



Product Information

***CompactPCI<sup>®</sup> Serial*** • SBV-RIO

16 Port USB 3.0 Rear I/O Module

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**Preliminary**

## General

*The CompactPCI® Serial rear I/O module SBV-RIO is a companion board to the CompactPCI® Serial peripheral card SBX-DUB, a 16-port xHCI SuperSpeed host controller. All USB 3.0 channels are passed across the the SBX-DUB backplane connectors P3/P4 to the corresponding SBV-RIO receptacles rJ3/rJ4.*

*The SBV-RIO is equipped with sixteen shrouded pin headers for system internal wiring of the USB ports to internal USB2.0 or USB3.0 devices.*

The 1.25mm pitch headers (Molex PicoBlade™) provide 10 pins each, suitable for the USB 2.0 D+/ D- and USB 3.0 Tx/Rx differential signal pairs, and in addition power and ground.

A DC-DC converter on the SBV-RIO delivers +5V VBUS to the USB pin headers. 1.5A power switches, individually assigned to each USB connector, prevent from potential damage caused by overcurrent or even a short circuit represented by the attached device.

## Feature Summary

### ▶ General

- ▶ PICMG® CompactPCI® Serial standard (CPCI-S.0) rear board (rear I/O module)
- ▶ 3U/4HP form factor 100x80mm<sup>2</sup>
- ▶ CPCI-S backplane connectors rJ2, rJ3, rJ4, proprietary pin assignment matches with SBX-DUB controller card
- ▶ rJ4: 8 x USB 3.0 ports 1.1 - 2.4
- ▶ rJ3: 8 x USB 3.0 ports 3.1 - 4.4
- ▶ rJ2: +12V power to on-board 12V/5V step-down converter ( $V_{BUS}$ )

