

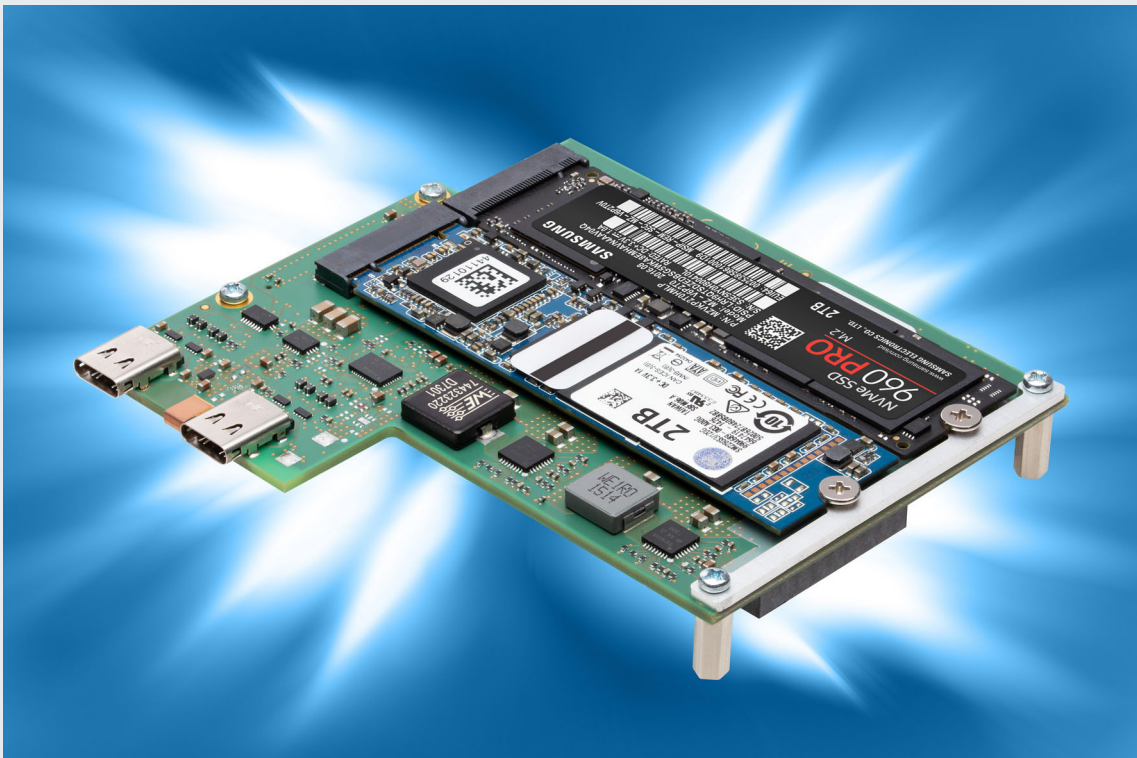


HSE(1-2) Connector(s)
(N-)EXP Connector
GBE Connector (PC7-FESTIVAL)

CPU Mezzanine Concept 2018/2020/2022

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25 August 2022 jj



General

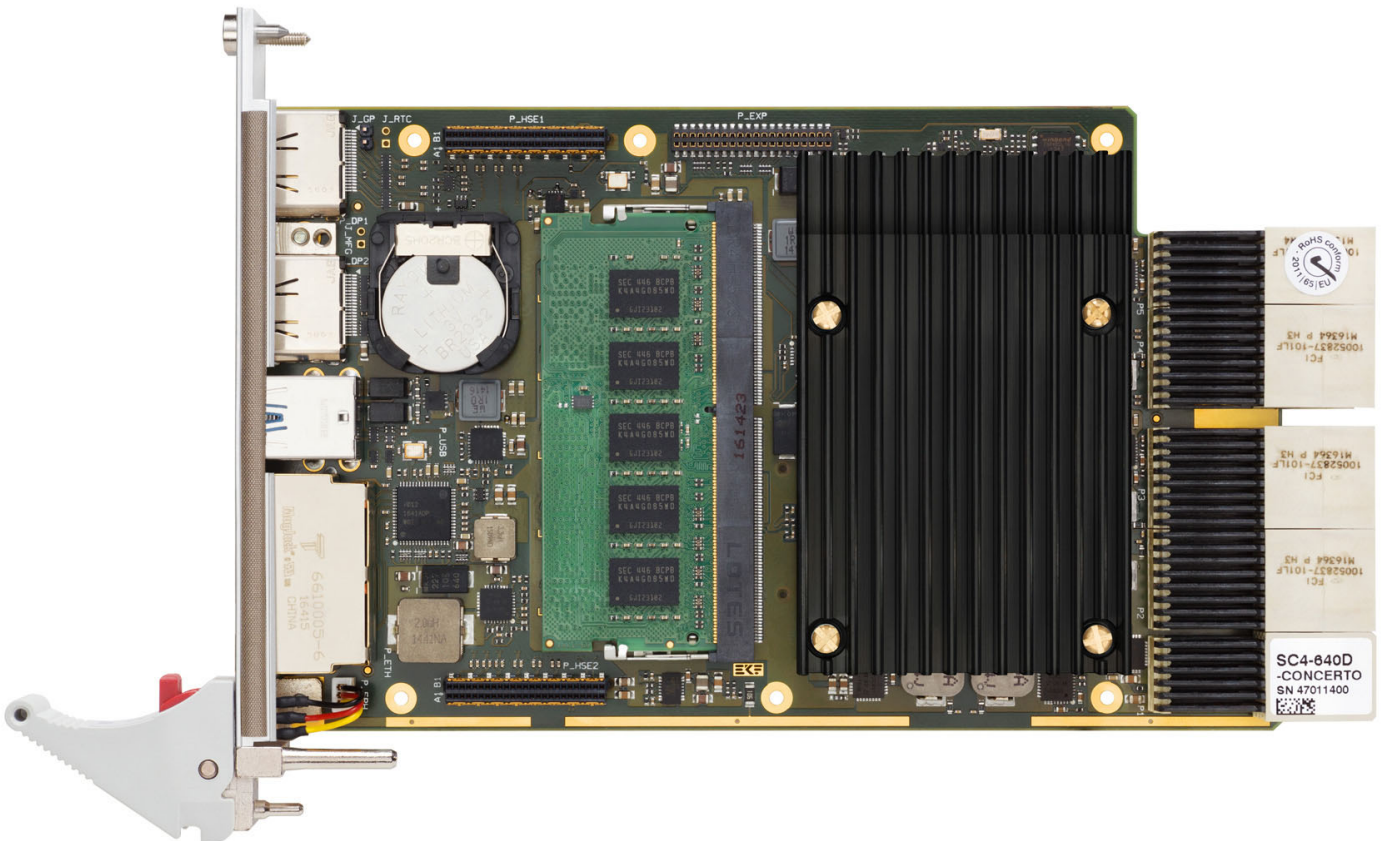
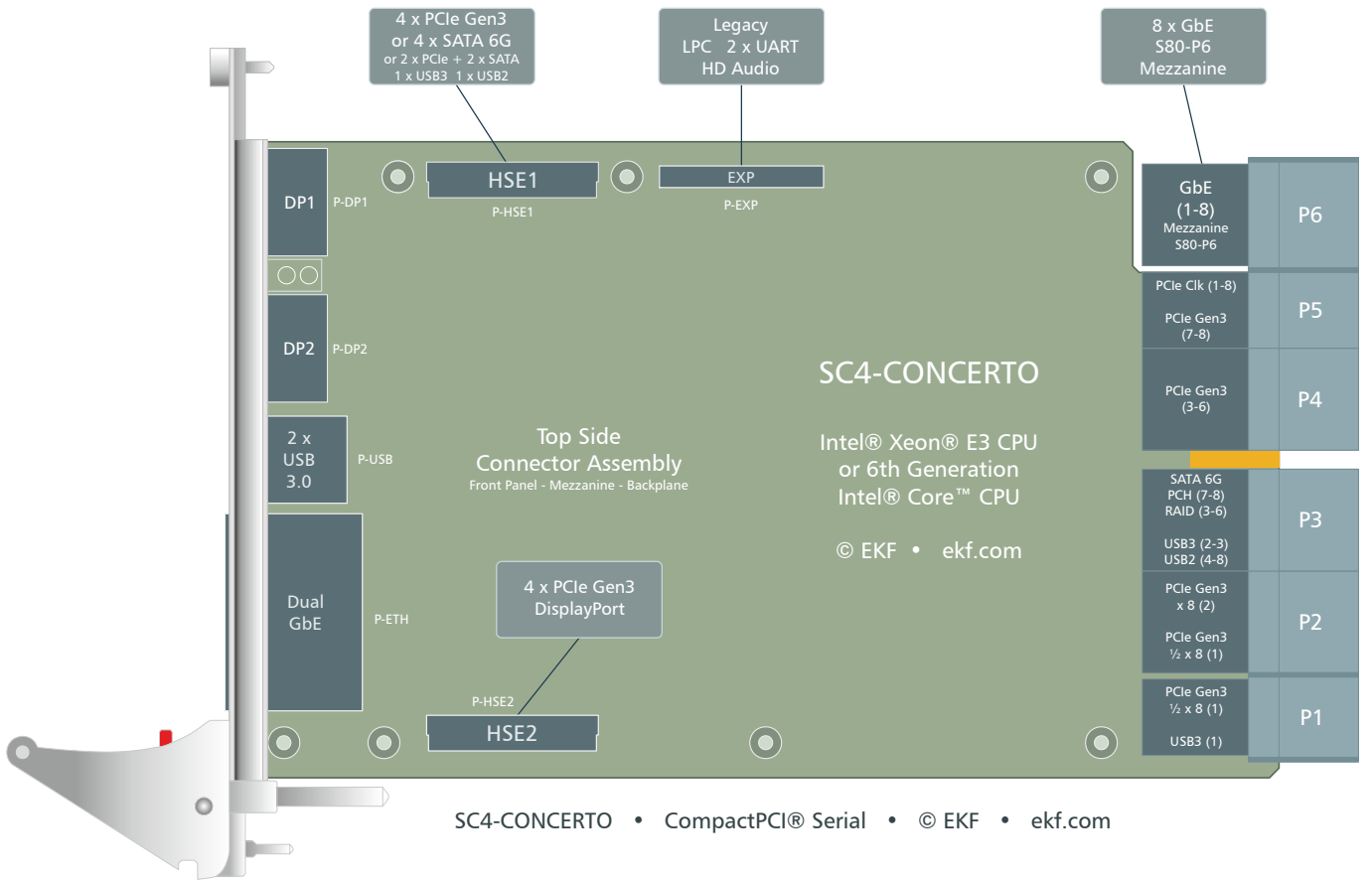
Over the years, the mezzanine expansion connectors used on EKF CPU carrier cards ran through several evolution steps. The latest addition now is the high speed connector HSE2, which replaces two formerly provided connectors known as PCIE and DP3.

