HiCOCAN

Technical Informations

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3	HiCOCAN-PCI104 added	10.07.2008 / Rr
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1 Introduction

HiCOCAN is the perfect solution for connecting your PC to a CAN net. No matter what applications you wish to develop, HiCOCAN provides the performance required for your specific design needs, at the highest bus rates.

The following HiCOCAN variants are available:

HiCOCAN-PCI-1	Standard PC card for the PCI bus of a standard PC with one CAN interface
HiCOCAN-PCI-2	Standard PC card for the PCI bus of a standard PC with two CAN interfaces
HiCOCAN-CPCI	Compact PCI card with two CAN interfaces
HiCOCAN-MiniPCI	miniPCI type IIIA board with two CAN interfaces
CAN-MiniPCI-4H	miniPCI type IIIA board with four CAN interfaces
HiCOCAN-104-2H	PC/104 variant with two CAN interface, high-speed (jumpers)
HiCOCAN-104-2L	PC/104 variant with two CAN interface, low-speed, fault-tolerant (jumpers)

All boards are shipped with a preinstalled firmware, which handles Layer 2 of the ISO/OSI reference model. The PC's function libraries are used for communications with the firmware and so provide optimum access to the CAN net.

This manual provides a description of the hardware.

2 HiCOCAN-PCI

2.1 Characteristics

Feature	Function	Options
Processor	MC68332G	
Clock frequency	20 MHz (crystal oscillator)	
SRAM buffered	128 KB (16 bits)	
Flash	512 KB (16 bits)	
CAN interface	1 x SJA1000	2 x SJA1000
Baud rate	1 Mbaud with up to 100% bus last	
CAN interface	ISO/DIS 11898-24V, electrically isolated, with DCDC converter	Without DCDC converter on request
PC interface	PCI via 2KB (8 bits) DPM	
Interrupts	HiCOCAN-PCI Set by BIOS	
Base address	HiCOCAN-PCI: Set by BIOS	
Supply voltage	5V +-5% + 3.3 VDC +-5% (PCI, CPC) about 350 mA	
Operating temperature	0°C to +70°C	extended temperature range on request
Storage temperature	-40°C to +85°C	
Rel. humidity	0…95%, non-condensing	
Weight	PCI, CPCI: 150g	
Board	Glasepoxi FR-4, UL listed	
Dimensions	PCI :	

2.2 Interfacing to the PCI bus

The connection of HiCOCAN-PCI to the PCI bus is via a PCI controller from PLX. The resources will be automatically set by the PC's BIOS.

The address region of the DPM and the configuration region of the PCI controller are beyond the 1-MB boundary.

2.3 Supply of the Digital Section

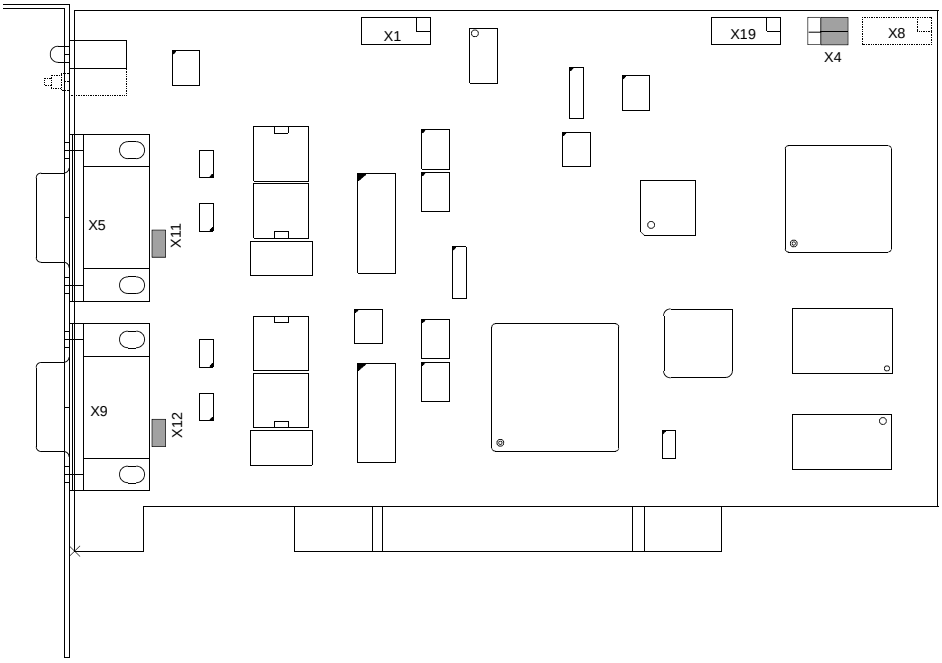
The voltage supplied is 5 volts and 3,3 volts with approx. 350mA.

