SYSTEM

Product Information

SX5-STREAM

CompactPCI® Serial • PCI Express® External Cabling
Host Side Adapter • Dual PCIe® Gen3 x8 Cable Connectors

Document No. 8680 • 16 April 2018

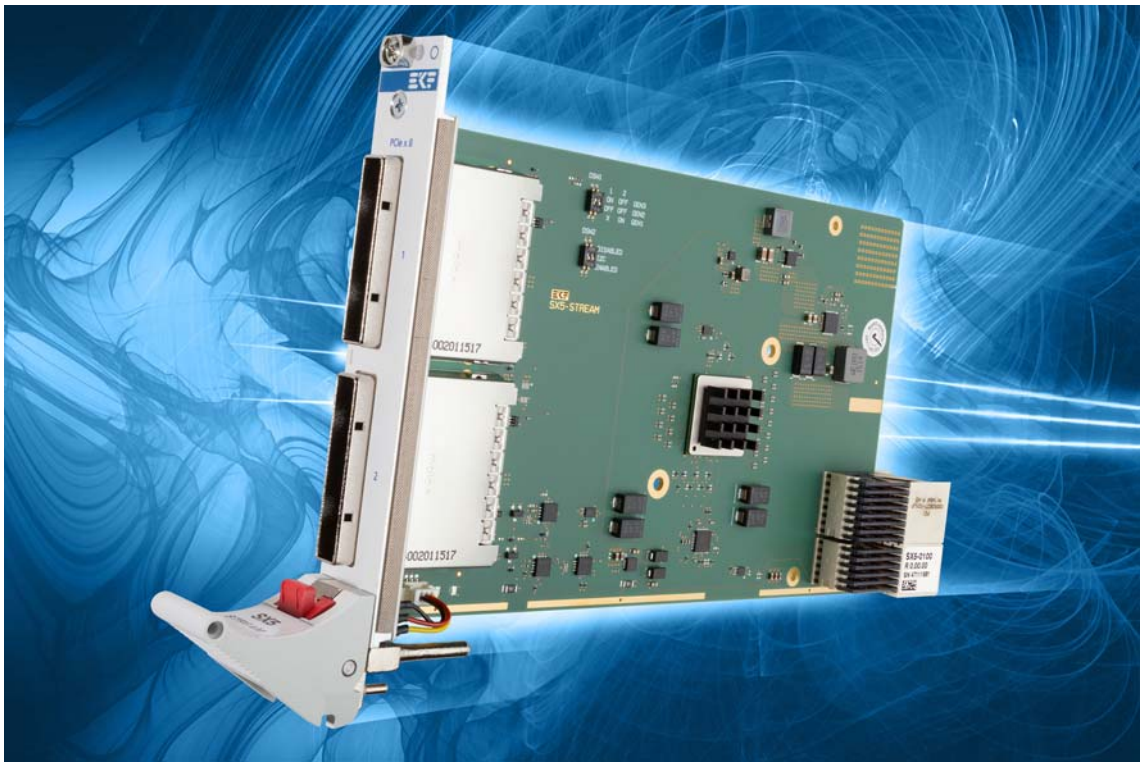
General

Most computer systems are based on the PCI Express® standard as a high speed backbone for interconnection of peripheral components with a host CPU. Typically all PCI Express® based devices are located closely in a common enclosure.

The PCI-SIG PCI Express® External Cabling Specification for Gen1 and Gen2 data transfer rates addresses extended applications, such as split-systems or I/O expansion by means of a suitable copper cable, available e.g. for a x8 PCI Express® link, up to 7m length. When used with an AOC (Active Optical Cable), distances of up to 300m can be bridged between host and target systems. Beyond the PCI-SIG cabling specification, the Samtec PCIEO series of AOC addresses also Gen3 speed up to 100m.

The SX5-STREAM is a CompactPCI® Serial host adapter card for dual PCI Express® x8 external cabling. The board is provided with two PCIe® x8 front panel connectors, for attachment of one ore two remote (target) systems via PCI Express® x8 links. The SX5-STREAM has been designed for operation in a CompactPCI® Serial fat pipe slot (PCIe® x8). The on-board Gen3 PCI Express® packet switch splits the upstream link into two concurrent PCI Express® downstream links x8, each delivering up to 64Gbps to an associated target system.

The advantages of PCI Express® as an communication path compared e.g. to 10Gbps Ethernet are higher data transfer speed at lower latency, and primarily merging distributed subsystems virtually into a single PCI Express® based computer assembly.

