AnaGate CAN X2

User Manual

Analytica GmbH

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AnaGate CAN X2: User Manual

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Abstract

This manual describes the interfaces and modes of operation of a *AnaGate CAN X2*.

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Revision 1.1	04.11.2014	ASc	Invalid data in spec.
Revision 1.2	20.09.2015	ASc	Additional information about fuse.
Revision 1.3	26.10.2015	JGo	Usage of WLAN / WWAN stick doumented.

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Introduction

This document describes the features and objectives of the CAN-Ethernet gateway *AnaGate CAN X2*.

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 model is addressed or it is not necessary to differentiate. Otherwise the full product name is used, like *AnaGate CAN USB*, *AnaGate CAN uno*, *AnaGate CAN duo*, *AnaGate CAN quattro*, *AnaGate CAN X2*, *AnaGate CAN X4* or *AnaGate CAN X8*.

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Chapter 1. Description

The *AnaGate CAN Gateway* connects a PC, an embedded PC or an other general device to 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.

For this reason the *AnaGate CAN X2* provides an ethernet interface and two independent electrically isolated CAN interface.

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 device with the supplied application libraries for Windows and Linux is much comfortable. The libraries includes the entire range of device functions 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*, *AnaGate CAN quattro*, *AnaGate CAN X2*, *AnaGate CAN X4* and *AnaGate CAN X8* can additionally interconnect two internal CAN interfaces. The *AnaGate CAN uno* do not support this so called *internal bridge mode*.

1.1. Features

-
- Variable CAN bus speed per interface (50, 100, 125, 250, 500, 800 or 1000 kbps).
- DIP switchable bus termination for each CAN interface.
- System is addressed using a proprietary network protocol.
- 4 analogue inputs and outputs, which can be accessed via LAN/Ethernet
- Several simultaneous network connections (5x TCP and 1x UPD) are supported on each existing CAN interface.
- Coupling of two independent CAN networks via LAN/internet 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 (not possible for *AnaGate CAN uno* and *AnaGate CAN USB*).

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1.2. Specification

Technical aspect		Specfication
System	Processor	ARM9 (32bit, 400Mhz)
	Memory	64MB RAM DDR2, 256MB NAND Flash
	Operating system	Linux (Kernel 3.9)
Measurements	DIN rail casing	125mm x 127.5 mm x 50mm (WxLxH)
	Weight	approx. 272g
CAN bus	Baud rate	50, 100, 125, 250, 500, 800 or 1000 kbps, software configuration
	CAN controller	2x FPGA (similar to SJA1000)
	CAN interface	2x ISO 11898-2, galvanic decoupled
	Interface	2x pluggable clamp (4-pole) incl. CAN_H, CAN_L and GND
Analogue IO	Inputs	4, galvanic decoupled (0–24V, $R_I \approx 500k\Omega$)
	Outputs[1]	4, galvanic decoupled (0-min(24V,V_{Input}), I_{max}=250mA)
LAN interface	Baud rate	10/100 Mbps
	TCP/IP	Static or dynamic (DHCP) IP address
	Interface	RJ45 socket
Voltage supply	Voltage[2]	V_{Input}=9-28V direct current
	Power consumption	about 5W (idling) without plugged USB consumers
Ambient temperature	Storage	0 .. 85 °C
	In operation	-20 .. 70 °C

[1]protected by fuse
[2]The integrated re-settable fuse resets at 750mA (25°C). If high environment temperatures are expected, the V_{Input} shall be high enough (see Section 2.1, " Initial installation").

Table 1.1. Technical data, AnaGate CAN X2

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 X2
- 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)

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- 2x 4 pole plug connector with screw terminals for analogue 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 plugs

1.4.1. AnaGate CAN X2

Figure 1.1. Top view AnaGate CAN X2

The upper connector strip of the *AnaGate CAN X2* 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.

Analog IO — The *AnaGate CAN Gateway* has 4 analogue inputs and 4 analogue outputs which can be used freely. The io's are not galvanically decoupled from the device and are internally power supplied (see Section 2.9, " Analogue IO").[1]

Power supply — The two-pole clamping socket can be used to connect an external power supply. The integrated re-settable fuse resets at 750mA

[1] protected by a fuse, see connector *power supply*

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(25°C). At 70°C the fuse resete at 450mA. If high environment temperatures are expected, the V_{Input} shall be high enough (see Section 2.1, " Initial installation"). The current demand is about 5W power consumption in idle mode (without connected USB device).

CAN port A

Term — Via this DIP switch the integrated CAN bus termination can be set for each CAN port (up=ON, down=OFF).

CAN — 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.

Pin	Description
1	GND
2	CAN_L
3	not connected
4	CAN_H

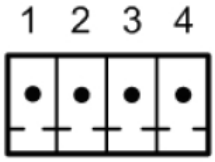

Table 1.2. Pin layout, CAN plug, upper connector strip

ACT LED — This green LED lights up when the *AnaGate CAN Gateway* is processing incoming and outgoing CAN messages.

ERR LED — This red LED lights up if the error state is in **warning** state which is set if at least one of the error counters equals or exceeds the error warning limit of 96.

The lower connector strip of the *AnaGate CAN X2* features the following connectors and LEDs (from left to right):

Fault LED — Reserved for future use.

Active LED — This red LED lights up when the *AnaGate CAN Gateway* is processing outgoing CAN messages.

Reset — The *AnaGate CAN Gateway* can be reset to the factory settings using this button. (see Section 2.10, " Factory reset" for further details)

USB Host 1, USB Host 2 — The *AnaGate CAN Gateway* has two USB 1.1 interface for further extensions or customer specific solutions.

CAN port B

Term — Via this DIP switch the integrated CAN bus termination can be set for each CAN port (up= OFF, down=ON).

CAN — 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.

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Pin	Description
1	GND
2	CAN_L
3	not connected
4	CAN_H

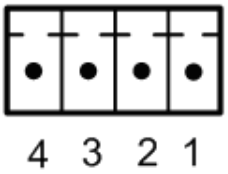

Table 1.3. Pin layout, CAN plug, lower connector strip

ACT LED — This green LED lights up when the *AnaGate CAN Gateway* is processing incoming and outgoing CAN messages.

ERR LED — This red LED lights up if the error state is in **warning** state which is set if at least one of the error counters equals or exceeds the error warning limit of 96.

