to connect the CAN bus.</p>

¹protected by a fuse, see specification

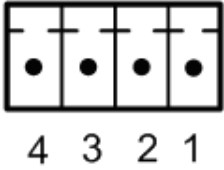
Pin	Description	
1	GND	
2	CAN_L	
3	not connected	
4	CAN_H	

Table 1.3. Pin layout, CAN socket, lower connector strip

- ACT LED This green LED lights up when sending and receiving CAN messages.
- ERR LED This red LED lights up during startup or if at least one error counter exceeds the limit value of 95 for the **warning status**.

Chapter 2. Configuration

2.1. Initial installation

First, the *AnaGate CAN Gateway* must be supplied with a voltage between 9V and 24V.



Important

The *AnaGate CAN F* series products have a resettable fuse installed, which resets at 1250mA (25°C). If high ambient temperatures are expected, a sufficiently high V_{Supply} must be provided, since the fuse triggers earlier at higher temperatures. A supply voltage of 24V is recommended in such cases.

Insert a LAN cable into the plug labeled LAN and connect it either to a hub or switch. If connecting directly to a PC, use a crossover LAN cable instead.

2.1.1. Factory settings

The *AnaGate CAN Gateway* has the following initial settings:

IP address	192.168.1.254
Address type	static
Network mask	255.255.255.0
Gateway	192.168.1.1
Web login password	password

The device can now be configured with a browser (Firefox, Chrome, etc.) by going to <http://192.168.1.254> .

The web interface is protected with a password (factory setting: "**password**"), which should be changed on the "Save/Reset Settings" page (see Section 2.6, "Save/Reset settings"). The local access can be locked again by clicking the menu item "Logout" or by closing the browser completely.

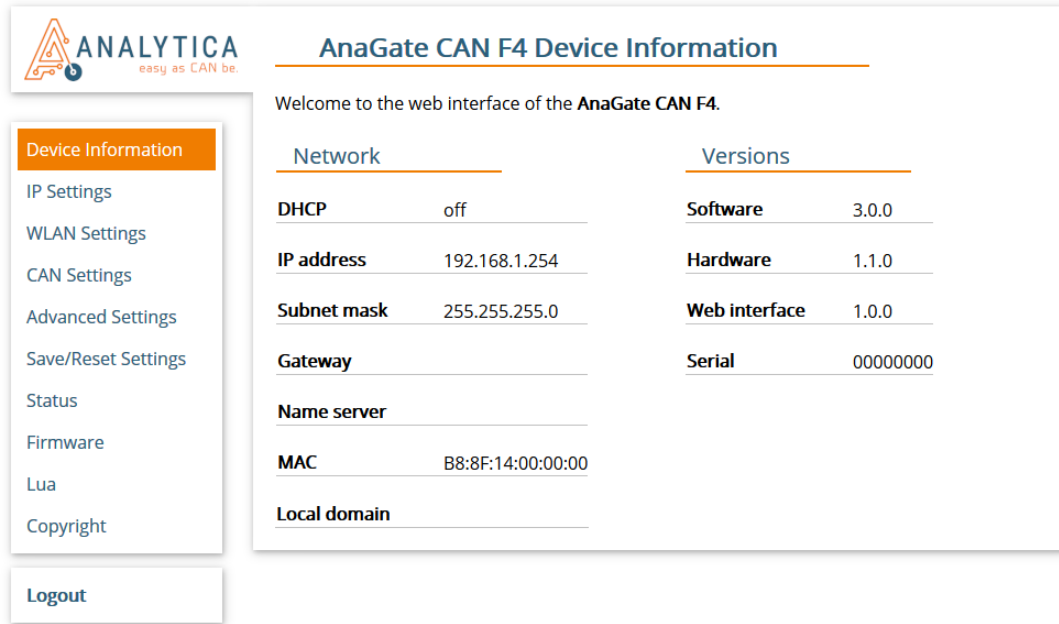


Figure 2.1. Web interface, AnaGate CAN F series



Note

The PC used for the configuration must be in the 192.168.1.x network. For example, the static IP address 192.168.1.2 with the subnet mask 255.255.255.0 can be used. If necessary, the settings of the network interface on the connected PC have to be changed temporarily.

2.2. Network settings

On the page *IP Settings* the following settings can be changed:

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AnaGate CAN F4 IP Settings

If DHCP is used, all of the following values are set by the DHCP server of the local network. Please ask your system administrator for the new IP address to access the AnaGate and this web interface.

DHCP ☐

Save all changes **Discard changes**

IP address 192.168.1.254

Subnet mask 255.255.255.0

Gateway

Name server

Local domain

Logout

Figure 2.2. Web interface, Network settings

DHCP	Here you can switch between static IP and dynamic (DHCP) addresses. If DHCP is being used, the remaining fields are ignored, because their values are retrieved from the DHCP server. In this case, a DHCP server must be available and accessible on the network.
IP address	The IP address of the <i>AnaGate CAN Gateway</i> is entered in dot format (e.g. 192.168.1.200).
Subnet mask	The subnet mask is entered in dot format (e.g. 255.255.255.0).
Gateway	The default gateway is entered in dot format (e.g. 192.168.1.1). Leave blank or enter 0.0.0.0, if a default gateway is not required.
Name server	The IP address of a name server, which resolves domain names (in dot format). If a name server is set, the end point of an IP bridge can be entered as a domain name (see Section 2.4, "CAN settings").
Local domain	Most queries for names within this domain can use short names relative to the local domain in the end point field of a CAN/IP bridge. The domain part begins after the first '.'. For example, if <i>xyz.local</i> is the local domain name, the short name <i>dest</i> is extended to <i>dest.xyz.local</i> .