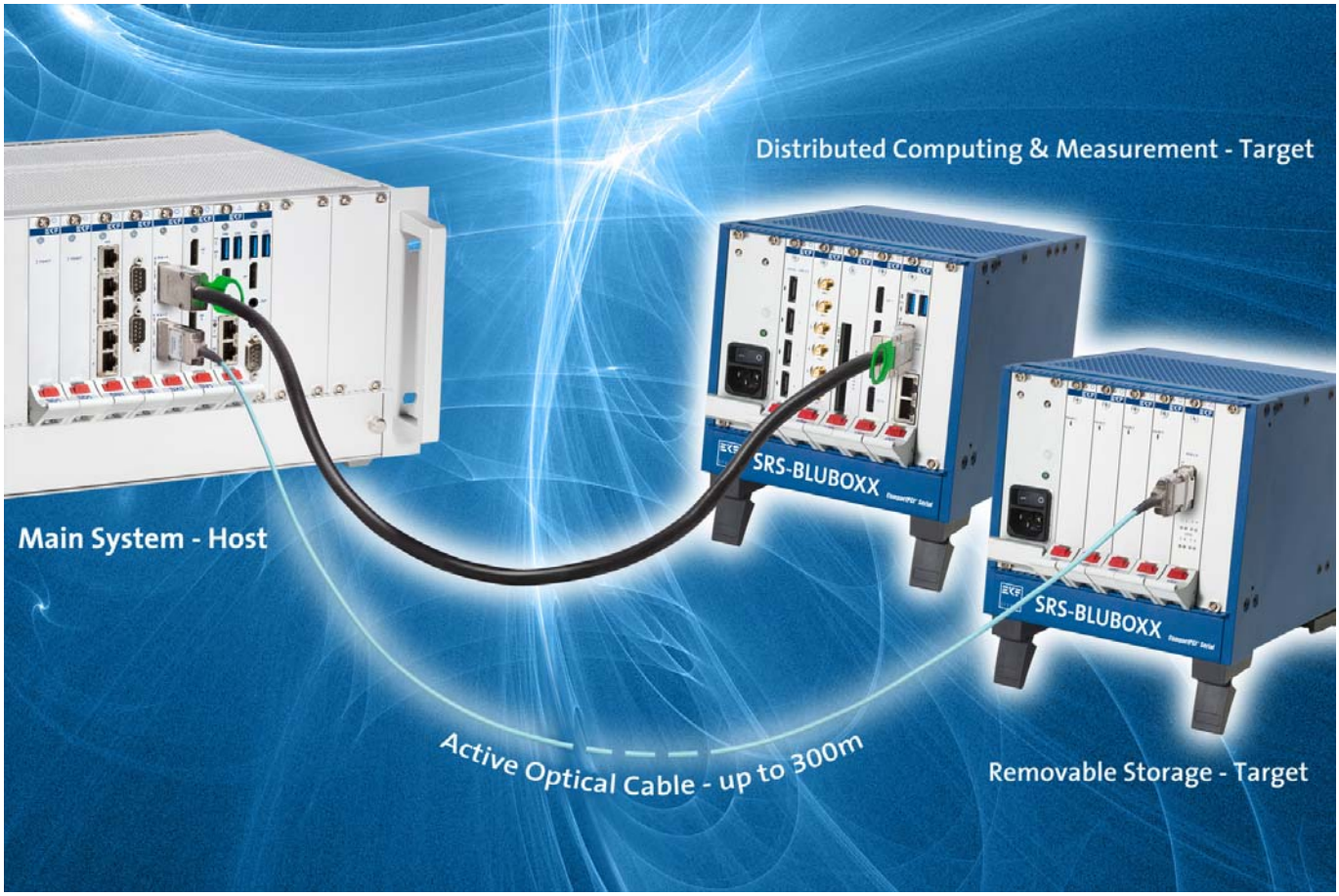


System Integration

The SX5-STREAM allows to control a remote PCI Express® based target (downstream) system by a CompactPCI® Serial host CPU via PCI Express® external cabling. The target system may be any PCI Express® based hardware with an external cabling adapter organized x8 or x4, not necessarily a CompactPCI® Serial system.

By means of the SX5-STREAM, a CompactPCI® Serial system backplane, with respect to its PCI Express® resources, can be virtually extended. Hence, PCI Express® based devices in a remote target system can be controlled by the CompactPCI® Serial host system CPU in an identical manner as its local resources.

Typical Application



By means of the Dolphin PCIe® Networking Software also pear to pear computing can be realized. The Dolphin drivers establish a 'Super Sockets' named TCP/IP stack (based on Berkeley Socket), so that existing software which is running over Ethernet can be used also across a PCIe® connection between two SX5-STREAM adapter cards, with 20Gbps transfer rate and low latency down to 0.6us. The Super Sockets are available for Linux, Windows, RTX and VXworks. Please contact sales@ekf.com if interested.