2.4 Supply of the Electrically Isolated Area

There are three ways to supply the electrically isolated areas CAN1 and CAN2. The first one is default, the other two possibilities are available on request.

- Voltage is supplied via one or two DCDC converters, which are soldered in the board.
- Voltage is supplied via the CAN bus, i.e., the voltage supply lines provide a voltage of 7V ... 12V, which is in accordance with the CAN specification. A soldered longitudinal controller provides 5 volts.
- The electrically isolated area is connected to the digital section via specific solder bridges. However, electrical isolation is lost in this case.

2.5 Connectors and Jumpers, HiCOCAN-PCI



2.5.1 Board Number, X4

Jumper	open	closed	Jumper	open	closed	Board No.
1-3	x		2-4	x		0
1-3		x	2-4	x		1
1-3	X		2-4		x	2
1-3		x	2-4		x	3

2.5.2 CAN1 DSUB-9, X5

Pin	Signal	Pin	Signal
1	-	2	CAN1_L
3	GND1	4	-
5	-	6	GND_ext.
7	CAN1_H	8	-
9	VCC_ext.		

2.5.3 CAN2 DSUB-9, X9

Pin	Signal	Pin	Signal
1	-	2	CAN2_L
3	GND2	4	-
5	-	6	GND_ext.
7	CAN2_H	8	-
9	VCC_ext.		

2.5.4 Terminal Resistors, X11, X12

If the jumper is inserted, CANx_L and CANx_H are terminated with 120 Ohm, which is in accordance with the CAN specification. X11 is assigned to CAN1 and X12 to CAN2.

3 HiCOCAN-CPCI

3.1 Characteristics

Feature	Function	Options
Processor	MC68332G	
Clock frequency	20 MHz (crystal oscillator)	
SRAM buffered	128 KB (16 bits)	
Flash	512 KB (16 bits)	
CAN interface	1 x SJA1000	2 x SJA1000
Baud rate	1 Mbaud with up to 100% bus last	
CAN interface	ISO/DIS 11898-24V, electrically isolated, with DCDC converter	Without DCDC converter on request
PC interface	CPCI via 2KB (8 bits) DPM	
Interrupts	HiCOCAN-CPCI: Set by BIOS	
Base address	HiCOCAN-CPCI: Set by BIOS	
Supply voltage	5 VDC +-5% about 350 mA	
Operating temperature	0°C to +70°C	extended temperature range on request
Storage temperature	-40°C to +85°C	
Rel. humidity	0…95%, non-condensing	
Weight	CPCI: 150g	
Board	Glasepoxi FR-4, UL listed	
Dimensions	CPCI :	

3.2 Interfacing to the CPCI bus

The connection of HiCOCAN-CPCI to the PCI bus is via a PCI controller from PLX. The resources will be automatically set by the PC's BIOS.

The address region of the DPM and the configuration region of the PCI controller are beyond the 1-MB boundary.

3.3 Supply of the Digital Section

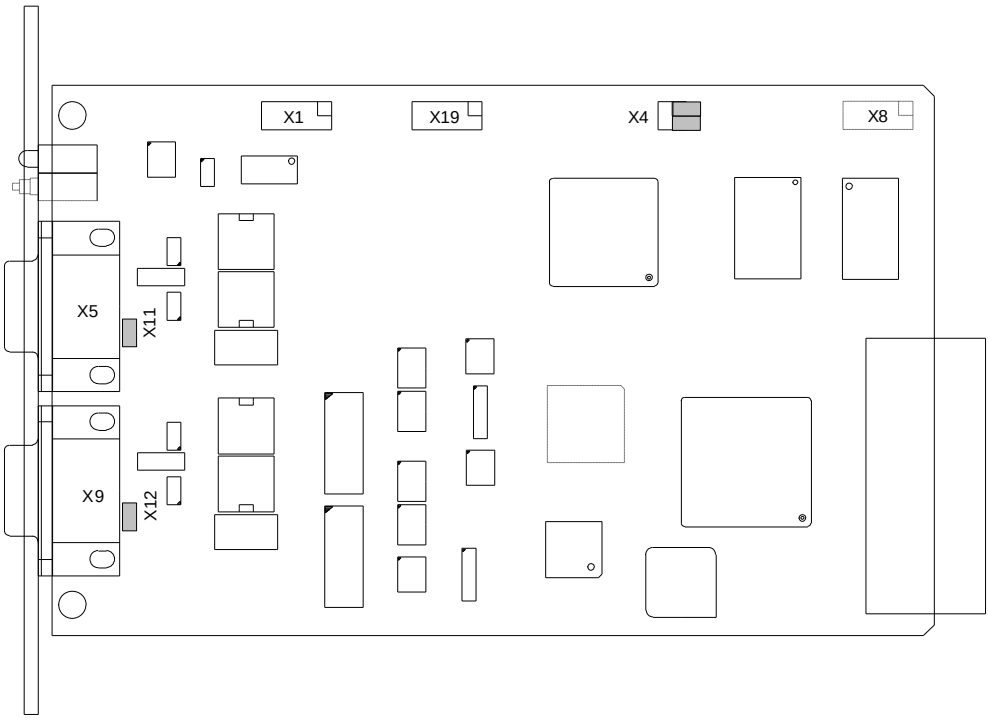
The voltage supplied is 5 volts with approx. 350mA.

