®®

Technical Information

PCZ-NVM
Mezzanine I/O Expansion Board
Multifunction CPU Side Card

Edition 1.2

Contents

About this Manual

This manual is a short form description of the technical aspects of the PCZ-NVM, required for installation and system integration. It is intended for the advanced user only. The latest version of this document may be obtained from www.ekf.com/p/pcz/pcz.html.

Edition History

Ed.	Contents/*Changes*	Author	Date
0	Technical Information PCZ-NVM, english, preliminary edition Text #9941, File: pcz_ti.wpd	jj	17 August 2021
1	Fixed M.2 maximum size (2280), MTBF 89.7 years	jj	1 June 2022
1.1	Added photos	jj	17 October 2022

Related Documents

Related Information PCZ-NVM	
PCZ-NVM Home	www.ekf.com/p/pcz/pcz.html
PCZ-NVM Technical Information (PDF)	www.ekf.com/p/pcz/pcz_ti.pdf
CompactPCI® PlusIO Concept (PDF)	www.ekf.com/p/plusio.pdf
PC7-FESTIVAL CPU Card Home	www.ekf.com/p/pc7/pc7.html
PC7-FESTIVAL CPU Card Product Information (PDF)	www.ekf.com/p/pc7/pc7_pi.pdf

Nomenclature

Signal names used herein with an attached '#' designate active low lines.

Trade Marks

Some terms used herein are property of their respective owners, e.g.

- Core™, XEON® : Intel®
- CompactPCI®, CompactPCI® PlusIO, CompactPCI® Serial: PICMG®
- Windows: Microsoft®
- EKF, ekf system: ® EKF

EKF does not claim this list to be complete.

Legal Disclaimer - Liability Exclusion

This manual has been edited as carefully as possible. We apologize for any potential mistake. Information provided herein is designated exclusively to the proficient user (system integrator, engineer). EKF can accept no responsibility for any damage caused by the use of this manual.

Standards

Reference Documents		
Term	Document	Origin
CompactPCI® PlusIO	PICMG® CompactPCI® 2.30	www.picmg.org
DisplayPort®	VESA DisplayPort Standard	www.vesa.org
M.2 Module	PCI Express M.2 Specification Revision 4.0 Formerly known as Next Generation Form Factor (NGFF)	www.pcisig.com
PCI Express®	PCI Express® Base Specification 3.1	www.pcisig.com
RS-232 EIA-232	Telecommunications Industry Association TIA 232 Sometimes inaccurately referred to as DOS COM port, based on a hardware interface called UART (universal asynchronous receiver/transmitter)	www.tiaonline.org
USB	USB 3.1 Universal Serial Bus Specification USB 2.0 Universal Serial Bus Specification	www.usb.org

Features

Feature Summary

General

- Mixed function mezzanine side card
- Based on mezzanine connectors HSE1/HSE2 (8 x PCIe® Gen3, DP, USB3)
- Suitable e.g. for use with CompactPCI® PlusIO CPU board PC7-FESTIVAL
- Provides additional front panel I/O, and dual M.2 NVMe SSD
- 8HP assembly together with CPU card
- 12HP assembly in total with CPU card and C32-FIO 3rd floor mezzanine

Front Panel I/O

- USB 3.1 Gen1 xHCI SuperSpeed F/P Type-A connector
- DisplayPort F/P connector (standard type, latched), 3rd graphics output
- 2 x RS-232 male D-Sub 9-pin (COM port) F/P connectors
- Option C32-FIO legacy front panel I/O (2 x RS-232, 1 x USB2 Type-A in addition)
- Integrated 8HP front panel for CPU card and PCZ-NVM (12HP when C32-FIO 3rd floor mezzanine is installed in addition)

On-Board Mass Storage Options

- 1 x M.2 connector (formerly known as NGFF), M-key, suitable for NVMe (PCIe® Gen3 x4) SSD modules, up to 2280 size, or autosense legacy M.2 SATA SSD
- 1 x M.2 connector, M-key, suitable for standard NVMe (PCIe® Gen3 x2) SSD

UART

- Diodes/Pericom PI7C9X7954 PCI Express® bridge to quad port UART (Universal Asynchronous Receiver Transmitter), 16C550-type compatible, up to 15Mbps
- Two ports with RS-232 transceivers MAX3243E, TIA/EIA-232-F, up to 250kbps, for front panel I/O (D-Sub connectors 9-pin male, PC COM port pin assignment)
- Two UART ports for use on C32-FIO mezzanine module (option), TTL level signals

Applications

- Versatile local expansion (side card) for EKF CPU boards
- NVMe SSD based mass storage solution, 2 x M.2 connectors for PCIe® based modules
- Classic COM port front I/O (RS-232), expandable to 4 ports
- 3rd DisplayPort receptacle (video output) for 4k capable multi-monitor applications
- USB 3.1 Gen1 based port for communication or removable storage

Feature Summary

Environmental, Regulatory

- Designed & manufactured in Germany
- ISO 9001 certified quality management
- Lifetime support
- Custom specific development available on request
- Long term availability
- Rugged solution
- Coating, sealing, underfilling on request
- RoHS compliant
- Operating temperature -40°C to +85°C (industrial temperature range)
- Storage temperature -40°C to +85°C, max. gradient 5°C/min
- Humidity 5% ... 95% RH non condensing
- Altitude -300m ... +3000m
- Shock 15g 0.33ms, 6g 6ms
- Vibration 1g 5-2000Hz
- EC Regulatory EN55024, EN55032, EN62368-1
- MTBF 89.7 years

General Information

Available as a mezzanine add-on expansion board (aka side card) e.g. to the PC7-FESTIVAL CompactPCI® PlusIO CPU, the PCZ-NVM is equipped with two M.2 SSD module sockets, as a rugged mass storage solution. In addition, frequently required I/O functions (RS-232, USB 3.0, DisplayPort) are provided via front panel connectors.

Both M.2 sockets are suitable for PCIe® based SSD modules (M-key) up to the 2280 format. The upper connector establishes a PCIe® Gen3 link x4 or will be automatically switched to SATA mode for a legacy SSD. The lower connector M.2 socket supports a PCIe® Gen3 link x2.

System Requirements

The PCZ-NVM is a mezzanine side card, to be fixed on top of a suitable CPU carrier board. The pitch between carrier PCB and mezzanine PCB is 4HP, resulting in a 8HP common front panel for the entire assembly.

Two mezzanine inter-board connectors are in use, for distribution of high speed I/O signals from the CPU carrier to the side board. These are referred to as *HSE1* (PCIe® x4 and USB3 High Speed Expansion), *and HSE2* (PCIe® x4 and DisplayPort). The mezzanine connectors are situated on the bottom side of the PCZ-NVM, facing towards their mating CPU card connectors.

For full functionality, suitable CPU carrier boards must conform to the EKF '2017 New Mezzanine Concept' (i.e. HSE1 and HSE2 connectors supported).

The PCZ-NVM also is a carrier board itself, which can accommodate a 3rd floor front panel I/O expansion card, as an option.

The PCZ-NVM is basically powered via its HSE mezzanine connectors. In addition, the board is equipped with the backplane connector J1 for high power demanding SSDs (CompactPCI® backplane w. CPU card system slot left).