Prior to this, low profile mezzanine expansion modules were dependent on SATA channels across HSE1. While maintaining compatibility with these modules (C4* Series), from now on HSE1 provides also alternate configurations, e.g. PCI Express® x4, as required for fastest NVMe SSD storage.

The functions of the PCIE and DP3 connectors now have been merged into a single high speed connector HSE2. This new connector has been aligned on the CPU carrier card in a way, that it can also be used for newly designed low profile mezzanine modules (S2* S4* S6* Series for 4HP envelope). The previous PCIE and DP connectors in contrast could only be utilized together with an 8HP assembly side board.

The new 2018 mezzanine connector concept is a major improvement in flexibility and miniaturisation and will be the basis for EKFs local expansion module design over the next years.





Carrier card connector 8mm female ERNI Microspeed 275.90.08.068.01

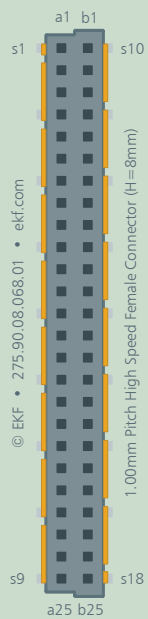
Supplement 1mm male connector for nominal height 9mm (C4*, B2B 9.5mm)

Supplement 2mm male connector for nominal height 10mm (S2*, S4*, B2B 10.0mm)

Supplement 2mm male connector for nominal height 10mm (S6*, S8*, B2B 10.8mm)

Supplement 10mm male connector for nominal height 18mm (SC* side card, B2B 18.7mm)

High Speed Expansion P-HSE1



CFG_12 *	a1	b1	CFG_34 *
1_SATA_PCIE_TXP	a2	b2	3_SATA_PCIE_TXP
1_SATA_PCIE_TXN	a3	b3	3_SATA_PCIE_TXN
GND	a4	b4	GND
1_SATA_PCIE_RXN	a5	b5	3_SATA_PCIE_RXN
1_SATA_PCIE_RXP	a6	b6	3_SATA_PCIE_RXP
GND	a7	b7	GND
2_SATA_PCIE_TXP	a8	b8	4_SATA_PCIE_TXP
2_SATA_PCIE_TXN	a9	b9	4_SATA_PCIE_TXN
GND	a10	b10	GND
2_SATA_PCIE_RXN	a11	b11	4_SATA_PCIE_RXN
2_SATA_PCIE_RXP	a12	b12	4_SATA_PCIE_RXP
GND	a13	b13	GND
1_USB2_P	a14	b14	2_USB3_TXP
1_USB2_N	a15	b15	2_USB3_TXN
GND	a16	b16	GND
2_USB2_P	a17	b17	2_USB3_RXP
2_USB2_N	a18	b18	2_USB3_RXN
GND	a19	b19	GND
1_2_USB_OC#	a20	b20	PCIE_CLK_P
PLTRST#	a21	b21	PCIE_CLK_N
+3.3VS ¹⁾	a22	b22	+5VS ¹⁾
+3.3VS ¹⁾	a23	b23	+5VS ¹⁾
+3.3VA ³⁾	a24	b24	+5VPS ²⁾
+12VPS ²⁾	a25	b25	+12VPS ²⁾

* CFG_12 and CFG_34 = GND defaults to SATA, high or open forces PCIe links/lanes (setup on mezzanine card)

- 1) Power rail switched on in S0 state only
- 2) Power rail switched on in S0-S4 state
- 3) Power always on

Carrier card connector 8mm female ERNI Microspeed 275.90.08.068.01

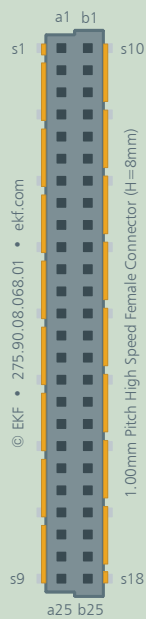
Supplement 1mm male connector for nominal height 9mm (C4*, B2B 9.5mm)

Supplement 2mm male connector for nominal height 10mm (S4*, B2B 10.0mm)

Supplement 2mm male connector for nominal height 10mm (S8*, B2B 10.8mm)

Supplement 10mm male connector for nominal height 18mm (SC* side card, B2B 18.7mm)

High Speed Expansion P-HSE2



1_PCIE_TXP	a1	b1	3_PCIE_TXP
1_PCIE_TXN	a2	b2	3_PCIE_TXN
GND	a3	b3	GND
1_PCIE_RXN	a4	b4	3_PCIE_RXN
1_PCIE_RXP	a5	b5	3_PCIE_RXP
GND	a6	b6	GND
2_PCIE_TXP	a7	b7	4_PCIE_TXP
2_PCIE_TXN	a8	b8	4_PCIE_TXN
GND	a9	b9	GND
2_PCIE_RXN	a10	b10	4_PCIE_RXN
2_PCIE_RXP	a11	b11	4_PCIE_RXP
GND	a12	b12	GND
DP_LANE0_P	a13	b13	DP_LANE2_P
DP_LANE0_N	a14	b14	DP_LANE2_N
GND	a15	b15	GND
DP_LANE1_P	a16	b16	DP_LANE3_P
DP_LANE1_N	a17	b17	DP_LANE3_N
GND	a18	b18	GND
PCIE_CLK_P	a19	b19	DP_AUX_P
PCIE_CLK_N	a20	b20	DP_AUX_N
GND	a21	b21	DP_CFG1
I2C_SCL ¹⁾	a22	b22	DP_HPD
I2C_SDA ¹⁾	a23	b23	PLTRST#
+12VPS ²⁾	a24	b24	+12VPS ²⁾
+12VPS ²⁾	a25	b25	+12VPS ²⁾

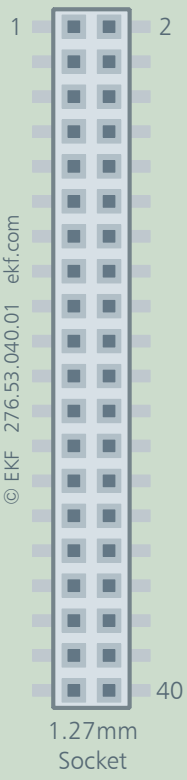
PCIe configured 1x4, 2x2, 4x1 via soft-straps (Flash image), programming tool will be provided by EKF

1) Connected to CM236 (CM238) PCH I2C Bus Controller 0

2) Power rail switched on in S0-S4 state

EXP (2018) • Expansion Board Interface (LPC/HD-Audio/UART)

1.27mm Socket 2 x 20 (276.53.040.01) 1.27mm + Stacker (276.03.040.01)



