



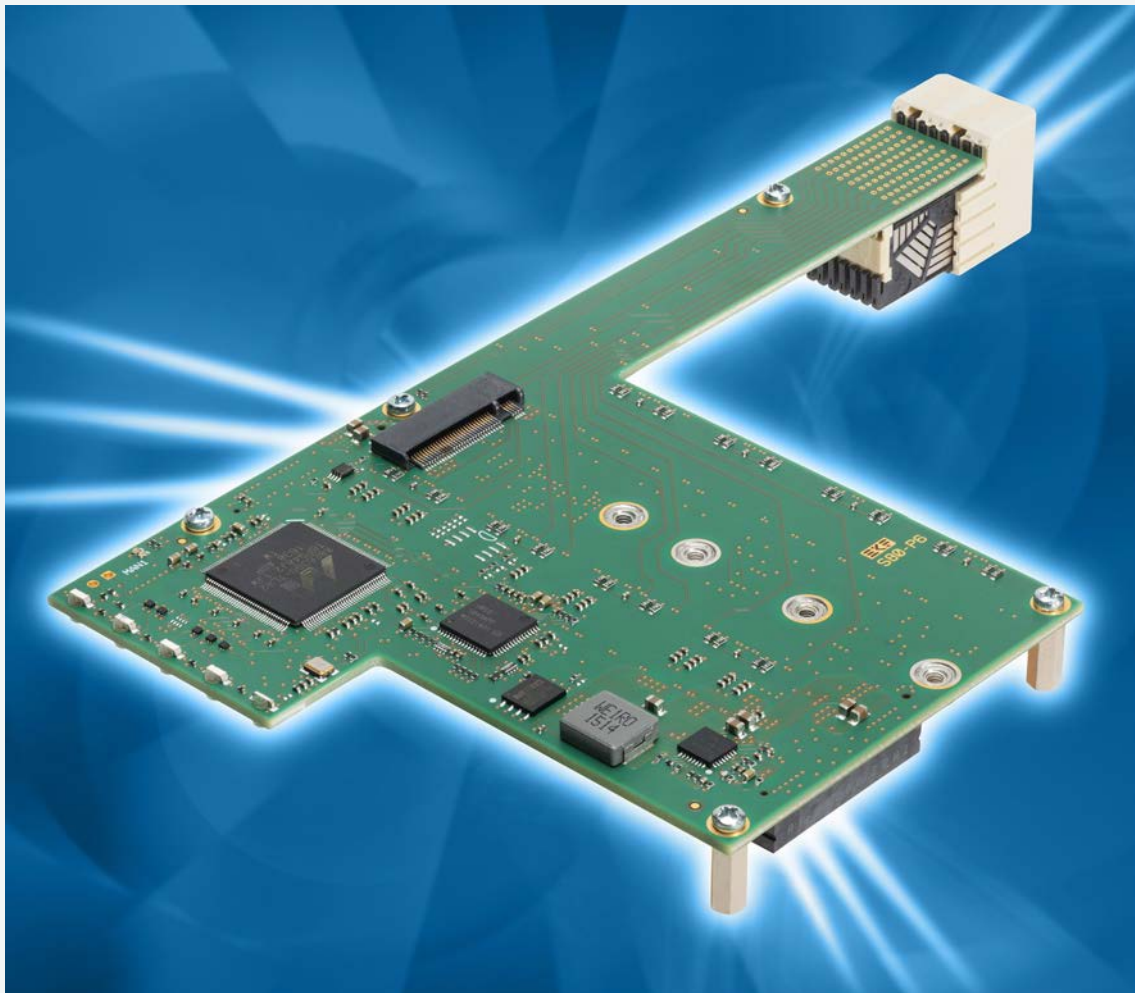
Technical Information

S80-P6

Low Profile Mezzanine Module

M.2 NVMe SSD Storage • Backplane Gigabit Ethernet Switch

Document No. 8423 • Ed. 9 • 12 September 2022



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About this Manual

This manual is a short form description of the technical aspects of the S80-P6, required for installation and system integration. It is intended for the advanced user only.

Edition History

Ed.	Contents/Changes	Author	Date
1	Technical Information S80-P6, English, preliminary edition Text #8423, File: s80_ti.wpd	jj	6 December 2016
2	S80 top view, bottom view modified/added, photo SC4-CONCERTO added	jj	13 February 2017
3	Added photos S80, SC4 w. S80	jj	2 August 2017
4	Added photos S80 w. M.2 module populated	jj	21 August 2017
5	Added S80 panorama photo w. M.2 module populated	jj	5 October 2017
6	MTBF added	jj	11 December 2017
7	S82-P6 added as alternate mezzanine	jj	20 April 2018
8	Full mesh backplane switching loop issue in multi-processor systems	jj	6 September 2019
9	Added photos SC9 w. S80	jj	12 September 2022

Related Documents

For a description of CPU cards which may act as carrier board with respect to the S80-P6, please refer to the correspondent CPU user guide, available by download (change URL accordingly for other potential carrier cards).

Download S80-P6 Carrier Card User Guides	
SC5-FESTIVAL	www.ekf.com/s/sc5/sc5.html
SC9-TOCCATA	www.ekf.com/s/sc9/sc9.html

Nomenclature

Signal names used herein with an attached '#1' designate active low lines.