The inputs are applied immediately after clicking the button **Save all changes** and saved permanently to the *AnaGate CAN Gateway*. A restart of the device is not necessary.



Note

After changing the IP address, it may be necessary to clear the *ARP cache* of the PC to access the device.

2.3. WLAN settings

Devices of the *AnaGate CAN F* series can use a WLAN ("Wireless Local Area Network") connection in addition to or instead of a wired Ethernet connection.



Note

Using WLAN on the *AnaGate CAN Gateway* requires a compatible WLAN-USB adapter. The WLAN settings are only displayed, if a compatible adapter has been detected. The adapter should be plugged in, before the *AnaGate CAN Gateway* is powered up. The following adapters are currently supported:

- TP-Link TL-WN721N
- TP-Link TL-WN721NC
- TP-Link TL-WN722N
- TP-Link TL-WN722NC

If a compatible WLAN adapter was detected, the following settings can be changed on the page *WLAN Settings*:

Figure 2.3. Web interface, WLAN settings

WLAN enabled	Here you can enable the wireless local area network.
SSID	The network name ("Service Set Identifier") can contain up to 32 ASCII characters or 34 to 64 hexadecimal characters.
Operation mode	This option allows the selection of the WLAN operation mode. When using the infrastructure mode, a connection to a central wireless access point is established. The wireless access point serves as a bridge or router to other networks.

	When using the ad-hoc mode, there is no central access point. Instead, all connected devices communicate directly with each other. Just like in infrastructure mode, all devices need to use the same SSID and encryption settings.
Channel	This option is only relevant in ad-hoc mode. It controls which channel and frequency range should be used. In infrastructure mode, the channel is selected by the central wireless access point instead.
Encryption mode	WPA ("Wi-Fi Protected Access") encryption offers the best security, but is only available in infrastructure mode. WEP encryption ("Wired Equivalent Privacy") is considered insecure and should only be enabled, if WPA cannot be used. WEP only offers slightly more protection than no encryption.
WPA mode	If WPA encryption is enabled, this option allows the selection of WPA, its successor WPA2 or both.
Cipher mode	If WPA encryption is enabled, this option allows the selection of the cipher mode. The encryption mode TKIP is deprecated. However, some older devices do not support the encryption algorithm AES.
Pre-shared key	<p>If WPA encryption is enabled, the network key can have a length of 8 to 63 ASCII or exactly 64 hexadecimal characters.</p> <p>If WEP encryption is enabled, the network key must have a length of exactly 13 ASCII or 26 hexadecimal characters.</p>
DHCP	Here you can switch between a static IP and dynamic allocation via DHCP.
IP address	Here you can enter the WLAN IP address of the <i>AnaGate CAN Gateway</i> , if DHCP is disabled.
Subnet mask	Here you can enter the WLAN subnet mask of the <i>AnaGate CAN Gateway</i> , if DHCP is disabled.
Gateway	Here you can enter the WLAN default gateway of the <i>AnaGate CAN Gateway</i> , if DHCP is disabled.



Note

If a gateway is configured for the WLAN interface, a gateway that was configured for the wired Ethernet interface will be disabled automatically.

The inputs are applied immediately after clicking the button **Save all changes** and saved permanently to the *AnaGate CAN Gateway*. A restart of the device is not necessary.



Note

After changing the IP address, it may be necessary to clear the *ARP cache* of the PC to access the device.



Figure 2.4. AnaGate CAN F4 with WLAN-USB adapter

2.4. CAN settings

The following settings for each CAN interface can be changed on the page *CAN Settings*:

Figure 2.5. Web interface, CAN settings

Nominal Bit Rate

The nominal bit rate can be selected in a list containing all supported values. If the option "User defined" is selected, the bit rate can be set directly by using the registers (BRP, T1, T2, SJW) of the MCP2518. User defined values are interpreted as hex values.

Termination

Activates/deactivates the internal termination resistor. For X* and FX* devices, the termination can only be set via the DIP switch.

High Speed

Activates/deactivates the *Highspeed mode*. In this operating mode all incoming or outgoing CAN telegrams are no longer confirmed by the opposite LAN partner in order to increase data throughput. Software filters are switched off in this mode.

Boot with operational mode

Start-up operating mode of the CAN controller. The default value is **offline**.

offline The CAN controller is not active on the CAN bus.

normal Normal operating mode. The set CAN baud rate is used.

listen The CAN controller is passive in listen mode. CAN messages are received, but no messages can be sent (no ACK, no error). The set CAN baud rate is used.

	<p>loopback In loopback mode, every sent CAN message is mirrored back by the CAN controller (no ACK, no errors). The set CAN baud rate is used.</p> <p>A more detailed description of the operating modes can be found in the data sheet of the CAN controller (Microchip MCP2518).</p>
Bridge	Activates/deactivates the <i>bridge mode</i> (see Section 3.2, "Bridge mode").
to IP	IP address of the partner AnaGate, to which a connection (bridge) is to be made (only in <i>bridge mode</i>). The IP address has to be entered in dot notation. A domain name can be used only, if a name server is set in the IP settings (see Section 2.2, "Network settings").
to Port	Port of the partner AnaGate, to which a connection (bridge) is to be made (only in <i>bridge mode</i>).
Remote Nominal Bit Rate	Nominal Bit Rate of the partner AnaGate, to which a connection (bridge) is to be made (only in <i>bridge mode</i>). If the option "User defined" is selected, the bit rate can be set directly by using the registers (BRP, T1, T2, SJW), if the partner AnaGate uses a MCP2518. User defined values are interpreted as hex values.
Remote-Termination	Activates/deactivates the termination of the partner AnaGate, to which a connection (bridge) is to be made (only in <i>bridge mode</i>). On target devices, which cannot set the CAN bus termination via software (e.g. AnaGate CAN X2/FX2), this setting is ignored.
CAN FD	Activates/deactivates the CAN FD mode.
ICO CRC	If enabled, the Stuff Bit Count (SBC) in the CRC field is included and a non-zero CRC initialization vector is used according to ISO 11898-1:2015.
Flexible Data Rate	The data bit rate can be selected in a list containing all supported values. If the option "User defined" is selected, the data bit rate can be set directly by using the registers (BRP, T1, T2, SJW, TDCO) of the MCP2518. User defined values are interpreted as hex values. TDCMOD is always set to "automatic" and TDCV is measured.
Remote ICO CRC	If enabled for the partner AnaGate, the Stuff Bit Count (SBC) in the CRC field is included and a non-zero CRC initialization vector is used according to ISO 11898-1:2015.
Remote Flexible Data Rate	The data bit rate of the partner AnaGate can be selected in a list containing all supported values. If

