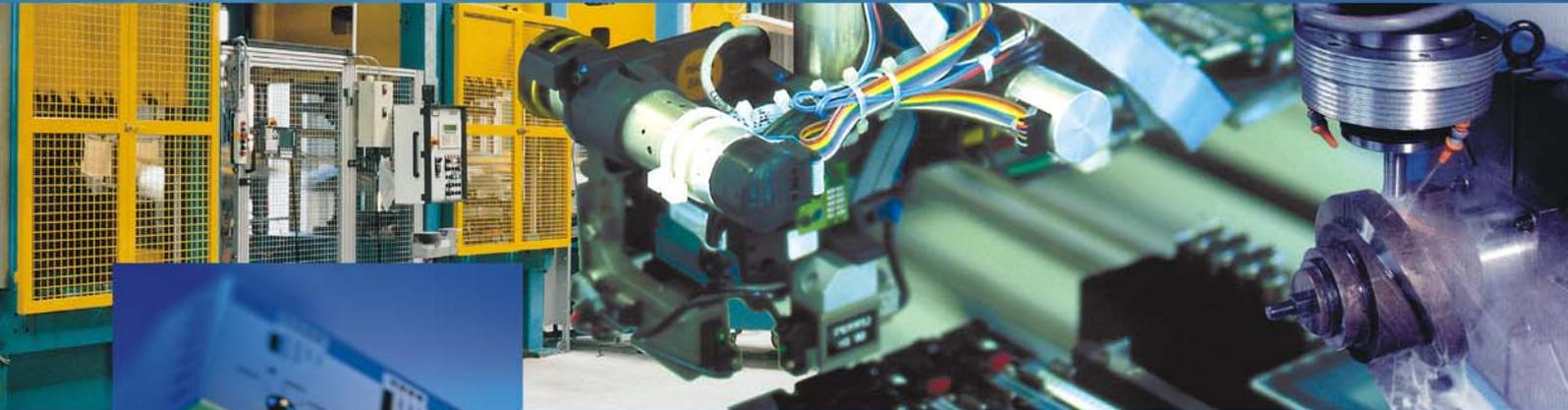


# XCx 300 / 500 / 540



## CNC/PLC Automation Systems Compact-, Basic- and Expansion Version

### System Description

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XCx Controllers and Coupling Modules

# XCx – Controllers of the Future...



## ...speed up machines and processes

1 ms PLC signal propagation time from input to output,  
1 ms CNC interpolation cycle and block cycle time

## ...interpolate

up to 16 CNC axes simultaneously in 8 NC programs

## ...synchronize

interpolated motions with switching processes, e.g.  
position-dependent valve switching

## ...coordinate

path motion with technology parameters, e.g. welding  
current according to path feedrate

## ...process

freeform contours and electronic cams as well as circle  
and helix contours

## ...transform

any machine kinematics into Cartesian coordinates

## ...control NC servo drives

via positioning processors with Sercos and SLM from  
Control Techniques, via positioning interface modules or  
via CANopen

## ...connect the sensor / actuator level

with a wide range of digital and analog I/O modules and  
via CANopen

## ...communicate

as standard via Ethernet and TCP/IP in any factory  
network, via Profibus-DP and CAN in any system

## ...visualize @ Web

in HTML and Java on any standard browser via integrated  
webserver and via OPC server for standard visualization  
software, and on directly connected low-cost terminals

## ...warn

e-mail with specific alarm messages such as  
"Coolant low"

## ...diagnose and log

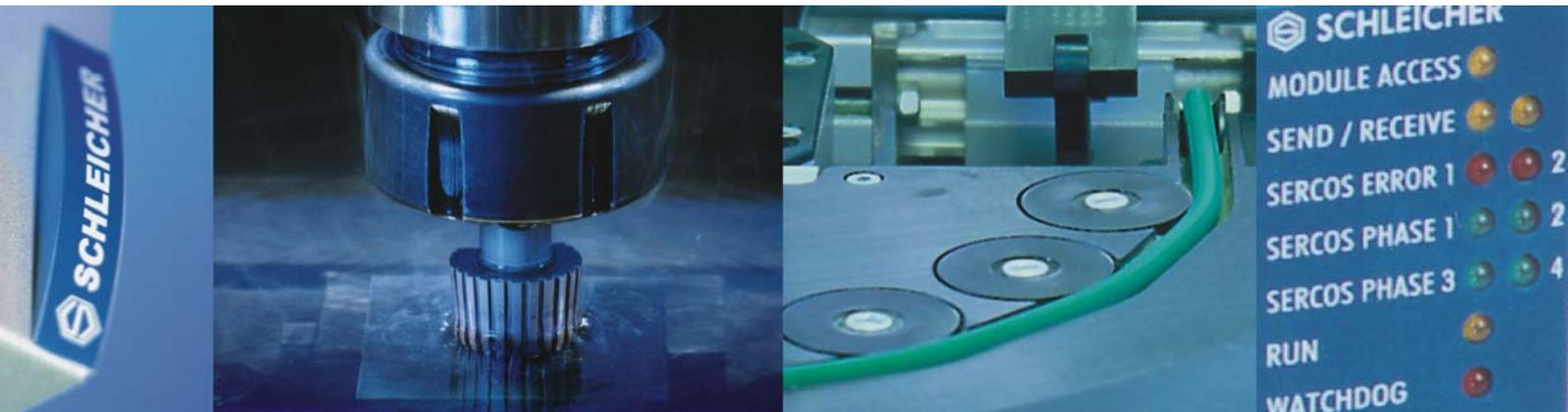
via serial interface or direct to compact flash

## ...allow

easy updating worldwide via compact flash

# Automation Solutions

for machine tools and production machines, robots and handling



## Integration

Complicated PLC programming of simple axis control? Doing without the convenience of a PLC in complex CNC applications? The answer is XCx. Its big feature is the integrated PLC that allows simple operation of complex CNC applications. Permanent CNC/PLC synchronization on the XCx creates unimagined new possibilities for solving complex control problems.

For example, on a production line you often need coordinated control of feed axes – and programming that just with a PLC is complicated. On the other hand, CNC machine tools often require path-dependent dynamic control of parameters, for example in order to allow for heat expansion measured by the PLC or for exact-position valve switching. Using XCx gives you elegant solutions for these kinds of problem in a wide variety of situations:

grinding • sharpening • milling • drilling • turning • cutting  
 • machining edges and profiles • spring twisting machines •  
 crane control • wave soldering systems • welding • painting  
 and polishing robots • feed and removal on injection  
 moulding and metal-bending machines • stacking and  
 palleting • insertion and mounting work ...

## Software

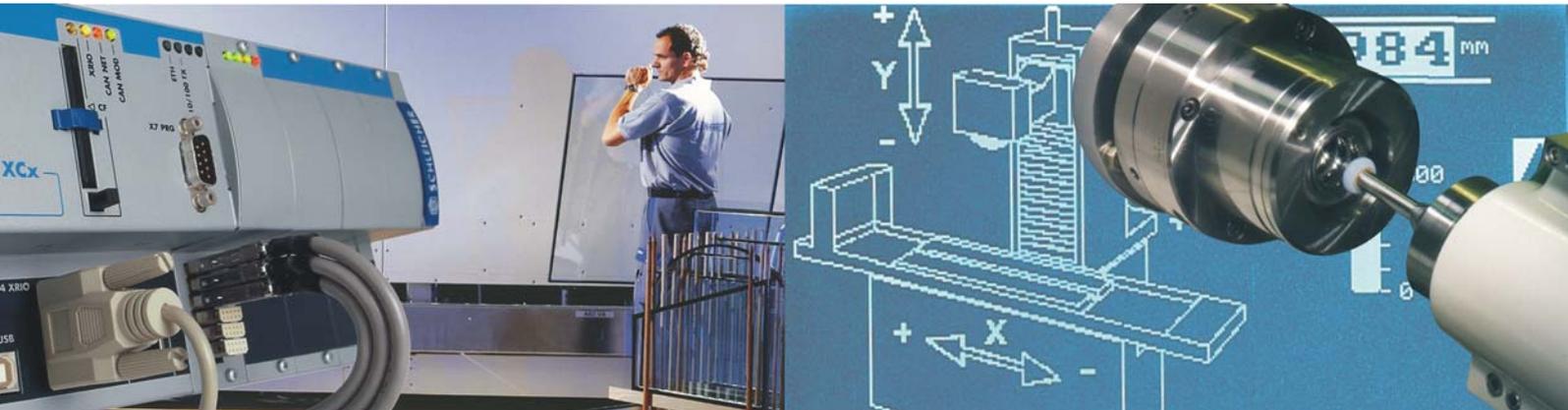
Integration in functionality and software is a fundamental characteristic of Schleicher controllers.

The real-time multi-tasking properties of the IEC 61131-3 operating system allow you to optimally adapt the controller to the process by executing time-critical functions with highest priority. The Motion Control function block library enables easy-to-parameterize axis controls even with a PLC.

The optional CNC operating system to DIN 66025 gives the XCx controllers a broad additional spectrum of standard and special Schleicher functions, such as multidimensional freeform interpolation and path optimization with Nerthus software.

For all controllers, configuring is carried out consistently with the programming system Multiprog according to IEC 61131-3. Hence, utilisation of software blocks and program libraries developed by the user is guaranteed across-the-controller. Multiprog is matched to the resources of the XCx to ensure easy operation.

The NC-Dialog PC tool is available for starting up and operating the XCx. It communicates with the controller via Ethernet. The program automatically detects which operating system is on the controller (pure PLC or CNC/PLC) and selects the appropriate input and display masks.



## Networking

XCx controllers are true communication professionals, open in all directions and easy to connect. Controllers can be connected via Ethernet to manage even complex and widely distributed processes.

Furthermore, the classic field buses CANopen and Profibus-DP as well as the upcoming Profinet no longer serve exclusively for networking but increasingly for controlling drives. Communication via Ethernet and TCP/IP with OPC server and integrated webserver means you can run visualization and data entry on any standard browser. The parameterizing, diagnosis and test functions can be called directly on site, in the local network or on the Internet. The higher factory level can easily request production data from the XCx and integrate it elsewhere.

## Concentration

The XCx unites the advantages of the IPC – many interfaces, interchangeable memory media, high performance – with the efficiency and long-term stability of a conventional controller. Supported by a wide selection of digital and analog I/Os and intelligent function modules it represents a controller system that can be flexibly adapted to almost any task. XCx gains its clear speed advantage by concentrating on the essentials in combination with convenient day-to-day use.

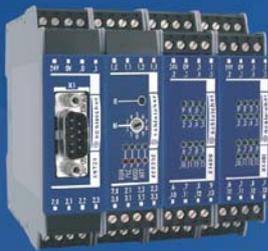


# Controllers Compared

## Family Ties

As a supplier of automation solutions with decades of experience, Schleicher can offer a broad spectrum of controllers in all performance classes, together with the associated I/O periphery.

Performance and functionality rise with demand and complexity of the production process. By means of modularity and networking the XCx matches the tasks and offers automation solutions all of a piece.