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Chapter 2. Configuration

2.1. Initial installation

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

Important

The*AnaGate CAN X* series products have an re-settable fuse installed, which resets at 750mA (25°C). The fuse operatues temperature sensitive, for example at 70°C the fuse resets at 450mA. If higher environment temperatures are expected, the voltage suppy V_{Input} shall be high enough, a voltage of 24V is recommended in this cases.

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

2.1.1. Factory settings

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`

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

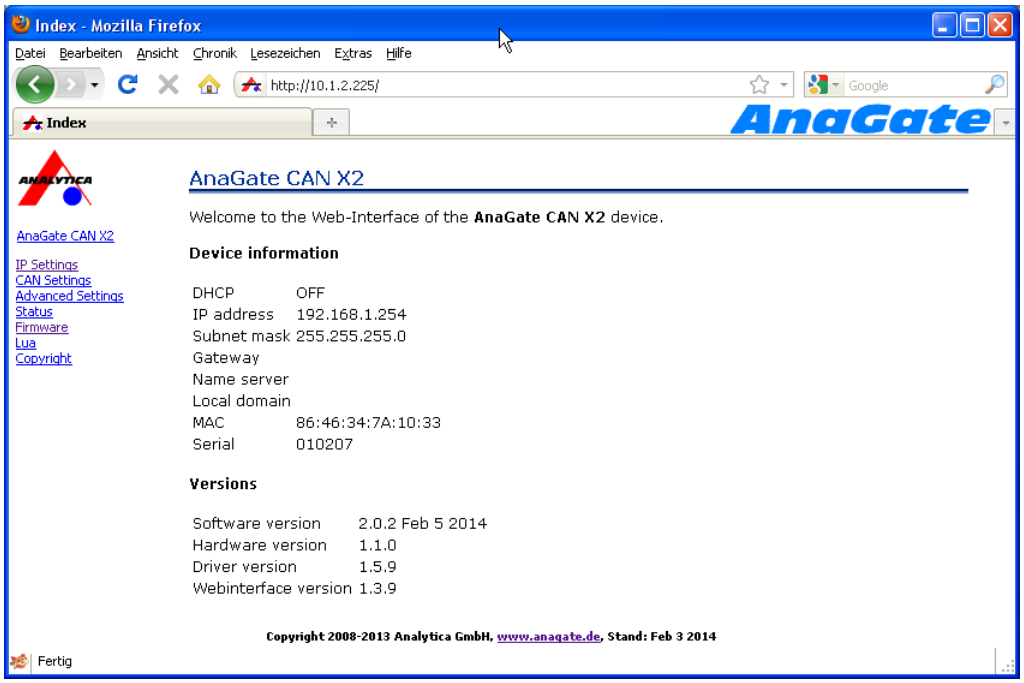

Figure 2.1. HTTP interface, AnaGate CAN X2

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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 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 adress of a name server, which resolves domain names (in dot format). If a name server is set, the end point of a IP bridge can be entered as domain name (see Section 2.5, " CAN settings").
Local domain	Local domain name. 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 is taken to be everything after the first '.'. Is *`xyz.local`* the local domain name, the short name *`dest`* will extended to *`dest.xyz.local`*.

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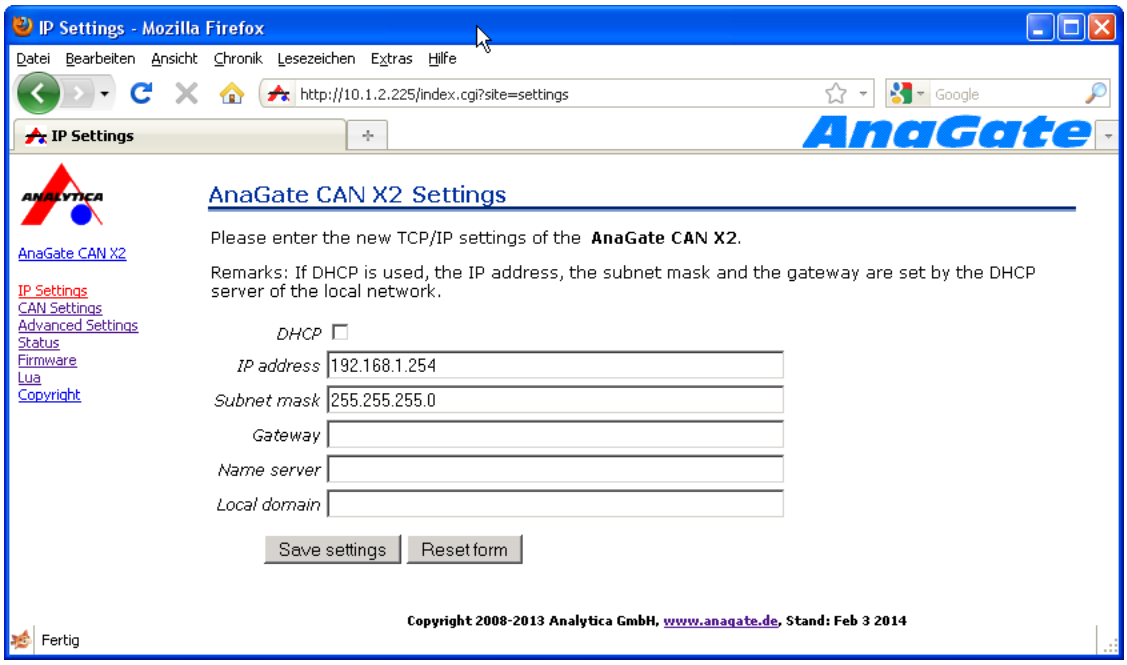

Figure 2.2. HTTP interface, network settings

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

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 X* series allow for using a WLAN ("Wireless Local Area Network") connection in addition to or instead of a wired Ethernet connection. This feature is only supported on devices that were shipped with firmware version 2.0.13 or later.

Note

Using WLAN on the *AnaGate CAN Gateway* requires a compatible WLAN USB adapter. The WLAN settings are only shown if a compatible adapter has been detected. The following adapters are currently supported:

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

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On the page *WLAN Settings* the following settings can be changed if a compatible WLAN adapter was detected.