Feature Summary

General

- PCI Express® external cabling host side adapter
- PICMG® CompactPCI® Serial (CPCI-S.0) fat pipe slot x8 recommended
- Single Size Eurocard 3U 4HP 100x160mm²
- CompactPCI® Serial backplane connectors P1, P2 for x8 PCI Express® lanes

Cabling

- *PCI Express® External Cabling Specification Revision 2.0*
- Two connectors PCIe® x8 68-pos. (front panel receptacles), iPass™ (Molex)
- Two target systems or devices can be attached simultaneously
- Suitable for remote target systems to be controlled by a CompactPCI® Serial host
- PCIe® Gen2 x8 allows for up to 40Gbps bandwidth on either cabling port
- PCIe® Gen3 x8 allows for up to 64Gbps bandwidth on either cabling port
- Connects to any PCIe® based target system or target device with PCI Express® x8 external cabling interface conforming to the cabling specification rev. 2.0
- Suitable for any PCIe® based target system with PCI Express® x4 external cabling interface via transition cable assembly
- Copper cable assemblies x8 host to x8 target 0.5m to 7m length available
- Copper cable assemblies x8 host to x4 target (transition cables) available
- PCIe® Gen2 active optical cable assemblies (AOC) up to 300m length available (Samtec)
- PCIe® Gen3 active optical cable assemblies (AOC) up to 100m length available (Samtec)
- AOC cable assemblies x8 host to x4 target available (Samtec)
- AOC half cable assemblies available iPass™ to MTP male/female (Samtec)

Special Features

- Gen3 PCI Express® 24-lanes packet switch on-board
- Host system must provide constant frequency clock (CFC) for active optical cables (AOC)
- Spread spectrum clock (SSC) or constant frequency clock (CFC) for copper cables