### XCx micro

The spectrum of controllers starts with the low-cost **XCx micro** controller for simpler automation tasks and distributed data (pre)processing. The small PLC with 22.5 mm housing especially matches the requirements of many machine manufacturers who want to add economic and compact versions to their array of products. The controllers connect to the field bus via CANopen or Profibus-DP. In addition to the XCx micro expansion modules you can also connect modules of the RIO series.

- Interfaces:  
CANopen or Profibus-DP,  
2x RS232

### XCx 300

The low-cost **XCx 300** is the obvious choice for higher demanding requirements. It is available in a range of versions as PLC and CNC/PLC. You can connect eight RIO I/O modules directly to the DIN rail via the integrated RIO interface. Via an coupling module you can also connect I/O modules from the XCx micro series. A free slot allows you to connect drives, additional I/Os or field bus interface.

- Up to 4 NC axes / 2 NC subsystems
- Additional axes via Motion Control blocks
- From 2 ms CNC interpolation cycle
- Interfaces:  
Ethernet, RS232, RS422, XRIO, 2x interrupt, Compact Flash
- Additional interface (CANopen, Profibus-DP, Sercos, XRIO) via card

### XCx 500 / XCx 540

The **XCx 500** is available as PLC and CNC/PLC versions, too. The controllers offer multiple interfaces for easy integration in the widest variety of production conditions. Digital, analog and function modules from the comprehensive RIO or XCx micro system connect the I/O level via the XRIO high-speed interface.



The **XCx 540** expansion version has all the features of the XCx 500, as well as 4 expansion slots for additional XRIO nodes and field bus and drive interfaces.

- Up to 16 NC axes / 8 NC subsystems
- Additional axes via MC blocks
- From 1 ms CNC interpolation cycle
- Interfaces:  
CANopen, Ethernet, USB, RS232, RS422, XRIO, 2x interrupt, IrDA, Compact Flash
- Additional interface (Sercos, Profibus-DP, Profinet, XRIO) via card (XCx 540 only)

## Typology

**XCx** stands for **eX**perienced **C**ontroller. The controllers are available in a range of versions with PLC and CNC/PLC operating system.

- **XCS** with PLC operating system
- **XCM** with PLC operating system and additional Motion Control functions (MC)
- **XCN** with CNC and integrated PLC operating system
- **XCN+MC** with CNC and PLC operating system and additional MC functions



### XCx 700

The **XCx 700** is the CNC/PLC controller for complex tasks and high requirements of speed and precision. It connects the I/O level with a wide range of digital and analog input, output and combination modules from the proven Promodul-U series. Relay modules, function modules for analog value processing and temperature control, and modules for axle positioning with Sercos interface or analog setpoint interface round off the periphery range.

- Up to 32 NC axes / 16 NC subsystems
- Additional axes via Motion Control blocks
- From 1 ms CNC interpolation cycle
- Interfaces: CANopen, Ethernet, 2x RS232, RS422/RS485, Compact Flash
- Additional interface (Sercos) via expansion module

### XCx 1100

The **XCx 1100** connects the advantages of the classic controller with those of the modern IPC with CPUs up to Intel Core 2 Duo for extreme high performance. Passive cooling and solid state disk instead of rotating mechanical devices guarantee steady operation even in rough environment. There is also no need for an uninterruptible power supply. The operating system VxWorks with Windows XP embedded saves process data permanently, so it always starts from a defined condition. Expansion modules are available from the Promodul-U series.

- Up to 64 NC axes / 32 NC subsystems
- Additional axes via Motion Control blocks
- From 1 ms CNC interpolation cycle
- Interfaces: CANopen, 5x Ethernet, 4x USB, RS232, RS422/RS485, DVI-I
- Additional interface (Sercos III, Profinet) via PCIe expansion moduls

### ProNumeric

**ProNumeric** is an IPC-based high performance CNC/PLC automation system where even complex applications are easy to operate. It consists of a computer box and a separate operator panel. Four slots for PCI cards allow you to run multi-axis applications with 64 Sercos drives in up to 32 subsystems. Fully tested hardware / software systems guarantee steady operation.

As **ProSyCon** the system is available as pure PLC without CNC functionalities.

- Up to 64 NC axes / 32 NC subsystems
- Additional axes via Motion Control blocks
- From 1 ms CNC interpolation cycle
- Interfaces: 2x USB, 2x RS232, 2x PS/2
- Slots: 4x PCI, 3x ISA, 1x AGP
- CANopen and Sercos interfaces via cards

# XCx 300 / 500

# / 540



# Precise Scalable Allrounders

## XCx 500

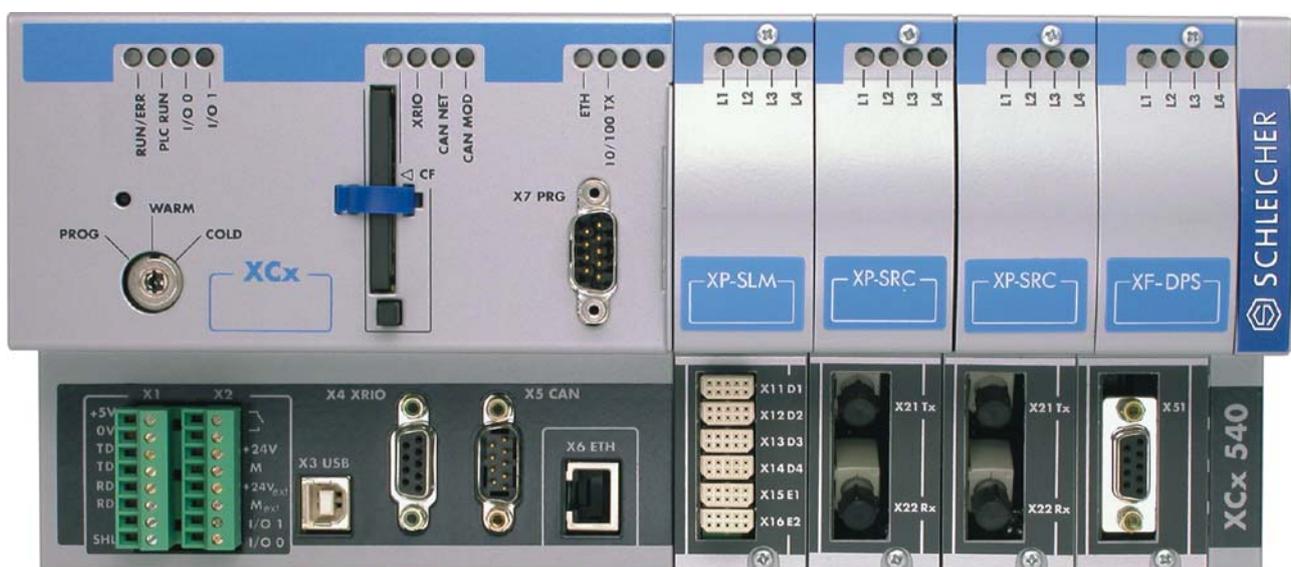
The basic version in the XCx family offers convincing performance and a wide range of interfaces.



- 1 ms PLC signal propagation time via XRIO,
- from 1 ms CNC interpolation cycle
- from 1 ms block cycle time
- Up to 16 interpolated axes in 8 NC subsystems
- 0.2 ms for 1K PLC instructions
- Operating mode lockswitch
- 2 fast interrupt inputs/outputs
- DIN rail or screw mounting, any orientation, no fan
- Interfaces:
  - Ethernet for networking
  - XRIO for connecting plant-floor I/Os
  - CANopen for field bus and drives
  - RS422 for operator panels
  - RS232 for programming
  - USB for additional communication
  - Compact Flash for operating system and user data

## XCx 540

The expansion version has all the features of the XCx 500, as well as 4 expansion slots for additional XRIO nodes and drive interfaces.



# With Made-to-Measure Performance



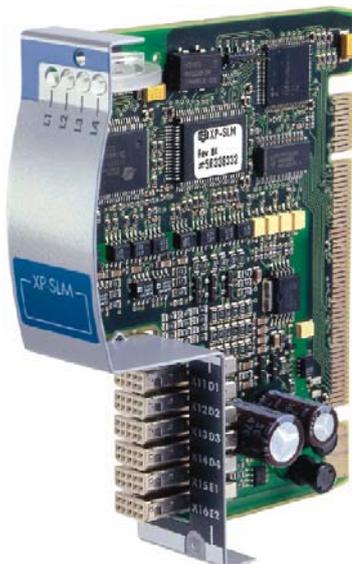
## XCx 300

The low-cost XCx 300 is the obvious choice for less demanding requirements. You can connect eight I/O modules from the RIO or XCx micro series directly to the DIN rail via the integrated RIO interface. A free slot allows you to connect Sercos, an additional XRIO interface, or a Profibus-DP or CANopen field bus interface.

- 1 ms PLC signal propagation time via XRIO, from 1 ms CNC interpolation cycle from 1 ms block cycle time
- Up to 4 interpolated axes in 2 NC subsystems
- 0.5 ms for 1K PLC instructions
- Mode switch
- 2 fast interrupt inputs/outputs
- DIN rail installation, no fan
- Interfaces:
  - Ethernet for networking
  - XRIO for I/O connection direct to controller
  - RS422 for operator panels
  - RS232 for programming
  - Compact Flash for operating system and user data

## Extras

The XCx 300 offers one slot for expansion cards– the XCx 540 four. This means you can adapt the controllers even more strongly to the conditions, be it additional I/O nodes, field bus networking or drive interfaces. For possible combinations of controller and expansion card, please turn to page 20.



## Periphery

A wide range of digital, analog and expert modules connect the I/O level.

- **XCx 300**  
Up to eight expansion modules can be connected via the integrated XRIO interface directly to the DIN rail, either from the RIO I/O series or – via a coupling module – from the XCx micro series.
- **XCx 500/540**  
Via special bus couplers expansion modules from the RIO or XCx micro series can be connected.

With the field bus interface you can also realize other I/O nodes.

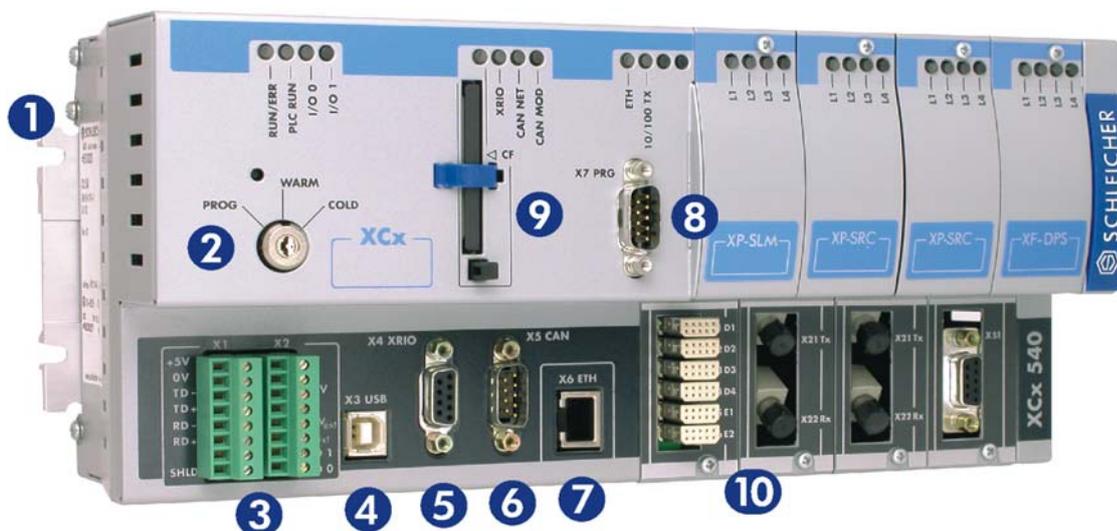


# More than the Sum of Parts –

**1** **Assembly** is simply by mounting on a standard DIN rail. Where there is a high mechanical load the XCx 500/540 can also be screwed down directly in any orientation. All XCx operate without a fan, so free air circulation has to be ensured.