Storage Options

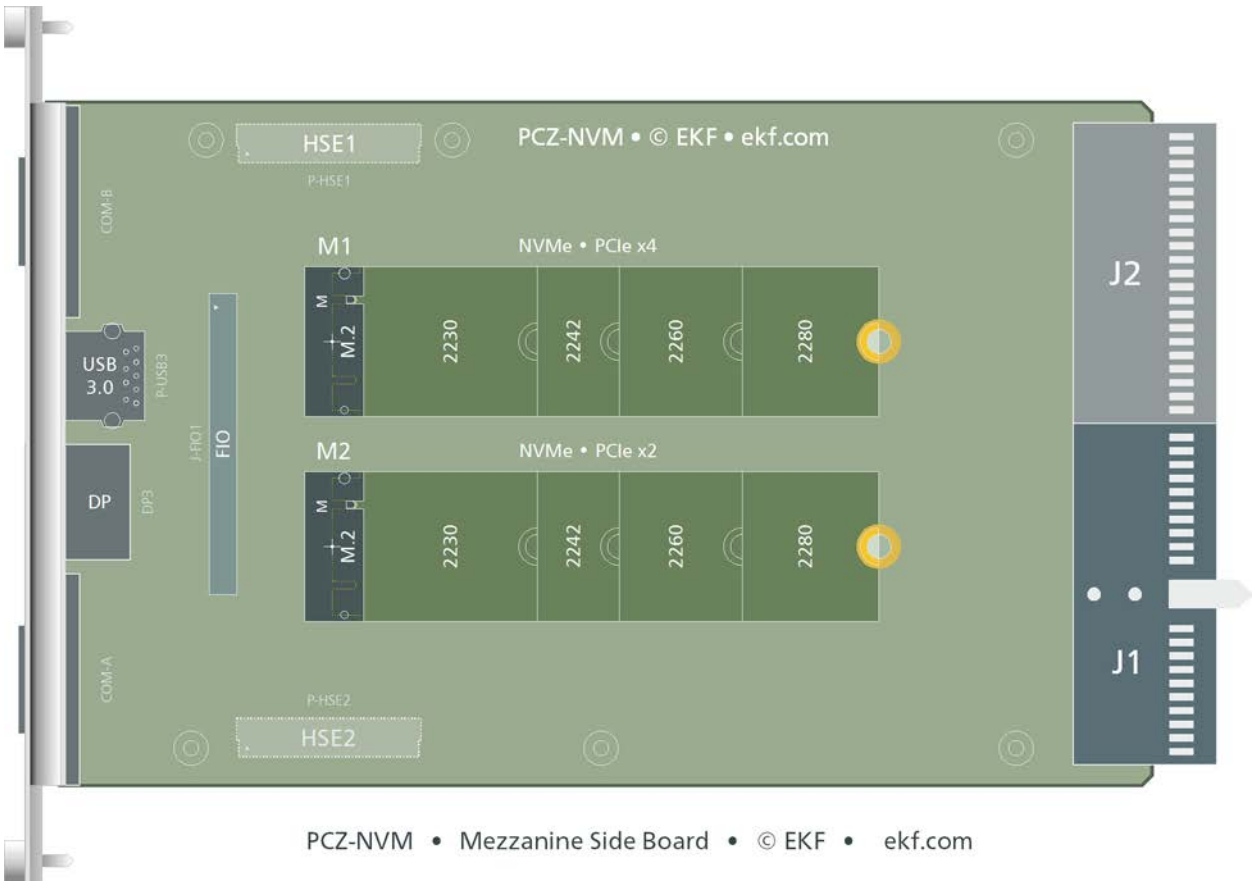
The PCZ-NVM can be populated with two M.2 (NGFF) PCI Express® driven SSD storage modules, up to the 2280 size.

Suitable PCIe® x4 SSD modules are provided with an M-key and conform to the M.2 specification 'Socket 3' pinout. M.2 NVMe SSD modules are available up to 2TB as of current, mostly as 2280 type.

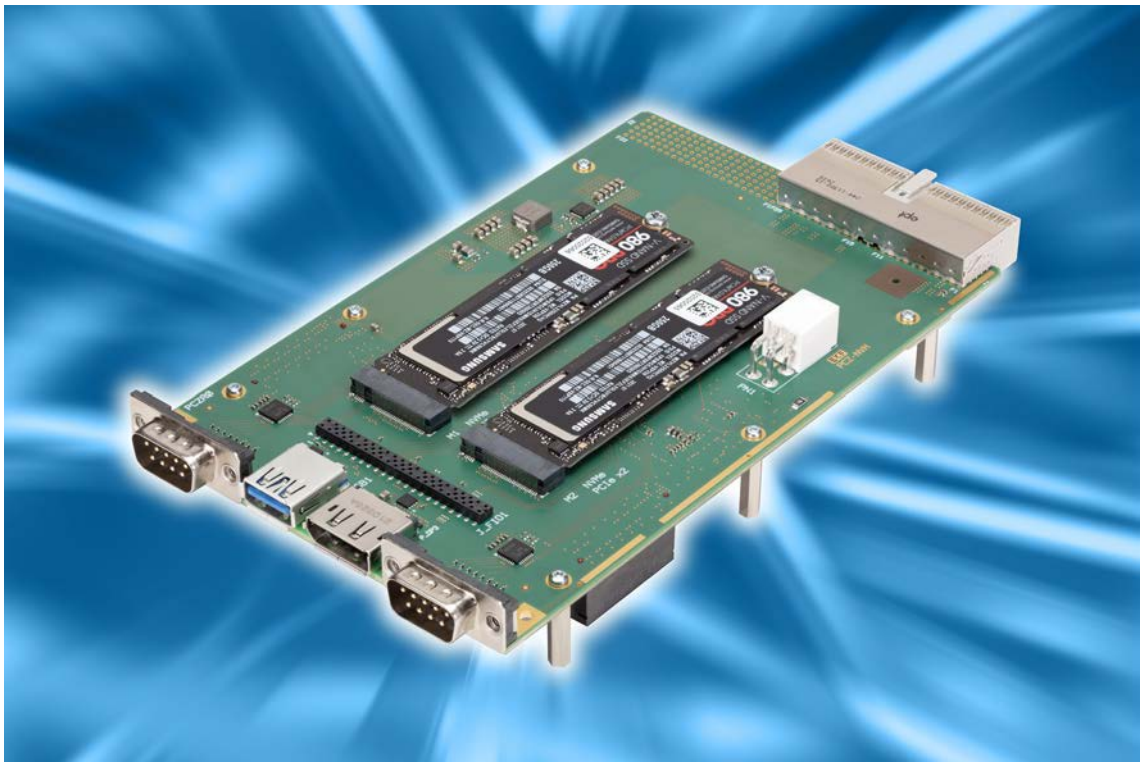
The upper socket *M1* is wired to the mezzanine connector HSE1, for a PCIe® Gen3 x4 link, resulting in a theoretical maximum bandwidth of 32Gbps, or SATA lane (6Gbps).

The lower M.2 connector *M2* is controlled by a x2 link, established via the HSE2 mezzanine connector, for a maximum data transfer rate of up to 16Gbps.