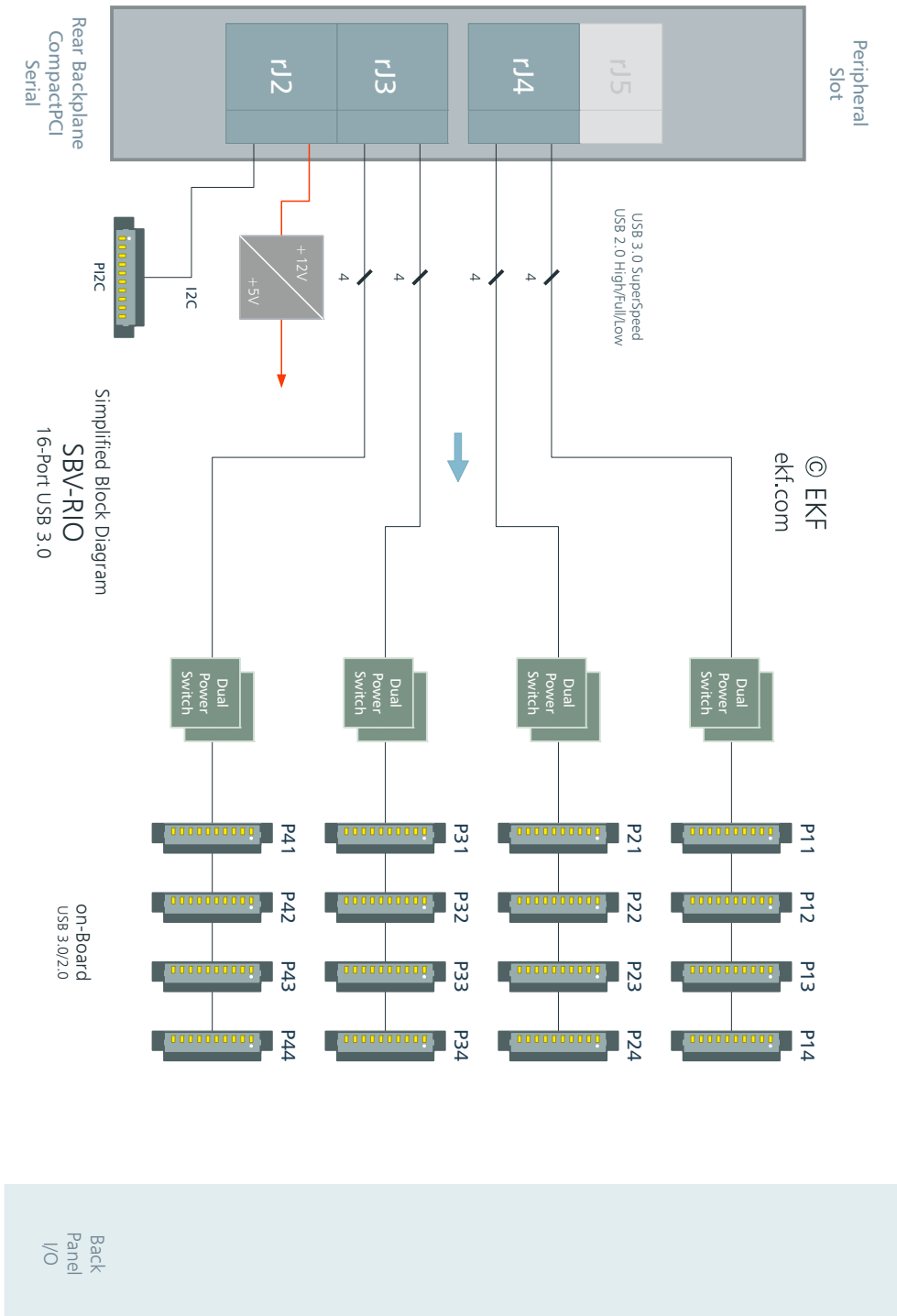
### ▶ USB Interfaces

- ▶ 16 x on-board connectors
- ▶ Single row 10 position 1.25mm pitch pin headers, e.g. Molex PicoBlade™, friction lock
- ▶ USB 3.0 xHCI (eXtensible host controller interface) SuperSpeed
- ▶ USB 2.0 high-speed, full-speed, low-speed
- ▶ ESD protection (TVS diodes)
- ▶ EMC protection (common mode inductors)
- ▶  $V_{BUS}$  (+5V) 1.5A high current power switches assigned to all connectors
- ▶ Rear panel provided with 16 x power good LEDs
- ▶ Custom specific rear I/O module design offered

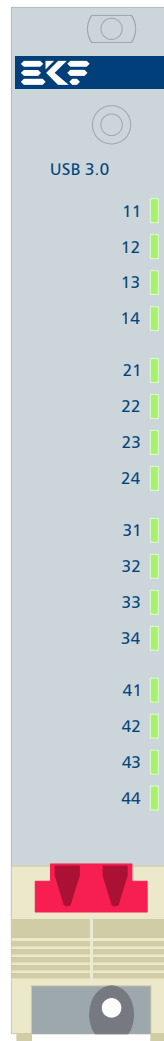
### ▶ Environment & Regulation

- ▶ Designed & manufactured in Germany
- ▶ ISO 9001 certified quality management
- ▶ Long term availability
- ▶ Rugged solution (coating, sealing, underfilling on request)
- ▶ RoHS compliant 2002/95/EC
- ▶ Operating temperature: -40°C to +85°C
- ▶ 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 tbd
- ▶ EC Regulations EN55022, EN55024, EN60950-1 (UL60950-1/IEC60950-1)

Block Diagram



## Rear Panel



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SBV-RIO

### LED Function

Green - USB Power

## USB Connectors

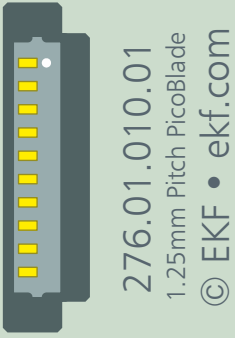
The SBV-RIO is equipped with 16 on-board pin headers, for attachment of system internal USB 2.0 or USB 3.0 devices. Proprietary cable assemblies are required mating with the 1.25mm pitch connectors.

When connected to USB 2.0 compliant devices, only the classic 4 contacts (data pair, +5V and GND) are in use. A four-wire cable (twisted pair with respect to D+/D-) is sufficient for those applications.

USB 3.0 devices in addition communicate via the SuperSpeed differential transmit and receive signal pairs. Due to the high speed data transfer rate, cable assemblies are much more critical compared to USB 2.0. The characteristic twisted pair cable impedance of 90 Ohm must be observed, and both ends of a particular wire pair must exhibit exactly the same length in order to avoid signal skew.

