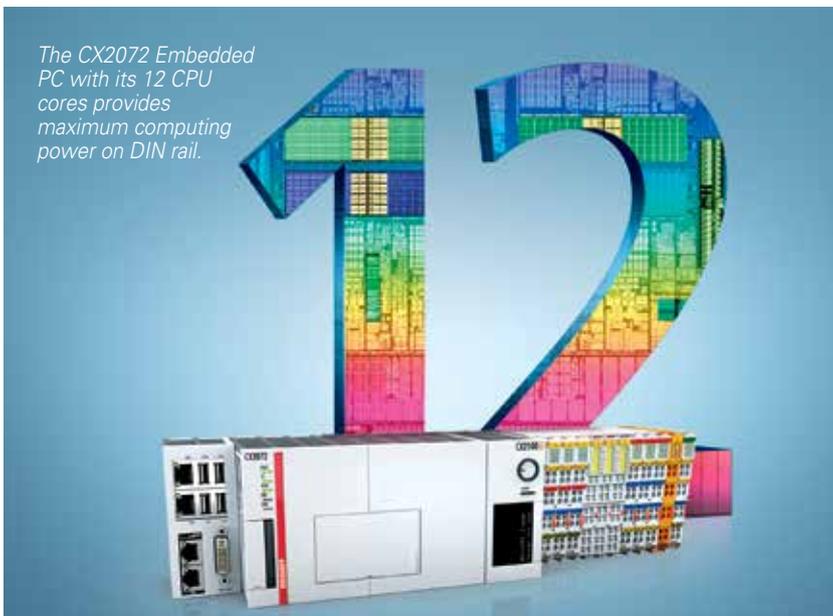


The CX2072 Embedded PC with its 12 CPU cores provides maximum computing power on DIN rail.



# Performance Leap for Embedded PCs

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In time for the 30<sup>th</sup> anniversary of PC-based control technology from Beckhoff, the company presents a new generation of Industrial PC devices in the high-end performance segment.

These devices are an extension of the CX series Embedded PCs for DIN rail mounting with directly connected I/O components. The product expansion comprises three new controller versions.

Table 1: Controllers differ in terms of the CPU.

CX Type	CPU	Cores	LL Cache	Clock	RAM
CX2042	XEON D-1529	4	6 MB	1,3 GHz	8 GB DDR4
CX2062	XEON D-1539	8	12 MB	1,6 GHz	16 GB DDR4
CX2072	XEON D-1559	12	18 MB	1,5 GHz	32 GB DDR4

As Table 1 shows, the controllers differ in terms of the CPU: These are processors of type Intel Xeon D, each with 4, 8 or 12 CPU cores in the fifth Intel Core microarchitecture generation, manufactured using 14 nm process technology.

Intel classes its Xeon D-type CPUs as 'mid-range server' CPUs. This explains how they constitute the link between client CPUs and genuine Xeon server CPUs, which – unlike Xeon D CPUs – can be used to set up multiple CPU systems with NUMA (Non-Uniform Memory Access) architecture.

In contrast, Xeon D processors function independently, offering the advantage of a simpler system design, as they already incorporate another chip that is typically required – the Platform Controller Hub (PCH). In other words, these are so-called SoC variants (System-on-a-Chip).

The end result is that these chips enable the design of extremely compact industrial motherboards, saving space in the control cabinets of end users. For example, the motherboard developed by this company for the CX20x2 series measures only 8,5 cm x 20,5 cm.

Despite its small dimensions, this Embedded PC series incorporates two independent 1-Gbit Ethernet MAC/PHYs (instead of internal 10-Gbit Ethernet ports, which are still quite rare in automation) which are compatible with, or even use the same chips as, the Ethernet controllers in the CX2000 Embedded PCs.

## Embedded PCs enter a new dimension of performance

Where conventional Core i7 CPUs reach the limit of their performance class with 4 cores per CPU, all Intel Xeon D CPUs offer up to 16 cores. Since the 16-core variant is not currently available as a thermally stable eTemp SKU, it has not been included in the newly extended CX series. This is because these new devices are intended to withstand operation in ambient temperatures from -25°C C to +60°C.

However, the 4, 8 and 12 cores used in the new device series offer sufficient processor power and parallelism for extremely demanding automation tasks. TwinCAT 3 automation software makes it possible to distribute individual tasks of the control process to the various processor cores, so that the CPU load can be planned in fine detail for a number of cores. When used together with EtherCAT as the high-performance fieldbus, it is possible to achieve task cycle times of 100 µs on the individual cores.

Another important aspect of the increased performance is the separate graphics card. Since Intel Xeon CPUs do not incorporate graphic cards, the CX20x2 is provided with an integrated graphic card equipped with a separate 2 GB of RAM. Separating the CPU RAM from the GPU RAM prevents the two computing units from interfering with one another.

