

CAN/CAN-Gateway

CG-ARM7/RMD

CG-ARM7/GT

User manual

User manual CG-ARM7/RMD Version 2.0, CG-ARM7/GT

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Our products are continuously improved. Due to this fact specifications may be changed at any time and without announcement.

FCC: This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

WARNING: CG-ARM7/RMD and CG-ARM7/GT hardware and software may not be used in applications where damage to life, health or private property may result from failures in or caused by these components.

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1 Overview

1.1 Attributes

- Connection of two physically separated CAN networks
- Filtering and mapping of identifiers
- Bus activity displayed by LED
- Gateway configuration via RS232 or CAN
- Wiring using a multiway connector
- Optional (Version GT) galvanic separation between CAN channels

1.2 General Description

The CAN/CAN gateway CG-ARM7 connects two physically divided CAN networks. The capability of having individual baudrates on both segments enables routing between networks with diverging baudrates.

The filtering of single identifiers or ranges of identifiers reduces the busload. The mapping of single identifiers or ranges of identifiers qualifies CG-ARM7 to be used under difficult higher level protocol conditions.

The device is configured via serial interface or via CAN. As the device is shipped without configuration there is no CAN identifier set for configuration purpose. Hence it is mandatory that the first configuration is loaded via the RS232 interface. Due to the intuitive structure of the configuration file in ASCII format, programming and administration is very easy.

CG-ARM7 is also available in version GT with galvanic separation between the CAN channels.

1.3 Ordering Information

12-20-403-xx	CG-ARM7/RMD Version 2.0
12-20-419-xx	CG-ARM7/GT

Note: xx denotes language of delivery:

10 german

20 english

2 Handling

2.1 Connection

CG-ARM7 has a multiway connector for flexible wiring of the CANn interfaces and the power supply. The RS232 interface on the device is used for programming and for the output of diagnostic information. For normal operation it is not required.

The connector assignment of the multiway connector and the RS232 interface is described in chapter "3.1 Pin Assignment".

2.2 Operation

To start up the gateway just connect the power supply, the device starts up automatically. As soon as the automatic diagnostic process is successfully completed the green power LED lites up permanently.

Important note: Ex factory the device offers no configuration and must be configured before its first run. Configuration instructions for the gateway are located in chapter "2.3 Configuration".

2.3 Configuration

The gateway configuration process consists of two steps:

- Creating a configuration file
- Loading the configuration into the device

2.3.1 Configuration File

The configuration file is a text file with the extension *.gcf. This file contains all data needed by the gateway for operation. A complete sample configuration is located in chapter "4.1 Configuration file".

The values can either be entered in decimal or hexadecimal notation. Using the hexadecimal notation, the character 'x' has to be entered directly before the particular value.

There are two types of parameters, general parameters and routing settings. General parameters include operating information for the gateway. Routing settings are used for mapping and filtering of identifiers.

Some parameters are optional. If they are not defined, the gateway uses default settings.

Simultaneous programming of several devices is not possible. It must be guaranteed, that each device can be clearly identified.

In the following all parameters are listed and described.

#	comment
---	---------

The configuration file can be provided with comments. Comments are prefaced with the character "#" and they end with the particular line.

Example:

```
# 1st comment  
key = value    # 2nd comment
```

version	version
---------	---------

The version number indicates the file format of the configuration file. It must be 1 for the actual version.

Example:

```
version = 1
```

btr | bit timing

The bit timing key indicates the speed of the particular CAN channel. BTR1 indicates the baudrate for CAN channel 1, BTR2 the baudrate for CAN channel 2. Both keys must exist in each configuration file.

This keys are directly related to the CANBTR registers of the used controller LPC2119. This allows most flexible customization of the baudrate settings. The basic CAN clock is 48 MHz.

Example:

```
# CAN channel 1: 1Mbit/s
btr1 = x00140005
# CAN channel 2: 500KBit/s
btr2 = x001C0005
```

Standard baud rates recommended by CiA are located in chapter "4.2 Standard Baudrates".

pidin, pidout | program identifier

The program identifiers (PIDs) are required for the gateway configuration via CAN. If you do not want to program the gateway via CAN, you can remove this keys from your configuration file.