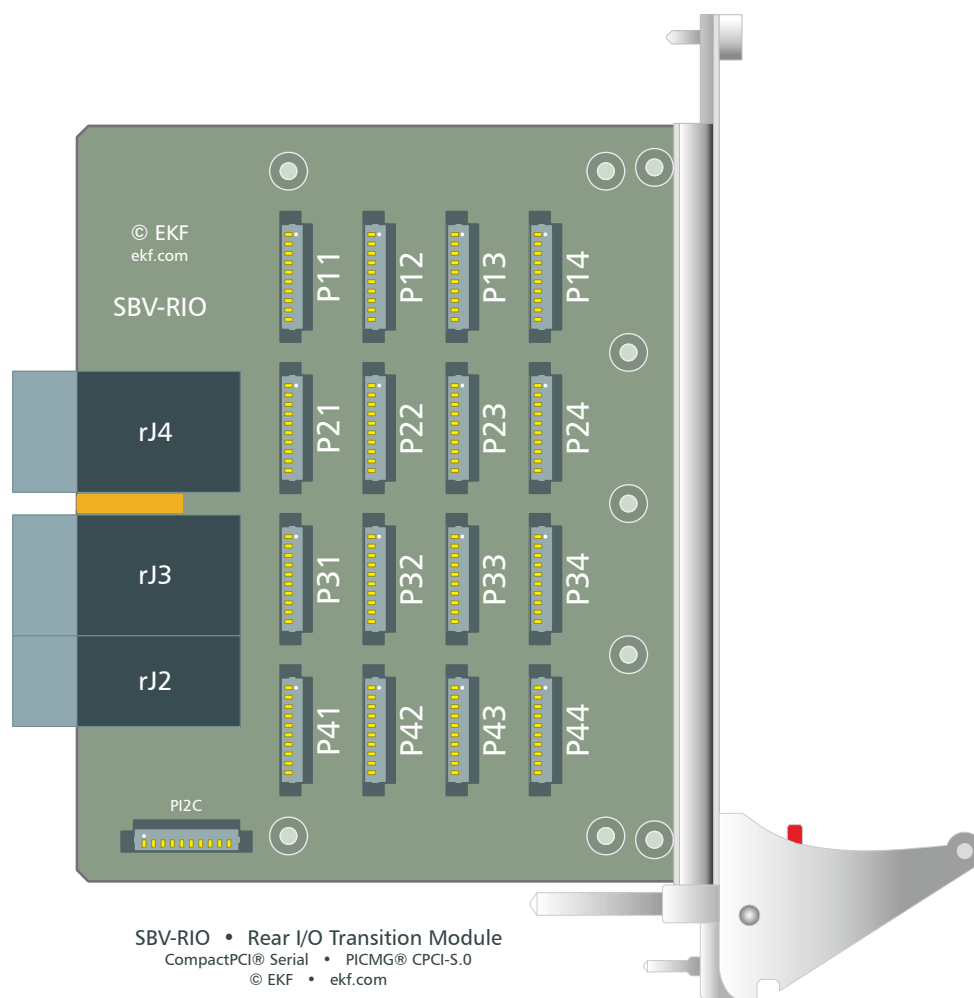
Please note, that the cable assembly will be a critical part of the system. For reliable operation, the cable length should be chosen as short as possible. Sample cable assemblies for the SBV-RIO can be made of standard USB cables, in replacing the type A standard USB plugs by suitable 1.25mm pitch cable connectors. EKF strongly recommends thorough evaluation of any custom made cable harness in the target environment prior to start volume system production.

Back panel LEDs are provided to indicate the power state and initialization status of each USB port.

USB 2.0 3.0 Pin Headers		
Single Row 1 x 10 Pins, 1.25mm Pitch • EKF Part #276.01.010.01		
	1	VBUS +5V 1A max
	2	SS RX-
	3	SS RX+
	4	GND
	5	SS TX-
	6	SS TX+
	7	GND
	8	USB D-
	9	USB D+
	10	GND

Each connector provides +5V (VBUS) for powering external devices. Electronic switches limit the maximum output current of each individual USB connector to a safe level. The maximum current which can be delivered to all USB devices in total must not exceed 8A continuously.

## Component Assembly



The 1.25mm pitch USB pin headers are widely known as PicoBlade™, a Molex brand. The matching cable connector (10 position crimp housing) has the Molex part number 51021-1000, to be used with 28-32 AWG crimp terminals Molex part no. 50058 (reel) or 50079 (bag). Molex offers also a hand crimp tool, part number 63819-0300. Other manufacturers of 1.25mm pitch wire-to-board connectors are e.g. Würth, FCI, Tyco, Harwin or Sullins.