**3** The **RS422 interface** (X1) is for direct connection of operator panels and displays, for example the COP handy. The terminal strip (X2) on the right contains the connection for supply voltage as well as a **ready contact** (ready-for-operation relay). On PLC stop (e.g. due to operational malfunction) the relay releases and can thus trigger external safety switching devices.

The two **combination interrupt channels** are unique in this price class. Each contact can be used as either input or output. The reaction time of each channel is less than 0.2 ms.



**XCx 540**

Except for the four extension slots (right) the XCx 540 is identical with the XCx 500.

**2** The three-position **operating mode switch** sets the startup behaviour of the controller. On the XCx 500/540 it is a key-operated switch, on the XCx 300 a slide switch. The **PROG** setting means PLC stop, programming mode. In this position a new PLC program or a boot project can be transferred to the controller from the programming system. **WARM** is the default setting (warm start of PLC, retain variables), while **COLD** causes cold start of the PLC and the retain variables are reinitialized.

The **reset button** under the front opening causes a hardware reset, equivalent to power off. This button functions only in **PROG** mode.

The **LEDs** give information on the CPU and PLC status, as well as the activity of the interrupt input/outputs.

**4** The XCx can communicate with active terminal devices such as notebooks via the **USB port** (X3). The connection corresponds to USB version 2.0 with a type B connector.

**5** The **XRIIO interface** (X4) allows you to connect digital or analog I/O modules. A high-speed protocol without field bus delay controls the modules via the serial interface. This connection reduces the PLC signal propagation time from input terminal to output terminal to less than 1 millisecond.

For more on the I/O interface see page 18.

# the XCx in Detail

**6** With **CANopen (X5)** the XCx 500/540 offers a standard field bus interface for controller networking, connecting drives, valve groups and special devices, and above all setting up additional I/O nodes. Up to 64 bus nodes are possible without repeaters. The RIO or XCx micro series offers digital, analog and expert modules with various numbers of channels, allowing configurations with up to 8000 I/O channels. In practice performance requirements are the only restriction.

CANopen as a drive interface opens up a further field of application for axis control with no extra work. On the XCx 540 you can also connect other drive interfaces (→ **10**).

The XCx 300 can be equipped with an optional CANopen interface via its expansion slot.

**7** IT networking is via **Ethernet (X6)** and TCP/IP with 10 or 100 Mbit/s (RJ45 connection). You can connect several controllers directly (via global PLC variables) or via a PC network. OPC servers then undertake communication with standard programs for visualization and operation.  
For more on networking see page 14.

**8** The **RS232 interface** is for serial connection of programming devices, logging printers and barcode readers. The LEDs on top display the Ethernet status and the transmission rate (10/100 Mbit/s).

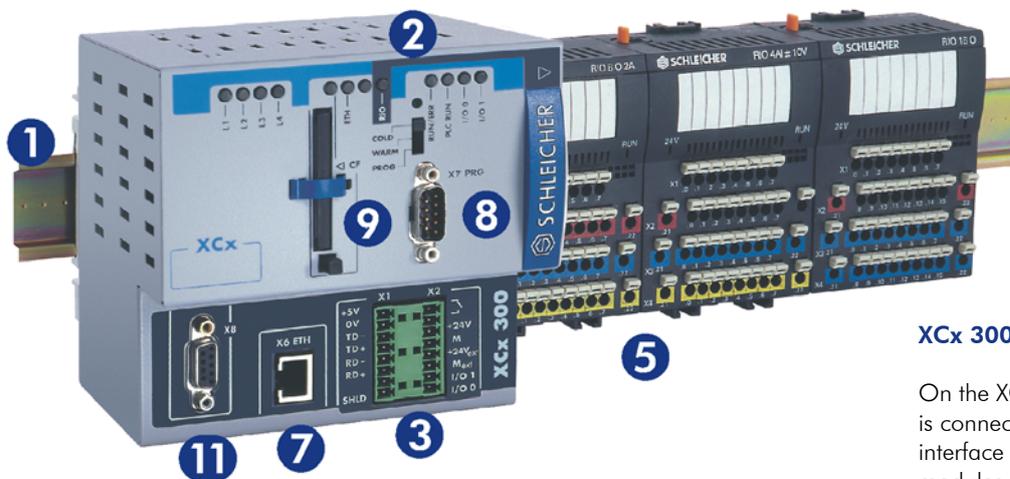
**9** The **operating system** and user data are saved on a compact flash card. The high memory capacity of the cards means that other data such as project documentation, maintenance manuals and the HTML and Java scripts of the webserver is also available directly on the controller. The compact flash (CF) can be plugged and unplugged during operation and the system status is available on the PLC. Data that should be saved automatically on the CF (e.g. log book) is saved on the controller RAM and transferred automatically when a CF is available again.

The **LEDs** on top display the status of compact flash, XRIO and CAN network and module status (XCx 500/540) or Compact Flash and Ethernet status (XCx 300).

**10** The XCx has four **expansion slots**:

- XRIO interface for more plant-floor I/O channels
- Field bus interface
  - Profibus-DP (master/slave)
  - Profinet (slave)
- Drive interfaces
  - Sercos (open drive interface)
  - SLM (Control Techniques)

**11** On the **XCx 300** a free slot allows you to connect Sercos, an additional XRIO interface, a Profibus-DP or CANopen field bus interface.



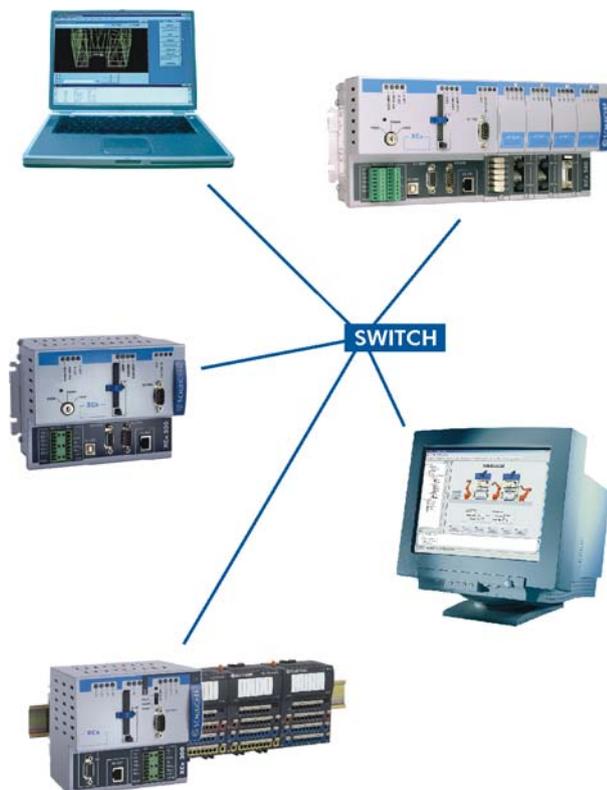
**XCx 300**

On the XCx 300 the I/O level is connected by an integrated interface (coupler), where the modules connect directly on the DIN rail.

# Networking and Visualization

## XCx Interconnected

Ethernet networking via TCP/IP is a central element on every XCx. In production lines, for example, it may make sense to distribute the tasks to several networked XCx controllers, which are then controlled via one or more operating units. Complex manufacturing processes are much easier to design with this modular and scalable control concept than with centralized architecture.



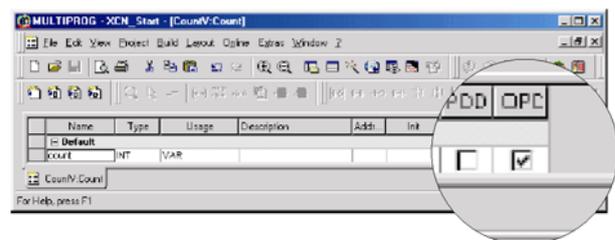
You can connect several controllers directly via global PLC variables, or via a PC network. OPC servers run the communication with standard visualizing and operating programs.

When the XCx is operated directly on a PC via a crosslink cable you do not have to change the preset IP address. But if you want to operate larger networks you will have to use the option of assigning individual IP addresses. The IP address is saved on the compact flash.

## OPC Server

OPC (OLE for Process Control) is a defined set of interfaces, based on OLE/COM and DCOM technology, for open data exchange between automation and controller applications, field periphery and business/office applications. OPC is based on COM (Microsoft Component Object Model), a software architecture that allows a program to use another program's interface in order to obtain data from it (if it is also programmed as a COM component). DCOM (Distributed Component Object Model) is the network version of the COM system.

The OPC server is part of the Multiprog programming system (see page 42) and is installed on the PC together with it. It allows process data exchange between the XCx and e-manufacturing programs such as standard visualization programs and Visual Basic applications.



In the variable dialogs on Multiprog the controller data and variables where the OPC server requires read/write access are simply designated OPC.

# Webserver – One for All



## Service Tool in the Controller

When servicing a machine the engineer usually has his standard tools such as measuring devices and laptop in his case. But what software should be installed on the computer? Which version matches the machine in question? Valuable time is easily lost if the tool is wrong. Standardization provides the remedy. The engineer applies his standard tool – the standard web browser on the computer, for example Microsoft Internet Explorer. The rest is done by the controller, or more precisely, the XCx webserver.

## On-Site or Networked

All parameterizing, diagnosis and test functions can be called directly on site, in the local network or on the Internet. The XCx webserver offers the engineer at the machine the same functionality as the master in his office, who can dial in to the controller. Teleservicing is also possible if the appropriate connection is provided.

## Webserver and Security

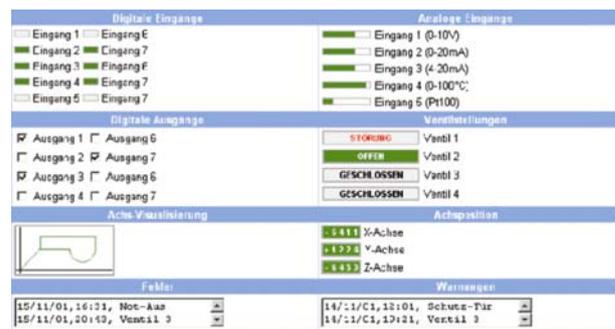
Access control, data security, machine safety – a range of security levels allow webserver services to be enabled flexibly. For example, a lockswitch on the machine can be used to block external access completely, while only the lower security levels allow write access to controller variables.