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 selecting 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 station. 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 selecting WPA, its successor WPA2 or both.
Cipher mode	If WPA encryption is enabled, this option allows selecting the cipher mode. The encryption mode TKIP is deprecated. However, some older devices don't support the encryption algorithm AES yet.
Pre-shared key	If WPA encryption is enabled, the network key can have a length of 8 to 63 ASCII or exactly 64 hexadecimal characters. If WEP encryption is enabled, the network key must have a length of exactly 13 ASCII or 26 hexadecimal characters.
DHCP	Here you can switch between a static IP and dynamic allocation via DHCP.
IP address	Here you can enter the IP address the *AnaGate CAN Gateway* will use in the wireless network if the DHCP option is disabled.
Subnet mask	Here you can enter the subnet mask the *AnaGate CAN Gateway* will use in the wireless network if the DHCP option is disabled.
Gateway	Here you can enter the default gateway the *AnaGate CAN Gateway* will use in the wireless network if the DHCP option is disabled.

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Note

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

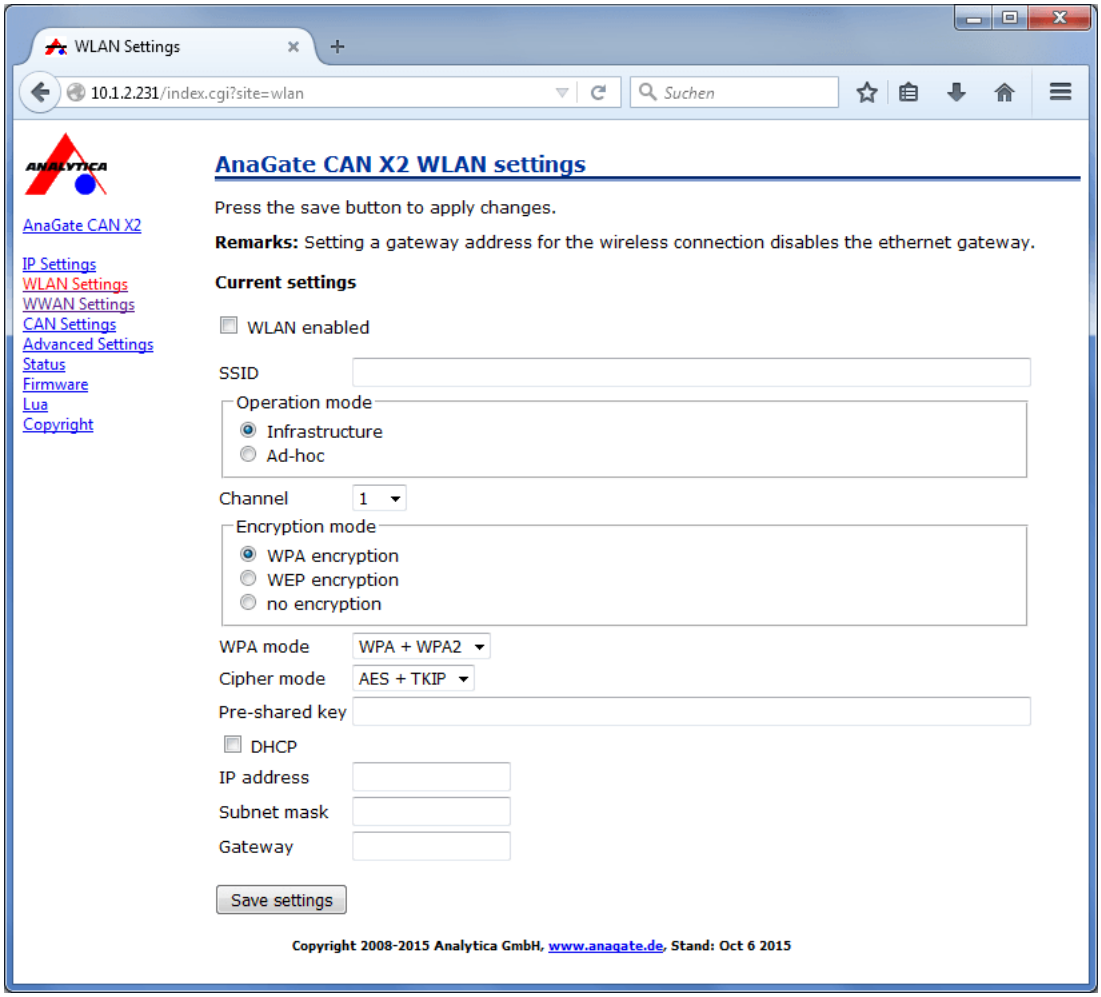

Figure 2.3. HTTP interface, WLAN settings

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

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

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Figure 2.4. AnaGate CAN X4 with WLAN USB stick

2.4. WWAN settings

Devices of the *AnaGate CAN X* series allow for using a mobile internet connection. This feature is only supported on devices that were shipped with firmware version 2.0.13 or later.

Note

Using WWAN ("Wireless Wide Area Network") on the *AnaGate CAN Gateway* requires a compatible mobile internet USB adapter. The WWAN settings are only shown if a compatible adapter has been detected. The following adapters are currently supported:

- Huawei HiLink E303 (USB-ID 12d1:14dc / 12d1:1f01)

On the page *WWAN Settings* the following settings can be changed if a compatible WWAN adapter was detected.

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WLAN enabled — Here you can enable the wireless wide area network.

Note

If a mobile connection is used, a gateway that was configured for the wired Ethernet or WLAN interfaces will be disabled automatically.

Note

Mobile providers usually only assign private IP addresses to devices connected via their networks, which are routed via carrier-grade NAT. This results in these devices not being directly accessible from outside over the internet. To access the CAN buses connected to the *AnaGate CAN Gateway* it is therefore advised to configure bridge connections on the *AnaGate CAN Gateway* (see Section 3.2, " Bridge mode").

To enable the *Huawei HiLink E303* to establish a mobile connection automatically, it needs to be connected to a PC first. Using the web interface of the WWAN adapter, you can save the PIN of the SIM card and configure a permanent internet connection. Afterwards the USB device can be used for the *AnaGate CAN Gateway*.

