



Product Information

PC9-TOCCATA • CompactPCI® PlusIO • CPU Card

Intel® Core™ & XEON® W Processors

Preliminary Edition

General

The PC9-TOCCATA is a rich featured high performance 4HP/3U CompactPCI® PlusIO CPU board, equipped with an Intel® 11th Generation XEON® Processor (Tiger Lake H45 platform) for demanding industrial applications.

The PC9-TOCCATA front panel is provided with three 2.5Gbps Ethernet jacks for networking and three 10Gbps USB Type-C receptacles (DisplayPort Alternate Mode enabled) for versatile device and display attachment.

On-board mass-storage solutions are based on low profile mezzanine expansion cards, which accommodate M.2 style PCIe® SSD modules.

The PC9-TOCCATA is equipped with up to 64GB DDR4 ECC RAM. 32GB memory-down are provided for rugged applications, and another 32GB are available via the DDR4 ECC SODIMM socket.

The XEON® and Core™ processors are accompanied by the RM590E mobile PCH, for a maximum of high speed I/O resources (e.g. PCI Express®, SATA, USB). The PC9-TOCCATA backplane connectors comply with the CompactPCI® PlusIO specification, suitable for system expansion with classic CompactPCI® peripheral cards via J1, and in addition high speed I/O such as PCI Express® and 2.5GBASE-T across J2.

Feature Summary

General

- ▶ PICMG® CompactPCI® PlusIO (PICMG® CPCI 2.30) CPU card
- ▶ Form factor single size Eurocard (board dimensions 100x160mm²)
- ▶ Mounting height 3U
- ▶ Front panel width 4HP (8HP/12HP assembly with optional full height mezzanine side card)
- ▶ Front panel I/O connectors for typical system configuration
- ▶ 3 x 10Gbps USB Type-C DP Alt Mode, 3 x 2.5Gbps Ethernet RJ45
- ▶ Backplane communication via CompactPCI® PlusIO connectors
- ▶ J1 - PCI® 32bit 66MHz (PICMG® CPCI 2.0)
- ▶ J2 - PCIe®, GbE, SATA, USB (PICMG® CPCI 2.30)
- ▶ On-board PCIe® mezzanine expansion option for mass storage modules or side cards
- ▶ Side cards and low profile mass storage modules available as COTS and also as custom specific

Feature Summary

Processor Characteristics

- ▶ Intel® 11th Generation Mobile XEON® W or Core™ processor
- ▶ Tiger Lake H45 platform
- ▶ Up to 8-core, up to 3MB cache per core
- ▶ DDR4 3200 ECC RAM
- ▶ Gen 12 graphics, 4 displays up to 8k60
- ▶ TCC/TSN
- ▶ Extended temperature operation (CPU junction temperature range T_j up to -40°C to $+100^{\circ}\text{C}$)
- ▶ Embedded & industrial use conditions
- ▶ 45/35W configurable TDP, 25W TDP
- ▶ BGA soldered for optimum reliability
- ▶ Mobile Intel® Series 500 PCH (RM590E IOTG)

- ▶ Intel® Xeon® W processors (Industrial Use Case *)
- ▶ Up to 8 cores, 24MB cache, 32EU, Intel® vPro™ eligible
- ▶ W-11865MRE | 8c 24M | 4.7GHz Turbo | 2.6GHz Base | 45/35W | 32EU 1350MHz | ECC | TCC/TSN | VPro | T_j -40°C to $+100^{\circ}\text{C}$ | SC9-650D-TOCCATA
- ▶ W-11555MRE | 6c 12M | 4.5GHz Turbo | 2.6GHz Base | 45/35W | 32EU 1350MHz | ECC | TCC/TSN | VPro | T_j -40°C to $+100^{\circ}\text{C}$
- ▶ W-11155MRE | 4c 8M | 4.4GHz Turbo | 2.4GHz Base | 45/35W | 16EU 1250MHz | ECC | TCC/TSN | T_j -40°C to $+100^{\circ}\text{C}$
- ▶ W-11865MLE | 8c 24M | 4.5GHz Turbo | 1.5GHz Base | 25W | 32EU 1350MHz | ECC | TCC/TSN | VPro | T_j 0°C to $+100^{\circ}\text{C}$ | SC9-440D-TOCCATA
- ▶ W-11555MLE | 6c 12M | 4.4GHz Turbo | 1.9GHz Base | 25W | 32EU 1350MHz | ECC | TCC/TSN | VPro | T_j 0°C to $+100^{\circ}\text{C}$
- ▶ W-11155MLE | 4c 8M | 3.1GHz Turbo | 1.8GHz Base | 25W | 16EU 1250MHz | ECC | TCC/TSN | T_j 0°C to $+100^{\circ}\text{C}$ | SC9-340D-TOCCATA
- * disable core/graphics turbo for industrial use condition

- ▶ Intel® Core™ processors (Embedded Use Case)
- ▶ i7-11850HE | 8c 24M | 4.7GHz Turbo | 2.6GHz Base | 45/35W | 32EU 1350MHz | VPro | T_j 0°C to $+100^{\circ}\text{C}$
- ▶ i5-11500HE | 6c 12M | 4.5GHz Turbo | 2.6GHz Base | 45/35W | 32EU 1350MHz | VPro | T_j 0°C to $+100^{\circ}\text{C}$
- ▶ i3-11100HE | 4c 8M | 4.4GHz Turbo | 2.4GHz Base | 45/35W | 16EU 1250MHz | T_j 0°C to $+100^{\circ}\text{C}$
- ▶ 6600HE | 2c 8M | 2.6GHz | 35W | 16EU 1100MHz | T_j 0°C to $+100^{\circ}\text{C}$ | SC9-140D-TOCCATA
- ▶ 6600HLE | 2c 8M | 2.1GHz | 25W | 16EU 1100MHz | T_j 0°C to $+100^{\circ}\text{C}$

Feature Summary

AI (Artificial Intelligence) Resources

- ▶ DL Boost - set of instructions to accelerate AI workloads
- ▶ AVX512 - Advanced Vector Extensions & VNNI - Vector Neural Network Instructions - X86 instruction set which is designed to accelerate convolutional neural network for INT8 inference, helps accelerate workloads like image recognition
- ▶ GNA - Gaussian & Neural Accelerator - a low-power neural coprocessor for continuous inference at the edge, designated for offloading workloads including but not limited to noise reduction or speech recognition, saves power and frees CPU resources
- ▶ Intel® OpenVINO™ (Open Visual Inference and Neural network Optimization) toolkit 2022 - deploy high-performance, deep learning inference
- ▶ Intel® Edge Software Hub - edge computation software and packages
- ▶ Intel® DevCloud for the Edge - allows you to actively prototype and experiment with AI workloads for computer vision

Firmware

- ▶ Phoenix® UEFI (Unified Extensible Firmware Interface) V2.7
- ▶ Phoenix SCT (SecureCore Technology) Release V4.3.0
- ▶ ACPI V6.1
- ▶ Fully customizable by EKF
- ▶ Secure Boot and Measured Boot supported - meeting all demands as specified by Microsoft®
- ▶ Windows®, Linux and other (RT)OS supported
- ▶ Intel® AMT vPro® supported (disabled by default, must be enabled via BIOS setup)

