AnaGate CAN quattro

User Manual

Analytica GmbH

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Abstract

This manual describes the intefaces and modes of operation of a *AnaGate CAN quattro*.

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Revision 1.0	08.02.2008	Uwe	Initial version
Revision 1.1	23.07.2008	Uwe	Integration AnaGate CAN duo
Revision 1.2	17.04.2009	ASc	Integration AnaGate CAN quattro
Revision 1.3	18.05.2009	ASc	Description *Firmware-Update* added
Revision 1.4	10.08.2010	ASc	Manual changed to **DocBook** format

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Introduction

This document describes the features and objectives of the CAN-Ethernet gateway *AnaGate CAN quattro*.

This device is part of a product line, whose single devices only differ in the number of CAN interfaces and/or the device case.

In this manual the term *AnaGate CAN Gateway* is uniformly used, if no specific modell is addressed or it is not necessary to differentiate. Otherwise the full product name is used, like *AnaGate CAN uno*, *AnaGate CAN duo* or *AnaGate CAN quattro*.

Chapter 1. Description

The *AnaGate CAN Gateway* connects a PC, an embedded PC or other general device one or more CAN busses via the TCP/IP network protocol. It basically works as a CAN master with no own CAN identifier on the bus.

Controlling and configuration of an *AnaGate CAN Gateway* is made through TCP/IP. The application protocol itself is described in detail (see [TCP-2010]). Thus the access to the device can be programmed via native calls to the TCP/IP socket interface. This means that any communication partner with a LAN interface is able to communicate to the device. Accessing the *AnaGate CAN Gateway* with the supplied application libraries for Windows and Linux are much comfortable and can be used with conventional programming languages.

In bridge mode the *AnaGate CAN Gateway* can interconnect two physically independent CAN networks via LAN/Ethernet (*LAN bridge mode*). With the coupling over LAN/Ethernet it is possible to connect separate CAN buses with different baud rates over long distances.

Note

The *AnaGate CAN duo* and *AnaGate CAN quattro* can additionally interconnect two internal CAN interfaces (*internal bridge mode*).

1.1. Features

- The *AnaGate CAN quattro* can send and receive CAN messages via its four existing CAN interfaces independantly. This can be done using a device that supports TCP sockets (like a personal computer or a PLC).

- Variable CAN bus speed per interface (10, 20, 50, 62.5, 100, 125, 250, 500, 800 or 1000 kbps).

- Software configurable bus termination for each CAN interface.

- Two different plugs for voltage supply.

- System is addressed using a proprietary network protocol.

- Static or dynamic assignment (DHCP) of IP address.

- 4 digital inputs and outputs, which can be accessed via LAN/Ethernet (except *AnaGate CAN USB* and *AnaGate CAN uno (DIN rail)*).

- Several simultaneous network connections (4x TCP and 1x UPD) are supported on each existing CAN interface.

- Coupling of two independent CAN networks via the LAN/internet via a LAN bridge over two seperate devices. All devices of the *AnaGate* product line except the *AnaGate CAN USB* support this feature.

- Coupling of two independent CAN networks via the internal CAN/CAN bridge (only *AnaGate CAN duo* and *AnaGate CAN quattro*).

1.2. Specification

Table 1.1. Technical data, AnaGate CAN quattro

Technical aspect		Specfication
Measurements	Desktop casing	155mm x 105mm x 40mm , fixable on DIN rail with optional adapter kit
	Weight	approx. 175g
CAN bus	Baud rate	10, 20, 50, 62.5, 100, 125, 250, 500, 800 or 1000 kbps, software configuration
	CAN controller	4x Microchip MCP 2515
	CAN interface	4x ISO 11898-2 galvanic decoupled
	Interface	4x pluggable clamp (4-pole) incl. CAN_H and CAN_L
Digital IO	Inputs	4, galvanic decoupled (3,3 – 24V)
	Outputs	4, galvanic decoupled, 3,3 – 24V ($I_{total\ max}$ = 0,5A)
LAN interface	Baud rate	10/100 Mbps
	TCP/IP	Static or dynamic (DHCP) IP address
	Interface	RJ45 socket
Voltage supply	Voltage	9V-28V direct current
	Power consumption	max. 350 mA (9V) without plugged USB consumers
Ambient temperature	Storage	0 .. 85 °C
	In operation	0 .. 60 °C (industrial version: -20 .. 70°C)

Note

Protect the *AnaGate CAN Gateway* from direct sunlight.