the option "User defined" is selected, the data bit rate can be set directly by using the registers (BRP, T1, T2, SJW, TDCO), if the partner AnaGate uses a MCP2518. User defined values are interpreted as hex values. TDCMOD is always set to "automatic" and TDCV is measured.

The inputs are applied immediately after clicking the button **Save all changes** and saved permanently to the *AnaGate CAN Gateway*. A restart of the device is not necessary.

2.5. Advanced settings

The page *Advanced Settings* contains the following settings:

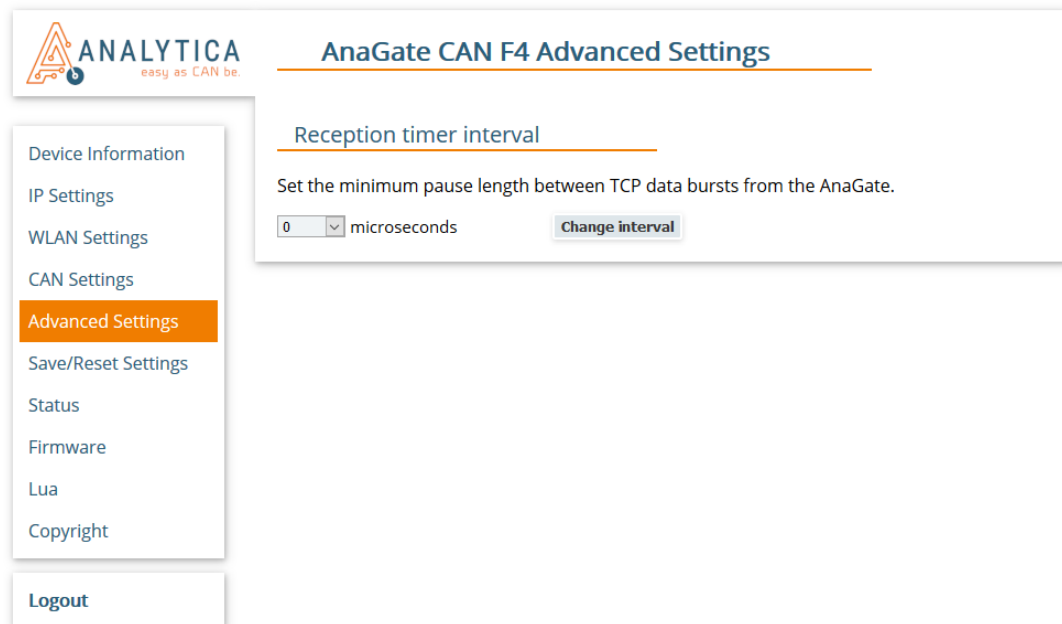


Figure 2.6. Web interface, Advanced settings

Reception timer interval

This value specifies the frequency with which the *AnaGate CAN Gateway* checks whether already received CAN messages are present in the internal driver buffer. The more frequently this check is performed, the shorter the latency times are when the CAN telegrams are passed on via Ethernet. By reducing the value, however, the maximum throughput is also reduced.

The interval is defined in microseconds and the default value is 0. If 0 is selected, the incoming message is immediately forwarded from the CAN driver to the firmware.

The inputs are applied immediately after clicking the button **Change interval** and saved permanently to the *AnaGate CAN Gateway*. A restart of the device is not necessary.

2.6. Save/Reset settings

The *Save/Reset Settings* page of the *AnaGate CAN F-series* web interface has the following settings:

Figure 2.7. Web interface, Save/Reset settings

Factory reset	A factory reset sets all CAN and network settings to default values (see Section 2.1, "Initial installation") and the firmware restarts.
Export settings	All CAN and network settings are downloaded as a backup file, which can be used to quickly configure multiple devices. The login password and WLAN PSK are encrypted.
Import settings	Select the backup file to import and upload it to the device. All previous settings will be deleted and the firmware will restart. All TCP connections have to be restarted.
Change login password	The login password can be changed by entering the old and new password and then clicking Change password .

If the password has been forgotten, the default password "**password**" can be restored with a factory reset by pushing the reset button (see Section 2.11, "Factory reset").



Note

After changing the IP address with a factory reset or backup import it may be necessary to clear the *ARP cache* of the PC to access the device.

2.7. Device status

The page *Status* summarizes the device status information.

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AnaGate CAN F4 Status

If JavaScript is enabled, the counters and the log are updated automatically every second.
Error counters can only be cleared by fixing the CAN bus problem or rebooting.

Internal temperature: 36.2 °C

TCP, CAN and Error Counters

[Clear Counters](#)

	CAN 1	CAN 2	CAN 3	CAN 4
TCP Received	0	0	0	0
TCP Transmitted	0	0	0	0
CAN Received	0	0	0	0
CAN Transmitted	0	0	0	0
CAN Bus Receive Error	0	0	0	0
CAN Bus Transmit Error	0	0	0	0
CAN Discarded Rx Full Queue	0	0	0	0
CAN Discarded Tx Full Queue	0	0	0	0
CAN Transmit Timeout	0	0	0	0

Diagnosis Log

[Clear Log](#)

Date	Description
2020 Mar 24 10:08:30	All CAN ports active.
2020 Mar 24 10:08:30	Firmware ready.