GND	1	2	+3.3VS ¹⁾
CLK_24MHZ (CLK_33MHz)	3	4	PLTRST#
LPC_AD0	5	6	LPC_AD1
LPC_AD2	7	8	LPC_AD3
LPC_FRAME#	9	10	NC (LPC_DRQ#)
GND	11	12	+3.3VS ¹⁾
SERIRQ	13	14	PME#
SMI#	15	16	CLK_14MHZ
2_UART_TXD (FWH_ID0)	17	18	2_UART_RXD (FWH_INIT#)
RCIN# ⁴⁾ (KBD_RST#)	19	20	2_UART_RTS# (A20GATE)
GND	21	22	+5VS ¹⁾
1_UART_TXD (2_USB2_N)	23	24	1_UART_RTS# (1_USB2_N)
1_UART_RXD (2_USB2_P)	25	26	1_UART_CTS# (1_USB2_P)
2_UART_CTS# (USB2_OC#)	27	28	DBRESET# ⁵⁾
I2C_SCL ³⁾	29	30	I2C_SDA ³⁾
GND	31	32	+5VS ¹⁾
HDA_SDOOUT	33	34	HDA_SDIN0
HDA_RST#	35	36	HDA_SYNC
HDA_BITCLK	37	38	HDA_SDIN1
SPEAKER	39	40	+12VPS ²⁾

pin orientation shows CPU carrier board top view

1) Power rail switched on in S0 state only

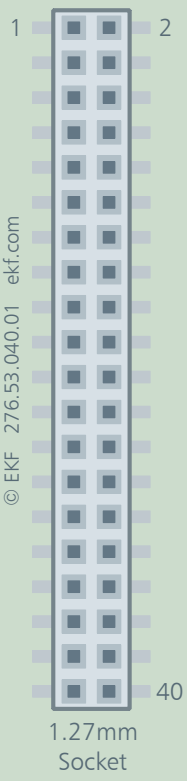
2) Power rail switched on in S0-S4 state

3) Connected to CM236 (CM238) PCH I²C Bus Controller 0

4) Connected to CM236 PCH pin RCIN#/GPP_A0

5) Connected to debug port reset logic in order to force hardware reset

From 2020, EKF introduces the N-EXP (next generation expansion port connector). The obsolete LPC interface has been replaced by the eSPI (Enhanced Serial Peripheral Interface) signal group. In addition also other pin assignments are modified. Mezzanine card solutions which are based on the 2018 EXP connector pinout are therefore not compatible with the N-EXP 2020 connector.

N-EXP (2020) • Next Gen Expansion Board Interface				
1.27mm Socket 2 x 20 (276.53.040.01) 1.27mm + Stacker (276.03.040.01)				
 <p>pin orientation shows CPU carrier board top view</p>	GND	1	2	+3.3VS ¹⁾
	eSPI_CLK	3	4	PLTRST#
	eSPI_IO[0]	5	6	eSPI_IO[1]
	eSPI_IO[2]	7	8	eSPI_IO[3]
	eSPI_CS0#	9	10	eSPI_RST#
	GND	11	12	+3.3VS ¹⁾
	GPP_H23/TIME_SYNC0	13	14	eSPI_ALERT#
	PPM (TSN)	15	16	PPS (TSN)
	UART_2TXD	17	18	UART_2RXD
	GPP_B1/TIME_SYNC1	19	20	UART_2RTS#
	GND	21	22	+5VS ¹⁾
	UART_1TXD	23	24	UART_1RTS#
	UART_1RXD	25	26	UART_1CTS#
	UART_2CTS#	27	28	RESET_IN# ⁴⁾
	EXP_SCL ³⁾	29	30	EXP_SDA ³⁾
	GND	31	32	+5VS ¹⁾
	HDA_SDOOUT	33	34	HDA_SDIN0
	HDA_RST#	35	36	HDA_SYNC
	HDA_BITCLK	37	38	VCC_RTC
	SPEAKER	39	40	+12VPS ²⁾

- 1) Power rail switched on in S0 state only
- 2) Power rail switched on in S0-S4 state
- 3) Connected to I2C controller 0 of WM590 PCH
- 4) Connected to the PLD reset logic to cause hardware reset

PC7-FESTIVAL w. P82-GBE

New in 2022 is an additional mezzanine connector pair in use for an assembly of the PC7-FESTIVAL CPU card and the P82-GBE low profile module, for passing two ethernet ports from the mezzanine module to the backplane connector J2 on the CPU carrier card. The connectors were chosen for a stacking height of 10mm board-to-board.

GBE (2022) • Expansion Connector for CompactPCI® PlusIO Backplane Ethernet

Zero8 2x10 pos low profile height 1.15mm plug 275.92.01.020.51

Used on CPU card PC7-FESTIVAL from Rev. 3 off

for signal names refer to J2 backplane connector according to the CompactPCI® PlusIO specification

1_ETH_A+	A1	B1	1_ETH_B+
1_ETH_A-	A2	B2	1_ETH_B-
GND	A3	B3	GND
1_ETH_C+	A4	B4	1_ETH_D+
1_ETH_C-	A5	B5	1_ETH_D-
2_ETH_A+	A6	B6	2_ETH_B+
2_ETH_A-	A7	B7	2_ETH_B-
GND	A3	B8	GND
2_ETH_C+	A9	B9	2_ETH_D+
2_ETH_C-	A10	B10	2_ETH_D-

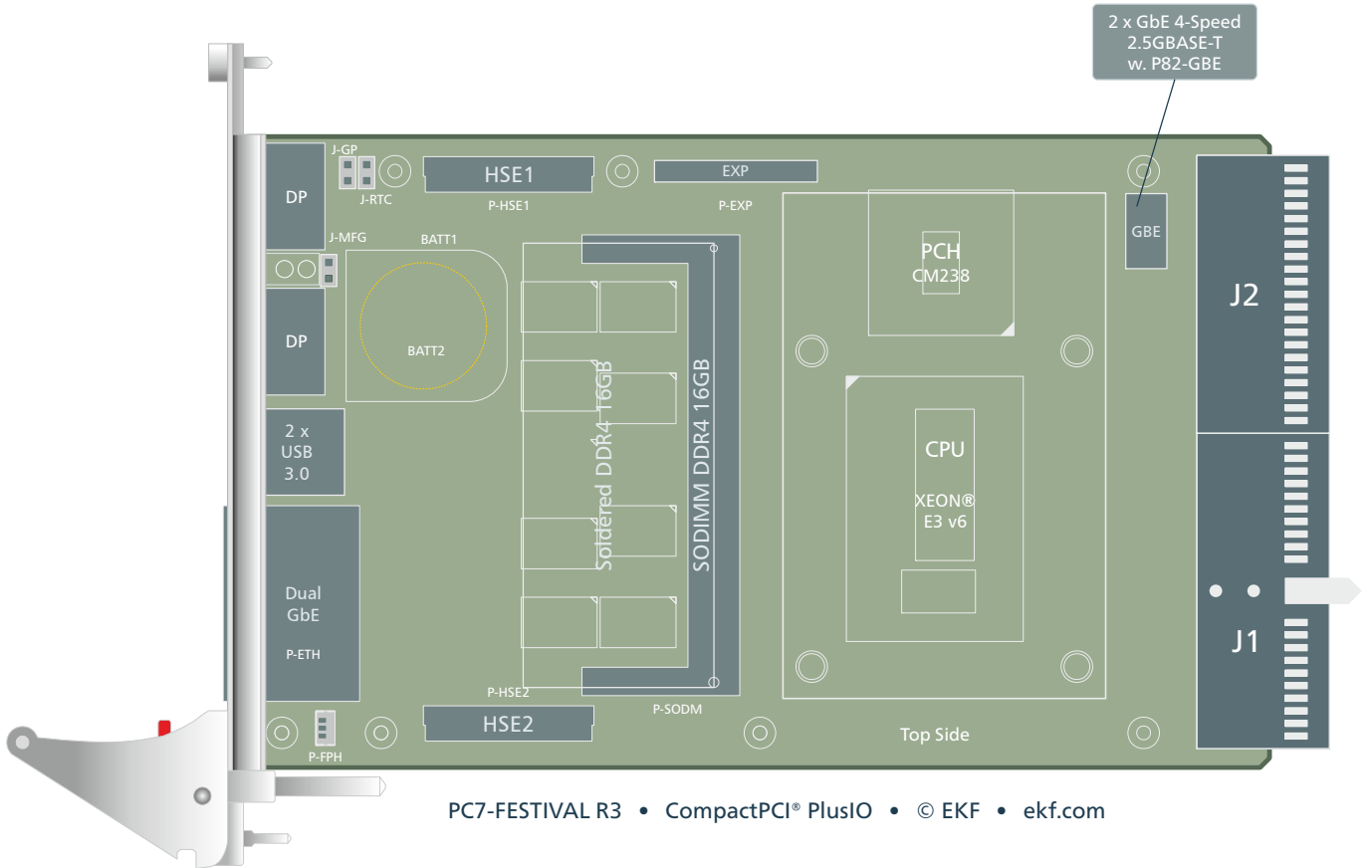
GBE (2022) • Expansion Connector for CompactPCI® PlusIO Backplane Ethernet