1.3. Scope of delivery

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

• 1x AnaGate CAN Gateway

• 1x CD with manual, programming API for Windows/Linux and CANopen driver for CANFestival

• 1x 1,8 m Cat. 5 LAN cable (standard, not crossed)

• 1x 10 pole Wago plug connector (for digital IO)

• 4x 4 pole plug connector for CAN interface

• 1x 2 pole Wago plug connector (for external power supply)

• 1 x plug-in power supply unit, compatible with country of delivery: EU, US or UK .

1.4. Interfaces and plugs

1.4.1. AnaGate CAN quattro - front view

Figure 1.1. Front view, AnaGate CAN quattro

The front panel of the *AnaGate CAN Gateway* features for each existing CAN interface, the following connectors and LEDs (from left to right):

Activity LED   This green LED lights up on activity on the relevant CAN line.

CAN port   4 pole plug to connect the CAN bus. The corresponding connector plug is included
                     in delivery (screw terminal up to 1,5mm²).
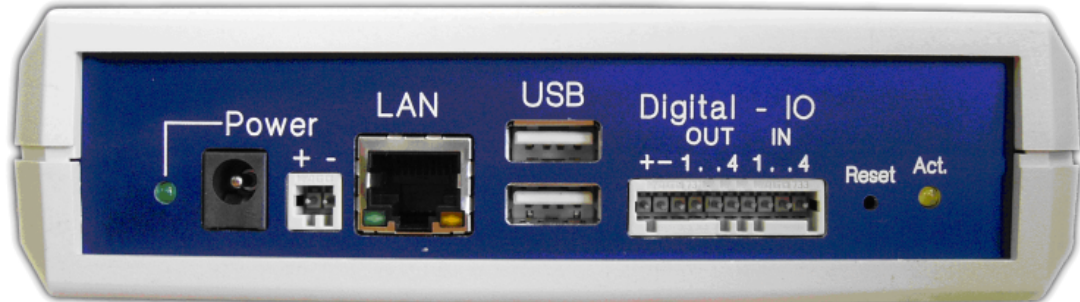
                     The pin allocation of the plug can be inferred from the following table.

Table 1.2. Pin layout, CAN plug

Pin	Description
1	GND
2	CAN_L
3	not connected
4	CAN_H

1.4.2. AnaGate CAN quattro - rear view

Figure 1.2. AnaGate CAN quattro, back panel

The rear panel of the *AnaGate CAN Gateway* features the following connectors and LEDs (from left to right):

Power LED
: This green LED lights up when voltage is being supplied.

Power supply
: The *AnaGate CAN Gateway* can be power supplied in two different ways.

  For the use as desktop device the barrel connector socket is intended, in order to supply the device via a plug power supply

  For the use in a switchboard the two-pole Wago clamping socket can be used to connect an external power supply.

> **⊗ Warning**
>
> Be sure to use only one power supply.

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.

USB Hosts
: The *AnaGate CAN Gateway* has two USB 1.1 interfaces for further extensions or customer specific solutions.

Digital IO
: The *AnaGate CAN Gateway* has 4 digital inputs and 4 digital outputs which can be used freely. The digital io are galvanically decoupled from the device and must be externally power supplied from 3,3V to 24V (see Section 2.5, " Digital IO").

Reset
: The *AnaGate CAN Gateway* can be reset to the factory settings using this button (see Section 2.7, " Factory reset" for further details).

Activity LED
: This yellow LED lights up when the *AnaGate CAN Gateway* is processing incoming CAN messages.

Chapter 2. Configuration

2.1. Initial installation

First the *AnaGate CAN Gateway* must be supplied via the power plug with a tension from 9 to 24 V.

Insert the included LAN cable into the plug labelled LAN and connect it either to a hub or switch. If connecting to a PC use a crossover LAN cable (not in scope of delivery) instead of the included LAN cable.

The *AnaGate CAN Gateway* is delivered with the following initial network settings:

IP address	192.168.1.254
Address type	static
Network mask	255.255.255.0
Gateway	192.168.1.1

The device can now be configured using a standard browser (Internet Explorer, Firefox, etc.) by using `http://192.168.1.254`.

