PMC-CAN/400-4

4x CAN with ARINC Protocol and IRIG-B

Hardware Manual

to Product C.2047.xx

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Document History

The changes in the document listed below affect changes in the hardware as well as changes in the description of the facts, only.

Revision	Chapter	Changes versus previous version
1.0	all	First English version

Technical details are subject to change without further notice.

Safety Instructions and Conformity

- When working with PMC-CAN/400-4 follow the instructions below and read the manual carefully to protect yourself and the PMC-CAN/400-4 from damage.
  The guarantee does not cover damages which result from improper use or disregard of safety instructions and warnings.
- The device does not contain any serviceable parts and does not require any manual configuration of the hardware.
- Protect the device from dust, moisture and steam.
- Protect the device from shocks and vibrations.
- The device may become warm during normal use. Always allow adequate ventilation around the device and use care when handling.
- Do not operate the device adjacent to heat sources and do not expose it to unnecessary thermal radiation. Ensure an ambient temperature as specified in the technical data.
- Do not use damaged or defective cables to connect the device.
- The device is intended for indoor use only.
- The operation of the device in hazardous areas, or areas exposed to potentially explosive materials is not permitted.
- The operation of the device for medical purposes is prohibited.

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1. Overview

The PMC-CAN/400-4 is a PMC-CAN interface board with up to 4x CAN and optional ARINC protocol and IRIG-B.

1.1 PMC-CAN/400-4

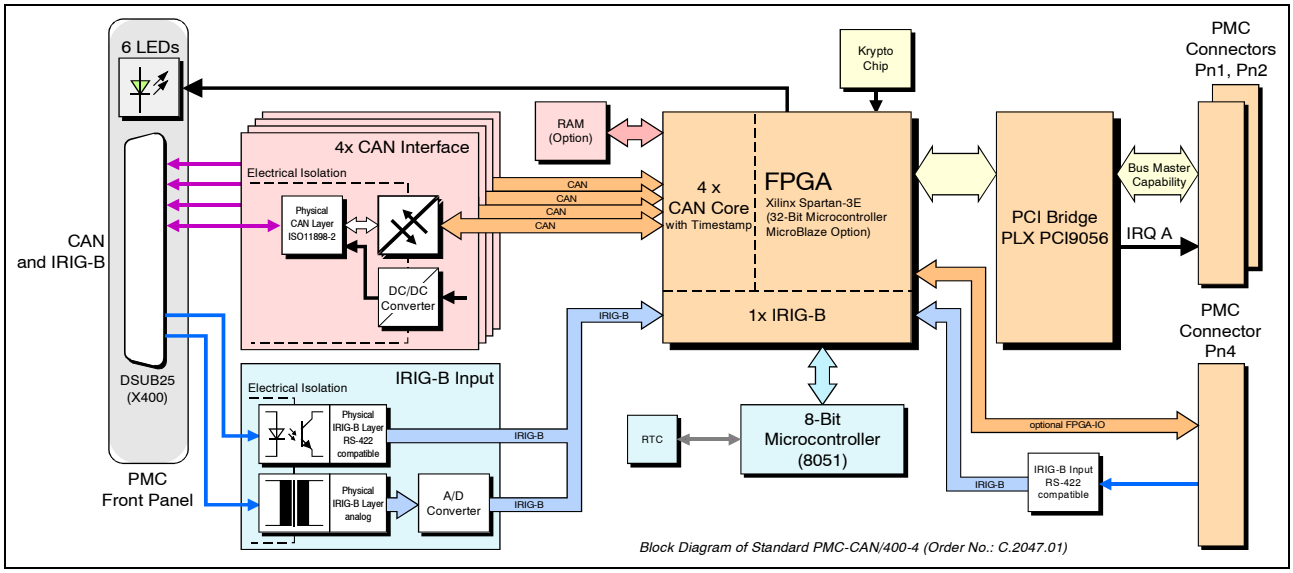


Fig. 1: Block circuit diagram PMC-CAN/400-4

The PMC-CAN/400-4 features four electrically isolated CAN High-Speed interfaces according to ISO 11898. Local data control and management is controlled by an FPGA. Optional the FPGA is available with integrated 32-bit soft microcontroller (MicroBlaze™).