Main Memory

- ▶ Integrated memory controller up to 64GB DDR4 3200 with hardware ECC *
 - ▶ DDR4 +ECC soldered memory up to 32GB (ultra rugged basic memory)
 - ▶ DDR4 +ECC SO-DIMM memory module socket up to 32GB (memory expansion option)
 - ▶ Total memory encryption
- * ECC with XEON® processor SKUs (industrial use)

Feature Summary

Graphics

- ▶ Integrated X^e Gen 12 graphics engine, 4 displays
- ▶ Up to 32EU
- ▶ Codec support HEVC/SCC/VP9/AV1
- ▶ HDR support power optimized
- ▶ Decode up to 8k60:
 - ▶ 2x 4k60 8b 4:2:0 AVC
 - ▶ 5k60 12b 4:2:2/4:4:4 HEVC/VP9/SCC
 - ▶ 8k60 12b 4:2:0 HEVC/VP9/SCC
 - ▶ 4k60 10b 4:2:0 AV1
- ▶ Encode up to 8k30:
 - ▶ 2x 4k60 8b 4:2:0 AVC
 - ▶ 5k60 10b 4:4:4 HEVC/VP9/SCC
 - ▶ 8k30 10b 4:2:0 HEVC/VP9/SCC
 - ▶ 2x 4k HEVC encode speed
- ▶ Up to 4 displays supported:
 - ▶ 1 Display: 8k60 HDR
 - ▶ 2 Displays: 8k60 SDR or 4k120 HDR + 5k120 HDR
 - ▶ 3 Displays: 4k60 HDR
 - ▶ 4 Displays: 4k60 HDR
- ▶ DisplayPort DP1.4a HBR3
- ▶ Multi-Stream Transport (MST) - display daisy chaining
- ▶ Integrated DP Alt Mode MUX
- ▶ Integrated audio

- ▶ Display front panel options:
 - ▶ 3 x Type-C connectors for either DisplayPort and USB usage
 - ▶ 4th DisplayPort optional via Type-C connector on low profile mezzanine card S48

Feature Summary

Networking

- ▶ Up to 7 Ethernet networking interfaces in total
- ▶ 3 x Front 2.5GBASE-T RJ45 - 3 x Intel® I226-IT NIC
- ▶ 2.5GBASE-T, 1000BASE-T, 100BASE-TX, 10BASE-T connections
- ▶ RJ45 Front port 1 - Intel® I226-IT, Intel® vPro®/AMT (Wake on LAN)
- ▶ RJ45 Front port 2 - Intel® I226-IT, TCC/TSN capable, PPS/PPM
- ▶ RJ45 Front port 3 - Intel® I226-IT, TCC/TSN capable
- ▶ Integrated TCC/TSN controller for front ports 2 & 3 (RM590E PCH) - Real Time networking
- ▶ TSN Precision time protocol (Time-Sensitive-Networking) as required e.g. for OPC UA and OpenAvnu
- ▶ Enables ultra-reliable low-latency communication (URLLC)
- ▶ Intel® Time Coordinated Computing (Intel® TCC) for time synchronisation and timeliness
- ▶ Option 2 x 2.5GBASE-T J2 backplane w. P82-GBE low profile mezzanine module - 2 x Intel® I226-IT NIC
- ▶ Option 4 x 2.5GBASE-T RJ45 front w. SCJ-VEENA side card - 4 x Intel® I226-IT NIC (8HP assembly)
- ▶ Option 4 x 1000BASE-T M12-X front w. SCL-RHYTHM side card - 4 x Intel® I210-IT NIC (8HP assembly)
- ▶ Option RJ45 port 1 jack (vPro®/AMT) replacement by M12-X connector w. S02-M12 mezzanine (8HP)

Security

- ▶ Total memory encryption - hardware based
- ▶ ROP attack prevention - hardware based protection against browser malware attacks
- ▶ Advanced Crypto Key protection - hardware based
- ▶ Trusted Platform Module SLM9670
- ▶ TPM 2.0 for highest level of certified platform protection
- ▶ Infineon Optiga™ cryptographic processor
- ▶ Conforming to TCG 2.0 specification

Front Panel I/O (4HP)

- ▶ 3 x 2.5Gbps Ethernet RJ45 receptacles
- ▶ 2.5GBASE-T, 1000BASE-T, 100BASE-TX, 10BASE-T
- ▶ Intel® vPro®/AMT supported (port 1 RJ45 connector - must be enabled via BIOS settings)
- ▶ Port 2 & 3 TCC/TSN enabled
- ▶ 3 x 10Gbps USB Type-C receptacles DisplayPort Alt Mode
- ▶ USB and/or DisplayPort usage
- ▶ USB 3.2 Gen 2x1 (formerly USB 3.1 Gen2) SuperSpeed+ 10Gbps
- ▶ USB-PD downstream facing ports 5V/3A (Infineon CYPD5225 EZ-PD™ CCG5 controller)
- ▶ DisplayPort 1.4
- ▶ Additional Type-C front I/O with low profile mezzanine e.g. S48

Feature Summary

Front Panel I/O (8/12HP)

- ▶ Variety of side cards available, common front panel 8HP/12HP with CPU card
- ▶ For backplanes with system slot right aligned
- ▶ Various I/O ports e.g. UART, Audio, RJ45 Ethernet, M12-X Ethernet, Wireless (SMA)
- ▶ Custom specific front panel and side card design

CompactPCI® (J1) Backplane Compliance

- ▶ PICMG® CompactPCI® Classic 32bit 33/66MHz
- ▶ Up to seven CompactPCI® peripheral cards on a classic style or hybrid backplane

CompactPCI® PlusIO (J2) Backplane Resources

- ▶ PICMG® CompactPCI® PlusIO CPU card (system slot controller)
- ▶ 4 x PCIe® based CompactPCI® Serial peripheral cards on a hybrid backplane, Gen1/2/3 x1
- ▶ Suitable also for PCIe® based rear I/O module (4 x 1, 1 x 4 configurable)
- ▶ Option 2 x 2.5GBASE-T Gigabit Ethernet via P82-GBE low profile mezzanine module (I226-IT NICs)
- ▶ 4 x SATA 6G
- ▶ 4 x USB2

Local Expansion & Mezzanine Mass Storage Options

- ▶ Mezzanine side card connectors for optional local expansion
- ▶ Low profile mezzanine modules available (4HP front panel)
- ▶ Side cards available (8HP F/P assembly)
- ▶ HSE1 - PCIe Gen4 x4, 1 x USB3 10Gbps & 2 x USB2
- ▶ HSE2 - PCIe Gen3 x4 (configurable also 2x2, 4x1), 4th DisplayPort
- ▶ EXP - Legacy interface (eSPI, Audio, UART, I2C, GPIO)
- ▶ GBE - 2 x 2.5GBASE-T

