



Ethernet/CAN Gateway

EtherCAN CI-ARM9/RMD

User manual

User manual EtherCAN CI-ARM9/RMD Version 3.0

Document version: 1.08
Documentation date: June 3rd, 2020

No part of this document or the software described herein may be reproduced in any form without prior written agreement from EMS Dr. Thomas Wünsche.

For technical assistance please contact:

EMS Dr. Thomas Wünsche
Sonnenhang 3

D-85304 Ilmmünster

Tel. +49-8441-490260
Fax +49-8441-81860

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: EtherCAN CI-ARM9/RMD 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.

Content

1	Overview	1
1.1	Attributes	1
1.2	General Description	1
1.3	Ordering Information	2
2	Hardware	3
3	Software	4
3.1	Build-in Capabilities	4
3.2	Communication and General Software	4
3.2.1	cansrv	4
3.3	Additional Software	7
4.	Electrical Characteristics	8
4.1	Absolute Limiting Values	8
4.2	Nominal Values	8
5	Operating Instructions	9
5.1	Connection Scheme	9
5.2	Installation	10
5.3	Configuration	11
5.3.1	General Configuration	11
5.3.2	Device Configuration	11
5.3.3	Configuration by Web Access	12
5.3.4	CAN Driver	12
5.3.5	Default Configuration	12
5.3.6	Restore Default Configuration	12
6	Appendix	13
6.1	Instruction for Disposal	13
6.2	FCC Statement	13
6.3	Declaration of Conformity CE	14
6.4	Declaration of Conformity REACH	15

1 Overview

1.1 Attributes

- Connection of CAN systems to Ethernet
- Coupling of CAN networks over Ethernet
- 2 CAN interfaces
- CiA DS 102 and ISO 11898-2 compatible physical layer
- 24V nominal power supply
- Galvanic decoupling of CAN transceivers
- 454 MHz ARM9 CPU (NXP I.MX287)
- 128 MByte DDR2 RAM
- 4 GByte EMMC Flash
- RS232 interface for configuration
- SD-Card slot for mass storage
- USB host interface
- Embedded Linux operating system
- Rail mountable

1.2 General Description

The rail mountable Ethernet/CAN gateway EtherCAN CI transmits signals between a CAN system and an Ethernet network.

Utilizing the Ethernet standard EtherCAN is usable in a wide range of applications. It can be used as a standard CAN interface in a LAN environment. Or two EtherCAN devices, working back to back, can bridge CAN networks over an Ethernet connection.

The powerful CPU and the huge amount of memory allow the implementation of standard or customized Linux applications on the device. As an example it is possible to run a web server on the EtherCAN CI enabling the visualisation of process parameters in a web browser.

1.3 Ordering Information

12-20-309-yy	EtherCAN CI-ARM9/RMD Ethernet/CAN gateway with IMX287 CPU, 128MByte DDR2, 4GByte EMMC, two CAN interfaces
--------------	---

Note: yy denotes language of delivery:

10 german

20 english

2 Hardware

EtherCAN CI includes a NXP I.MX287 CPU with 454MHz clock. In addition the device has 128 MByte DDR2 RAM and 4 GByte EMMC Flash. The connection to the CAN bus is provided by the two internal Flexcan controllers of the CPU and supports the CAN protocols 2.0a and 2.0b.

The device has two identical CAN interfaces with CAN transceivers NXP PCA82C251. Both CAN segments are equipped with pluggable screw terminals and have individual galvanic separation. Power is supplied by a pluggable screw terminal.

EtherCAN CI includes also an RJ45 Ethernet connector with integrated LEDs (Link status: yellow, Ethernet active: green) and a serial RS232 connection (D-SUB) on the front panel.

Furthermore there are four LEDs on the front panel. The two green LEDs are controlled by the CAN transceiver and indicate CAN traffic, while the yellow ones are controlled by the CPU, their meaning is application specific. Please refer to the related program documentation for details.

3 Software

3.1 Build-in Capabilities

- an Embedded Linux operating system with kernel 3.14.19
- a powerful TCP/IP stack
- a CAN server application

3.2 Communication and General Software

The communication software normally consists of two parts. One part is executed by the processor inside EtherCAN CI (server application). The other part (client application) runs on a device connected to EtherCAN CI via the Ethernet. This device can be a PC or any other device supporting IP networking.

Server and client use an ASCII protocol when communicating via TCP or UDP. This protocol is not included in this document, but can be obtained on demand.