Trade Marks

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

- ▶ Intel, Atom™, 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 document 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® Serial	CompactPCI Serial Specification, PICMG® CPCI-S.0	www.picmg.org
DisplayPort	DisplayPort Alt Mode on USB Type-C	www.vesa.org
Ethernet	IEEE Std 802.1, 802.3 IEEE Std 1588 Precision Time Protocol	standards.ieee.org
M.2	PCI Express M.2 Specification Revision 1.1	www.pcisig.com
NVMe	NVM Express 1.2.1 specification	www.nvmexpress.org
SATA	Serial ATA Specification	www.sata-io.org

Product Description

Overview

Available as a mezzanine add-on expansion board e.g. to the SC5-FESTIVAL and successor CPU carrier cards, the main purpose of the S80-P6 is to provide a Solid State Drive mass storage solution, and in addition to supply the backplane with eight Gigabit Ethernet ports.

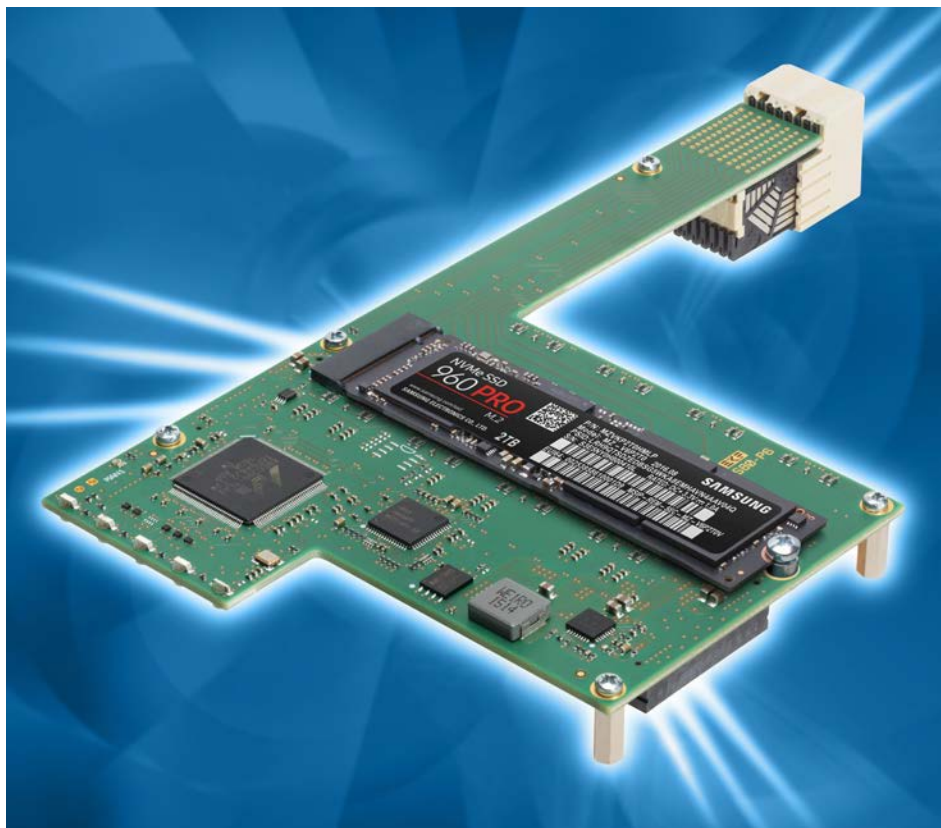
The S80-P6 is equipped with an M.2 PCIe x4 socket, suitable for a high speed NVMe type SSD module, with a maximum capacity of 2TB as of current, sufficient for installation of an operating system and also data storage.

A nine-port Gigabit Ethernet switch is provided on-board. Eight ports are available for CompactPCI® Serial backplane communication via the P6 connector. Another port is connected to the local GbE controller.

The Gigabit Ethernet switch provides latest features such as 802.1 Audio Video Bridging (AVB/TSN) and Quality of Service (QoS) support, and allows light in-band management.

Ethernet is the preferred interface for a multiprocessing configuration. With a suitable Ethernet enabled CompactPCI® Serial backplane, both networking architectures are supported, either single star for reasonable backplane cost, or full mesh for optimum system flexibility.

The S80-P6 connects to the mezzanine expansion connectors HSE1 and HSE2 of the CompactPCI® Serial CPU carrier board, maintaining the 4HP (20.32mm) total assembly height.