## Background

All relevant data can be output via OPC server, and via a webserver that is an optional component of the PLC operating system. Static visualization pages are in HTML, while dynamic processes and entry options are realized with Java scripts. This means that any operator panel with Ethernet connection and a standard browser can be used for communication:

- MS Explorer V5+ or Netscape Navigator V6+
- Terminals with Windows CE, if the browser meets the requirements for Javascript 1.5, Java 2, HTTP1.1.

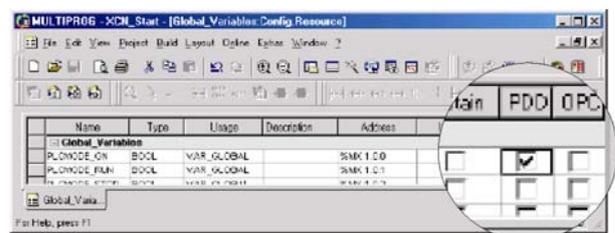
The machine and visualization data is saved on the XCx Compact Flash. Applications (web pages) are transferred by FTP or by copying directly into a special area on the CF. From there the webserver reads the data and applications (HTML, JavaScript, Java) and sends it to the browser. The browser is thus the *thin client* for data visualization.



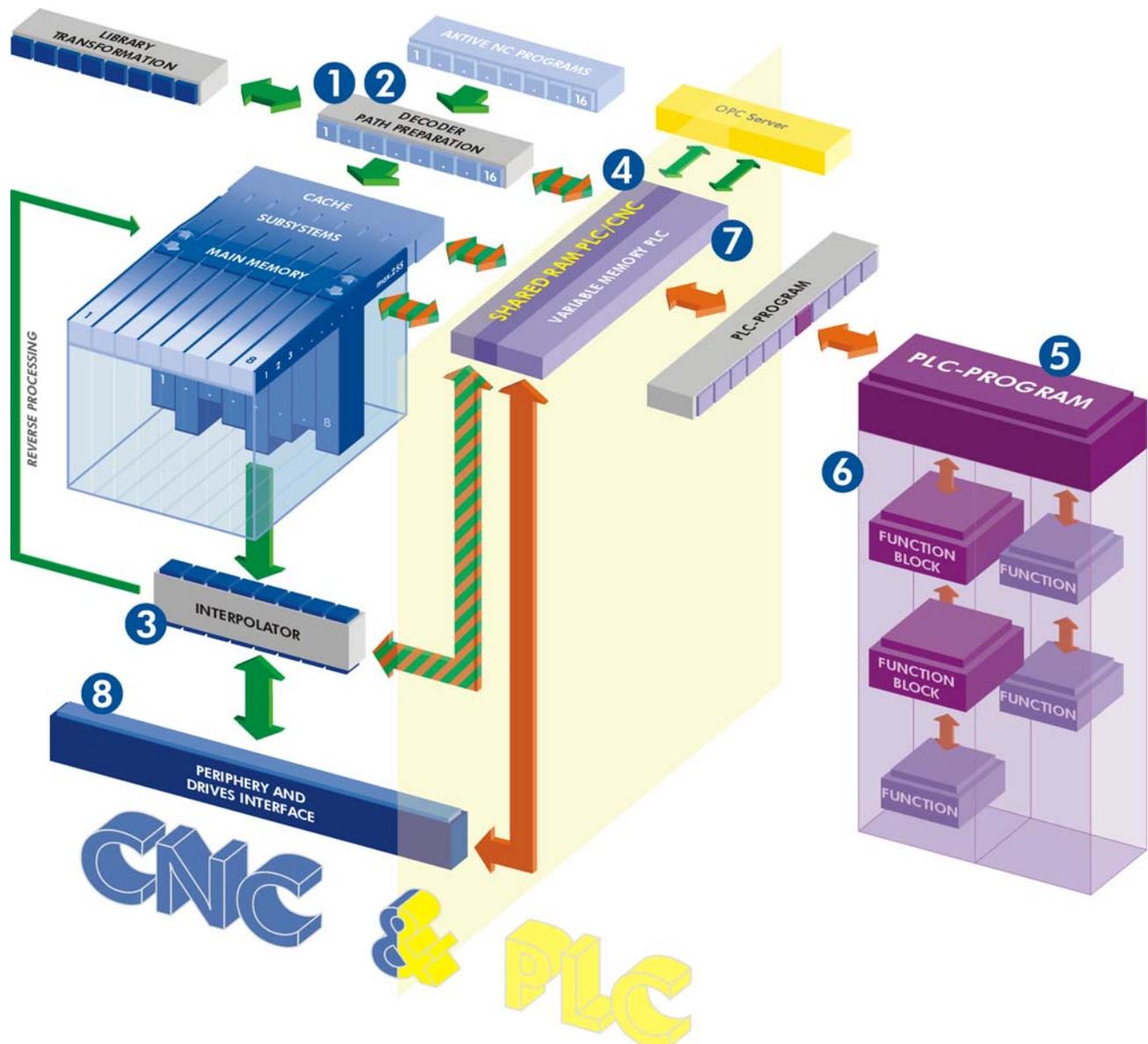
A special Java Applet allows cyclical parameter refresh through bidirectional data exchange between the browser and the controller. This applet supports functions that can be called by the HTML/Javascript language. These functions allow the application to write one or more PLC variable values.

## Declaring

The variables that are to be visualized are marked as PDD (Process Data Directory) in ProdocPlus during PLC programming. Only these variables are enabled for web visualization, so only they can be read and written by the webserver. This secures the system against unauthorized manipulation.



# Inner Values –



## 1 DECODER

- Parallel program memory management for 8 subsystems
- Standard and advanced to DIN 66025
- Fully parameterizable programming with cycles

## 2 PATH PREPARATION

- Up to 16 independent interpolating axes
- Tool compensation
- Transformation

## 3 INTERPOLATOR

- Straight, circular, freeform interpolation
- Electronic cams
- Reverse processing of programs
- Special cycles
- Switching signals

## 4 SHARED RAM

- Functional data exchange with the integrated permanent-synchronous PLC

## 5 PROGRAMMING LANGUAGE

- IEC 61131-3
- Instruction list (IL), function block diagram (FBD), ladder diagram (LD), structured text (ST), sequential function chart (SFC)

## 6 PROGRAM STRUCTURE

- Program organization units (POUs): Functions, function blocks, programs

## 7 PLC RUNTIME SYSTEM

- Multitasking: Cyclical tasks (priority-controlled), event tasks, system tasks

## 8 PERIPHERY

- Drives
- Digital/analog I/O, expert modules
- Field buses

# The Structure of the XCx

## Operating System

The PLC and CNC runtime and the optional webserver run on the real-time multitasking operating system VxWorks. PLC configuring is carried out with the Windows programming system Multiprog, while the CNC and PLC are started up and operated using the Schleicher-Dialog software. For more on operating and programming systems see page 41.

## Shared RAM

One special highlight of the XCx is direct coupling of CNC functions with PLC according to IEC 61131. This is practically unique on the market. The PLC and CNC systems simultaneously access one shared RAM to exchange data. The PLC can fulfil a master function. In the multi-tasking operating system PLC task 6 is synchronized with the interpolation task of the CNC controller. The cycle time of task 6 is then oriented on the interpolation cycle of the CNC.

Shared RAM data takes the form of variables as per IEC 61131-3, which are declared as global variables during configuring in Multiprog. They are accessible to the OPC server as standard and are displayed in the NC dialog.

The close link between the CNC and the PLC system now enables you to carry out complex processes which would not be possible with separate CNC and PLC controllers. You can, for example, synchronize the PLC with position control. The PLC can also activate sensor signals in the position control cycle. This enables you to create highly dynamic sensor-driven CNC functions.

- Valve control linked to path motion
- Position detection on interrupt signal
- Welding current according to path feedrate

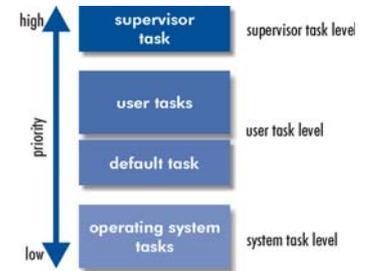
This means that the engineer can use a PLC user program to test the effects of end-user actions on the CNC before they are actually executed, and activate the relevant error messages or warnings.

### Example: thermal displacement

In order to compensate for positional displacement caused by operational thermal expansion, temperature measurements are made at the critical points. The PLC uses this data to calculate compensation values and sends them to the CNC, which includes them in its interpolation.

## Multitask

In a real-time multi-tasking operating system the PLC is priority-controlled to optimize computing capacity for each task. A task is made up of program modules and is assigned precisely the amount of time required



to process it. This means that valuable performance is not wasted in unnecessary waiting cycles. Furthermore, the tasks are assigned different priorities that ensures they are processed in order of importance.

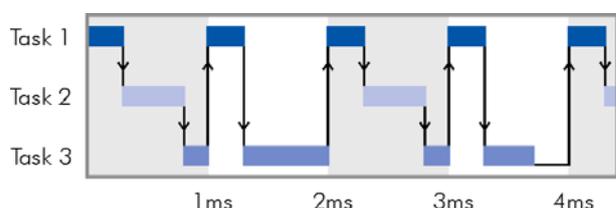
- **Supervisor tasks** (supervisor task level) detect errors (division by zero, task overrun, etc.) and activate the corresponding operating system task.
- **User and default tasks** (user task level)
  - *Cyclical tasks* execute the programs assigned to them within a defined interval under a defined priority. The task with the highest priority is called first.
  - *Event tasks* are started by the XCx operating system when particular events occur, for example interrupt signal, CANopen task or interpolation task.
  - *Default task* is activated when all higher-priority user tasks have been processed.
- **Operating system tasks** (system task level) such as communication, debugging, memory management and system control run outside the control of the user.

## Task Priorities

The XCx supports 8 user tasks. The time-critical programs of the machine process are controlled in the fast high-priority tasks. Comprehensive user guidance can be processed in the mid-range tasks, and non-time-critical monitoring programs in the low priority tasks. Tasks are processed in order of priority, ensuring that the critical processes are handled first, and completely. The less critical processes are handled in the remaining time according to their priority.

### Example: PLC program with three tasks

- Task 1 • Cycle time 1 ms • Processing time 0.3 ms
- Task 2 • Cycle time 2 ms • Processing time 0.5 ms
- Task 3 • Cycle time 4 ms • Processing time 1.5 ms



# I/O Interface XRIO

## XRIO versus Field Bus

XCx connects the direct I/O level in a number of different ways:

- via Schleicher-specific XRIO bus
- via field buses CANopen, Profibus-DP and Profinet

The proprietary high-speed interface XRIO provides external accessibility of the internal controller bus. This connection reduces the PLC signal propagation time from input terminal to output terminal to less than 1 millisecond. Electrically XRIO is similar to Interbus-S. It is a point-to-point connection with one data link for each transmission direction, according to RS422 with 500 kBit/s transmission rate.