3.4 Supply of the Electrically Isolated Area

There are three ways to supply the electrically isolated areas CAN1 and CAN2. The first one is default, the other two possibilities are available on request.

- Voltage is supplied via one or two DCDC converters, which are soldered in the board.
- Voltage is supplied via the CAN bus, i.e., the voltage supply lines provide a voltage of 7V ... 12V, which is in accordance with the CAN specification. A soldered longitudinal controller provides 5 volts.
- The electrically isolated area is connected to the digital section via specific solder bridges. However, electrical isolation is lost in this case.

3.5 Connectors and Jumpers, HiCOCAN-CPCI



3.5.1 Board Number, X4

Jumper	open	closed	Jumper	open	closed	Board No.
1-3	x		2-4	x		0
1-3		x	2-4	x		1
1-3	X		2-4		x	2
1-3		x	2-4		x	3

3.5.2 CAN1 DSUB-9, X5

Pin	Signal	Pin	Signal
1	-	2	CAN1_L
3	GND1	4	-
5	-	6	GND_ext.
7	CAN1_H	8	-
9	VCC_ext.		

3.5.3 CAN2 DSUB-9, X9

Pin	Signal	Pin	Signal
1	-	2	CAN2_L
3	GND2	4	-
5	-	6	GND_ext.
7	CAN2_H	8	-
9	VCC_ext.		

3.5.4 Terminal Resistors, X11, X12

If the jumper is inserted, CANx_L and CANx_H are terminated with 120 Ohm, which is in accordance with the CAN specification. X11 is assigned to CAN1 and X12 to CAN2.

4 HiCOCAN-104-xx

4.1 Characteristics

Feature	Function	Options
Processor	MC68332G	
Clock frequency	20 MHz (crystal oscillator)	
SRAM buffered	128 KB (16 bits)	
Flash	512 KB (16 bits)	
CAN interface	1 x SJA1000	2 x SJA1000
Baud rate	1 Mbaud with up to 100% bus last	
CAN interface	HiCOCAN-104-2Hx: ISO/DIS 11898-24V, electrically isolated, with DCDC converter HiCOCAN-104-2L: Fault tolerant with DCDC converter	Without DCDC converter on request
Galvanic Isolation	HiCOCAN-104-2HV: 3KV Other variants: 750V	
PC interface	PC/104 via 2KB (8 bits) DPM	
Interrupts	Settable via jumpers	
Base address	Settable via jumpers	
Supply voltage	5 VDC +-5% (PC-104) about 350 mA	
Operating temperature	0°C to +70°C	Extended temperature range on request
Storage temperature	-40°C to +85°C	
Rel. humidity	0…95%, non-condensing	
Weight	PC-104: 70g	
Board	Glasepoxi FR-4, UL listed	
Dimensions	PC-104 : 96 mm x 90 mm x 22 mm	

4.2 Interface of HiCOCAN-104-x

The connection of HiCOCAN-104-x to the PC104 bus is via an address decoder and a jumper field.

A memory space of 4KBytes is needed and a single interrupt line. For more details, see a later chapter of this document.