SC4/SC5 w. S80-P6



Feature Summary

Feature Summary

Form Factor

- ▶ Proprietary size mezzanine module
- ▶ Fits basically into the 4HP (20.3mm) envelope of the CPU carrier board
- ▶ Typically delivered as a ready to use assembly unit (including SC4-CONCERTO or successor CPU card)
- ▶ Mounting position right (on top of a CPU board)

Host I/F Connectors

- ▶ High speed mezzanine connectors
- ▶ Suitable for PCI Express® Gen3
- ▶ Bottom mount male connectors HSE1 and HSE2 (high speed expansion)
- ▶ Mating with the carrier card female connectors HSE1/2
- ▶ Board-to-board height 10.8mm for a 4HP assembly

HSE1

- ▶ PCI Express® 1x4 support (dedicated to the NVMe SSD module M.2 socket)
- ▶ Power sourcing 12V/1.5 A maximum continuous current (2 pins)

HSE2

- ▶ PCI Express® 1x4 support (dedicated to the PCIe® based on-board Gigabit Ethernet controller)
- ▶ Power sourcing 12V/3.0 A maximum continuous current (4 pins)

M.2 NVMe Module Connector

- ▶ Single M.2 socket, maximum M.2 size 2280 (M.2 formerly known as NGFF)
- ▶ Suitable for M.2 NVMe SSD module, key Id M, PCIe x4 I/F
- ▶ PCIe x4 sourced via HSE1 mezzanine connector
- ▶ Maximum (theoretical) 32Gbps I/O data transfer rate (Gen3 PCIe 8GT/s)
- ▶ Power switch, undervoltage lockout, short-circuit protection, quick discharge
- ▶ Module dimensions 2230/2242/2260/2280, screw fixed
- ▶ Module height (Label) S1-S5

Feature Summary

Gigabit Ethernet Switch

- ▶ Marvell® 88E6390 based Gigabit Ethernet switch (in use 8 x GbE MAC/PHY 1000BASE-T, 1 x GbE MAC SerDes)
- ▶ Eight GbE ports wired to the backplane connector P6 (isolated by magmods)
- ▶ High performance, non-blocking, Gigabit Ethernet
- ▶ Support for up to 16K MAC addresses, 10KByte Jumbo Frames
- ▶ Supports 802.1 Audio Video Bridging (AVB) Gen 2
- ▶ Time Sensitive Networking (TSN) Standards, IEEE 1588v2 one-step PTP
- ▶ Synchronous Ethernet
- ▶ Quality of Service (QoS) support with 8 traffic classes
- ▶ Supports 4096 802.1Q VLANs, three levels of 802.1Q security
- ▶ Unmanaged or managed solution
- ▶ Integrated microprocessor (IMP) enables enhanced managed switch designs (customer programming)
- ▶ IMP GUI debugger w. ANSI C compiler & assembler available on request from Marvell®
- ▶ Remote (in-band) management available on request via Marvell® SOHO Switch GUI Software
- ▶ Configurable in-band management through SerDes switch port (connected to the optional on-board NIC), or GbE PHY switch port via P6 backplane Ethernet (1_ETH)

Gigabit Ethernet Controller

- ▶ Intel® I210-IS Gigabit Ethernet controller internally wired to the GbE switch port 9 via SerDes
- ▶ 9.5KB Jumbo Frame support
- ▶ Hardware-based time stamping (IEEE 1588) and support for 802.1AS
- ▶ IEEE 802.1Qav compliant Audio-Video Bridging (AVB)
- ▶ IPv4, IPv6, TCP/UDP checksum offloads
- ▶ Based on PCI Express® x1 derived from the mezzanine connector HSE2
- ▶ Driver support for all major operating systems

Applications

- ▶ Low profile mezzanine module for EKF CPU Cards (SC4-CONCERTO and later)
- ▶ 4HP assembly CPU carrier board and S80-P6 mezzanine card
- ▶ Adds SSD mass storage and backplane Ethernet networking to the CPU carrier
- ▶ M.2 based mass storage, 1 x M.2 PCIe x4 socket (NVMe)
- ▶ On-board GbE switch for backplane communication and multiprocessing via backplane connector P6, eight GbE ports (suitable for single star architecture or full mesh or RIO)

Feature Summary

Environment & Regulatory

- ▶ Designed & manufactured in Germany
- ▶ Certified quality management according to ISO 9001
- ▶ Long term availability
- ▶ Rugged solution
- ▶ Coating, sealing, underfilling on request
- ▶ RoHS compliant
- ▶ Operating temperature 0°C to +70°C (commercial temperature range) available
- ▶ Operating temperature -40°C to +85°C (industrial temperature range) available
- ▶ 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
- ▶ MTBF 50.3 years
- ▶ EC Regulations EN55022, EN55024, EN60950-1 (UL60950-1/IEC60950-1)