- ▶ 4HP Low profile mezzanine module preferred options:
 - ▶ S48-SSD Mezzanine module - 2 x M.2 2280 NVMe SSD sockets, 1 x USB Type-C
 - ▶ P82-GBE Mezzanine module - 1 x M.2 2280 NVMe, 2 x backplane (J2) 2.5GbE ports
 - ▶ Custom specific storage & I/O module design

- ▶ 8HP Mezzanine side card options:
 - ▶ SCJ-VEENA Short side card - M.2 2280 NVMe SSD socket, 4 x 2.5GbE NIC, front panel RJ45, USB3
 - ▶ SCL-RHYTHM Short side card - M.2 2280 NVMe SSD socket, 4 x GbE NIC, front panel M12-X
 - ▶ PCZ-NVM Dual M.2 NVMe SSD, quad UART
 - ▶ S02-M12 - RJ45 port 1 (vPro®/AMT) replacement by M12-X connector (top or bottom mount)
 - ▶ Custom specific side card design - I/O and storage

Feature Summary

Applications

- ▶ High performance industrial and embedded computing, for x86 based software
- ▶ Automation, process control, test systems, demanding applications
- ▶ Edge computing, AI

Environmental & Regulatory

- ▶ Designed & manufactured in Germany
- ▶ ISO 9001 certified quality management
- ▶ Long term availability
- ▶ Rugged solution
- ▶ Coating, sealing, underfilling on request
- ▶ Lifetime application support
- ▶ RoHS compliant
- ▶ Operating temperature 0°C to +70°C
- ▶ Operating temperature -40°C to +85°C (industrial temperature range) on request
- ▶ 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 years (MIL-HDBK-217F, SN29500 @+40°C)
- ▶ EC Regulatory EN55035, EN55032, EN62368-1 (CE)

all items are subject to changes w/o further notice



Related Information

PC9-TOCCATA Home	https://www.ekf.com/p/pc9/pc9.html
CompactPCI® PlusIO Home	https://www.ekf.com/p/plus.html

Related Mezzanine Modules and Side Cards

S48-SSD Low Profile Mezzanine	https://www.ekf.com/s/s48/s48.html
SCJ-VEENA Mezzanine Side Card	https://www.ekf.com/s/scj/scj.html
SCL-RHYTHM Mezzanine Side Card	https://www.ekf.com/s/scl/scl.html
P82-GBE Low Profile Mezzanine	https://www.ekf.com/p/p82/p82.html
PCZ-NVM Mezzanine Side Card	https://www.ekf.com/p/pcz/pcz.html
S02-M12 Mezzanine Side Card	https://www.ekf.com/s/s02/s02.html

Ordering Information

For popular PC9-TOCCATA SKUs please contact sales@ekf.com

CompactPCI® PlusIO

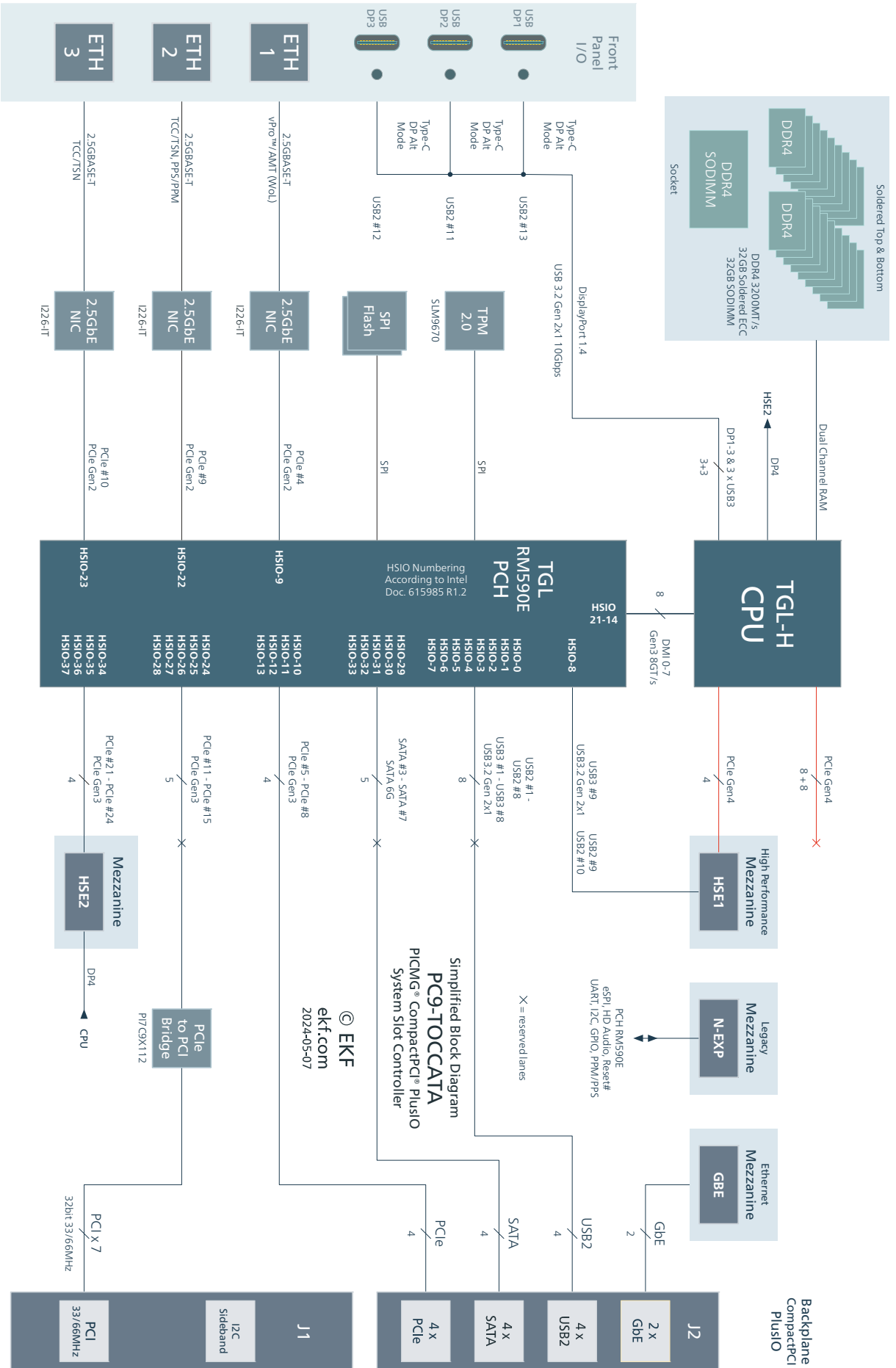
CompactPCI® PlusIO (PICMG® 2.30) is an enhancement to CompactPCI® Classic (PICMG® 2.0) which enables system expansion and rear I/O across J2. High speed signal lines (PCI Express®, SATA, Gigabit Ethernet and USB) are passed from the PC9-TOCCATA via the J2 connector to the backplane, for usage either with a PlusIO rear I/O transition module, or CompactPCI® Serial peripheral cards.