Figure 2.1. HTTP interface, AnaGate CAN uno
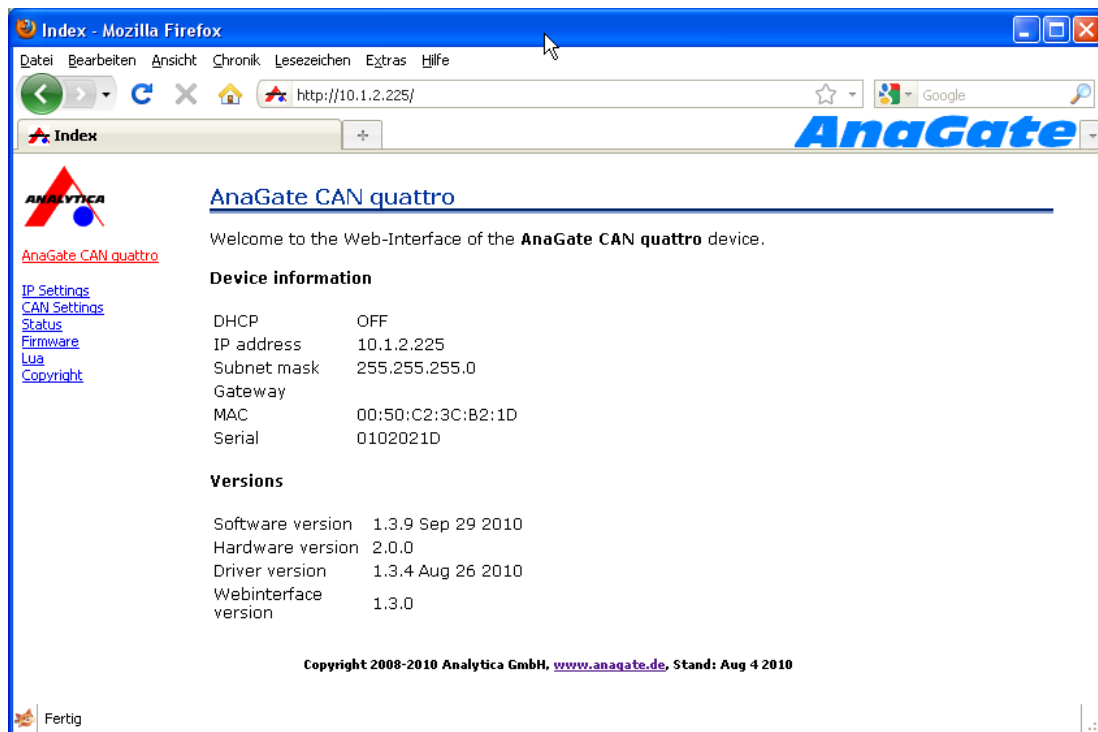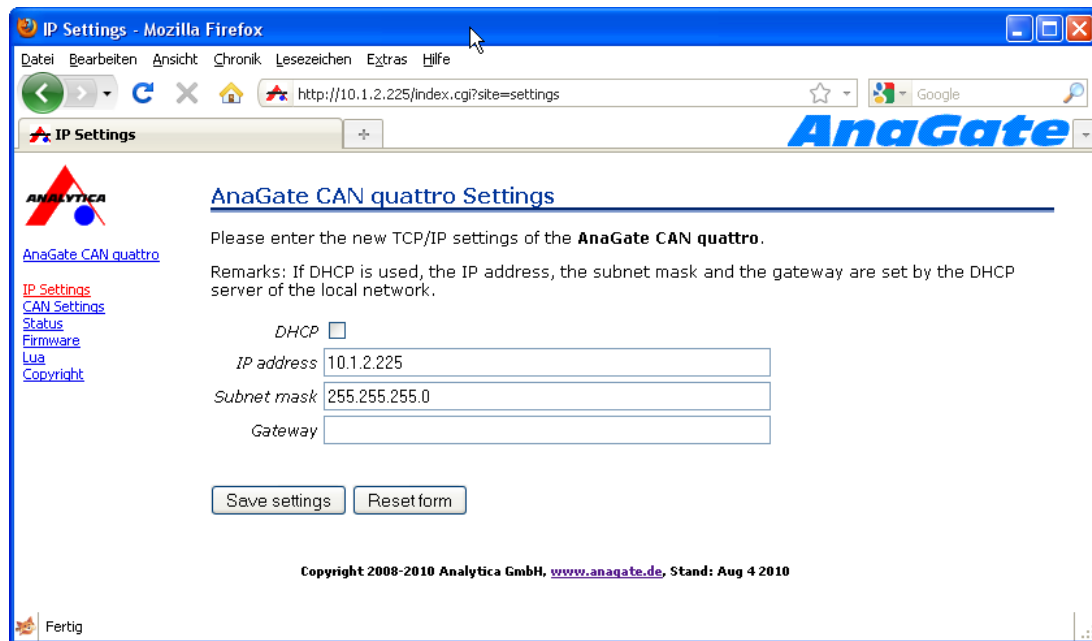

> **Note**
>
> The PC used for the configuration must be in the `192.168.1.x` network. The static IP address `192.168.1.2` with the subnet mask `255.255.255.0` can be e.g. used. If neccessary the settings of the network interface on the configuration pc has to be changed temporarily.