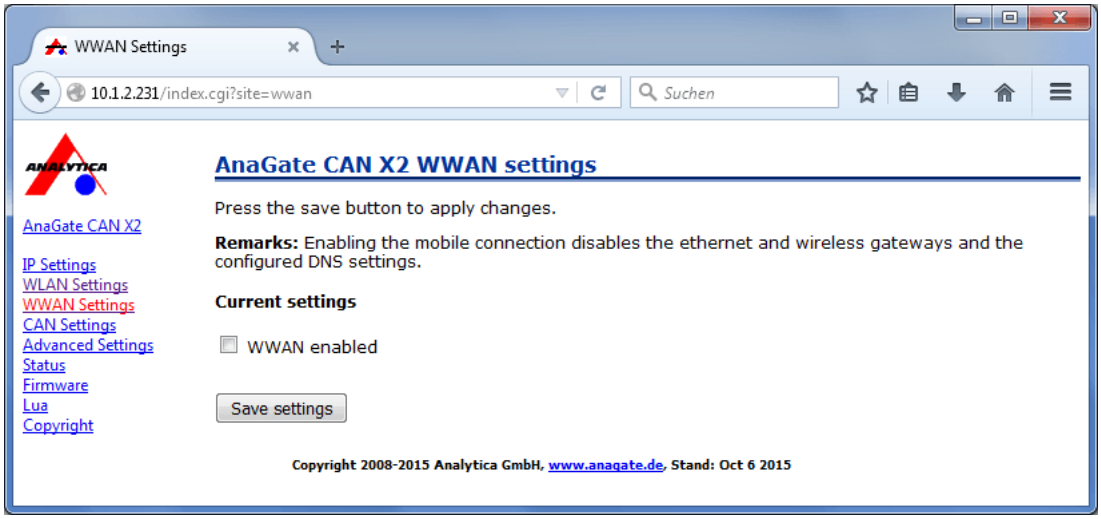

Figure 2.5. HTTP interface, WWAN settings

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.

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Figure 2.6. AnaGate CAN X4 with WWAN USB stick

2.5. CAN settings

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

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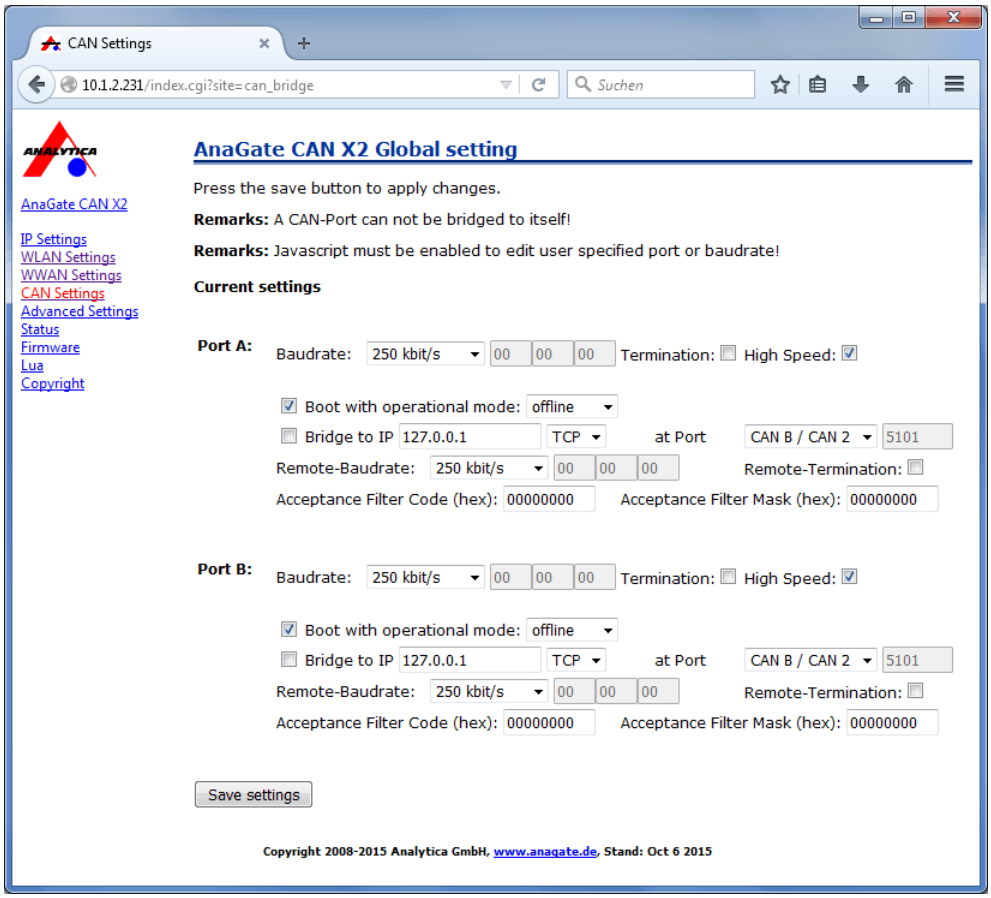

Figure 2.7. HTTP interface, CAN settings

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.
Boot with operational mode	Initial operating mode of the CAN controller. Default value is **offline**.

offline	The CAN controller is not active on the CAN bus (offline).
normal	Normal operating mode. The default setting of CAN baud rate is used.
listen	In listen mode the CAN controller is passive. CAN messages are received, but

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no messages can be sent (no ACK, no error). The default setting of CAN baud rate is used.

loopback — In loopback mode every sent CAN message is mirrored back by the CAN controller (no ACK, no errors). The default setting of CAN baud rate is used.

A more detailed description of the operating modes can be found in the data sheet of the CAN controller (Microchip MCP2515).

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. The IP address has to be entered in dot notation. A domain name can be entered only if a name server is entered in the IP settings (see Section 2.2, " Network settings"). (only *Bridge Modus*).

at Port — Port of the partner device, to which a connection (bridge) is to be made (only *Bridge Modus*).

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*). On destination devices, which can not software-configure the CAN bus termination (like the CAN X2/X4/X8), this setting is ignored.

Acceptance Filter Code (hex) — Devices of the *AnaGate CAN X* series support filtering telegrams that were received on the CAN bus by their CAN ID in the CAN controller. This filter affects all connections to the respective port of the *AnaGate CAN Gateway*. If a filter mask (see below) is set, all bits of the CAN ID defined by the filter mask are compared to the respective bits of this filter code. The CAN telegram is only forwarded if all bits defined by the filter mask match. The filter code is entered in hexadecimal format.