The PMC-CAN/400-4 provides high resolution hardware timestamps.

The IRIG-B interface offers inputs for analog or RS-422 compatible IRIG-B coded signals at the front panel. Both are electrically isolated.
Additionally a digital input (RS-422 compatible) for IRIG-B is available at the PMC connector Pn4 (without electrical isolation).

IRIG-B evaluation is controlled by an additional microcontroller.

For the 25-pin DSUB connector in the front panel an adapter cable to 9-pin DSUBs for CAN and IRIG-B (analog and RS-422 compatible) is available.

1.2 Conduction Cooled Version PMC-CAN/400-4-CC

At the conduction cooled version PMC-CAN/400-4-CC the CAN interfaces are accessible with LVTTL signal level (3.3 V, not 5 V tolerant) at the PMC connector Pn4 only.
The physical layer of the IRIG-B input at Pn4 is RS-422 compatible.

Note:
esd offers a VMEbus carrier board in conduction cooled design to carry up to two PMC-CAN/400-4-CC.

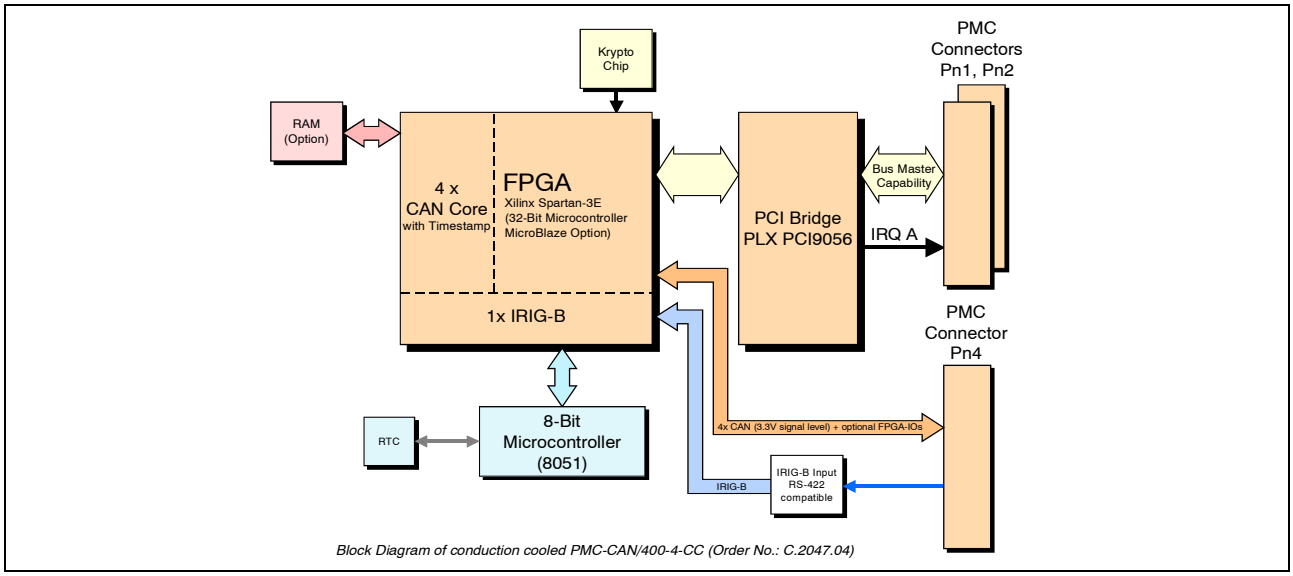


Fig. 2: Block circuit diagram PMC-CAN/400-4-CC

2. PCB-View with Connector Position

2.1 PMC-CAN/400-4

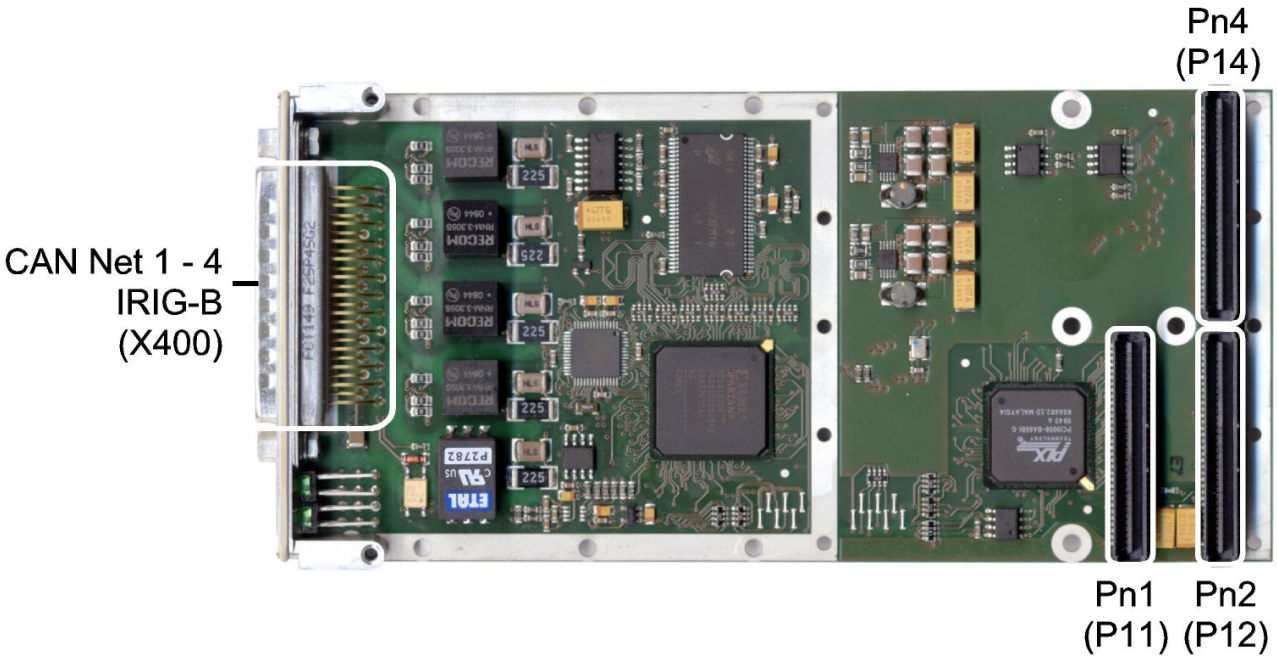


Fig. 3: Top view of PMC-CAN/400-4 facing the carrier board

2.2 PMC-CAN/400-4-CC

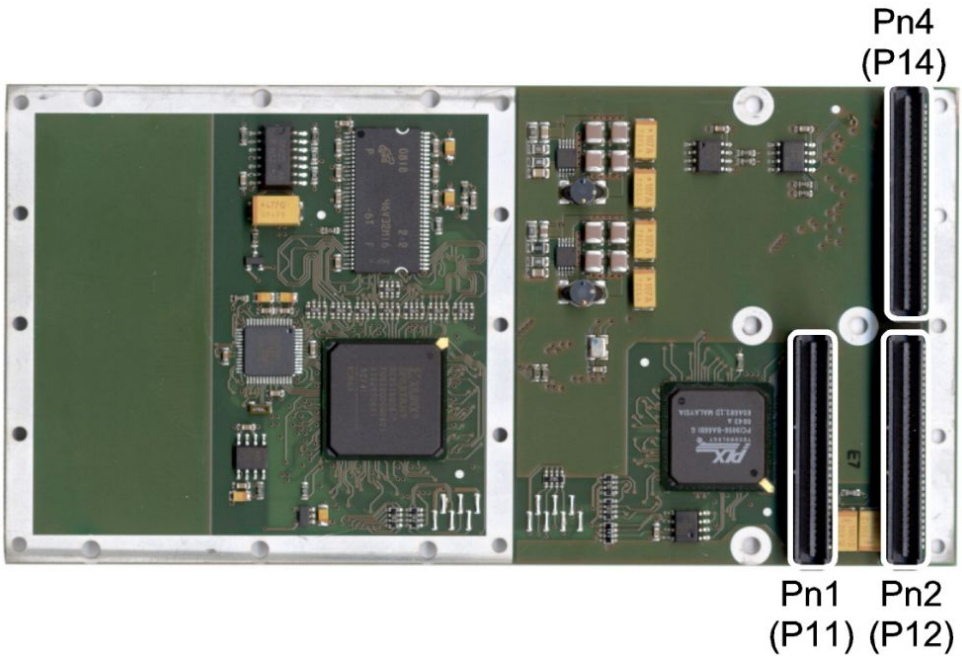


Fig. 4: Top view of PMC-CAN/400-4-CC facing the carrier board

3. LEDs

The PMC-CAN/400-4 is equipped with 6 green LEDs in the front panel.