Feature Summary

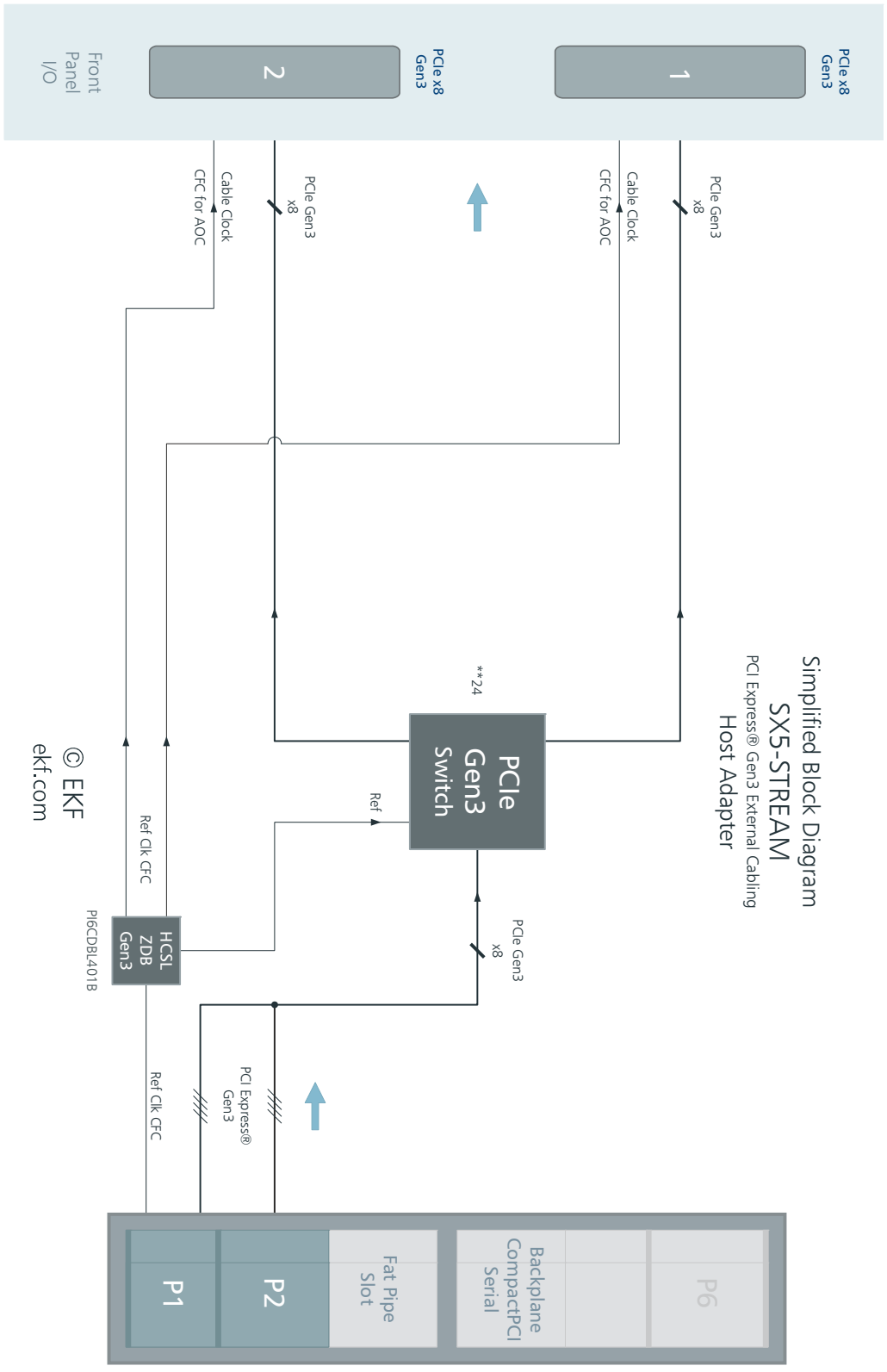
Applications

- For lowest latency at fastest speed connected systems
- Distributed computing - host to target system hierarchy
- Peer to peer computing - special TCP/IP stack (Dolphin) available
- Split-systems, hybrid systems, or system expansion applications
- Direct host to target device connection (e.g. PCIe® based remote NVMe mass storage)
- Mating target device controller board available for CompactPCI® Serial (SXC-LOOP)

Regulatory

- Long term availability
- Designed & manufactured in Germany
- ISO 9001 certified quality management
- Rugged solution (coating, sealing, underfilling on request)
- RoHS compliant
- Commercial and industrial temperature range
- Humidity 5% ... 95% RH non condensing
- Altitude -300m ... +3000m
- Shock 15g 0.33ms, 6g 6ms
- Vibration 1g 5-2000Hz
- MTBF 61.2 years
- EC Regulations EN55022, EN55024, EN60950-1 (UL60950-1/IEC60950-1)

Block Diagram



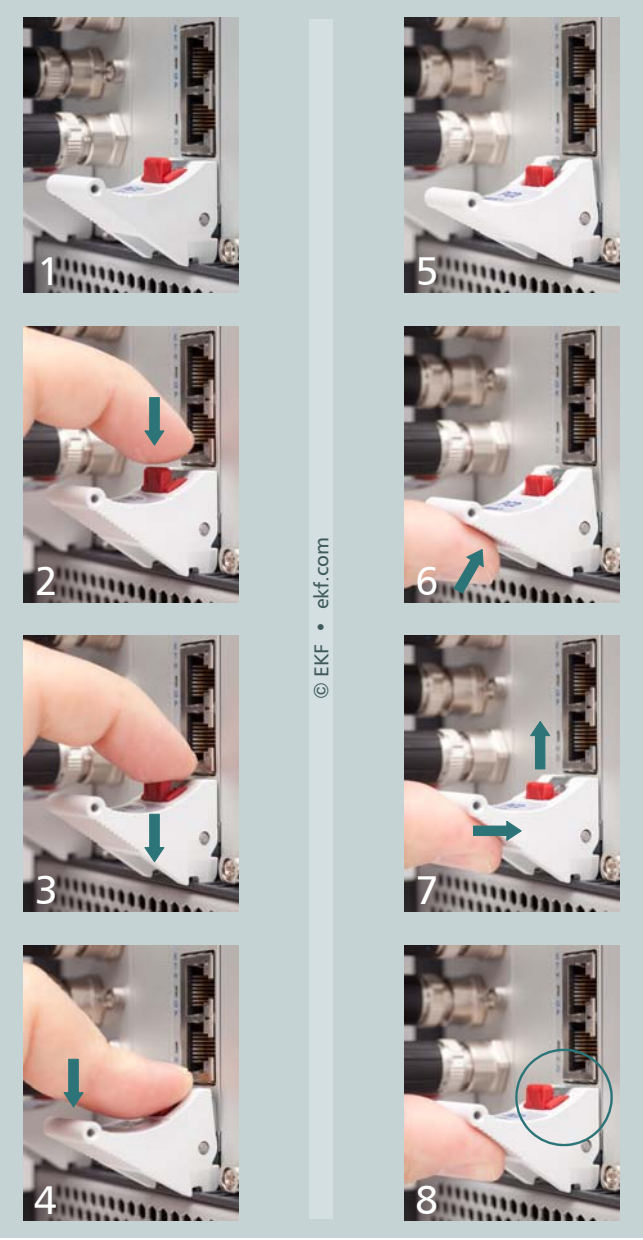
Front Panel

SX5-STREAM

F/P LEDs from top to bottom: cable port 1 - upstream port - cable port 2 - special function
Port LED off - no PCIe® link established
Port LED on - PCIe® Gen3 link established
Port LED blinking 2Hz - PCIe® Gen2 link established
Port LED blinking 1Hz - PCIe® Gen1 link established
Special function LED green - cable port power on
Special function LED blue - remove (I2C software controlled)
Special function LED red - attention (I2C software controlled)

As result of the PCI Express® link training, links are established which are suitable for communication between both sides, i.e. host controller (SX5-STREAM) and target side adapter. The link width can vary between 1 - 2 - 4 - 8, and the data transfer rate may be either 2.5GT/s (Gen1), 5GT/s (Gen2) or 8GT/s (Gen3). With respect to the SXC-LOOP target side adapters, connected downstream port LEDs and the upstream port LED should be steady on (indicating Gen3).