Acceptance Filter Mask (hex) — The filter mask defines which bits of the CAN ID of telegrams received on the CAN bus are compared to the filter code. Bits with the value 1 are compared; Bits with the value 0 are ignored. Accordingly, the filter mask 00000000 causes all CAN IDs to be accepted (regardless of the filter code value). The filter mask 1FFFFFFF means that all CAN ID bits must match the filter code. The filter mask is entered in hexadecimal format.

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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.

2.6. Advanced settings

On the page *CAN Settings* the advanced settings of the unit are displayed and can be changed individually.

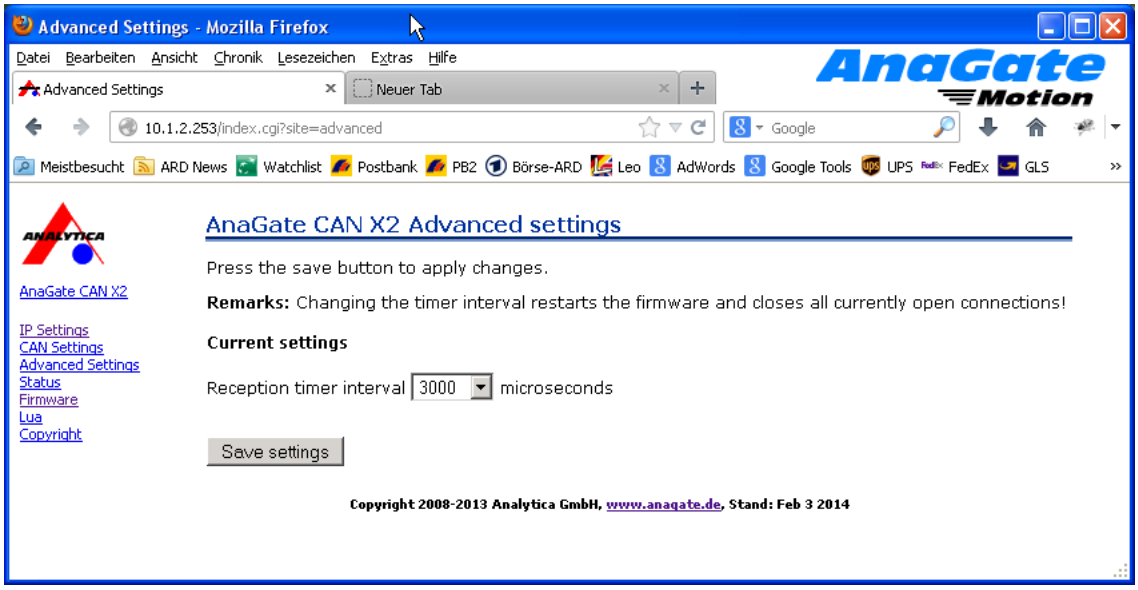

Figure 2.8. HTTP interface, CAN settings

Reception timer interval

This value specifies the frequency which is used to examine if new CAN telegrams are available in the internal driver buffer. The more frequently this examination is done, the shorter is the latency of the re-transmission of the CAN data via ethernet. On the other hand, its maximum message throughput is decreased.

The interval is defined in micro seconds, default value is `3000`. To give control immediately to the firmware after a CAN telegram is received by the CAN driver, the value `0` has to be set.

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.

2.7. Device status

On the page *Status* the device dependand status information is shown.

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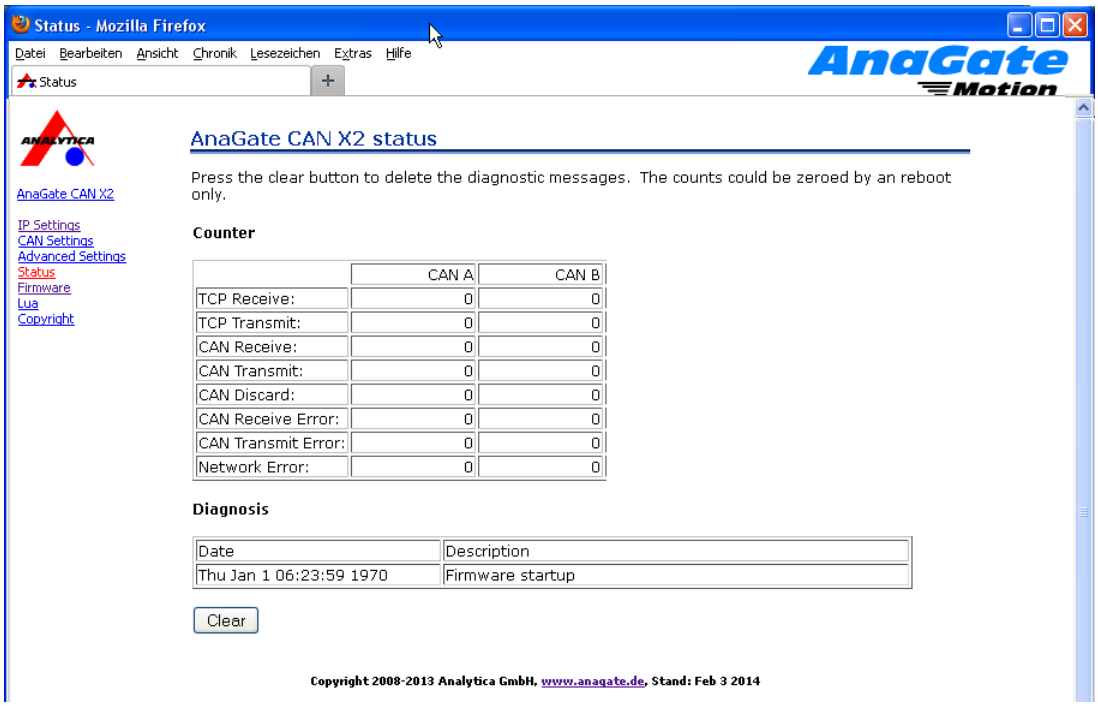

Figure 2.9. HTTP interface, Status

TCP Receive — Number of via TCP/UDP received CAN messages (CAN firmware)

TCP Transmit — Number of via TCP/UDP transmitted CAN messages (CAN firmware)

CAN Receive — Number of received CAN messages (CAN bus, CAN driver)

CAN Transmit — Number of transmitted CAN messages (CAN bus, CAN driver)

CAN Discard

- Timeout sending CAN telegram (1s)

  This indicates that no active partner is connected to the CAN bus (no ACK received). Also a wrong baud rate or missing termination can cause this error.