PCZ-NVM • On-Board M.2 PCIe® x4 SSD Module Sockets



PCZ-NVM • Mezzanine Side Board • © EKF • ekf.com

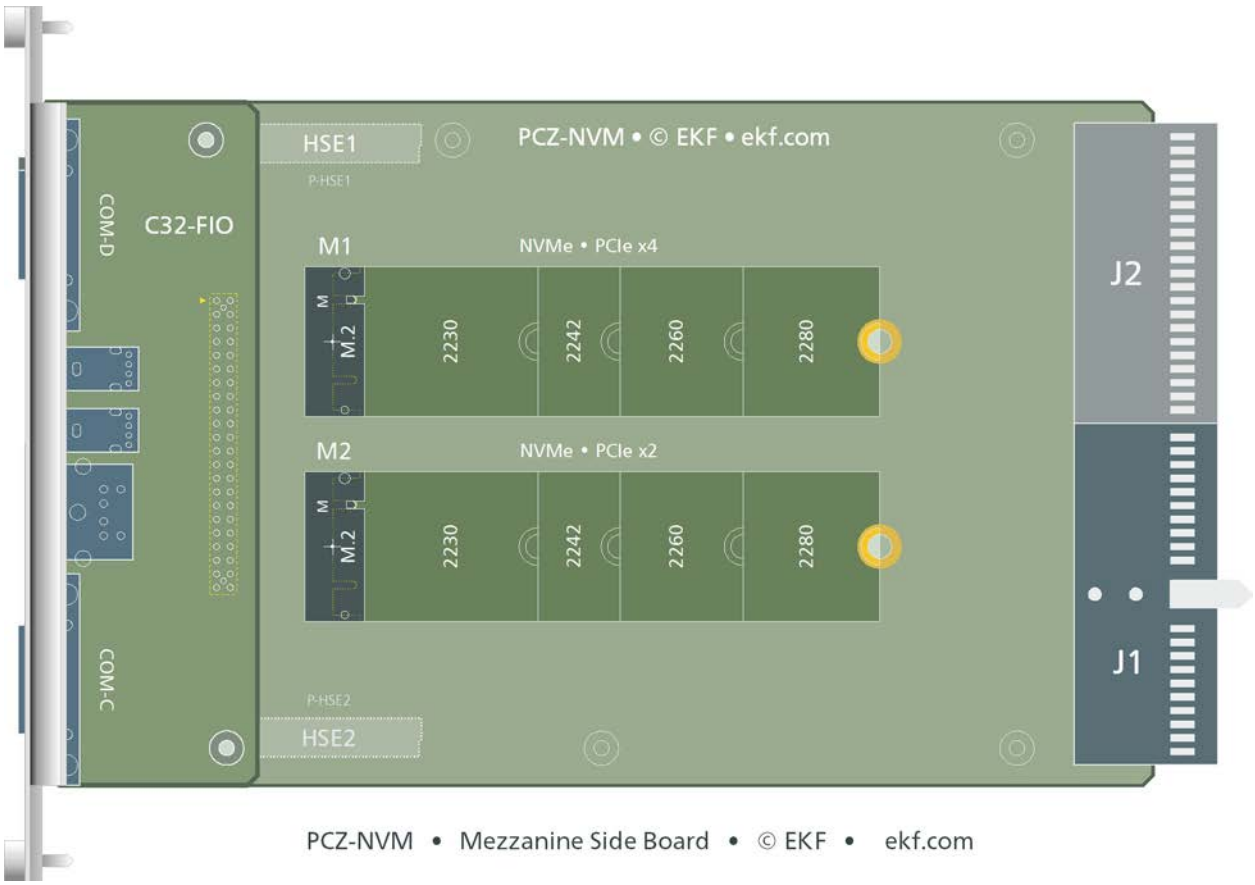


Front Panel I/O

The PCZ-NVM expands the suite of front panel connectors of the CPU carrier board by an USB 3.0 receptacle, a DisplayPort video output, and two D-Sub connectors with EIA-232 signal level COM port pin assignment.

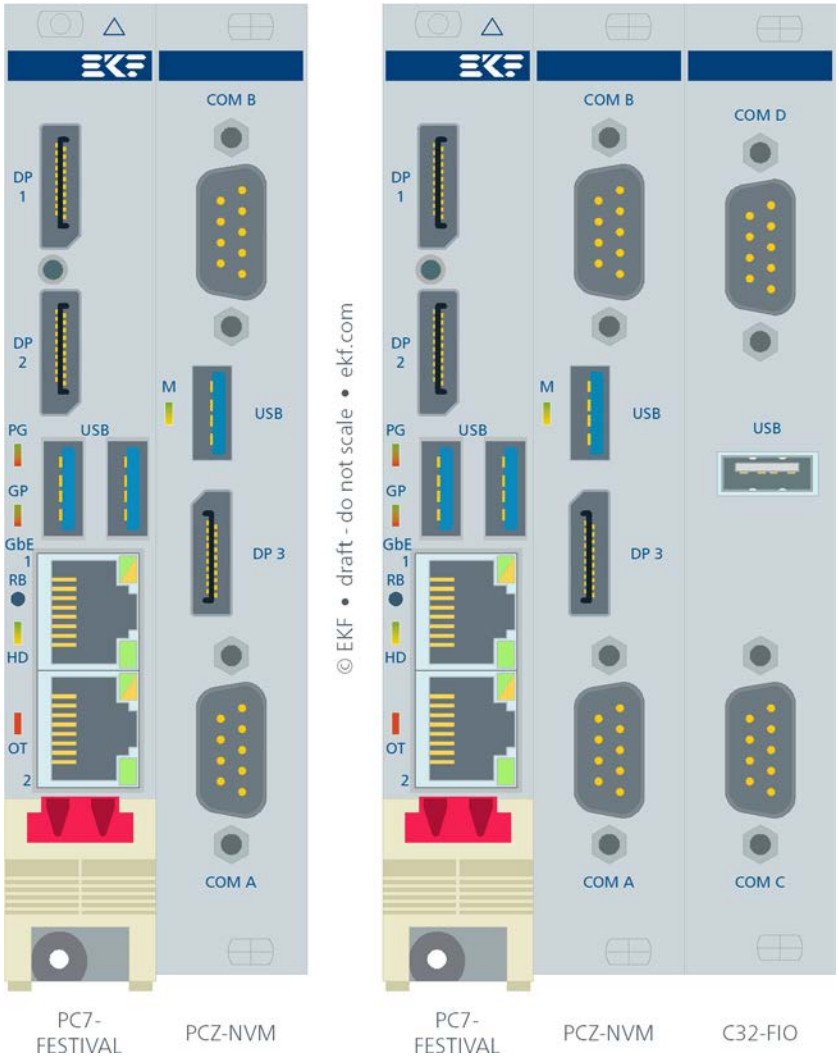
In addition, the PCZ-NVM can accommodate the C32-FIO front panel I/O mezzanine module, for a total front panel width of 12HP. The C32-FIO provides another two RS-232 COM ports, and an USB 2.0 receptacle.