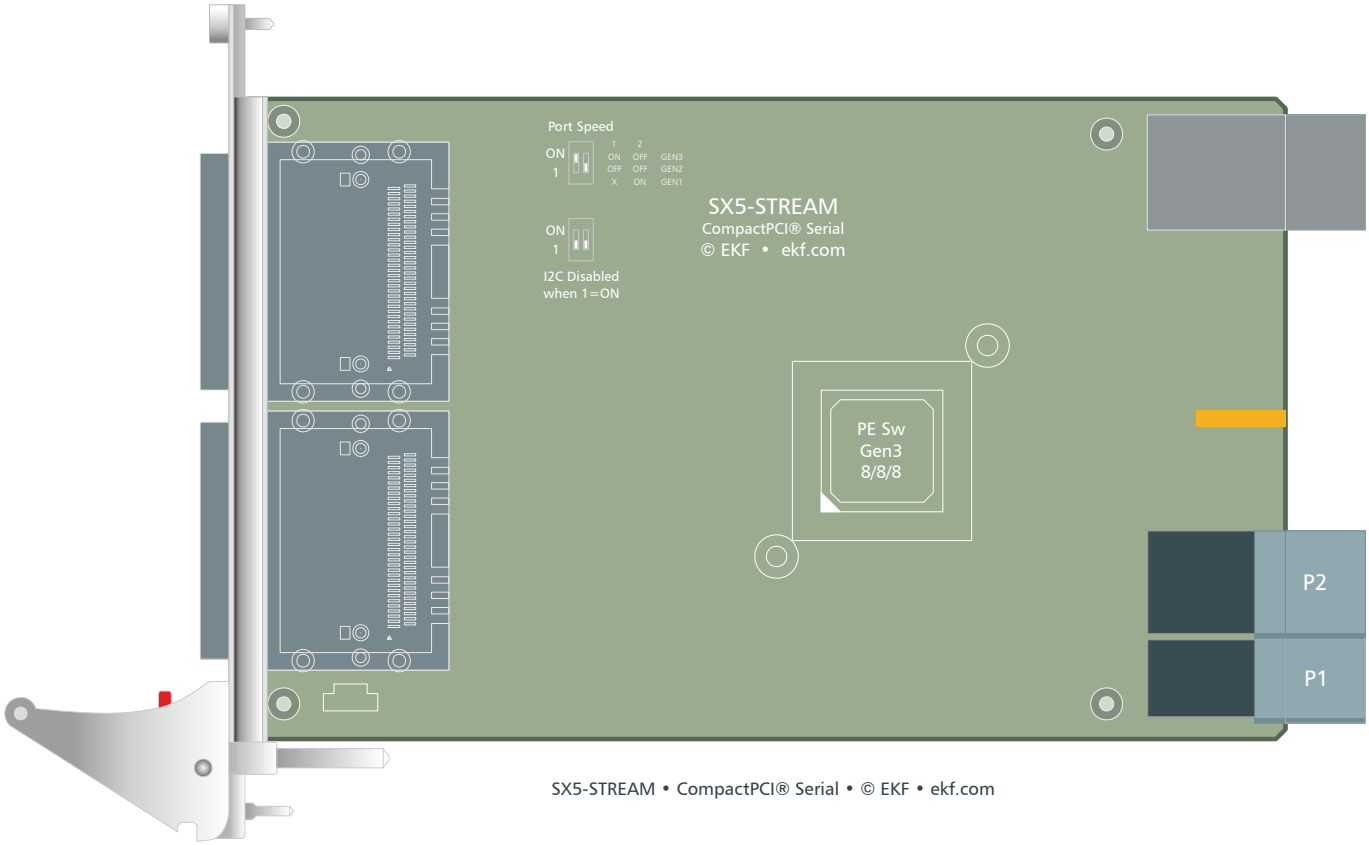
Please note: The front handle is provided with a built-in microswitch, which is used to disable the on-board power circuit when released. Vice versa, the *on-board devices are enabled not before the handle gets locked*. Please refer to the illustration below and make sure that the eject lever has reached its final position for proper board operation, as shown in picture 8. A gentle click should be audible, when the red actuator pin moves into its raised position, indicating that the board is locked and ready for use.