2.2. Network settings

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

DHCP   Here you can switch between static IP and dynamic (via DHCP) addresses. If DHCP is being used, the remaining fields are ignored, because this information is retrieved from the DHCP server.

In this case, a DHCP server must be available and accessible in the network.

IP address   The IP address of the *AnaGate CAN Gateway* is entered in a.b.c.d format (e.g. 192.168.1.200).

Subnet mask   The subnet mask is entered in a.b.c.d format (e.g. 255.255.255.0).

Gateway   The default gateway is entered in a.b.c.d format (e.g. 192.168.1.1). Leave blank or enter 0.0.0.0 if a default gateway is not required.

Figure 2.2. HTTP interface, network settings

The inputs will be taken over immediately after clicking the button Save settings and saved permanently on the *AnaGate CAN Gateway*. A restart of the device is not necessary for activation of the settings.
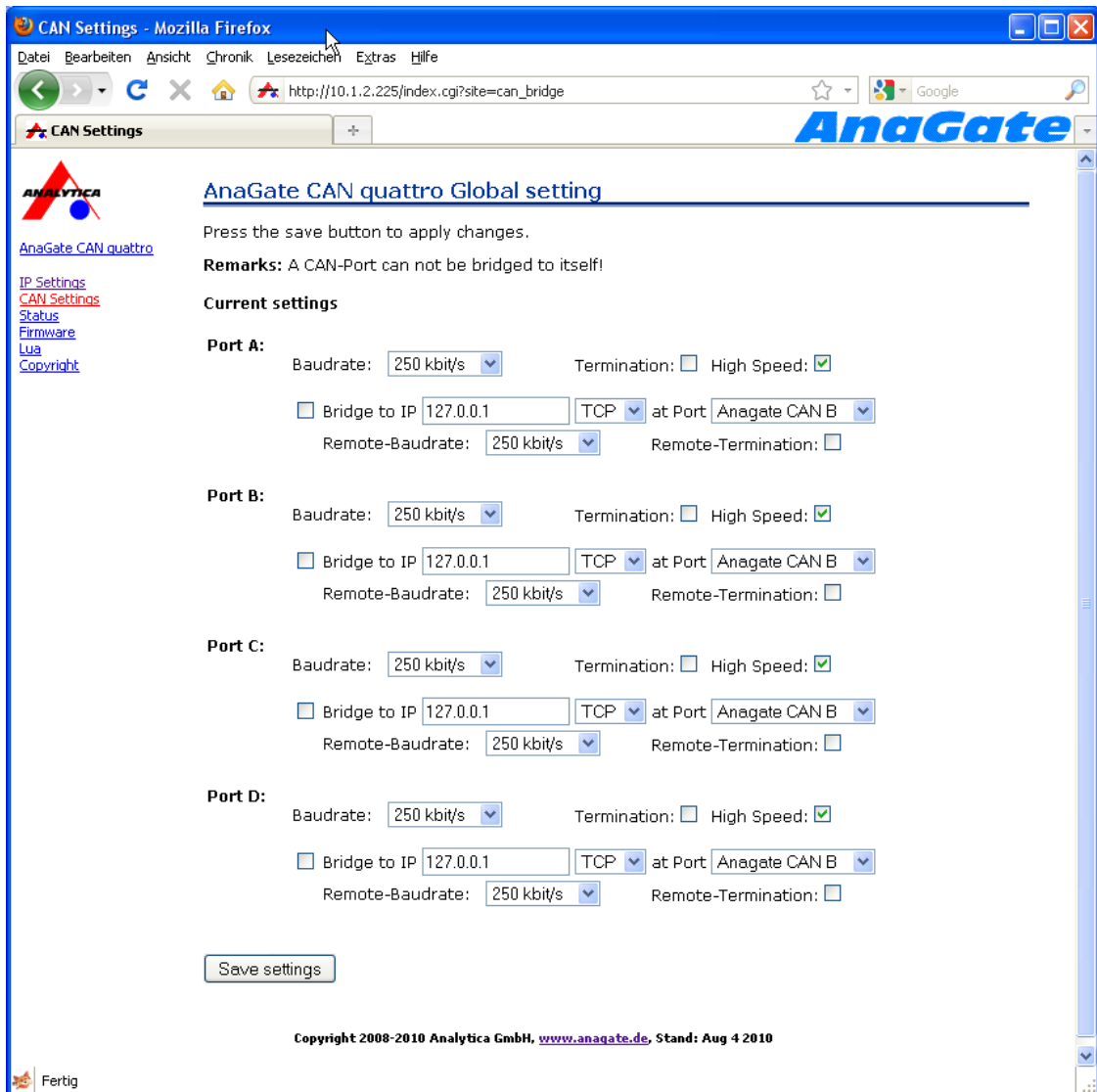
Note

