Design Guide

netJACK Communication Module

Hilscher Gesellschaft für Systemautomation mbH

www.hilscher.com

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Table of Contents

1 Introduction

1.1 About this document

Hilscher now introduces a new generation of universal and easy to use Fieldbus and Real-Time-Ethernet communication modules in a plastic housing for integration on various host systems: The netJACK communication module. All netJACK modules have the same dimensions; they differ only in their connectors and electrical features. Therefore, it is easy to switch between the different Fieldbus systems, e.g. PROFIBUS-DP, CANopen, DeviceNet, and Ethernet by simply changing the module.

Currently, there are two different types of modules available:

- Modules with a parallel Dual-Port-Memory interface (60/80 pin connector)
- Modules with a serial PCI-Express interface (20/40 pin connector)

A special advantage of the netJACK modules is that no accessory parts are required for mounting. This offers you maximum flexibility for your own design.

The netJACK modules is a new generation of Modules and offer beside Fieldbus communication also Real-Time Ethernet communication.

The aim of this manual is to provide all information needed by the hardware engineer to include the netJACK communication modules into your own design.

This manual only describes the hardware part of the modules. The general application interface that is common to all our netJACK and comX modules and cifX PC cards is described in our Toolkit-Manual and the Fieldbus related respectively Real-Time Ethernet related details are defined in our Protocol API Manuals.

1.2 List of revisions

Rev	Date	Name	Revision
4	2013-09-09	RGo	Added NJ100DN-CO, NJ100DN-DN, NJ100DN-RE Added NJ10D-CCS, NJ10D-COS, NJ10D-DNS, NJ10D-DPS Added NJ51D-RE Added missing EMV data for NJ100DN-DP and NJ50D-RE Added missing EMV data for NJ10D-CCS,COS,DNS 100 nF capacitor for signals PETP and PETN already built-in in netJACK Updated section "*Timing diagram dual-port memory interface*" for NJ51D, corrections for NJ10D and column "Common" of *Table 14.* Adapted note in section "*Busy line to the host system*". Added new section "*Serial dual-port memory mode – Signals of the host interface*"
5	2014-10-07	RGo	Additional information for NJ 10D and NJ 51D in *Table 7: netJACK pinning of the NJ51D/52D (Parallel dual-port memory mode)*
6	2021-07-22	HHe, RGo	Subsection *Placement of components on carrier board* added.
			Subsections *Address bus and data bus*, *Dual-port memory control lines* and *Busy line to the host system* extended.
			Section *Serial dual-port memory interface* (X7) added.
			Section *Reset signal*: information about reset generator added.
			Added NJ52D-DPS
			Removed NJ10D-CCS, NJ10D-COS, NJ10D-DNS, NJ10D-DPS
			Removed NJ50D-RE
7	2022-03-17	HHe, RGo	Added NJ52D-COS, NJ52D-DNS

Table 1: List of revisions

1.3 References to documents

This document refers to the following other documents:

[1] Hilscher Gesellschaft für Systemautomation mbH: Dual-Port Memory Interface Manual, netX based products, Revision 17, English, 2020 (DocID DOC060302DPM17EN)

[2] Hilscher Gesellschaft für Systemautomation mbH: netJACK User Manual, Revision 8, English, 2022 (DocID DOC110504UM08EN) (also available in German as “netJACK Benutzerhandbuch” , Revision 8, DocID DOC110504UM08DE)

[3] PCI SIG: PCI Express Card Electromechanical Specification, Revision 3.0, 2011

[4] Hilscher Gesellschaft für Systemautomation mbH: Technical Data Reference Guide, netX 51/52, Revision 3, English, 2012-17 (DocID DOC120503TRG03EN)

[5] Hilscher Gesellschaft für Systemautomation mbH: EtherCAT Slave V4 Protocol API, Revision 12, English, 2011-2021 (DocID DOC110909API12EN)

[6] Hilscher Gesellschaft für Systemautomation mbH: Sercos Slave V3.5/V5.1 Protocol API, Revision 18, English, 2008-2021 (DocID DOC100205API18EN)

[7] Hilscher Gesellschaft für Systemautomation mbH: Getting Started Guide, Serial Dual-Port Memory Interface with netX, Revision 6, English, 2018

2 netJACK product overview

Hilscher now introduces a new generation of universal and easy to use Fieldbus and Real-Time-Ethernet communication modules in a plastic housing for integration on various host systems: The netJACK communication module. All netJACK modules have the same dimensions; they differ only in their connectors and electrical features. Therefore, it is easy to switch between the different fieldbus systems, e.g. PROFIBUS-DP, CANopen and DeviceNet, or Real-Time Ethernet by simply changing the communication module.

Currently, there are two different types of modules available:

- Modules with a parallel dual-port-memory interface (60/80-pin connector)
- Modules with a serial PCI Express interface (20/40-pin connector)

A special advantage of the netJACK modules is that no accessory parts are required for mounting. This offers you maximum flexibility for your own design.

2.1 Features

Common technical features for netJACK

- Communication module with either PCI Express or 8/16-bit dual-port memory for various Fieldbus and Real-time-Ethernet systems
- Solid mechanical assembly with closed housing
- Protection class IP40
- Compact dimensions
- No tool required for mounting, can easily plugged in or pulled out manually.
- No accessory parts such as connector and guide rails are required for mounting. Signal areas and notches in PCB of base device are sufficient for easy and solid mounting. This offers you maximum flexibility for your own design.
- PCI-Express version: Easy to use 1-lane PCI-Express interface especially suited for high-performance embedded applications.
- PCI-Express version: Driver interface compatible to Hilscher's cifX PC card family. Easy access via cifX device driver.
- Dual-port memory version: Easy to use dual-port memory interface
- Dual-port memory version: Host interface is designed for 64 KByte address space of dual-port memory with selectable bus width of 8 or 16 bit. Usable size of dual-port memory: 16 kB.
- Integrated USB (all types) or serial diagnostic interface (UART, only at dual-port memory types)
- 3.3 V power supply allows low power consumption

Now you can have only one type of communication module on stock and you can mount the requested bus interface shortly before shipment to the customer.

Feature for future use:

- Integrated I/Os and I^2C interface, for instance for connection with address switches and synchronization signals for drives

2.2 Overview

netJACK mechanic and pinning

The following table gives an overview on the available types of netJACK modules and refers to the section and page for detailed description for each module type.

netJACK	Interface	Detailed description about
NJ 52D-COS, NJ 52D-DNS, NJ 52D-DPS, NJ 51D-RE	60 pin with dual-port memory interface	▪ Dimension see section *Dimensions netJACK* on page 12 ▪ Cut-out see section *Necessary cutout in front panel of housing* on page 15 ▪ Carrier board see section *Carrier board for 60 pin netJACK modules* on page 22 ▪ U-notch coding see *Figure 13: Footprint for carrier board for 60 pin netJACK modules* on page 22 and section *U-notch coding* on page 17 ▪ Pinning see section ▪ *netJACK NJ 51D / NJ 52D pinning – 60-pin* on page 28
NJ 100EN-RE, NJ 100EN-CO, NJ 100EN-DN, NJ 100EN-DP	40 pin with PCI Express interface	▪ Dimension see section *Dimensions netJACK* on page 12 ▪ Cut-out see section *Necessary cutout in front panel of housing* on page 15 ▪ Carrier board see section *Carrier board for 40 pin netJACK modules* on page 20 ▪ U-notch coding see *Figure 11: Footprint for carrier board for 40 pin netJACK modules* on page 20 and section *U-notch coding* on page 17 ▪ Pinning see section *netJACK NJ 100EN pinning – 40-pin* on page 26
NJ 100DN-RE, NJ 100DN-CO, NJ 100DN-DN, NJ 100DN-DP	80 pin with dual-port memory and system interface	▪ Dimension see section *Dimensions netJACK* on page 12 ▪ Cut-out see section *Necessary cutout in front panel of housing* on page 15 ▪ Carrier board see section *Carrier board for 80 pin netJACK modules* on page 24 ▪ U-notch coding see *Figure 15: Footprint for carrier board for 80 pin netJACK modules* on page 24 and section *U-notch coding* on page 17 ▪ Pinning see section *netJACK NJ 100DN pinning – 80-pin* on page 30

Table 2: netJACK types – Overview: mechanic and pinning

netJACK and protocols

The following table gives an overview on the available types of netJACK modules and the applicable protocol/firmware for each module type.

netJACK	Protocol	Host Interface
NJ 52D-COS	CANopen Slave	Dual-port memory
NJ 52D-DNS	DeviceNet Slave	
NJ 52D-DPS	PROFIBUS-DP Slave	
NJ 51D-RE	PROFINET IO Device/Slave EtherCAT Slave Ethernet/IP Adapter/Slave Sercos Slave Open Modbus/TCP	
NJ 100DN-CO	CANopen Master CANopen Slave	
NJ 100DN-DN	DeviceNet Master DeviceNet Slave	
NJ 100DN-DP	PROFIBUS-DP Master PROFIBUS-DP Slave	
NJ 100DN-RE	PROFINET IO Controller/Master PROFINET IO Device/Slave EtherCAT Master EtherCAT Slave EtherNet/IP Scanner/Master Ethernet/IP Adapter/Slave Sercos Master Sercos Slave POWERLINK Controlled Node/Slave Open Modbus/TCP VARAN Client/Slave	
NJ 100EN-RE	PROFINET IO Controller/Master PROFINET IO Device/Slave EtherCAT Master EtherCAT Slave EtherNet/IP Scanner/Master Ethernet/IP Adapter/Slave Sercos Master Sercos Slave POWERLINK Controlled Node/Slave Open Modbus/TCP VARAN Client/Slave	PCI Express
NJ 100EN-CO	CANopen Master CANopen Slave	
NJ 100EN-DN	DeviceNet Master DeviceNet Slave	
NJ 100EN-DP	PROFIBUS-DP Master PROFIBUS-DP Slave	

Table 3: netJACK types – Overview: protocol and host interface

Whether the netJACK acts as a master or a slave depends on the loaded firmware.

2.3 Host interface: Dual-port memory or PCI-Express

In general, there are two kinds of netJACK communication modules available, which differ concerning their host interface

- PCI Express
- Dual-port memory

PCI Express is a standardized serial high-speed interface, which has been developed for use in personal computers. It is also used in some cifX communication interfaces from Hilscher such as the cifX 50E, the cifX 70E and the cifX 90E. Therefore, it is possible to access a PCI Express based netJACK module via the Hilscher cifX Device Driver.

The dual-port memory interface can alternatively be used to connect a netJACK communication module to its host device. This is the same kind of access, which is also used, in the established series of comX communication modules from Hilscher. The netJACK modules with dual-port memory-based host interface can be configured to be used with parallel interface. This can be configured by the level of the mode discrimination signal DPM_DIRQn/CSMD that is used as output (but used as input during start-up)

- Use the mode discrimination signal always with high level to select parallel dual-port memory mode.
- To use the mode discrimination signal with low level for serial DPM (via an SPI-like high-speed serial interface) is currently not allowed, because this option is not yet available).

Important: Never drive the mode discrimination signal DPM_DIRQn/CSMD. Instead, operation with pull-down and pull-up resistors is recommended.

There is also a possibility to configure the width of the dual-port memory (8 or 16 bit).

The width discrimination signal DPM_SIRQn/CMBW provides the possibility to configure the width of the dual-port memory to 8 or 16 bit.

- If the level of the width discrimination signal is high, DPM will operate in 8-bit mode. This is the default.
- If the level of the width discrimination signal is low, DPM will operate in 16-bit mode.

The dual-port memory types differ from the PCI Express types in their pin assignment, so they cannot be used on the same boards! In order to avoid the use of an incorrect type, the netJACK modules are protected by U-notch coding, see page 17.

2.4 Designation

Each netJACK module has a matrix code label.

Figure 1 shows the matrix label for the NJ100EN-RE, for instance:

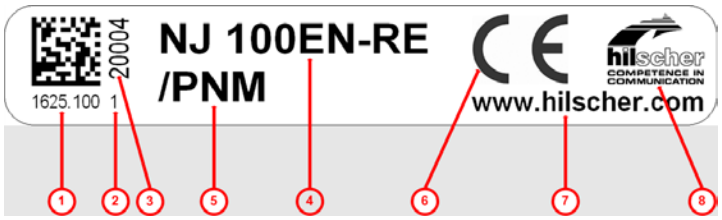

Figure 1: Matrix code label for netJACK communication modules (Example)

This matrix code label also contains the following items of information:

1. Hilscher part number
2. Hardware revision
3. Serial number of individual device
4. Abbreviation of module name
5. Name of firmware (Master firmware always contains a master license.)
6. CE sign
7. Hilscher's web address
8. Hilscher logo

3 Design-in - Mechanical aspects

3.1 Dimensions

3.1.1 Dimensions netJACK

The netJACK module has the following dimensions:

Dimension	Measured	Length
Overall length	Including fieldbus connectors exceeding the front panel surface	Depends on connector
Overall length	Excluding fieldbus connectors exceeding the front panel surface	62 mm
Length	Measured without front panel and fieldbus connectors	60 mm
Overall width	At the front panel	53.4 ± 0.10 mm
Maximum width behind front panel	Measured between light grey housing parts	50.4 ± 0.10 mm
Width	Measured between black housing parts	50 mm
Height	Of front panel	25.20 ± 0.10 mm
Height	Directly behind front panel	22.20 ± 0.10 mm
Height	At the body of the housing	19.30 ± 0.10 mm

Table 4: Dimensions of netJACK module

The following figure shows

- The top view onto the netJACK housing (central part)
- The front view onto the netJACK housing (left part)
- The left side view onto the netJACK housing (upper part)
- The back side view onto the netJACK housing (right part)

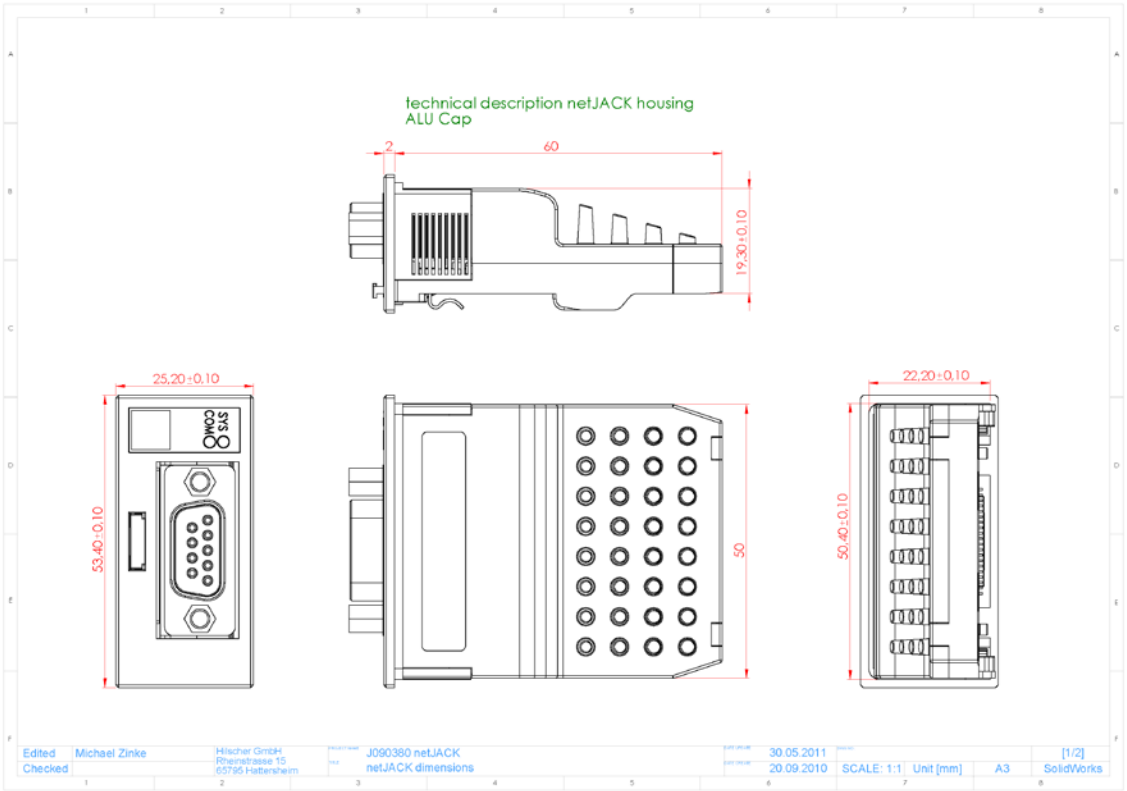

Figure 2: Dimensions of netJACK module – Housing with aluminum cap

The following figure shows the same for netJACK communication modules with plastic cap.