PCZ-NVM w. C32-FIO



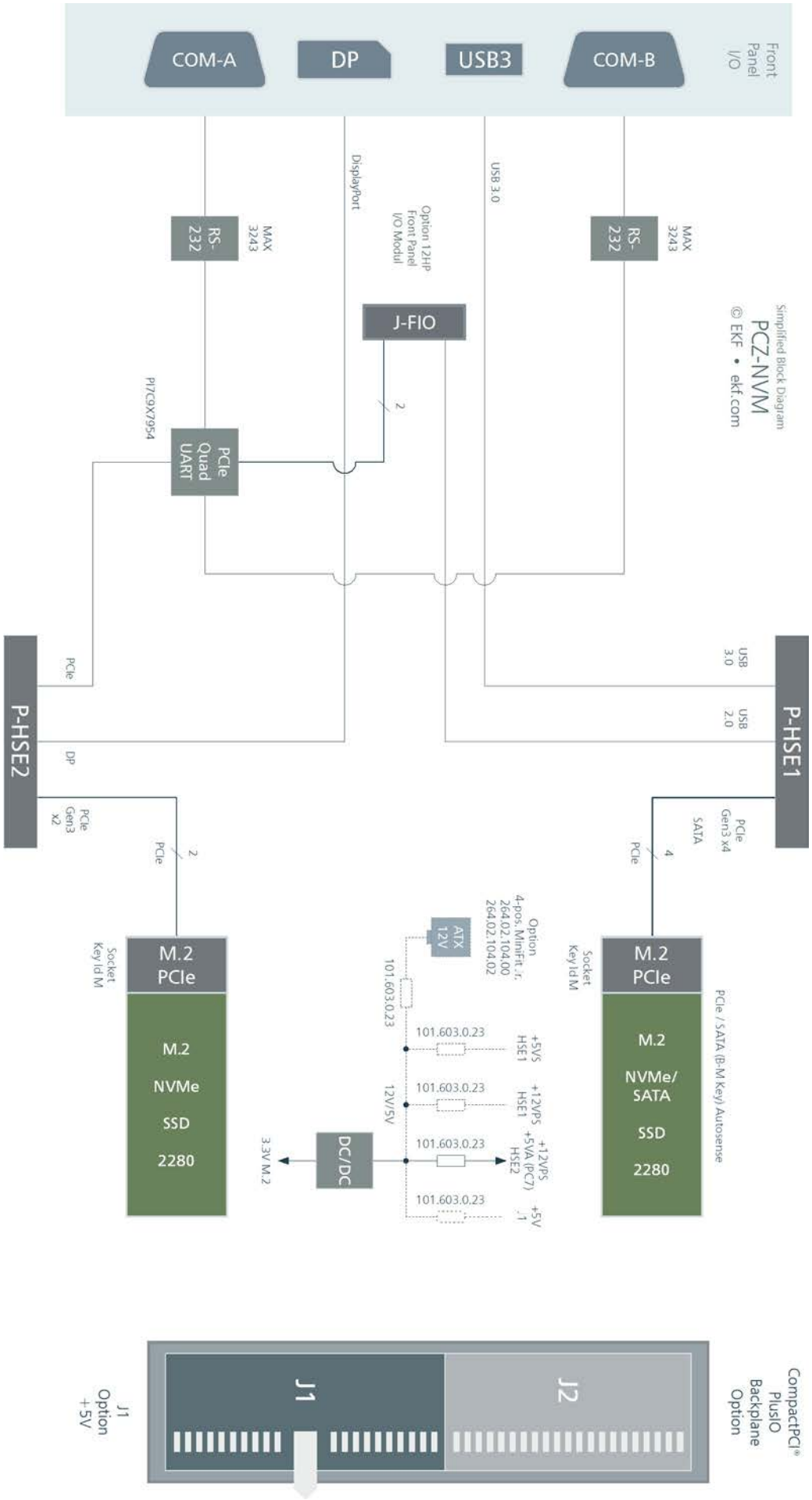
Related Documents	
C32-FIO Mezzanine Front I/O Module	www.ekf.com/c/ccpu/c32/c32_tie.pdf

Sample Front Panels 8HP & 12HP




COM B
DP 1
DP 2
USB
USB
DP 3
PC7
FESTIVAL
COM A
SAMSUNG
SAMSUNG

Block Diagram



Summary of Connectors

Not all of the connectors or other elements listed below may be present or functional on your actual PCZ-NVM board. Assembly of these connectors is highly custom specific. Discuss your needs (target application) with EKF before ordering, for an optimum CPU & side card configuration.

Front Panel Connectors

COM-A	D-Sub 9-pin male connector, EIA 232 signal level
COM-B	D-Sub 9-pin male connector, EIA 232 signal level
DP3	DisplayPort video output connector, latching type, standard mount
USB3	USB 3.0 receptacle Type-A (USB 3.1 Gen1 5Gbps)

On-Board Connectors

FIO	Option, 12HP front panel I/O mezzanine card connector, suitable for the C32-FIO module (UART ports TTL level, USB)
M1	M.2 module socket (M-key), suitable for an on-board M.2 style NVMe SSD storage module, PCIe® Gen3 x4 support, 2230-2280 module size
M2	M.2 module socket (M-key), suitable for an on-board M.2 style NVMe SSD storage module, PCIe® Gen3 x2 support, 2230-2280 module size

Inter-Board Connectors (CPU Carrier)

HSE1	High speed mezzanine connector, available from bottom of the PCZ-NVM PCB, mating with the corresponding connector on the CPU carrier board, comprising of: ▸ PCI Express® Gen3, configured for single link x4 ▸ 1 x USB3 ▸ 1 x USB2
HSE2	High speed mezzanine connector, available from bottom of the PCZ-NVM PCB, mating with the corresponding connector on the CPU carrier board, comprising of: ▸ PCI Express® Gen3, configured as two links x2 ▸ 1 x DisplayPort

Power Connectors

J1	Backplane connector, option, reinforces the +5V power rail
ATX	ATX auxiliary power connector, option

Installing and Replacing Components

Before You Begin

Warnings

The procedures in this chapter assume familiarity with the general terminology associated with industrial electronics and with safety practices and regulatory compliance required for using and modifying electronic equipment. Disconnect the system from its power source and from any telecommunication links, networks or modems before performing any of the procedures described in this chapter. Failure to disconnect power, or telecommunication links before you open the system or perform any procedures can result in personal injury or equipment damage. Some parts of the system can continue to operate even though the power switch is in its off state.

Caution

Electrostatic discharge (ESD) can damage components. Perform the procedures described in this chapter only at an ESD workstation. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the system chassis or board front panel. Store the board only in its original ESD protected packaging. Retain the original packaging (antistatic bag and antistatic box) in case of returning the board to EKF for repair.

Installing the Board

Warning

This procedure should be done only by qualified technical personnel. Disconnect the system from its power source before doing the procedures described here. Failure to disconnect power, or telecommunication links before you open the system or perform any procedures can result in personal injury or equipment damage.

Typically you will perform the following steps:

- Switch off the system, remove the AC power cord
- Attach your antistatic wrist strap to a metallic part of the system 
- Remove the board assembly packaging, be sure to touch the board only at the front panel
- Identify the related CompactPCI® slot (peripheral slot for I/O boards, system slot for CPU boards, with the system slot typically most right or most left to the backplane)
- Insert card carefully (be sure not to damage components mounted on the bottom side of the board by scratching neighboured front panels)
- A card with onboard connectors requires attachment of associated cabling now
- Lock the ejector lever, fix screws at the front panel (top/bottom)
- Retain original packaging in case of return

Removing the Board

Warning

This procedure should be done only by qualified technical personnel. Disconnect the system from its power source before doing the procedures described here. Failure to disconnect power, or telecommunication links before you open the system or perform any procedures can result in personal injury or equipment damage.

Typically you will perform the following steps:

- Switch off the system, remove the AC power cord
- Attach your antistatic wrist strap to a metallic part of the system
- Identify the board, be sure to touch the board only at the front panel
- Unfasten any front panel screws (top/bottom), unlock the ejector lever
- Remove any onboard cabling assembly
- Activate the ejector lever
- Remove the card assembly carefully (be sure not to damage components mounted on the bottom side of the board by scratching neighboured front panels)
- Store board in the original packaging, do not touch any components, hold the board at the front panel only

Warning

Do not expose the card to fire. Battery cells and other components could explode and cause personal injury.