The high power density from the CPU and GPU being located so closely together makes it necessary to incorporate a fan for heat removal. However, the fan speed is regulated and can be continuously monitored by TwinCAT PLC. Thus, any irregular behavior can be detected early on, allowing a scheduled replacement of the fan if necessary. This kind of service is very easy for the user to accomplish because the fan is simply plugged in without cables.

## Continuity in the system toolbox

The three new controller types are integrated seamlessly into the CX2000 Embedded PC family. The housings extend 6 cm further along the DIN rail than the previously largest CX2040 controller, but at 205 mm x 100 mm x 91 mm, it is still extremely compact for the high processing power it offers. All announced versions use an identical housing, regardless of the specific type of Xeon D processor they contain. All the original basic interfaces from the CX2000 series are still available on the new devices – 2 x Gbit Ethernet, 4 x USB 3.0,

CB	– Current Branch	PC	– Personal Computer
CPU	– Central Processing Unit	PCH	– Platform Controller Hub
DIN	– Deutsches Institut für Normung (German Institute for Standardisation)	PLC	– Programmable Logic Controller
GPU	– Graphics Processing Unit	RAM	– Random Access Memory
I/O	– Input/Output	SKU	– Stock Keeping Unit
IoT	– Internet of Things	SoC	– System-on-a-Chip
LTSB	– Long-Term Servicing Branch	UPS	– Uninterruptible Power Supply
NUMA	– Non-Uniform Memory Access	USB	– Universal Serial Bus
		VGA	– Video Graphics Array

## Abbreviations/Acronyms

DVI-I (including VGA), as well as the flexibly configurable multi-option interface. This last interface offers a way to extend the device in the factory. In each case, this is made possible by an additional interface, e.g. an EtherCAT slave, RS232, RS485, various older fieldbuses as master or slave, or a second DVI-D or display port output.

All the existing CX2000 plug-in modules – including those installed from the left and right – can be used on the new devices. This gives the user the wide selection of pluggable Ethernet, USB 3.0, RS232, RS485, PoE, PROFIBUS master/slave and CAN master/slave interfaces on the left, and the choice of CFast, hard disks and USB distance transfer modules on the right.

The new devices use the same standard power supplies as the existing CX2000 series, namely the CX2100-0014 and CX2100-0914. The latter offers a method of using an electrochemical battery to create an Uninterruptible Power Supply (UPS). This makes it possible to maintain power for 15 to 25 minutes – which is sufficient for an orderly shutdown of the entire system in the event of a power failure, or even to bridge an outage completely.

Another familiar feature is automatic recognition of connected I/O terminals that can be attached to power supply units. Whether these are I/O terminals of the E-bus type (EtherCAT Terminals) or K-bus (Bus Terminals), each component is detected automatically and quickly forms the I/O system for the application.

For these new Embedded PC devices, this company aims to provide long-term availability: 10 years as a new device followed by a further 10-year service period. Our many years of industrial experience have taught us that in spite of always using latest-generation PC technologies – or maybe even because of it – our equipment can operate in the field far longer than that.

### TwinCAT 3 on the basis of the Windows 10 operating system

Microsoft Windows 10 IoT Enterprise is used as the operating system in the so-called Long-term Servicing Branch (LTSB). This designation refers to a fully equipped Windows 10 Enterprise system, but

one that allows more control over the installed updates: on the one hand, updates will not be installed automatically, and on the other hand, these systems only receive error corrections and safety-critical patches. Unlike the CB version (CB = Current Branch), LTSB does not include any functional extensions or later additions. This is intended to ensure that the operating system retains its functional availability.

It completely removes the component-based scalability from Windows 10 – this version of the operating system is monolithic, providing users an advantage in that they no longer need to inquire whether or not specific components required for their software are contained in the operating system.

CX2042, CX2062 and CX2072 devices are available only with the 64-bit version of this operating system. Newly-developed projects will certainly be based on TwinCAT 3 and a 64-bit operating system in order to facilitate multi-core task allocation and the ability to address more than 4 GB of RAM – both major limitations of 32-bit systems.

### 'Server processing power' in a DIN rail-mounted format

The CX series devices equipped with the new Intel Xeon CPUs are high-performance industrial control systems that are modular, flexible, robust, versatile and available for the long term. Their CPUs, each with up to 12 cores, and their separate graphics hardware, enable these devices to offer unprecedented processing power on DIN rail.

### Acknowledgement

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Beckhoff introduces a new generation of Industrial PC devices in the high-end performance segment.



Embedded PCs in this new high-end series accommodate the full spectrum of existing CX2000 plug-in modules.