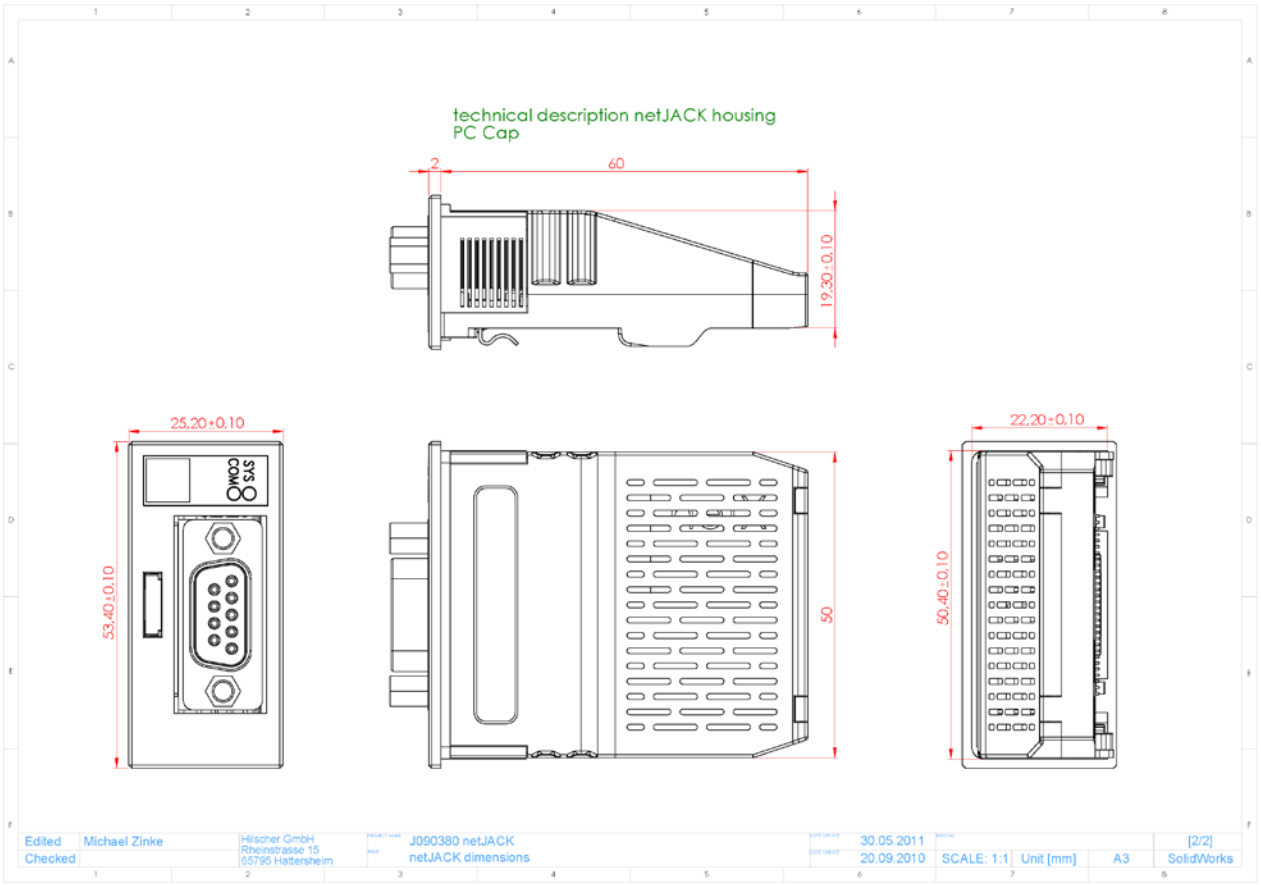

Figure 3: Dimensions of netJACK module – Housing with plastic cap

Bottom Views of the netJACK communication modules

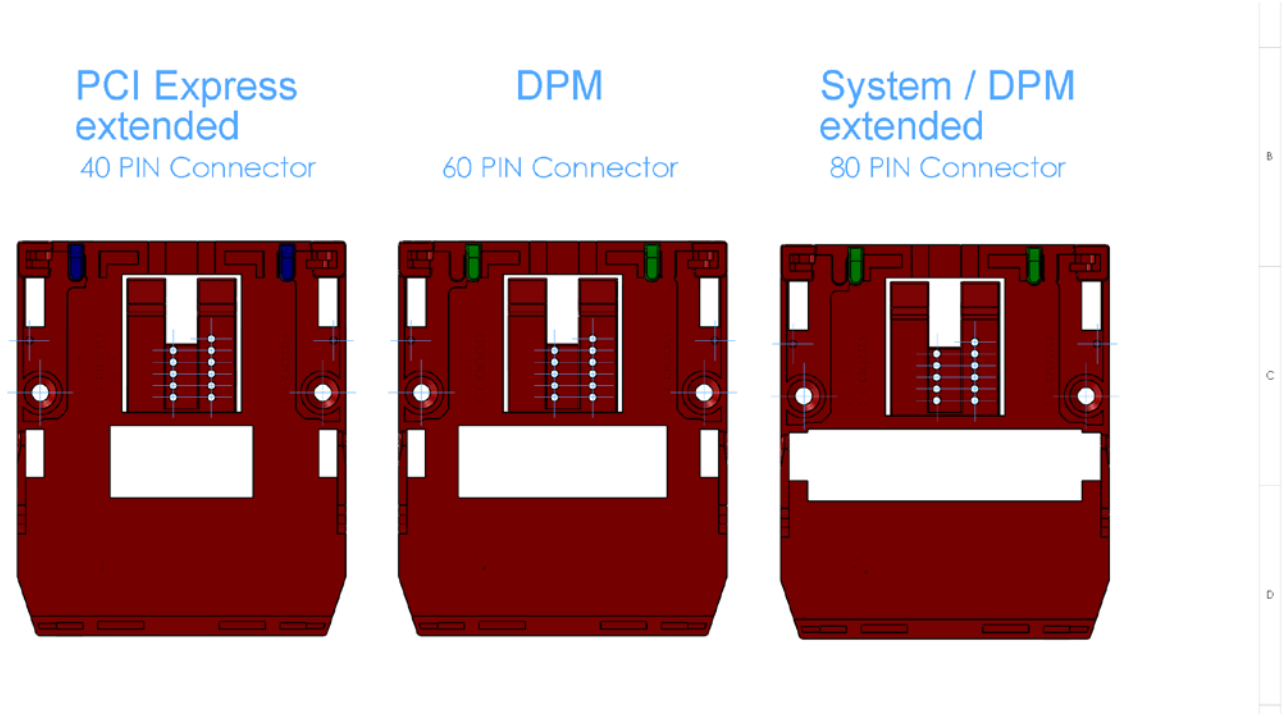

Figure 4: netJACK communication modules - Bottom views

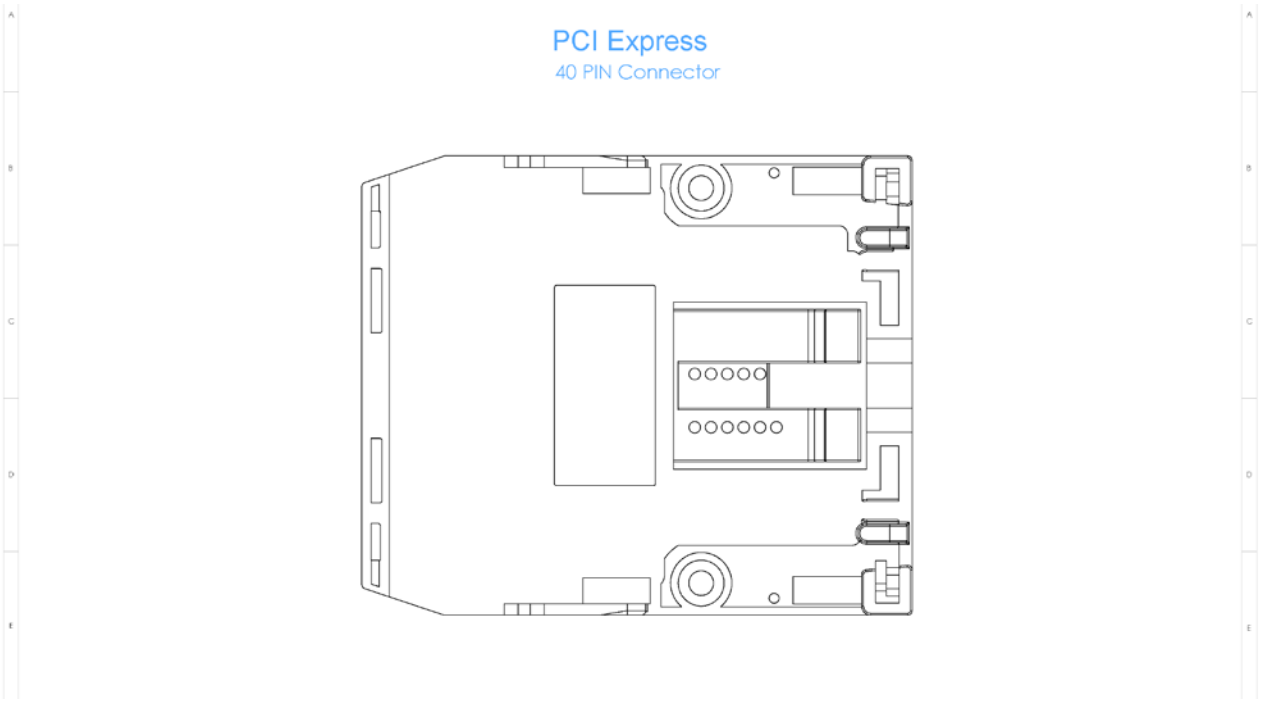

Figure 5: Bottom view of a netJACK100 with 40 Pin PCI Express

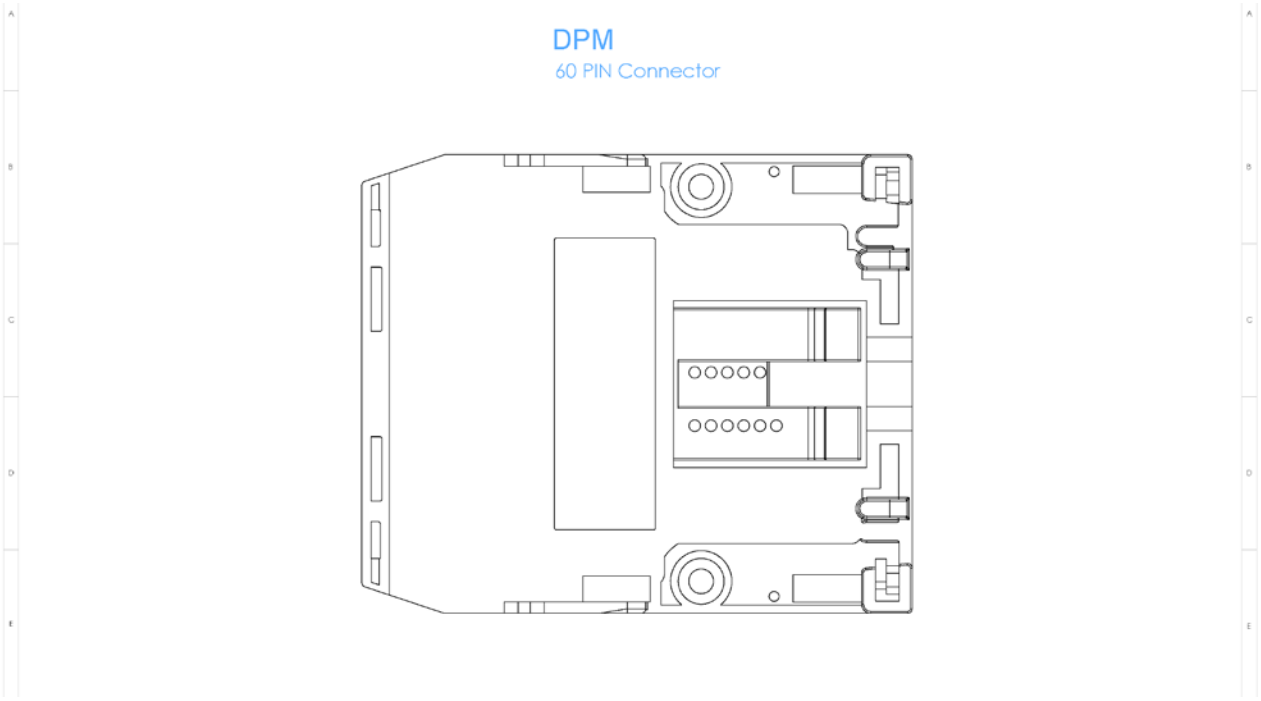

Figure 6: Bottom view of a netJACK 50 with 60 Pin dual-port memory interface

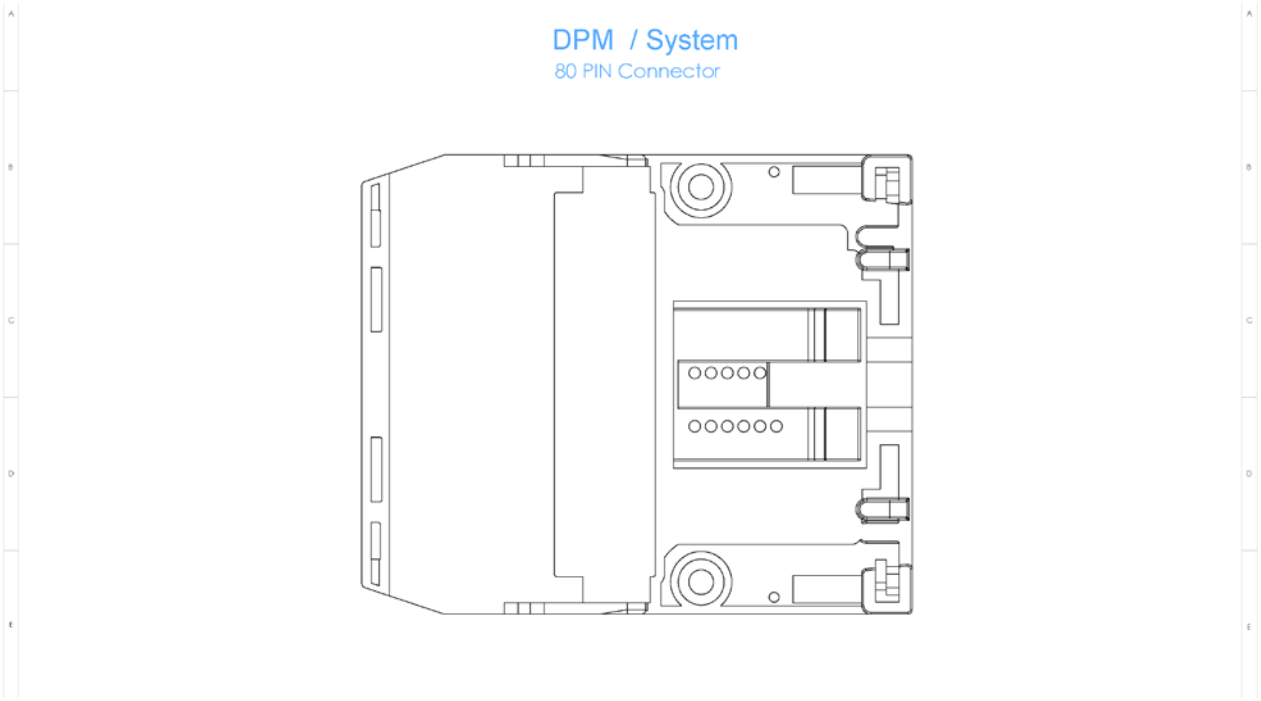

Figure 7: Bottom view of a netJACK100 with 80 Pin dual-port memory and system interface

3.1.2 Necessary cutout in front panel of housing

In the front panel of your device under construction there needs to be a cutout into which the front side of the netJACK module must fit. This cutout should be dimensioned as in *Figure 8* below:

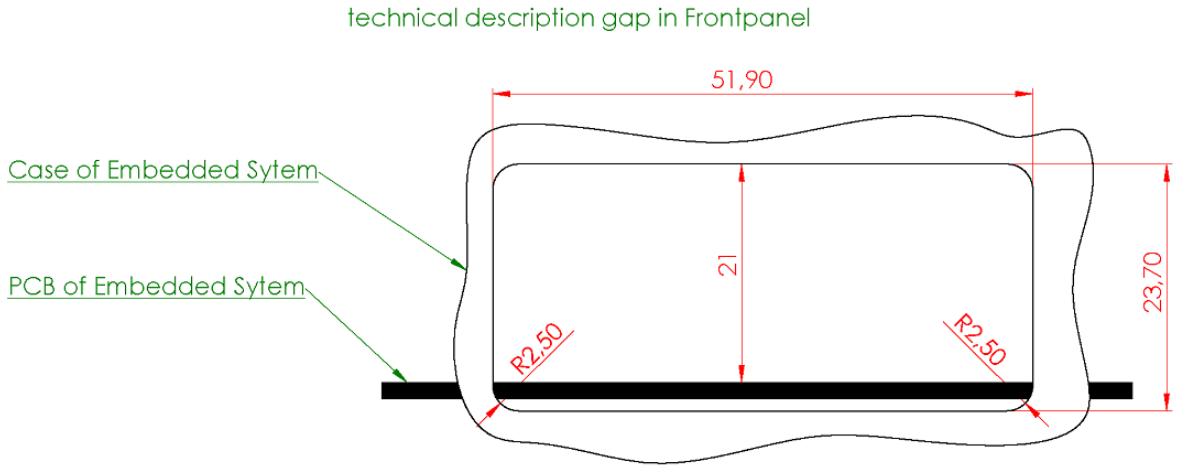

Figure 8: Cutout in front panel of housing

The following applies:

- There should be a rectangular cut-out with a width of 51.90 mm and a height of 23.70 mm. This rectangular hole has rounded corners with a radius of 2.50 mm (or smaller).
- The dimensions of the front panel of the netJACK housing are each exactly 1.5 mm larger than these of the rectangular cutout as the front panel should completely cover this hole.
- The upper edge of this rectangular cut-out should be located exactly 21 mm above the top edge of your printed circuit board.

3.1.3 Necessary space requirements for mounting/demounting the netJACK communication module

Figure 9 below illustrates how to insert a netJACK Communication Module as embedded system into its host device and how much free space is required in front of the front panel of your device in order to “plug in” the netJACK module without any spatial problems.

The upper part of Figure 9 shows a perspective view on the cutout in the front panel of the device in which to mount the netJACK module.

The lower part gives you the right side view.

The spatial requirements of the necessary free space in front of the device’s front panel are in detail:

- There must be at least 34 mm of free space in front of the device’s front panel.
- This free space must at least extend (in vertical direction) from the lower edge of the cutout in the front panel to 11 mm below this point. It is marked in *Figure 9* with square grid of light blue lines.
- There must be a gap of 2.45 mm between the case of the netJACK module and the PCB.

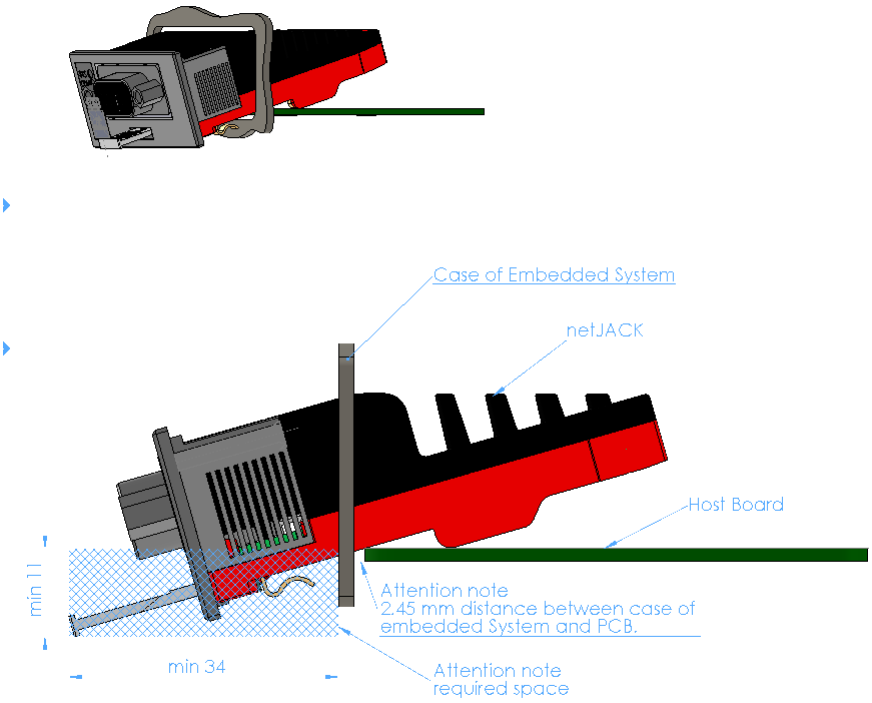

Figure 9: Necessary space requirements for mounting/demounting the netJACK communication module

3.2 U-notch coding

The requirements on the carrier board differ depending on, whether the netJACK module uses he dual-port memory interface or the PCI-Express interface for host communication

U-notches prevent problems by using the wrong type of netJACK module. In this context, a U-notch is a notch in the shape of the letter ‘U’ on the left and right side indicating whether the net-JACK is of dual-port memory or PCI-Express type:

1. For dual-port memory, the U-notches are required on both the left and right side of the module/carrier board at a distance of 13.58 ± 0.05 mm between the center of the U-notch and the center of the module.
2. For PCI-Express, the U-notches are required on the left and right side of the module/carrier board at a distance of 16.08 ± 0.05 mm between the center of the U-notch and the center of the module.

Also, see *Figure 17* at page 26, *Figure 18* at page 28 and *Figure 19* at page 31.

The center of the U-notch is located 16.10 mm from the center of the carrier board, see plan shown on the preceding page.

Other combinations of U-notches are reserved for future netJACK products.

3.3 LED label

Naming of the LEDs at the cover is as shown in the following *Figure 10: LED label on cover*:

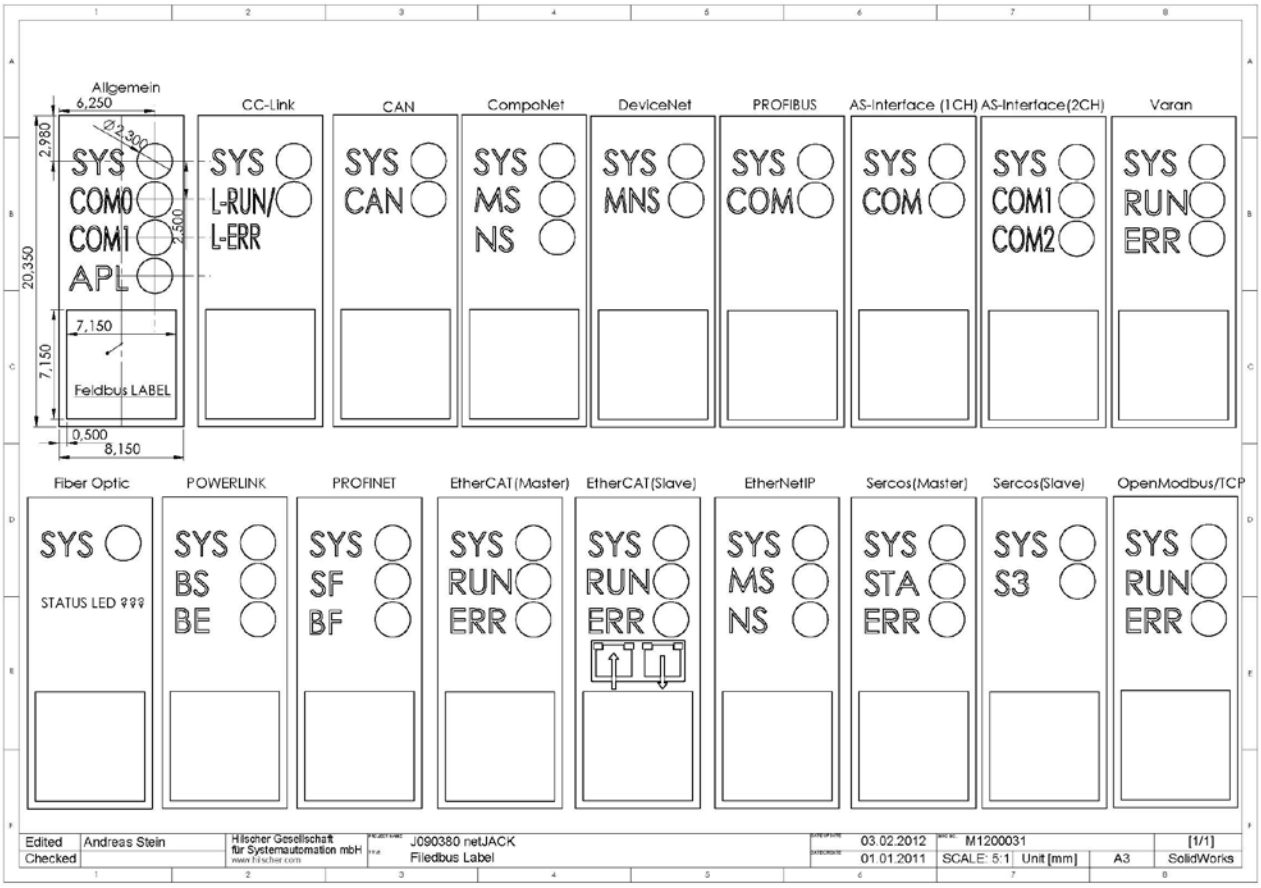

Figure 10: LED label on cover

Note: Some of the shown labels apply to systems, which are not available now and/or in future.

3.4 No mounting and demounting under voltage

Important: In general, the netJACK communication modules have not been designed for hot-plugging, i.e. mounting and demounting while being under voltage! So always, take off the voltage before starting any mounting or demounting activities.

Nevertheless, we analyzed the consequences of mounting and demounting of the netJACK modules while being under voltage. The analysis results are available as separate documents for PCI-Express and DPM based types of the netJACK communication module.

Although the risks do not seem to be very severe, we strictly recommend mounting and demounting the netJACK communication modules only when not under voltage.

3.5 Carrier board

3.5.1 Design guidelines

The following design guidelines apply for the carrier boards and have to be obeyed strictly in order to avoid severe mechanical problems and eventually electrical follow-on problems:

Important: The milling tolerance of less than ±0.2 mm must be complied in either case in order to ensure correct mounting the netJACK. Failure to comply with the tolerance limit in milling might cause the following problems:

1. The netJACK communication module cannot be mounted, as it does not fit into the carrier board.
2. The netJACK communication module has too much room to move and thus wobbles or hangs loose.
3. The force demand at demounting is too high thus; the module cannot be demounted any more.

Important:

The production tolerance for the thickness of the carrier board is **1.6 mm ± 0.1 mm**.

Failure to comply with the thickness tolerance limit may cause severe problems with the retaining brackets!

Therefore, before developing the carrier board for your specific needs, you have to evaluate the technical feasibility of the developing project together with your PCB supplier taking into account these tolerance requirements with respect to milling tolerances of the footprint holes within the carrier board and thickness tolerances of the carrier board.

3.5.1.1 Placement of components on carrier board

Important:

Due to thermal and isolation issues, no electronic components may be placed at the backside of the carrier board opposite to the area of the netJACK module. This area must be kept free.

3.5.2 Carrier board for 40 pin netJACK modules

The general layout of the corresponding carrier board for 40 pin netJACK modules is shown in *Figure 11* below.

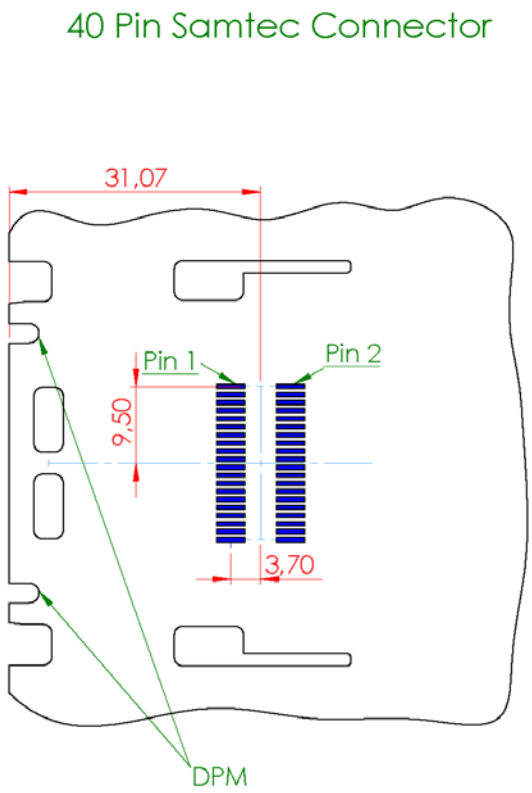

Figure 11: Footprint for carrier board for 40 pin netJACK modules

The figure on the next page provides you with the exact dimensions for your carrier board for a 40-pin netJACK module.

Important: The tolerances of the footprint holes for the netJACK module within the carrier board must be very small i.e. significantly below 0.2 mm in order to achieve good fitting of the netJACK module!