The XRIO I/O driver interfaces connected RIO modules, provides corresponding input and output maps, and refreshes them. The minimum task cycle time is largely determined by the transmission time, that on its part is determined by the number of bytes to be sent. A transmit time of 22  $\mu$ s per byte can be taken as a rule of thumb. The maximum task cycle time is 80 ms. In case of exceeding the maximum time the watchdog for the RIO modules triggers, and the LED XRIO on the controller is red.

The XCx operating system automatically recognizes the XRIO configuration. If the current configuration differs from the previously saved configuration automatic PLC start will not be carried out. The XRIO configuration is saved on the XCx compact flash.

### Bus Nodes

A bus node comprises the bus coupler and up to 8 expansion modules from the RIO or XCx micro series providing up to 128 digital or 56 analog channels per node.

- **Digital I/O Modules**  
with up to 16 channels detect and switch control and position signals from the process level
- **Analog I/O Modules**  
detect 2- or 4-channel measured values and pass position signals to the process level
- **Function Modules**  
The function modules for temperature, counter and axis control allow data processing to take place directly in the bus node.

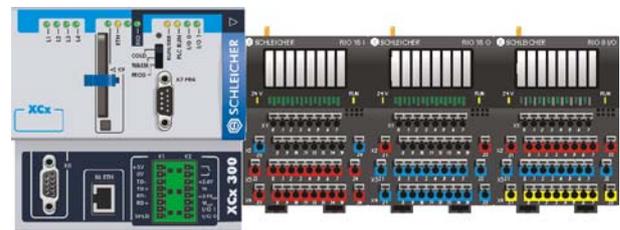
You will find more information on RIO and XCx micro series in the appropriate system descriptions and manuals (→ page 44).

## XCx 300

The XCx 300 has an integrated XRIO interface. Up to eight expansion modules can be connected directly to the DIN rail, either from the RIO I/O series or – via a coupling module – from the XCx micro series.

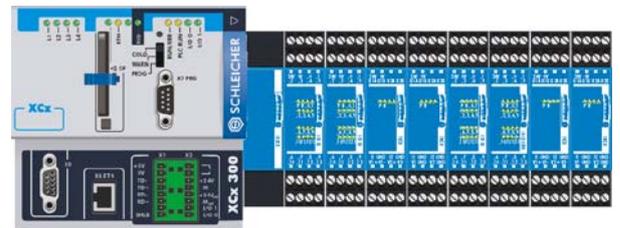
### XCx 300 ↔ RIO-I/O

The RIO modules connect directly to the controller, the internal bus connection is provided by integrated slide contacts.



### XCx 300 ↔ Coupling Module ↔ micro-I/O

The micro modules connect to the controller via the X2RIO coupling module (→ page 40), the internal bus connection is provided by lateral connectors.



### Further Expansion

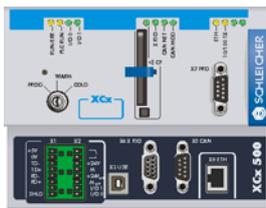
The free slot on the XCx 300 allows you to connect an additional XRIO interface for more I/O nodes (→ page 32).

## XCx 500/540

The XCx 500 and 540 controllers are equipped with a XRIO interface by default, the XCx 540 expansion slots can be equipped with three more XRIO cards additionally. That provides four times four bus nodes with 8 modules each and a total of more than 2000 digital I/Os. Connecting the bus nodes to the XRIO interface on the controller is done using two different bus couplers:

- **RIO EC X2** – connects directly to RIO modules or to micro modules via X2RIO coupling module (→ page 37)
- **XBCX** – connects directly to micro modules or to RIO modules via X1RIO coupling module (→ page 38)

Both bus couplers can be mixed within a bus segment, as well as the I/O modules from the RIO or micro series within a bus node (using a coupling module, see right).

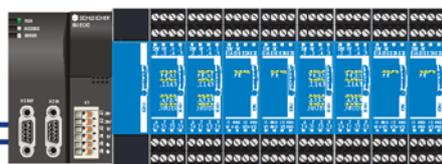


The bus couplers provide interfaces for incoming and outgoing data links. The max cable length is 10 meters between two connection points.

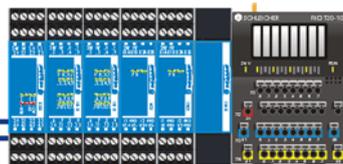
**RIO EC X2 + RIO I/Os**



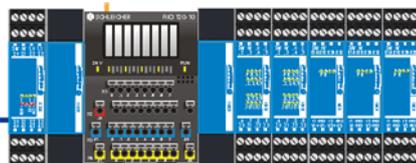
**RIO EC X2 + micro I/Os**



**XBCX + micro I/Os + RIO I/Os**



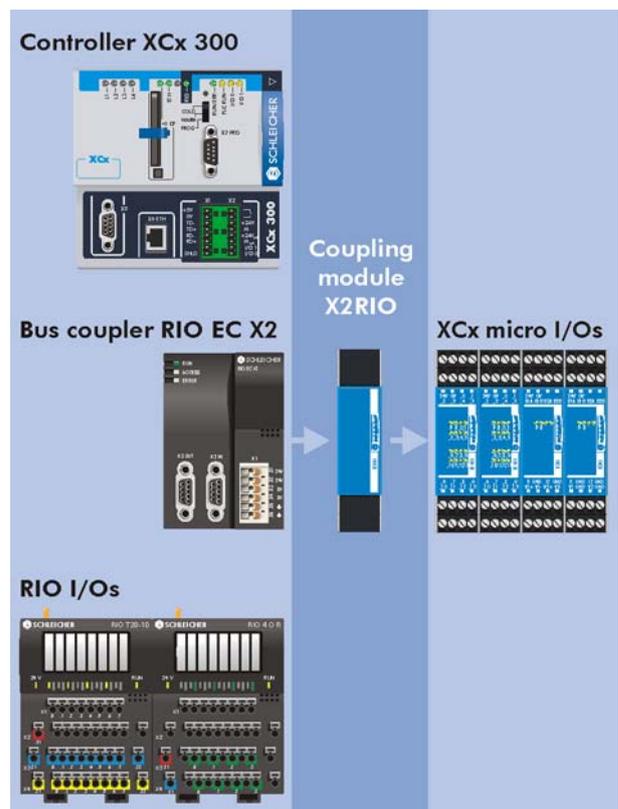
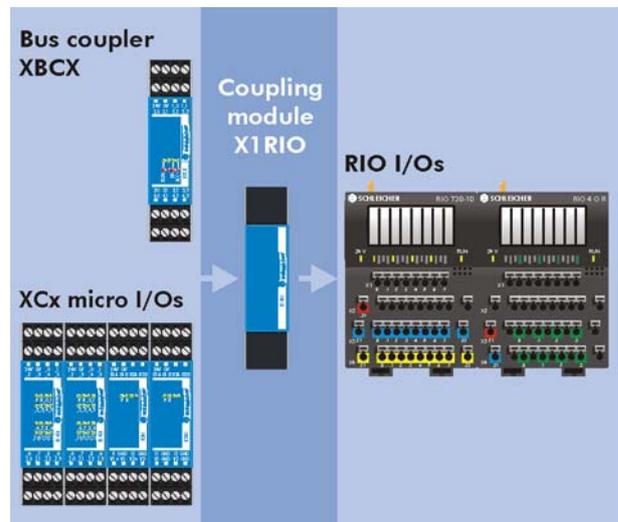
**XBCX + RIO I/Os + micro I/Os**



## Coupling Modules

The expansion modules of the RIO and micro series can be mixed within a bus node if required. Two coupling modules are available; both have no electronic components and require no power supply:

- **X1RIO** couples from micro to RIO (→ page 39)
- **X2RIO** couples from RIO to micro (→ page 40)



# Field Buses and Drives

## Field Buses

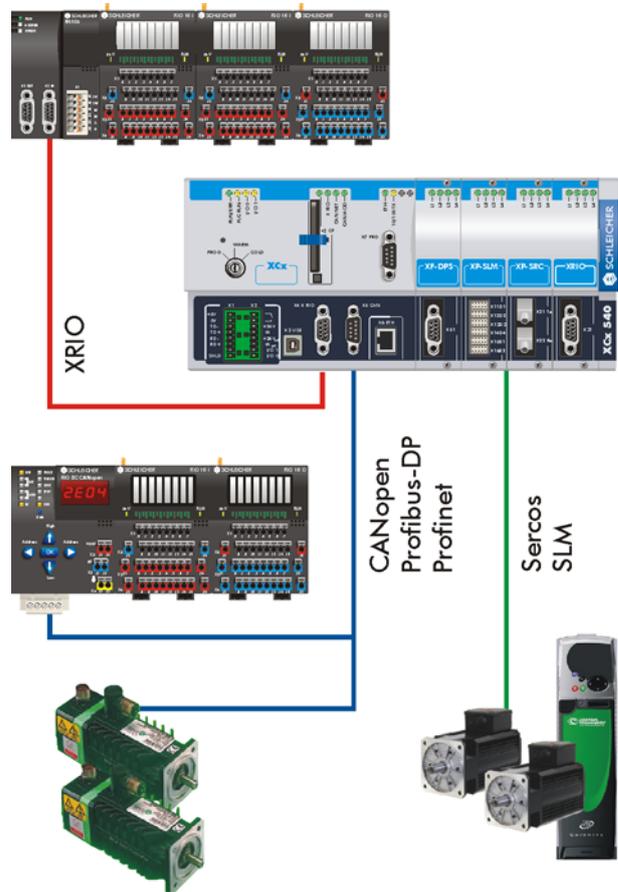
With **CANopen** the XCx offers a field bus interface for controller networking, special devices, and setting up additional I/O nodes with more than 8000 I/O channels (→ page 33).

Using one of the **Profibus** expansion modules you can also turn the XCx 540 into a master or a slave in a Profibus-DP system (→ page 34).

The **Profinet** interface module integrates XCx controllers in networks with higher-level Profinet controllers for distributed operation (→ page 36).

## Drives

Expansion cards for **SLM** (Control Techniques) and the open **Sercos** Standard are available as drive interfaces. The XCx 300 offers one slot for expansion cards to control up to 16 interpolated NC axes, while the XCx 540 has four. Drives, valve groups, etc. can also be controlled via field buses.