- A CAN telegram received from CAN bus is discared because the receive buffer is full (600 entries)

  This happens when the CAN firmware does not read telgrams fast enough out of the driver receive buffer. This may be the case even if CAN telegrams routed via TCP/UPD can not received fast enough by the connected ethernet client(PC,PLC) because of load problems (e.g. full receive TCP buffers).

- The firmware discards outgoing CAN telegrams because the send buffer is running full (1000 entries)

  This happens when CAN telegrams are not sent fast enough successfully to CAN bus. This may be a resultant problem

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	of timeouts during transmission or of overloading the CAN bus concerning the current used baud rate.
CAN Receive Error	Register *`Rx-Err-Count`* of the CAN-Transceiver
CAN Transmit Error	Register *`Tx-Err-Count`* of the CAN-Transceiver
Network Error	TCP/UPD transmit error (CAN firmware)

After clicking the button **Clear** all saved diagnosis entries are deleted on the device. To reset the system counters the device must be switched off.

2.8. Functional extensions based on Lua

On an *AnaGate CAN X2* it is possible to execute self-created applications with an installed Lua script interpreter (see [Prog-2013] for a detailed description of all programming features).

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

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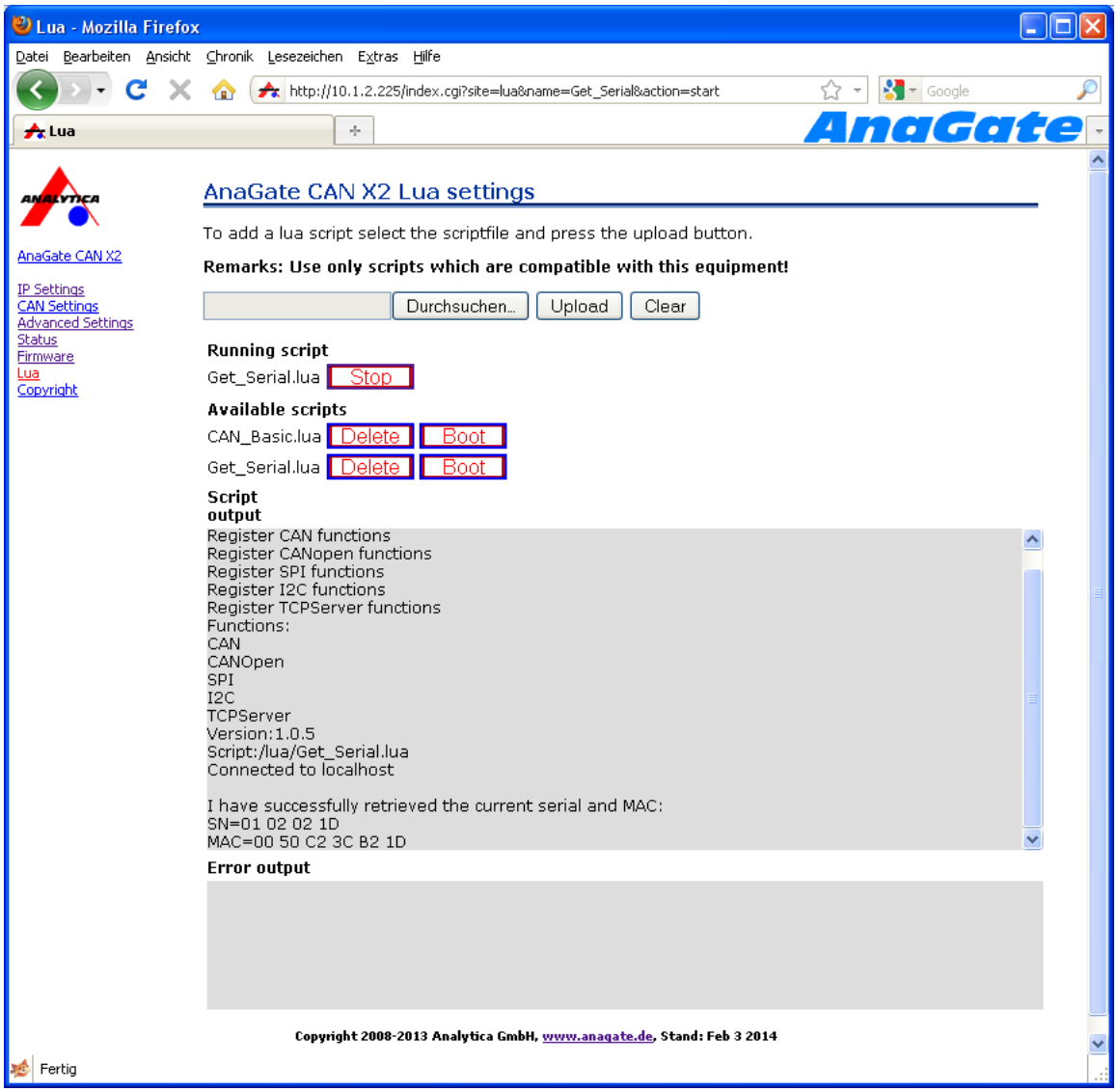

Figure 2.10. HTTP interface, Lua settings

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.

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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.

2.9. Analogue IO

There are 4 analogue inputs and 4 analogue outputs installed on the *AnaGate CAN X2* . The analogue inputs and outputs can also be referenced as digital inputs and outputs.

2.9.1. Pin layout of plug

Over two 4-pole pin rows on the upper connector strip of the *AnaGate CAN Gateway* four analogue inputs and four analogue outputs are led out, which can be used freely. The IO's are internally power supplied (reference potential is the internal ground potential), so they are not electrically isolated from the *AnaGate CAN Gateway*.

2.9.1.1. Connecting the digital inputs

In digital mode the inputs `IN1` to `IN4` refer to input voltage U_V. A voltage level greater than $U_V/2$ is interpreted as logically `HI`, a voltage level less than $U_V/2$ is interpreted as `LOW`. The typical input impedance is ca. 470 Ohm.