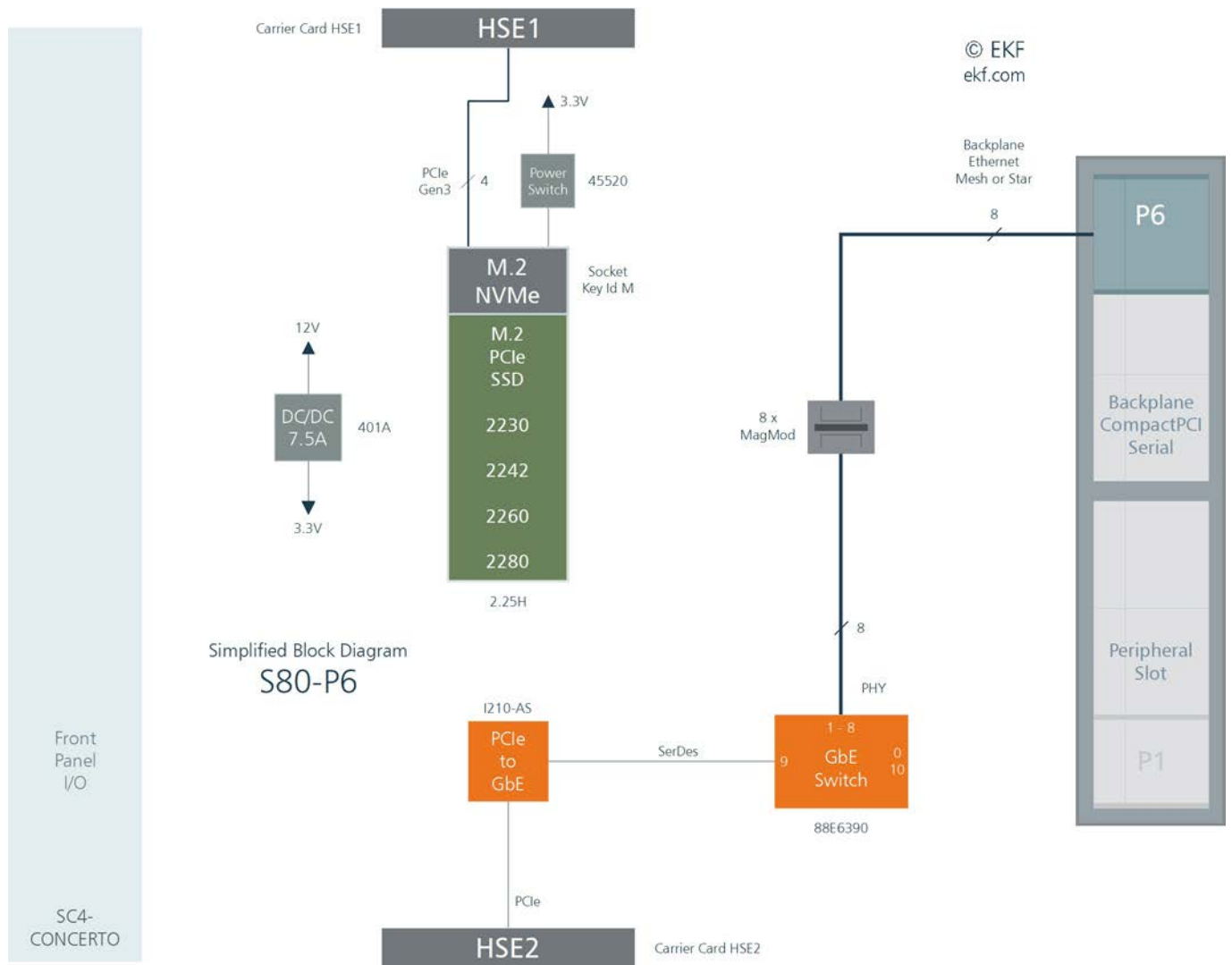
Custom specific modifications or development on request
All items are subject to technical changes