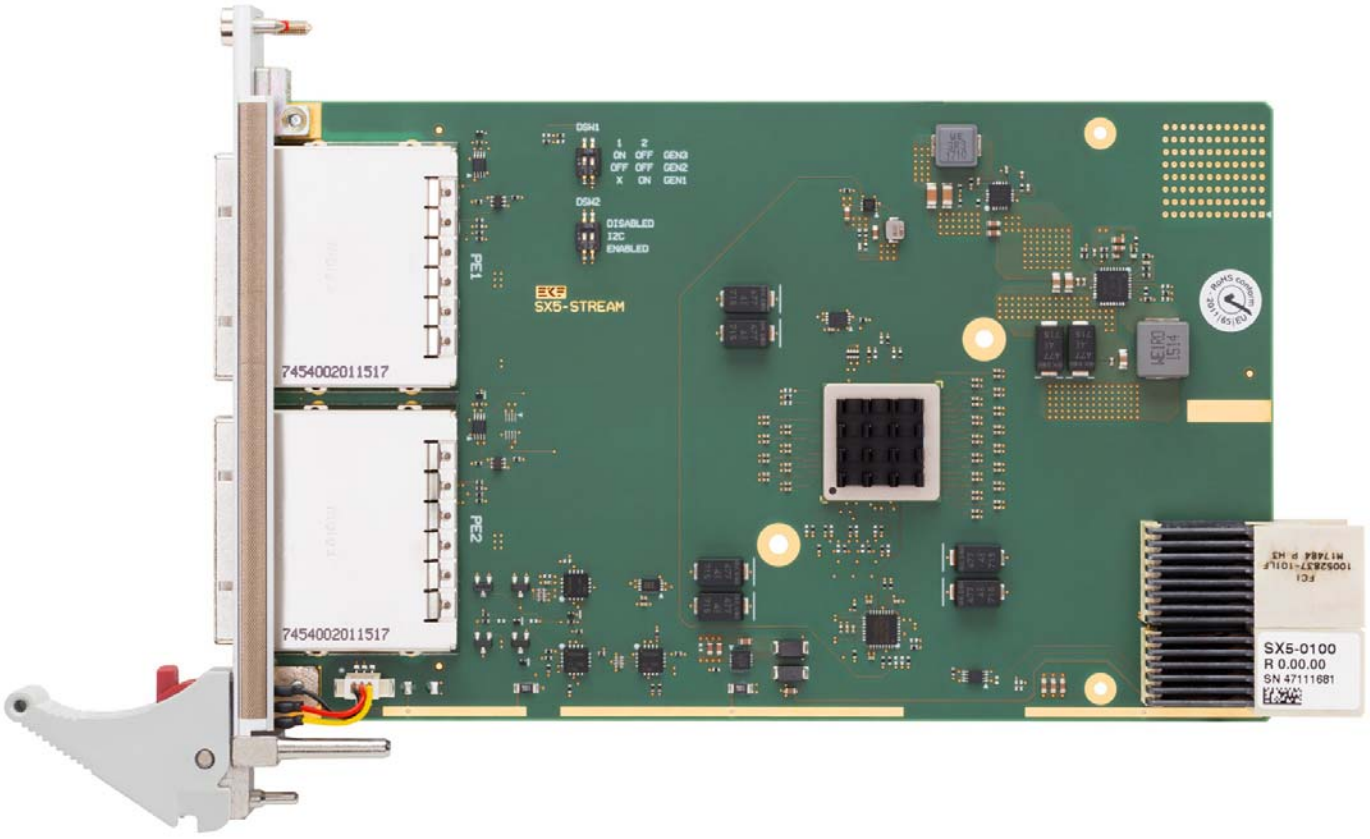
1 - 4: remove board
5 - 8: install board

1 & 8: on-board power enabled
2-7: on-board power disabled

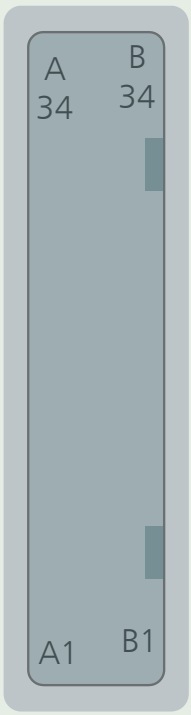
Component Assembly



SX5-STREAM • CompactPCI® Serial • © EKF • ekf.com



PCIe® x8 Cable Connectors



Part #255.3.4.068.00 & 255.3.4.168.00
draft - do not scale • © EKF • ekf.com

Front Panel Connectors PCIe® x8 Pin Numbers A1-17, B1-17 EKF Parts #255.3.4.068.00 (Receptacle) & 255.3.4.168.00 (Guide Frame)			
GND	A1	B1	GND
PETp0	A2	B2	PERp0
PETn0	A3	B3	PERn0
GND	A4	B4	GND
PETp1	A5	B5	PERp1
PETn1	A6	B6	PERn1
GND	A7	B7	GND
PETp2	A8	B8	PERp2
PETn2	A9	B9	PERn2
GND	A10	B10	GND
PETp3	A11	B11	PERp3
PETn3	A12	B12	PERn3
GND	A13	B13	GND
CREFCLKp	A14	B14	PWR +3.3V
CREFCLKn	A15	B15	PWR +3.3V
GND	A16	B16	PWR +3.3V
RSVD	A17	B17	PWR_RTN 1)

PWR +3.3V - protected by on-board PolyFuse 1.5A

For signal descriptions please refer to PCI Express External Cabling Specification Rev. 2.0