Figure 2.8. Web interface, Status

AnaGate CAN F-series devices display the current internal temperature.

TCP, CAN and Error Counters

The counters can be reset by clicking **Clear Counters**. CAN bus error counters can only be cleared by fixing the CAN bus problem or rebooting.

TCP Received	Number of via TCP/UDP received CAN messages (CAN firmware)
TCP Transmitted	Number of via TCP/UDP transmitted CAN messages (CAN firmware)
CAN Received	Number of received CAN messages (CAN bus, CAN driver)
CAN Transmitted	Number of transmitted CAN messages (CAN bus, CAN driver)
CAN Bus Receive Error	Receive error counter of the CAN controller
CAN Bus Transmit Error	Transmit error counter of the CAN controller
CAN Discarded Rx Full Queue	A successfully received CAN telegram was discarded because of a full firmware receive buffer. This problem occurs, if the CAN messages forwarded via TCP/UPD are not retrieved fast enough by the connected Ethernet client (PC, PLC).
CAN Discarded Tx Full Queue	A telegram to be sent was discarded because of a full firmware send buffer. This problem occurs, if telegrams cannot be sent successfully via CAN bus in time. This can occur as a consequence of timeouts or when trying to overload the CAN bus at the currently set baud rate.
CAN Transmit Timeout	Timeout while sending via CAN. This problem occurs, if no receiver on the CAN bus has acknowledged the message with an ACK (e.g. faulty physical connection, wrong baud rate, wrong termination).

Diagnosis Log

The diagnosis log lists general events and errors (highlighted in red) since the last device startup. Clicking **Clear Log** will permanently delete the diagnosis log.

2.8. Firmware update

The firmware of the *AnaGate CAN F-series* can be uploaded directly on the page *Firmware Update*. Further information and the firmware files can be found on the product homepage: www.anagate.de

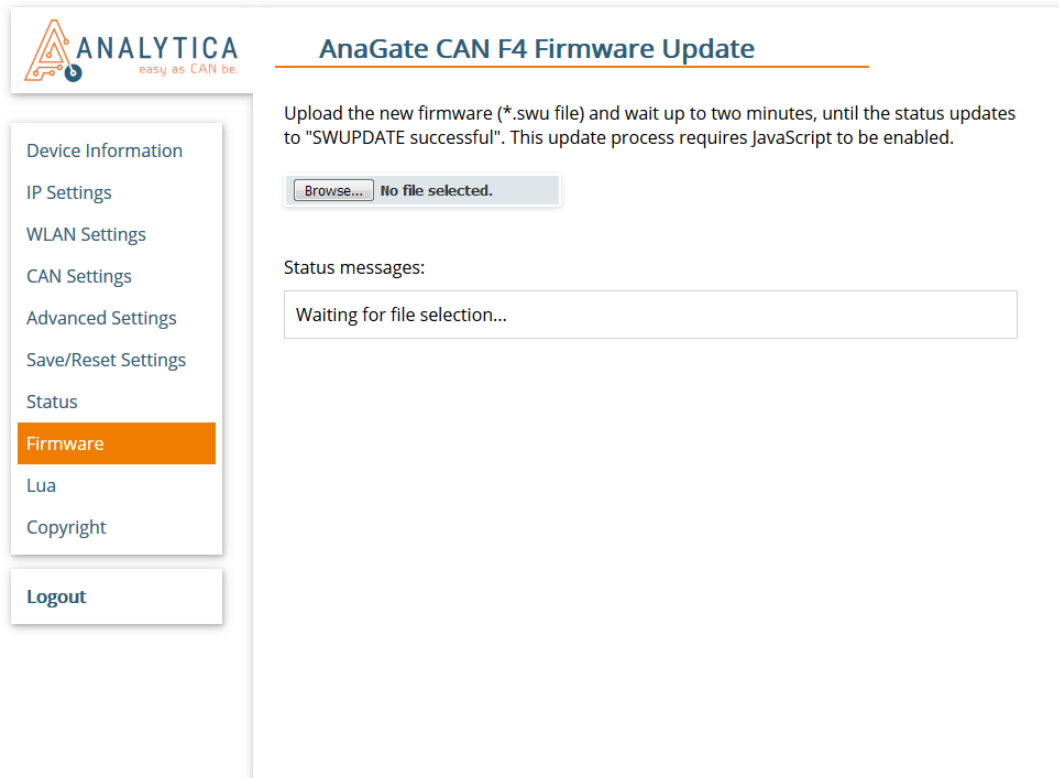


Figure 2.9. Web interface, Firmware update



Important

This update process requires JavaScript to be enabled in the browser.

All settings, logins and Lua scripts are usually retained after a firmware update.

The current firmware version is displayed on the start page *Device Information* of the web interface.

To install a different firmware version, click the file selection button on the page *Firmware Update* and select the firmware file (file extension *.swu). The firmware file must be selected directly, i.e. not compressed as *.zip or similar.

After the file selection, the file upload and then the update process start automatically. The update process can take up to two minutes and the individual steps are continuously updated under "*Status messages:*".

A successful update is confirmed with "*SWUPDATE successful*". Otherwise, an error message is displayed (highlighted in red).

After the update, reload the website or click on **Logout**. After logging in, check whether the new firmware version is displayed on the start page *Device Information*.

2.9. Functional extensions based on Lua

The *AnaGate CAN FX2* supports the execution of custom applications with an installed Lua script interpreter (see [Prog-2013] for a detailed description of all programming features).