In analogue mode the voltage is measured at the inputs. The measuring range is between 0 and 24V (independently from the power supply). The resolution is about 8mV.

2.9.1.2. Connecting the digital outputs

The outputs are implemented as push/pull outputs. If an output is active, the supply voltage of is switched on.

In digital mode the input voltage of the device is switched on, if the output is active. Each output can be operated by 250mA. For logically `High` U_{max} is applied, for logically `Low` U_{min} is applied.

In analogue mode any voltage between U_{min}~0.3-0,5V and $U_{max}=U_V$-1V can be applied in 8mV resolution.

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Warning

For thermical reasons the maximum power dissipation of the output stage P_V must not exceed 0.5W each channel (P_V= (input voltage U_V - U_{OUT})*I_{LOAD}). Maximum current is 250mA.

Warning

The outputs are not short-circuit-safe!

2.10. 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 the operating system and the 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.

2.10.1. 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)

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- 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 2.11. 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.

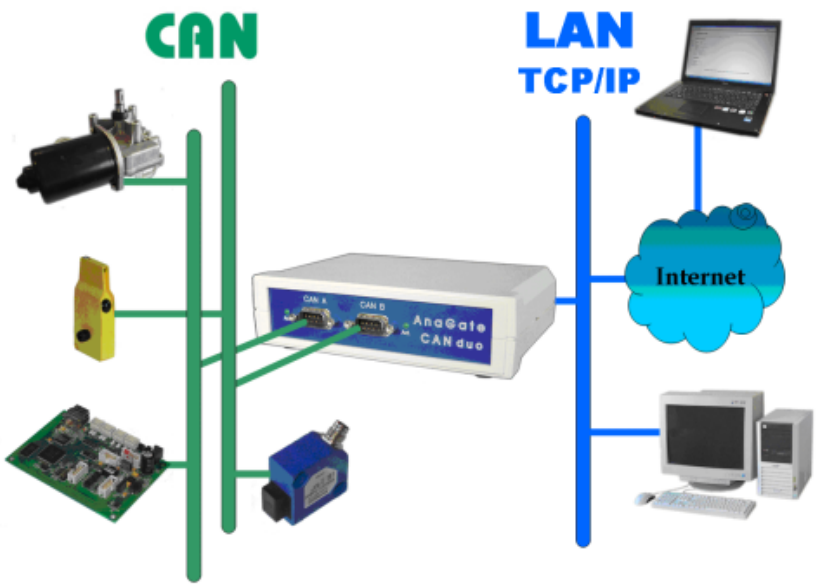

Figure 3.1. AnaGate CAN Gateway in gateway mode

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

- 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.

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- 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 in both directions.

It is possible to mix 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 2.5, " 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.

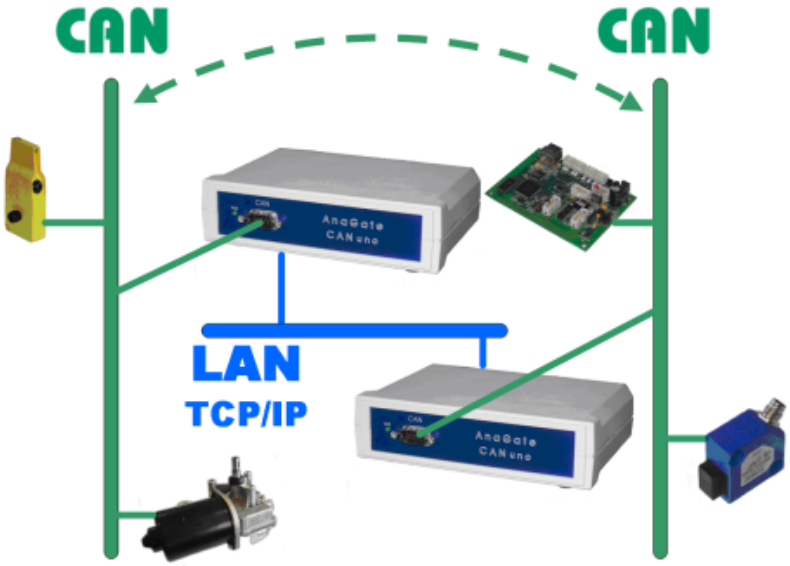

Figure 3.2. AnaGate CAN Gateway in bridge mode

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 (see Table A.1, " Using AnaGate hardware with firewall ").

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- The baudrate of the partner device. The baudrate of the parter device is independant of the own baudrate and has to be configured separatly. So, it is possible to interconnect networks with different baudrates.

- The internal termination resistor is to be set on/off for the CAN port of the parter device. On destination devices, which can not software-configure the CAN bus termination (like the AnaGste CAN X2/X4/X8), this setting is ignored.

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.

Tip

It is recommended to configure the `operational mode` of the *AnaGate CAN Gateway*, which is connected by the active device, to **offline** or **normal** (together with the valid baud rate). This reduces the risk that error frames are created on the local CAN network, because of an invalid configured baud rate during startup phase until the successful established TCP interconnection.