EMC Recommendations

In order to comply with the CE regulations for EMC, it is mandatory to observe the following rules:

- The chassis or rack including other boards in use must comply entirely with CE
- Close all board slots not in use with a blind front panel
- Front panels must be fastened by built-in screws
- Cover any unused front panel mounted connector with a shielding cap
- External communications cable assemblies must be shielded (shield connected only at one end of the cable)
- Use ferrite beads for cabling wherever appropriate
- Some connectors may require additional isolating parts

Technical Reference

Caution

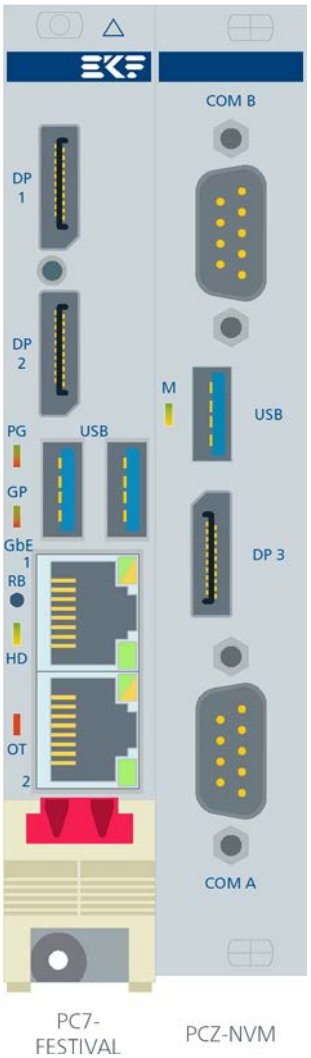
Some of the connectors may provide operating voltage (e.g. +12V, +5V and +3.3V) to devices inside the system chassis, such as internal peripherals. Not all of these connectors are overcurrent protected. Do not use these connectors for powering devices external to the computer chassis. A fault in the load presented by the external devices could cause damage to the board, the interconnecting cable and the external devices themselves.

Please Note

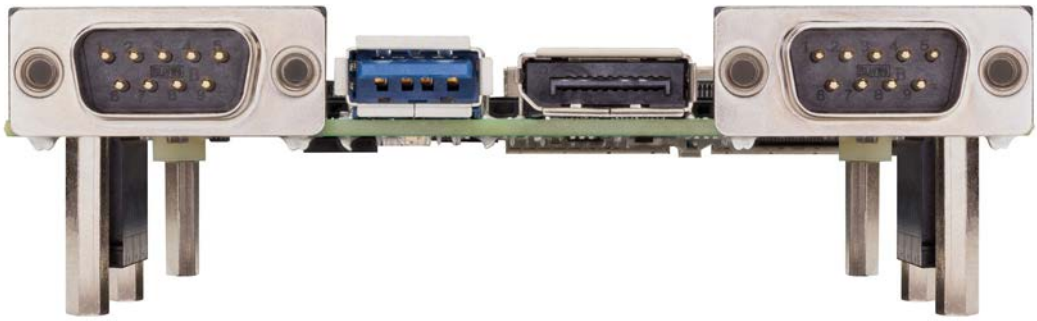
The PCZ-NVM mezzanine module may be equipped with several on-board connectors for system internal usage. Not all of these connectors may be present on a particular board. Be sure to specify your individual needs when ordering the PCZ-NVM board. Characteristic features and the pin assignments of each connector are described on the following pages (connector designation in alphabetical order within the groups 'front panel connectors', 'on-board connectors', 'inter-board connectors', and 'rear I/O connectors').

Front Panel Elements

As of current, suitable CPU carrier boards for use together with the PCZ-NVM side card are the SC4-CONCERTO and SC5-FESTIVAL. The PCZ-NVM side board mounts on top (at the right side) of the CPU card. By default, the PCZ-NVM shares an 8HP (~40.6mm) front panel with the CPU. When combined with the C32-FIO mezzanine module, the assembly width would be 12HP (~61mm) in total. Further more, custom specific front panel options are available on request. Shown below is a popular variant of the PCZ-NVM front assembly.



COM-A	Male D-SUB 9-pin, RS-232E
COM-B	Male D-SUB 9-pin, RS-232E
DP3	DisplayPort front panel video connector
LED M	M.2 Module activity LED M1=green, M2=yellow
USB3	USB 3.0 Type-A



COM-A/B

The PCZ-NVM is provided with an on-board PCI Express® to quad port UART bridge (Diodes/Pericom PI7C9X7954). Two asynchronous serial interfaces are available via the front panel (EIA/TIA 232). The other two (TTL-level) can be used across the mezzanine connector FIO by means of the C32-FIO mezzanine board (12HP front panel assembly). Two on-board ESD protected RS-232E transceivers (MAX3243E) allow a bit rate of 250kbps via COM-A/B.

COM-A/B • RS-232 Male D-Sub 9 (261.02.009.23)				
			1	DCD
	DSR	6		
			2	RXD
	RTS	7		
			3	TXD
	CTS	8		
			4	DTR
	RI	9		
			5	GND

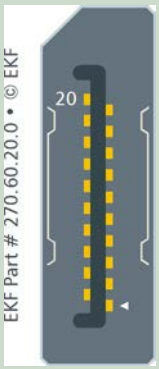
DisplayPort

As of current, the Intel® graphics processing unit (GPU) on the CPU carrier card incorporates three external DisplayPort video channels. Two video outputs are typically available via the CPU card front panel. The PCZ-NVM front panel is provided with a third DP connector.

The related PCZ-NVM DisplayPort video signals are passed from the CPU carrier board through the HSE2 inter-board mezzanine connector to the side card. Independent operation of multiple displays (e.g. Windows® Expanded Desktop) is enabled by the Intel® graphics drivers.

DP3 • DisplayPort Video

Standard DisplayPort Receptacle, 20-lead (270.60.20.0)



20	Power +3.3V 0.5A 1)	19	Return
18	Hot Plug Detect	17	AUX(N)
16	GND	15	AUX(P)
14	CONFIG2 (GND)	13	CONFIG1
12	LANE3(N)	11	GND
10	LANE3(P)	9	LANE2(N)
8	GND	7	LANE2(P)
6	LANE1(N)	5	GND
4	LANE1(P)	3	LANE0(N)
2	GND	1	LANE0(P)

[1)] sourced via electronic power switch (back driving protected), maximum current for short circuit detection >1.5A

For optimum manual handling of latching DP cable connectors, the PCZ-NVM DP receptacle intentionally is a *standard* mount type, while the DP connectors of the CPU card front panel are *reverse* mount.

Specified by the VESA DisplayPort connector standard is a dedicated power pin 20 (+3.3V 0.5A). Both the PCZ-NVM (source side) and a DP monitor (sink side) must provide power via this pin. A VESA specified standard DisplayPort cable however must not connect the pins 20 of both cable ends, in order to avoid a back driving conflict. Unfortunately there are cable assemblies available with pin 20 passed through, with unpredictable results on the system behaviour, e.g. for CPU sleep states. Therefore the PCZ-NVM is equipped with a power switch in order to protect the CPU and side card assembly from back driving effects caused by non VESA style cables.

Sample VESA Compliant DisplayPort Cable Assemblies 2.0m Plug to Plug, w. Latches • EKF Part. #270.66.1.02.0	
Manhattan	307116, 391931
Molex	68783-0007
TE (Tyco)	2040687-2, 2040638-2

USB 3.0

The PCZ-NVM is equipped with a front panel Type-A USB 3.0 receptacle (USB 3.1 Gen1 SuperSpeed 5Gbps). This port is derived from the CPU carrier card PCH (platform controller hub) and passed across the inter-board mezzanine connector HSE1 to the PCZ-NVM.