Zero8 2x10 pos mid profile height 7.85mm socket 275.92.08.020.01

Used on P82-GBE low profile mezzanine module

for signal names refer to J2 backplane connector according to the CompactPCI® PlusIO specification

1_ETH_B+	B1	A1	1_ETH_A+
1_ETH_B-	B2	A2	1_ETH_A-
GND	B3	A3	GND
1_ETH_D+	B4	A4	1_ETH_C+
1_ETH_D-	B5	A5	1_ETH_C-
2_ETH_B+	B6	A6	2_ETH_A+
2_ETH_B-	B7	A7	2_ETH_A-
GND	B8	A3	GND
2_ETH_D+	B9	A9	2_ETH_C+
2_ETH_D-	B10	A10	2_ETH_C-



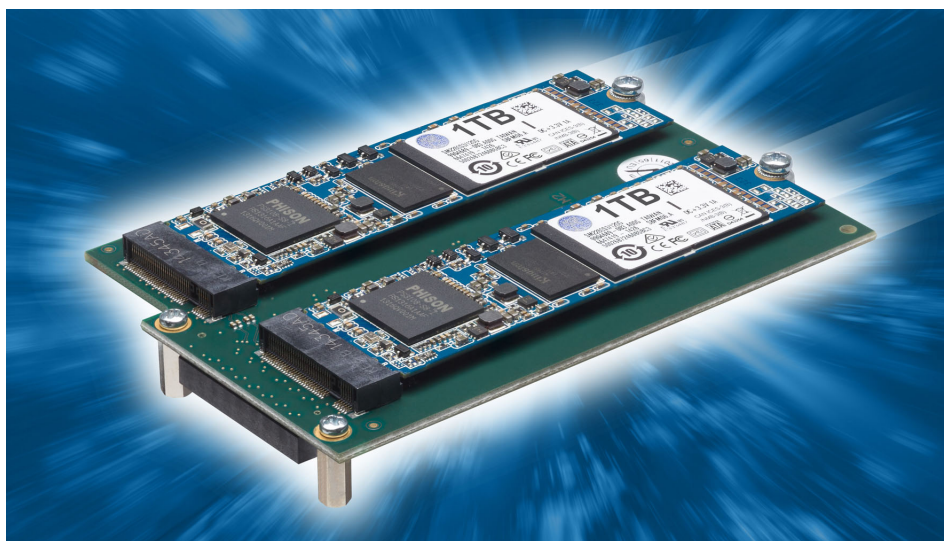
GBE Connector for J2 Rear I/O Dual GbE w. P82-GbE Low Profile Mezzanine Module

C4* Mezzanine Series

The purpose of the proven C4* mezzanine modules is to provide an SATA SSD mass storage solution for the particular CPU carrier card. Modules for different SSD storage types are available, e.g. the C47-MSATA (dual mSATA sockets), or C48-M2 (dual M.2 SATA sockets). The C4* low profile mezzanine modules use only HSE1 as connector to the carrier board, automatically configured as SATA x4. With a stacking height of 9.5mm board-to-board, also double sided M.2 SSDs can be populated on the C48-M2 mezzanine, without violating the 4HP envelope. On all C4* modules the mezzanine PCB is not recessed over HSE2.



HSE1 Connector



C48-M2 Dual M.2 SATA

S2* S4* S6* S8* P82 Mezzanine Series

These newly designed high performance low profile mezzanine modules may be equipped with additional Type-C front I/O connectors. Primarily used for USB 3.1 Gen1 (formerly known as USB 3.0 5Gbps SuperSpeed), these receptacles can be also employed for other high speed serial interface standards, e.g. DisplayPort. The Type-C connectors require a board-to-board space of 10.0mm. Since S6* and S8* mezzanines are based on 10.8mm B2B, Type-C receptacles are available only with the S2* and S4* mezzanine series (10.0mm B2B).

Series	Board to Board Space	HSE1	HSE2	M.2 Height Label	Type-C Front I/O	P6 Ethernet Backplane	Side Card Option 8HP (HSE2)
C4*	9.5mm	SATA x4 3)	1)	S1 - S5 D1 - D4	○	○	○
S2*	10.0mm	PCIe x4, USB3	2)	S1 - S5 D1 - D4	✓	○	✓
S4*	10.0mm	PCIe x4, USB3	PCIe x4, DP	S1 - S5 D1 - D4	✓	○	○
S6*	10.8mm	PCIe x2, SATA x2, USB3	2)	S1 - S5	○	✓	✓
S8*	10.8mm	PCIe x4, USB3	PCIe x4, DP	S1 - S5	○	✓	○
P82 4)	10.0mm	PCIe x4 M.2 NVMe	PCIe 2x1 2 x I226	S1 - S5 D1 - D4	○	J2 PlusIO 2 x GbE	○

- 1) HSE2 covered by mezzanine PCB - not usable for additional 8HP side card
- 2) HSE2 recessed on mezzanine PCB - available for additional 8HP side card (option)
- 3) Two SATA ports in use on mezzanine (C47: SATA 2/3, C48: SATA 1/2)
- 4) For use with PC7-FESTIVAL from PCB revision 3 off (2022 Q4)

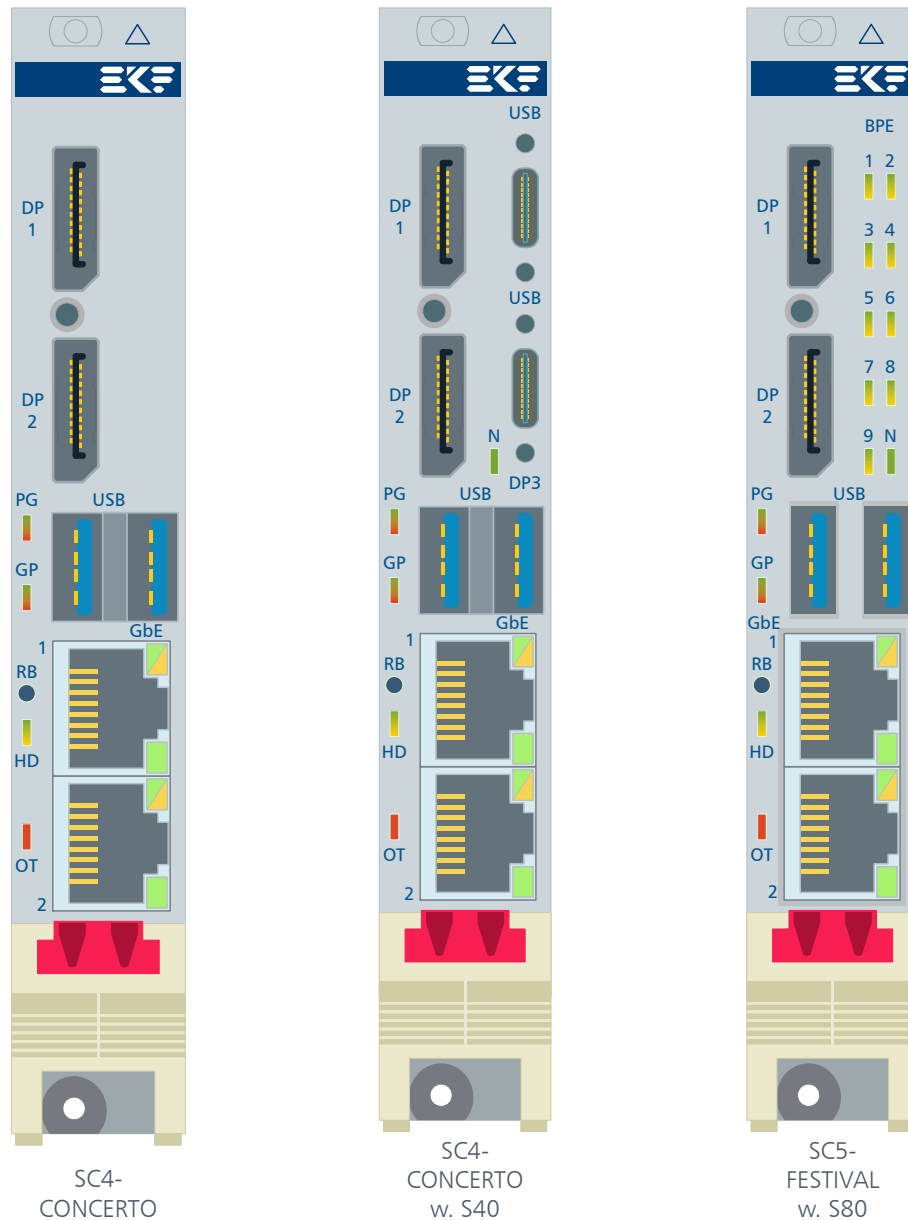
- ✓ Feasible (option)
- Not scheduled or infeasible

Popular M.2 component heights:

D3 Double sided M.2 (top 1.5mm, bottom 1.35mm)

S3 Single sided M.2 (top 1.5mm)

For full nomenclature please refer to the PCI Express M.2 Mechanical Specification chapter 2.2