EtherCAN CI is delivered with a monitor program running under Windows OS as client application.

3.2.1 cansrv

The CAN server application *cansrv* is intended to provide a point to point communication link with a client over a TCP connection.

While the main purpose is the connection with a PC based client application, *cansrv* can also be used in a back to back configuration with another EtherCAN CI device. In this configuration one device acts as a server and the other as a client, they form a transparent link for the CAN networks connected.

Once *cansrv* is started as a server it listens on a port for incoming connections. After the connection is established the client is able to send and receive CAN messages and to configure the CAN parameters of the remote CAN controller.

The use of a configuration file allows to specify more detailed CAN controller register values and to configure a software filter for standard identifier CAN messages.

For each CAN channel one instance of *cansrv* has to be started.

The following command line options are available for the CAN server application:

-h (--help)

Show the available options

-v (--version)

Show the version information

-b (--baudrate) BAUDRATE

The CAN baud rate used.

1000|800|500|250|125|100|50|25|20|10 kBaud can be set with this option. Please notice that a baud rate specified with this option can not be changed dynamically by a connected client.

-d (--device-file) DEVICE

The device, default is /dev/cpc_fcan0 and addresses the first CAN channel. For the second CAN channel /dev/cpc_fcan1 has to be used.

-f (--config-file) CONFIGFILE

Allows the use of a configuration file for bar rate settings and identifier filtering. A sample configuration file can be found in 5.3.5. A baud rate given within this file cannot be changed dynamically by a connected client.

-p (--port) PORT

The port to listen at for incoming connection requests (default is 1500).

-w (--trigger-watchdog)

This option is without effect on this device

-o (--busoff-recovery-time) TIMEOUT

This time specifies the period which is waited before the CAN controller is reinitialized after a bus off event. The time value is given in ms, 0 indicates to immediately go bus on again. As default the option is not set and this means actually "do not go bus on again".

To form a bridge for two independent CAN networks two EtherCAN CI devices (connected by their Ethernet interfaces) can be used, one running as a server, the other as a client. In this case, the following parameters can be used.

-i (--ip-address) IPADDRESS

IP address of the server the client wants to connect to. The parameter '-p' should then also be used.

-k (--keep-alive)

The connection will be running using a keep alive mechanism that reestablishes broken connections.

Please note: In order for the keep alive mechanism to run properly, both applications (server and client) have to be started with this option.

For debugging purposes the following options can be used. For performance reasons it is not recommended to use them in production systems.

-t (--show-tcp-frames)

Show TCP frames on the serial terminal

-c (--show-cpc-frames)

Show CPC messages on the serial terminal

Further description:

Server mode:

If option '-i' is not given, *cansrv* will start in servermode and listen on <PORT> for incoming connections.

If options '-b' or '-f' are given a baud rate setting via TCP/IP will be ignored.

Client mode (back-to-back operation only):

If option '-i' is given, *cansrv* will start in client mode. It will try to open a connection to <IPADDRESS> and <PORT> of the server. A baud rate option with '-b' or '-f' is mandatory. If option '-f' is given and there is a baud rate configured in this file, it will override <BAUDRATE> given by the '-b' option.

If option '-k' is set, a keep alive mechanism will reestablish a broken connection.

The *cansrv* program will use the status LEDs as described here:

- **Blinking:** *cansrv* is running, but there is no connection to a client established
- **On:** *cansrv* has an established connection to a client

Examples:

cansrv -p 1500

This will start *cansrv* as a server listening on port 1500. This is the default setting. As no baud rate is specified at the command line, the server will initialize its CAN controller with the parameter sent by the client.

cansrv -p 1500 -i 192.168.0.176 -k -b 500

This will start *cansrv* as a client which will try to connect to the host with IP address 192.168.0.176 on port 1500. The client will use the keep alive mechanism. It will also advertise this baud rate to the client. The client takes it, if no *-b* or *-f* option is set.

Automatic start of *cansrv*:

Normally *cansrv* is started automatically at boot up. This is done by the init script *"/etc/init.d/ems-cansrv0"* and *"/etc/init.d/ems-cansrv1"*.

The web configuration offers means to set needed parameters and to enable startup while booting.

3.3 Additional Software

EtherCAN CI may be equipped with additional application specific software, either by 3rd party vendors or written by the customer. Please contact 3rd party vendor for additional help on this software packages or EMS Dr. Thomas Wuensche for support on application development.