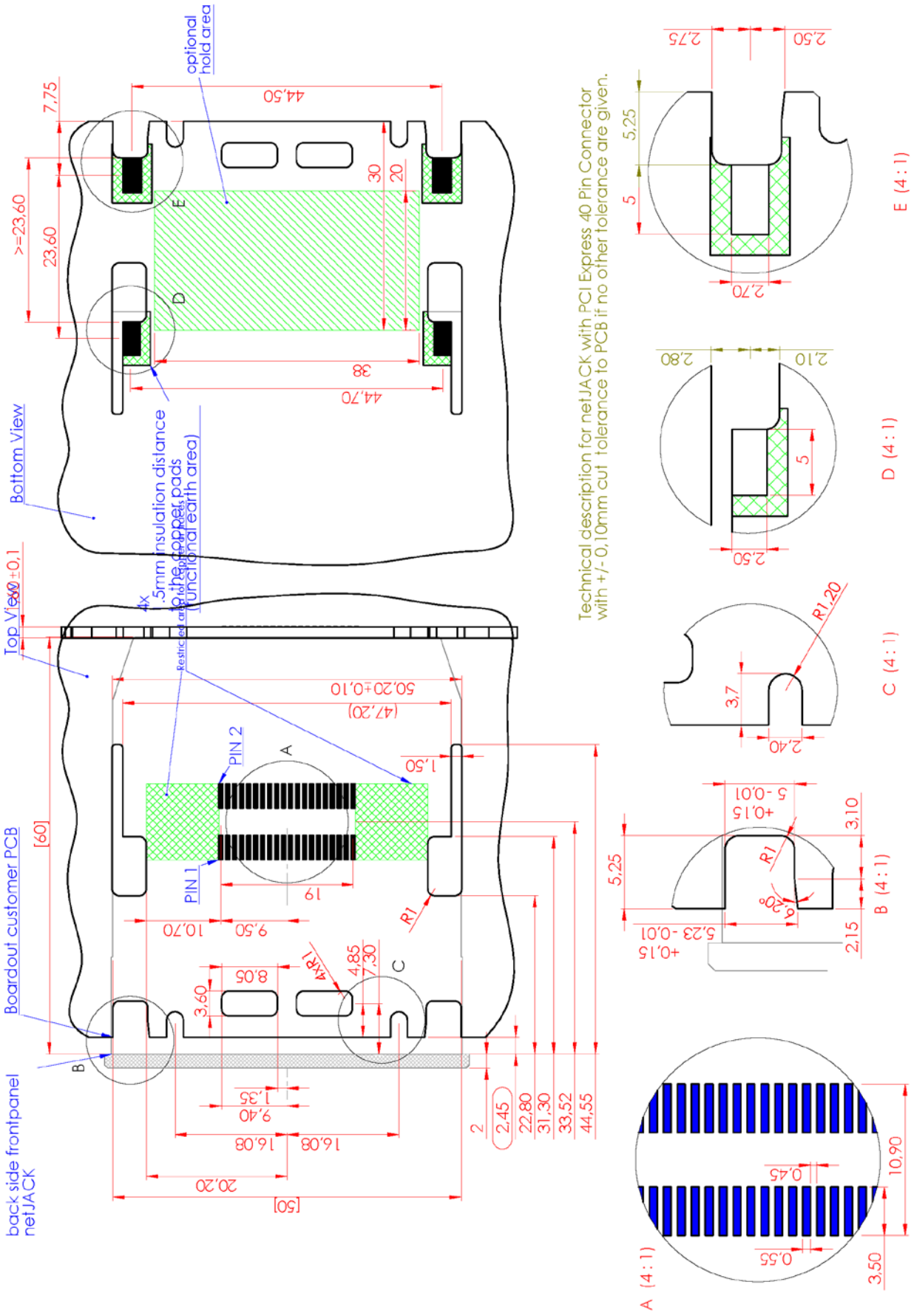

Figure 12: Dimension of carrier board for netJACK with 40-pin connector

3.5.3 Carrier board for 60 pin netJACK modules

The general layout of the corresponding carrier board or 60 pin netJACK modules is shown in *Figure 13* below. Such a carrier board is adequate for netJACK modules with a parallel dual-port memory interface (without system bus extension).

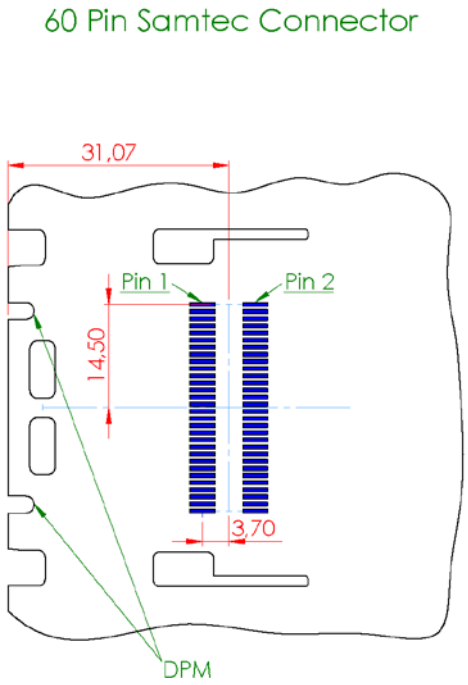

Figure 13: Footprint for carrier board for 60 pin netJACK modules

The figure on the next page shows the exact dimensions for the carrier board for a netJACK with dual-port memory interface.

Important: The tolerances of the footprint holes for the netJACK module within the carrier board must be very small i.e. significantly below 0.2 mm in order to achieve good fitting of the netJACK module!

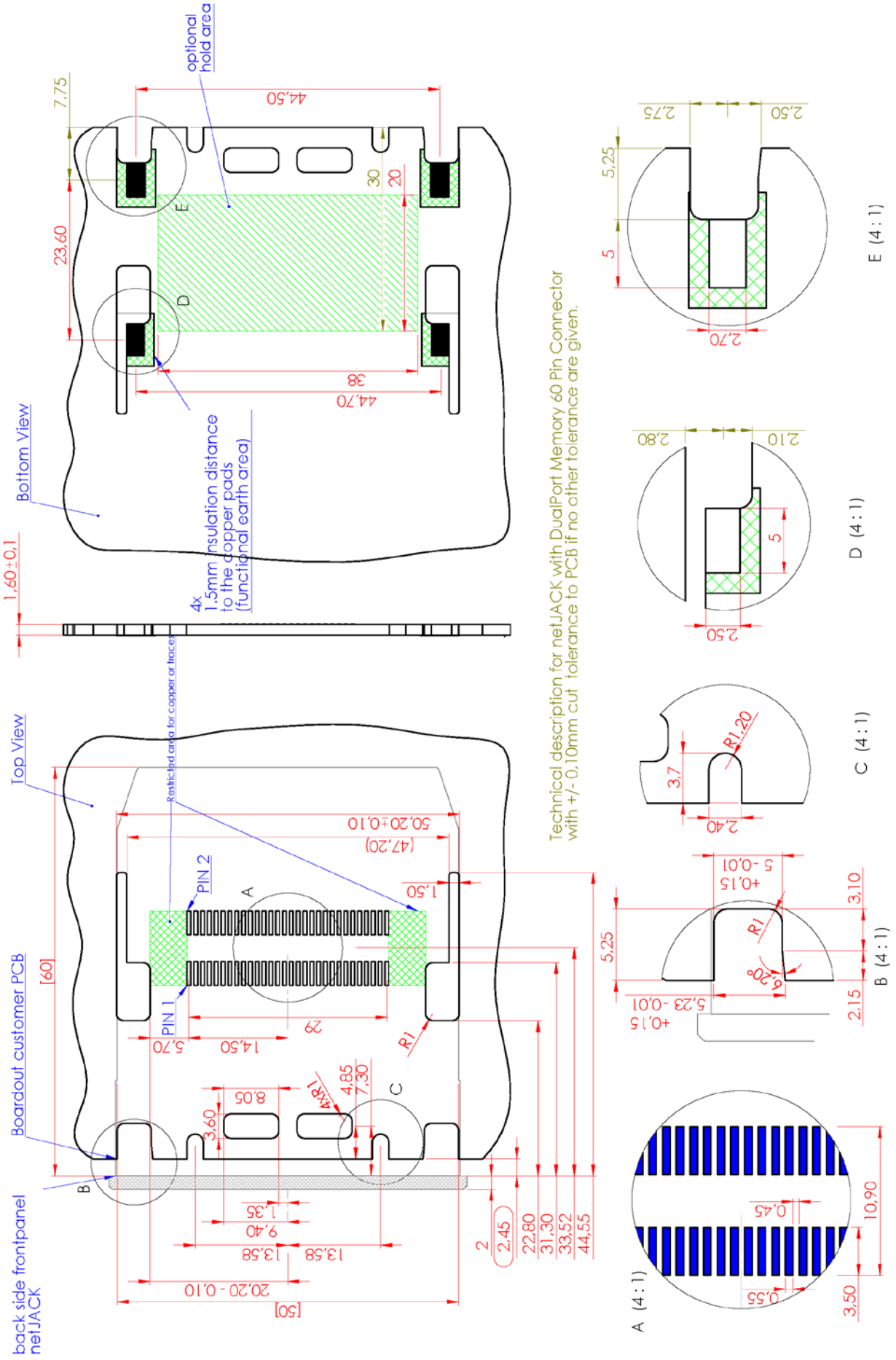

Figure 14: Dimension of carrier board for netJACK with dual-port memory 60-pin connector

3.5.4 Carrier board for 80 pin netJACK modules

The general layout of the corresponding carrier board or 80 pin netJACK modules is displayed in *Figure 15* below. Such a carrier board is adequate for netJACK modules with a parallel dual-port memory interface with system bus extension (not yet available).

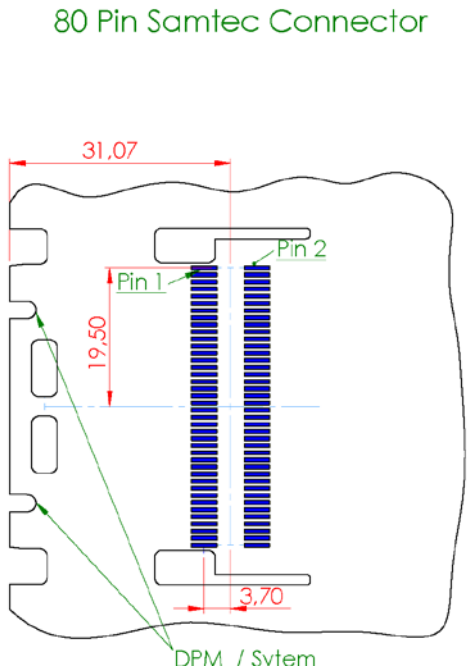

Figure 15: Footprint for carrier board for 80 pin netJACK modules

The figure on the next page shows the exact dimensions for the carrier board for a netJACK with 80-pin dual-port memory interface.

Important: The tolerances of the footprint holes for the netJACK module within the carrier board must be very small (i.e. significantly below 0.2 mm) in order to achieve good fitting of the netJACK module!

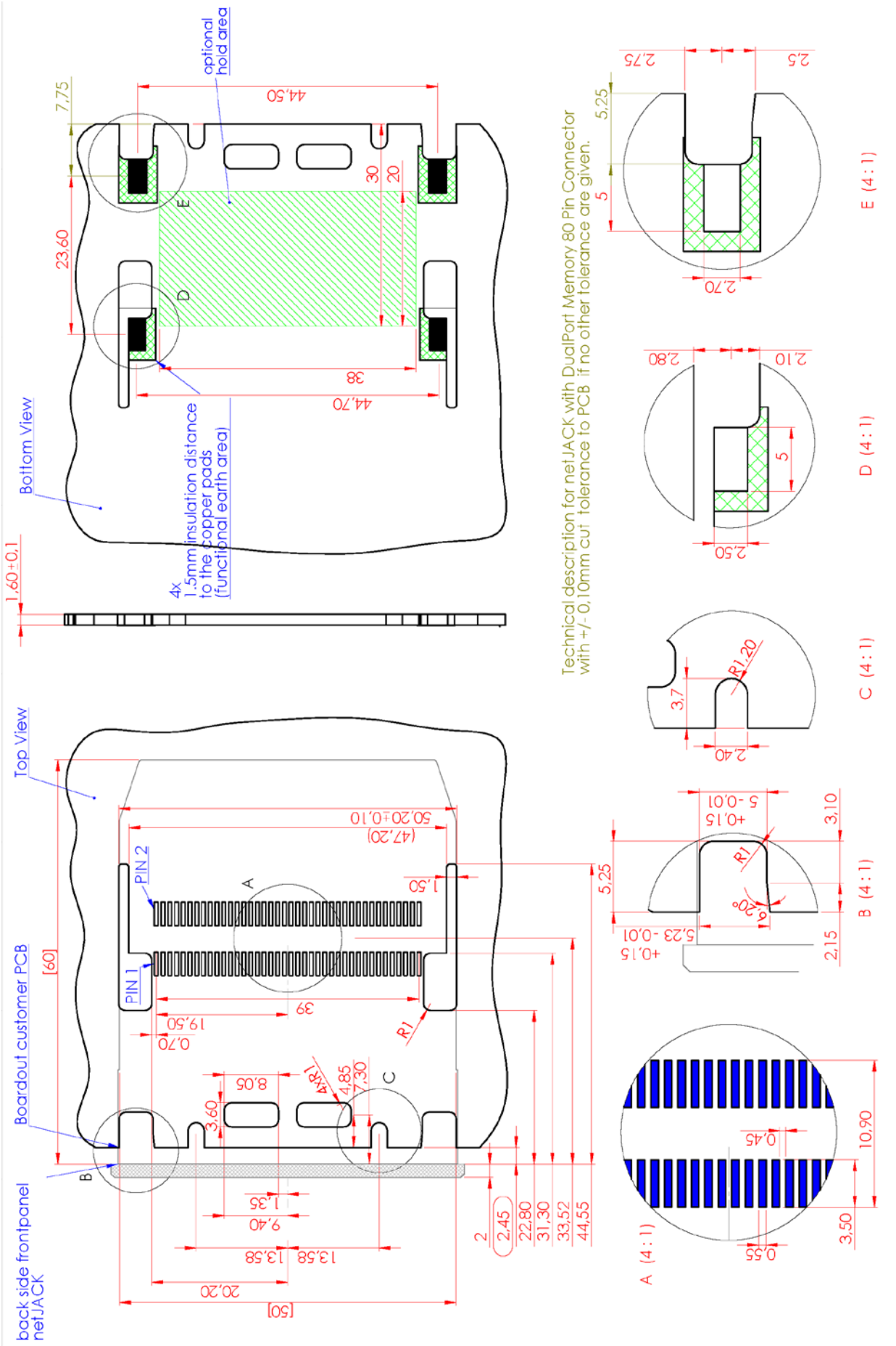

Figure 16: Dimension of carrier board for netJACK with dual-port memory 80-pin connector

4 Design-in - Electrical aspects

4.1 Host interface

This chapter describes the host interface of the netJACK family of communication modules. In general all PCI-Express based netJACK modules have identical pinning, see section 4.1.1 "*netJACK NJ 100EN pinning – 40-pin*". All DPM based netJACK modules also have identical pinning which however differs from the pinning of the PCI-Express based netJACK modules. See section 4.1.2 "*netJACK NJ 51D / NJ 52D pinning – 60-pin*". The NJ100 types have additional 20 pins for future extensions. For NJ100DN, see section 4.1.3 "*Carrier board for 80 pin netJACK modules*"

The color-coding for the following tables is as follows:

	PCI Express	
	USB	USB
	UART	UART0_
	I2C (not supported)	I2C_
	Dual-Port-Memory	DPM_
	Control Signals	Various (SYNC0/1, BOOTn …)
	+3.3V Supply voltage, to be supplied by user	+3V3
	0V Reference Potential, to be supplied by user	GND

Table 5: Color-coding used within pinning tables

The right column displays the prefix of the respective group of pin denominations.

4.1.1 netJACK NJ 100EN pinning – 40-pin

The following figure shows the position of pin 1 and 2 for the 40-pin connector.

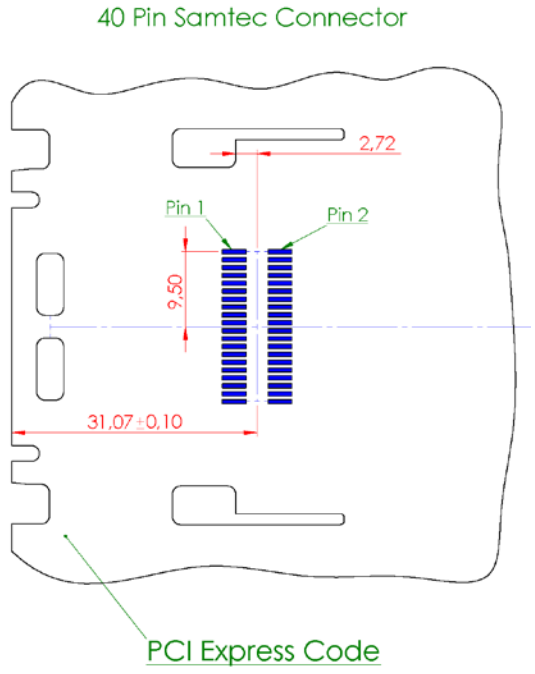

Figure 17: Position of pin 1 and 2 for 40-pin connector

The netJACK NJ 100EN family of modules has a 40 pin-host interface based on PCI-Express.

Pin	Signal	Type	Description
1	Reserved		
2	Reserved		
3	Reserved		
4	Reserved		
5	Reserved		
6	Reserved		
7	Reserved		
8	Reserved		
9	Reserved		
10	Reserved		
11	+3V3		Supply voltage (3.3 V)
12	+3V3		Supply voltage (3.3 V)
13	SYNC1	Input /Output, max. 6 mA	SYNC Signal 1
14	USB+	USB_DPOS	USB (positive), diagnostic line
15	SYNC0	Input /Output, max. 6 mA	SYNC Signal 0
16	USB-	USB_DNEG	USB (negative), diagnostic line
17	PORn (PERSTn)	Input, active low	Power-on Reset
18	GND		Ground
19	I2C_SCL	Input, max. 6 mA	Serial Clock Line of I^2C interface (not supported)
20	PERn0 (PERN)	LVTTL, Input	PCI Express Receive (negative)
21	I2C_SDA	Input /Output, max. 6 mA	Serial Data Line of I^2C interface (not supported)
22	PERp0 (PERP)	LVTTL, Input	PCI Express Receive (positive)
23	GND		Ground
24	GND		Ground
25	PETp0 (PETP)	LVTTL, Output	PCI Express Transmit (positive)
26	REFCLK+	LVTTL, Input	PCI Express Clock (positive)
27	PETn0 (PETN)	LVTTL Output	PCI Express Transmit (negative)
28	REFCLK-	LVTTL, Input	PCI Express Clock (negative)
29	GND		Ground
30	GND		Ground
31	Reserved		
32	Reserved		
33	Reserved		
34	Reserved		
35	Reserved		
36	Reserved		
37	Reserved		
38	Reserved		
39	Reserved		
40	Reserved		

Table 6: netJACK 100 pinning of the NJ 100EN (PCI-Express interface)

The reserved pins 1-10, 13-16, 19, 21 and 31-40 may be left unconnected when unused. There is no additional protection circuitry required.

Note 1: Within this table, input and output are seen from the point of view of the netJACK.

Note 2: Pin denominations within brackets are those of the PCI Express specification (reference [3]).

4.1.2 netJACK NJ 51D / NJ 52D pinning – 60-pin

The following figure shows the position of pin 1 and 2 for the 60-pin connector.

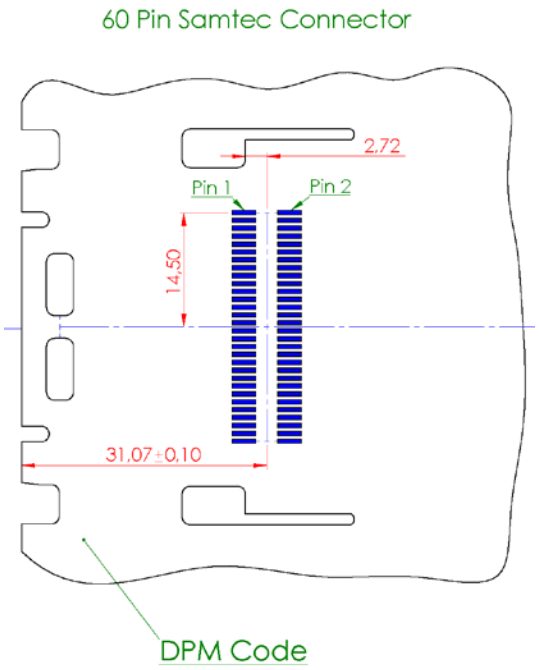

Figure 18: Position of pin 1 and 2 for 60-pin connector

The netJACK NJ 51D / NJ 52D family of modules have a 60-pin-host interfaces based on dual-port memory. The following pinning is correct for parallel dual-port memory mode:

Pin	Signal	Type	Description
1	DPM_A0	LVTTL Input	Address line 0
2	DPM_A1	LVTTL Input	Address line 1
3	DPM_A2	LVTTL Input	Address line 2
4	DPM_A3	LVTTL Input	Address line 3
5	DPM_A4	LVTTL Input	Address line 4
6	DPM_A5	LVTTL Input	Address line 5
7	DPM_A6	LVTTL Input	Address line 6
8	DPM_A7	LVTTL Input	Address line 7
9	DPM_A8	LVTTL Input	Address line 8
10	DPM_A9	LVTTL Input	Address line 9
11	DPM_A10	LVTTL Input	Address line 10
12	DPM_A11	LVTTL Input	Address line 11
13	DPM_A12	LVTTL Input	Address line 12
14	DPM_A13	LVTTL Input	Address line 13
15	DPM_BUSYn	LVTTL Output, active low	BUSY Signal
16	DPM_A14	LVTTL Input	Address line 14
17	DPM_DIRQn/CSMD	During operation: LVTTL Output, active low At start-up: LVTTL Input (Control signal)	Interrupt Request High(1) indicates Parallel DPM mode Low(0) indicates SPI mode (i.e. Serial DPM mode, currently not supported!).
18	DPM_A15	LVTTL Input	Address line 15
19	DPM_SIRQn/CMBW	At start-up: LVTTL Input (Control signal) , active low	DPM_SIRQn/CMBW (Word Interface) High(1) indicates 8-bit DPM mode (default) Low(0) indicates 16-bit DPM mode
20	GPIO		General Purpose IO (not supported)
21	+3V3		Supply voltage (+3.3 V)
22	+3V3		Supply voltage (+3.3 V)
23	SYNC1	SYNC Signal 1, max. 6 mA	SYNC Signal 1
24	USB+	USB_DPOS	USB (positive), Diagnostic line
25	SYNC0	SYNC Signal 0, max. 6 mA	SYNC Signal 0
26	USB-	USB_DNEG	USB (negative), Diagnostic line
27	DPM_RESETn	Input, active low (For more details see section “ *Dual-port memory and* signals *”*.)	Power-on Reset
28	DPM_D8 (SPM_MISO)	LVTTL Input / Output	Data line 8 (Alternatively for NJ 51D/NJ 52D used as MISO signal for serial DPM)
29	I2C_SCL	I2C Serial Clock Line Signal	Serial Clock Line of I^2C interface (not supported)
30	DPM_D9 (SPM_MOSI)	LVTTL Input / Output	Data line 9 (Alternatively for NJ 51D/NJ 52D used as MOSI signal for serial DPM)
31	I2C_SDA	I2C Serial Data Line Signal	Serial Data Line of I^2C interface (not supported)
32	DPM_D10 (SPM_CSn)	LVTTL Input / Output	Data line 10 (Alternatively for NJ 51D/NJ 52D used as Chip select signal for serial DPM)
33	BOOTn	LVTTL Input, active low	Boot signal
34	DPM_D11 (SPM_CLK)	LVTTL Input / Output	Data line 11 (Alternatively for NJ 51D/NJ 52D used as Clock signal for serial DPM)
35	UART0_TXD	LVTTL Output, UART	UART-Transmit Data, Diagnostic line
36	DPM_D12 (SPM_DIRQ)	LVTTL Input / Output	Data line 12
37	UART0_RXD	LVTTL Input, UART	UART-Receive Data, Diagnostic line

Pin	Signal	Type	Description
38	DPM_D13 (SPM_SIRQ)	LVTTL Input / Output	Data line 13
39	GND		Ground
40	GND		Ground
41	DPM_CSn	LVTTL Input, active low	Dual-port memory Chip Select n
42	DPM_D14	LVTTL Input / Output	Dual-port memory Data line 14
43	DPM_BHEn	LVTTL Input, active low	Dual-port memory Bus high enable
44	DPM_D15	LVTTL Input / Output	Dual-port memory Data line 15
45	DPM_RDn	LVTTL Input, active low	Dual-port memory Read
46	DPM_D0	LVTTL Input / Output	Dual-port memory Data line 0
47	DPM_WRn	LVTTL Input, active low	Dual-port memory Write
48	DPM_D1	LVTTL Input / Output	Dual-port memory Data line 1
49	Reserved		
50	DPM_D2	LVTTL Input / Output	Dual-port memory Data line 2
51	Reserved		
52	DPM_D3	LVTTL Input / Output	Dual-port memory Data line 3
53	Reserved		
54	DPM_D4	LVTTL Input / Output	Dual-port memory Data line 4
55	Reserved		
56	DPM_D5	LVTTL Input / Output	Dual-port memory Data line 5
57	Reserved		
58	DPM_D6	LVTTL Input / Output	Dual-port memory Data line 6
59	Reserved		
60	DPM_D7	LVTTL Input / Output	Dual-port memory Data line 7

Table 7: netJACK pinning of the NJ51D/52D (Parallel dual-port memory mode)

Note: Within this table, input and output are seen from the point of view of the netJACK.