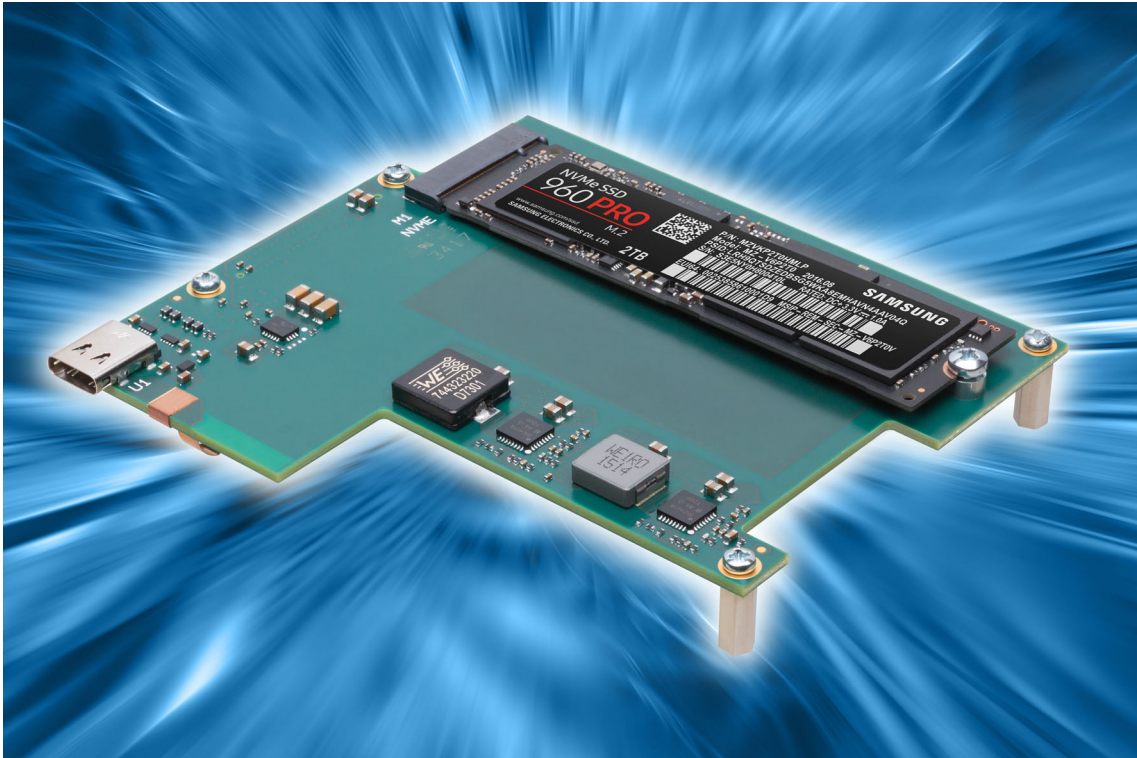
If provided, Type-C receptacles (S2*, S4* mezzanines) are suitable for dual screw locking cable connectors according to the '2016 Universal Serial Bus Type-C Locking Connector Specification'. As can be seen above (right illustration), the clearance between the DP and Type-C cable connectors may be extremely low. *EKF cannot guarantee that any configuration of commercial available Type-C and DisplayPort cable assemblies will fit here.* Please observe that only tight molded cable connectors with a slim profile are used. For some applications it may be tolerable to employ only one DP/Type-C receptacle each, so that staggered usage of the upper Type-C and lower DP (or vice versa) can help for sufficient clearance.

S2* Mezzanine Series

The major purpose of the S2* mezzanine modules is to provide a flexible SSD mass storage solution for the particular CPU carrier card. NVMe is preferred due to its superior data throughput, enabled by a PCIe x4 link (maximum 32Gbps theoretically). In contrast, M.2 SATA SSDs are based on a single 6Gbps channel. With a stacking height of 10.0mm board-to-board, single and double sided M.2 SSDs can be populated on an S2* series low profile mezzanine module (4HP envelope maintained).

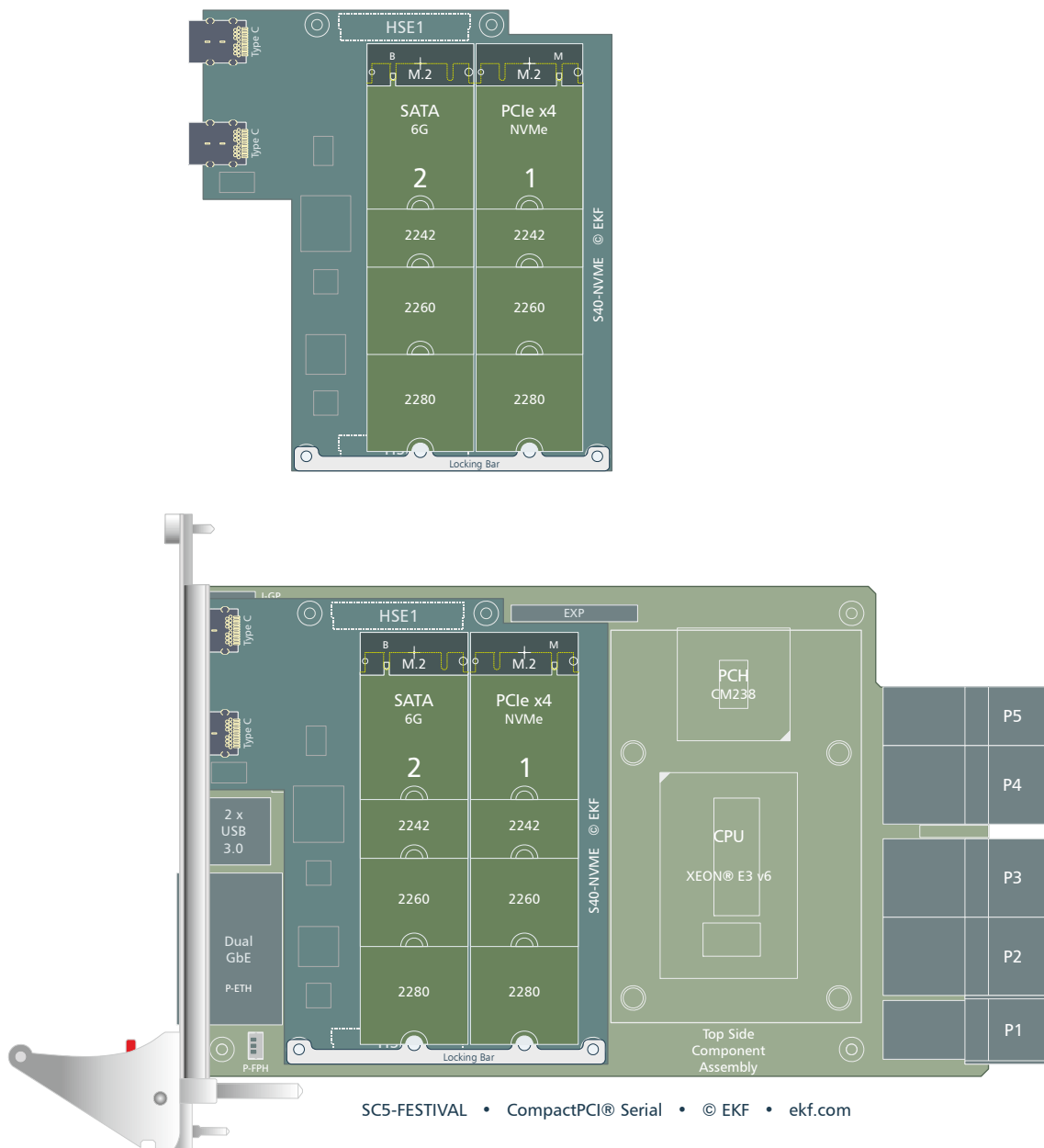
The S2* low profile mezzanine modules use only HSE1 as connector to the carrier board. Possible HSE1 configurations are SATA x4, or PCIe x 4, or SATA x2 and PCIe x2. The landing zone for HSE2 is recessed, for additional mounting of an HSE2 based side card in an optional 8HP assembly. A single Type-C receptacle on the mezzanine may be assigned to the HSE1 USB 3.0 port. An NVMe based M.2 SSD requires PCIe x4. The S2* PCB dimensions would allow also two M.2 SATA sockets, 1 x 2280 and 1 x 2260 size. The dual M.2 SATA alternate would allow optional employment of two PCIe lanes from HSE1 for I/O controllers, e.g. USB3.1 (future), combined with up to three Type-C front I/O connectors.