CompactPCI® Serial (PICMG® CPCIS.0) defines a card slot based on PCI Express®, SATA, Gigabit Ethernet and USB serial data lines. On a hybrid backplane, both peripheral card styles CompactPCI® and CompactPCI® Serial can reside, with the PC9-TOCCATA in the middle as system controller for both backplane segments, combining the technologies of both worlds.

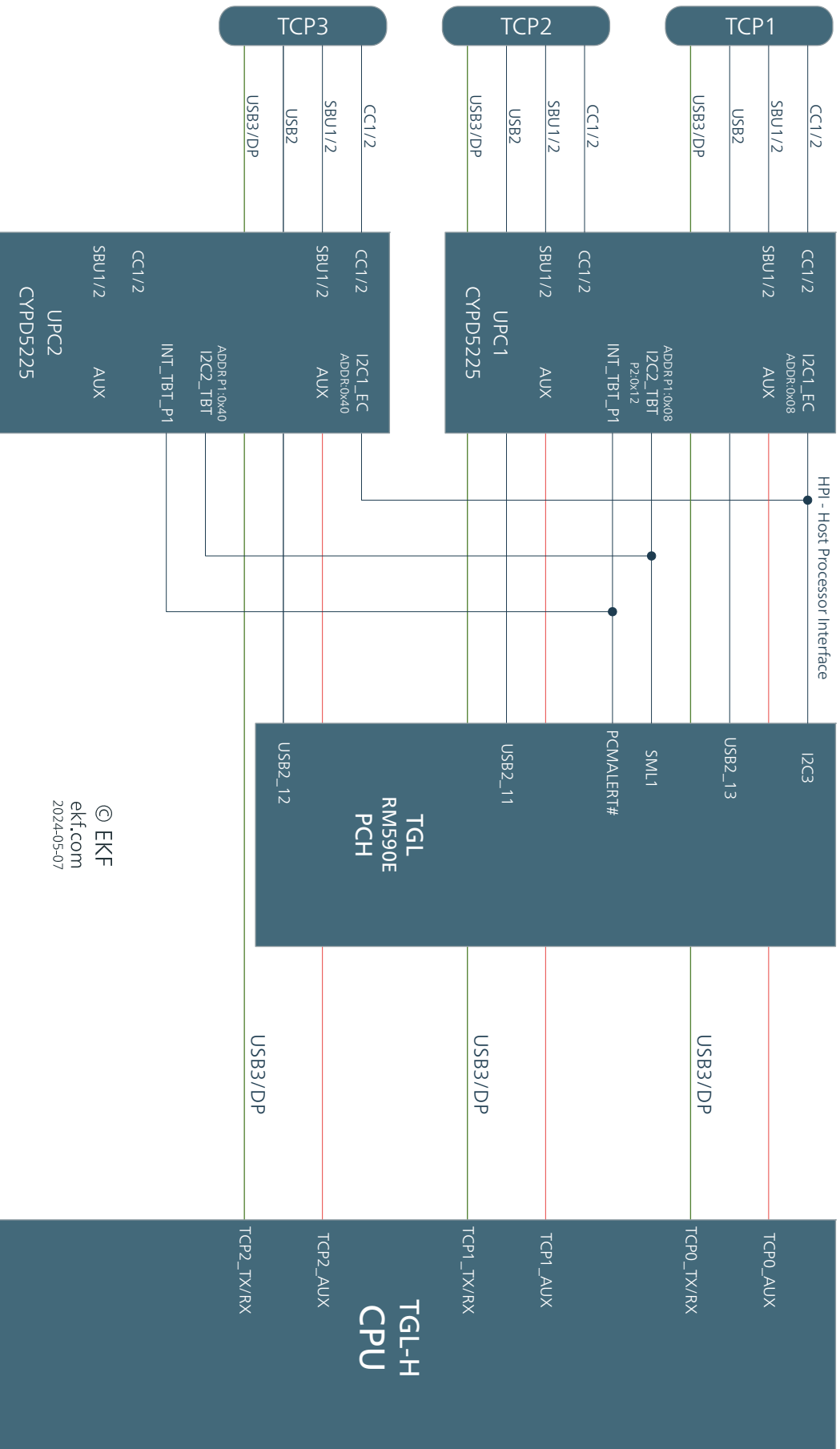


SRP-BLUBOXX

Block Diagram

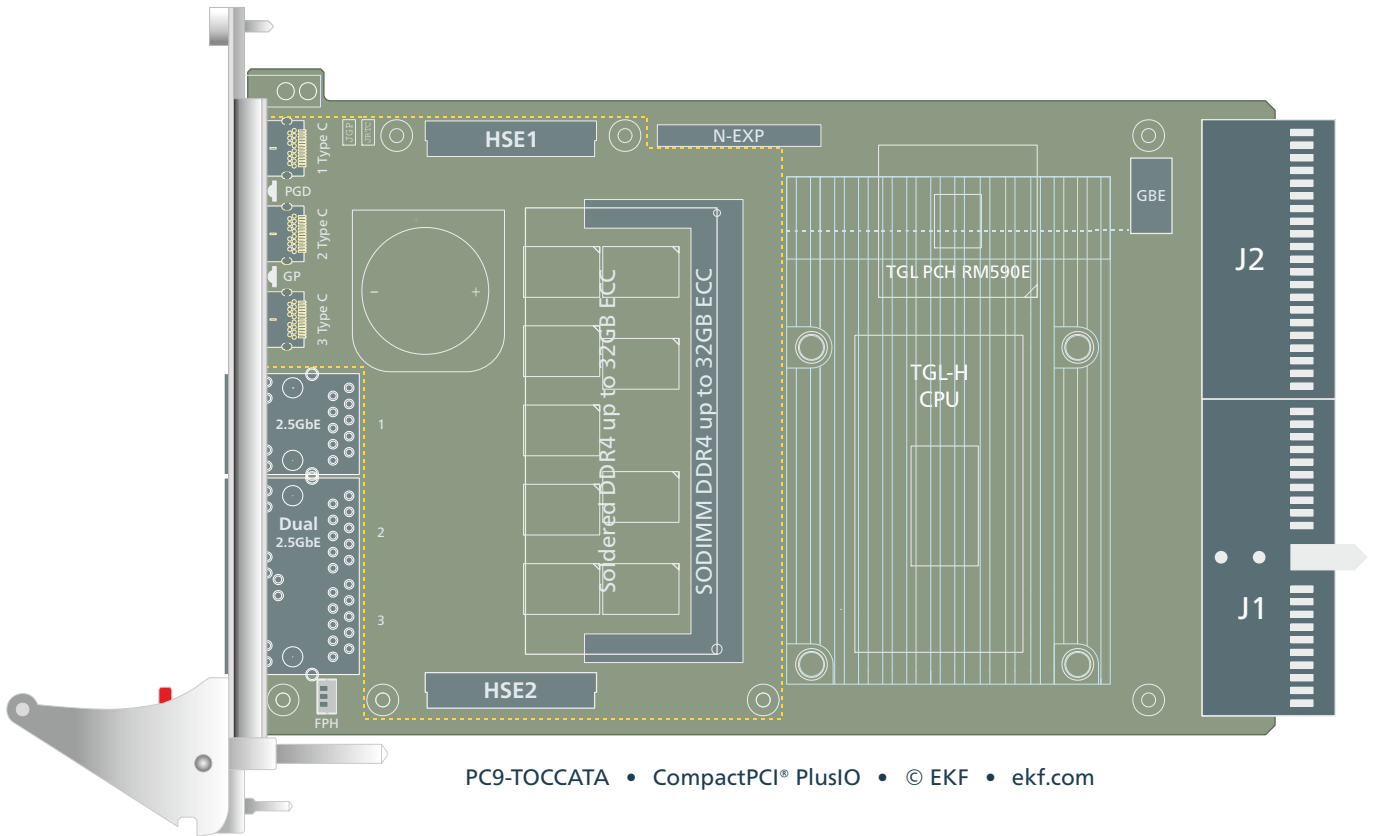


PC9-TOCCATA TCSS (Type-C Subsystem)