USB 3.0 Receptacle		
	1	VBUS +5V 1.5Amax
	2	USB D-
	3	USB D+
	4	GND
	5	SS RX-
	6	SS RX+
	7	GND
	8	SS TX-
	9	SS TX+

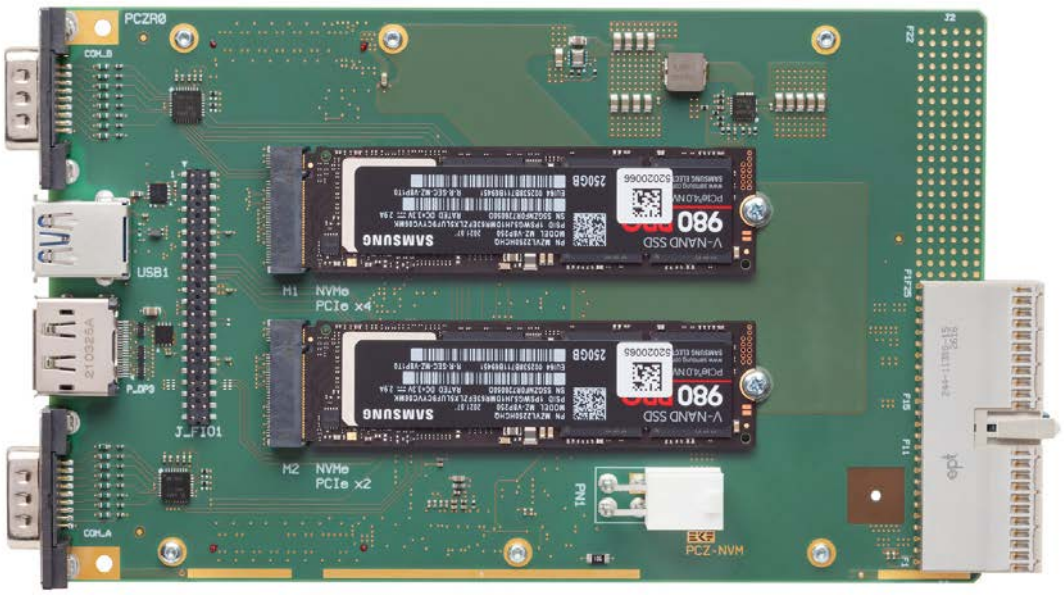
The connector provides +5V (V_{BUS}) for powering external devices. The electronic power switch (TPS2064) used on the PCZ-NVM limits the maximum V_{BUS} output current to a safe level. The USB power switch is rated at >1.5A current limit, which is suitable even for applications where heavy capacitive loads are likely to be encountered, e.g. V_{BUS} powered USB disk drives. The electronic switch signals a fault condition to the CPU card PCH.

On-Board Connectors

The PCZ-NVM is equipped with several on-board connectors, for M.2 SSD accommodation and front I/O mezzanine module expansion.

FIO (Mezzanine Expansion Module C32-FIO)	
I/F Type	SOURCE
Serial (UART) COM-C COM-D	PCZ-NVM on-board PI7C9X7954
USB 2.0	CPU carrier (HSE1)

M.2 (2 x Sockets for M.2 Style NVMe SSD)	
I/F Type	SOURCE
PCI Express®	CPU Carrier (HSE1, HSE2)

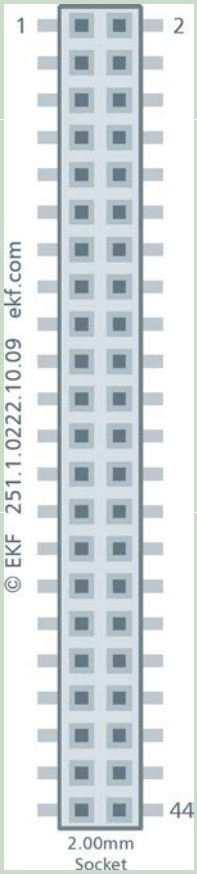


FIO

As an option, the PCZ-NVM can be expanded by a small front panel I/O mezzanine module, the C32-FIO. This requires a 12HP front panel in total (CPU carrier, PCZ-NVM, C32-FIO). The C32-FIO provides additional COM-Ports and an USB 2.0 Type-A receptacle.

J-FIO is a 2mm pitch dual row socket on top of the PCZ-NVM, which connects to the C32-FIO by means of a board stacker element. For a description of the C32-FIO mezzanine module refer to www.ekf.com/c/ccpu/c32/c32_tie.pdf.

FIO • Secondary I/O Mezzanine Expansion Interface (COM - USB)
2.00mm Socket 2 x 22 (251.1.0222.10.09)



GND	1	2	+3.3VS 2)
SP4_RI#	3	4	SP4_DSR#
SP4_TXD	5	6	SP4_RXD
SP4_RTS#	7	8	SP4_DTR#
SP4_DCD#	9	10	SP4_CTS#
GND	11	12	+3.3VS 2)
SP3_RI#	13	14	SP3_DSR#
SP3_TXD	15	16	SP3_RXD
SP3_RTS#	17	18	SP3_DTR#
SP3_DCD#	19	20	SP3_CTS#
GND	21	22	+5VS 2)
USB_2N 1)	23	24	NC
USB_2P 1)	25	26	NC
USB_OC# 1)	27	28	RSVD
NC	29	30	NC
NC	31	32	NC
GND	33	34	+5VPS 2)
SP3_DRVSEL1	35	36	SP4_DRVSEL1
SP3_DRVSEL2	37	38	SP4_DRVSEL2
SP3_DRVSEL3	39	40	SP4_DRVSEL3
NC	41	42	NC
NC	43	44	NC

1) passed from/to CPU carrier card mezzanine connector HSE1
2) power voltages - please refer to the HSE1 connector table

The SP3/SP4 serial port signals (UART TTL-level) are wired to RS-232 transceivers on the C32-FIO. For future mezzanines with RS-485 transceivers there are additional control signals SP*_DRVSEL1-3 available, which would be required for PartyLine operation (half-duplex RS-485).

12HP Assembly PC7-FESTIVAL w. PCZ-NVM & C32-FIO

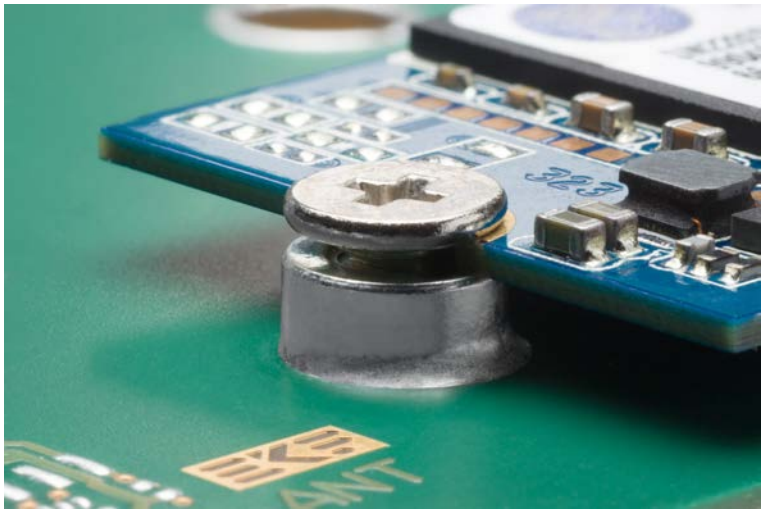
M.2 Connectors

The PCZ-NVM is equipped with two M.2 module host connectors. Mechanical details and pin-out configurations are described by the PCI-SIG 'PCI Express M.2 Specification'. The M.2 pin-out complies with the 'Socket 3 M SSD Drive', with module dimensions from 'Type 2242 to 2280', either height option 'S2, D2, S3, D3, D5'.