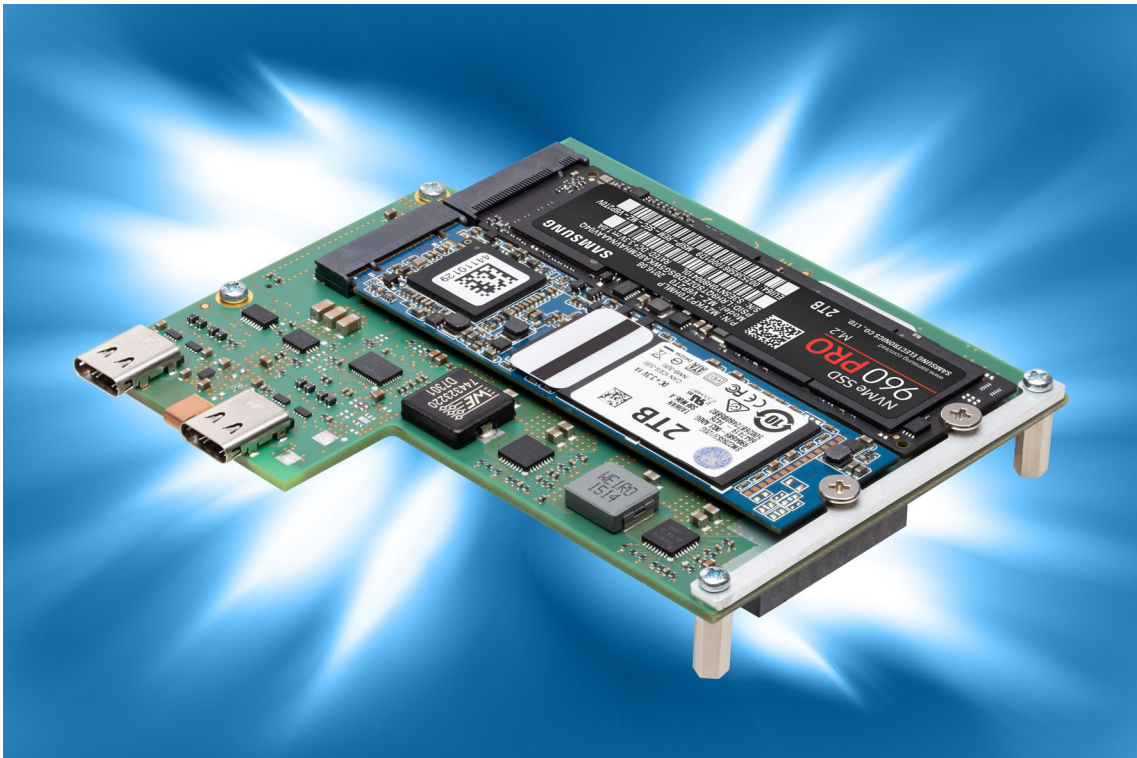
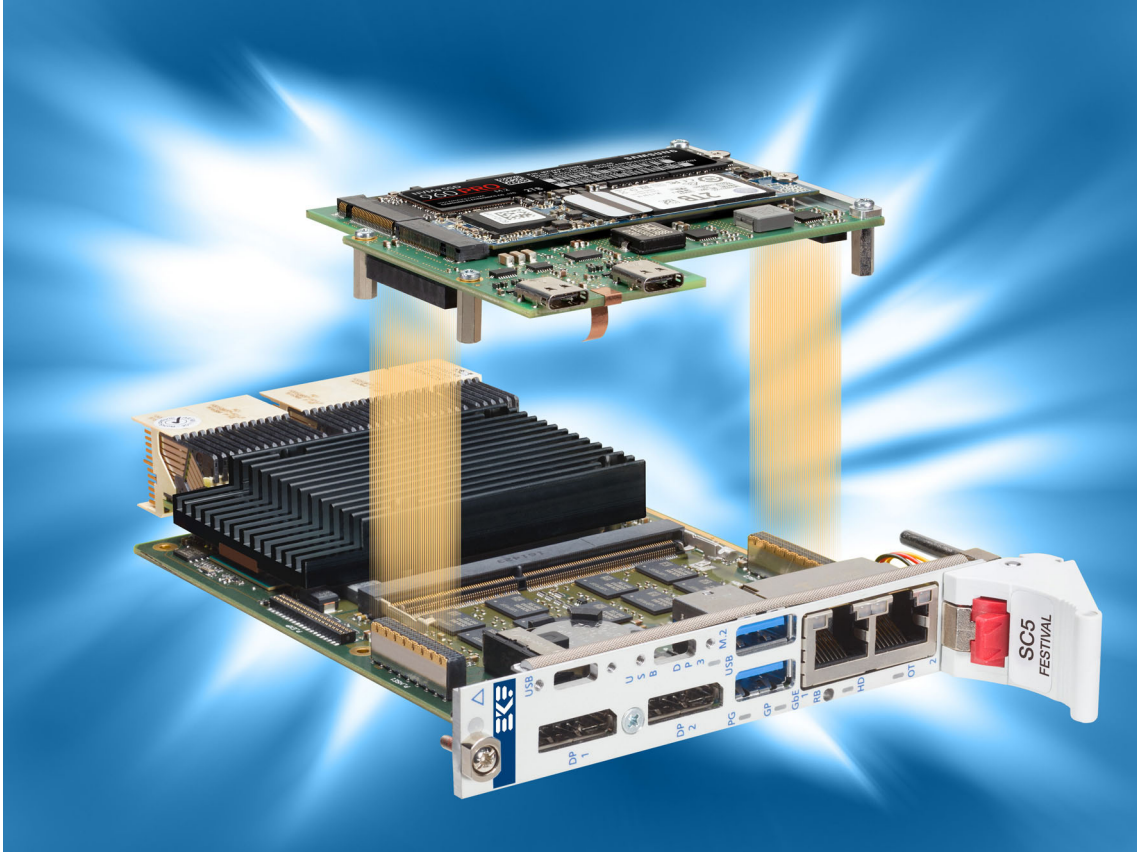




S4* Mezzanine Series

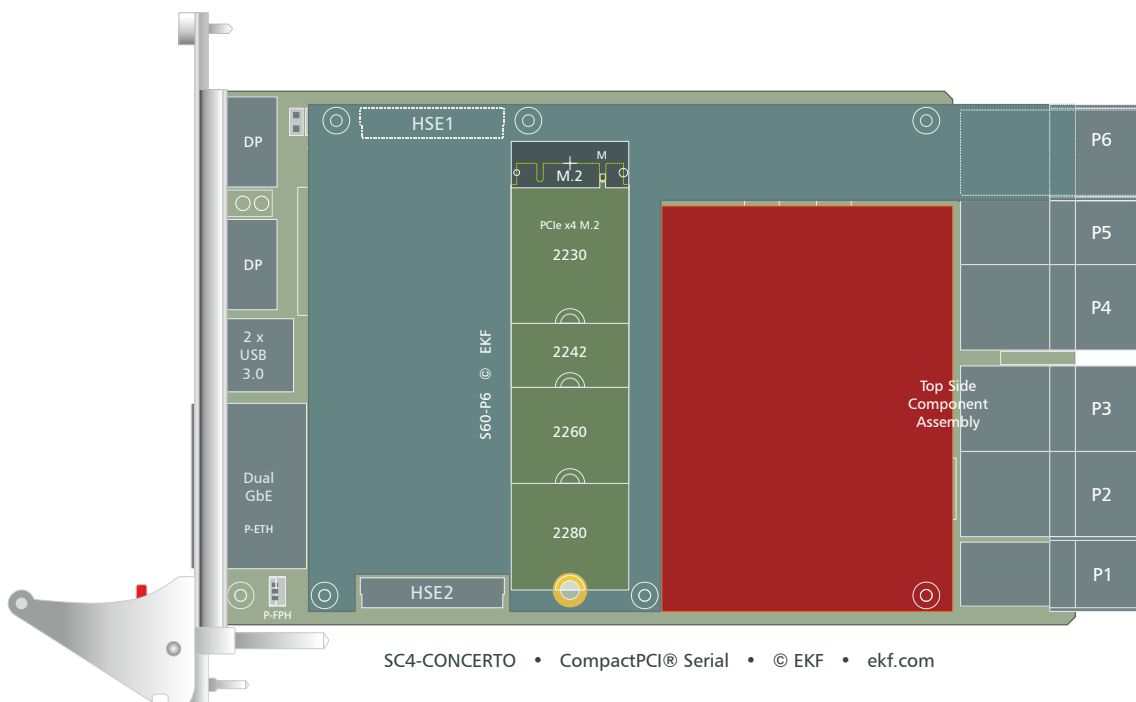
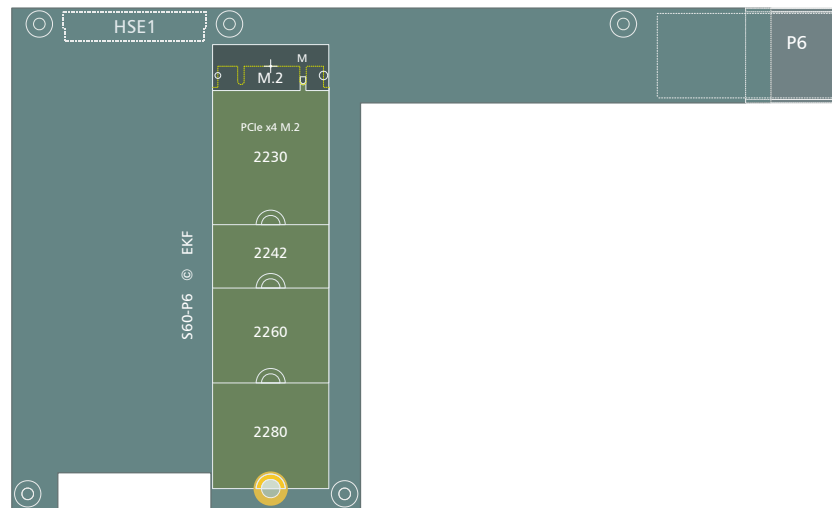
The S4* low profile mezzanine modules are designed to match with both carrier card connectors HSE1 (PCIe x4, USB3) and in addition HSE2 (PCIe x4, DisplayPort). S4* modules may be equipped with front panel Type-C receptacles for USB 3.1 Gen1 or Gen2 SS+ (future). One of the Type-C connectors may be MUXed between DisplayPort (alternate usage) and USB. One or two M.2 sockets are provided for NVMe (M-key) and SATA (B-key) SSDs, size up to 2280. HSE1 is typically assigned to a PCIe x4 NVMe M.2. HSE2 may be used for PCIe based I/O controllers (e.g. SATA, USB), or a secondary NVMe M.2 SSD. The NVMe M.2 (right) can be fixed at the 2280 edge as usual. However, a secondary 2280 M.2 (left) would require a special edge fixing solution common to both M.2 modules. S4* mezzanine modules are designed for a board-to-board height of 10.0mm. No additional 8HP assembly side card can be combined with an S4* module.