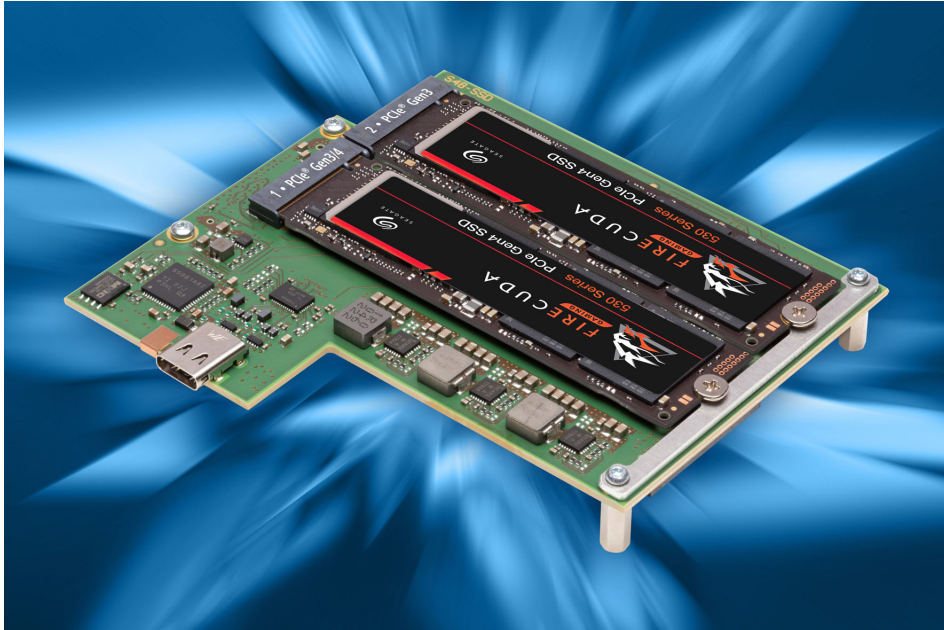
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Connector Alignment