The PIDs determine which identifiers will be used for programming the gateway. "pidin" defines the identifier the configuration software uses to send requests to the gateway. The key "pidout" defines the identifier which the gateway uses to reply to the configuration software.

For CAN channel 1 and CAN channel 2 different PIDs can be set. But it is also possible to program the gateway just via one CAN channel. To set the identifiers for CAN channel 1 use the keys "pidin1" and "pidout1". For CAN channel 2 use the keys "pidin2" and "pidout2".

To use a 29-bit identifier prepend the character "x" before the particular key. Without prefix 11-bit identifiers will be sent.

Example:

```
# PIDs for CAN channel 1
# CAN 1: 11-bit IN-Id: 0x5
pidin1 = x5
# CAN 1: 29-bit OUT-Id: 0xA00
xpidout1 = xA00

# PIDs for CAN channel 2
# CAN 2: 29-bit IN-Id:0x6E
# xpidin2 = x6E
# CAN 2: 29-bit OUT-Id: 0x1FFE
# xpidout2 = x1FFE
```

name	configuration label
------	---------------------

For easier identification of the programmed settings, the configuration can be labeled. The configuration name must not have more than 32 characters and must not contain space characters or tabs. If this key is missing, no name will be assigned to the configuration. This name can be read out and displayed by the configuration software.

Example:

```
name = Sample_Configuration
```

deviceid	device ID
----------	-----------

During the configuration process via CAN it is needed that the device can clearly be identified in the network. This process is based on the serial number of the device.

If there is the need to have the configuration process independent of the serial number, a device id can be assigned. Then the identification of the device depends on the device id and not on the serial number. Care must be taken to use a particular device id just once in a network, if more than one gateway is used.

The device id can have values between 1 and 99999999.

Example:

```
deviceid = 50
```

busoff	bus off behavior
--------	------------------

This key specifies the period of time in milliseconds, which will pass by until the gateway gets bus on again after a bus off condition has occurred. If this value is not defined, the device remains in bus off state. If a bus off time of 0 milliseconds is set, the gateway tries immediately to get bus on again.

Example:

```
busoff = 100
```

password	password
----------	----------

Using a password, the gateway can be protected against unauthorized access. If the key is not defined or the value is set to 0, password protection is disabled. The password is an up to 14-digit hexadecimal value.

The password protection supports two security levels. For the highest security level the highest bit (56th bit) of the password must be set to 1. This security level prevents any communication with the gateway, if the device has not been unlocked with the correct password before.

At the normal security level, the highest bit (56th bit) is 0. Read out of information about the gateway and the configuration is enabled.

Changing the configuration however is not possible!

Example:

```
# Security: high  
password = 800705AFD6B0D1  
# Security: normal  
password = 000705AFD6B0D1
```

fil	routing
-----	---------

The routing settings contain the filtering and mapping rules for a single identifier or a ranges of identifiers. Only specified identifiers or ranges of identifiers are transmitted and, if existent, the adequate mapping rule is applied. All incoming messages with identifiers to which no rules applies are ignored (defined programming identifiers excepted). Additionally the frame format must be set within the filtering rule.

Different from the basic keys, the routing key is constructed in a more complex way. On the left side of the assignment there are three parameters:

```
[inff] fil channel [outff] = ...
```

inff: Defines the frame format for incoming messages.

The frame format for incoming messages specifies whether the filtering rule is applied to standard or extended messages. If *inff* is set to 's' standard frame format is specified. When set to 'x' the extended frame format is defined.

channel: Defines the channel number.

The channel number specifies whether the filtering rule is applied to incoming messages on CAN channel 1 or on CAN channel 2.

outff: Defines the frame format for outgoing messages.

The frame format for outgoing messages specifies whether the result of the filtering rule is sent via standard or extended identifier. If *outff* is set to 's' standard frame format is specified. When set to 'x' extended frame format is defined.

On the right side of the assignment up to three parameters specify the identifier of the outgoing CAN message.