4 Electrical Characteristics

4.1 Absolute Limiting Values

Any (also temporary) stress in excess of the limiting values may cause permanent damage on EtherCAN CI and connected devices.

Parameter	Min.	Max.	Unit
Storage temperature	-40	85	°C
Operating temperature	-20	60	°C
Voltage on CAN bus pins*	-36	36	V
Supply voltage	10	30	V

4.2 Nominal Values

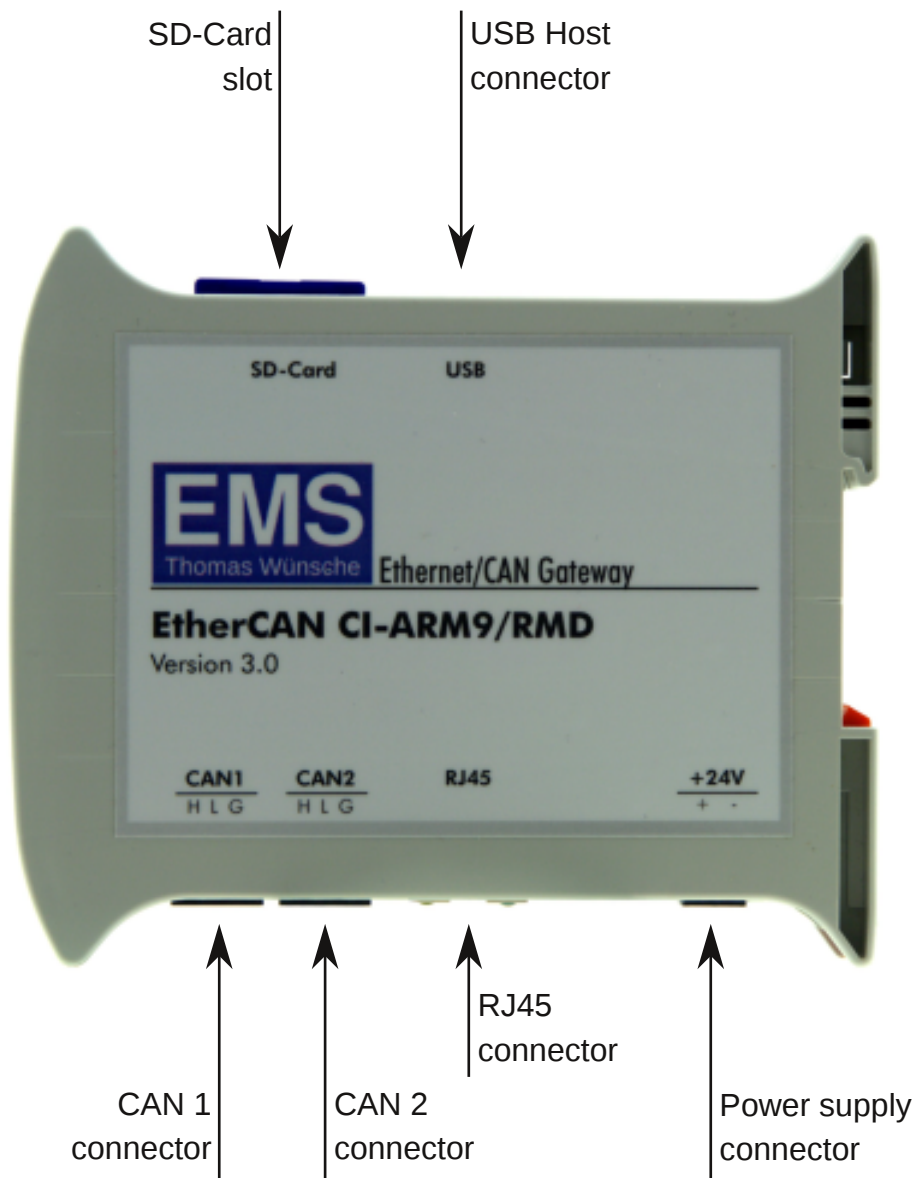
Parameter	Min.	Typ.	Max.	Unit
Voltage on CAN bus pins*	-30	-	30	V
Supply current**	-	100	150	mA
CAN controller clock frequency	-	24	-	MHz

* This potential is measured against the ground potential of the related CAN transceiver

** Value measured with a supply voltage of 24V

5 Operating Instructions

5.1 Connection Scheme



The following table shows the assignment of the RS232 male connector located at the front panel of the device.