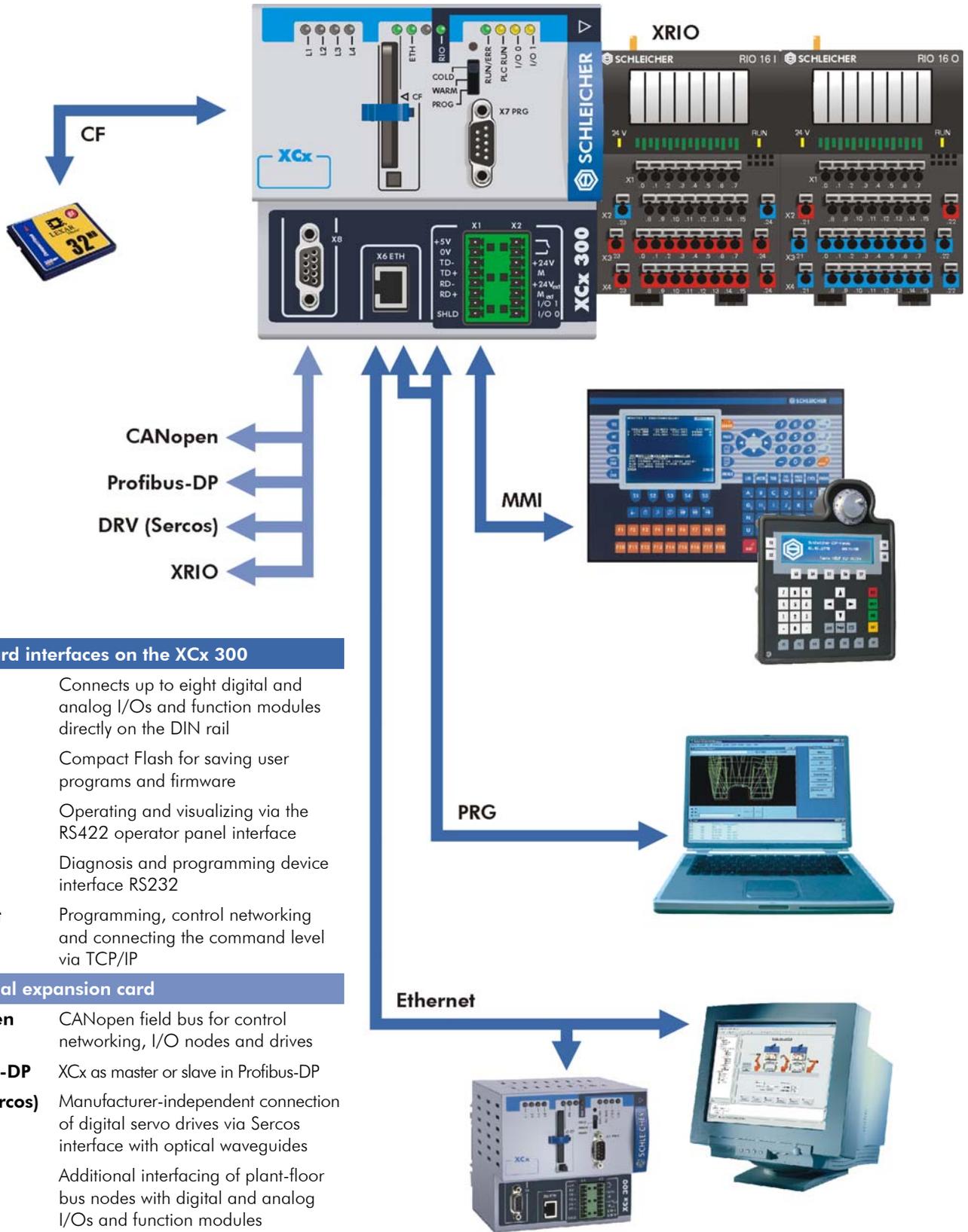


## Overview – Standard and Optional



	XCx 300	XCx 500	XCx 540
<b>Standard</b>			
XRIO	Interface integrated, 8 I/O modules RIO or XCx micro connected directly	4 bus nodes each with 8 I/O modules connected via external bus couplers	4 bus nodes each with 8 I/O modules connected via external bus couplers
CANopen	● (dep. on version, see below)	●	●
<b>Optional expansion cards (Number)</b>			
XRIO	●	–	● ● ●
CANopen	●	–	–
Profibus-DP Master	●	–	● ● ● ●
Profibus-DP Slave	●	–	● ● ● ●
Profinet Slave	–	–	● ● ● ●
SLM	–	–	● ● ● ●
Sercos	●	–	● ●

# System Overview XCx 300



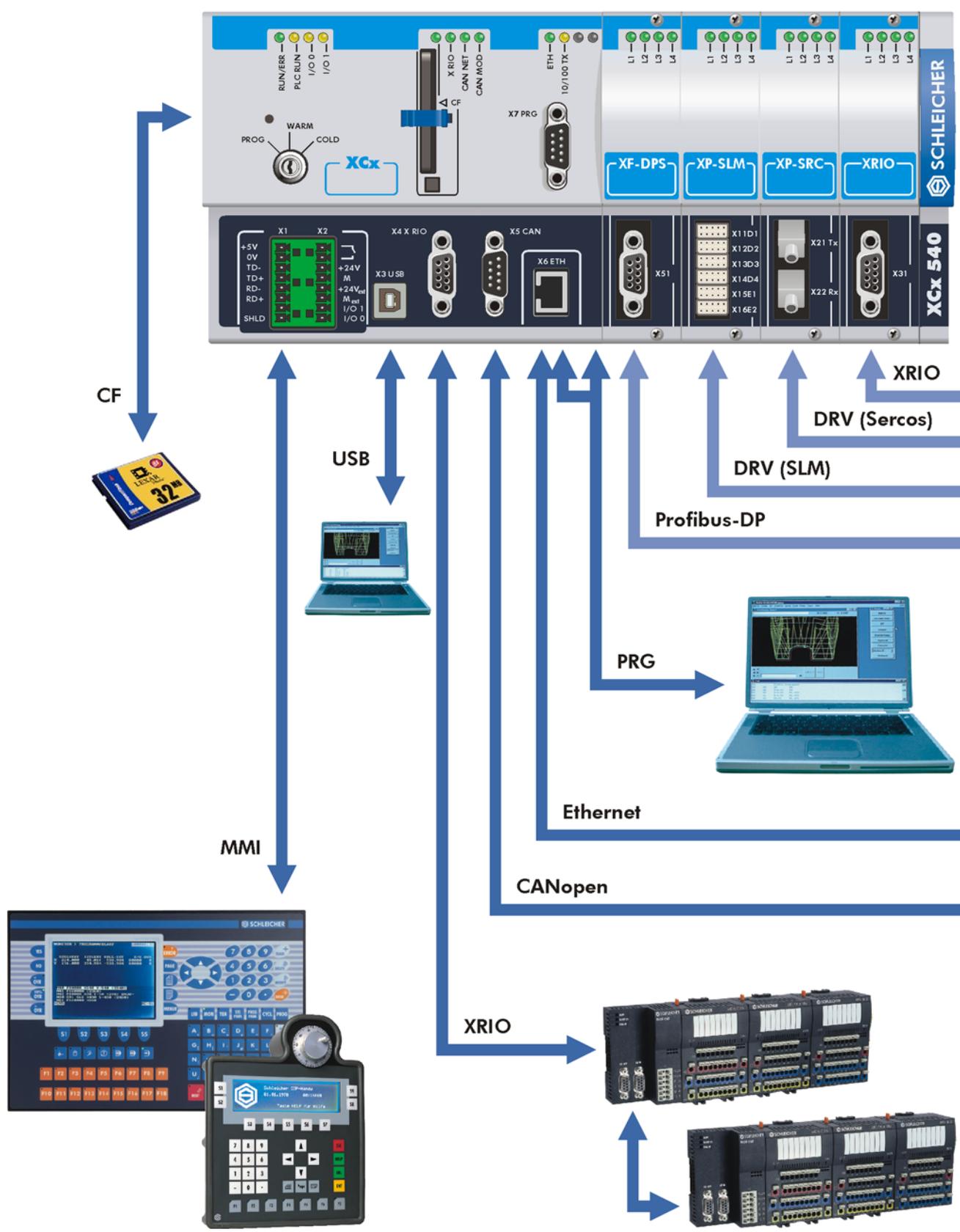
## Standard interfaces on the XCx 300

- XRIO** Connects up to eight digital and analog I/Os and function modules directly on the DIN rail
- CF** Compact Flash for saving user programs and firmware
- MMI** Operating and visualizing via the RS422 operator panel interface
- PRG** Diagnosis and programming device interface RS232
- Ethernet** Programming, control networking and connecting the command level via TCP/IP

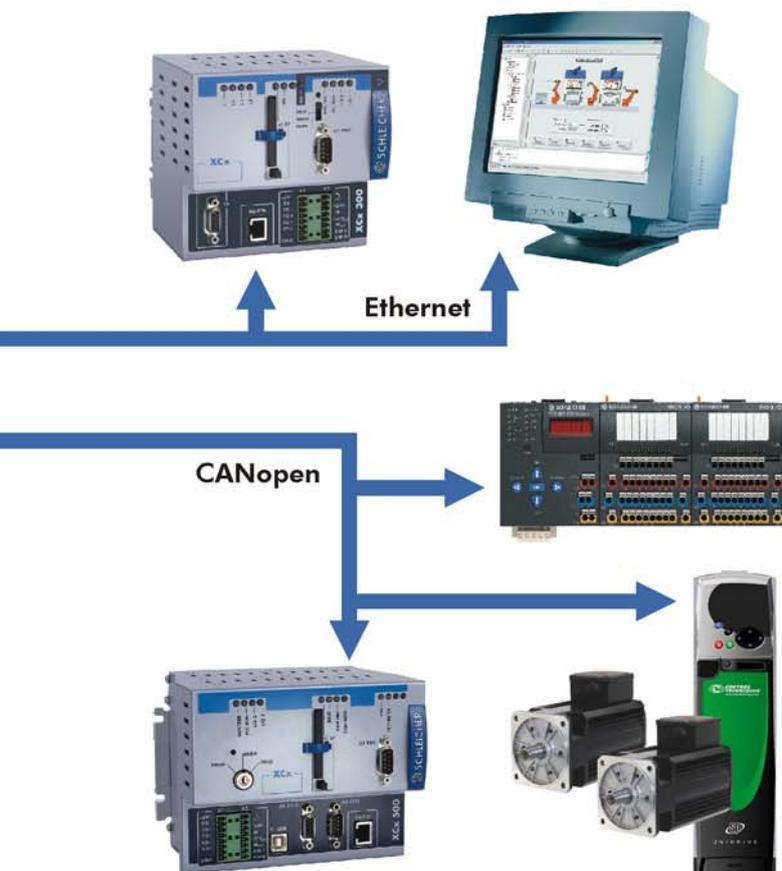
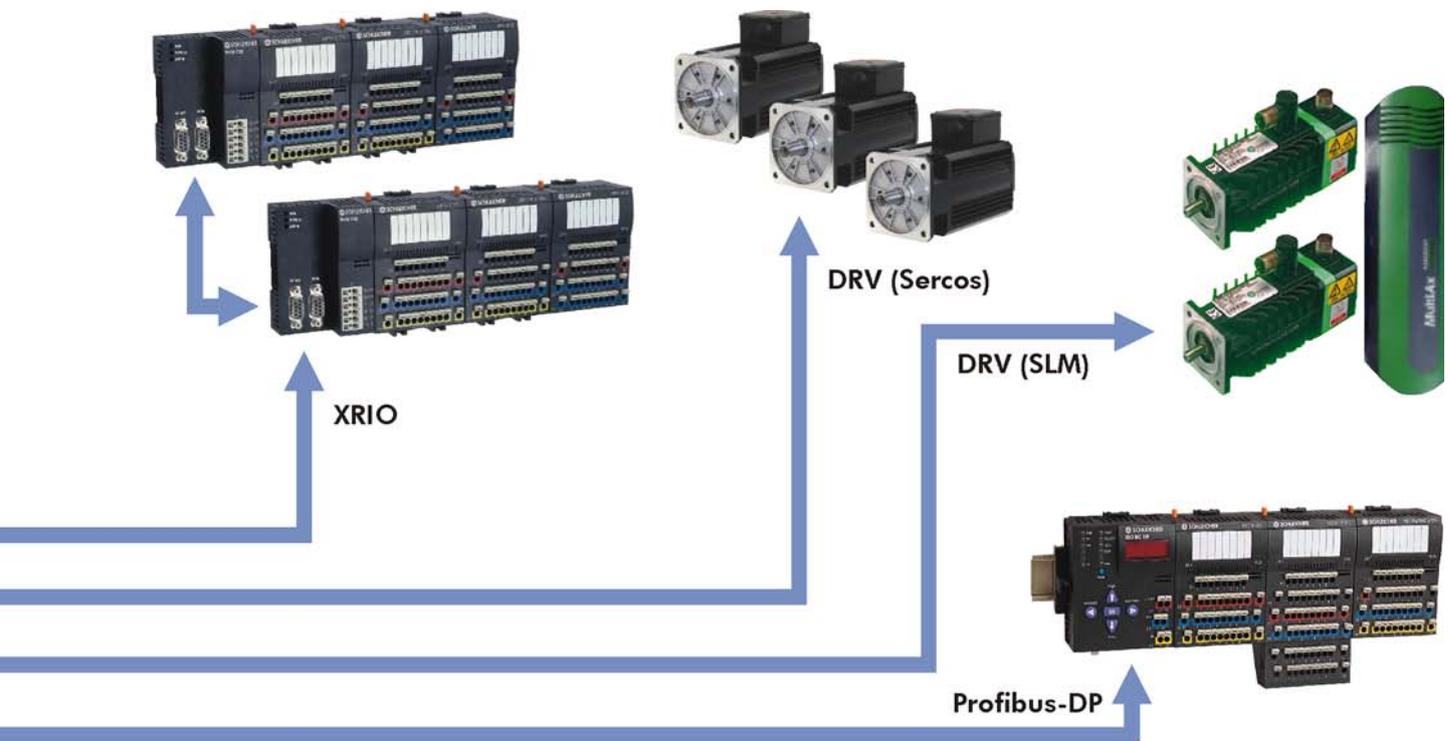
## Optional expansion card