Maybe the *ARP cache* of the PC has to be deleted to find the device with the changed IP address.

2.3. CAN settings

On the page *CAN Settings* the global settings for all existing CAN interfaces are displayed and can be changed individually.

Figure 2.3. HTTP interface, CAN settings

Baudrate	The baud rate can be selected easily via a list box containing all supported values.
Termination	Use the check box to switch on/off the internal termination resistor.
High Speed	Activates/deactivates the *Highspeed mode*. In this operating mode all incoming/outgoing CAN telegrams are not longer confirmed by the opposite LAN side to accelerate process throughput. Software-Filters are switched off too in this mode.
Bridge	Activates/deactivates the *bridge mode* (see Section 3.2, " Bridge mode").
to IP	IP address of the partner device, to which a connection (bridge) is to be made (only *Bridge Modus*).
at Port	Port of the partner device, to which a connection (bridge) is to be made (only *Bridge Modus*).

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Remote-Baudrate   Baudrate of the partner device, to which a connection (bridge) is to be made (only *Bridge Modus*).

Remote-Termination   Terminierung of the partner device, to which a connection (bridge) is to be made (only *Bridge Modus*).

The inputs will be taken over immediately after clicking the button `Save settings` and saved permanently on the *AnaGate CAN Gateway*. A restart of the device is not necessary for activation of the settings.

2.4. Functional extensions based on LUA

On a *AnaGate CAN quattro* it is possible to execute self-created applications with an installed LUA script interpreter (see [Prog-2010] for a detailed description of all programming features).

On the page *LUA* LUA script files can be downloaded to the device and executed locally.

Figure 2.4. HTTP interface, LUA settings
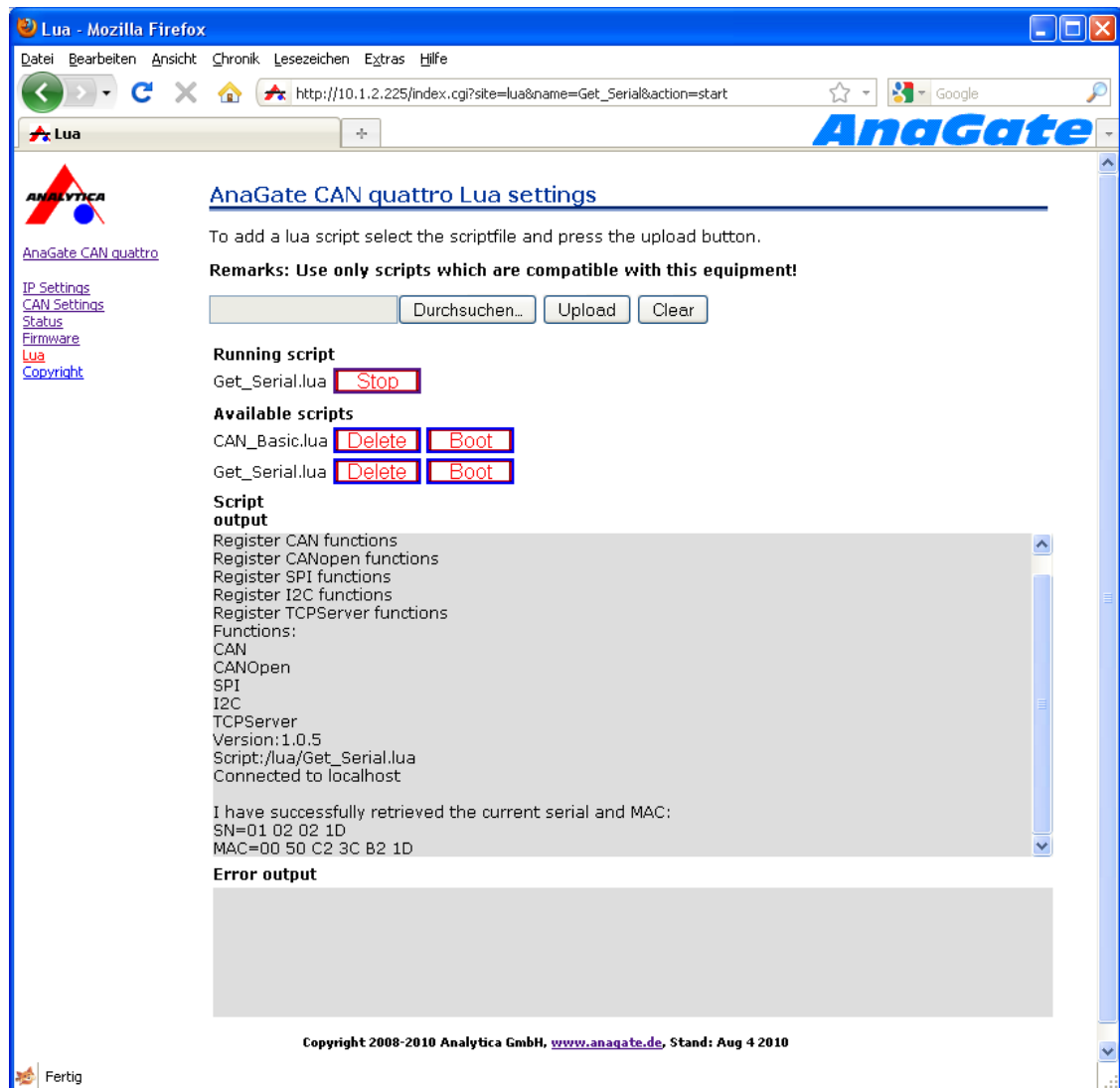
`Browse...`   Opens a file upload dialog to select a LUA script file.