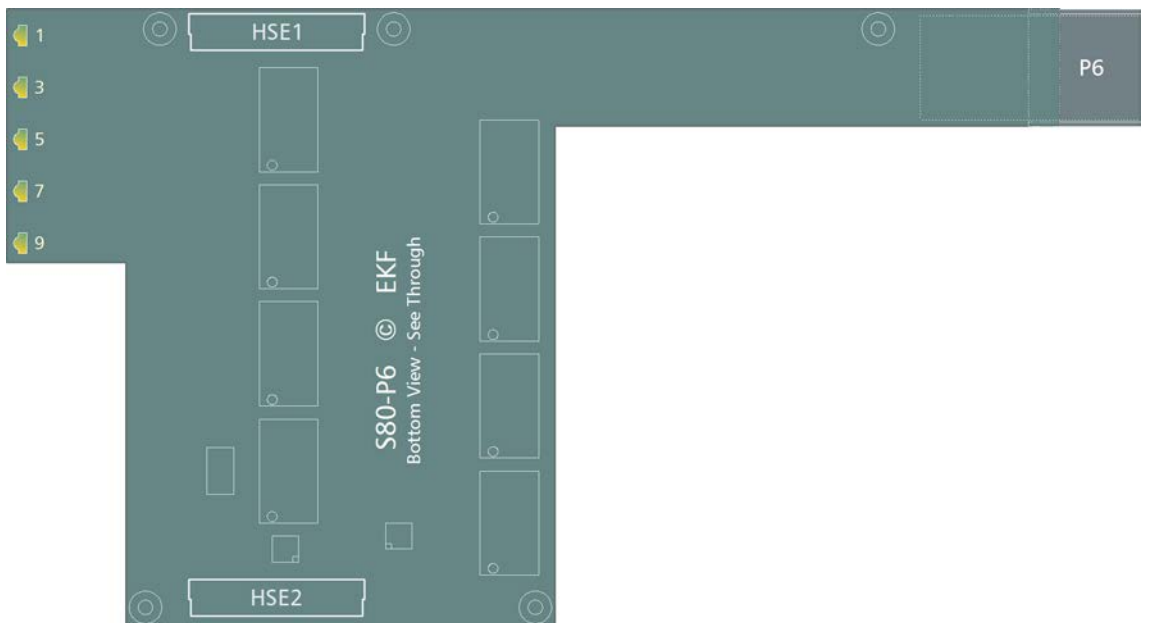
SC9 w. S80-P6

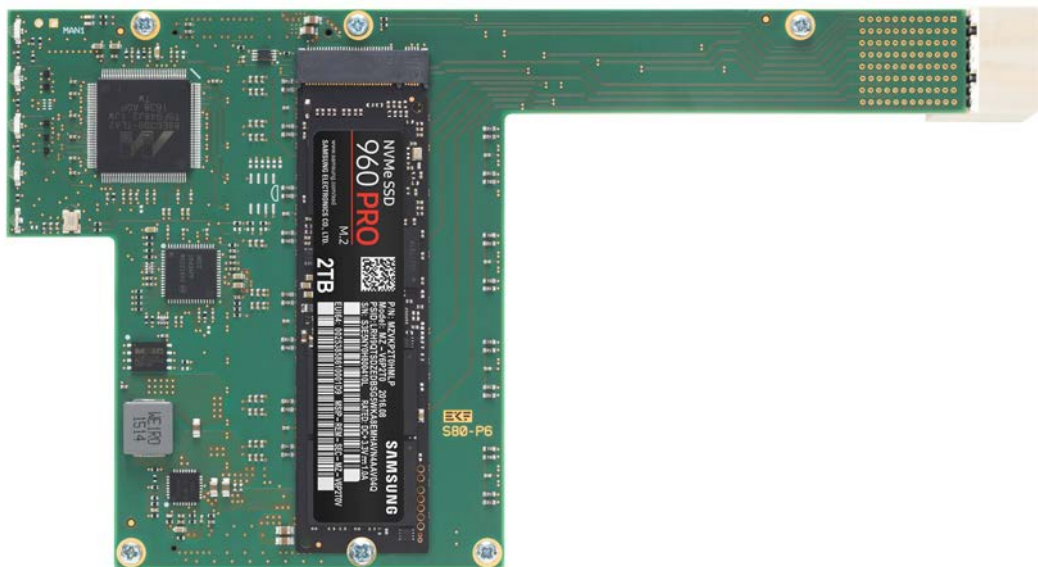


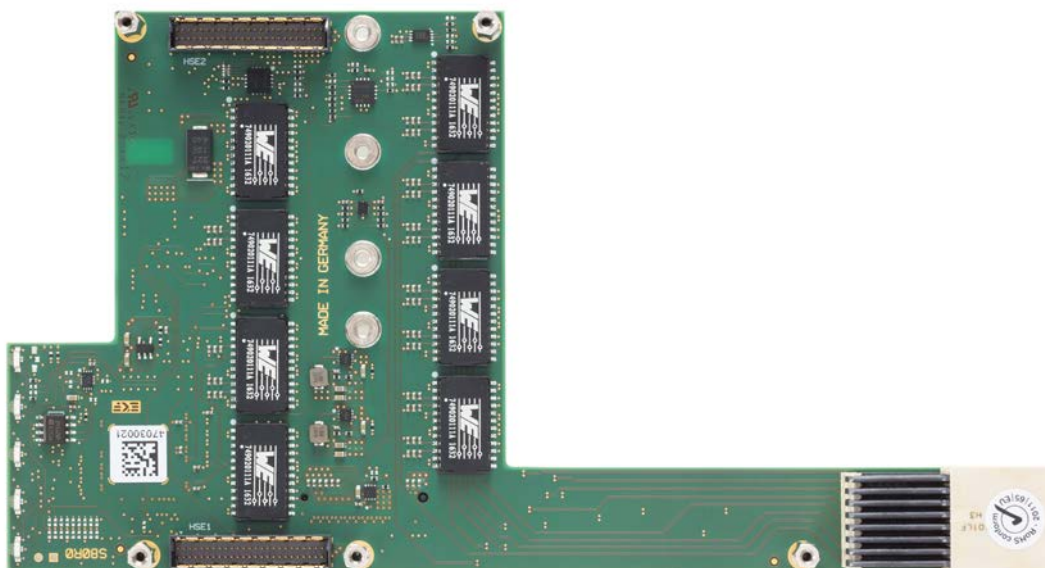
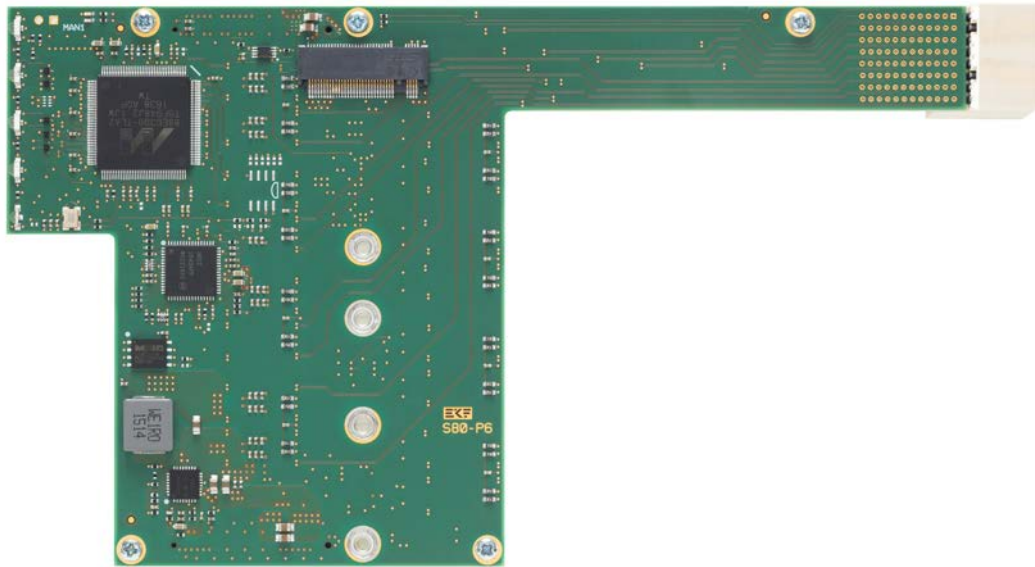
Block Diagram