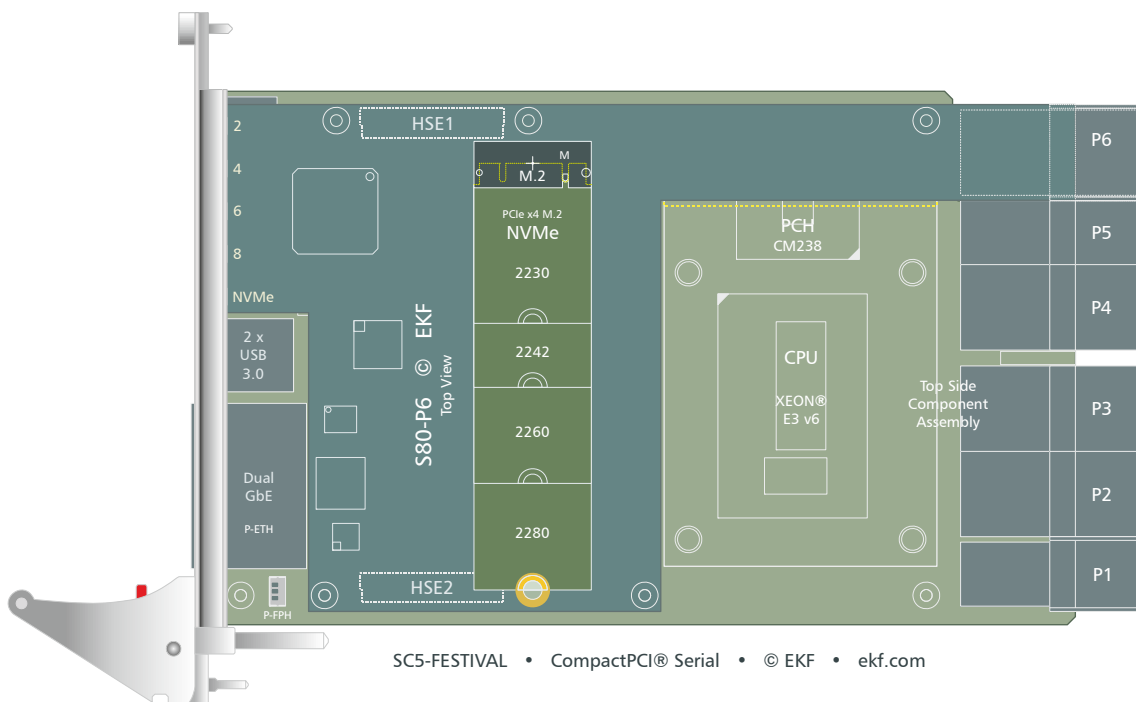
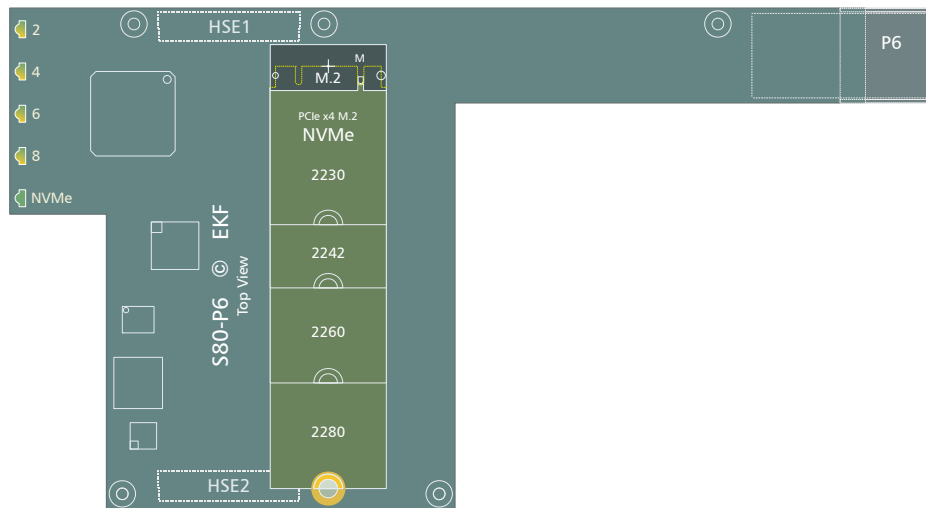
S6* Mezzanine Series

The S6* low profile mezzanine modules are equipped with the backplane connector P6, for Gigabit Ethernet communication according to the CompactPCI® Serial specification, up to 8 ports. The S60-P6 mezzanine provides a GbE x 8 Switch (Marvell 88E6390), which is connected to the HSE1 via an i210-IS GbE NIC. In addition, the SATA M.2 socket is assigned to the HSE1 expansion connector, which is setup for SATA x2 and PCIe x2 automatically. S6* mezzanine modules are designed for a board-to-board height of 10.8mm, thus only a single sided M.2 (S1-S3) module is allowed in order to maintain the 4HP envelope for the entire assembly comprised of CPU carrier board, S80 mezzanine, and the M.2 module. No Type-C F/P connectors are provided on the S6* mezzanines. The landing zone for HSE2 is recessed, for additional mounting of an HSE2 based side card in an optional 8HP assembly.