PC9-TOCCATA • CompactPCI® PlusIO • © EKF • ekf.com

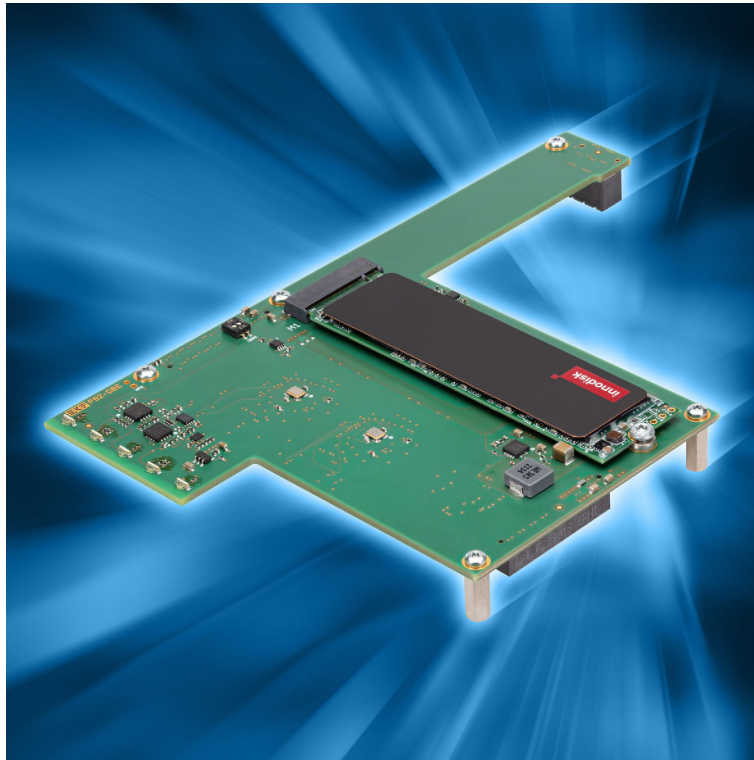
Low Profile Mezzanine Mass Storage 4HP



S48-SSD • Dual M.2 NVMe SSD Low Profile Mezzanine



4HP Assembly • CPU Card w. S48-SSD

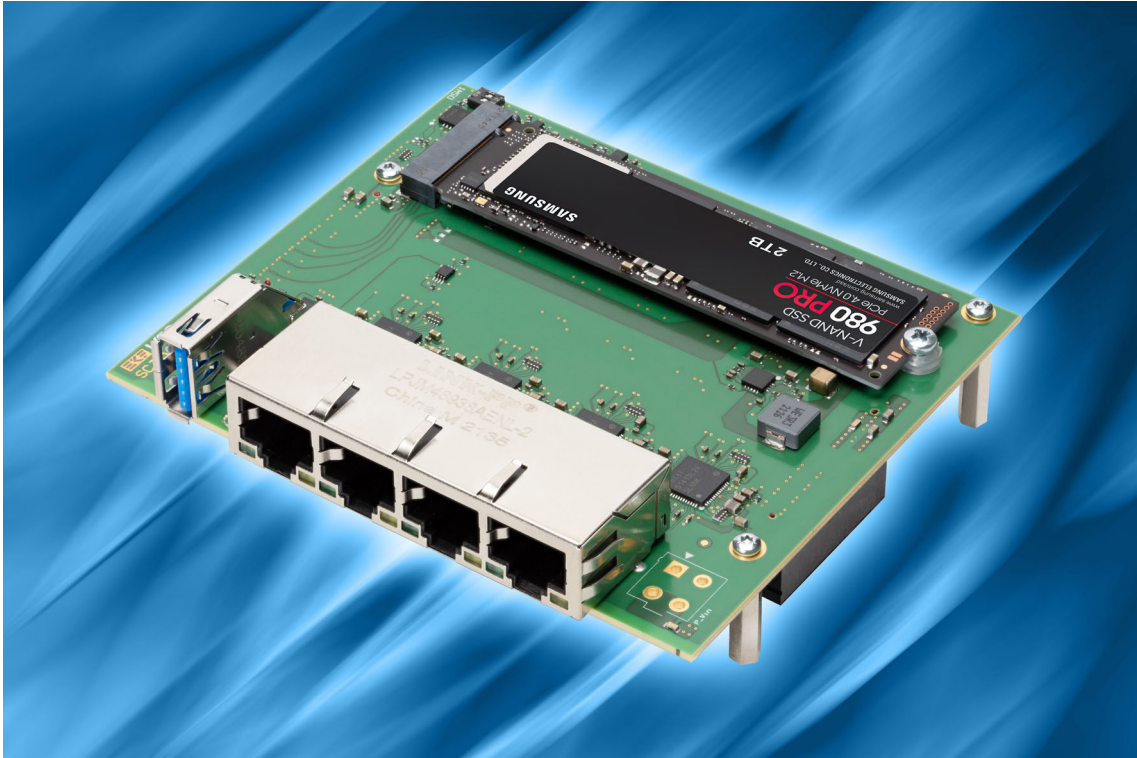


P82-GBE



4HP Assembly • CPU Card w. P82-GBE

Side Card Assemblies 8/12HP



SCJ-VEENA • Quad 2.5GBASE-T NICs & M.2 NVMe

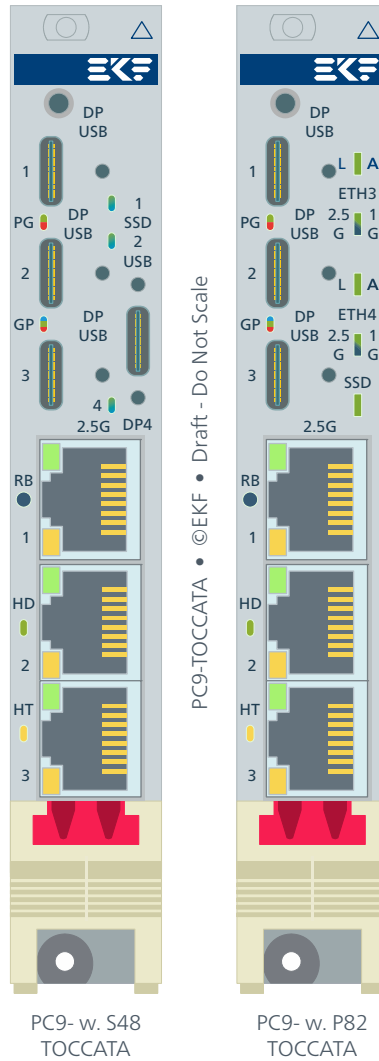


8HP Assembly • CPU Card w. SCJ-VEENA



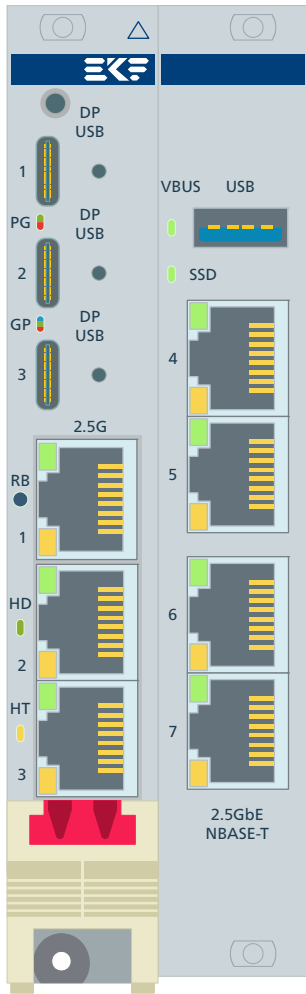
12HP Assembly w. PCZ-NVM & C32-FIO

Front Panel 4HP



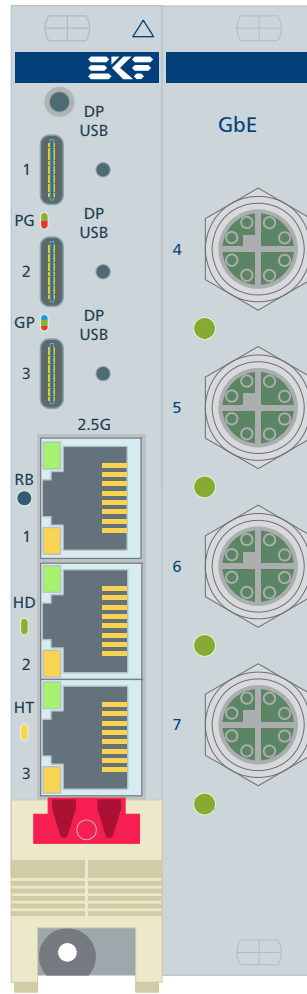
The PC9-TOCCATA requires a mass storage enabled mezzanine module for stand-alone operation. In a system with a PCIe® or SATA based CompactPCI® Serial peripheral card equipped with an SSD this would be not mandatory, although recommended.