The PMC-CAN/400-4-CC (order No.: C.2047.04) does not feature LEDs!

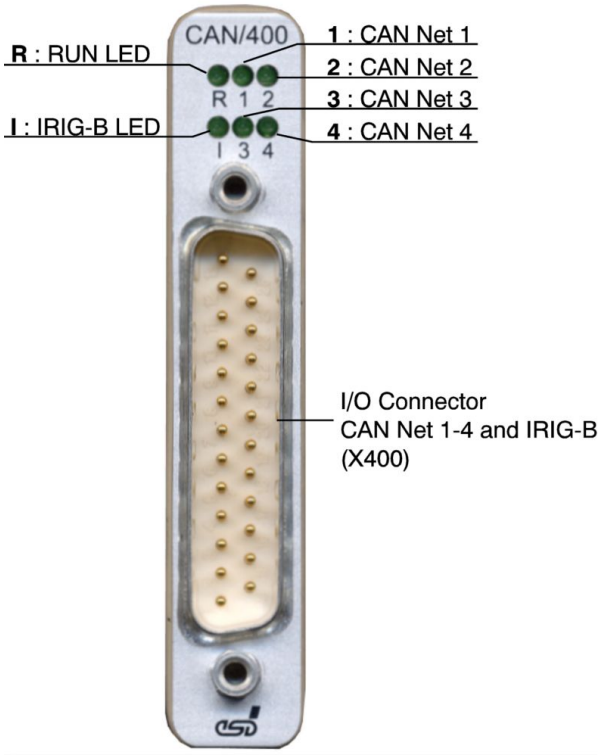


Fig. 5: Front panel view of PMC-CAN/400-4

LED	Function	**Indication** (LED on)
R	RUN	Board (FPGA) booted
I	IRIG-B	IRIG-B Link
1	CAN1	Traffic on CAN-Line 1
2	CAN2	Traffic on CAN-Line 2
3	CAN3	Traffic on CAN-Line 3
4	CAN4	Traffic on CAN-Line 4

4. Hardware Installation

Danger!
Electric shock risk. Never carry out work while power supply voltage is switched on!

Attention !
Electrostatic discharges may cause damage to electronic components. To avoid this, please perform the following steps *before* you touch the module, in order to discharge the static electricity from your body:

- Switch off the power of your computer, but leave it connected to the mains until you have discharged yourself.
- Please touch the metal case of the computer now to discharge yourself.
- Furthermore, you should prevent your clothes from touching the computer, because your clothes might be electrostatically charged as well.

Procedure:

1. Switch off your computer and all connected peripheral devices (monitor, printer, etc.).
2. Discharge your body as described above.
3. Disconnect the computer from the mains.
   If the computer does not have a flexible mains cable, but is directly connected to mains, disconnect the power supply via the safety fuse and make sure that the fuse cannot switch on again unintentionally (i.e. with caution label).

   Danger!
   Never carry out work while power supply voltage is switched on!
4. Open the case.
5. A conductive O-ring is contained in the product package of the PMC-CAN/400-4 module (order No.:C.2047.01…03). Mount the conductive O-ring on the front panel of the PMC-CAN/ 400-4 to obtain EMC shielding.
6. Remove the carrier board (if already installed) and plug the PMC-CAN/400-4 carefully on the carrier board. Pay attention that the PMC module is correctly installed on the carrier board. Fix the PMC-CAN/400-4 with the screws on the carrier board. Use the four M 2.5 x 6 mm screws which are contained in the product package of the module.
7. Install the carrier board in your system.
8. Close the computer case again.
9. Connect the CAN interfaces and the IRIG-B via the DSUB25 connector in the front panel of the PMC-CAN/400-4.
10. Connect the computer to mains again (mains connector or safety fuse).
11. Switch on the computer and the peripheral devices.
12. End of hardware installation.
13. Set the interface properties in your operating system. Refer to the documentation of the operating system.