Both M-key coded connectors are suitable for PCIe® (NVMe) SSD modules. The M1 connector provides a PCIe® Gen3 x4 link, derived from the HSE1 mezzanine interface, while the M2 connector is PCIe® Gen3 x2 configured, routed via HSE2. Both M.2 sockets can be used together with PCIe® x4 based M.2 modules, but only the upper socket M1 delivers the maximum data transfer rate of 4x8Gbps, while the lower socket has its bandwidth limit at 2x8Gbps. The M1 connector can be used also for a legacy SATA type SSD - the PC7-FESTIVAL carrier card CPU detects the type of SSD and switches the particular PCIe® lane to SATA mode.

M.2 NVMe and M.2 PCIe® x4 are often used as synonyms. However, NVMe (NVM Express™ - non-volatile memory attached through the PCI Express® bus) is both an interface and also a command set or software protocol. Any recent operating system should incorporate NVMe drivers. In addition, the UEFI firmware (aka BIOS) should be verified in order to be able to boot from an NVMe device. This is true for EKF CPU cards such as the PC7-FESTIVAL.

After insertion, an M.2 module must be locked manually by a screw, in order to withstand shock and vibration.



M.2 Module Fixation (Picture Similar)

NVMe PCIe® x4 M.2 M-Key • Pin 1 - 38 EKF Part #255.50.2.2242.10			
GND	1	2	+3.3V
GND	3	4	+3.3V
PETN3	5	6	NC
PETP3	7	8	NC
GND	9	10	LED1#
PERN3	11	12	+3.3V
PERP3	13	14	+3.3V
GND	15	16	+3.3V
PETN2	17	18	+3.3V
PETP2	19	20	NC
GND	21	22	NC
PERN2	23	24	NC
PERP2	25	26	NC
GND	27	28	NC
PETN1	29	30	NC
PETP1	31	32	NC
GND	33	34	NC
PERN1	35	36	NC
PERP1	37	38	NC

PE*2 and PE*3 supported on socket M1 only

NVMe PCIe® x4 M.2 M-Key continued • Pin 39 - 75			
GND	39	40	SMB_CLK
PETN0 (SATA)	41	42	SMB_DATA
PETP0 (SATA)	43	44	NC
GND	45	46	NC
PERN0 (SATA)	47	48	NC
PERP0 (SATA)	49	50	PERST#
GND	51	52	CLKREQ#
REFCLKN	53	54	NC
REFCLKP	55	56	RSV
GND	57	58	RSV
M-Key	59	60	M-Key
M-Key	61	62	M-Key
M-Key	63	64	M-Key
M-Key	65	66	M-Key
NC	67	68	RSV
PEDET	69	70	+3.3V
GND	71	72	+3.3V
GND	73	74	+3.3V
GND	75		

PCIe/SATA mode detection (pin 69 PEDET) supported on socket M1 only

Power for the M.2 sockets is generated by a +3.3V DC/DC step-down converter, which is wired normally to the +5V rail provided by the carrier card (via mezzanine connectors). The permanent current available at the M.2 sockets depends on several conditions, e.g. USB powered devices attached to the PCZ-NVM and C32-FIO. Thus, very demanding SSDs might require higher power than can be provided by the carrier card. Additional power can be applied either via the backplane connector J1 or by means of the ATX auxiliary power connector.

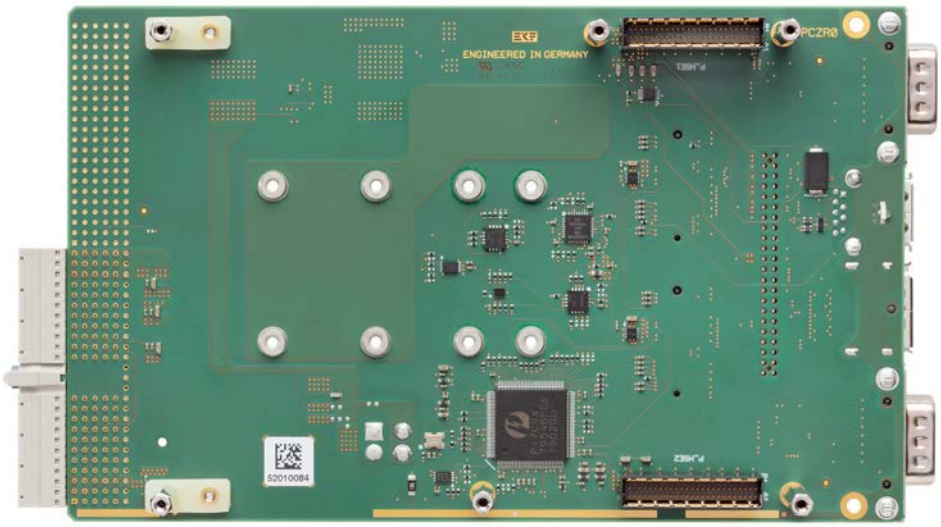
Inter-Board (Mezzanine) Connectors

The PCZ-NVM is equipped with 2 inter-board connectors. These are the HSE1 (4-lane PCI Express® & USB) and the HSE2 (4-lane PCI Express® & DisplayPort) connectors. The host CPU inter-board connectors are situated at the bottom of the PCZ-NVM and establish the data path and power link to the carrier board CPU.

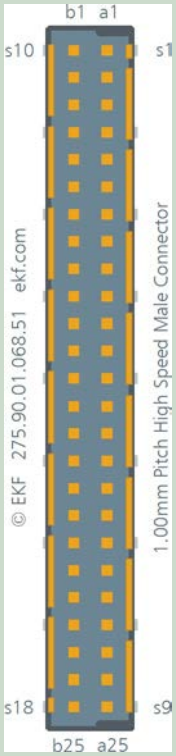
As the PCZ-NVM comes typically mounted as a unit together with the PC7-FESTIVAL (or other carrier board), there is normally no need for the user to get access to any of the inter-board connectors. They are described here as a reference only and for better understanding of the PCZ-NVM.