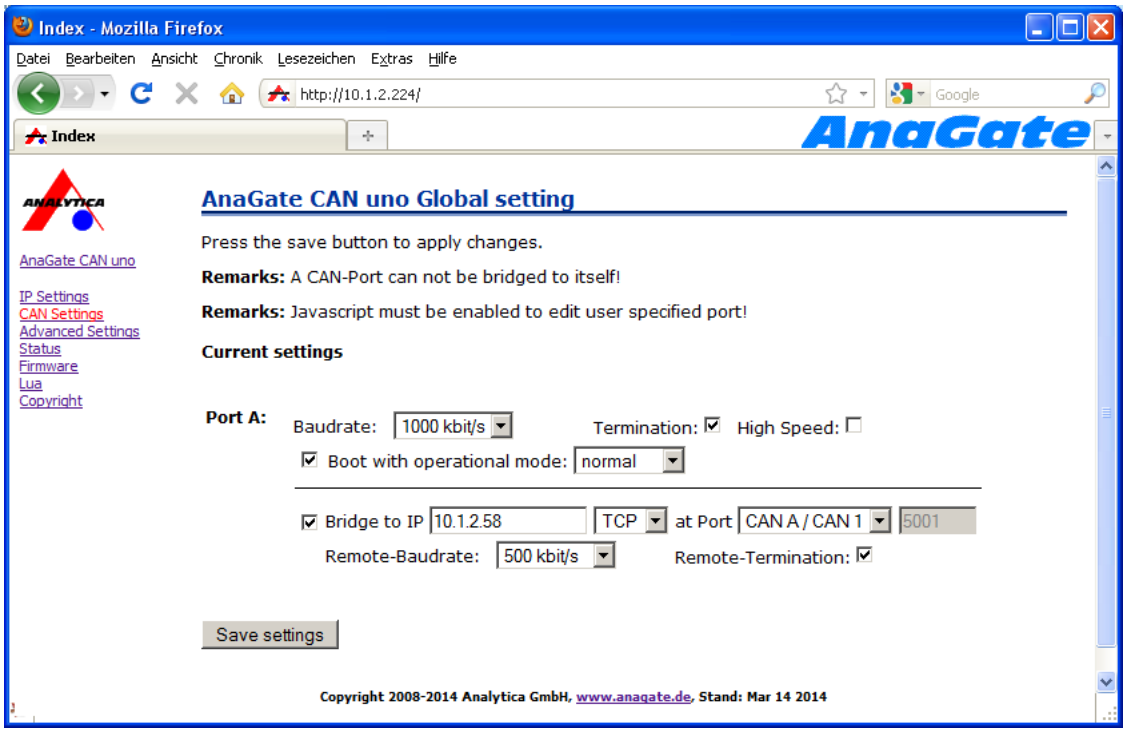

Figure 3.3. Bridge mode: Setting for device which initiates the bridge (here AnaGate CAN uno)

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).

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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.

3.3. CANopen Conformance Test Tool

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

All CAN ethernet gateways and the CAN USB gateway offered by *Analytica GmbH* can be used by the *CANopen Conformance Test Tool* of the CiA.

To use the *AnaGate CAN Gateway* with the *CCT* the AnaGate-COTI extension must be copied to the installation path of the *CCT*. The COTI extension files can be find on the AnaGate CD in the path `Tools\COTI`. In addition, the configuration file `Settings.ini` must be customized. The configuration file must also be placed in the installation path of the *CCT*, it can be edited by a standard text editor like *Notepad*.

The following entries are contained in the file `Settings.ini`:

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

Example 3.1. Settings.ini

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

Default address is `192.168.1.254`, this is the standard network address of all models with Ethernet interface.

Port — Used CAN Port of the *AnaGate CAN Gateway*.

Following settings are to be used:

Port A, Port 1 — *`Port=0`*

Port B, Port 2 — *`Port=1`*

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Appendix A. FAQ - Frequently asked questions

Here is a list of frequently asked questions.

A.1. Common questions

Q: No network connection (1)

A: Please check the physical connection to the device first. In general the *AnaGate* has 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 turns on when LAN cable is plugged in. The yellow light stays on until the connection breaks down. On some hardware models the link LED flickers synchronously 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 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 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*.

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Q: No network connection after changing the network address

A: After changing the network address of the AnaGate device via web interface the device is not longer reachable. The used internet browser displays only an empty web page, additional error messages are not available.

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 activity is suspicious for 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. Because of this behaviour it is necessary to use different IP addresses.

This problem can also occur if devices with identical IP addresses are used not concurrently but within short intervals. For example this can arise if some 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. The necessary information is cached in the *ARP table*. If there is a wrong entry in the ARP table or even an entry which is not up-to-date it is not possible to communicate with the corresponding host.

An entry in the ARP table is deleted if it is not used any more after a short period time. The time interval used depends on the operating system. On a current Linux distribution an unused entry is discarded after about 5 minutes. The ARP cache can be displayed and manipulated with the **arp** on Windows and Linux.

```
C:\>arp -a

Schnittstelle: 10.1.2.50 --- 0x2
  Internetadresse       Physikal. Adresse     Typ
  192.168.1.254         00-50-c2-3c-b0-df     dynamisch
```

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

Note

Possibly the *ARP cache* of the PC has to be deleted if the IP address of a device is changed.

Q: Using a firewall

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

Device	Port number
AnaGate I2C	5000

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Device	Port number
AnaGate I2C X7	5100, 5200, 5300, 5400, 5500, 5600, 5700
AnaGate CAN	5001
AnaGate CAN USB	5001
AnaGate CAN uno	5001
AnaGate CAN duo	5001, 5101
AnaGate CAN quattro	5001, 5101, 5201, 5301
AnaGate CAN X1	5001
AnaGate CAN X2, AnaGate CAN-FD X2	5001, 5101
AnaGate CAN X4, AnaGate CAN-FD X4	5001, 5101, 5201, 5301
AnaGate CAN X8	5001, 5101, 5201, 5301, 5401, 5501, 5601, 5701
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. Using AnaGate hardware with firewall

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 a 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 resistance is 120 Ohm, as required by the CAN bus.

Q: Does Analytica offer a CAN gateway which does not have a 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 a galvanically isolated device because the device is power supplied by the PC.

Q: How to directly interconnect two CAN ports!

A: If you want to interconnect two *AnaGate CAN* just via a direkt link CAN cable, you have to switch on the internal termination on both *AnaGate CAN* devices. A CAN bus network must have a termination on each side.

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Note

it may work with lower baud rates without termination, but it is recommended to use a termination.

Q: Receiving a NAK when sending a CAN telegram.

A: If no CAN partner is connected to the *AnaGate CAN* (aka the CAN network), it is not possible to send CAN telegrams. The *AnaGate CAN* gets a NAK from the CAN controller. These NAK errors are sent to the AnaGate client via a data confirmation telegram.

Warning

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

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Appendix B. Technical support

The AnaGate hardware series, software tools 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.

E-Mail

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

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Abbreviations

I2C	Inter-Integrated Circuit
SCL	Serial Clock Line
SDA	Serial DAta Line
SPI	Serial Peripheral Interface
CLK	Clock
MISO	Master In Slave Out
SS	Slave Select
MOSI	Master Out Slave In
TRST	Test Reset
SRST	Slave Reset
JTAG	Joint Test Action Group
TDI	Test Data Input
TDO	Test Data Output
TMS	Test Mode Select Input
TCK	Test Clock
DHCP	Dynamic Host Configuration Protocol

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