*The connectors are described by Molex as 'friction locked'. Actually be very careful when extracting a receptacle from a pin header, in order not to damage the cable harness or even tear off the SMD pin header from the PCB.*

While the electronic power switches provided on the SBV-RIO are rated at  $>1.5A V_{BUS}$  current, the 1.25mm headers are specified by Molex at 1A/pin. Hence do not attach USB devices which require more than 1A supply permanently.

Please note, that the PicoBlade™ headers and cable housings are not explicitly specified for high speed data rates as required for USB 3.0. Successful SuperSpeed operation therefore depends on the cable assembly and the USB device attached, and cannot be guaranteed by EKF under all conditions.

## CompactPCI® Serial Backplane Connectors

The CompactPCI® Serial specification describes up to 4 backplane connectors rJ2 - rJ5 for 3U rear boards, for user-defined applications. While rJ3 and rJ4 are assigned to 8 USB ports each on the SBV-RIO, rJ2 provides +12V system power, and side band signals (I<sup>2</sup>C ports and GPIO lines) which are not normally used on the SBV-RIO. RJ5 is not engaged on the SBV-RIO.

The pin assignment of rJ2 - rJ4 is proprietary and matches the corresponding USB 3.0 controller board SBX-DUB. The ports are grouped four by four, reflecting the four associated USB 3.0 quad channel controller chips on the SBX-DUB. Please note that four ports 1.1 - 2.1 - 3.1 - 4.1 can be switched optionally to the SBX-DUB front panel. If configured for front I/O, these channels would be not available for usage via the SBV-RIO.

Any USB port is accompanied by two signals for power control. PWRON# (input to the SBV-RIO) enables the particular power switch. OC# (output from the SBV-RIO) indicates an overcurrent situation for a specific USB port. Rear panel LEDs indicate power good for any USB connector.

### rJ4 CompactPCI® Serial Rear Board Backplane Connector

EKF Part #250.3.1208.10.00 • 96 pos. 12x8

rJ4	A	B	C	D	E	F	G	H	I	J	K	L
8	GND	1.2 USB2 D+	1.2 USB2 D-	GND	1.2 USB PWRON#	1.2 USB OC#	GND	1.1 USB2 D+	1.1 USB2 D-	GND	1.1 USB PWRON#	1.1 USB OC#
7	1.2 USB3 TX+	1.2 USB3 TX-	GND	1.2 USB3 RX+	1.2 USB3 RX-	GND	1.1 USB3 TX+	1.1 USB3 TX-	GND	1.1 USB3 RX+	1.1 USB3 RX-	GND
6	GND	1.4 USB2 D+	1.4 USB2 D-	GND	1.4 USB PWRON#	1.4 USB OC#	GND	1.3 USB2 D+	1.3 USB2 D-	GND	1.3 USB PWRON#	1.3 USB OC#
5	1.4 USB3 TX+	1.4 USB3 TX-	GND	1.4 USB3 RX+	1.4 USB3 RX-	GND	1.3 USB3 TX+	1.3 USB3 TX-	GND	1.3 USB3 RX+	1.3 USB3 RX-	GND
4	GND	2.2 USB2 D+	2.2 USB2 D-	GND	2.2 USB PWRON#	2.2 USB OC#	GND	2.1 USB2 D+	2.1 USB2 D-	GND	2.1 USB PWRON#	2.1 USB OC#
3	2.2 USB3 TX+	2.2 USB3 TX-	GND	2.2 USB3 RX+	2.2 USB3 RX-	GND	2.1 USB3 TX+	2.1 USB3 TX-	GND	2.1 USB3 RX+	2.1 USB3 RX-	GND
2	GND	2.4 USB2 D+	2.4 USB2 D-	GND	2.4 USB PWRON#	2.4 USB OC#	GND	2.3 USB2 D+	2.3 USB2 D-	GND	2.3 USB PWRON#	2.3 USB OC#
1	2.4 USB3 TX+	2.4 USB3 TX-	GND	2.4 USB3 RX+	2.4 USB3 RX-	GND	2.3 USB3 TX+	2.3 USB3 TX-	GND	2.3 USB3 RX+	2.3 USB3 RX-	GND