- CANopen** CANopen field bus for control networking, I/O nodes and drives
- Profibus-DP** XCx as master or slave in Profibus-DP
- DRV (Sercos)** Manufacturer-independent connection of digital servo drives via Sercos interface with optical waveguides
- XRIO** Additional interfacing of plant-floor bus nodes with digital and analog I/Os and function modules

**XCx 540**  
**XCx 500**



# System Overview XCx 500 / XCx 540

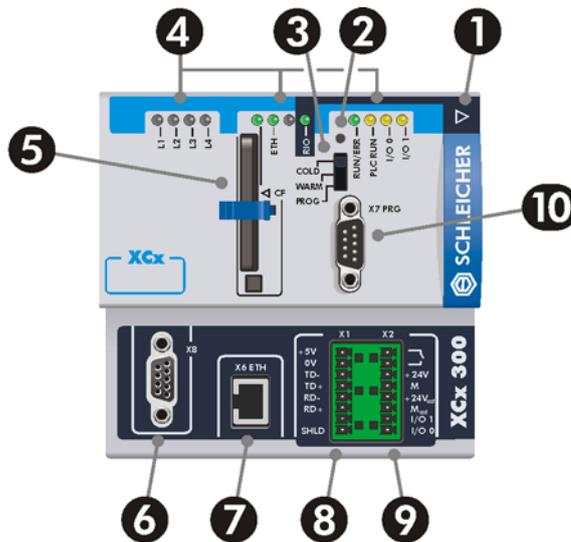


## Standard interfaces on the XCx 500 / XCx 540

- CF** Compact Flash for saving user programs and firmware
- MMI** Operating and visualizing via the RS422 operator panel interface
- USB** USB port as additional programming device interface
- XRIO** Interfacing of up to four plant-floor bus nodes with digital and analog I/Os and function modules
- CANopen** CANopen field bus for control networking, I/O nodes and drives
- Ethernet** Programming, control networking and connecting the command level via TCP/IP
- PRG** Diagnosis and programming device interface RS232

## Optional expansions for the XCx 540

- Profibus-DP** XCx as master or slave in Profibus-DP
- Profinet** XCx as slave in Profinet
- DRV (SLM)** Connecting digital servo drives via SLM interface (Control Techniques)
- DRV (Sercos)** Manufacturer-independent connection of digital servo drives via Sercos interface with optical waveguides
- XRIO** Additional interfacing of plant-floor bus nodes with digital and analog I/Os and function modules



- ❶ Integrated interface for direct interfacing with RIO or XCx micro modules
- ❷ RESET button
- ❸ Mode slide switch
- ❹ LED displays for controller, periphery, network and optional expansion card
- ❺ Compact Flash for operating system and user data
- ❻ X8 Slot for optional expansion card
- ❼ X6 ETH RJ45 Ethernet interface
- ❽ X1 RS422 interface for operator panels and displays
- ❾ X2 Connection for supply voltage, interrupt inputs/outputs and BUSY contact
- ❿ X7 PRG RS232 interface for programming units

The **XCx 300** is the compact version of the XCx controller family where the CNC/PLC performance requirements are less high. Networking with Ethernet and TCP/IP ensures fast controller access for programming, diagnosis and operation. A free slot allows you to connect Sercos or SLM (Control Techniques), an additional XRIO interface, or a Profibus-DP or CANopen field bus interface.

The I/O level is connected with I/O modules from the RIO or XCx micro series. With the integrated interface you can connect up to eight I/O modules on the DIN rail directly on the right-hand side of the controller. More I/O points can be set up with an optional XRIO interface.

The optional CANopen interface realizes axis drives and makes the XCx suitable for application as a subcontroller in factory automation control systems. Configuring is carried out with the Windows programming system Multiprog according to IEC 61131-3. It is matched to the resources of the XCx to ensure easy operation. Webserver functionality is available as an optional extra.

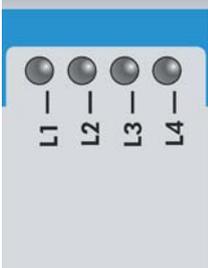
### Options

The controller is available in two pure PLC versions and four PLC/CNC versions, with and without CANopen interfacing. The CANopen module occupies the free slot. If you require a different configuration (e.g. Profibus-DP interfacing, XRIO interface or digital drive interface), please order the controller version without CANopen, and order the appropriate expansion module separately.

XCS 300	PLC-CPU
XCS 300 C	PLC-CPU, with CANopen
XCN 300 E	CNC/PLC controller, max. 4 axes
XCN 300 CE	CNC/PLC controller, max. 4 axes, with CANopen
XCN 300	CNC/PLC controller, max. 4 axes
XCN 300 C	CNC/PLC controller, max. 4 axes, with CANopen

Technical data	XCS 300	XCS 300 C	XCN 300 E	XCN 300 CE	XCN 300	XCN 300 C
Article number	R4.501.0060.0	R4.501.0020.0	R4.501.0030.0	R4.501.0040.0	R4.501.0050.0	R4.501.0010.0
Controller	PLC		CNC/PLC			
<b>Hardware and memory</b>						
CPU	Intel XScale PXA 210 (16 Bit, 200 MHz)					
Memory	SD-RAM: 16 MB S-RAM: 512 KB Flash (internal): 2 MB					
Real-time clock	Battery-buffered with calendar and leap year, resolution: 1 s					
Buffering	Min. 3 months with vanadium pentoxide lithium cell, 3V / 50 mAh + SuperCAP					
Compact Flash (type 2, external)	For operating system and user data 16 MB to 1 GB					
<b>CNC/PLC properties</b>						
Processing time 1 K PLC instructions	Bit: approx. 0.8 ms Byte / Word / DWord: approx. 0.5 ms					
PLC signal propagation time	1 ms input to output via XRIO interface					
Function blocks	Any number of firmware functions and function blocks					
Number of NC axes / subsystems	- / -	- / -	4 / 2	4 / 2	4 / 2	4 / 2
CNC interpolation cycle from	-	-	2 ms	2 ms	2 ms	2 ms
Block cycle time from	-	-	2 ms	2 ms	2 ms	2 ms
Operating system	VxWorks, multitasking operating system (time-driven / priority-driven)					
Number of user tasks	18					
Task cycle times	Programmable $\geq$ 1 ms (whole number)					
Memory	Data: max. 1 6384 KB Programs: 4096 KB					
PLC flags	Retentive: 256 KB Non-retentive: 2048 KB					
Memory management	Dynamic					
Times and counters	Any number programmable from 1 ms ... 290 h (number limited only by memory capacity)					
<b>Software / Field Bus</b>						
PLC operating system	●	●	●	●	●	●
CNC operating system	-	-	●	●	●	●
CANopen	-	●	-	●	-	●
Configuring	Multiprog (programming environment to IEC 61131-3, incl. OPC server) • (option) ProCANopen (CANopen network configurator) • (option)					
<b>Interfaces</b>						
RS422 (X1)	Operator panel interface, 8-pin plug-in terminal					
Interrupt inputs/outputs (X2) *	2 combination channels (can be used as inputs or outputs), on 8-pin plug-in terminal					
Ready contact (X2)	Ready-for-operation relay, releases on PLC stop, on 8-pin plug-in terminal DC 24 V, max. 2 A, General Purpose, potential-free relays contact, NO					
Ethernet (X6)	Networking, RJ45, 10 Mbit/s					
RS232 (X7)	Programming and diagnosis interface, 9-pin subminiature plug connector					
Slot for expansion card (X8)	Slot for expansion card on CANopen versions occupied by CANopen field bus interface for I/Os and drives, 9-pin subminiature plug connector					
XRIO	Direct interfacing of max. 8 RIO I/O modules (via integrated coupler) or XcX micro modules (via coupling module X2RIO), max. 128 I/Os					

\* see general technical data, page 45.