... = sid [- eid] [: mid]

sid: Defines the identifier the filtering rule is applied to.

If a range of identifiers is defined, *sid* is the start identifier. If the prefix 'x' is added before the value the identifier is interpreted as a hexadecimal number.

eid: Defines the end identifier for ranges of identifiers.

If no range of identifiers is used, the value is not needed. If the prefix 'x' is added before the value the identifier is interpreted as a hexadecimal number.

mid: Defines the mapping identifier.

The mapping identifier states the start identifier, to which the single identifier or a range of identifiers is mapped. If no mapping is needed, this value may be missing. If the prefix 'x' is added before the value the identifier is interpreted as a hexadecimal number.

Examples:

```
# The received extended identifiers in the range of
# 0x30 to 0x40 via CAN channel 1 are sent via CAN
# channel 2 as standard identifiers in the range of
# 0x400 to 0x410.
xfil1s = x30 - x40 : x400
```

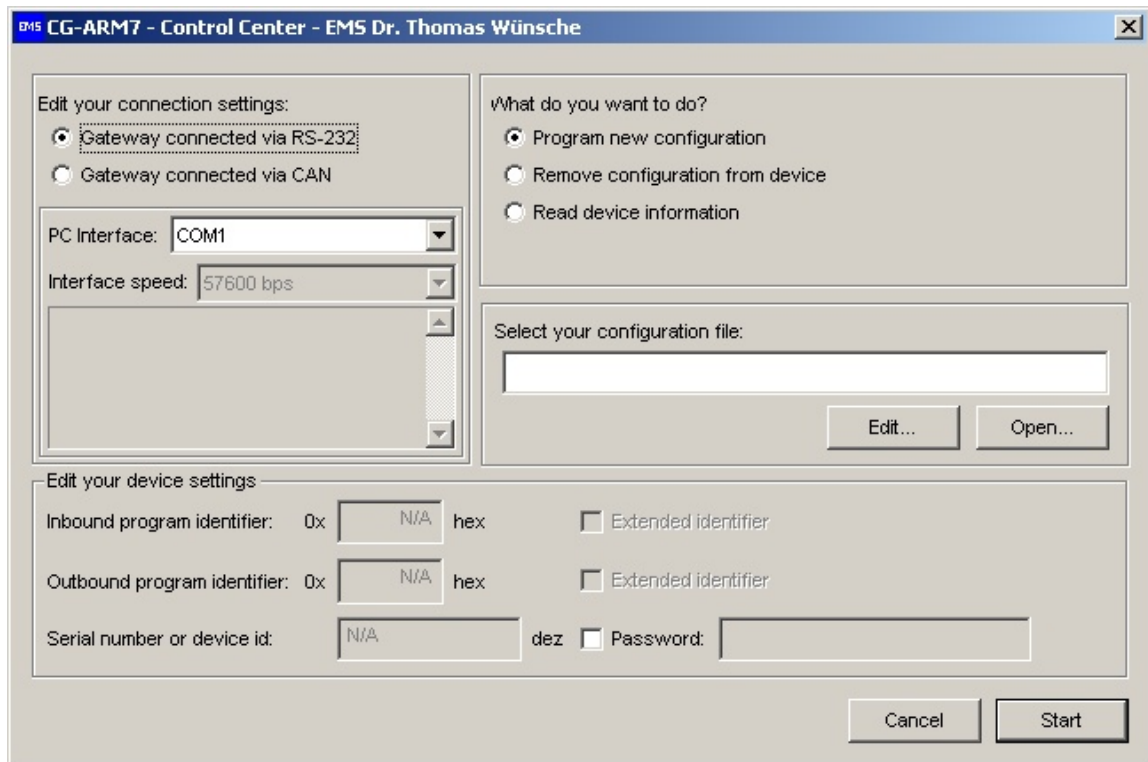
```
# The via CAN channel 2 received extended identifier
# 0x1FFFFFFF is sent via CAN channel 1 as extended
# identifier with the value 0x01.
xfil2x = x1FFFFFFF : x1
```

```
# The via CAN channel 1 received standard identifiers
# in the range of 0x100 to 0x200 are sent via CAN
# channel 2 as standard identifiers in the range of
# 0x100 to 0x200.
sfil1s = x100 - x200
```

2.3.2 Programming the Device

CG-ARM7 is programmed by means of the configuration software. It offers the possibility to configure the gateway via serial connection or via CAN. For the configuration a null modem cable or a PC/CAN interface from EMS Dr. Thomas Wuensche is needed.