Front Panel 8HP



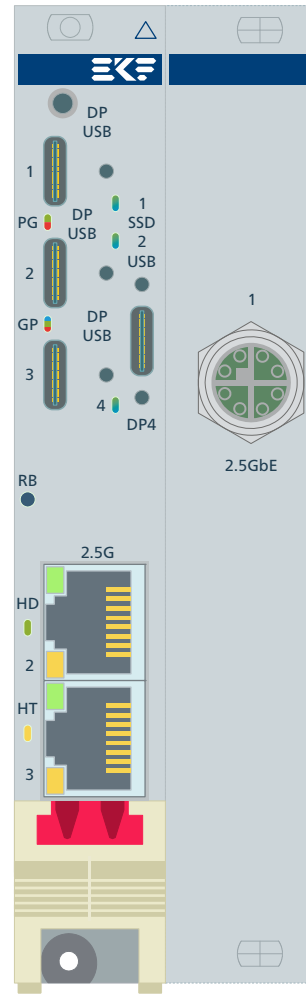
PC9-TOCCATA

SCJR1-VEENA



PC9-TOCCATA

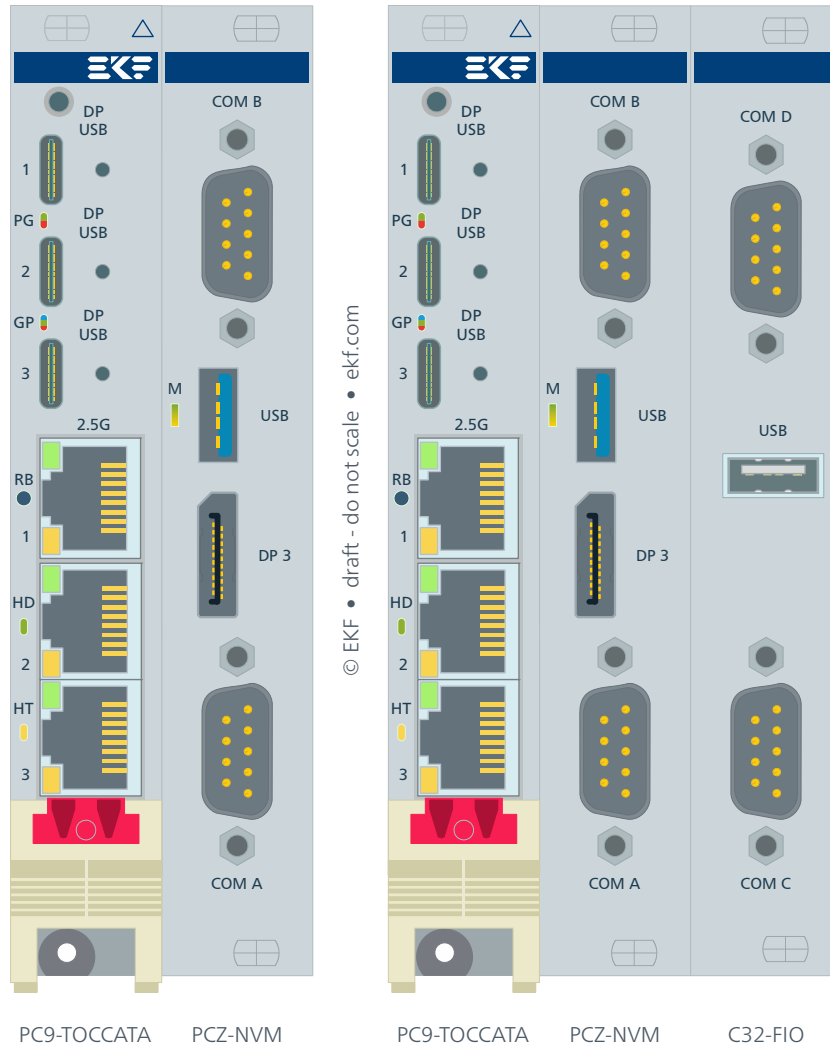
SCL-RHYTHM



PC9-w. S48 TOCCATA

S02-M12

Front Panel 12HP



PC9-TOCCATA

PCZ-NVM

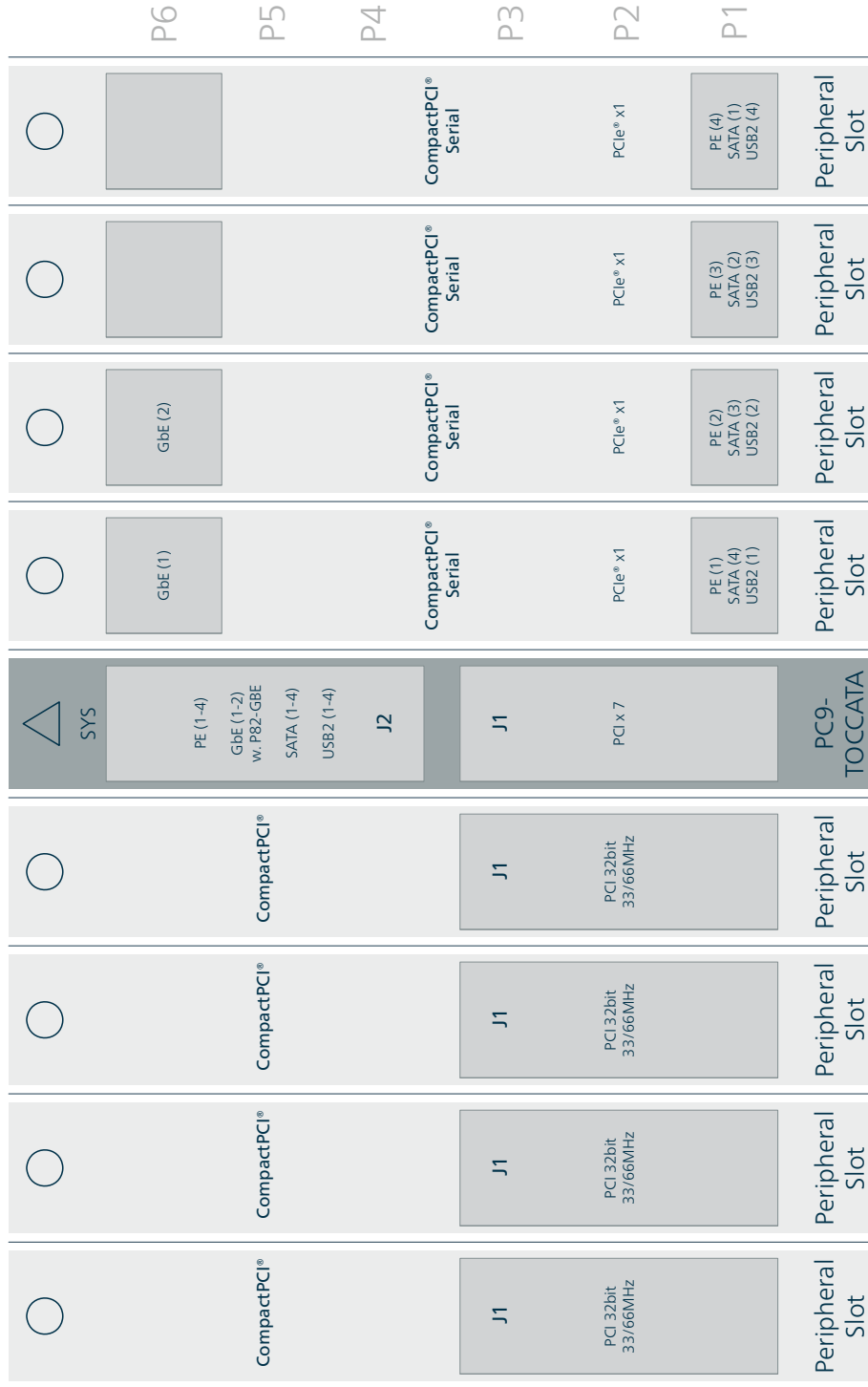
PC9-TOCCATA

PCZ-NVM

C32-FIO

Typical Hybrid Backplanes

PC9-TOCCATA • Resources w. 4+1+4 Slots Hybrid Backplane

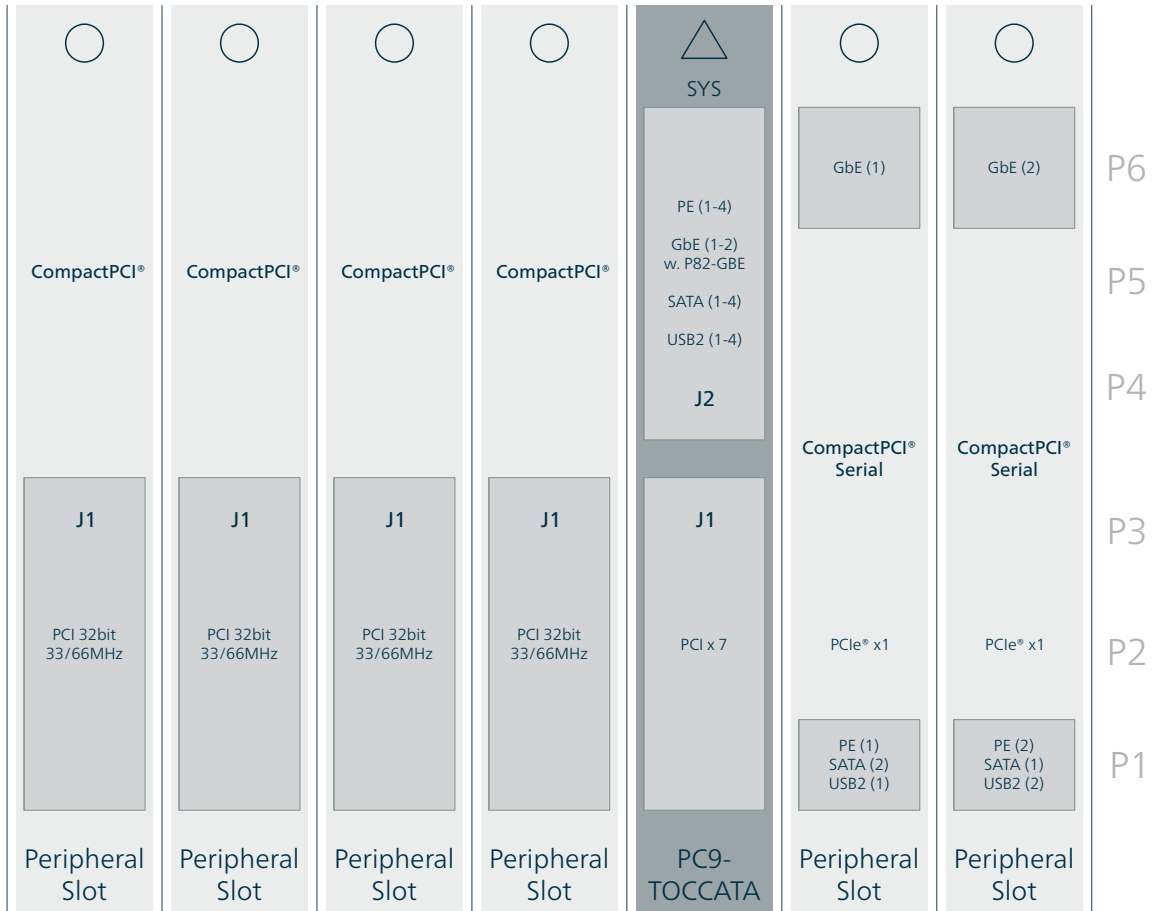


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For 8HP front panel CPU assemblies consider a spare slot right to the system slot

Backplane or RIO Ethernet requires the P82-GbE low profile mezzanine card equipped

PC9-TOCCATA • Resources w. 4+1+2 Slots Hybrid Backplane



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For 8HP front panel CPU assemblies consider a spare slot right to the system slot

Backplane or RIO Ethernet requires the P82-GBE low profile mezzanine card equipped

The components used on the PC9-TOCCATA are capable for PCIe® Gen3 and SATA 6G transfer speed. However, due to the J2/P2 legacy backplane connector construction, the CompactPCI® 2.30 PlusIO specification describes only PCIe® Gen1/2 and SATA 1.5G/3G protocols. Higher operational speed may work in a particular system configuration but cannot be guaranteed therefore.