Lua script files can be uploaded to the device and executed locally on the page *Lua*.

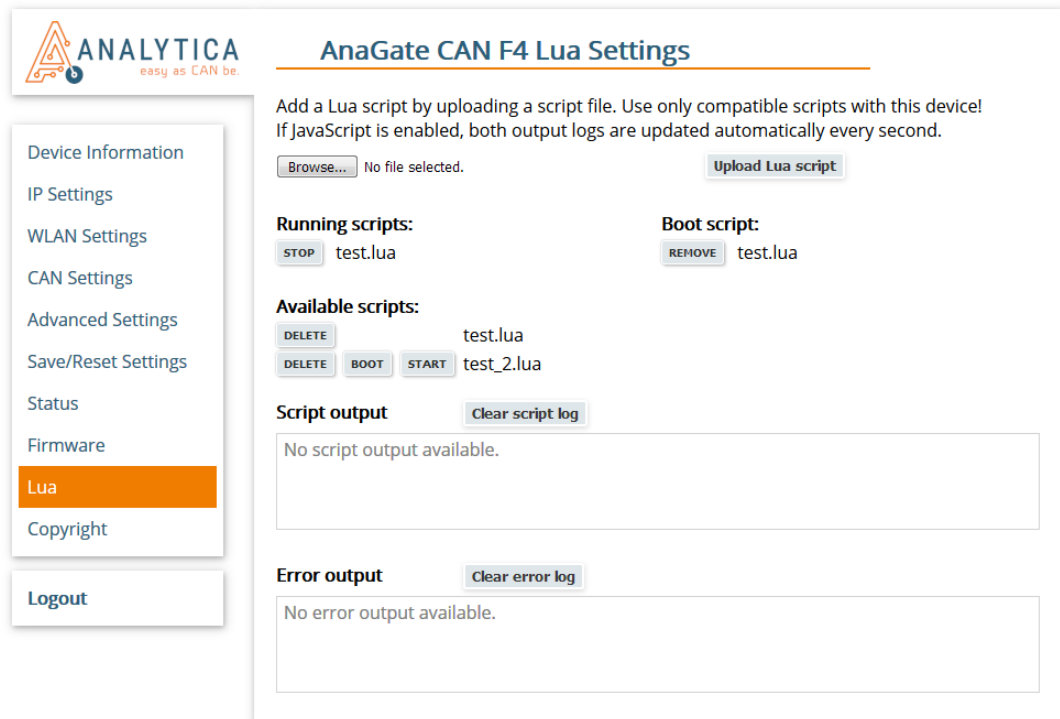


Figure 2.10. Web interface, Lua settings

Browse...	Opens a file upload dialog to select a Lua script file.
Upload Lua script	Uploads the selected script file to the device.
Running script	Displays the currently executing script file. The button Stop cancels the execution.
Boot script	Script file executed on system startup. The button Remove deactivates the boot script. Only one boot script is allowed.
Available scripts	Displays all currently available scripts on the device. To start a script, click on the button Start . The button Delete deletes the script from the device and the Boot button sets the script to be the boot script.
Script output	The standard output (stdout) of the currently running script is displayed in this text area. The button Clear script log erases previous output in this text area.

Error output The standard error output (stderr) of the currently running script is displayed in this text area. The button **Clear error log** erases previous output in this text area.

While a script is running, the text areas for standard output and standard error output are automatically updated, if JavaScript is enabled in the browser. Otherwise, the page must be refreshed manually.

2.10. Analog IO

There are 4 analog inputs and outputs available on the *AnaGate CAN FX2* , which can also be used as digital IOs.

2.10.1. Pin layout

The two 4-pole pin headers on the upper connector strip of the *AnaGate CAN Gateway* have four analog inputs and four analog outputs. There is no electrical isolation to the device, so the reference potential corresponds to the device supply (GND).

2.10.2. Connecting the inputs

In digital mode, the inputs are measured relative to the supply voltage U_S . A voltage level less than $U_S/2$ is interpreted as logical **LOW**, while a voltage level greater than $U_S/2$ is interpreted as logical **HIGH**. The typical input resistance is $\sim 500\text{ k}\Omega$.

In analog mode, the voltage of the inputs is measured. The measuring range is between 0 and 24V (independent from the supply voltage). The voltage values are given in mV and the resolution is $\sim 22\text{mV}$.

2.10.3. Connecting the outputs

The outputs are implemented as push/pull outputs.

In digital mode, the supply voltage U_S of the device is applied, if the output is active. If the optional PoE/PoE+ is used, U_S is 24V. Each output can be operated with a maximum current of 250mA. For logical **HIGH** $U_{\max} = \min(U_S - 1V; 24.5V)$ and for logical **LOW** $U_{\min} \sim 0.5V$ is applied.

In analog mode, any voltage between U_{\min} and U_{\max} can be applied with a resolution of $\sim 6\text{mV}$.



Warning

For thermal reasons, the maximum power dissipation P_D of each output must not exceed 0.5W ($P_D = (\text{supply voltage } U_S - U_{\text{OUT}}) \cdot I_{\text{LOAD}}$). The maximum current is 250mA.

2.11. Factory reset

In order to restore the default factory settings, press the *RESET* button for approx. 10 seconds. After the device is reset successfully, the yellow activity LED blinks until the *RESET* button is released.

The default factory settings are activated immediately without a restart of the device:

IP address	192.168.1.254
Address type	static
Network mask	255.255.255.0
Gateway	192.168.1.1
Web login password	password



Important

If the button is pressed for less than 10 seconds, the current IP address and network mask are flashed by the yellow LED. In this case, the device is not reset. A brief push of the button terminates the flashing immediately.