5. Summary of Technical Data

5.1 General Technical Data

Power supply voltage	Nominal voltage: 5 V/DC or 3.3 V/DC, Universal board Current consumption (20 °C): typical: 5 V : 56 mA 3,3V: 570 mA	
Connector	P11 (Pn1):	(64-pin PMC connector) - PCI bus
	P12 (Pn2):	(64-pin PMC connector) - PCI bus
	P14 (Pn4):	(64-pin PMC connector) - CAN, IRIG-B (TTL level only) (CAN signals only available at PMC-CAN/400-4-CC, order No.: C.2047.04)
	X400:	(DSUB25) - CAN, IRIG-B (physical layers available) Note: X400 is not available at conduction cooled version (C.2047.04).
Temperature range	standard:	0...50 °C ambient temperature (PMC-CAN/400-4 order No.: C.2047.01…03)
	extended:	-20...+75 °C (on request)
	conduction cooled:	-40...+85 °C (only PMC-CAN/400-4-CC, order No.: C.2047.04)
Humidity	max. 90%, non-condensing	
Dimensions	74.0 mm x 149.0 mm (single PMC size)	
Weight	PMC-CAN/400-4 : 81 g PMC-CAN/400-4-CC : 50 g	

5.2 PCI Bus

Host bus	PCI-Bus according to PCI Local Bus Specification 2.2
PMC specification	IEEE Standard 1386.1-2001
PCI bus master capability	yes
PCI-data bus	32 bit
PCI bus clock rate	66 MHz / 3.3 V signal level 33 MHz /3.3 V signal level or 5 V signal level Universal board
Microprocessor	optional: 32-bit microprocessor in FPGA
Memory	Block RAM: 72 KB optional DRAM: 64 MB
Interrupt	interrupt signal INT A
Connectors	P11 (Pn1), P12 (Pn2), P14 (Pn4) according to IEEE Standard P1386.1-2001

5.3 CAN Interfaces

Number	4x CAN High-Speed
CAN controller	CAN core integrated in FPGA, according to ISO11898-1 (CAN 2.0 A/B)

Module type	PMC-CAN/400-4	PMC-CAN/400-4-CC
Order no.	C.2047.01 C.2047.02 C.2047.03	C.2047.04
Physical interface	physical layer in accordance with ISO11898-2, bit rate up to 1 Mbit/s	LVTTL level (3.3V, NOT 5V-tolerant !), bit rate up to 1 Mbit/s
Electrical isolation	via dual digital isolators and DC/DC converters	none
Bus termination	has to be set externally	none
Connector	X400 (DSUB25 male)	Pn4 (PMC I/O)

5.4 IRIG-B Input

Input / decoder analog	- coding IRIG B120/B123 + IEEE1344-1995 - isolating transformer - 12 bit A/D converter - connector: X400 (DSUB25 male) *
Input digital	- RS-422 compatible - coding IRIG B020/B023 + IEEE1344-1995 - connector: X400 (DSUB25 male) * electrical isolation
	- RS-422 compatible - coding IRIG B020/B023 + IEEE1344-1995 - connector: Pn4 *
Controller	8051

*** Note:**
At the standard module types without conduction cooling the IRIG-B RS-422 compatible input is available at Pn4 as well. Please take attention that the interface is connected alternatively to X400 OR Pn4, not simultaneously!

5.5 Software

CAN layer 2 (CAN-API) software drivers are available for Windows, VxWorks*, QNX* and Linux* supporting up to 24 CAN nets. Drivers for other operating systems are available on request.

The CANopen software package is available for Windows, VxWorks* and Linux*.

ARINC 825 as another higher layer protocol is available as an option.

* For a detailed information about the driver availability of your special operation system please contact our sales team.