`Upload`   Uploads the selected script file to the device.

`Clear`   Clears the current script file selection.

Boot script   Script file executed on system startup. Via the button `Delete` the boot script can be deactivated. Only one boot script is allowed.

Running script   Displays the currently executing script file. Via the button `Stop` the execution can be cancelled.

Available scripts   Displays all scripts which are currently available on the device.

   To start the execution of a script click on the button `Start`. Via button `Delete` a script can be deleted on the device and via `Boot` a script can be defined as boot script.

script output area   In this text area the standard output (stdout) of the currently executing script is displayed. Via the button `Clear` this text area can be cleared.

error output area   In this text area the standard error output (stderr) of the currently executing script is displayed. Via the button `Clear` this text area can be cleared.

Tip

The text areas for script and error output are not refreshed automatically. A manual page reload of the current page refreshes both text areas.

2.5. Digital IO

Over the 10-pole pin row on the back of the *AnaGate CAN Gateway* four digital inputs and four digital outputs are led out, which can be used freely. Since the IO's are electrically isolated from the *AnaGate CAN Gateway*, they must be separately supplied via the pins 1 us 2 with a voltage by 3,3V - 24V DC.

Figure 2.5. Pin layout, digital IO plug
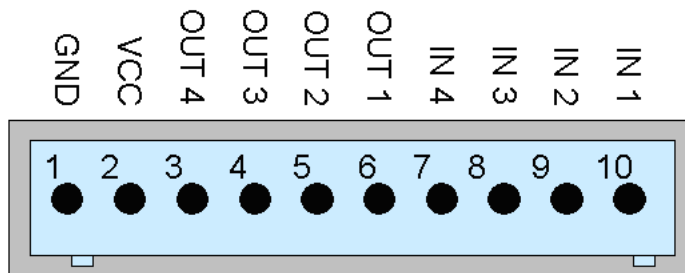
2.5.1. Connecting the digital inputs

At the inputs IN1 to IN4 any external voltage between VCC and GND can be applied. As soon as the voltage difference between INx and GND is more than 1.0 V, the *AnaGate CAN Gateway* interprets the input as logically `HI` otherwise `LOW`.

2.5.2. Connecting the digital outputs

The outputs are implemented as open collector drivers. If a output is active, it is pulled down to GND. In the inactive condition the output is floating.

In principle the maximum current of each individual output is 400mA. For thermal reasons is the sum of all output currents is limited to 500mA. The outputs not short-circuit proofed, and must be protected with a pre-resistor.

2.6. Firmware update

Use the *Firmware* page to load a new firmware to the *AnaGate CAN Gateway*.