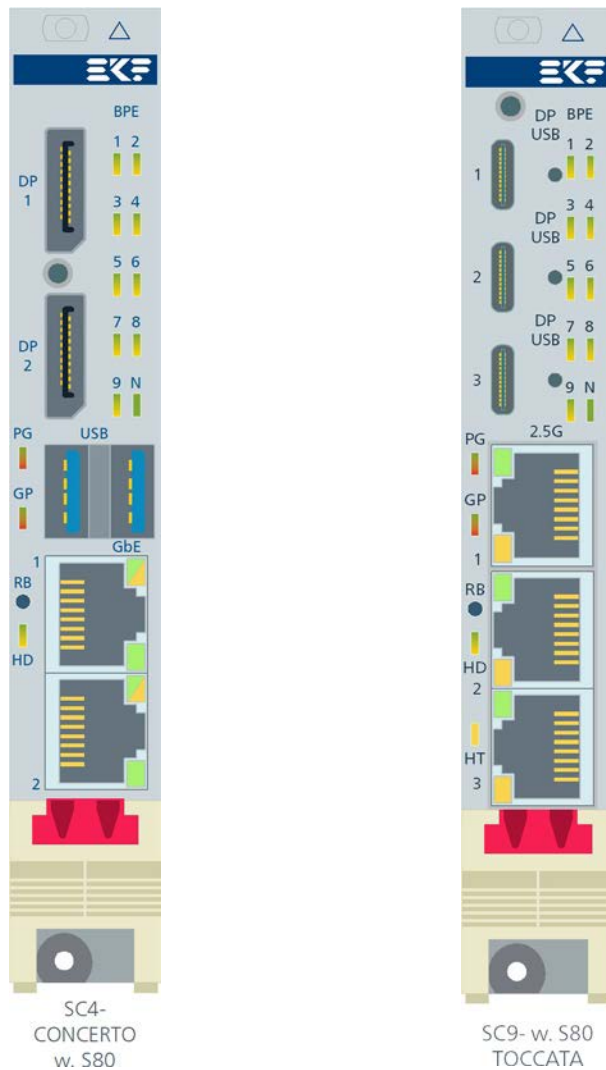
Top/Bottom View Component Assembly







Front Panel



LED 1-8: Backplane Ethernet Ports (P6), green=100Mbps, orange=1Gbps, blink=Activity
 LED 9: Internal Switch Port - I210 NIC, orange=1Gbps, blink=Activity
 LED N: M.2 NVMe Activity



Theory of Operation

The S80-P6 is equipped with a Marvell® 88E6390 Gigabit Ethernet switch as its main component. This device provides eight PHY ports (1-8) with integrated Gigabit Ethernet transceivers, which are wired across magnetics modules to the CompactPCI® Serial backplane connector P6.

In addition, a SerDes port (9) of the switch is connected internally to the Intel® I210-IS on-board Gigabit Ethernet controller, for switch access by the CPU card (PCI Express®).

The CPU carrier card with the S80-P6 mezzanine typically would be inserted into the system slot of a CompactPCI® Serial backplane, suitable for star architecture networking, or full mesh backplane Ethernet. Both structures allow backplane multiprocessing and other Ethernet bound communication over P6/J6 between CompactPCI® Serial boards, with higher flexibility (and backplane cost) offered by the mesh version. An alternative application would be rear I/O Ethernet across P6 (this requires a rear I/O enabled backplane slot).

Switch Management

By default, the 88E6390 Ethernet switch does not require management (self-managed switch). As an option, slight remote (in-band) management is available, by means of a Windows® based diagnostics tool, the Marvell® SOHO Switch GUI. Please contact support@ekf.de for details.

Remote management can be enabled either for the SerDes switch port internally connected to the I210-IS NIC, or for the switch port assigned to the backplane connector P6/1_ETH (neither path activated for management by default).

The Marvell® 88E6390 Gigabit Ethernet switch comprises an integrated microprocessor (IMP). This is a 200MHz CPU with on-chip RAM, which can be used to implement enhanced remote switch management, to execute protocols like Spanning Tree (RSTP), and offload time critical protocols like PTP. The IMP boots from EEPROM, and includes a NIC which is internally connected to the switch fabric. The CPU is fast enough to echo more than 100,000 Ethernet frames per second. ANSI C & Assembler development tools are supported by Marvell's IMP GUI package.