Pin	Name	Function
2	RxD	Receiving data line
3	TxD	Sending data line
4	DSR	Data-Set_Ready line
5	GND	Ground
6	DTR	Data-Terminal-Ready line



5.2 Installation

To setup and use EtherCAN CI within a network, the following is needed:

- A PC running Windows 7/8/8.1/10 or Linux, connected to the Ethernet network
- An Ethernet network with a free twisted pair connection for EtherCAN CI
- A 24V DC power supply
- A terminal program to connect to the RS232 port of EtherCAN CI. With this terminal it is always possible to get access to the device. Login over Ethernet is also possible, but needs a working Ethernet connection.

5.3 Configuration

5.3.1 General Configuration

EtherCAN CI can be accessed by using a terminal program connected to its RS232 port.

- Connect a serial cable to the RS232 port of the EtherCAN CI.
- Connect the other end to a free COM port of your PC.

Note: The serial cable must have the pins 2 and 3 crossed and pin 5 connected directly (Nullmodem-Cable).

- Start the terminal software. Configure the software for a direct connection using the PC's COM port. The communication parameters are the following:

Baud rate	: 115200 Baud
Data bits	: 8
Parity	: none
Stop bits	: 1
Flow control	: none

- Power on EtherCAN CI
- On the terminal window the output from the startup procedure is displayed. When it has finished login as user "root". The default password is "EMSethercan".

This method to connect to the device via RS232 will always work. Besides this it is also possible to login via ssh, but then the IP address of the device has to be known.

5.3.2 Device Configuration

As the device is run by an embedded Linux operating system, it is configured as such. Start/Stop scripts are located in "/etc/init.d". If a service controlled by such script should start at boot time, a symbolic link has to be created from within "/etc/rc.d" to the related script in "/etc/init.d".

This enables customized applications and third party programs to be integrated into the system.

5.3.3 Configuration by Web Access

To offer a convenient way to configure basic settings the device offers a web page for this purpose. Direct your web browser to the IP address of the EtherCAN and a login screen will appear. Login with:

User : admin
Password : admin

We strongly recommend to change the password as soon as possible for security reasons. This change will take effect with the next login attempt. Other changes may need a device reboot to take effect.

5.3.4 CAN Driver

The default driver for the CAN controller is `ems_fcan.ko`. It is used by the `cansrv` application. If an application needs the `socketCAN` driver (`flexcan.ko`), it can be selected in the web configuration instead. When the `socketCAN` driver is selected, the `cansrv` application is not available.

5.3.5 Default Configuration upon Delivery

The default delivery of EtherCAN CI has the following parameters set:

IP address : 192.168.1.15
Netmask : 255.255.255.0
Gateway : none
Nameserver : none
CAN driver : `ems_fcan`
cansrv 1 : configured as server listening on port 1500
cansrv 2 : configured as server listening on port 1501
root password : `EMSethercan`

5.3.6 Restore Default Configuration

In order to restore the default configuration the following command must be run after login at the serial console:

`$/etc/restore`

After a reboot changes will take effect.

6 Appendix

6.1 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.

6.2 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.

6.3 Declaration of Conformity CE

Declaration of Conformity



The manufacturer

EMS Dr. Thomas Wünsche e.K.
Sonnenhang 3
85304 Ilmmünster
Germany

hereby declares, that the following products:

Name	Article Number
EtherCAN CI-ARM9/RMD – Version 3.0	12-20-309-xx
EtherCAN CI-ARM9/RMD – M4D – Version 3.0	12-20-310-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

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, 02.06.20

Dr. Thomas Wünsche



6.4 Declaration of Conformity REACH

Declaration of Conformity REACH

The manufacturer

EMS Dr. Thomas Wünsche e.K.
Sonnenhang 3
85304 Ilmmünster
Germany

hereby declares, that the following products

Name	Article Number
EtherCAN CI-ARM9/RMD – Version 3.0	12-20-309-xx
EtherCAN CI-ARM9/RMD – M4D – Version 3.0	12-20-310-xx

contain the following SVHC (*Substances of Very High Concern*), which are part of the REACH Candidate List published by ECHA on the 16.01.2020 in Helsinki.

Substance	CAS Nr.
Lead monoxide (lead oxide)	1317-36-8
Diboron trioxide	1303-86-2
Lead titanium trioxide	12060-00-3

Ilmmünster, 30.01.2020



Dr.-Ing. Thomas Wünsche