Rear I/O Backplane Slot for Usage w. SBX-DUB

rJ3 CompactPCI® Serial Rear Board Backplane Connector

EKF Part #250.3.1208.10.00 • 96 pos. 12x8

rJ3	A	B	C	D	E	F	G	H	I	J	K	L
8	GND	3.2 USB2 D+	3.2 USB2 D-	GND	3.2 USB PWRON#	3.2 USB OC#	GND	3.1 USB2 D+	3.1 USB2 D-	GND	3.1 USB PWRON#	3.1 USB OC#
7	3.2 USB3 TX+	3.2 USB3 TX-	GND	3.2 USB3 RX+	3.2 USB3 RX-	GND	3.1 USB3 TX+	3.1 USB3 TX-	GND	3.1 USB3 RX+	3.1 USB3 RX-	GND
6	GND	3.4 USB2 D+	3.4 USB2 D-	GND	3.4 USB PWRON#	3.4 USB OC#	GND	3.3 USB2 D+	3.3 USB2 D-	GND	3.3 USB PWRON#	3.3 USB OC#
5	3.4 USB3 TX+	3.4 USB3 TX-	GND	3.4 USB3 RX+	3.4 USB3 RX-	GND	3.3 USB3 TX+	3.3 USB3 TX-	GND	3.3 USB3 RX+	3.3 USB3 RX-	GND
4	GND	4.2 USB2 D+	4.2 USB2 D-	GND	4.2 USB PWRON#	4.2 USB OC#	GND	4.1 USB2 D+	4.1 USB2 D-	GND	4.1 USB PWRON#	4.1 USB OC#
3	4.2 USB3 TX+	4.2 USB3 TX-	GND	4.2 USB3 RX+	4.2 USB3 RX-	GND	4.1 USB3 TX+	4.1 USB3 TX-	GND	4.1 USB3 RX+	4.1 USB3 RX-	GND
2	GND	4.4 USB2 D+	4.4 USB2 D-	GND	4.4 USB PWRON#	4.4 USB OC#	GND	4.3 USB2 D+	4.3 USB2 D-	GND	4.3 USB PWRON#	4.3 USB OC#
1	4.4 USB3 TX+	4.4 USB3 TX-	GND	4.4 USB3 RX+	4.4 USB3 RX-	GND	4.3 USB3 TX+	4.3 USB3 TX-	GND	4.3 USB3 RX+	4.3 USB3 RX-	GND

rJ2 CompactPCI® Serial Peripheral Slot Backplane Connector


EKF Part #250.3.1206.10.00 • 72 pos. 12x6

rJ2	A	B	C	D	E	F	G	H	I	J	K	L
6	GND	3 TUSB GPIO0	3 TUSB GPIO1	GND	3 TUSB GPIO2	3 TUSB GPIO3	GND	4 TUSB GPIO0	4 TUSB GPIO1	GND	4 TUSB GPIO2	4 TUSB GPIO3
5	1 TUSB GPIO0	1 TUSB GPIO1	GND	1 TUSB GPIO2	1 TUSB GPIO3	GND	2 TUSB GPIO0	2 TUSB GPIO1	GND	2 TUSB GPIO2	2 TUSB GPIO3	GND
4	GND	5 I2C Clock	5 I2C Data	GND	6 I2C Clock	6 I2C Data	GND	7 I2C Clock	7 I2C Data	GND	8 I2C Clock	8 I2C Data
3			GND			GND	3 I2C Clock	3 I2C Data	GND	4 I2C Clock	4 I2C Data	GND
2	GND			GND			GND	Reset#		GND		
1	+12V	+12V	GND	+12V	+12V	GND	+12V	+12V	GND	+12V	+12V	GND

pin positions printed white: not connected  
pin positions printed grey: reserved (test)

## I2C Connector (Option)

The SBX-DUB provides I2C connectivity across the backplane connector P2. The SBV-RIO can be optionally equipped with an I2C pin header, which allows the customer to use the corresponding I2C channels for their own purpose within a system.

I2C Pin Header (Option)		
Single Row 1 x 10 Pins, 1.25mm Pitch • EKF Part #276.01.010.01		
 <p>276.01.010.01 1.25mm Pitch PicoBlade © EKF • ekf.com</p>	1	+5V 1Amax
	2	I2C SCL 3 *
	3	I2C SDA 3 *
	4	GND
	5	I2C SCL 4
	6	I2C SDA 4
	7	GND
	8	I2C SCL 5
	9	I2C SDA 5
	10	GND

\* I2C port #3 also in use on the SBV-RIO for board identification (EEPROM at default address 7, GPIO expander at fixed address 5).

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