Please visit our Web site `http://www.anagate.de` for further information.

2.7. Factory reset

In order to restore the default factory settings, hold the *RESET* for approx. 10 seconds. If the device is reset successfully, the yellow LED blinks until the *RESET* 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`

Important

If the *RESET* push-button is pressed too briefly, the actual IP address and network mask is pulsed via the yellow LED (Morse code). A second push of the *RESET*, terminates the pulsing, the device is not reset.

Note

The factory reset is not possible directly after power on until complete loading of operating system and firmware of the device. This initialization period is signalled via the yellow activity LED. On power on the LED is switched on and after initialization the LED is switched off.

Note

Maybe the *ARP cache* of the PC has to be deleted to find the device with the changed IP address.

2.7.1. Examining the network settings

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

After pressing shortly the *RESET* button the device starts to pulse out the current n settings via the yellow activity LED. Pressing again the buttons stops the pulsing immediately.

The IP address and subnet mask are pulsed out, one after the other. Following pulse codes are used:

- Digits 1, 2, 3, ..., 9: 1x, 2x, ...9x Flashing (200ms delay between each flash)

- Digit 0: 10x flashing (200ms delay between each flash)

- Dot: 1x very fast flash

Between two single digits a delay of 1 seconds is made, and between the IP address and subnet mask two fast flashes are pulsed out.

Figure 2.6. AnaGate CAN Gateway, Example blinking output

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Chapter 3. Fields of application

If the *AnaGate CAN Gateway* is connected to the CAN bus, mind the following facts:

- **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**: This line can be connected optionally to GND of the other bus devices.

3.1. Gateway mode

In gateway mode the CAN messages are transferred transparently over TCP/IP between the CAN network and the host platform (e.g. PC) in both directions. The *AnaGate CAN Gateway* uses no 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
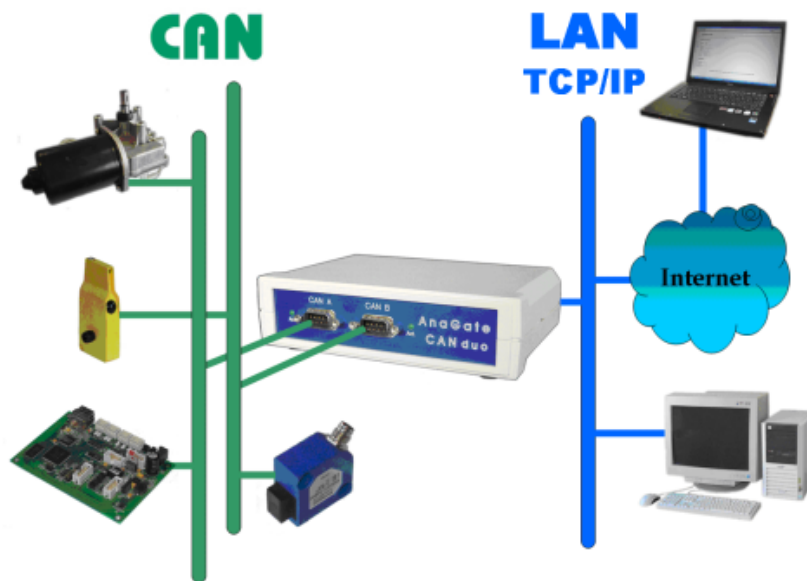
- The software program CAN Monitor, which is included on the documentation CD, can be used to monitor a CAN bus or to create single CAN telegrams.

- Application programs, which are using the included software API inteface.

- Self-created batch files which are executed via the included LUA interpreter with integrated AnaGate software API.

3.2. Bridge mode

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

It is possible to mix the different *AnaGate CAN Gateway* models in bridge mode.

> ⚠️ **Important**
>
> It is recommended to use unique CAN identifiers in the interconnected CAN networks.

Via HTTP interface both *AnaGate CAN Gateway* are configured as usual.

Subsequently one of the two devices has to be configured for the bridge mode. This can be done by the page *CAN Settings* of the web interface (see Section 2.3, " CAN settings"). This device acts in a manner of speaking as master and establishes the network connection to the second device and manages connection control. Basically a bridge can be created for each existing CAN interface of the device.