6. Order Information

Type	Description	Order No.
Modules:		
PMC-CAN/400-4	4x CAN, 1x IRIG-B, ARINC 825 firmware, standard cooling *	C.2047.01
	4x CAN, 1x IRIG-B, standard cooling *	C.2047.02
	4x CAN, standard cooling *	C.2047.03
PMC-CAN/400-4-CC	4x CAN, 1x IRIG-B, ARINC 825 firmware, conduction cooling, interfaces available at Pn4 with TTL level only	C.2047.04
Adapter:		
PMC-CAN/400-4-1C5	Adapter cable DSUB25 female to 4x DSUB9 male (4x CAN) + 1x DSUB9 female (IRIG-B), length: 0.5 m	C.2047.18
Software:		
PMC-CAN/400-4-Vx	VxWorks object licence	C.2047.55
PMC-CAN/400-4-QNX	QNX object licence	C.2047.32
CAN-DRV-LCD	CAN layer 2 (CAN-API) object licence for Windows and Linux incl. CD-ROM	C.1101.02
CANopen-LCD	CANopen object licence for Windows and Linux incl. CD-ROM	C.1101.06
Manuals:		
PMC-CAN/400-4-ME	PMC-CAN/400-4 manual in English (this manual)	C.2047.21
PMC-CAN/400-4-MD	PMC-CAN/400-4 manual in German	C.2047.20
CAN-API-ME	Software manual for the host-software drivers in English	C.2001.21
CANopen-ME	CANopen manuals	C.2002.21

*... All PMC-CAN/400-4 versions, except of the conduction cooled version, come with front panel and EMC shielding O-ring and fixing screws.

7. Connector Assignment

7.1 I/O Connector X400 (DSUB25 male) Pin Assignment

X400

Signal	Pin		Signal
CAN1_L	1	14	CAN1_H
CAN1_GND	2	15	-
-	3	16	CAN2_L
CAN2_H	4	17	CAN2_GND
-	5	18	-
CAN3_L	6	19	CAN3_H
CAN3_GND	7	20	-
-	8	21	CAN4_L
CAN4_H	9	22	CAN4_GND
-	10	23	-
-	11	24	IRIG-B_RX+
IRIG-B_RX-	12	25	IRIG-B_A+
IRIG-B_A-	13		

Description of Signals at X400

Name	Description
-	This pin is not connected at the module.
CANx_L, CANx_H, CANx_GND	CAN signals of CAN node x (x= 1, 2, 3, 4). Physical layer according to ISO11898-2.
IRIG-B_RX+, IRIG-B_RX-,	IRIG-B input. Physical layer RS-422 compatible.
IRIG-B_A+, IRIG-B_A-,	IRIG-B analog input.

7.2 PMC Connectors

The PMC-CAN/400-4 module uses the PMC connectors Pn1, Pn2 and Pn4. Pn1 and Pn2 provide the PCI interface and power supply connection. Pn4 has a complete module specific pin out.

7.2.1 PMC Connector Pn1 (P11)

Pn1

Signal	Pin		Signal
TCK	1	2	-12V
GND	3	4	INTA#
n.c. (INTB#)	5	6	n.c. (INTC#)
GND (BMODE1#)	7	8	+5V
n.c. (INTD#)	9	10	n.c. (reserved)
GND	11	12	+3.3VAUX
PCI-CLK	13	14	GND
GND	15	16	GNT#
REQ#	17	18	+5V
VIO	19	20	AD[31]
AD[28]	21	22	AD[27]
AD[25]	23	24	GND
GND	25	26	C/BE3#
AD[22]	27	28	AD[21]
AD[19]	29	30	+5V
VIO	31	32	AD[17]
FRAME#	33	34	GND
GND	35	36	IRDY#
DEVSEL#	37	38	+5V
GND (XCAP)	39	40	LOCK#
n.c. (SDONE#)	41	42	n.c. (SBO)
PAR	43	44	GND
VIO	45	46	AD[15]
AD[12]	47	48	AD[11]
AD[09]	49	50	+5V
GND	51	52	C/BE0#
AD[06]	53	54	AD[05]
AD[04]	55	56	GND
VIO	57	58	AD[03]
AD[02]	59	60	AD[01]
AD[00]	61	62	+5V
GND	63	64	n.c. (REQ64#)

For signal description please refer to the PCI Local Bus Specification 2.2.