The reserved pins 49, 51, 53, 55, 57 and 59 may be left unconnected when unused. There is no additional protection circuitry required.

4.1.3 netJACK NJ 100DN pinning – 80-pin

The following figure shows the position of pin 1 and 2 for 80-pin connector.

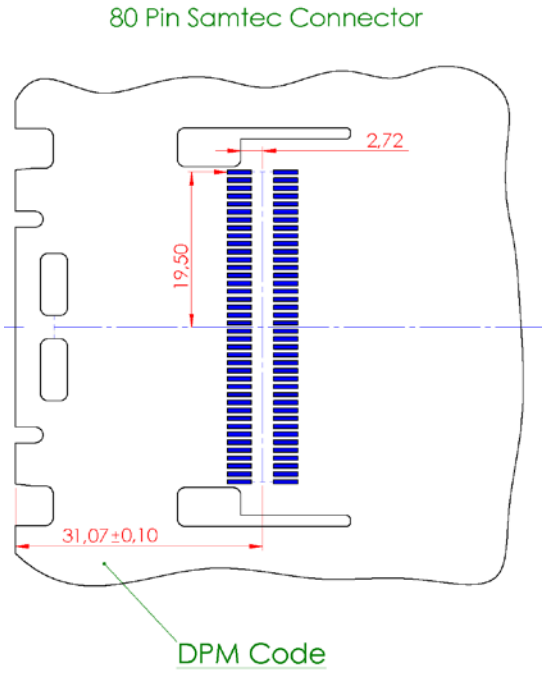

Figure 19: Position of pin 1 and 2 for 80-pin connector

The netJACK NJ 100DN family of modules has an 80 pin-host interface based on dual-port memory. The pin-out is as follows:

Pin	Signal	Type	Description
1	Reserved		
2	Reserved		
3	Reserved		
4	Reserved		
5	Reserved		
6	Reserved		
7	Reserved		
8	Reserved		
9	Reserved		
10	Reserved		
11	DPM_A0	LVTTL Input	Address line 0
12	DPM_A1	LVTTL Input	Address line 1
13	DPM_A2	LVTTL Input	Address line 2
14	DPM_A3	LVTTL Input	Address line 3
15	DPM_A4	LVTTL Input	Address line 4
16	DPM_A5	LVTTL Input	Address line 5
17	DPM_A6	LVTTL Input	Address line 6
18	DPM_A7	LVTTL Input	Address line 7
19	DPM_A8	LVTTL Input	Address line 8
20	DPM_A9	LVTTL Input	Address line 9
21	DPM_A10	LVTTL Input	Address line 10
22	DPM_A11	LVTTL Input	Address line 11
23	DPM_A12	LVTTL Input	Address line 12
24	DPM_A13	LVTTL Input	Address line 13
25	DPM_BUSYn	LVTTL Output, active low	BUSYn
26	DPM_A14	LVTTL Input	Address line 14
27	DPM_DIRQn/CSMD	At start-up: LVTTL Input (Control signal) During operation: LVTTL Output, active low	Interrupt request High(1) indicates Parallel DPM mode Low(0) indicates SPI mode (i.e. Serial DPM mode, currently not supported!).
28	DPM_A15	LVTTL Input	Address line 15
29	DPM_SIRQn/CMBW	At start-up: LVTTL Input (Control signal), active low During operation: Signal not used	DPM_SIRQn/CMBW (Word Interface) High(1) indicates 8-bit DPM mode (default) Low(0) indicates 16-bit DPM mode
30	GPIO		General Purpose IO (not supported)
31	+3V3		Supply voltage (3.3 V)
32	+3V3		Supply voltage (3.3 V)
33	SYNC1	SYNC Signal 1, max. 6 mA	SYNC Signal 1
34	USB+	USB_DPOS	USB (positive), Diagnostic line
35	SYNC0	SYNC Signal 0, max. 6 mA	SYNC Signal 0
36	USB-	USB_DNEG	USB (negative), Diagnostic line
37	DPM_RESETn	Input (For more details see section “ *Dual-port memory and* signals ”.)	Power-on Reset (negative)
38	DPM_D8	LVTTL Input / Output	Data line 8
39	I2C_SCL	I2C Serial Clock Line Signal	Serial Clock Line of I^2C interface (not supported)
40	DPM_D9	LVTTL Input / Output	Data line 9
41	I2C_SDA	I2C Serial Data Line Signal	Serial Data Line of I^2C interface (not supported)

42	DPM_D10	LVTTL Input / Output	Data line 10
43	BOOTn	LVTTL Input, active low	Boot signal
44	DPM_D11	LVTTL Input / Output	Data line 11
45	UART0_TXD	LVTTL Output, UART	UART-Transmit Data, Diagnostic line
46	DPM_D12	LVTTL Input / Output	Data line 12
47	UART0_RXD	LVTTL Input, UART	UART- Receive Data, Diagnostic line
48	DPM_D13	LVTTL Input / Output	Data line 13
49	GND		Ground
50	GND		Ground
51	DPM_CSn	LVTTL Input, active low	Dual-port memory Chip Select n
52	DPM_D14	LVTTL Input / Output	Dual-port memory Data line 14
53	DPM_BHEn	LVTTL Input, active low	Dual-port memory Bus high enable
54	DPM_D15	LVTTL Input / Output	Dual-port memory Data line 15
55	DPM_RDn	LVTTL Input, active low	Dual-port memory Read
56	DPM_D0	LVTTL Input / Output	Dual-port memory Data line 0
57	DPM_WRn	LVTTL Input, active low	Dual-port memory Write
58	DPM_D1	LVTTL Input / Output	Dual-port memory Data line 1
59	Reserved		
60	DPM_D2	LVTTL Input / Output	Dual-port memory Data line 2
61	Reserved		
62	DPM_D3	LVTTL Input / Output	Dual-port memory Data line 3
63	Reserved		
64	DPM_D4	LVTTL Input / Output	Dual-port memory Data line 4
65	Reserved		
66	DPM_D5	LVTTL Input / Output	Dual-port memory Data line 5
67	Reserved		
68	DPM_D6	LVTTL Input / Output	Dual-port memory Data line 6
69	Reserved		
70	DPM_D7	LVTTL Input / Output	Dual-port memory Data line 7
71	Reserved		
72	Reserved		
73	Reserved		
74	Reserved		
75	Reserved		
76	Reserved		
77	Reserved		
78	Reserved		
79	Reserved		
80	Reserved		

Table 8: netJACK pinning of the NJ 100DN (Parallel dual-port memory mode)

The reserved pins 1 to 10, 59, 61, 63, 65, 67 and 69 and 71 to 80 may be left unconnected when unused. There is no protection circuitry required.

Note: Within this table, input and output are seen from the point of view of the netJACK.

4.1.4 Supply voltage of the netJACK

Only a single 3.3 V operation voltage is needed to operate the netJACK communication modules. The voltage must be regulated and can have a tolerance of ±5% (3.15 - 3.45 Volt) and must be connected twice to the host connector at the bottom of the netJACK device. To avoid EMI problems we suggest using bypass capacitors in the power supply path. All other special voltages required on the netJACK module are generated by on board DC/DC converter.

A voltage supervisor circuit on all netJACK modules supervises the voltage and the microprocessor. If the voltage decreases below the voltage-reset level of typically 2.93 V (2.85 - 3.00 V), the netJACK modules are held in reset state. If the voltage exceeds the reset voltage threshold, the netJACK module will begin with the power up sequence. To avoid problems with the power supply we recommend using a voltage of 3.3 V. Therefore, the operation will be in the safe range of voltage operation area and short voltage drops, spikes and noise will not cause any reset conditions.

The maximum power consumption depends on netJACK module type. For power consumption values, see section *Technical data* on page 66.

4.1.5 Retaining brackets

The four retaining brackets of the netJACK are electrically connected with one another. You should connect them with Functional Earth.

4.1.6 GPIO

The GPIO pin may be left unconnected when unused. There is no protection circuitry required. GPIO is not yet supported.

4.1.7 I^2C

I^2C means *Inter-Integrated Circuit*. I^2C is a serial data bus system based on the master-slave-principle. It can be used to connect devices with a low transmission rate to a system easily. I^2C is not yet supported. You do not need to connect the unused pins.

4.1.8 SYNC

There are two SYNC signal lines:

- SYNC0 (pin #15)
- SYNC1 (pin #13)

The SYNC signal has LVTTL level (3.3 V). A maximum load of 6 mA may not be exceeded.

NOTICE

Possible destruction of the device due to high current!

Make sure that never two outputs drive against each other. Two outputs that drive against each other cause a too high current and result in device damage.

This situation can happen for example, if the host system has an output signal connected to SYNC0 and a firmware is loaded that uses SYNC0 as output, too.

In general, both SYNC signal lines can be used as input or output. The loaded firmware determines whether the line is used for an input signal or output signal. When used as output, both SYNC signal lines can drive a current up to 6 mA.

The following table shows the meaning of the SYNC signals for the real-time Ethernet protocols currently offering SYNC signal support.

Protocol	Signal SYNC0 Input/output	Signal SYNC1 Input/output	Since Firmware Version	Remarks
EtherCAT Slave	SYNC 0 Output	SYNC 1 Output	-	Configurable, for details see reference [5]
PROFINET IO Device	Bus cycle start (PROFINET IRT) Output	-	3.4.x.x	-
Sercos Master	External trigger to start bus cycle Input Rising edge	-	2.0.8.0	-
Sercos Slave	CON_CLK Output	DIV_CLK Output	3.0.10.0	Configurable, for details see reference [6]

Table 9: Meaning of the SYNC signals for Real-Time-Ethernet protocols with SYNC signal support

4.1.9 Dual-port memory and signals

Note: This subsection only applies to the dual-port memory based netJACK modules such as the NJ 51D, NJ 52D and NJ100DN.

The communication for all input and output data and control commands between the netJACK and the host system are exchanged over the dual-port memory.

From host system side, the dual-port memory looks like static RAM. The netJACK modules always provide addressing capabilities for 64 KByte dual-port memory. However, only 16 KByte (NJ52D: 8 KByte) dual-port memory can be used together with the standard firmware. Only a few signals are used to control the access to the dual-port memory.

These data lines can drive 6 mA at maximum.

Important: To avoid data loss by simultaneous access at the same memory cell, it is necessary to use the DPM_BUSYn signal.

Please refer to the special documents for the basic description of the data model and communication methods with devices based on the netX.

4.1.9.1 Overview: Dual-port memory sizes and modes

The following table lists the dual-port memory size and the supported dual-port memory modes for the different netJACK modules.

Module	Fieldbus / Protocol	Dual-port Memory Size	Parallel Mode	Serial Mode
NJ 51				
NJ 51D-RE	Real-time Ethernet Slave	64 KB, where 16 KB used by firmware (lowest 16 KB)	yes	yes
NJ 52				
NJ 52D-COS	CANopen Slave	64 KB, where 8 KB used by firmware (lowest 8 KB)	yes	yes
NJ 52D-DNS	DeviceNet Slave		yes	yes
NJ 52D-DPS	PROFIBUS DP Slave		yes	yes
NJ 100				
NJ 100DN-CO	CANopen Master or Slave	64 KB, where 16 KB used by firmware (lowest 16 KB)	yes	-
NJ 100DN-DN	DeviceNet Master or Slave		yes	-
NJ 100DN-DP	PROFIBUS DP Master or Slave		yes	-
NJ 100DN-RE	Real-time Ethernet Master or Slave		yes	-

Table 10: Dual-port memory size and supported modes of the netJACK modules

In general, the netJACK module supports 16 address lines and thus a dual-port memory size of 64 KB. However, the firmware only supports the lowest 16 KB of the available address space.

In case of the NJ 52D modules even only the lowest 8 KB of the available address space are supported by the firmware. So not all address lines need to be used. Unused address lines may be equipped with a pull-down resistor of 560 Ω.

The following table explains the available possibilities:

netJACK modules	Host address space	Connect to netJACK	netJACK address lines to be connected with 560 Ω pull-down
NJ 52	8 KByte	A0 ... A12	A13 ... A15
NJ 51/52/100	16 KByte	A0 ... A13	A14 ... A15
NJ 51/52/100	32 KByte	A0 ... A14	A15
NJ 51/52/100	64 KByte	A0 ... A15	none

Table 11: Possibilities for usage of dual-port memory

4.1.9.2 Host interface mode for NJ 100

netJACK communication modules support the parallel dual-port memory mode only (also see *Table 10* on page 36).

The Second Stage Boot Loader evaluates the host interface mode during the boot process. The Second Stage Boot Loader uses this setting to initialize the selected dual-port memory mode in the host interface.

Parallel dual-port memory mode

Depending on the type of netJACK communication module, the according pin numbers of the signals DPM_DIRQn/CSMD and DPM_SIRQn/CMBW can be taken from the following table:

Signal	NJ51D/NJ52D (60 pin interface)	NJ100DN (80 pin interface)
DPM_DIRQn/CSMD	pin 17	pin 27
DPM_SIRQn/CMBW	pin 19	pin 29

Table 12: Pin numbers for signals DPM_DIRQn/CSMD and DPM_SIRQn/CMBW

- A high signal at DPM_DIRQn/CSMD activates the dual-port memory mode. Leave the pin unconnected, if polling mode is to be used. Connect this pin to the interrupt input of the host CPU, if interrupt mode is to be supported.
- The data width of the dual-port memory can be set to 8 or 16 bit. The default is 8 bit. The data width is set at DPM_SIRQn/CMBW during the start-up phase.
  - A high signal at DPM_SIRQn/CMBW sets the data width of 8 bit. Leave pin unconnected.
  - A low signal at DPM_SIRQn/CMBW (via a 680 Ω pull-down resistor) sets the data width of 16 bit.

Important: Never drive the host interface mode signal DPM_DIRQn. Instead, operation with pull-down and pull-up resistors is recommended.

4.1.9.3 Host Interface Mode for NJ 51 and NJ 52

NJ 51 and NJ 52 modules support two host interface modes:

- parallel dual-port memory mode
- serial dual-port memory mode.

This can be configured by the level of the mode-setting signal, which is evaluated during start-up phase of the module.

The host interface mode is evaluated by the Second Stage Boot Loader during boot. The Second Stage Boot Loader uses this setting to initialize the selected dual-port memory mode in the host interface.

How to set the host interface mode

Parallel dual-port memory mode

- A high signal at DPM_DIRQn during start-up phase activates the dual-port memory mode.
- The data width of the dual-port memory can be set to 8 or 16 bit. The data width is set at DPM_SIRQn during the start-up phase.
  - A high signal at DPM_SIRQn sets the data width of 8 bit: pin is unconnected.
  - A low signal at DPM_SIRQn sets the data width of 16 bit: 680 Ω pull-down resistor.

Serial dual-port memory mode

- A low signal at DPM_DIRQn activates the serial dual-port memory mode (via a 680 Ω pull-down resistor). Pin DPM_SIRQn: let the input open.

Signals DPM_DIRQn and DPM_SIRQn have a pull-up resistor of 3.9 kΩ on the NJ 51 or NJ 52 module.

Important: Never drive the host interface mode signal DPM_DIRQn. Instead, operation with pull-down and pull-up resistors is recommended.

4.1.9.4 Interrupt line to the host system

The signal DPM_DIRQn/CSMD (also used as mode discrimination signal) can be used to generate an interrupt to the host system when the netX processor of the netJACK module writes into the specific handshake cells of the dual-port memory. These cells are used for synchronization of the netJACK modules and the host system and have handshake bits. The interrupt will be cleared if the host reads the handshake cell that was written from the netX of the netJACK module.

Important: In interrupt mode, when an 8 bit-host performs a read access to any of the 16-bit wide handshake registers, the netX releases the interrupt as soon as the high byte or the low byte was read. The read order (high byte first or low byte first) is irrelevant. An 8 bit-host shall use polling mode instead of interrupt mode!

For detailed information about the handshake bits, refer to the *Dual-port memory interface manual* [1].

4.1.9.5 Reset signal

It is possible to reset the netJACK module by the global power-on reset signal DPM_RESETn. As long as the signal DPM_RESETn is at high level, the module stays in operation mode.

The netJACK module is in reset mode when the signal DPM_RESETn has a static low level. To reset the netJACK module the DPM_RESETn signal must be low for more than 10 µs. Afterwards, the netJACK module begins with the program execution and initialization. This power up time is different for each netJACK module and loaded firmware.

netJACK modules with parallel dual-port memory are typically equipped with a MIC 6315 reset generator on the module.

Important:

During reset, all signals of the dual-port memory are configured as inputs! The output level could be floating.

If the host system needs a stable level, a pull-up or pull-down resistor is required on the host board. The netJACK has pull-up resistors on board for the output line DPM_BUSYn.

4.1.9.6 Address bus and data bus

These signal lines contain the address bus lines DPM_A0 up to DPM_A15 and data bus lines DPM_D0 up to DPM_D15 of the dual-port memory. The address and data lines are non-multiplexed. The NJ100DN devices may address up to 64 KB dual-port memory in parallel mode (i.e. if signal DPM_DIRQn/CSMD is set to high at start-up). Have in mind, that practically only 16 KB dual-port memory can be used when the standard firmware is applied.

If your host interface cannot support a width of 16 bit, connect the DPM_SIRQn/CMBW signal to V_{cc} in order to work in 8-bit mode. Connect the unused data bus lines DPM_D8 up to DPM_D15 via a 10 kΩ pull-down resistor. Then, the signal DPM_BHEn is not used. At the NJ100DN, it may remain unconnected. At the NJ50D, a 10 kΩ pull-down resistor is required in order to activate access to the whole word. This also applies for the signal DPM_A0 if the signal DPM_BHEn is not used.

In case of a 16-bit system, you have to generate the DPM_BHEn and DPM_A0 signal according the following table.

DPM_BHEn	DPM_A0	Function
0	0	word access
0	1	access high byte
1	0	access low byte
1	1	no access

Table 13: Function table of the 16 Bit decode logic

Connect the data bus lines DPM_D0 up to DPM_D15 with the respective lines of your 16-bit capable interface.

If you use the NJ51 or NJ52 with SPM (serial dual-port memory) as host interface, then the address bus lines DPM_A0 up to DPM_A15 and data bus lines DPM_D0 up to DPM_D15 of the dual-port memory may be left unconnected.

Also see section 4.1.9.1“*Overview: Dual-port memory sizes and modes*” on page 36.

4.1.9.7 Dual-port memory control lines

Integration of the netJACK module is done by mapping the memory space of the dual-port memory into the address range of the host system.

Dual-port memory access is handled over the control lines DPM_WRn (write), DPM_RDn (read) and DPM_CSn (Chip select) and could be like standard static RAM.

All signals are low active.

If you use the NJ51 or NJ52 with SPM (serial dual-port memory) as host interface, then the signals DPM_CSn, DPM_BHEn, DPM_RDn and DPM_WRn may be left unconnected.

4.1.9.8 Busy line to the host system

The signal DPM_BUSYn is used to insert wait states into a current access from host system to a netJACK module. When the signal is active the host must wait for the current transfer.

The timing diagram is described in section *Timing diagram dual-port memory interface* on page 41.

Important note 1: Avoid dual-port memory access errors
It is mandatory that the host CPU always uses the BUSY signal, otherwise this causes wrong data to be read from the dual-port memory or dual-port memory write accesses are being ignored. This behavior does not affect the NJ51D and NJ52D modules.

- The maximum value for accesses cannot be specified.
- For maximum performance, the host CPU must always evaluate the DPM_BUSYn signal
- If you use a host CPU that cannot use the DPM_BUSYn signal, then contact our technical support.

Important note 2: The netJACK has a 10 kΩ (NJ100DN) pull-up resistor on board for the output line DPM_BUSYn

If you use the NJ51 or NJ52 with SPM (serial dual-port memory) as host interface, the signal DPM_BUSYn may be left unconnected.

4.1.9.9 Boot signal

The boot signal BOOTn is an input signal and active low.

Note: The signal level during the reset (and shortly afterwards) must be low in order to force the netJACK into the boot mode.

You can connect this signal via a pushbutton with GND, if you want to provide your device with a simple boot possibility.

4.1.9.10 Timing diagram dual-port memory interface

For NJ100DN and NJ100EN

The following diagram shows the timing for dual-port memory read access.