Recommended Marvell® Documentation (Under NDA)

IMP GUI User Guide

Link Street® Integrated Micro Processor User Guide

SMI Register Access GUI User Guide

Backplane Switching Loop

Ethernet enabled CompactPCI® Serial backplanes conform either to the star architecture, or a full mesh schematic. For a multi-processor system with three or more S80-P6 equipped CPU cards on a full mesh backplane, a switching loop would occur, which must be avoided. This is not a problem caused by the S80-P6, but a general Ethernet switching issue.

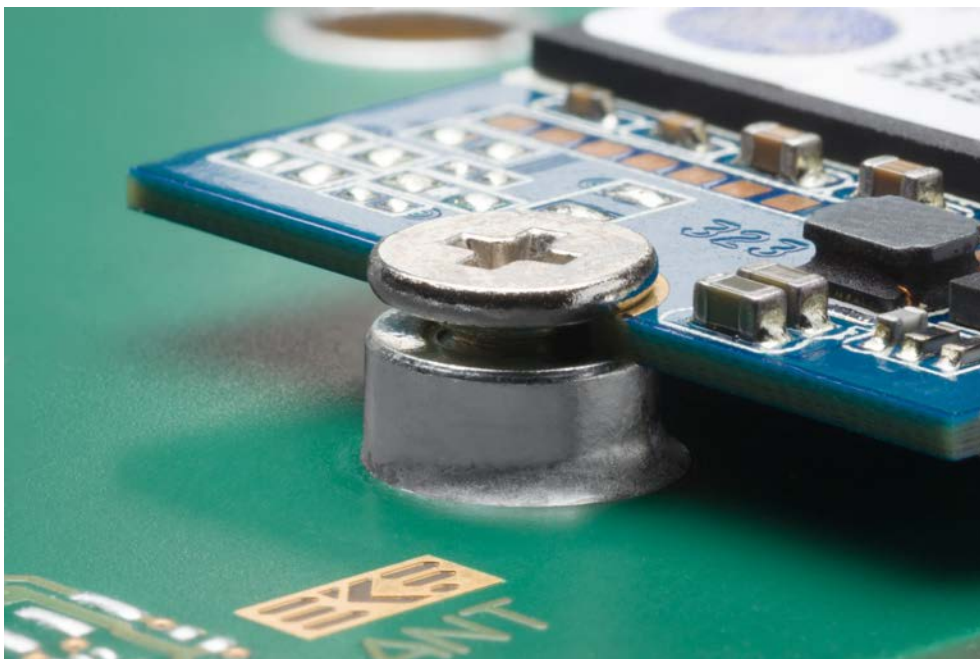
A full mesh backplane connects any P6 Ethernet slot with each other, which would redirect broadcast data packages between more than two switches. Since the S80-P6 on-board Ethernet switch is unmanaged, no spanning tree protocol or other method can prevent this situation. For multi-processor systems therefore EKF recommends the S82-P6, which is equipped with four I210 NICs (no switch solution).

Technical Reference - Connectors

M.2 SSD Host Connector

The S80-P6 is provided with an M.2 (formerly NGFF) module host connector. This socket is M-keyed, for a PCIe x4 based SSD module. After inserted, the M.2 module must be locked manually by a screw (M2.5 threaded inserts provided on the PCB), in order to withstand shock and vibration. The S80-P6 accepts module sizes up to 2280.

The PCIe x4 NVMe SSD is suitable for demanding applications, but legacy operating systems may not include NVMe protocol drivers. There are also PCIe x4 based SSDs available for OEMs which comply with the AHCI (SATA) protocol, for legacy systems. When ordering PCIe based SSD modules, be sure to choose the version which is most suitable for your application.



M.2 Module Fixation (Picture Similar)

Please note that the S80-P6 is a carrier card which typically comes without M.2 module(s) populated, unless otherwise expressly ordered. Photos shown within this document and at other places may be equipped with M.2 modules just for application demonstration. If you need a turnkey solution with an M.2 NVMe storage module populated, please contact sales@ekf.com before ordering.

NVMe PCIe x4 M.2 M-Key • Pin 1 - 38 EKF Part #255.50.2.2223.10			
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



NVMe PCIe x4			
M.2 M-Key continued • Pin 39 - 75			
GND	39	40	SMB_CLK *
PETNO	41	42	SMB_DATA *
PETPO	43	44	ALERT *
GND	45	46	NC
PERNO	47	48	NC
PERPO	49	50	PERST#
GND	51	52	CLKREQ#
REFCLKN	53	54	PEWAKE#
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	SUSCLK
PEDET	69	70	+3.3V
GND	71	72	+3.3V
GND	73	74	+3.3V
GND	75		

* Logic level 1.8V signals - LSF0204 level shifter to 3.3V on-board

PCI Express® M.2 Specification Socket 3 PCIe-based Module Pinout (Module Key M)

Mezzanine Connectors HSE1, HSE2

The S80-P6 is provided with two male mezzanine connectors on the bottom side of the PCB, which mate with the female mezzanine connectors on the carrier CPU card, for a resulting board-to-board mounting height of 10.8mm.

HSE1

HSE1 is used to pass a PCIe x4 link from the CPU carrier card to the on-board M.2 NVMe connector.

HSE2

HSE2 is provided to supply the S80-P6 mezzanine with additional PCIe lanes. A PCIe x1 link is established for the on-board I210-IS Gigabit Ethernet controller, provided as local access to the Ethernet switch.