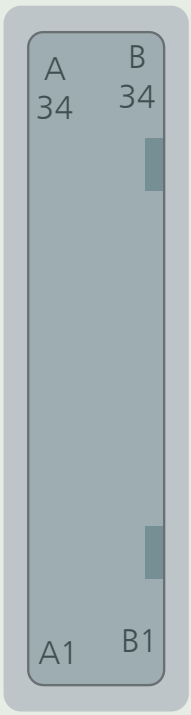
1) connected to GND

Front Panel Connectors PCIe® x8

Pin Numbers A18-34, B18-34

EKF Parts #255.3.4.068.00 (Receptacle) & 255.3.4.168.00 (Guide Frame)

PCIe x8



Part #255.3.4.068.00 & 255.3.4.168.00
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RSVD	A18	B18	PWR_RTN 1)
SB_RTN 2)	A19	B19	PWR_RTN 1)
CPRSNT# 3)	A20	B20	CWAKE# 3)
CPWRON 4)	A21	B21	CPERST# 4)
GND	A22	B22	GND
PETp4	A23	B23	PERp4
PETn4	A24	B24	PERn4
GND	A25	B25	GND
PETp5	A26	B26	PERp5
PETn5	A27	B27	PERn5
GND	A28	B28	GND
PETp6	A29	B29	PERp6
PETn6	A30	B30	PERn6
GND	A31	B31	GND
PETp7	A32	B32	PERp7
PETn7	A33	B33	PERn7
GND	A34	B34	GND

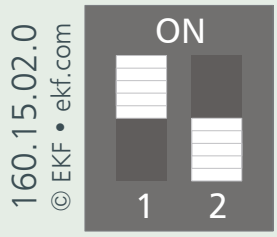
For signal descriptions please refer to PCI Express External Cabling Specification Rev. 2.0

1) connected to GND
2) Sideband reference GND
3) Input from Downstream System (Target) to Upstream System (Host)
4) Output from Upstream System (Host) to Downstream System (Target)

PCIe® Cable Assemblies	
255.3.4.968.0.020	PCIe® x8 external copper cable assembly, 68-circuit, 2m
255.3.4.968.1.020	PCIe® x8 to x4 transition copper cable assembly, 68-circuit, 2m
255.3.4.968.8.0015	PCIe® x8 active optical cable assembly, 1.5m
255.3.4.968.8.0100	PCIe® x8 active optical cable assembly, 10m
255.3.4.968.9.0015	PCIe® x8 to x4 active optical cable assembly, 1.5m
255.3.4.968.9.0100	PCIe® x8 to x4 active optical cable assembly, 10m
other configurations on request	

For distances up to 300m between host system and target system active optical cables (AOC) are recommended. Below 7m (e.g. when connecting racks in a common enclosure) a lower cost copper cable is sufficient. *Please note, that an AOC employs a host side connector and a target side connector, which must not be interchanged*. A PCI Express® copper cable however is configured identical at both endings. While a copper cable is spread spectrum clock (SSC) compatible, the AOC requires a constant frequency clock (CFC) provided by the host. Hence, for proper operation over AOC, setup the host system (BIOS) for CFC. Target systems with a x4 cabling interface can be attached by means of a transition cable x8 to x4 (available with both types, copper and AOC). Particularly helpful for long fiber distances, AOC half cables are available with small MTP™ male or female connectors, to simplify the installation.

Cable Port Setup

On-Board DIP Switch EKF Part 160.15.02.0			
	Maximum Link Speed		
	1	ON	PCIe® Gen 3 (8GTps)
	2	OFF	
	1	OFF	PCIe® Gen 2 (5GTps)
	2	OFF	
	1	X	PCIe® Gen 1 (2.5GTps)
	2	ON	

Settings are common to cable ports and upstream (backplane)

By default, this Dip-switch should be set to 1=on, 2=off for up to PCIe® Gen 3 (8GTps), depending on the link training after reset. For testing purposes the transfer speed of all ports can be limited to a maximum of PCIe® Gen 2 (5GTps), and even PCIe® Gen 1 (2.5GTps).

Power Sequencing

Please understand, that host and connected target hardware should be considered as distributed parts of a common computer system. During BIOS POST the whole system will be explored for PCI Express® devices attached to the PCIe® root complex (processor on host system CPU card). Devices which are not active (powered up) at this time, will not be enumerated by the BIOS and are consequently not available for the operating system afterwards.

Hence a power sequencing procedure must be observed for host system and target system. The rule is simple: Power up the target system(s) before the host system, or simultaneously. If power sequencing conditions cannot be maintained, the host system must be restarted again, until the remote target devices are visible to the host CPU.

If the host system is equipped with an EKF processor board such as the SC3-LARGO or later, a startup time delay up to 12s can be configured via BIOS setup:

Setup (F2): Advanced -> Miscellaneous Configuration -> Execute Delay after Reset

The adjusted delay would be executed before enumeration and initialization of PCI Express® devices, thus permitting a reasonable power up time lag for the remote target system. The delay countdown is indicated by a red blinking LED GP in the CPU card front panel.