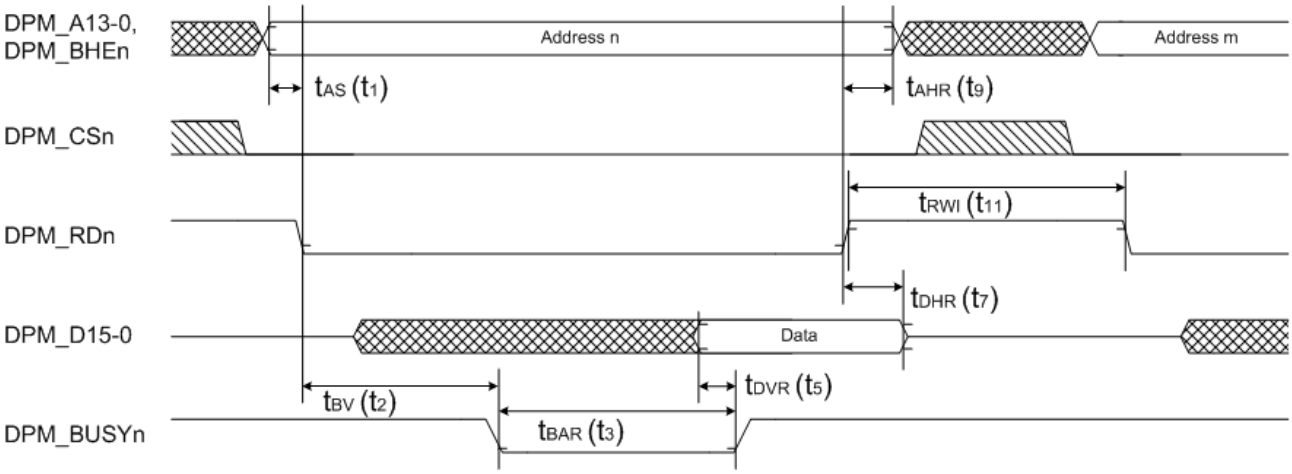

Figure 20: netJACK timing diagram for read access

The following diagram shows the timing for dual-port memory write access.

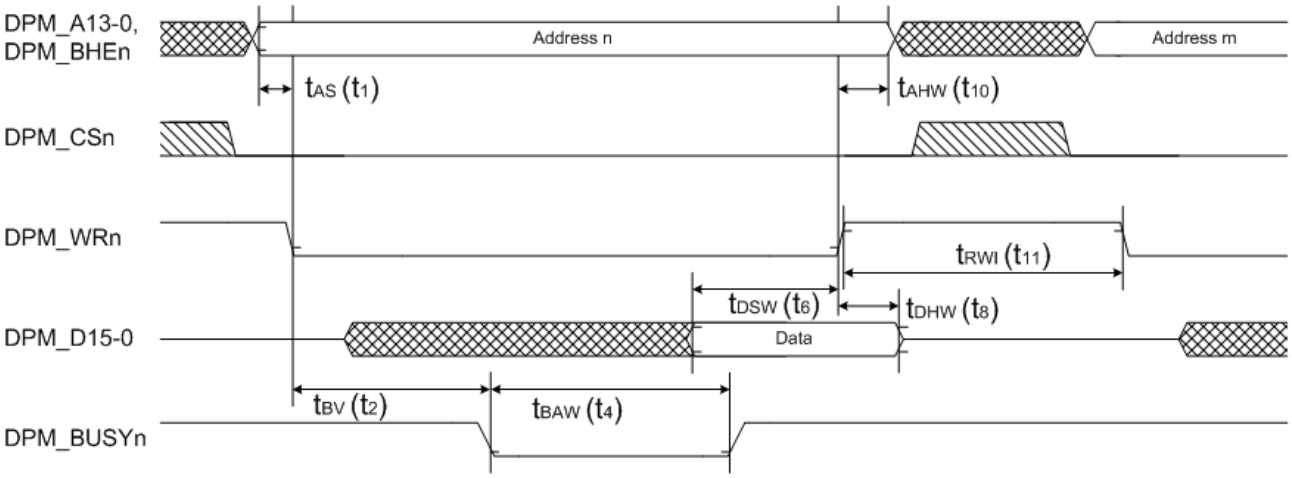

Figure 21: netJACK timing diagram for write access

Description and values are on the next page.

The following table gives the values for the timing parameters for netJACK 100 modules using the netX 100 chip and for the former netJACK 50 modules using the netX 50 chip. For exchangeability of netJACK 50 with netJACK 100 communication modules and vice versa, use the values of column **Common** of Table 14.

Symbol		Description	netJACK 50 netX 50	netJACK 100 netX 100	Common
t_1	t_{AS} min.	Minimum address setup time	1.9 ns	0 ns	2 ns
t_2	t_{BV} max.	Maximum time from cycle start until DPM_BUSYn signal is valid	35.5 ns	30 ns	40 ns
t_3	t_{BAR} typ.	**Typical** BUSY active time (read access) See note 2	50 ns	80 ns	-
	t_{BAR} max.	**See important note 1**	-	-	-
t_4	t_{BAW} min.	Minimum BUSY active time (write access)	0 ns	0 ns	0 ns
	t_{BAW} max.	**See important note 1**	-	-	-
t_5	t_{DVR} min.	Minimum time between valid data bus signals and rising edge of DPM_BUSYn signal	8.3 ns	5 ns	5 ns
t_6	t_{DSW} min.	Minimum setup time for write data	12.1 ns	25 ns	25 ns
t_7	t_{DHR} min.	Minimum read data hold time	1.5 ns	0 ns	0 ns
t_8	t_{DHW} min.	Minimum hold time for write data	0 ns	0 ns	2.8 ns
t_9	t_{AHR} min.	Minimum address hold time	0 ns	0 ns	0 ns
t_{10}	t_{AHW} min.	Minimum address hold time	0 ns	0 ns	2.9 ns
t_{11}	t_{RWI}	Minimum inactive time for DPM_RDn or DPM_WRn	10 ns	10 ns	12.5 ns

Table 14: Symbols for netJACK timing diagram for read and write access

Important note 1: Avoid dual-port memory access errors

It is mandatory that the host CPU always uses the DPM_BUSYn signal, otherwise this causes wrong data to be read from the dual-port memory or dual-port memory write accesses are ignored.

- The maximum value for accesses cannot be specified.
- For maximum performance, the DPM_BUSYn signal must always be evaluated by the host CPU.
- If you use a host CPU that cannot use the DPM_BUSYn signal, then contact our technical support.

Note 2: The value for t_{BAR} typ. (t_3 typ.) depends on the used firmware/application on the netX.

Note 3: DPM_BHEn is only relevant for 16-bit interface.

For NJ51D and NJ52D

For the NJ51D/ NJ52D modules, the situation is significantly more sophisticated as you have to separately take into account various cases of read and write accesses.

At first, the host can access netJACK 51/ netJACK 52 in parallel or serial mode. Serial mode is not described within this section. Then, parallel mode can be multiplexed or non-multiplexed. Multiplexed parallel mode is not within the scope this section.

Read accesses in non-multiplexed parallel mode can be:

- controlled by signal DPM_RDn
- controlled by signal DPM_CSn
- in burst mode (not taken into account within the scope of this section)

Write accesses in non-multiplexed parallel mode can be:

- with insertion of wait cycles (that means, internal netX DPM side is busy)
- without insertion of wait cycles (that means, internal netX DPM side is idle)

The following diagram shows the timing for dual-port memory read access controlled by DPM_RDn in parallel mode, not multiplexed, no burst mode.

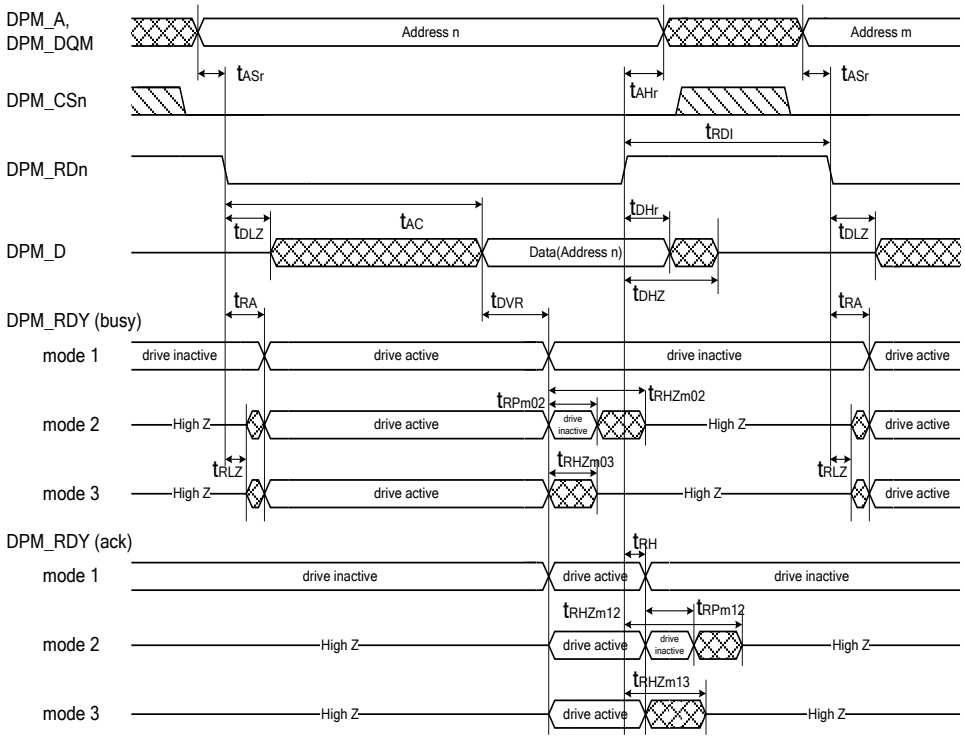

Figure 22: netJACK timing diagram for read access controlled by DPM_RDn

The following diagram shows the timing for dual-port memory read access controlled by DPM_CSn in parallel mode, not multiplexed, no burst mode.

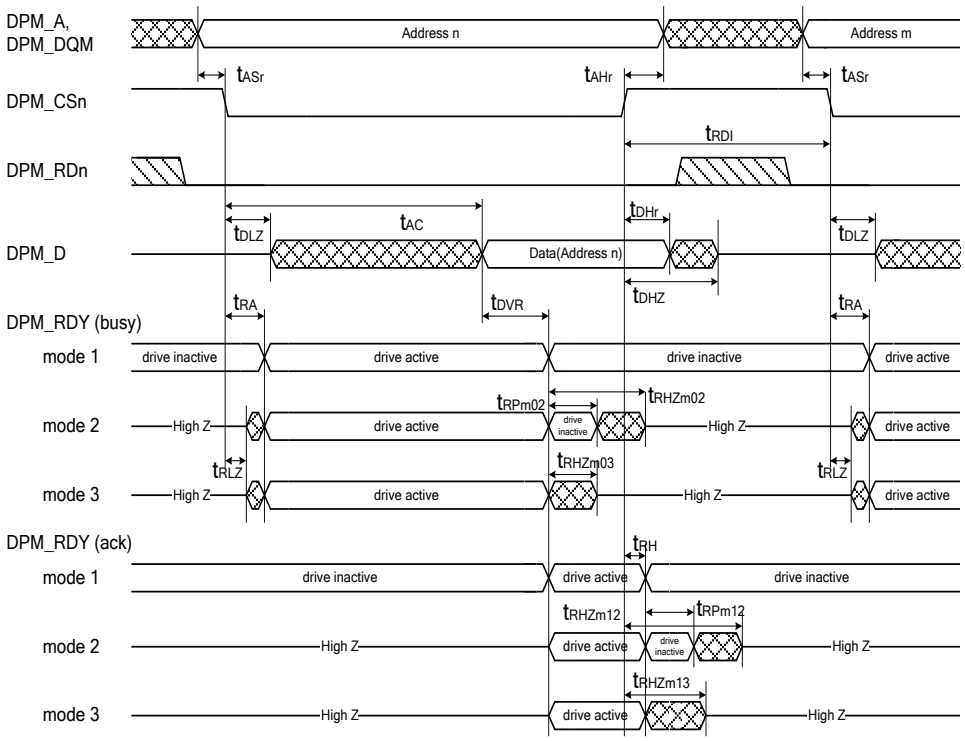

Figure 23: netJACK timing diagram for read access controlled by DPM_CSn

The following diagram shows the timing for dual-port memory write access.

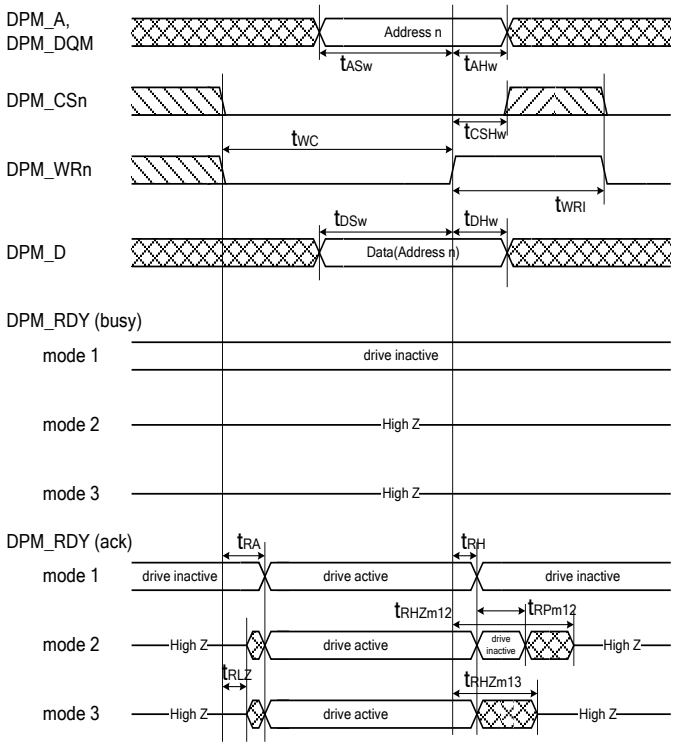

Figure 24: Detailed timing DPM SRAM mode write access when internal netX DPM side is idle (no insertion of wait cycles, DPM_RDn signal is all time inactive high)

After the positive edge of the DPM_WRn signal indicates the end of an external write access, the internal access to the netX address area will be started. If a new external DPM write access is initiated before a prior write access finished internally, external wait cycles are inserted by asserting DPM_RDY signal.

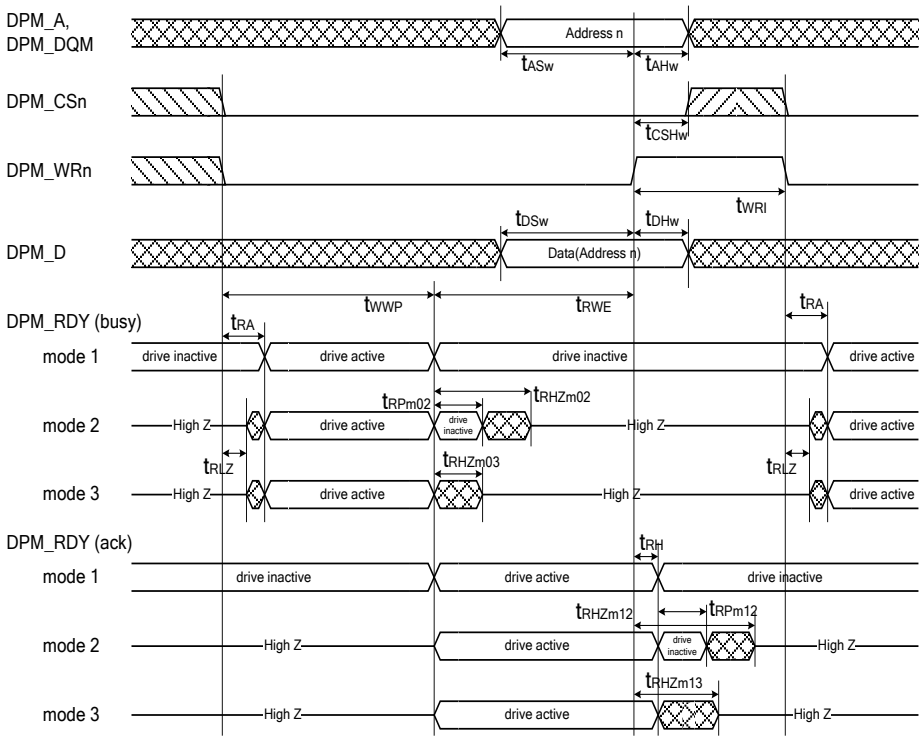

Figure 25: Detailed timing DPM SRAM mode write access when internal netX DPM side busy (insertion of wait cycles, DPM_RDn signal is all time inactive high).

The following table gives the values for the timing parameters for the netJACK 51/52 modules using the netX 51/52 chip. For comparison, the values for the former netJACK 10 modules using the netX 10 chip are listed here, too.

Symbol		Description	netJACK 51 or 52 netX 51 or 52	netJACK 10 netX 10
t_1	t_{ASr} min.	Address setup time (Read cycle) Minimum address setup time (read access)	0.9 ns	0 ns
t_1	t_{ASw} min.	Address setup time (Write cycle) Minimum address setup time (write access)	10.8 ns	
t_2	T_{RA} max.	Ready active time Maximum time from cycle start until DPM_RDY signal is valid	5.7 ns	5,7 ns
t_5	t_{DVR} min.	Data valid to ready time Minimum Time between valid data bus signals and rising edge of DPM_RDY signal	7.8 ns (See note 1 below)	7.8 ns (See note 1 below)
t_6	t_{DSw} min.	Data setup time Minimum setup time for write data	10.8 ns	12.8 ns
t_7	t_{DHr} min.	Data hold time (Read cycle) Minimum read data hold time	2.1 ns	2.1 ns
t_8	t_{DHw} min.	Data hold time (Write cycle) Minimum hold time for write data	0.8 ns	2.8 ns
t_9	t_{AHr} min.	Minimum address hold time (Read cycle)	0 ns	0 ns
t_{10}	t_{AHw} min.	Minimum address hold time (Write cycle)	0.9 ns	2.9 ns
t_{11}	t_{RDI}	Read inter access idle time Minimum inactive time for DPM_RDn	10.5 ns	12.5 ns
t_{11}	t_{WRI}	Write inter access idle time Minimum inactive time for DPM_RDn or DPM_WRn	10.5 ns	12.5 ns

Table 15: Symbols for netJACK NJ51D/ NJ52D timing diagrams for read and write Access

Important note: Assertion of DPM_RDY

In order to increase the Data Valid to Ready Time (y 0...7 system clock cycles, use the programmable timing parameter t_{RDS} as follows

- For t_{RDS}=0, DPM_RDY will be asserted 0.7ns before read data is valid. This is the minimum value.
- For t_{RDS}=1 to 7, DPM_RDY (in units of nanoseconds) can be calculated by t_{RDS} -2.2.

For correct t_{RDS} setting view host device requirements and datasheet.

For timing differences and details of multiplexed mode, non-multiplexed burst mode or serial mode refer to reference [4].

4.1.10 Serial dual-port memory mode – Signals of the host interface

The NJ 51 and NJ 52 modules offer an SPI slave interface for serial access to the dual-port memory of the netJACK. The following figure illustrates the general connection of the serial dual-port memory to any SPI capable host CPU.

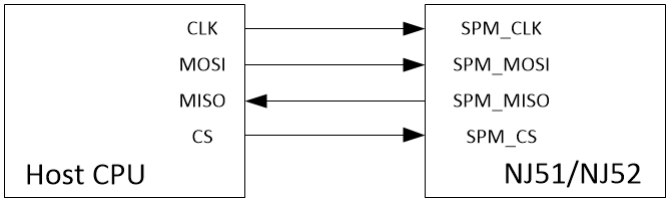

Figure 26: Serial dual-port memory Interface

The default SPI mode is mode 3, CPOL = 1 and CPHA = 1.

Timing diagram for serial dual-port memory interface

To access the dual-port memory of the NJ 51/52 modules, see the timing diagram in section *Serial Mode IO Timing* in [4], pages 265 - 266.

Software implementation and protocol

For information about the software implementation and the protocol see section *Host Software Implementation* and section *Serial DPM protocol description* in [7].

4.1.11 PCI Express

Note: This subsection explains the details of the various signals of the netJACK modules with PCI Express interface.

4.1.11.1 PCI Express interface

The following pins of the system connector X1 relate to the PCI-Express interface. The table provides the according signal denominations as used in the PCI-Express specification and how to protect the signal:

Description	Corresponding Signal according to PCI Express specification	Protection
PCI Express Receive (negative)	PERN	none
PCI Express Receive (positive)	PERP	none
Ground	GND	-
PCI Express Transmit (positive)	PETP	100 nF (already built-in in the netJACK module)
PCI Express Clock (positive)	REFCLK+	none
PCI Express Transmit (negative)	PETN	100 nF (already built-in in the netJACK module)
PCI Express Clock (negative)	REFCLK-	none

Table 16: Pins of the NJ 100EN system connector X1 related to the PCI Express interface, their signal denominations and protection measures

All signals must match the PCI-Express specification (reference #3).

4.1.11.2 Reset signal

It is possible to reset the netJACK module by the power-on reset signal PERSTn. For operation of the netJACK module it is important to switch the signal PERSTn to high level. Then the netJACK module begins with program execution and initialization. This power up time is different for each netJACK module. Normally, the time is about some seconds.

The netJACK module is in reset state when the signal PERSTn has a static low level. To reset the netJACK module the PERSTn signal must be low for more than 10 µs.

The filter displayed in Figure 27 is already integrated on the netJACK. The following schematic applies to PCI-Express only:

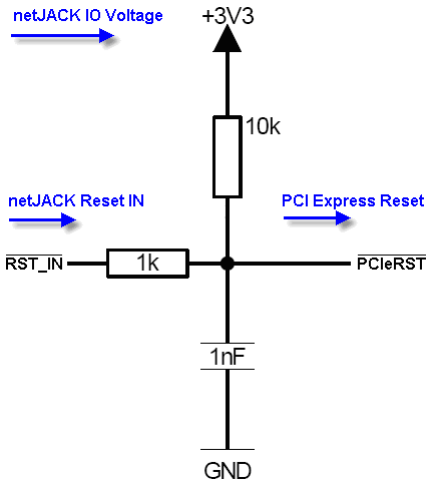

Figure 27: Filter for power-on reset signal PERSTn (only for PCI-Express)

For information about the reset level, also refer to the remarks in section *Supply voltage of the netJACK* on page 34.

4.2 Diagnostic interface

We strongly recommend integrating either a USB port or a RS-232C interface into your host device.