Screenshot of the download tool:



Setting up the PC interface:

The PC interface is set in the upper left field.

First it is decided, if the gateway shall be accessed via RS232 or via CAN interface. Speed can only be selected, if a connection via CAN has been made. A predefined standard baudrate compliant to the CiA recommendation or custom specific CAN settings may be used. The selected baudrate must be the same as the baudrate of the gateway.

If no configuration is loaded, which is the default case when device is shipped, it is not possible to communicate with the gateway via CAN. Hence it is mandatory that the first configuration is loaded via the RS232 interface.

Process selection:

In the right upper field of the configuration software the process to be performed is chosen.

- **Program new configuration**

A new configuration is selected and programmed into the device.

- **Remove configuration from device**

The current configuration of the device is deleted. Afterwards the gateway is in delivery state again. It is not needed to delete the configuration before a new one is programmed, as this is done automatically.

- **Read device information**

Information about the gateway and its current configuration is read out.

Optional device settings

If CG-ARM7 is password protected, the field "password" has to be activated and the correct password has to be inserted. Depending on the security level, it is possible to request information about the device even without password.

If CAN has been chosen as the PC interface the "Inbound Program Identifier" (pidin), the "Outbound Program Identifier" (pidout) and the frame format for the program identifiers have to be set. At last the serial number or the device id has to be set. If only one gateway is in the network, also the value '0' may be used here. If there is more than one CG-ARM7 in the network, the value '0' must not be used.

Starting the download:

To start the download the start button has to be used. The operation may take a while. It should be avoided to disconnect the power supply to the device during the configuration process. At that time the routing functionality of the gateway is deactivated. After successful completion no status message is given. If an error occurs a status message is displayed.

2.4 LED

The device status is displayed by three LEDs.

Power

On	The device is in normal operation mode. Routing of CAN messages is enabled
Blinking	The device is in programming mode. Routing of CAN messages is disabled

CAN 1 Active

On	There is a bus error on CAN 1
Blinking	There is bus activity on CAN 1

CAN 2 Active

On	There is a bus error on CAN 2
Blinking	There is bus activity on CAN 2

3 Technical data

3.1 Pin Assignment

Pin assignment of the multiway connector

	CG-ARM7/RMD		CG-ARM7/GT	
Pin	Signal	Description	Signal	Description
1	+24V	+24 Volt power supply	+24V	+24 Volt power supply
2	GND	Ground	GND1	Ground 1
3	GND	Ground	GND1	Ground 1
4	CAN1-H	CAN1-high	CAN1-H	CAN1-high
5	CAN1-L	CAN1-low	CAN1-L	CAN1-low
6	GND	Ground	GND2	Ground 2
7	CAN2-H	CAN2-high	CAN2-H	CAN2-high
8	CAN2-L	CAN2-low	CAN2-L	CAN2-low

Pin assignment RS232

	CG-ARM7/RMD		CG-ARM7/GT	
Pin	Signal	Description	Signal	Description
1, 4, 6, 9	NC	Not connected	NC	Not connected
2	RxD	Receive signal	RxD	Receive signal
3	TxD	Transmit signal	TxD	Transmit signal
5	GND	Ground	GND1	Ground 1
7	RTS	Not used	RTS	Not used
8	CTS	Not used	CTS	Not used

3.2 Limiting Values

Stress above the specified values can lead to permanent damage of CG-ARM7.