HSE1	
I/F Type	Origin (PC7-FESTIVAL)
PCI Express® x4 Gen3	PCH (Platform Controller Hub)
1 x USB 3.0	PCH (Platform Controller Hub)
1 x USB 2.0	PCH (Platform Controller Hub)

HSE2	
I/F Type	Origin (PC7-FESTIVAL)
PCI Express® x4 Gen3 (2x2 cfg.)	PCH (Platform Controller Hub)
DisplayPort	CPU/GPU



Carrier card connector 8mm female - mezzanine card connector 10mm male
nominal stack height 18mm (calculated B2B 18.7mm)

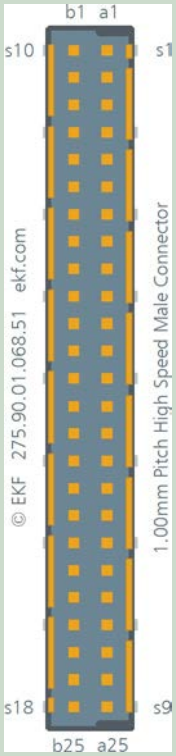


High Speed Expansion P-HSE1			
CFG_34 *	b1	a1	CFG_12 *
3_PCIE_TXP	b2	a2	1_PCIE_TXP
3_PCIE_TXN	b3	a3	1_PCIE_TXN
GND	b4	a4	GND
3_PCIE_RXN	b5	a5	1_PCIE_RXN
3_PCIE_RXP	b6	a6	1_PCIE_RXP
GND	b7	a7	GND
4_PCIE_TXP	b8	a8	2_PCIE_TXP
4_PCIE_TXN	b9	a9	2_PCIE_TXN
GND	b10	a10	GND
4_PCIE_RXN	b11	a11	2_PCIE_RXN
4_PCIE_RXP	b12	a12	2_PCIE_RXP
GND	b13	a13	GND
2_USB3_TXP	b14	a14	1_USB2_P
2_USB3_TXN	b15	a15	1_USB2_N
GND	b16	a16	GND
2_USB3_RXP	b17	a17	2_USB2_P
2_USB3_RXN	b18	a18	2_USB2_N
GND	b19	a19	GND
PCIE_CLK_P	b20	a20	1_2_USB_OC#
PCIE_CLK_N	b21	a21	PLTRST#
+5VS [1]	b22	a22	*+3.3VS* [1]
+5VS [1]	b23	a23	*+3.3VS* [1]
+5V	b24	a24	+3.3V
+12V [2]	b25	a25	+12V [2]

* CFG_12 and CFG_34 = open on PCZ (PU on CPU carrier board) indicating that a PCIe® x4 link is requested

1) Power rail switched on in S0 state only
2) If supported via backplane (system power supply)

Carrier card connector 8mm female - mezzanine card connector 10mm male
nominal stack height 18mm (calculated B2B 18.7mm)

High Speed Expansion P-HSE2				
	3_PCIE_TXP	b1	a1	1_PCIE_TXP
	3_PCIE_TXN	b2	a2	1_PCIE_TXN
	GND	b3	a3	GND
	3_PCIE_RXN	b4	a4	1_PCIE_RXN
	3_PCIE_RXP	b5	a5	1_PCIE_RXP
	GND	b6	a6	GND
	4_PCIE_TXP	b7	a7	2_PCIE_TXP
	4_PCIE_TXN	b8	a8	2_PCIE_TXN
	GND	b9	a9	GND
	4_PCIE_RXN	b10	a10	2_PCIE_RXN
	4_PCIE_RXP	b11	a11	2_PCIE_RXP
	GND	b12	a12	GND
	DP_LANE2_P	b13	a13	DP_LANE0_P
	DP_LANE2_N	b14	a14	DP_LANE0_N
	GND	b15	a15	GND
	DP_LANE3_P	b16	a16	DP_LANE1_P
	DP_LANE3_N	b17	a17	DP_LANE1_N
	GND	b18	a18	GND
	DP_AUX_P	b19	a19	PCIE_CLK_P
	DP_AUX_N	b20	a20	PCIE_CLK_N
	DP_CFG1	b21	a21	GND
	DP_HPD	b22	a22	SMB_SCL [1)]
	PLTRST#	b23	a23	SMB_SDA [1)]
	+5V	b24	a24	+5V
	+5V	b25	a25	+5V

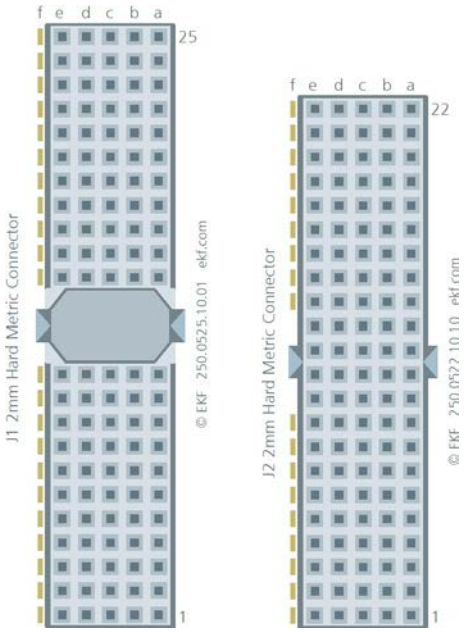
PCIe® pre-configured 2x2 via soft-straps (CPU carrier card Flash image)

1) Connection to SMBus, isolated after system reset
2) If supported via backplane (system power supply)

Backplane/Power Connectors

The backplane connector suite is comprised of two hard metric 2.0mm compliant to CompactPCI® PICMG® 2.0. Both connectors are optional. J1 is only used for enforcement of the +5V power rail, no data signals are in use. J2 can be stuffed as an option for even more mechanical ruggedness of the assembly and is not connected over all pins.

Typically, there is no need at all for the connectors J1/J2. For demanding M.2 SSDs however and with USB powered devices attached, J1 can strengthen the +5V rail (which is used by a DC/DC converter to generate +3.3V for the M.2 sockets). On a backplane with the system slot (CPU card) right aligned, the PCZ-NVM board and its J1 connector would be out of the backplane shape (however a custom backplane with an additional slot could solve this issue). In such a system the +5V power rail would be sourced via the mezzanine connectors HSE1/2 only. A backplane with left aligned system slot allows additional +5V current via J1, but this means loss of a peripheral card slot.



CompactPCI® J1

J1	A	B	C	D	E
25	5V	NC	NC	NC	5V
24	NC	5V	NC	NC	NC
23	NC	NC	NC	5V	NC
22	NC	GND	NC	NC	NC
21	NC	NC	NC	NC	NC
20	NC	GND	NC	NC	NC
19	NC	NC	NC	GND	NC
18	NC	GND	NC	NC	NC
17	NC	NC	NC	GND	NC
16	NC	GND	NC	NC	NC
15	NC	NC	NC	NC	NC
14	KEY AREA (not keyed)				
13					
12					
11	NC	NC	NC	GND	NC
10	NC	GND	NC	NC	NC
9	NC	NC	NC	GND	NC
8	NC	GND	NC	NC	NC
7	NC	NC	NC	GND	NC
6	NC	GND	NC	NC	NC
5	NC	NC	NC	GND	NC
4	NC	NC	NC	NC	NC
3	NC	NC	NC	5V	NC
2	NC	5V	NC	NC	NC
1	5V	NC	NC	NC	5V

ATX 12V Power Connector

Typically, the M.2 sockets are powered from the +5V rail, provided by the PC7-FESTIVAL CPU carrier card, or the J1 backplane connector. Via a DC/DC step-down converter +3.3V is applied to the M.2 sockets.

As an option, the PCZ-NVM can be equipped with an ATX style 4-pos. auxiliary power connector. By stuffing option, +12V from the ATX connector is applied to the DC/DC converter, instead of +5V. This allows highest +3.3V current at the M.2 sockets for demanding SSDs.

4.20mm Connector 2x2 Dual Row Part #264.02.104.02				
	GND	1	2	GND
	+12V	3	4	+12V

Mating cable connectors are available e.g. from Molex, under the Mini-Fit® Jr.™ brand. A suitable housing would be e.g. the Molex part #0039013042, to be used with crimp terminals e.g. Molex part #0039000060 (18-24 AWG). Other manufacturers for 4.20mm style connectors are e.g. WE and TE. Since ATX specification 2.03 many ATX power supplies have a suitable +12V auxiliary power cable harness.

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