4.2.1 Diagnostic interface USB

The netJACK modules have a USB (Universal Serial Bus) port for diagnostic purposes. It is supported by all standard firmware. There are two USB signal lines:

Pin	Signal	Description
#2	USB-	USB negative signal line
#3	USB+	USB positive signal line

Table 17: SYNC signal lines

The USB Signals have LVTTL level (3.3 V). The following schematic shows how to set up a USB interface with the netJACK:

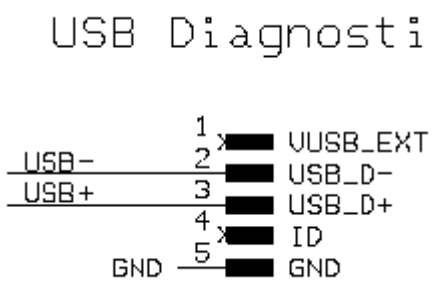

Figure 28: Example schematic for the USB interface

Note: USB is only used for diagnostic purposes. The external USB power supply pin (Pin 1 of Mini-USB connector) is not used by the netJACK.

Note: At the USB interface, there is no protection circuitry necessary in your design as the netJACK already comes along with an internal ESD protection and 22 Ω resistor. The pins USB+ and USB- may remain unconnected.

The following pins of the system connector X1 relate to the USB interface. The table provides the signal denominations and how to protect the signal:

Description	Protection (internal)	Shared with
USB+	22 Ω	-
USB-	22 Ω	-

Table 18: Pins of the NJ 100EN system connector X1 related to Universal Serial Bus (USB)

Consider the following:

- There is an internal 22 Ω resistor for protection.
- There are no reset regards.
- Use a special USB Driver as PAD.
- Use a protection diode due to ESD aspects.

All signals must match the USB specifications.

4.2.2 Diagnostic interface RS-232C

Moreover, at the dual-port memory based types of the netJACK there are two UART signals available for diagnostic purposes, which is supported by some but not all firmware implementations.

Signal	Description
UART0_TXD	UART transmit signal
UART0_RXD	UART receive signal

Table 19: UART signal lines for RS-232C diagnostic interface

The signals UART0_TXD and UART0_RXD have LVTTL level (3.3 V). They allow setting up an interface for diagnostic purposes. If not used, connect signal UART0_TXD to a 10k pull-up resistor.

The diagnostic interface can be connected (via RS-232 drivers) to the 9-pin male DSub-connector.

The following table shows the pinning of the connector.

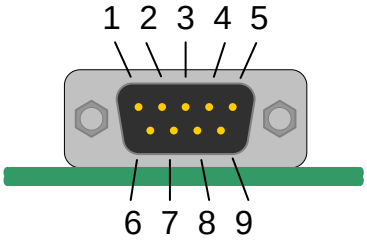

Figure 29: Diagnostic interface connector

Pin	Name	Description
5	GND	Ground
3	TXD	Transmit data from netJACK
2	RXD	Receive data to netJACK

Table 20: Pinning of the diagnostic interface connector

All other pins are not connected.

5 Evaluation board

Important: No CE Sign: The evaluation boards NJEB-D and NJEB-E described in this chapter have been designed only for test and not for production purposes. Therefore, it does not carry the CE sign We urgently recommend not to use the NJEB-D evaluation board in a production environment.

Important: The Evaluation Boards NJEB-D and NJEB-E offer contact possibilities for various future extensions. Currently usable are only the following features:

- USB Diagnostic Interface
- UART Diagnostic Interface

5.1 Evaluation board NJEB-D

The NJEB-D evaluation board (Part no. 1600.000) allows evaluation of netJACK communication modules with dual-port memory interface. Connector X100 supplies the evaluation board with power externally.

Important: This NJEB-D evaluation board requires an external power supply with a voltage in the range between 9 V and 24 V DC. A suitable power supply is available from Hilscher. We urgently recommend not using any other power supply for the NJEB-D evaluation board.

Important: In general, the netJACK communication modules have not been designed for hot-plugging, i.e. mounting and demounting while being under voltage! This also affects changing the netJACK communication module plugged onto the NJEB-D evaluation board. Therefore, always take off the voltage before starting any mounting or demounting activities. See section *No mounting and demounting under* voltage on page 19.

Note: Please note that some features of the NJEB-D evaluation board (Card reader, second field bus interface and analog signals, for instance) can only be used with netJACK communication modules having a system interface (such as the NJ 100DN) and/or running a customer-specific firmware.

5.1.1 Top view evaluation board NJEB-D

The following figure shows the top side of the NJEB-D evaluation board.

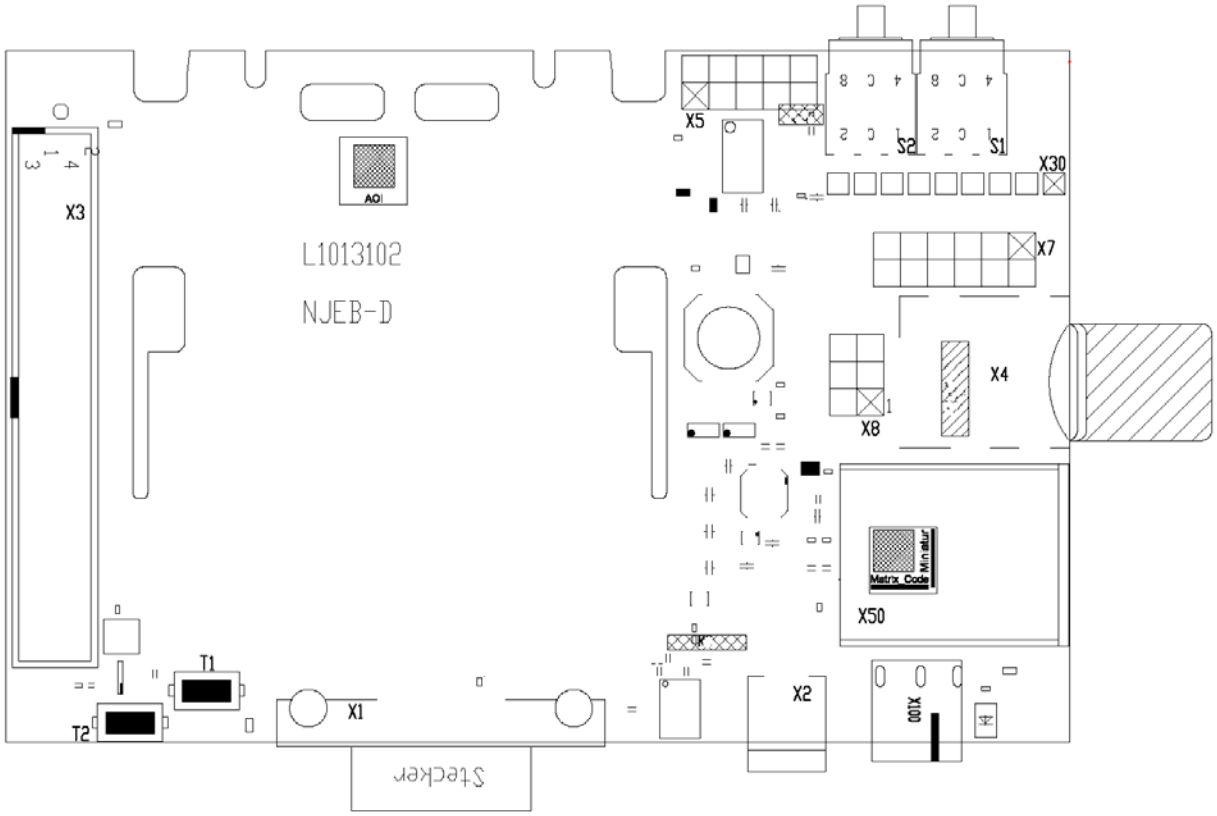

Figure 30: Top side of the NJEB-D evaluation board

5.1.2 Switches/push buttons

There are two push buttons T1 and T2 that can be set, see *Figure 30* on page 53 and

Figure 31 on page 54:

Push Button	Symbol	Function
T1	RESET	Reset
T2	BOOT	Boot mode. If pressed, connects the boot pin (#43) of the system connector X10 with GND

Table 21: Push button of NJEB-D

Furthermore, the evaluation board is equipped with two rotary switches S1 and S2 for setting up the slave address when operating the netJACK on the board with a slave firmware. These rotary switches are connected via an I^2C interface (I^2C address = `0x21`). They are not required and used when operating the netJACK on the board with a master firmware.

5.1.3 Connectors of the NJEB-D

The evaluation board NJEB-D is equipped with the following connectors:

Connector	Description in Section	Page
X1	*UART for serial diagnostic interface (X1)*	55
X2	*USB diagnostic interface – Mini-B USB (X2)*	55
X3	*Dual-port memory interface (X3)*	56
X7	*Serial dual-port memory interface* (X7)	57
X8	*SYNC/I2C connector X8*	58
X10	*netJACK system connector X10*	58
X100	*Power connector X100*	58

Table 22: Connectors of the evaluation board NJEB-D

Connectors shown below but not mentioned are either currently not supported or reserved!

The following figure shows the position of connectors and switches of the NJEB-D:

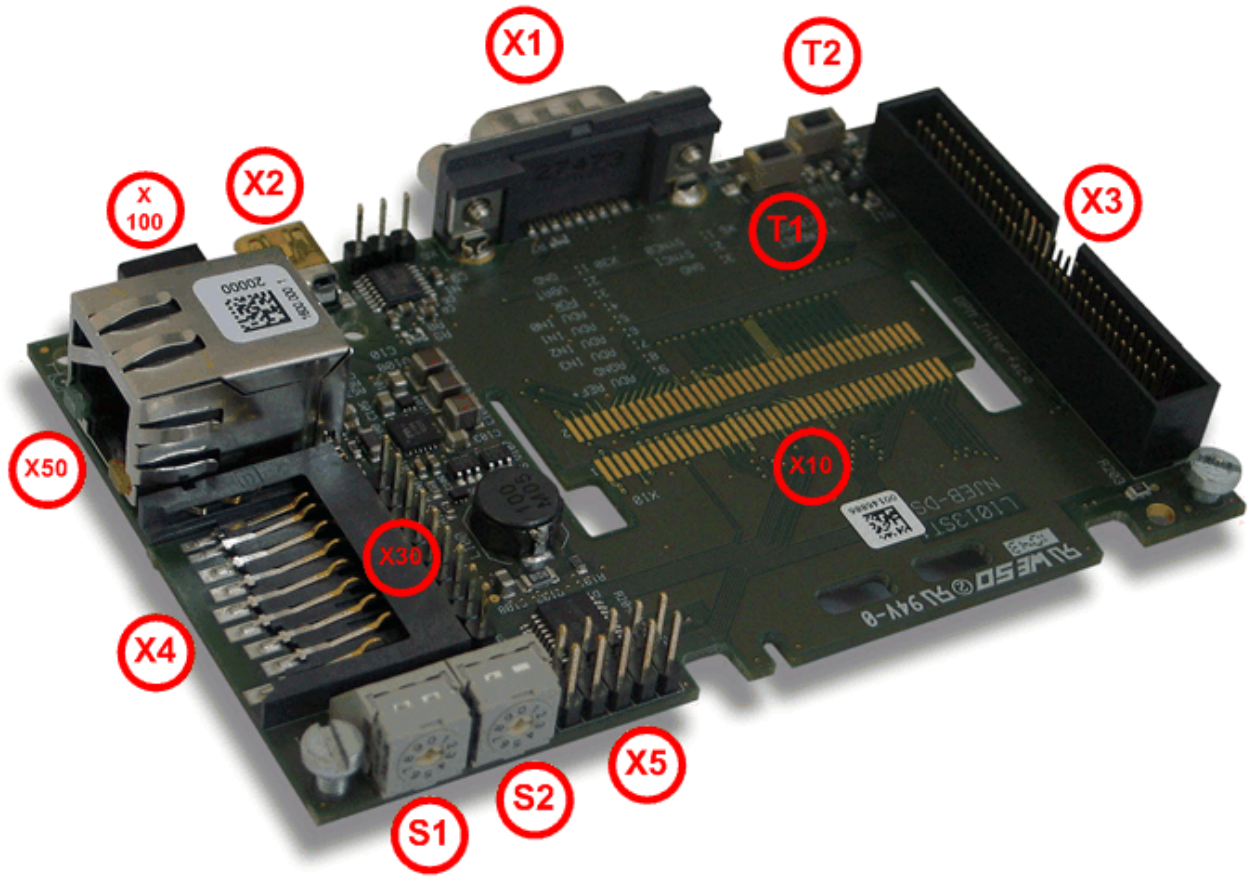

Figure 31: Position of the connectors and switches at the evaluation board NJEB-D

5.1.3.1 UART for serial diagnostic interface (X1)

The diagnostic interface of the netJACK evaluation board NJEB-D is connected to the 9-pin male DSub-connector X3 via RS-232 drivers.

The following table shows the pinning of the connector.

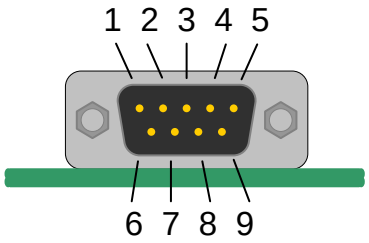

Figure 32: Diagnostic interface connector

Pin	Name	Description
5	GND	Ground
3	UART0_TXD	Transmit Data from netJACK
2	UART0_RXD	Receive Data to netJACK

Table 23: Pinning of the Diagnostic interface connector

All other pins are not connected.

5.1.3.2 USB diagnostic interface – Mini-B USB (X2)

Another available diagnostic interface of the netJACK evaluation board NJEB-D has a 5-pin Mini-B USB Connector according to the following description.

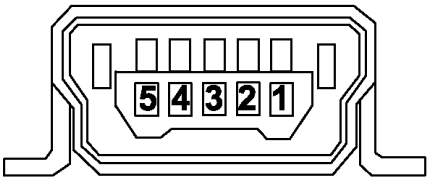

Figure 33: Mini-B USB connector (5-pin)

Pin	Name	Description
1	USB_EXT	USB Bus Power (+5 V DC, supplied externally)
2	D-	Data -
3	D+	Data +
4	ID	Not connected
5	GND	Ground

Table 24: Pinning Mini-B USB connector

5.1.3.3 Dual-port memory interface (X3)

The dual-port memory interface connector X3 is located at the left side of the evaluation board. It has the following pinout.

Pin	Signal	Symbol	Type
1	Not connected		
2	Ground	GND	
3	Not connected		
4	Not connected		
5	Ground	GND	
6	Not connected		
7	Reset in	RSTIN	Low-active
8	Not connected		
9	Not connected		
10	Not connected		
11	Dual-port memory interrupt request	DPM_DIRQn/CSMD	Low-active
12	Dual-port memory busy	DPM_BUSYn	Low-active
13	Ground	GND	
14	Dual-port memory	DPM_AD	Low-active
15	Not connected		
16	Dual-port memory	DPM_WE	Low-active
17	Not connected		
18	Dual-port memory	DPM_SIRQn/CMBW	Low-active
19	Dual-port memory Bus high enable	DPM_BHEn	Low-active
20	Ground	GND	
21	Not connected		
22	Not connected		
23	Not connected		
24	Dual-port memory chip select	DPM_CSn	Low-active
25	Ground	GND	
26	Not connected		
27	Not connected		
28	Not connected		
29	Not connected		
30	Not connected		
31	Not connected		
32	Not connected		
33	Ground	GND	
34	Address line 15	DPM_A15	
35	Address line 14	DPM_A14	
36	Address line 13	DPM_A13	
37	Address line 12	DPM_A12	
38	Address line 11	DPM_A11	
39	Address line 10	DPM_A10	
40	Address line 9	DPM_A9	
41	Address line 8	DPM_A8	
42	Address line 7	DPM_A7	
43	Address line 6	DPM_A6	
44	Address line 5	DPM_A5	
45	Address line 4	DPM_A4	
46	Address line 3	DPM_A3	
47	Address line 2	DPM_A2	
48	Address line 1	DPM_A1	
49	Address line 0	DPM_A0	
50	Ground	GND	

Pin	Signal	Symbol	Type
51	Data line 15	DPM_D15	
52	Data line 14	DPM_D14	
53	Data line 13	DPM_D13	
54	Data line 12	DPM_D12	
55	Data line 11	DPM_D11	
56	Data line 10	DPM_D10	
57	Data line 9	DPM_D9	
58	Data line 8	DPM_D8	
59	Data line 7	DPM_D7	
60	Data line 6	DPM_D6	
61	Data line 5	DPM_D5	
62	Data line 4	DPM_D4	
63	Data line 3	DPM_D3	
64	Data line 2	DPM_D2	
65	Data line 1	DPM_D1	
66	Data line 0	DPM_D0	
67	Not connected		
68	Not connected		

Table 25: Dual-port memory interface connector X3

5.1.3.4 Serial dual-port memory interface (X7)

The serial dual-port memory interface is an SPI interface. The netJACK on the evaluation board NJEB-D works as SPI Slave.

Pin	Signal	Symbol	Type
1	Master in Slave out	SPM_MISO	Output
2	Ground	GND	-
3	Master out Slave in	SPM_MOSI	Input
4	Ground	GND	-
5	Chip select	SPM_CS	Input
6	Ground	GND	-
7	Serial clock	SPM_CLK	Input
8	Ground	GND	-
9	DIRQ for host (optional), e.g. data IRQ	SPM_DIRQ	Output
10	Ground	GND	-
11	SIRQ for host (optional), e.g. service IRQ)	SPM_SIRQ	Output
12	Ground	GND	-

Table 26: Serial dual-port memory interface (X7)

5.1.3.5 SYNC/I2C connector X8

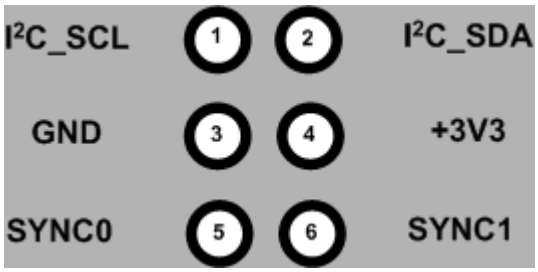

Figure 34: SYNC/I2C connector X8 (Contact strip)

At the contact strip X8, some SYNC and I²C-related signals are available:

Pin	Signal	Symbol	Type	Connected to
1	Serial Clock Line	I2C_SCL	I²C Serial Clock Line Signal	pin 29 of X10
2	Serial Data Line	I2C_SDA	I²C Serial Data Line Signal	pin 31 of X10
3	Ground	GND		
4	Operating voltage 3,3 V	+3V3		
5	SYNC0	SYNC0	SYNC Signal 0, max. 6 mA	pin 25 of X10
6	SYNC1	SYNC1	SYNC Signal 1, max. 6 mA	pin 23 of X10

Table 27: SYNC/I²C connector X8

Whether the SYNC feature is supported or not depends on the loaded firmware. Currently, there is no firmware supporting SYNC on netJACK communication modules with dual-port-memory host interface.

5.1.3.6 netJACK system connector X10

The pinning of the netJACK System Connector X10 is similar to that described in *Table 8: net-JACK pinning of the NJ 100DN (Parallel dual-port* memory mode) on page 33, see there.

5.1.3.7 Power connector X100

Connect the power supply of the NJEB-D evaluation board with power connector X100. The power supply voltage must be in the range between 9V and 24V DC. However, operation at 24 V is recommended. A diode protects the input against incorrect wiring.

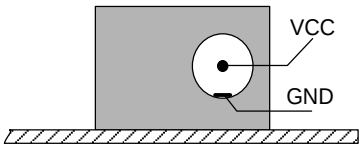

Figure 35: External power supply connector

5.2 Evaluation board NJEB-E

The evaluation Board NJEB-E is a PCI-Express card allowing to access and test a netJACK module with PCI-Express by plugging it onto the NJEB-E and then mounting the NJEB-E into a PC.

The PC supplies the evaluation board with power via the PCI-Express connector **X2**.

Important: No CE Sign: As already stated on the beginning of this chapter, the Evaluation Board NJEB-E described in this chapter has been designed **only for test** and **not for production purposes**. Therefore, it does not carry the CE sign. We urgently recommend not using the NJEB-E evaluation Board in a production environment.

Important: The evaluation Board NJEB-E offers contact possibilities for various future extensions s. Currently usable are only the following features:

- USB Diagnostic Interface

5.2.1 Important safety instructions

WARNING!

Hazardous voltage inside of open PC

As long as the PC is open, never touch any part inside of the PC, as there might be hazardous voltage!
The housing of a PC mounted with an Evaluation Board NJEB-E cannot be closed as otherwise; the connector of the netJACK would be inaccessible inside the closed PC housing. As well, LEDs and switches would also be inaccessible in that case.

USA:

WARNING

Hazardous voltage inside of open PC

As long as the PC is open, never touch any part inside of the PC, as there might be hazardous voltage!

The housing of a PC mounted with an Evaluation Board NJEB-E cannot be closed as otherwise; the connector of the netJACK would be inaccessible inside the closed PC housing. As well, LEDs and switches would also be inaccessible in that case.

5.2.2 No support for hot-plugging

Important:

In general, the netJACK communication modules have not been designed for hot-plugging, i.e. mounting and demounting while being under voltage! This also affects changing the netJACK communication module plugged onto the NJEB-E. Therefore, always take off the voltage before starting any mounting or demounting activities. For more information on this topic, see section *No mounting and demounting under* voltage on page 19.

5.2.3 Top view evaluation board NJEB-E

The following figure shows the top side (and the slot plate) of the Evaluation Board NJEB-E.

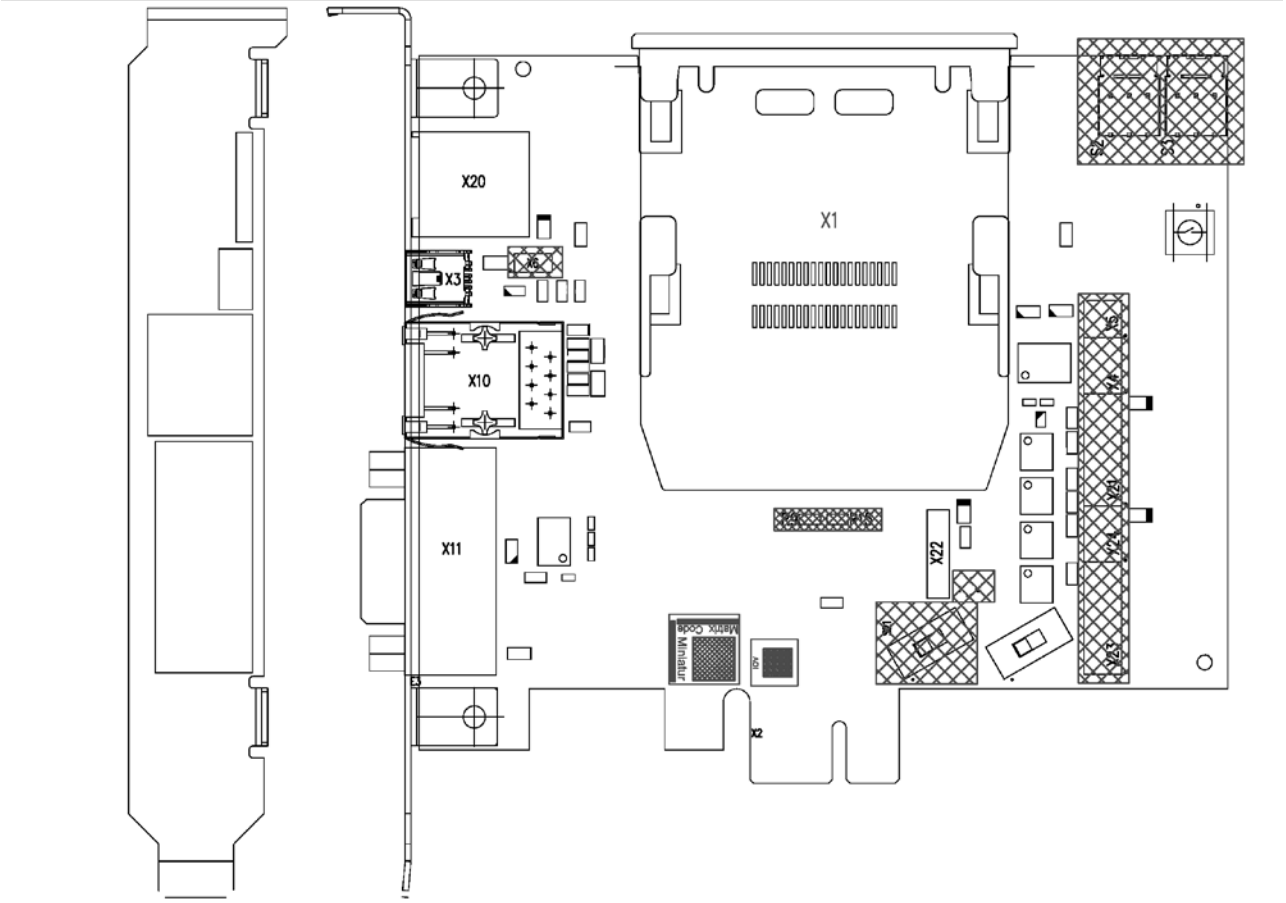

Figure 36: Top side (and slot plate, left) of the NJEB-E evaluation board

Figure 36 shows the NJEB-E evaluation board with mounted netJACK communication module on the system connector X1.