7.2.2 PMC Connector Pn2 (P12)

Pn2

Signal	Pin		Signal
+12V	1	2	TRST#
TMS	3	4	TDO (bridged to TDI)
TDI (bridged to TDO)	5	6	GND
GND	7	8	n.c. (reserved)
n.c. (reserved)	9	10	n.c. (reserved)
n.c. (MODE2#)	11	12	+3.3V
PCI-RST#	13	14	n.c. (MODE3#)
+3.3V	15	16	n.c. (MODE4#)
n.c. (PME#)	17	18	GND
AD[30]	19	20	AD[29]
GND	21	22	AD[26]
AD[24]	23	24	+3.3V
IDSEL	25	26	AD[23]
+3.3V	27	28	AD[20]
AD[18]	29	30	GND
AD[16]	31	32	C/BE2#
GND	33	34	n.c (IDSELB)
TRDY#	35	36	+3.3V
GND	37	38	STOP#
PERR#	39	40	GND
+3.3V	41	42	SERR#
C/BE1#	43	44	GND
AD[14]	45	46	AD[13]
M66EN	47	48	AD[10]
AD[08]	49	50	+3.3V
AD[07]	51	52	n.c. (REQB#)
+3.3V	53	54	n.c. (GNTB#)
n.c. (reserved)	55	56	GND
n.c. (reserved)	57	58	n.c. (EREADY)
GND	59	60	RESETOUT#
n.c. (ACK64#)	61	62	+3.3V
GND	63	64	MONARCH#

For signal description please refer to the PCI Local Bus Specification 2.2.

7.2.3 PMC Connector Pn4 (P14) Pin Assignment

7.2.3.1 PMC-CAN/400-4

Pn4 (P14)

Direction	Signal	Pin		Signal	Direction
n.a.	-	1	2	-	n.a.
n.a.	-	3	4	-	n.a.
n.a.	-	5	6	-	n.a.
n.a.	-	7	8	-	n.a.
n.a.	-	9	10	-	n.a.
n.a.	-	11	12	-	n.a.
n.a.	-	13	14	-	n.a.
n.a.	-	15	16	-	n.a.
tbd.	(FPGA_IO)	17	18	-	n.a.
tbd.	(FPGA_IO)	19	20	-	n.a.
tbd.	(FPGA_IO)	21	22	-	n.a.
tbd.	(FPGA_IO)	23	24	-	n.a.
tbd.	(FPGA_IO)	25	26	-	n.a.
tbd.	(FPGA_IO)	27	28	-	n.a.
tbd.	(FPGA_IO)	29	30	-	n.a.
tbd.	(FPGA_IO)	31	32	-	n.a.
n.a.	-	33	34	(FPGA_IO)	tbd.
n.a.	-	35	36	(FPGA_IO)	tbd.
n.a.	-	37	38	(FPGA_IO)	tbd.
n.a.	-	39	40	(FPGA_IO)	tbd.
n.a.	-	41	42	-	n.a.
n.a.	-	43	44	-	n.a.
tbd.	(FPGA_IO)	45	46	-	n.a.
n.a.	-	47	48	-	n.a.
n.a.	-	49	50	(FPGA_IO)	tbd.
tbd.	(FPGA_IO)	51	52	(FPGA_IO)	tbd.
tbd.	(FPGA_IO)	53	54	(FPGA_IO)	tbd.
tbd.	(FPGA_IO)	55	56	(FPGA_IO)	tbd.
tbd.	(FPGA_IO)	57	58	(FPGA_IO)	tbd.
Input	**IRIG-B.POS**	59	60	(FPGA_IO)	tbd.
Input	**IRIG-B.NEG**	61	62	(FPGA_IO)	tbd.
tbd.	(FPGA_IO)	63	64	(FPGA_IO)	tbd.

Name	Description of Signals at PN4
-	This pin is not connected at the module.
n.a.	not applicable
tbd.	to be defined
(…)	Pins with signal names in brackets are reserved for future use. These signals are not supported at the moment.
IRIG-B.POS, IRIG-B.NEG	IRIG-B digital input. Physical layer RS-422 compatible.