4.3 Supply of the Digital Section

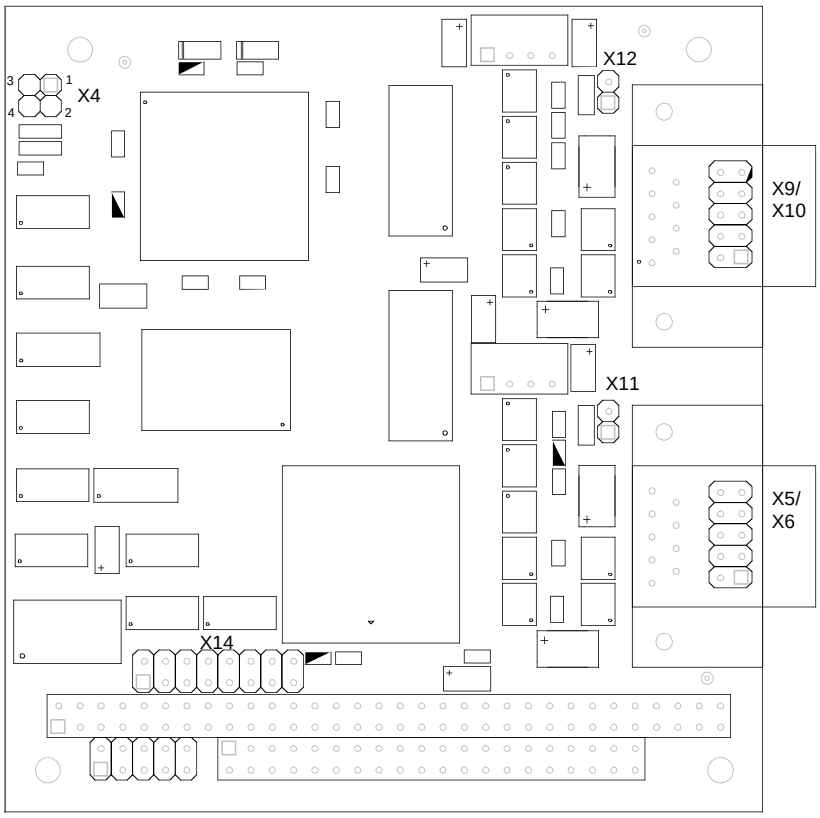
The voltage supplied is 5 volts with approx. 350mA. It can either be supplied via the PC/104 connector or the ISA/PCI/CPCI interface.

4.4 Supply of the Electrically Isolated Area

There are three ways to supply the electrically isolated areas CAN1 and CAN2. The first one is default, the other two possibilities are available on request.

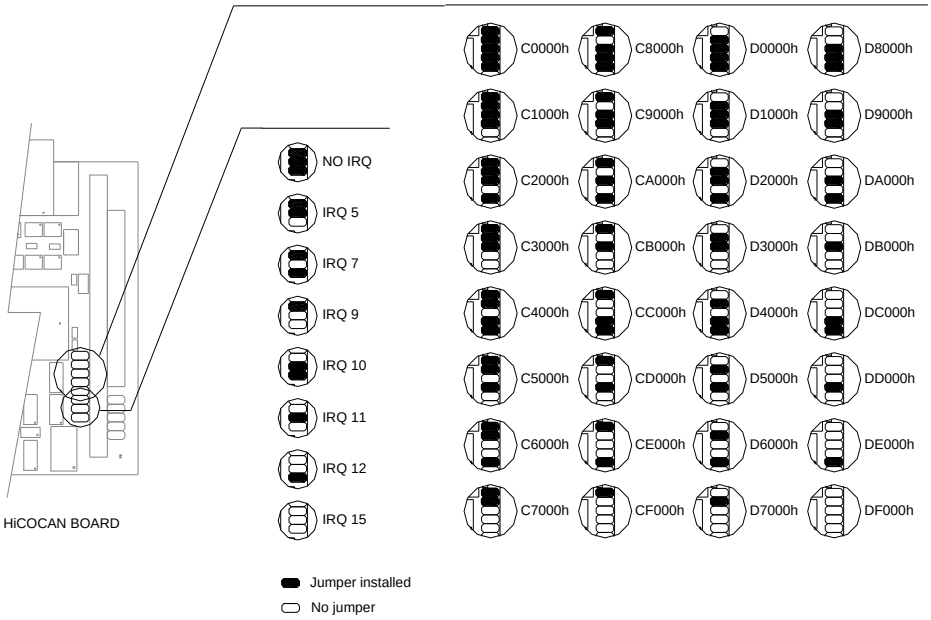
- Voltage is supplied via one or two DCDC converters, which are soldered in the board.
- Voltage is supplied via the CAN bus, i.e., the voltage supply lines provide a voltage of 7V ... 12V, which is in accordance with the CAN specification. A soldered longitudinal controller provides 5 volts.
- The electrically isolated area is connected to the digital section via specific solder bridges. However, electrical isolation is lost in this case.