Parameter	Min.	Max.	Unit
Storage temperature	-20	80	°C
Operating temperature	0	60	°C
Supply voltage	-100	+30	V

3.3 Nominal Values

Parameter	Min.	Typ.	Max.	Unit
Supply voltage	10	24	30	V
Supply consumption (running idle)	-	40	-	mA
CAN Baudrates	10	10	1000	kBit/s

4 Appendix

4.1 Configuration File Example

```
# Gateway CG-ARM7/RMD configuration file

# Baudrate CAN interface 1 - 1000 kbps
btr1 = x00140005

# Baudrate CAN interface 2 - 500 kbps
btr2 = x001C0005

# Version number of configuration file
version = 1

# Device ID
deviceid = 120000

# Set bus off recovery time to 1000 ms
busoff = 1000

# Password protection: security level
# normal
password = 11AA33BC

# Configuration name
name = router

# Program identifier CAN channel 1
pidin1 = x1          # Standard identifier 0x01
xpidout1 = x2       # Extended identifier 0x02

# Program identifier CAN channel 2
xpidin2 = x10       # Extended identifier 0x10
xpidout2 = x20      # Extended identifier 0x20

# Filter settings
# All standard identifiers from CAN channel
# 1 are sent as standard identifiers to CAN
# channel 2
sfil1s = x0-x7FF
```

```
# All standard identifiers from CAN channel
# 2 are sent as standard identifiers to CAN
# channel 1
sfil2s = x0-x7FF
```

```
# All extended identifiers from CAN channel
# 1 are sent as extended identifiers to CAN
# channel 2
xfil1x = x0-x1FFFFFFF
```

```
# All extended identifiers from CAN channel
# 2 are sent as extended identifiers to CAN
# channel 1
xfil2x = x0-x1FFFFFFF
```

4.2 Standard CAN Baud Rates

Baudrates recommended by CiA:

Bitrate	Bit Timing Register
1000 kBaud	0x00140005
800 kBaud	0x00160005
500 kBaud	0x001C0005
250 kBaud	0x001C000B
125 kBaud	0x001C0017
100 kBaud	0x001C001D
50 kBaud	0x001C003B
20 kBaud	0x001C0095
10 kBaud	0x001C012B

4.3 Instruction for Disposal

Electronic Equipment Act (WEEE)

EMS is selling its products exclusively to commercial customers. This is the reason why all devices are designed for commercial use and have to be disposed appropriately. In accordance to § 10 para. 2 clause 3 Electronic Equipment Act (WEEE) the disposal of EMS products is regulated the following way.

The equipment must not be disposed at the public collection points. In accordance with the applicable law the disposal has to be done by the customer for own account. The same applies to products, which have been sold to third parties, if those parties do not take care of a disposal in accordance to the applicable law. As an alternative the products can be returned to EMS free of charge.

4.4 FCC Statement

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

4.5 CE Conformity

Declaration of Conformity



The manufacturer

EMS Dr. Thomas Wünsche e.K.
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85304 Ilmmünster
Germany

hereby declares, that the following products:

Name	Article Number
CG-ARM7/RMD V2.0	12-20-403-xx
CG-ARM7/GT	12-20-419-xx

meet the requirements of the following standards:

Electromagnetic Immunity

EN 55035:2018-04; VDE 0878-35:2018-04 – Electromagnetic compatibility of multimedia equipment – Immunity requirements (CISPR 35:2016, modified); German version EN 55035:2017

Electromagnetic Emission

EN 55032:2016-02; VDE 0878-32:2016-02 – Electromagnetic compatibility of multimedia equipment – Emission Requirements (CISPR 32:2015); German version EN 55032:2015

and therefore conform with the EU requirements on:

Electromagnetic compatibility (2014/30/EU)

In accordance with the above mentioned EU directives, the EC declarations of conformity and the associated documentation are held at the disposal of the competent authorities.

RoHS 3 EEE

The RoHS 3 (EU 2015/863) commits manufacturers of „Electrical and Electronic Equipment“ (EEE) to secure compliance with the RoHS Directive before placing a CE mark.

Based on technical documentation and to the best of our knowledge, we hereby confirm that the above mentioned products do not contain any of the restricted substances according to Article 4 of the RoHS Directive in excess of the maximum concentration values tolerated by weight in any of their homogeneous materials.

Ilmmünster, 23.05.2023

Dr. Thomas Wünsche