P1 CompactPCI® Serial Backplane Connector

P1 CompactPCI® Serial Peripheral Slot Backplane Connector EKF Part #250.3.1206.20.02 • 72 pos. 12x6, 14mm Width												
P1	A	B	C	D	E	F	G	H	I	J	K	L
6	GND	1 PE TX02+	1 PE TX02-	GND	1 PE RX02+	1 PE RX02-	GND	1 PE TX03+	1 PE TX03-	GND	1 PE RX03+	1 PE RX03-
5	1 PE TX00+	1 PE TX00-	GND	1 PE RX00+	1 PE RX00-	GND	1 PE TX01+	1 PE TX01-	GND	1 PE RX01+	1 PE RX01-	GND
4	GND	*1_ USB2+*	*1_ USB2-*	GND	PE_CLK IN+	PE_CLK IN-	GND	*1 SATA TX+*	*1 SATA TX-*	GND	*1 SATA RX+*	*1 SATA RX-*
3	*1 USB3 TX+*	*1 USB3 TX-*	GA0	*1 USB3 RX+*	*1 USB3 RX-*	GA1	*SATA SDI*	*SATA SDO*	GA2	*SATA SCL*	*SATA SL*	GA3
2	GND	I2C SCL	I2C SDA	GND	*RSV*	*RSV*	GND	RST#	WAKE#	GND	PE_ EN#	SYS EN#
1	+12V	STBY	GND	+12V	+12V	GND	+12V	+12V	GND	+12V	+12V	GND

pin positions printed white/italic: not connected

For signal descriptions please refer to PICMG CPCI-S.0 R1.0 CompactPCI® Serial Specification

P2 CompactPCI® Serial Backplane Connector

P2 CompactPCI® Serial Fat Pipe Peripheral Slot Backplane Connector

EKF Part #250.3.1208.20.00 • 96 pos. 12x8, 16mm Width

P2	A	B	C	D	E	F	G	H	I	J	K	L
8	GND	*IO*	*IO*	GND	*IO*	*IO*	GND	*IO*	*IO*	GND	*IO*	*IO*
7	*IO*	*IO*	GND	*IO*	*IO*	GND	*IO*	*IO*	GND	*IO*	*IO*	GND
6	GND	*IO*	*IO*	GND	*IO*	*IO*	GND	*IO*	*IO*	GND	*IO*	*IO*
5	*IO*	*IO*	GND	*IO*	*IO*	GND	*IO*	*IO*	GND	*IO*	*IO*	GND
4	GND	*IO*	*IO*	GND	*IO*	*IO*	GND	*IO*	*IO*	GND	*IO*	*IO*
3	*IO*	*IO*	GND	*IO*	*IO*	GND	*IO*	*IO*	GND	*IO*	*IO*	GND
2	GND	1 PE TX06+	1 PE TX06-	GND	1 PE RX06+	1 PE RX06-	GND	1 PE TX07+	1 PE TX07-	GND	1 PE RX07+	1 PE RX07-
1	1 PE TX04+	1 PE TX04-	GND	1 PE RX04+	1 PE RX04-	GND	1 PE TX05+	1 PE TX05-	GND	1 PE RX05+	1 PE RX05-	GND

pin positions printed italic/white: not connected

For signal descriptions please refer to PICMG CPCI-S.0 R1.0 CompactPCI® Serial Specification

Related Documents

Related Cards Using PCIe® External Cabling	
SX2-SLIDE	CompactPCI® Serial • PCIe® External Cabling x4 • Host Side Dual Gen2 x4 www.ekf.com/s/sx2/sx2.html
SX9-HOWL	CompactPCI® Serial • PCIe External Cabling • Target Side Gen2 x4 • PCIe System Slot Replicator www.ekf.com/s/sx9/sx9.html
SXC-LOOP	CompactPCI® Serial • PCIe External Cabling • Target Side Gen3 x8 • PCIe System Slot Replicator 2 x Gen3 x8 Fat Pipe Slots www.ekf.com/s/sxc/sxc.html
SXS-STRING	CompactPCI® Serial • PCIe External Cabling • Target Side Gen2 x4 • 8-Port SATA RAID www.ekf.com/s/sxs/sxs.html
DC2-STAG	XMC Mezzanine Module • PCIe External Cabling • Host Side Dual Gen2 x4 http://www.ekf.com/d/dpxc/dc2/dc2.html

Reference Documents		
Term	Document	Origin
CompactPCI® Serial	CPCI-S.0	www.picmg.org
PCI Express®	PCI Express® External Cabling Specification 2.0	www.pcisig.com

Ordering Information

Ordering Information
For popular SX5-STREAM SKUs please refer to www.ekf.com/liste/liste_21.html#SX5

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