Carrier card connector 8mm female ERNI Microspeed 275.90.08.068.01

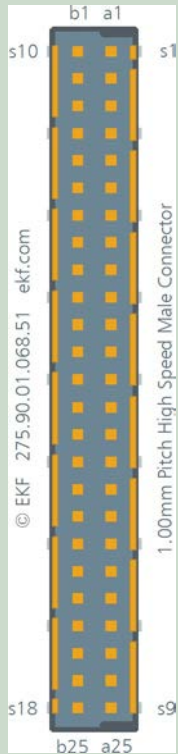
Supplement 1mm male connector for nominal height 9mm (C4*, B2B 9.5mm)

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_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⁾
+5VPS ²⁾	b24	a24	+3.3VA ³⁾
+12VPS ²⁾	b25	a25	+12VPS ²⁾

* CFG_12 and CFG_34 = open (10k PU on CPU carrier board) indicating that a PCIe x4 link is requested

- 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

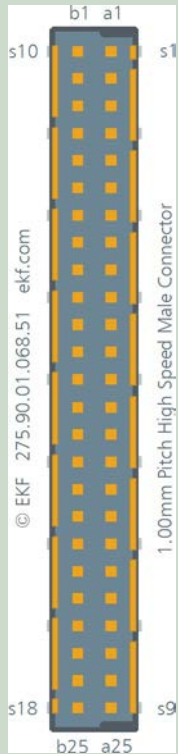
Supplement 1mm male connector for nominal height 9mm (C4*, B2B 9.5mm)

Supplement 2mm male connector for nominal height 10mm (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-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⁾
+12VPS ²⁾	b24	a24	+12VPS ²⁾
+12VPS ²⁾	b25	a25	+12VPS ²⁾

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

1) Connection to SMBus, isolated after system reset

2) Power rail switched on in S0-S4 state

Backplane Connector P6

P6 CompactPCI® Serial Peripheral Slot Backplane Connector												
EKF Part #250.3.1208.20.02 • 96 pos. 12x8, 18mm width												
P6	A	B	C	D	E	F	G	H	I	J	K	L
8	PU 1)	8 ETH A+	8 ETH A-	PU 2)	8 ETH B+	8 ETH B-	GND	8 ETH C+	8 ETH C-	GND	8 ETH D+	8 ETH D-
7	7 ETH A+	7 ETH A-	GND	7 ETH B+	7 ETH B-	GND	7 ETH C+	7 ETH C-	GND	7 ETH D+	7 ETH D-	GND
6	GND	6 ETH A+	6 ETH A-	GND	6 ETH B+	6 ETH B-	GND	6 ETH C+	6 ETH C-	GND	6 ETH D+	6 ETH D-
5	5 ETH A+	5 ETH A-	GND	5 ETH B+	5 ETH B-	GND	5 ETH C+	5 ETH C-	GND	5 ETH D+	5 ETH D-	GND
4	GND	4 ETH A+	4 ETH A-	GND	4 ETH B+	4 ETH B-	GND	4 ETH C+	4 ETH C-	GND	4 ETH D+	4 ETH D-
3	3 ETH A+	3 ETH A-	GND	3 ETH B+	3 ETH B-	GND	3 ETH C+	3 ETH C-	GND	3 ETH D+	3 ETH D-	GND
2	GND	2 ETH A+	2 ETH A-	GND	2 ETH B+	2 ETH B-	GND	2 ETH C+	2 ETH C-	GND	2 ETH D+	2 ETH D-
1	1 ETH A+	1 ETH A-	GND	1 ETH B+	1 ETH B-	GND	1 ETH C+	1 ETH C-	GND	1 ETH D+	1 ETH D-	GND

pin assignments reflect standard mount P6 connector

- 1) DECT_RIO Signal
- 2) DECT_BPR Signal

On backplanes suitable for Ethernet (either star or mesh) both pins DECT_* are tied to GND. Open pins indicate a P6 rear I/O enabled backplane slot. The CPU carrier card with S80-P6 mezzanine must not be inserted into backplane slots which are designated for rear I/O over P6/J6 with an other signal assignment than Ethernet. A RIO module with up to 8 x RJ45 GbE ports is planned by EKF, as an alternate to backplane networking, suitable for an P6/J6 rear I/O enabled backplane slot.

Ordering Information

Ordering Information
For popular S80-P6 SKUs please refer to www.ekf.com/liste/liste_21.html#S80

Please note that the S80-P6 is a mezzanine card which typically comes without an M.2 module populated, unless otherwise expressly ordered. Photos shown within this document and at other places may be equipped with M.2 modules just for application demonstration. If you need a turnkey solution with an M.2 NVMe SSD storage module populated, please contact sales@ekf.com before ordering.

Alternate Products

Low Profile CPU Card Mezzanine Storage Modules	
S20-NVME	M.2 NVMe Socket, 1 x Type-C USB Front I/O
S40-NVME	M.2 NVMe & M.2 SATA Sockets, 2 x Type-C Front I/O
S48-SSD	Dual M.2 NVMe, 1 x Type-C Front I/O
S82-P6	M.2 NVMe & 4 x GbE NICs for Backplane Ethernet

Beyond All Limits: EKF High Performance Embedded



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