5.2.4 Switches

The following switches can be set on the NJEB-E:

Switch	Type	Function
S1	Push button	Boot start. If pressed, connects the boot pin (pin #9) of the system connector X1 with GND
S2	Rotary switch	Rotary switch for selection of Slave ID (x1)
S3	Rotary switch	Rotary switch for selection of Slave ID (x10)
S20	Push button	Allows switching X22 between AIFX Connector and IO Field.

Table 28: Rotary switches and push buttons of NJEB-E

5.2.5 LEDs

The following LEDs are available:

LED	State	Function
P20	ON	LED of AIFX
	OFF	IO Field
P21	ON	LED of PIO8-15
	OFF	IO Field
P22	ON	LED of microSD card reader
	OFF	IO Field
P23	ON	LED of External SPI
	OFF	IO Field
X10B		Link LED (green) and Activity LED (yellow) of Ethernet interface Meaning depends on applied Real-Time Ethernet protocol.

Table 29: LEDs of NJEB-E

5.2.6 Connectors of the NJEB-E

The evaluation board NJEB-E is designated for netJACK modules of the NJ100EN series with PCI Express interface. It is equipped with the following connectors:

Connector	Description
X1	*netJACK (PCI-Express) system connector X1*
X2	*PCI-Express interface X2*
X3	*Mini-B USB connector for USB diagnostic interface X3*
X4	*SYNC on IO Field connector X4*
X6	*Manual USB device detect X6*
X11	*Connector for serial diagnostic interface X11 (UART)*

Table 30: Connectors of the NJEB-E

Connectors shown in *Figure 36* but not mentioned here are either currently not supported or reserved!

5.2.6.1 netJACK (PCI-Express) system connector X1

The following table explains the meaning of pins of the system connector of netJACK for PCI-Express.

Number (left pin)	Meaning (left pin)	Meaning (right pin)	Number (right pin)
1	Reserved	Reserved	2
3	Reserved	Reserved	4
5	Reserved	Reserved	6
7	Reserved	Reserved	8
9	Reserved	Reserved	10
11	+3V3	+3V3	12
13	SYNC1(XC3-IO1)	USB+	14
15	SYNC0(XC3-IO0)	USB-	16
17	PORn (PERSTn)	GND	18
19	SCL	PERn0 (PERN)	20
21	SDA	PERp0 (PERP)	22
23	GND	GND	24
25	PETp0 (PETP)	REFCLK+	26
27	PETn0 (PETN)	REFCLK-	28
29	GND	GND	30
31	Reserved	Reserved	32
33	Reserved	Reserved	34
35	Reserved	Reserved	36
37	Reserved	Reserved	38
39	Reserved	Reserved	40

Table 31: netJACK (PCI-Express) system connector X1

The connector consists of 40 metalized contact spots for the spring contacts of the netJACK communication module’s system interface.

5.2.6.2 PCI-Express interface X2

This is a standard PCI-Express plug (with only one single lane) for inserting the evaluation board NJEB-E into any PCI-Express slot of a PC. The meaning of the various contacts is:

Contact	Name	Description	Contact	Name	Description
A1	A1_B17	PCIe Card Detect	B1		Not connected
A2		Not connected	B2		Not connected
A 3		Not connected	B 3		Not connected
A 4	GND	Ground	B 4	GND	Ground
A 5		Not connected	B 5		Not connected
A 6		Not connected	B 6		Not connected
A 7		Not connected	B 7	GND	Ground
A 8		Not connected	B 8	+3V3	Supply voltage +3.3V
A 9	+3V3	Supply voltage +3.3V	B 9		Not connected
A10	+3V3	Supply voltage +3.3V	B10		Not connected
A11	PORn (PERSTn)	Power-on reset (connected to pin #17 of X1). Also see section *Reset signal* on page 49.	B11		Not connected
A12	GND	Ground	B12		Not connected
A13	REFCLK+	PCI Express Reference Clock (positive signal)	B13	GND	Ground
A14	REFCLK-	PCI Express Reference Clock (negative signal)	B14	PERp0 (PERP)	PCI Express Receive X1 Lane (positive signal)
A15	GND	Ground	B15	PERn0 (PERN)	PCI Express Receive X1 Lane (negative signal)
A16	PETp0 (PETP)	PCI Express Transmit X1 Lane (positive signal)	B16	GND	Ground
A17	PETn0 (PETN)	PCI Express Transmit X1 Lane (negative signal)	B17	A1_B17	PCI Express Card Detect
A18	GND	Ground	B18	GND	Ground

Figure 37: Pinning PCI-Express interface X2

5.2.6.3 Mini-B USB connector for USB diagnostic interface X3

One diagnostic interface of the netJACK evaluation board NJEB-E has a 5-pin Mini-B USB Connector according to the following description.

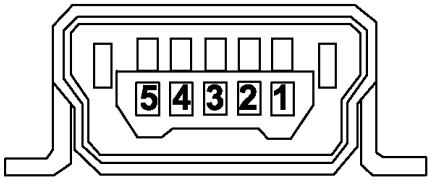

Figure 38: Mini-B USB connector (5-pin)

Pin	Name	Description
1	USB_EXT	USB Bus Power (+5 V DC, supplied externally)
2	D-	Data -
3	D+	Data +
4	ID	Not connected
5	GND	Ground

Table 32: Pinning Mini-B USB connector

5.2.6.4 SYNC on IO Field connector X4

This connector allows access to the SYNC signals SYNC0 and SYNC1 on an IO Field. For more information on the SYNC signals, refer to section SYNC on page 35.

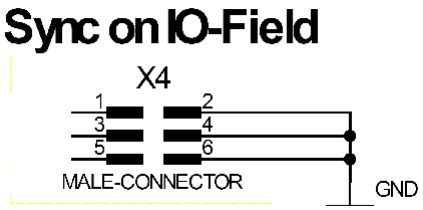

Figure 39: Pinning of SYNC on IO Field connector X4

It is implemented as a pin header with six pins on the evaluation board. These pins have the following meaning:

Pin	Name	Description
1	SYNC1	SYNC1-Signal of netX processor (directly connected to pin 13 of X1, see *Table 31: netJACK (PCI-Express) system connector X1*)
2	GND	Ground
3	SYNC0	SYNC0-Signal of netX processor (directly connected to pin 15 of X1, see *Table 31: netJACK (PCI-Express) system connector X1*)
4	GND	Ground
5	-	Not connected
6	GND	Ground

Table 33: Pinning of SYNC on IO connector X4

Important: These SYNC signal lines can currently only be used at the NJ 100EN-RE and only when running the EtherCAT Slave, Sercos Master or Sercos Slave firmware.

5.2.6.5 Manual USB device detect X6

This connector allows manual device detection of USB devices. It is realized as a contact strip (pin header) with two pins on the evaluation board.

Important: This feature is only available when a netJACK module with system interface (not yet available) is plugged onto the motherboard. It requires a customer-specific firmware of the netJACK. The standard netJACK firmware does not provide any support for this feature.

5.2.6.6 Connector for serial diagnostic interface X11 (UART)

The serial diagnostic interface of the netJACK evaluation board NJEB-E is connected via RS232 drivers to the 9-pin male DSub-connector X3. The following table shows the pinning of the connector.

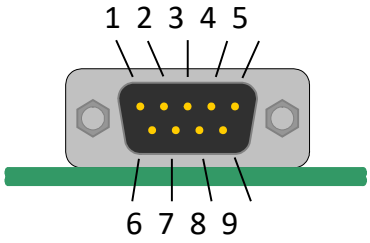

Figure 40: Diagnostic interface connector

Pin	Name	Description
5	GND	Ground
3	TXD	Transmit Data from netJACK
2	RXD	Receive Data to netJACK

Table 34: Pinning of the diagnostic interface connector

All other pins are not connected.

6 Technical data

6.1 Technical data netJACK modules NJ 100EN

6.1.1 NJ 100EN-CO

NJ 100EN-CO	Parameter	Value
Device identification	Part number	1625.500
Communication controller	Type	netX 100 processor
Integrated memory	RAM	8 MB SDRAM
	FLASH	4 MB serial Flash EPROM
Host interface	Type	PCI Express
	Port type	One-Lane-Port
	Frequency	1,5 GHz
	Connector type	40 pin connector (SAMTEC FSI-120-03-G-D-AB)
CANopen communication	Supported firmware	CANopen Master, CANopen Slave
CANopen interface	Transmission rate	10 kBits/s to 1 MBit/s
	Interface type	ISO 11898, potential-free
Diagnostic Interface	USB	Signal at host interface Available only if integrated in host system
Display	LED Display	SYS System Status
		CAN Communication Status
Power supply	Voltage	+3,3 V ± 5 % DC
	Current at 3,3 V (typically)	590 mA
	Power Consumption	1,95 W (at 590 mA)
Signal lines	Voltage of IO signal lines	+3,3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 … +65 °C
Dimensions (L x W x H)	Length (DSUB connector)	68.2 mm/ 60 mm (with/ without DSUB connector)
	Width	53.4 mm (at front panel)/ 50,4 mm (at body)
	Height	25.2 mm (at front panel)/ 19.2 mm (at body)
Weight	Weight	approx. 68 g
Device	Housing	Closed module
	Protection class	IP40
	Width/distance of pins	0,55 mm/0,45 mm
	Mounting	Via milled footprint holes in the carrier board and retaining brackets. No mounting accessories required
	Number of mounting/pulling cycles	<= 10
Certification	CE Sign	yes
	UKCA Sign	yes
	RoHS	yes
	Reach	yes
	UL Certification	yes
		cURus
	UL File No	E334100
Applied tests	Emission	CISPR 11; Class A
	Immunity	according to EN 61131-2:2003
	Shock and vibration	EN60068-2-6 Fc / EN60068-2-27 Ea

Table 35: Technical data NJ 100EN-CO

Electrical immunity to interference and radio frequency

NJ 100EN-CO	Method	Criterion
Electrostatic discharge (ESD) according to IEC/EN 61000-4-2:1995	8 kV Air discharge method	Criterion A
	4 kV Contact discharge method	Criterion A
Fast transient interferences (Burst), according to IEC/EN 61000-4-4:1995	2 kV Communication and data lines	Criterion A
Surge voltage, according to IEC/EN 61000-4-5:1995	1 kV Communication and data lines	Criterion A

Table 36: Electrical immunity to interference and radio frequency NJ 100EN-CO

6.1.2 NJ 100EN-DN

NJ 100EN-DN	Parameter	Value
Device identification	Part number	1625.510
Communication controller	Type	netX 100 processor
Integrated memory	RAM	8 MB SDRAM
	FLASH	4 MB serial Flash EPROM
Host interface	Type	PCI Express
	Port type	One-Lane-Port
	Frequency	1,5 GHz
	Connector Type	40 pin connector (SAMTEC FSI-120-03-G-D-AB)
DeviceNet communication	Supported firmware	DeviceNet Master, DeviceNet Slave
DeviceNet interface	Transmission rate	125 kBits/s, 250 kBits/s, 500 kBits/s
	Interface type	ISO 11898, potential-free
	Connector	CombiCon connector, 5-pin
Diagnostic Interface	USB	Signal at host interface Available only if integrated in host system
Display	LED Display	SYS System Status
		MNS Module Network Status (green: MS, red: NS)
Power supply	Voltage	+3,3 V ± 5 % DC
	Current at 3,3 V (typically)	590 mA
	Power Consumption	1,95 W (at 590 mA)
Signal lines	Voltage of IO signal lines	+3,3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 … +65 °C
Dimensions (L x W x H)	Length	60 mm
	Width	53.4 mm (at front panel)/ 50,4 mm (at body)
	Height	25.2 mm (at front panel)/ 19.2 mm (at body)
Weight	Weight	approx. 54 g
Device	Housing	Closed module
	Protection class	IP40
	Width/distance of pins	0,55 mm/0,45 mm
	Mounting	Via milled footprint holes in the carrier board and retaining brackets. No mounting accessories required.
	Number of mounting/pulling cycles	<= 10
Certification	CE Sign	yes
	UKCA Sign	yes
	RoHS	yes
	Reach	yes
	UL Certification	yes
		cURus
	UL File No	E334100
Applied tests	Emission	CISPR 11; Class A
	Immunity	according to EN 61131-2:2003
	Shock and vibration	EN60068-2-6 Fc / EN60068-2-27 Ea

Table 37: Technical data NJ 100EN-DN

6.1.3 NJ 100EN-DP

NJ 100EN-DP	Parameter	Value
Device identification	Part number	1625.400
Communication controller	Type	netX 100 processor
Integrated memory	RAM	8 MB SDRAM
	FLASH	4 MB serial Flash EPROM
Host interface	Type	PCI Express
	Port type	One-Lane-Port
	Frequency	1,5 GHz
	Connector Type	40 pin connector SAMTEC FSI-120-03-G-D-AB
PROFIBUS communication	Supported firmware	PROFIBUS DP Master, PROFIBUS DP Slave
PROFIBUS interface	Transmission rate	Fixed values ranging from 9,6 kBits/s to 12 MBit/s
	Interface type	RS-485, potential-free
Diagnostic Interface	USB	Signal at host interface Available only if integrated in host system
Display	LED Display	SYS System Status
		COM Communication Status
Power supply	Voltage	+3,3 V ± 5 % DC
	Current at 3,3 V (typically)	560 mA
	Power Consumption	1,85 W (at 560 mA)
Signal lines	Voltage of IO signal lines	+3,3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 … +70 °C
Dimensions (L x W x H)	Length (DSUB connector)	68.2 mm/ 60 mm (with/ without DSUB connector)
	Width	53.4 mm (at front panel)/ 50,4 mm (at body)
	Height	25.2 mm (at front panel)/ 19.2 mm (at body)
Weight	Weight	approx. 68 g
Device	Housing	Closed module
	Protection class	IP40
	Width/distance of pins	0,55 mm/0,45 mm
	Mounting	Via milled footprint holes in the carrier board and retaining brackets. No mounting accessories required
	Number of mounting/pulling cycles	<= 10
Certification	CE Sign	yes
	UKCA Sign	yes
	RoHS	yes
	Reach	yes
	UL Certification	yes
		cURus
	UL File No	E334100
Applied tests	Emission	CISPR 11; Class A
	Immunity	according to EN 61131-2:2003
	Shock and vibration	EN60068-2-6 Fc / EN60068-2-27 Ea

Table 38: Technical data NJ 100EN-DP

Electrical immunity to interference and radio frequency

NJ 100EN-DP	Method	Criterion
Electrostatic discharge (ESD) according to IEC/EN 61000-4-2:1995	8 kV Air discharge method	Criterion A
	4 kV Contact discharge method	Criterion A
Fast transient interferences (Burst), according to IEC/EN 61000-4-4:1995	1.1 kV Communication and data lines	Criterion A
Surge voltage, according to IEC/EN 61000-4-5:1995	1 kV Communication and data lines	Criterion A
Radiated RF, according to IEC/EN 61000-6-2	80-1000MHz, 10V/m, 80% AM / 1kHz, dwell time 1s	Criterion A
	1.0-2.7GHz, 3V/m, 80% AM / 1kHz, dwell time 1s	Criterion A
Conducted RF, according to IEC/EN 61000-6-2	0,15-80MHz, 10V, 80% AM / 1kHz for lines > 3m, dwell time 1s	Criterion A

Table 39: Electrical immunity to interference and radio frequency NJ 100EN-DP

6.1.4 NJ 100EN-RE

NJ 100EN-RE	Parameter	Value	
Device identification	Part number	1625.100	
Communication controller	Type	netX 100 processor	
Integrated memory	RAM	8 MB SDRAM	
	FLASH	4 MB serial Flash EPROM	
Host interface	Type	PCI Express	
	Port type	One-Lane-Port	
	Frequency	1,5 GHz	
	Connector Type	40 pin connector, SAMTEC FSI-120-03-G-D-AB	
	Data transport:	PCI Express	
Ethernet communication	Supported firmware	EtherCAT Master, EtherCAT Slave, EtherNet/IP Scanner/ Master, EtherNet/IP Adapter/Slave, Open Modbus/TCP, POWERLINK Controlled Node/Slave, PROFINET IO Controller, PROFINET IO Device, Sercos Master, Sercos Slave, TCP/IP, VARAN Client	
Ethernet interface	Transmission rate	100 MBit/s or 10 MBit/s (depending on loaded firmware)	
	Interface type	100 BASE-TX, isolated or 10 BASE-T (depending on loaded firmware)	
	Half duplex/Full duplex	supported (at 100 MBit/s)	
	Auto-Negotiation	depending on firmware	
	Auto-Crossover	depending on firmware	
Diagnostic Interface	USB	Signal at host interface Available only if integrated in host system	
Display	LED Display	SYS System Status	Link
		COM0/1 Communication status	Activity
Power supply	Voltage	+3,3 V ± 5 % DC	
	Current at 3,3 V (typically)	750 mA	
	Power Consumption	2,50 W	
Signal lines	Voltage of IO signal lines	+3,3 V ± 5 %	
Environmental conditions	Ambient temperature range for operation	-20 … +65°C	
Dimensions (L x W x H)	Length	62 mm/ 60 mm (with/ without RJ45 connector)	
	Width	53.4 mm (at front panel) / 50,4 mm (at body)	
	Height	25.2 mm (at front panel) / 19.2 mm (at body)	
Weight	Weight	approx. 60 g	
Device	Housing	Closed module	
	Protection class	IP40	
	Number of pins	40	
	Width/distance of pins	0,55 mm/ 0,45 mm	
	Mounting	Via milled footprint holes in the carrier board and retaining brackets. No mounting accessories required	
	Number of mounting/pulling cycles	<= 10	
Certification	CE Sign	yes	
	UKCA Sign	yes	
	RoHS	yes	
	Reach	yes	
	UL Certification	yes	
		cURus	
	UL File No	E334100	
Applied tests	Emission	CISPR 11; Class A	
	Immunity	according to EN 61131-2:2003	
	Shock and vibration	EN60068-2-6 Fc / EN60068-2-27 Ea	

Table 40: Technical data NJ 100EN-RE

Electrical immunity to interference and radio frequency

NJ 100EN-RE	Method	Criterion
Electrostatic discharge (ESD) according to IEC/EN 61000-4-2:1995	8 kV Air discharge method	Criterion A
	4 kV Contact discharge method	Criterion A
Fast transient interferences (Burst), according to IEC/EN 61000-4-4:1995	1.1 kV Communication and data lines	Criterion A
Surge voltage (IEC/EN 61000-4-5:1995)	1 kV Communication and data lines,	Criterion A

Table 41: Electrical immunity to interference and radio frequency NJ 100EN-RE

6.2 Technical data netJACK modules NJ 52D

6.2.1 NJ 52D-DPS

NJ52D-DPS	Parameter	Value
Device identification	Part number	1672.420
Communication controller	Type	netX 52 processor
Integrated memory	RAM	8 MB SDRAM
	FLASH	4 MB serial Flash EPROM
Host interface	Type	Parallel or serial dual-port memory
	Dual-port memory size	64 KB (16 address lines), where 8 KB used by firmware (13 address lines, lowest 8 KB)
	Data width (parallel)	8 or 16 bit
	Serial dual-port memory interface	SPI Slave, Mode 3 , CPOL = 1, CPHA = 1
	Serial transmission rate	Max. 50 MHz
	Connector Type	60 pin connector, SAMTEC FSI-130-03-G-D-AB
PROFIBUS communication	Supported firmware	PROFIBUS DP Slave
PROFIBUS interface	Transmission rate	Fixed values ranging from 9,6 kBits/s to 12 MBit/s
	Interface type	RS-485, potential-free
Diagnostic Interface	USB or UART	Signal at host interface Available only if integrated in host system
Display	LED Display	SYS System Status
		COM Communication Status
Power supply	Voltage	+3,3 V ± 5 % DC
	Current at 3,3 V (typically)	375 mA
	Current at 3,3 V (maximum)	400 mA (no short circuit) 450 mA (in case of short circuit between VP and ISOGND)
Signal lines	Voltage of IO signal lines	+3,3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 … +75 °C
Dimensions (L x W x H)	Length (DSUB connector)	68.2 mm/ 60 mm (with/without DSUB connector)
	Width	53.4 mm (at front panel)/ 50,4 mm (at body)
	Height	25.2 mm (at front panel)/ 19.2 mm (at body)
Weight	Weight	approx. 68 g
Device	Housing	Closed module
	Protection class	IP40
	Width/distance of pins	0,55 mm/0,45 mm
	Mounting	Via milled footprint holes in the carrier board and retaining brackets. No mounting accessories required
	Number of mounting/pulling cycles	<= 10
Certification	CE Sign	yes
	UKCA Sign	yes
	RoHS	yes
	Reach	yes
	UKCA	
	UL Certification	no
Applied tests	Emission	CISPR 11; Class A
	Immunity	according to EN 61131-2:2003
	Shock and vibration	EN60068-2-6 Fc / EN60068-2-27 Ea

Table 42: Technical data NJ52D-DPS

Electrical immunity to interference and radio frequency

NJ52D-DPS	Method	Criterion
Electrostatic discharge (ESD) according to IEC/EN 61000-4-2:1995	10 kV Air discharge method	-
	6 kV Contact discharge method	Criterion B
Fast transient interferences (Burst), according to IEC/EN 61000-4-4:1995	1 kV Communication and data lines	Criterion B
Surge voltage, according to IEC/EN 61000-4-5:1995	1 kV Communication and data lines	Criterion A