4.5 Connectors and Jumpers



4.5.1 Setting the Resources, X14

The following figure shows the settings of the resources (addresses, interrupts) on the board.



4.5.2 Board Number, X4

Jumper	open	closed	Jumper	open	closed	Board No.
1-3	x		2-4	x		0
1-3		x	2-4	x		1
1-3	X		2-4		x	2
1-3		x	2-4		x	3

4.5.3 CAN1 DSUB-9, X5

Pin	Signal	Pin	Signal
1	-	2	CAN1_L
3	GND1	4	-
5	-	6	GND_ext.
7	CAN1_H	8	-
9	VCC_ext.		

4.5.4 CAN2 DSUB-9, X9

Pin	Signal	Pin	Signal
1	-	2	CAN2_L
3	GND2	4	-
5	-	6	GND_ext.
7	CAN2_H	8	-
9	VCC_ext.		

4.5.5 CAN1 Connector, X6

Optional available only with HiCOCAN-104.

Pin	Signal	Pin	Signal
1	-	2	GND_ext.
3	CAN1_L	4	CAN1_H
5	GND1	6	-
7	-	8	VCC_ext.
9	-	10	-

4.5.6 CAN2 Connector, X10

Optional available only with HiCOCAN-104.

Pin	Signal	Pin	Signal
1	-	**2**	GND_ext.
3	CAN2_L	**4**	CAN2_H
5	GND2	**6**	-
7	-	**8**	VCC_ext.
9	-	**10**	-

4.5.7 Terminal Resistors, X11, X12

If the jumper is inserted, CANx_L and CANx_H are terminated with 120 Ohm, which is in accordance with the CAN specification. X11 is assigned to CAN1 and X12 to CAN2.

5 Firmware Description of HiCOCAN-104, HiCOCAN-PCI and HiCOCAN-CPCI

This is a brief description for HiCOCAN-104/PCI/CPCI. The firmware serves to control the communication between the interfaces installed on the board. That is, it handles the data transfer between the interfaces, processes control statements of the application, and detects, clears and reports error conditions to the applications.

5.1 Communications Interfaces

There are two kinds of interfaces: one or (optional) two CAN interfaces and the DPM - the communications interface for the application.

5.1.1 CAN

The CAN connections are controlled by the Philips SJA1000 CAN controller, which operates in the so-called PeliCAN mode. This mode supports both CAN2.0a (11-bit identifier) and CAN2.0b (29-bit identifier).

5.1.2 Dual-Port RAM (DPM)

The DPM installed on the HiCOCAN board is essential: it serves as a means of communication via which the data transfer between the application and the PC and the firmware on the HiCOCAN is effected. All the PC's control commands as well as the HiCOCAN status messages occur via the DPM.

For each **configured** CAN node a message queue is provided, which consists of a receive and a transmit queue. The transmit queue contains the CAN messages to be sent, the receive queue the CAN messages received; the size of the queues and the maximum number of messages that can be entered depend on the number of configured CAN nodes (Table 1).

Number of configured CAN nodes	1	2
Max. number of messages in the transmit queue	64	32
Max. number of messages in the receive queue	32 for each node	16 for each node

Table 1: Maximum number of message, dependent on the number of configured CAN nodes

Further areas serve as a status and command interface for the CAN nodes and the board itself. Via these so-called controlled areas commands are transferred to the firmware, or status information about the CAN nodes and the assigned message queues can be obtained from them. In addition, the semaphores for keeping the data consistency and to avoid access conflicts between driver and firmware are handled.

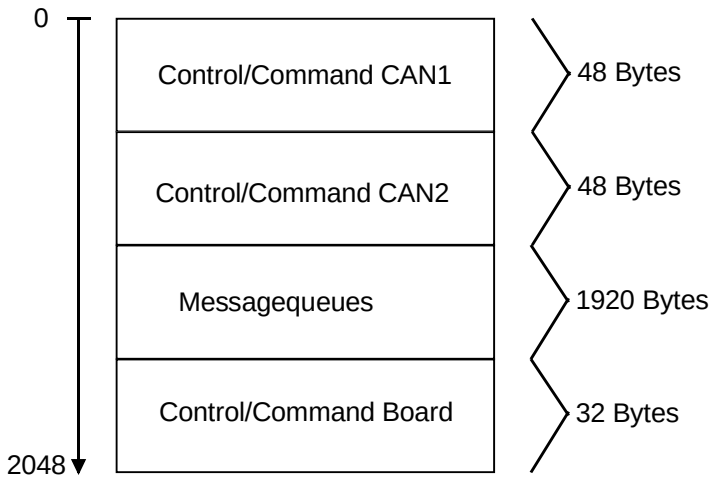


Fig. 1: Structure of the DPM and allocation of addresses

5.2 Error Messages During Operation

The bootstrap loader or the firmware writes the information on the errors occurred into the status cells in the board's communication area. This information can then be requested via specific function calls or is yielded in the form of return values of a function.