Note

A factory reset immediately after power on is not possible, until the operating system and the firmware are ready. This initialization period is indicated by the red activity LEDs of the CAN ports, when the device is switched on.



Note

After changing the IP address, it may be necessary to clear the *ARP cache* of the PC to access the device.

2.11.1. Checking the IP address

It is possible to check the current network settings directly on the device.

After briefly pressing the *RESET* button, the yellow activity LED starts to flash the current network settings. Pressing the button again stops the flashing immediately.

The IP address and subnet mask are displayed one after the other. The following pulse codes are used:

- Digits 1, 2, 3, ... 9: 1x, 2x, 3x, ...9x flashes (200ms pause between each flash)
- Digit 0: 10x flashes (200ms pause between each flash)
- Dot: 1x very fast flash

There is a one second pause between two successive digits. Two fast flashes are pulsed out between the IP address and the subnet mask.

1 9 2 . 1 6 8 . 1 . 1 |

■ ■■■■■■■■ ■■ □ ■ ■■■■■■ ■■■■■■■■ □ ■ □ ■ □□

Figure 2.11. AnaGate CAN Gateway, Example flash sequence

Chapter 3. Use cases

Wiring guide for connecting the *AnaGate CAN Gateway* to a CAN bus:

- **CAN_L**: This line has to be connected to the CAN_Low line of the CAN bus.
- **CAN_H**: This line has to be connected to the CAN_High line of the CAN bus.
- **GND**: As an option, this line can be connected to the GND of the other bus devices.

3.1. Gateway mode

In the gateway mode, CAN messages are transferred over TCP/IP between the CAN network and the host platform (e.g. PC) in both directions. The *AnaGate CAN Gateway* does not use a unique CAN ID when sending telegrams. This ID has to be set explicitly for each transmitted message.

All CAN messages received by the device are transmitted to all active LAN-connected host systems. It is possible to discard all incoming messages in general or to set individual software filters to reduce the message traffic to the host systems.

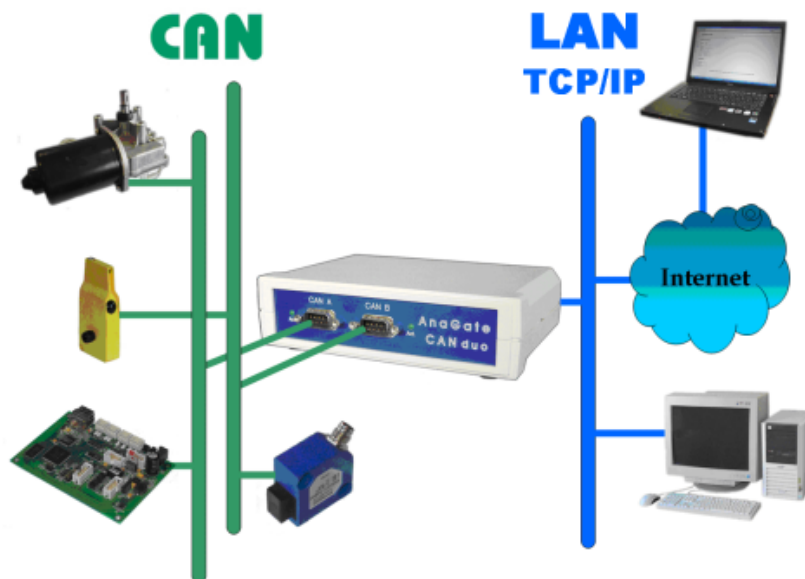


Figure 3.1. AnaGate CAN Gateway in gateway mode

The *AnaGate CAN Gateway* can be accessed via the following interfaces:

- The software CAN Monitor can be used to observe a CAN bus or to send CAN telegrams.
- Self-developed applications, which use the AnaGate software API for accessing the device.

- Self-developed batch files, which are executed using a Lua interpreter with the integrated AnaGate software API.

Further information and downloads for the CAN Monitor, AnaGate software API and Lua interpreter are available on www.anagate.de.

3.2. Bridge mode

In the bridge mode, two CAN networks can be interconnected by two *AnaGate CAN Gateways*. The CAN messages are exchanged over TCP/IP between the two devices in both directions.

It is possible to mix different *AnaGate CAN Gateway* models in bridge mode. CAN FD is only supported by the *AnaGate CAN F-series*.



Important

It is recommended to use unique CAN IDs in the interconnected CAN networks.

Use the web interface to configure the network and CAN settings of both *AnaGate CAN Gateways*.

Subsequently, one of the two devices has to be configured for the bridge mode. This can be done on the page *CAN Settings* of the web interface (see Section 2.4, "CAN settings"). This device establishes the network connection to the second device and manages the connection control. A bridge can be created for each CAN port of the device.

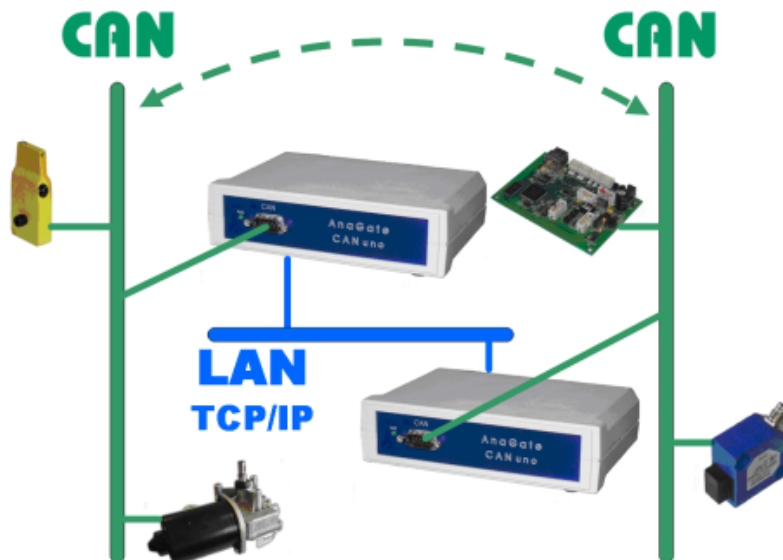


Figure 3.2. AnaGate CAN Gateway in bridge mode

The following additional parameters must be set for the device:

- The IP address of the partner device to which it should connect.
- The CAN port of the partner device to which it should connect (see Table A.1, "AnaGate ports").
- The baud rate of the partner device. The baud rate of the partner device is independent of the own baud rate and has to be configured separately. It is possible to interconnect CAN networks with different baud rates. CAN FD is only supported by the *AnaGate CAN F-series*.
- The internal termination resistor must be configured for the CAN port of the partner device. On target devices, which cannot set the CAN bus termination via software (e.g. AnaGate CAN X2/FX2), this setting is ignored.

After the *AnaGate CAN Gateway* establishes the connection to the partner device, the specified baud rate and the integrated termination are automatically configured on the partner device.



Important

It is also possible to bridge a CAN FD network to a CAN network. However, it is important to note that CAN telegram data sent from CAN FD networks to CAN networks may be lost, since standard CAN supports only telegrams with a maximum of 8 data bytes.



Tip

It is recommended to configure the *operational mode* of the target device to **offline** or **normal** (with the local baud rate). This reduces the risk that error frames are created on the local CAN network. If an invalid baud rate is selected on the target device, error frames can be created during the start-up phase of the target device, until the bridge mode is active.



Note

AnaGate CAN Gateways with more than one CAN port can interconnect two CAN ports on the same device (internal bridge mode).

To interconnect two CAN ports on a single device, the own IP address or 127.0.0.1 has to be used. In this case, the specified remote baud rate and remote termination is used on the target port.

3.3. CANopen Conformance Test Tool

The *CANopen Conformance Test Tool (CCT)* is a software tool, which is developed by *CAN in Automation (CiA)*. It is used by the CiA to certificate CANopen devices. This tool requires Microsoft Windows and a hardware device to get access to the CAN bus as well as the manufacturer-specific application library `COTI.dll`.

All CAN Ethernet gateways and the CAN USB gateway offered by *Analytica GmbH* can be used for the CANopen Conformance Test with the CCT of the CiA.

In order to use the *AnaGate CAN Gateway* with the CCT, the AnaGate-COTI extension must be copied to the installation directory of the CCT. The COTI extension files

are available on www.anagate.de . Furthermore, the configuration file `Settings.ini` must be customized for the CAN interface in use. The configuration file must also be placed in the installation directory of the CCT. It can be edited by any text editor, e.g. *Notepad*.

The file `Settings.ini` must contain the following settings:

```
[Interface0]
IP=192.168.2.1
Port=0
```

Example 3.1. Settings.ini

IP IP-Address of the *AnaGate CAN Gateway*.

The default address is `192.168.1.254`, which is the default network address of all *AnaGate CAN Gateways* with Ethernet interface.

Port Selected CAN Port of the *AnaGate CAN Gateway*.

Use the following settings:

Port 1 *Port=0*

Port 2 *Port=1*

Appendix A. FAQ - Frequently asked questions

A.1. General questions

Q: No network connection (1)

A: Please check the physical connection to the device first. Usually, the *AnaGate* has to be connected directly to a PC or to an active network component (hub, switch). If the *AnaGate* is connected to a PC, a crossover network cable must be used to connect the device.



The physical connection is OK, if the yellow link LED of the RJ45 socket turns on when the LAN cable is plugged in. The Link LED lights up constantly as long as the connection is maintained. On some *AnaGate* models, the LED also flashes synchronously with the green activity LED of the RJ45 socket during data transfer.

If the link LED is always off, then please check the wiring between the *AnaGate* and the hub, switch or PC.

Q: No network connection (2)

A: If the link LED indicates a proper Ethernet connection (see previous FAQ), but you still can't connect to the *AnaGate*, then please try the following:

1. Check if the *AnaGate* can be pinged. Open a command prompt and enter the command **ping a.b.c.d**, where a.b.c.d is the device IP address.
2. If the *AnaGate* is unreachable via ping, reset the device to factory settings. Set the IP address of your PC to 192.168.1.253 and the subnet mask to 255.255.255.0. Check if the *AnaGate* can be reached via **ping 192.168.1.254**.
3. If the device can be pinged, then try to open a TCP connection to port 5001. Open a command prompt and enter **telnet a.b.c.d 5001**, where a.b.c.d is the device IP address. If this command fails, check if a firewall runs on your PC or if there is a packet filter in the network between your PC and the *AnaGate*.

Q: No network connection after changing the network address

- A:** After changing the network address of the *AnaGate* on the web interface, the device is not longer reachable. The Internet browser displays only an empty web page without any error messages.

Please check if your anti-virus software has blocked the new network address. After changing the network address you are redirected to the new network address in the browser. Such actions are considered suspicious by some anti-virus software, so they block the new web page, sometimes even without notification of the user.

- Q:** Connection problems using multiple devices

- A:** If multiple devices with identical IP addresses are used in a local area network at the same time, the connections to the devices are not stable. It is therefore necessary to use different IP addresses on all devices.

This problem can also occur, if devices with identical IP addresses are not simultaneously connected to the network, but connected one after the other in short time intervals. For example, this can occur, if new devices, which have the default IP address 192.168.1.254, are configured from a single PC.

The **Address Resolution Protocol (ARP)** is used in IPv4 networks to determine the MAC address of a given IP address. This information is stored in the *ARP cache*. If wrong or no longer up-to-date entries are present, the affected hosts cannot be reached anymore.