Figure 3.2. AnaGate CAN Gateway in bridge mode
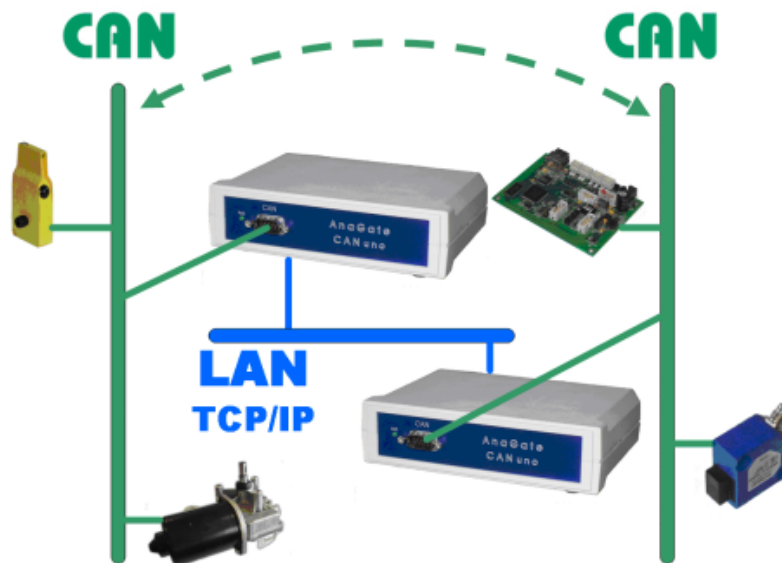
The following additional parameters can be set for the device:

• IP address of the partner device, which is to be connected.

• CAN port of the partner device, which is to be connected.

• The baudrate of the partner device. The baudrate of the parter device is independant of the own baud rate.

• The internal termination resistor is to be set on/off for the CAN port of the parter device.

When the *AnaGate CAN Gateway* establishes the connection to the partner device succesfully, the specified baud rate and integrated termination option is automatically set on the partner device.

Note

On the models with more than one CAN interface, it is possible to interconnect one CAN interface to another interface of the same device (this is called internal bridge).

To interconnect the two CAN interface 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 termination is used on the interconnected interface.

Appendix A. FAQ - Frequent asked questions

Here is a list of frequently asked questions.

A.1. Common questions

Q: No network connection (1)

A: Please check first the physical connection to the device. Basically the *AnaGate* have to be connected directly to a personal computer or to an active network component (hub, switch). If the AnaGate device is connected to a personal computer a cross-wired network cable must be used to connect the device, otherwise the included network cable is to be used.

The physical interconnection is ok, if the yellow link LED changes to light on, if LAN cable is plug in. The yellow light keeps beeing on until the connection break down. On some hardware models the link LED flickers synchronous to the green activity LED if there is traffic on the network line.

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

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 reached via ping. To do so in Windows, open a command prompt and enter the command **ping a.b.c.d**", where `a.b.c.d` is the device IP address.

2. In case the *AnaGate* is unreachable via ping, reset the device to factory settings. Set the IP adress 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 reached via ping then the next step is to try if you can open a TCP connection to port 5001. Open a Windows 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: Using a firewall

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

Table A.1. Using AnaGate hardware with firewall

Device	Port number
AnaGate I2C	5000
AnaGate CAN	5001
AnaGate CAN USB	5001
AnaGate CAN uno	5001
AnaGate CAN duo	5001, 5101
AnaGate CAN quattro	5001, 5101, 5201, 5301
AnaGate SPI	5002
AnaGate Renesas	5008
AnaGate Universal Programmer	5000, 5002, 5008

A.2. Questions concerning 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 driven by an FET transistor. The resistor itself has 110 Ohm while the internal resistance of the FET is 10 Ohm if the FET is activated. So the resulting resitance is 120 Ohm, as required by the CAN bus.

Q: Does Analytica offer a CAN gateway which does not have an galvanically isolated CAN interface?

A: Any device that is actively connected to a CAN bus should be galvanically isolated. Especially when using USB-operated devices (like the *AnaGate USB*), it is essential to have an galvanically isolated device, because the device is power supplied by the PC.

Appendix B. Technical support

The AnaGate hardware series and all existing programming interfaces are developed and supported by Analytica GmbH. Technical support can be requested as follows:

Internet

The AnaGate web site [http://www.anagate.de/en/index.html] of Analytica GmbH contains information and software downloads for AnaGate Library users:

• Product updates featuring bug fixes or new features are available here free of charge.

EMail

If you require technical assistance over the Internet, 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 AnaGate library

• AnaGate hardware series model and firmware version

• Name and version of the operating system you are using

Abbreviations

CAN   Controller Area Network

CiA   CAN in Automation

DHCP   Dynamic Host Configuration Protocol

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