In addition, LEDs will go on or off, depending on the type of error.
Table 2 below lists the corresponding error states.

Red LED	Yellow LED	Significance
On	Off	Hardware error or bootstrap loader faulty
Is flashing	Off	Checksum error in bootstrap loader area
Is flashing	On	Checksum error in firmware area
Off	Is flashing	Missing or faulty configuration data
Off	On	No error has occurred
On	On	Firmware has detected an overload

Table 2: Significance of the LED signals

6 HiCOCAN-MiniPCI

Two independent CAN channels compliant with the CAN 2.0B specification on a high quality miniPCI (type IIIA) hardware in industrial temperature range. Integrated CAN Tranceivers with optional TTL-signals for galvanic isolation.

6.1 CAN connector pinout

The onboard female connector for the CAN signals connector is **Molex 53780-1470** and the male connector is **Molex 51146-1400** (for more information visit www.molex.com).

Pin	Signal
1	+3,3V
2	CAN1 + / CAN1 TD
3	CAN1 - / CAN1 RD
4	CAN1 IO or CAN1 ERR
5	Ground
6	CAN2 + / CAN2 TD
7	CAN2 - / CAN2 RD
8	CAN2 IO or CAN2 ERR
9	Ground
10	reserved, do not use
11	reserved, do not use
12	reserved, do not use
13	reserved, do not use
14	reserved, do not use

6.2 Mechanical Data

PCB	Glasepoxi FR-4 UL-listed, 6 layers
Dimensions	60 mm x 51 mm x 3 mm compliant with miniPCI type IIIA Weight 11g
Delivered Cable	1x 14-pins connector to 3x DSUB-9. Length 30 cm

6.3 Electrical Data

Supply voltage	+3.3V, ±5%
Current consumption	80 mA max.

6.4 Environmental Conditions

Operating temperature	-40 ... +85°C
Storage temperature	-55 ... +125°C
Relative humidity	0 ... 95 %, non-condensing

6.5 Fault Tolerant CAN (optional)

The Board is provided by default with a CAN-transceiver on each channel and the pins 2/3 and 6/7 provide the signals CANx+/CANx-. The board can be optionally delivered without the CAN transceivers and the TTL level CAN TD and CAN RD signals lead to the pins 2/3 and 6/7 of the onboard connector thus enabling the implementation of external galvanic isolation.

There are two IO-pins (one for each CAN node), which can be used as error lines for Fault-Tolerant CAN or for other customer specific purposes.

6.6 Firmware overview

Firmware consists of two parts; the bootloader (FW1) and the actual firmware (FW2). FW1 is permanent and can be updated only with special hardware. FW2, however, can be updated without any risk of damaging the boot loader. The Processor on the board communicates with the host PC via 8Kbytes of Dual Ported Memory (DPM).

6.7 Onboard LEDs

Normal use

When the board firmware is running the application firmware (FW2), the green leds indicate traffic on the CAN bus. When a telegram is sent or received the led is turned on for a short time (~20ms).

The Red led is turned on for a short time when a buffer overflow occurred. The red led is also turned on if the node is in error mode (error passive or Bus-Off)

Firmware exception

In case the firmware run into an exception both of the red leds are turned on and off at constant interval (~200ms). In case of an exception, the state of the green leds is undefined. However, if both of the green leds are on – it is likely that the failure happened in the bootloader (FW1) during firmware update or after unsuccessful fw update (i.e. no valid FW2 found).

7 CAN-MiniPCI-4H

Four independent CAN channels compliant with the CAN 2.0B specification on a high quality miniPCI (type IIIA) hardware in industrial temperature range. The board contains four high speed CAN transceivers supporting 1 MBaud.

7.1 CAN connector pinout

The onboard female connector for the CAN signals connector is **Molex 53780-1470** and the male connector is **Molex 51146-1400** (for more information visit www.molex.com).