An entry in the ARP cache is deleted, if it is not used anymore after a short period of time. The time interval is set by the operating system. The ARP cache can be displayed and modified with the **arp** command on Windows and Linux.

```
C:\>arp -a

Interface: 10.1.2.50 --- 0x2
    Internet Address      Physical Address      Type
    192.168.1.254         00-50-c2-3c-b0-df    dynamic
```

The command **arp -d** can be used to empty the *ARP cache*.



Note

After changing the IP address of a device, it may be necessary to clear the *ARP cache* of the PC to access the device.

- Q:** Open port in firewall

- A:** When working with a firewall, a TCP port has to be opened for communication with the *AnaGate*:

Device	Port
AnaGate I2C	5000
AnaGate I2C X7	5100, 5200, 5300, 5400, 5500, 5600, 5700
AnaGate CAN	5001
AnaGate CAN USB	5001

Device	Port
AnaGate CAN uno	5001
AnaGate CAN duo	5001, 5101
AnaGate CAN quattro	5001, 5101, 5201, 5301
AnaGate CAN X1	5001
AnaGate CAN X2 / FX2 / F2	5001, 5101
AnaGate CAN X4 / FX4 / F4 / FZ16C4	5001, 5101, 5201, 5301
AnaGate CAN X8 / FX8 / F8 / FZ8	5001, 5101, 5201, 5301, 5401, 5501, 5601, 5701
AnaGate CAN FZ16	5001, 5101, 5201, 5301, 5401, 5501, 5601, 5701, 5801, 5901, 6001, 6101, 6201, 6301, 6401, 6501
AnaGate SPI	5002
AnaGate Renesas	5008
AnaGate Universal Programmer UP/UPP	5000, 5002, 3333, 4444, 20, 21
AnaGate Universal Programmer UPR	5000, 5002, 5008, 3333, 4444, 20, 21
AnaGate Universal Programmer UP 2.0	5000, 5002, 3333, 4444, 20, 21

Table A.1. AnaGate ports

A.2. Questions about AnaGate CAN

- Q:** What is the value of the termination resistor when the termination option of the device is activated?
- A:** The termination resistor of the *AnaGate* is switched by a FET transistor. The resistor itself has 110 Ohm, while the internal resistance of the FET is 10 Ohm, when the FET is activated. The total resistance is 120 Ohm, as required by the CAN bus.
- Q:** Does Analytica offer a CAN gateway, which does not have an electrically isolated CAN interface?
- A:** Any device that is actively connected to a CAN bus should be electrically isolated. Especially, when using USB-operated devices (like the *AnaGate USB*), it is critical to have an electrically isolated device, since the device is powered by the PC.
- Q:** What to consider when connecting two CAN ports directly?
- A:** When directly connecting two CAN ports on the same or two separate *AnaGates*, the internal termination has to be active on both ports. A CAN bus network must have a termination on each end.



Note

It is recommended to use proper termination, even if it may seem to work without termination with lower baud rates.

Q: Receiving a NAK after sending a CAN telegram

A: If no CAN partner is connected to the *AnaGate CAN*, it is not possible to send CAN telegrams. The *AnaGate CAN* receives a NAK from its CAN controller, indicating that the package could not be sent.



Warning

If data confirmations are switched off, no errors are sent to the client. The option *send data confirmations for data requests* can be set in the API function `CANOpenDevice`. In High Speed Mode, data confirmations are always disabled.

Appendix B. Technical support

The AnaGate hardware series, programming interfaces and related software tools are developed and supported by Analytica GmbH. Technical support can be requested as follows:

Internet

The AnaGate web site www.anagate.de of Analytica GmbH contains the documentation and software downloads for AnaGate Library users.

Furthermore, the latest software and firmware updates, which include bug fixes or new features, are available here.

E-Mail

If you require individual technical assistance, please send an e-mail to:

`<support@anagate.de>`

To help us provide you with the best possible support, please keep the following information and details at hand, when you contact our support team:

- Version number of the used programming tool or AnaGate library
- AnaGate hardware series model and firmware version
- Name and version of the operating system you are using

Abbreviations

DHCP	<u>D</u> ynamic <u>H</u> ost <u>C</u> onfiguration <u>P</u> rotocol
CAN	<u>C</u> ontroller <u>A</u> rea <u>N</u> etwork
CAN FD	<u>C</u> ontroller <u>A</u> rea <u>N</u> etwork <u>F</u> lexible <u>D</u> ata-Rate
CiA	<u>C</u> AN in <u>A</u> utomation
I2C	<u>I</u> nter- <u>I</u> ntegrated <u>C</u> ircuit
SCL	<u>S</u> erial <u>C</u> lock <u>L</u> ine
SDA	<u>S</u> erial <u>D</u> ata Line
SPI	<u>S</u> erial <u>P</u> eripheral <u>I</u> nterface
CLK	<u>C</u> lock
MISO	<u>M</u> aster <u>I</u> n <u>S</u> lave <u>O</u> ut
SS	<u>S</u> lave <u>S</u> elect
MOSI	<u>M</u> aster <u>O</u> ut <u>S</u> lave <u>I</u> n
JTAG	<u>J</u> oint <u>T</u> est <u>A</u> ction <u>G</u> roup
TRST	<u>T</u> est <u>R</u> eset
SRST	<u>S</u> lave <u>R</u> eset
TDI	<u>T</u> est <u>D</u> ata <u>I</u> ntput
TDO	<u>T</u> est <u>D</u> ata <u>O</u> utput
TMS	<u>T</u> est <u>M</u> ode <u>S</u> elect Input
TCK	<u>T</u> est <u>C</u> lock

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