Table 43: Electrical immunity to interference and radio frequency NJ52D-DPS

6.2.2 NJ 52D-COS

NJ52D-COS	Parameter	Value
Device identification	Part number	1672.540
Communication controller	Type	netX 52 processor
Integrated memory	RAM	8 MB SDRAM
	FLASH	4 MB serial Flash EPROM
Host interface	Type	Parallel or serial dual-port memory
	Dual-port memory size	64 KB (16 address lines), where 8 KB used by firmware (13 address lines, lowest 8 KB)
	Data width (parallel)	8 or 16 bit
	Serial dual-port memory interface	SPI Slave, Mode 3 , CPOL = 1, CPHA = 1
	Serial transmission rate	Max. 50 MHz
	Connector Type	60 pin connector, SAMTEC FSI-130-03-G-D-AB
CANopen communication	Supported firmware	CANopen Slave
CANopen interface	Transmission rate	10 kBits/s to 1 MBit/s
	Interface type	ISO 11898, potential-free
Diagnostic Interface	USB or UART	Signal at host interface Available only if integrated in host system
Display	LED Display	SYS System Status
		CAN Communication Status
Power supply	Voltage	+3,3 V ± 5 % DC
	Current at 3,3 V (typically)	360 mA
	Current at 3,3 V (maximum)	380 mA
Signal lines	Voltage of IO signal lines	+3,3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	Tbd.
Dimensions (L x W x H)	Length (DSUB connector)	68.2 mm/ 60 mm (with/ without DSUB connector)
	Width	53.4 mm (at front panel)/ 50,4 mm (at body)
	Height	25.2 mm (at front panel)/ 19.2 mm (at body)
Weight	Weight	< 80 g
Device	Housing	Closed module
	Protection class	IP40
	Width/distance of pins	0,55 mm/0,45 mm
	Mounting	Via milled footprint holes in the carrier board and retaining brackets. No mounting accessories required
	Number of mounting/pulling cycles	<= 10
Certification	CE Sign	yes
	UKCA Sign	yes
	RoHS	yes
	Reach	yes
	UKCA	
	UL Certification	no
Applied tests	Emission	CISPR 11; Class A
	Immunity	according to EN 61131-2:2003
	Shock and vibration	EN60068-2-6 Fc / EN60068-2-27 Ea

Table 44: Technical data NJ52D-COS

6.2.3 NJ 52D-DNS

NJ52D-DNS	Parameter	Value
Device identification	Part number	1672.520
Communication controller	Type	netX 52 processor
Integrated memory	RAM	8 MB SDRAM
	FLASH	4 MB serial Flash EPROM
Host interface	Type	Parallel or serial dual-port memory
	Dual-port memory size	64 KB (16 address lines), where 8 KB used by firmware (13 address lines, lowest 8 KB)
	Data width (parallel)	8 or 16 bit
	Serial dual-port memory interface	SPI Slave, Mode 3 , CPOL = 1, CPHA = 1
	Serial transmission rate	Max. 50 MHz
	Connector Type	60 pin connector, SAMTEC FSI-130-03-G-D-AB
DeviceNet communication	Supported firmware	DeviceNet Slave
DeviceNet interface	Transmission rate	125 kBits/s, 250 kBits/s, 500 kBits/s
	Interface type	ISO 11898, potential-free
	Connector	CombiCon connector, 5-pin
Diagnostic Interface	USB or UART	Signal at host interface Available only if integrated in host system
Display	LED Display	SYS System Status
		MNS Module Network Status
Power supply	Voltage	+3,3 V ± 5 % DC
	Current at 3,3 V (typically)	410 mA
	Current at 3,3 V (maximum)	430 mA
Signal lines	Voltage of IO signal lines	+3,3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	Tbd.
Dimensions (L x W x H)	Length	60 mm
	Width	53.4 mm (at front panel)/ 50,4 mm (at body)
	Height	25.2 mm (at front panel)/ 19.2 mm (at body)
Weight	Weight	< 80 g
Device	Housing	Closed module
	Protection class	IP40
	Width/distance of pins	0,55 mm/0,45 mm
	Mounting	Via milled footprint holes in the carrier board and retaining brackets. No mounting accessories required
	Number of mounting/pulling cycles	<= 10
Certification	CE Sign	yes
	UKCA Sign	yes
	RoHS	yes
	Reach	yes
	UL Certification	no
Applied tests	Emission	CISPR 11; Class A
	Immunity	according to EN 61131-2:2003
	Shock and vibration	EN60068-2-6 Fc / EN60068-2-27 Ea

Table 45: Technical data NJ52D-DNS

6.3 Technical data netJACK modules NJ 51D

6.3.1 NJ 51D-RE

NJ51D-RE	Parameter	Value
Device identification	Part number	1662.100
Communication controller	Type	netX 51 processor
Integrated memory	RAM	8 MB SDRAM
	FLASH	4 MB serial Flash EPROM
Host interface	Type	Parallel or serial dual-port memory
	Dual-port memory size	64 KB (16 address lines), where 16 KB used by firmware (14 address lines, lowest 16 KB)
	Data width (parallel)	8 or 16 bit
	Serial dual-port memory interface	SPI Slave, Mode 3, CPOL = 1, CPHA = 1
	Serial transmission rate	Max. 50 MHz
	Connector Type	60 pin connector, SAMTEC FSI-130-03-G-D-AB
Ethernet interface	Supported firmware	EtherCAT Slave, EtherNet/IP Adapter/Slave, Open Modbus/ TCP, PROFINET IO Device, Sercos Slave
	Transmission rate	100 MBit/s or 10 MBit/s (depending on loaded firmware)
	Interface type	100 BASE-TX, isolated or 10 BASE-T (depending on loaded firmware)
	Half duplex/Full duplex	supported (at 100 MBit/s)
	Auto-Negotiation	depending on loaded firmware
	Auto-Crossover	depending on loaded firmware
Diagnostic Interface	USB or UART	Signal at host interface Available only if integrated in host system
Display	LED Display	SYS System Status
		COM0/1 Communication status
		Link0/1, Activity0/1
Power supply	Voltage	+3,3 V ± 5 % DC
	Current at 3,3 V (typically)	not measured yet
	Current at 3,3 V (maximum)	not measured yet
	Power consumption	not measured yet
Signal lines	Voltage of IO signal lines	+3,3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 … +65°C
Dimensions (L x W x H)	Length	62 mm/ 60 mm (with/ without RJ45 connector)
	Width	53.4 mm (at front panel)/ 50,4 mm (at body)
	Height	25.2 mm (at front panel)/ 19.2 mm (at body)
Weight	Weight	approx. 60 g
Device	Housing	Closed module
	Protection class	IP40
	Width/distance of pins	0,55 mm/ 0,45 mm
	Mounting	Via milled footprint holes in the carrier board and retaining brackets. No mounting accessories required!
	Number of mounting/pulling cycles	<= 10
Certification	CE Sign	yes
	UKCA Sign	yes
	RoHS	yes
	Reach	yes
	UL Certification	yes

NJ51D-RE	Parameter	Value
		cURus
	UL File No	E334100
Applied tests	Emission	CISPR 11; Class A
	Immunity	according to EN 61131-2:2003
	Shock and vibration	EN60068-2-6 Fc / EN60068-2-27 Ea

Table 46: Technical data NJ51D-RE

Electrical immunity to interference and radio frequency

NJ51D-RE	Method	Criterion
Electrostatic discharge (ESD) according to IEC/EN 61000-4-2:1995	8 kV Air discharge method (Communication lines)	Criterion A
	4 kV Contact discharge method (Communication lines)	Criterion A
Fast transient interferences (Burst), according to IEC/EN 61000-4-4:1995	2.2 kV (Communication and data lines)	Criterion B
Surge voltage, (IEC/EN 61000-4-5:1995)	1 kV (Communication and data lines)	Criterion A

Table 47: Electrical immunity to interference and radio frequency NJ51D-RE

6.4 Technical data netJACK modules NJ 100DN

6.4.1 NJ 100DN-CO

NJ 100DN-CO	Parameter	Value
Device identification	Part number	1623.500
Communication controller	Type	netX 100 processor
Integrated memory	RAM	8 MB SDRAM
	FLASH	4 MB serial Flash EPROM
Host interface	Type	Parallel dual-port memory
	Dual-port memory size	64 KB (16 address lines), where 16 KB used by firmware (14 address lines, lowest 16 KB)
	Data width (parallel)	8 or 16 bit
	Connector Type	80 pin connector, SAMTEC FSI-140-03-G-D-AB
CANopen communication	Supported firmware	CANopen Master, CANopen Slave
CANopen interface	Transmission rate	10 kBits/s to 1 MBit/s
	Interface type	ISO 11898, potential-free
Diagnostic Interface	USB or UART	Signal at host interface Available only if integrated in host system
Display	LED Display	SYS System Status
		CAN Communication Status
Power supply	Voltage	+3,3 V ± 5 % DC
	Current at 3,3 V (typically)	not measured yet
	Power Consumption	not measured yet
Signal lines	Voltage of IO signal lines	+3,3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 … +70 °C
	Ambient temperature range for storage	-40 … +85°C
Dimensions (L x W x H)	Length (DSUB connector)	68.2 mm/ 60 mm (with/ without DSUB connector)
	Width	53.4 mm (at front panel)/ 50,4 mm (at body)
	Height	25.2 mm (at front panel)/ 19.2 mm (at body)
Weight	Weight	< 80 g
Device	Housing	Closed module
	Protection class	IP40
	Width/distance of pins	0,55 mm/0,45 mm
	Mounting	Via milled footprint holes in the carrier board and retaining brackets. No mounting accessories required
	Number of mount-ing/pulling cycles	<= 10
Certification	CE Sign	yes
	UKCA Sign	yes
	RoHS	yes
	Reach	yes
	UL Certification	yes
		cURus
	UL File No	E334100
Applied tests	Emission	CISPR 11; Class A
	Immunity	according to EN 61131-2:2003
	Shock and vibration	EN60068-2-6 Fc / EN60068-2-27 Ea

Table 48: Technical data NJ 100DN-CO

6.4.2 NJ 100DN-DN

NJ 100DN-DN	Parameter	Value
Device identification	Part number	1623.510
Communication controller	Type	netX 100 processor
Integrated memory	RAM	8 MB SDRAM
	FLASH	4 MB serial Flash EPROM
Host interface	Type	Parallel dual-port memory
	Dual-port memory size	64 KB (16 address lines), where 16 KB used by firmware (14 address lines, lowest 16 KB)
	Data width (parallel)	8 or 16 bit
	Connector Type	80 pin connector, SAMTEC FSI-140-03-G-D-AB
DeviceNet communication	Supported firmware	DeviceNet Master, DeviceNet Slave
DeviceNet interface	Transmission rate	125 kBits/s, 250 kBits/s, 500 kBits/s,
	Interface type	ISO 11898, potential-free
	Connector	CombiCon connector, 5-pin
Diagnostic Interface	USB or UART	Signal at host interface Available only if integrated in host system
Display	LED Display	SYS System Status
		MNS Module Network Status
Power supply	Voltage	+3,3 V ± 5 % DC
	Current at 3,3 V (typically)	not measured yet
	Power Consumption	not measured yet
Signal lines	Voltage of IO signal lines	+3,3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 … +70 °C
	Ambient temperature range for storage	-40 … +85°C
Dimensions (L x W x H)	Length	60 mm
	Width	53.4 mm (at front panel)/ 50,4 mm (at body)
	Height	25.2 mm (at front panel)/ 19.2 mm (at body)
Weight	Weight	< 80 g
Device	Housing	Closed module
	Protection class	IP40
	Width/distance of pins	0,55 mm/0,45 mm
	Mounting	Via milled footprint holes in the carrier board and retaining brackets. No mounting accessories required
	Number of mount-ing/pulling cycles	<= 10
Certification	CE Sign	yes
	UKCA Sign	yes
	RoHS	yes
	Reach	yes
	UL Certification	yes
		cURus
	UL File No	E334100
Applied tests	Emission	CISPR 11; Class A
	Immunity	according to EN 61131-2:2003
	Shock and vibration	EN60068-2-6 Fc / EN60068-2-27 Ea

Table 49: Technical data NJ 100DN-DN

6.4.3 NJ 100DN-DP

NJ100DN-DP	Parameter	Value
Device identification	Part number	1623.400
Communication controller	Type	netX 100 processor
Integrated memory	RAM	8 MB SDRAM
	FLASH	4 MB serial Flash EPROM
Host interface	Type	Parallel dual-port memory
	Dual-port memory size	64 KB (16 address lines), where 16 KB used by firmware (14 address lines, lowest 16 KB)
	Data width (parallel)	8 or 16 bit
	Connector Type	80 pin connector, SAMTEC FSI-140-03-G-D-AB
PROFIBUS communication	Supported firmware	PROFIBUS DP Master, PROFIBUS DP Slave
PROFIBUS interface	Transmission rate	Fixed values ranging from 9,6 kBits/s to 12 MBit/s
	Interface type	RS-485, potential-free
Diagnostic Interface	USB or UART	Signal at host interface Available only if integrated in host system
Display	LED Display	SYS System Status
		COM Communication status
Power supply	Voltage	+3,3 V ± 5 % DC
	Current at 3,3 V (typically)	not measured yet
	Power Consumption	not measured yet
Signal lines	Voltage of IO signal lines	+3,3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20°C – 70°C
	Ambient temperature range for storage	-40 … +85°C
Dimensions (L x W x H)	Length	68,20 mm/ 60 mm (with/without DSUB connector)
	Width	53.4 mm (at front panel)/ 50,4 mm (at body)
	Height	25.2 mm(at front panel)/ 19.2 mm (at body)
Weight	Weight	approx. 68 g
Device	Housing	Closed module
	Protection class	IP40
	Width/distance of pins	0,55 mm/ 0,45 mm
	Mounting	Via milled footprint holes in the carrier board and retaining metal brackets. No mounting accessories required!
	Number of mounting/pulling cycles	<= 10
Certification	CE Sign	yes
	UKCA Sign	yes
	RoHS	yes
	Reach	yes
	UL Certification	yes
		cURus
	UL File No	E334100
Applied tests	Emission	CISPR 11; Class A
	Immunity	according to EN 61131-2:2003
	Shock and vibration	EN60068-2-6 Fc / EN60068-2-27 Ea

Table 50: Technical data NJ100DN-DP

Electrical immunity to interference and radio frequency

NJ 100EN-DP	Method	Criterion
Electrostatic discharge (ESD) according to IEC/EN 61000-4-2:1995	8 kV Air discharge method (Communication lines)	Criterion A
	4 kV Contact discharge method (Communication lines)	Criterion A
Fast transient interferences (Burst), according to IEC/EN 61000-4-4:1995	1.1 kV (Communication and data lines)	Criterion A
Surge voltage, according to IEC/EN 61000-4-5:1995	1 kV (Communication and data lines)	Criterion A

Table 51: Electrical immunity to interference and radio frequency NJ100DN-DP

6.4.4 NJ 100DN-RE

NJ 100DN-RE	Parameter	Value	
Device identification	Part number	1623.100	
Communication controller	Type	netX 100 processor	
Integrated memory	RAM	8 MB SDRAM	
	FLASH	4 MB serial Flash EPROM	
Host interface	Type	Parallel dual-port memory	
	Dual-port memory size	64 KB (16 address lines), where 16 KB used by firmware (14 address lines, lowest 16 KB)	
	Data width (parallel)	8 or 16 bit	
	Connector Type	80 pin connector, SAMTEC FSI-140-03-G-D-AB	
Ethernet communication	Supported firmware	EtherCAT Master, EtherCAT Slave, EtherNet/IP Scanner/ Master, EtherNet/IP Adapter/Slave, Open Modbus/TCP, POWERLINK Controlled Node/Slave, PROFINET IO Controller, PROFINET IO Device, Sercos Master, Sercos Slave, VARAN Client	
Ethernet interface	Transmission rate	100 MBit/s or 10 MBit/s (depending on loaded firmware)	
	Interface type	100 BASE-TX, isolated or 10 BASE-T (depending on loaded firmware)	
	Half duplex/Full duplex	supported (at 100 MBit/s)	
	Auto-Negotiation	depending on firmware	
	Auto-Crossover	depending on firmware	
Diagnostic Interface	USB or UART	Signal at host interface Available only if integrated in host system	
Display	LED Display	SYS System Status	Link
		COM0/1 Communication status	Activity
Power supply	Voltage	+3,3 V ± 5 % DC	
	Current at 3,3 V (typically)	not measured yet	
	Power Consumption	not measured yet	
Signal lines	Voltage of IO signal lines	+3,3 V ± 5 %	
Environmental conditions	Ambient temperature range for operation	-20 … +70°C	
	Ambient temperature range for storage	-40 … +85°C	
Dimensions (L x W x H)	Length	62 mm/ 60 mm (with/ without RJ45 connector)	
	Width	53.4 mm (at front panel) / 50,4 mm (at body)	
	Height	25.2 mm (at front panel) / 19.2 mm (at body)	
Weight	Weight	< 80 g	
Device	Housing	Closed module	
	Protection class	IP40	
	Width/distance of pins	0,55 mm/ 0,45 mm	
	Mounting	Via milled footprint holes in the carrier board and retaining brackets. No mounting accessories required	
	Number of mounting/pulling cycles	<= 10	
Certification	CE Sign	yes	
	UKCA Sign	yes	
	RoHS	yes	
	Reach	yes	
	UL Certification	yes	
		cURus	
	UL File No	E334100	
Applied tests	Emission	CISPR 11; Class A	
	Immunity	according to EN 61131-2:2003	
	Shock and vibration	EN60068-2-6 Fc / EN60068-2-27 Ea	

Table 52: Technical data NJ 100DN-RE

Electrical immunity to interference and radio frequency

NJ 100EN-DP	Method	Criterion
Electrostatic discharge (ESD) according to IEC/EN 61000-4-2:1995	8 kV Air discharge method (Communication lines)	Criterion A
	6 kV Contact discharge method (Communication lines)	Criterion A
Fast transient interferences (Burst), according to IEC/EN 61000-4-4:1995	4.4 kV (Communication and data lines)	Criterion A
Surge voltage, according to IEC/EN 61000-4-5:1995	1 kV (Communication and data lines)	Criterion A

Table 53: Electrical immunity to interference and radio frequency NJ100DN-RE

7 Appendix

7.1 Bus interface

7.1.1 Real-Time Ethernet interface

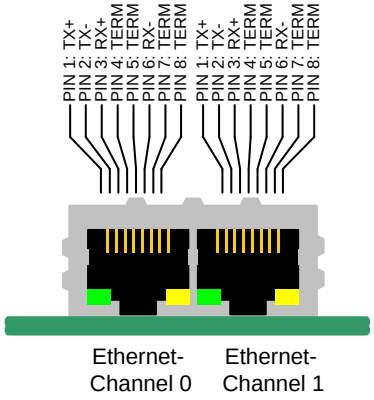

Figure 41: Pinning of Ethernet connectors

Pin	Signal	Signal (in Figure 22)	Description
1	TX +	TXP0	Transmit Data +
2	TX –	TXN0	Transmit Data –
3	RX +	RXP0	Receive Data +
4	TERM		Bob Smith Termination
5	TERM		
6	RX –	RXN0	Receive Data –
7	TERM		Bob Smith Termination
8	TERM		

Table 54: Ethernet interface channel 0 and channel 1 pin assignment

Auto-crossover function is supported in the netJACK modules.

7.1.2 CANopen interface

It has a 9 pole male DSub connector. The signals and their corresponding pins on the connector are

Signal	Pin at CANopen connector	Description of signal
CAN-L	2	CANopen -Data line L (negative).
CAN-H	7	CANopen -Data line H (positive).
CAN-GND	3	Ground for CANopen.

Table 55: CANopen interface - Signals and pins

The following drawing shows the CANopen interface (D-Sub-male connector, 9-pole)

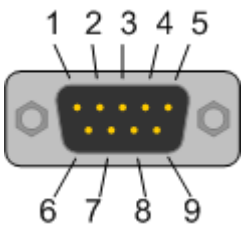

Figure 42: CANopen interface (DSub male connector, 9 pole)

7.1.3 DeviceNet interface

The DeviceNet interface of the netJACK communication modules is designed as potential-free interface according to ISO 11898. All electric signals are conforming to the DeviceNet standard. It has a 5-pole CombiCon connector.

The signals and their corresponding pins on the connector are

Pin	Signal	Color	Description
1	V-	Black	Data reference potential of the DeviceNet power supply
2	CAN_L	Blue	CAN Low signal
3	Drain		Shield
4	CAN_H	White	CAN High signal
5	V+	Red	+24 V DeviceNet supply voltage

Table 56: Pinning of the DeviceNet interface of the NJ100EN-DN

The following figure shows the DeviceNet interface of the NJ100EN-DN (CombiCon plug, 5-pin):

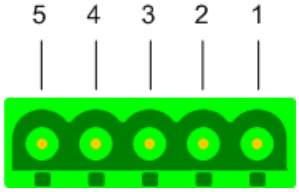

Figure 43: DeviceNet interface (CombiCon-plug, 5-pin) of the NJ100EN-DN

7.1.4 PROFIBUS DP interface

The PROFIBUS-DP interface of the netJACK communication modules is designed as potential-free RS-485 interface. All electric signals are conforming to the PROFIBUS-DP standard. It can be connected to a 9-pole female connector. The signals and their corresponding pins on the connector are

Signal	Pin at PROFIBUS-DP	Description of Signal
RXD/TXD_N	8	PROFIBUS-DP-Data line A (negative)
RXD/TXD_P	3	PROFIBUS-DP-Data line B (positive)
CNTR_P	4	Return To Send Line for line control
ISOGND	5	Ground for PROFIBUS-DP
VP	6	5 V power line for PROFIBUS-DP

Table 57: PROFIBUS-DP interface - Signals and pins

The following figure shows the PROFIBUS-DP interface (D-Sub-female connector, 9-pole):

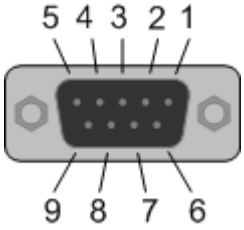

Figure 44: PROFIBUS-DP interface (D-Sub-female connector, 9-pole)

7.2 Use of VARAN client

In order to use the netJACK communication module with VARAN, you need a license which you can acquire at the VNO (VARAN Bus-Nutzerorganisation, Bürmooser Straße 10, A-5112 Lamprechtshausen, info@varan-bus.net) after getting a member of VNO.

The license as well as the Vendor ID and the Device ID can be adjusted with the SYCON.net configuration software or with the netX Configuration Tool.

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- “EtherCAT Conformance Test Policy”
- “EtherCAT Vendor ID Policy”

These documents are available at the ETG homepage www.ethercat.org or directly over info@ethercat.org.

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9 List of tables

10 List of figures

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