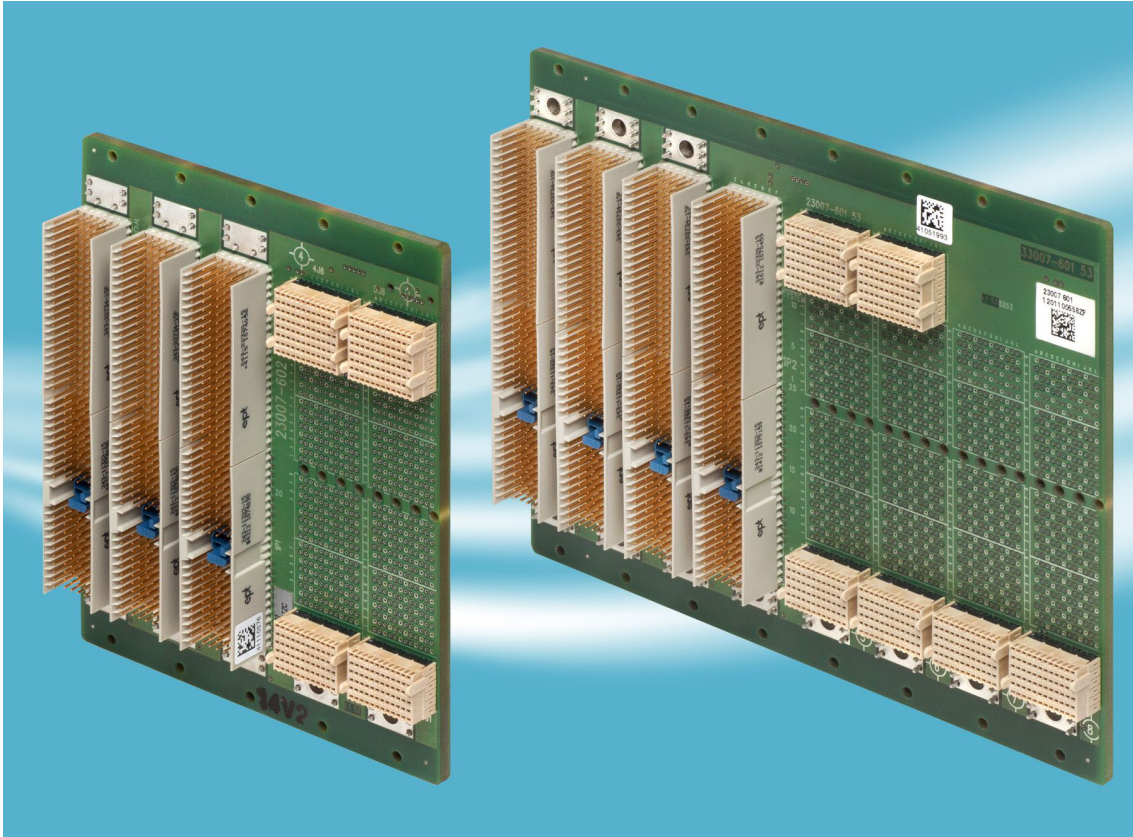


SRP-4401



SRP-3201-BLUBOXX

Backplane Ethernet



On a hybrid backplane the center slot with P1/P2 connectors is reserved for the CompactPCI® PlusIO CPU card (system slot). To the left there are CompactPCI® classic peripheral card slots (32-bit). On the right side CompactPCI® Serial peripheral cards can be plugged. When backplane Ethernet is required, the low profile mezzanine module P82-GBE can be assembled together with the PC9-TOCCATA. Then, adjacent to the CPU card slot, two CompactPCI® Serial slots would be Gigabit Ethernet enabled, via their J6 backplane connectors.

Rear I/O

The I/O resources provided by the PC9-TOCCATA backplane connector J2 can also be used for a rear I/O module. EKF can offer custom specific RIO design - please contact sales@ekf.de.



Sample PlusIO RIO Module

Industrial Computers Made in Germany
boards. systems. solutions.



Beyond All Limits:
EKF High Performance Embedded

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