Pin	Signal
1	+3,3V
2	CAN1H
3	CAN1 L
4	CAN1 IO
5	GND
6	CAN2H
7	CAN2L
8	CAN2 IO
9	GND
10	CAN3H
11	CAN3 L
12	CAN4H
13	CAN4 L
14	GND

7.2 Mechanical Data

PCB	Glasepoxi FR-4 UL-listed, 6 layers
Dimensions	60 mm x 51 mm x 3 mm compliant with miniPCI type IIIA Weight 11g
Delivered Cable	1x 14-pins connector to 4x DSUB-9. Length 200 mm

7.3 Electrical Data

Supply voltage	+3.3V, ±5%
Current consumption	80 mA max.

7.4 Environmental Conditions

Operating temperature	-40 ... +85°C
Storage temperature	-55 ... +125°C
Relative humidity	0 ... 95 %, non-condensing

7.5 Firmware overview

Firmware consists of two parts; the bootloader (FW1) and the actual firmware (FW2). FW1 is permanent and can be updated only with special hardware. FW2, however, can be updated without any risk of damaging the boot loader. The Processor on the board communicates with the host PC via 8Kbytes of Dual Ported Memory (DPM).

7.6 Onboard LEDs

Normal use

When the board firmware is running the application firmware (FW2), the green leds indicate traffic on the CAN bus. When a telegram is sent or received the led is turned on for a short time (~20ms).

The Red led is turned on for a short time when a buffer overflow occurred. The red led is also turned on if the node is in error mode (error passive or Bus-Off)

Firmware exception

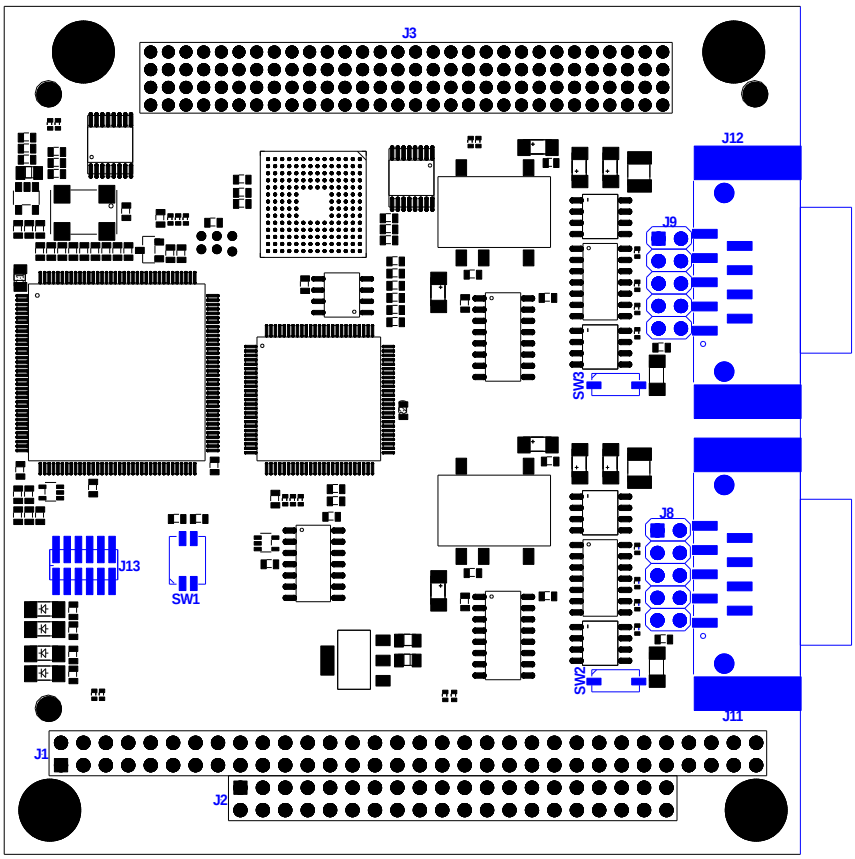
In case the firmware run into an exception both of the red leds are turned on and off at constant interval (~200ms). In case of an exception, the state of the green leds is undefined. However, if both of the green leds are on – it is likely that the failure happened in the bootloader (FW1) during firmware update or after unsuccessful fw update (i.e. no valid FW2 found).