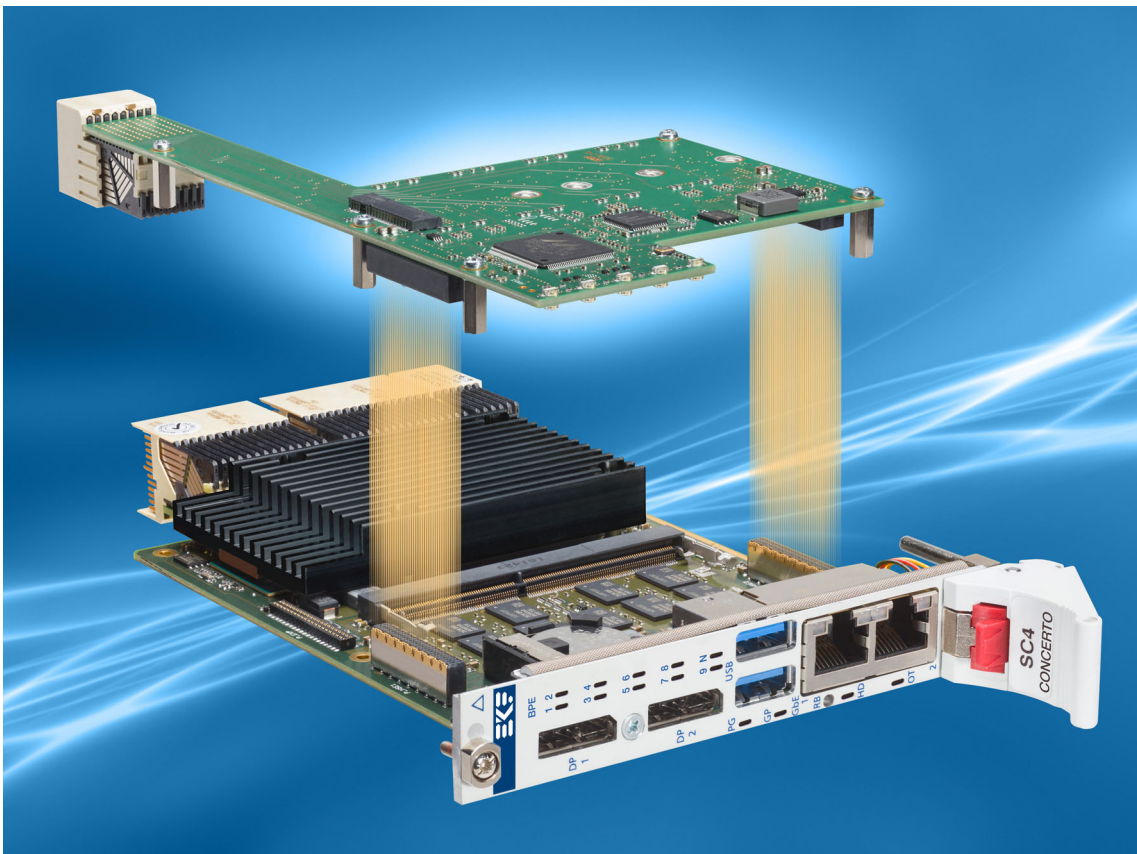
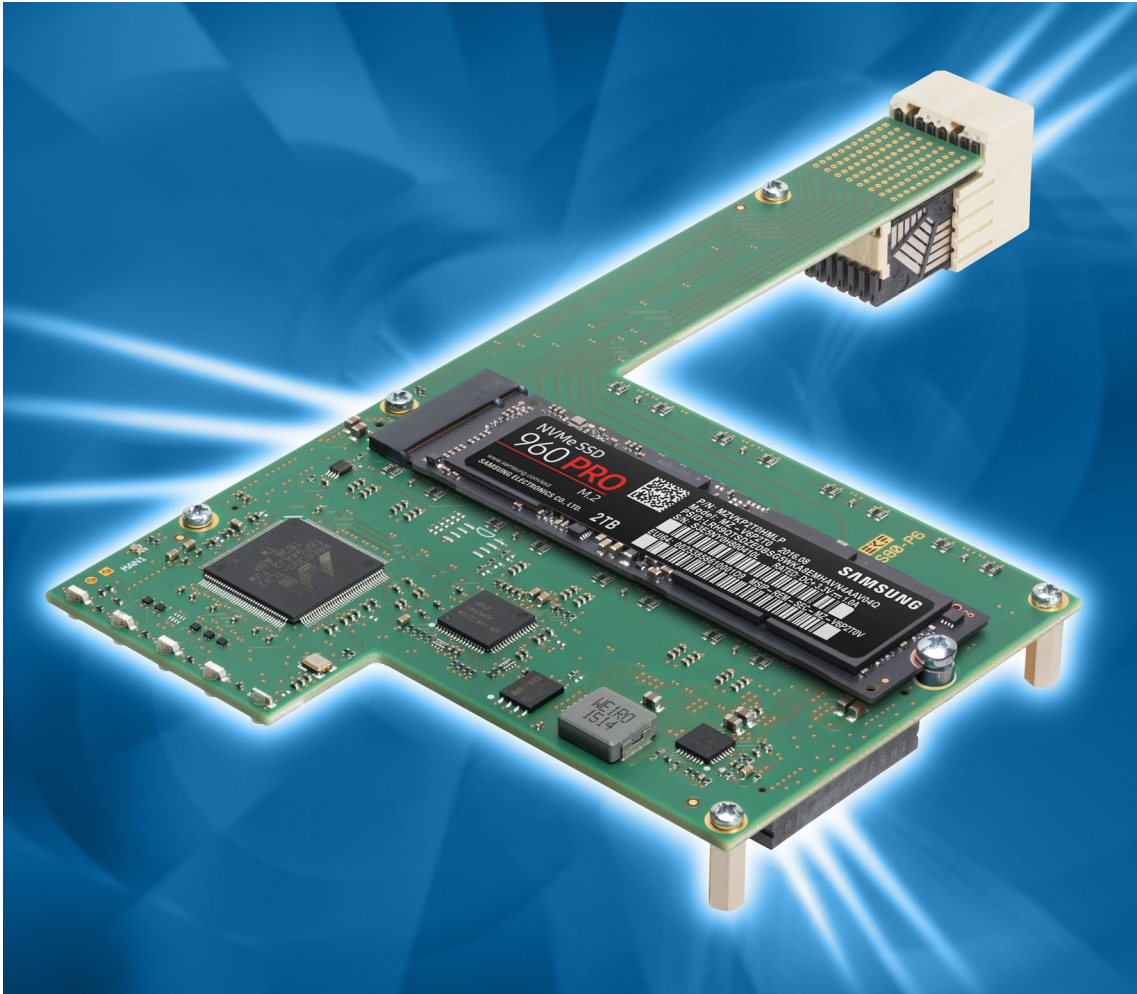


S8* Mezzanine Series

The S8* low profile mezzanine modules are equipped with the backplane connector P6, for Gigabit Ethernet communication according to the CompactPCI® Serial specification, up to 8 ports. The S80-P6 mezzanine provides a GbE x 8 Switch (Marvell 88E6390), which is connected to the HSE2 via an i210-IS GbE NIC. The NVMe M.2 socket is assigned to the HSE1 expansion connector (PCIe x4). S8* mezzanine modules are designed for a board-to-board height of 10.8mm, thus only a single sided M.2 (S1-S3) module is allowed in order to maintain the 4HP envelope for the entire assembly comprised of CPU carrier board, S80 mezzanine, and the NVMe module. No Type-C F/P connectors are provided on the S8* mezzanines. No additional 8HP assembly side card can be combined with an S8* module.



SC5-FESTIVAL • CompactPCI® Serial • © EKF • ekf.com



SC* PC* Side Cards

The major purpose for an 8HP assembly side card is to provide mass storage and additional front panel I/O (rear I/O as an option). All expansion connectors HSE1, HSE2 and EXP may be used. The B2B stacking height for a side card would be 18.7mm.

Custom specific side card solutions are available on request.



SCL-RHYTHM

The SCL-RHYTHM is equipped with 4 x M12 GbE front panel connectors, and a single socket for an M.2 NVMe SSD.



SCJ-VEENA

The SCJ-VEENA enables Gen4 PCIe® via the HSE1 mezzanine connector when combined with the SC9-TOCCATA CPU carrier card, wired to the M.2 SSD socket. The main purpose of the SCJ-VEENA is front I/O networking (4 x 2.5GBASE-T 4-speed).



SCZ-NVM

The SCZ-NVM provides dual M.2 NVMe support, and a quad UART. With the C32-FIO in addition a 12HP assembly is available.



SCZ-NVM w. C32-FIO 12HP Assembly

Related Information CPU Cards

SC4-CONCERTO (Intel® Xeon® processor E3 v5)	www.ekf.com/s/sc4/sc4.html
SC5-FESTIVAL (Intel® Xeon® processor E3 v6)	www.ekf.com/s/sc5/sc5.html
PC7-FESTIVAL (Intel® Xeon® processor E3 v6)	www.ekf.com/p/pc7/pc7.html
SC8-FLUTE (Intel® EHL SoC)	www.ekf.com/s/sc8/sc8.html
SC9-TOCCATA (Intel® TGL-H)	www.ekf.com/s/sc9/sc9.html

Related Information Expansion Side Cards

SCJ-VEENA (HSE1/2, M.2 NVMe SSD, 4 x RJ45 Gigabit Ethernet NIC)	www.ekf.com/s/scj/scj.html
SCL-RHYTHM (HSE1/2, M.2 NVMe SSD, 4 x M12 Gigabit Ethernet NIC)	www.ekf.com/s/scl/scl.html
SCZ-NVM (HSE1/2, Dual M.2 NVMe SSD, quad UART, front I/O)	www.ekf.com/s/scz/scz.html
PCZ-NVM (HSE1/2, Dual M.2 NVMe SSD, quad UART, front I/O)	www.ekf.com/p/pcz/pcz.html

Related Information Low Profile Mezzanine Modules

S20-NVME (HSE1, M.2 NVMe SSD & Type-C front I/O)	www.ekf.com/s/s20/s20.html
S40-NVME (HSE1/2, Dual M.2 NVMe/SATA SSD & Type-C front I/O)	www.ekf.com/s/s40/s40.html
S48-SSD (HSE1/2, Dual M.2 NVMe SSD up to Gen4 & Type-C front I/O)	www.ekf.com/s/s48/s48.html
S80-P6 (HSE1/2, M.2 NVMe SSD & P6 Backplane GbE switch x 8)	www.ekf.com/s/s80/s80.html
S82-P6 (HSE1/2, M.2 NVMe SSD & P6 Backplane GbE NIC x 4)	www.ekf.com/s/s82/s82.html
P82-GBE (HSE1/2, M.2 NVMe SSD & J2 Backplane GbE NIC x 2)	www.ekf.com/p/p82/p82.html
C47-MSATA (HSE1, Dual mSATA SSD)	www.ekf.com/c/ccpu/c47/c47.html
C48-M2 (HSE1, Dual M.2 SATA)	www.ekf.com/c/ccpu/c48/c48.html

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