7.2.3.2 PMC-CAN/400-4-CC

Pn4 (P14)

Direction	Signal	Pin		Signal	Direction
Input	**CAN1_RX**	1	2	-	n.a.
Output	**CAN1_TX**	3	4	-	n.a.
Input	**CAN2_RX**	5	6	-	n.a.
Output	**CAN2_TX**	7	8	-	n.a.
Input	**CAN3_RX**	9	10	-	n.a.
Output	**CAN3_TX**	11	12	-	n.a.
Input	**CAN4_RX**	13	14	-	n.a.
Output	**CAN4_TX**	15	16	-	n.a.
tbd.	(FPGA_IO)	17	18	-	n.a.
tbd.	(FPGA_IO)	19	20	-	n.a.
tbd.	(FPGA_IO)	21	22	-	n.a.
tbd.	(FPGA_IO)	23	24	-	n.a.
tbd.	(FPGA_IO)	25	26	-	n.a.
tbd.	(FPGA_IO)	27	28	-	n.a.
tbd.	(FPGA_IO)	29	30	-	n.a.
tbd.	(FPGA_IO)	31	32	-	n.a.
n.a.	-	33	34	(FPGA_IO)	tbd.
n.a.	-	35	36	(FPGA_IO)	tbd.
n.a.	-	37	38	(FPGA_IO)	tbd.
n.a.	-	39	40	(FPGA_IO)	tbd.
n.a.	-	41	42	-	n.a.
n.a.	-	43	44	-	n.a.
tbd.	(FPGA_IO)	45	46	-	n.a.
n.a.	-	47	48	-	n.a.
n.a.	-	49	50	(FPGA_IO)	tbd.
tbd.	(FPGA_IO)	51	52	(FPGA_IO)	tbd.
tbd.	(FPGA_IO)	53	54	(FPGA_IO)	tbd.
tbd.	(FPGA_IO)	55	56	(FPGA_IO)	tbd.
tbd.	(FPGA_IO)	57	58	(FPGA_IO)	tbd.
Input	**IRIG-B.POS**	59	60	(FPGA_IO)	tbd.
Input	**IRIG-B.NEG**	61	62	(FPGA_IO)	tbd.
tbd.	(FPGA_IO)	63	64	(FPGA_IO)	tbd.

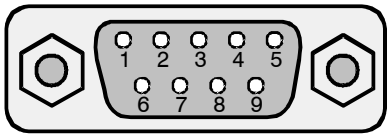
Name	Description of Signals at PN4
-	This pin is not connected at the module.
n.a.	not applicable
tbd.	to be defined
(…)	Pins with signal names in brackets are reserved for future use. These signals are not supported at the moment.
CANx_RX, CANx_TX	CAN signals of CAN node x (x= 1, 2, 3, 4). 3.3 V signal levels only (not 5 V tolerant!)
IRIG-B.POS, IRIG-B.NEG	IRIG-B digital input. Physical layer RS-422 compatible.

7.3 Adapter Cable DSUB25 to 5x DSUB9 (Order no. C.2047.18)

esd offers an adapter cable called PMC-CAN/400-4-1C5 to connect the CAN interfaces and the IRIG-B input to the front panel connector X400 (see order information on page 15). This cable offers one DSUB9 male connector for each CAN interface and one DSUB9 female connector for IRIG-B.

7.3.1 CAN Interfaces at DSUB9 Male (4x)

Pin Position:



Pin Assignment:

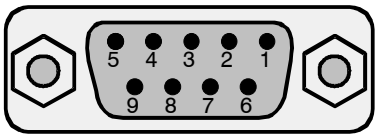
Signal	Pin		Signal
-	1	6	-
CANx_L	2	7	CANx_H
CANx_GND	3	8	-
-	4	9	-
-	5		

Pin Description:

Name	Description
-	This pin is not connected at the module.
CANx_L, CANx_H, CANx_GND	CAN signals of CAN node x (x= 1, 2, 3, 4). Physical layer according to ISO11898-2.

7.3.2 IRIG-B Analog and RS-422 Compatible Input at DSUB9 Female

Pin Position:



Pin Assignment:

Signal	Pin		Signal
IRIG-B_A+	1	6	-
-	2	7	-
-	3	8	IRIG-B_A-
IRIG-B_RX-	4	9	IRIG-B_RX+
	5		

Pin Description:

Name	Description
-	This pin is not connected at the module.
IRIG-B_RX+, IRIG-B_RX-,	IRIG-B input. Physical layer RS-422 compatible.
IRIG-B_A+, IRIG-B_A-,	IRIG-B analog input.