8 CAN-PCI-104

CAN-PCI-104 is a CAN board with PCI-104 or PC/104-Plus “PCI-Only” interface which provides the following features:

- 2 CAN channels compliant with the CAN 2.0B specification, each supporting 100% load at 1Mbit/s
- support of passive mode
- integrated CAN Transceivers for high-speed or low-speed fault-tolerant
- each CAN channel separately galvanic isolated
- industrial temperature range

8.1 Connectors and Jumpers



8.1.1 SW1 - Board ID

DIP1	DIP2	Device ID
ON	ON	0
OFF	ON	1
ON	OFF	2
OFF	OFF	3

8.1.2 SW2 / SW3 – Termination resistor

OFF = no termination

ON = 120 Ohm termination resistor

8.1.3 J11 / J12 CAN connector with DSUB-9

J11 is CAN channel 2 and J12 is CAN channel 1.

Pin	Signal
1	n.c.
2	CAN-L
3	GND
4	n.c.
5	n.c.
6	GND (can be optionally n.c. if R6 is not populated)
7	CAN-H
8	n.c.
9	+12V (fault-tolerant only, n.c. for high-speed)

8.1.4 J8 / J9 CAN connector with Headers

J8 is CAN canal 2 and J9 is CAN channel 1.

Signal	Pin	Pin	Signal
n.c.	**1**	**2**	n.c.
+12V (fault-tolerant only, n.c. for high-speed)	**3**	**4**	n.c.
n.c.	**5**	**6**	GND
CAN-H	**7**	**8**	CAN-L
GND (can be optionally n.c. if R6 is not populated)	**9**	**10**	n.c.

8.1.5 J13 - Debug connector

Signal	Pin	Pin	Signal
ISP_MODE# (RTS)	**1**	**2**	DBG_UART_TXD
JTAG_TRST	**3**	**4**	DBG_UART_RXD
+3.3V	**5**	**6**	GND
JTAG_TDI	**7**	**8**	JTAG_TCK
JTAG_TMS	**9**	**10**	JTAG_RTCK
JTAG_TDO	**11**	**12**	RESET_JTAG#

8.2 Mechanical Data

Weight[1]	70 g to 100 g depending on version
Board	Glasepoxi FR-4 UL-listed, 6 layers
Dimensions	60 mm x 51 mm x 3 mm compliant with PCI-104 and PC/104-Plus

8.3 Electrical Data

Supply voltage	+5V, ±5%
Current consumption[1]	Typ. 260 mA; max. 500 mA

8.4 Environmental Conditions

Operating temperature	Standard: 0°C... +70°C; Industrial: -40°C... +85°C
Storage temperature	-55 ... +125°C
Relative humidity	0 ... 95 %, non-condensing

8.5 Fault Tolerant CAN (optional)

The Board is provided by default with a ISO/DIS 1189 compliant CAN-transceiver on each channel. The board can be optionally delivered with fault tolerant CAN transceivers.

There are two IO-pins (one for each CAN node), which can be used as error lines for Fault-Tolerant CAN or for other customer specific purposes.

8.6 Firmware overview

Firmware consists of two parts; the bootloader (FW1) and the actual firmware (FW2). FW1 is permanent and can be updated only with special hardware. FW2, however, can be updated without any risk of damaging the boot loader. The Processor on the board communicates with the host PC via 8Kbytes of Dual Ported Memory (DPM).

8.7 Onboard LEDs

Normal use

When the board firmware is running the application firmware (FW2), the green leds indicate traffic on the CAN bus. When a telegram is sent or received the led is turned on for a short time (~20ms).

The Red led is turned on for a short time when a buffer overflow occurred. The red led is also turned on if the node is in error mode (error passive or Bus-Off)

Firmware exception

In case the firmware run into an exception both of the red leds are turned on and off at constant interval (~200ms). In case of an exception, the state of the green leds is undefined. However, if both of the green leds are on – it is likely that the failure happened in the bootloader (FW1) during firmware update or after unsuccessful fw update (i.e. no valid FW2 found).

9 Troubleshooting

9.1 Support

This product has been thoroughly tested over the development period. Due to its complexity, however, no guarantee can be given that it will seamlessly operate under any circumstances. We are therefore grateful for any feedback regarding an incorrect operation of the boards.

If any problems should occur, have a look at the FAQ section of this manual first. Or visit our website at http://www.emtrion.com/support_en.php_en.php for the latest FAQ.

If you cannot find the necessary information, contact our Support Team via email, fax or phone.

To accelerate the process, please fill out the supplied form, which can be found in the Support directory of the CD or on the internet at http://www.emtrion.com/support_form_en.php.

Please fill in the form and send, fax or email it to:

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