Technical data	XCS 300	XCS 300 C	XCN 300 E	XCN 300 CE	XCN 300	XCN 300 C
<b>Mode switch</b>						
Version	3-position lockswitch					
Controller startup behaviour (→ also page 12)	PROG	PLC stop, programming mode				
	WARM	Default, PLC warmstart, retain variables				
	COLD	PLC cold start, reinitialize retain variables				
Reset button	For hardware reset (= Power Off), effective only in PROG mode					
<b>Housing, electrical data</b>						
Dimensions (W x H x D)	125 x 125 x 129 mm					
Weight	1.025 kg					
Supply voltage	DC 24 V (±20 %, max. 5 % residual ripple)					
Power consumption	max. 40 W			max. 40 W		
Current consumption	max. 4.5 A (incl. all digital I/Os)					
Isolation (from internal electronics)	X1 (RS422):	yes				
	X2 (digital I/O):	yes				
	X6 ETH (Ethernet)	yes				
	X7 PRG (RS232):	no				
	X8 (free slot):	yes				
<b>LED displays</b>						
	L1, L2, L3, L4	Free (reserved for optional expansion module, → page 30)				
	CF	green, on red, on	Compact Flash CF access access error			
	ETH	green, flashing red, on	Ethernet network network access no network connection			
	RIO	green, on green, flashing red, on yellow, on	RIO direct connection Operational Pre-operational Bus error Frame error			
	RUN/ERR	green, on red, on red, flashing off	CPU status Operating voltage OK, no error CPU not running (watchdog) CPU has detected fatal error No operating voltage			
	PLC RUN	yellow, on yellow, flashing off	PLC status PLC running PLC running, but outputs shut down (ready-for-operation relay released) PLC stop			
	I/O 1 I/O 2	yellow, on off	Interrupt input/output Input/output set Input/output not set			

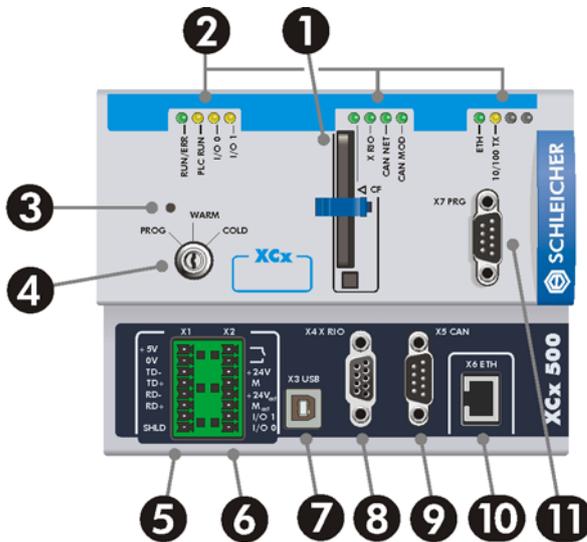
For general technical data see page 45.

**CNC/PLC Controller • Basic Version**

**XCx 500**

**CNC/PLC Controller • Expansion Version**

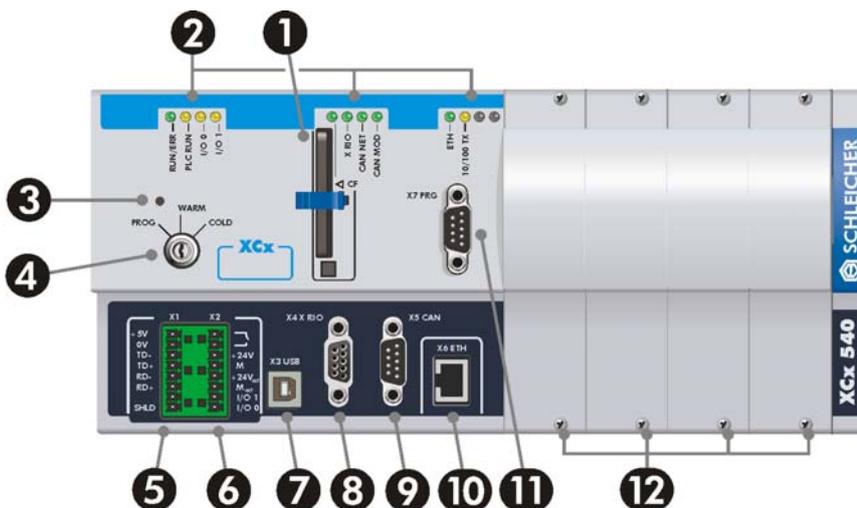
**XCx 540**



- 1 Compact Flash for operating system and user data
- 2 LED displays for controller, periphery and network
- 3 RESET button
- 4 Operating mode lockswitch
- 5 X1 RS422 interface for operator panels and displays
- 6 X2 Connection for supply voltage, interrupt inputs/outputs and ready contact
- 7 X3 USB connection for external programming units
- 8 X4 XRIO Interfacing of plant-floor bus nodes
- 9 X5 CANopen drive and field bus interface
- 10 X6 ETH RJ45 Ethernet interface
- 11 X7 PRG RS232 interface for programming units
- 12 Slots for max. 4 expansion cards (XCx 540 only)

The **XCx 500** is the basic version in the XCx controller family. Its high performance makes it suitable both for pure PLC requirements and for complex CNC/PLC applications. It is equipped with a large number of interfaces, making it suitable for a huge range of production environments. Networking with Ethernet and TCP/IP ensures fast controller access for programming, diagnosis and operation. The CANopen interface realizes axis drives and makes the XCx suitable for application as a subcontroller in factory automation control systems. The plant-floor I/O level is connected with the XRIO interface and I/O modules from the RIO or XCx micro series.

Configuring is carried out with the Windows programming system Multiprog according to IEC 61131-3. It is matched to the resources of the XCx to ensure easy operation. Webserver functionality is available as an optional extra.



**Options**

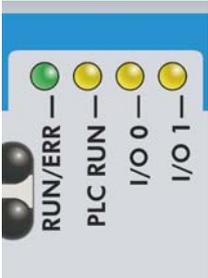
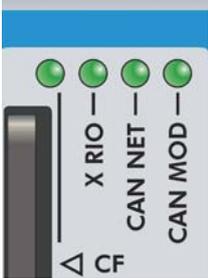
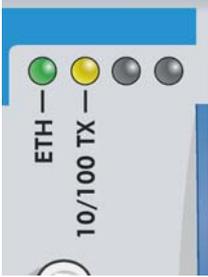
The controller is available in one pure PLC version and two PLC/CNC versions.

XCS 500	PLC-CPU
XCN 500 E	CNC/PLC controller, max. 4 axes
XCN 500	CNC/PLC controller, max. 16 axes
XCS 540	PLC-CPU
XCN 540 E	CNC/PLC controller, max. 4 axes
XCN 540	CNC/PLC controller, max. 16 axes

The **XCx 540** is the expansion version in the XCx controller family. As well as all the features of the XCx 500, it also has 4 expansion slots for additional XRIO nodes and drive interfaces.

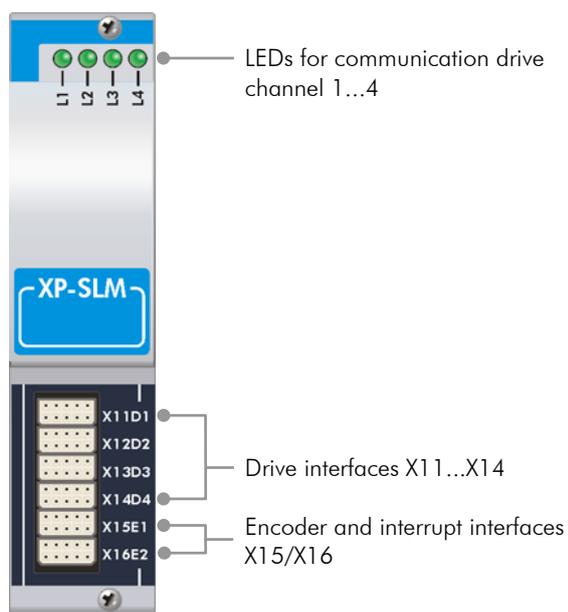
Technical data	XCS 500	XCN 500 E	XCN 500	XCS 540	XCN 540 E	XCN 540
Article number	R4.501.0070.0	R4.501.0080.0	R4.501.0090.0	R4.501.0100.0	R4.501.0110.0	R4.501.0120.0
Controller	PLC	CNC/PLC		PLC	CNC/PLC	
<b>Hardware and memory</b>						
CPU	Intel StrongARM SA 1110 (32 Bit, 206 MHz)					
Memory	SD-RAM: 32 MB S-RAM: 1 KB Flash (internal): 2 MB					
Real-time clock	Battery-buffered with calendar and leap year, resolution: 1 s					
Buffering	Min. 3 months with vanadium pentoxide lithium cell, 3V / 50 mAh + SuperCAP					
Compact Flash (type 2, external)	For operating system and user data 16 MB to 1 GB					
<b>CNC/PLC properties</b>						
Processing time for 1K PLC instructions	Bit: approx. 0.4 ms Byte / Word / DWord: approx. 0.2 ms					
PLC signal propagation time	1 ms input to output via XRIO interface					
Function blocks	Any number of firmware functions and function blocks					
Number of NC axes / subsystems	- / -	4 / 2	16 / 8	- / -	4 / 2	16 / 8
CNC interpolation cycle from	-	1 ms	1 ms	-	1 ms	1 ms
Block cycle time from	-	1 ms	1 ms	-	1 ms	1 ms
Operating System	VxWorks, multitasking operating system (time-driven / priority-driven)					
Number of user tasks	18					
Task cycle times	Programmable $\geq$ 1 ms (whole number)					
Memory	Data: max. 1 6384 KB Programs: 4096 KB					
PLC flags	Retentive: 256 KB Non-retentive: 2048 KB					
Memory management	Dynamic					
Times and counters	Any number programmable from 1 ms ... 290 h (number limited only by memory capacity)					
<b>Software</b>						
PLC operating system	●	●	●	●	●	●
CNC operating system	-	●	●	-	●	●
Configuring	Multiprog (programming environment to IEC 61131-3, incl. OPC server) • (option) ProCANopen (CANopen network configurator) • (option)					
<b>Interfaces</b>						
RS422 (X1)	Operator panel interface, plug-in terminal 8-pin					
Interrupt inputs/outputs (X2) *	2 combination channels (can be used as inputs or outputs), on 8-pin plug-in terminal					
Ready contact (X2)	Ready-for-operation relay, releases on PLC stop, on 8-pin plug-in terminal DC 24 V, max. 2 A, General Purpose, potential-free relays contact, NO					
USB (X3)	Programming, diagnosis and operator panel interface, version 2.0, slave, connector type B					
XRIO (X4)	Proprietary field bus interface (XRIO) for connecting the RIO I/O system via special bus coupler modules (RIO EC X2), distance up to 10 m, max. 512 I/Os (XCx 540 only: more I/O modules via optional XRIO interfaces)					
CAN (X5)	CANopen field bus interface for I/Os and drives, subminiature 9-pin plug connector					
Ethernet (X6)	Networking, RJ45, 10/100 Mbit/s					
RS232 (X7)	Programming and diagnosis interface, 9-pin subminiature plug connector					
Slots for expansion cards	-			4		

\* see general technical data, page 45.

Technical data	XCS 500	XCN 500 E	XCN 500	XCS 540	XCN 540 E	XCN 540
<b>Mode switch</b>						
Version	3-position lockswitch					
Controller startup behaviour (→ also page 12)	PROG		PLC stop, programming mode			
	WARM		Default, PLC warmstart, retain variables			
	COLD		PLC cold start, reinitialize retain variables			
Reset button	For hardware reset (= Power Off), effective only in PROG mode					
<b>Housing, electrical data</b>						
Dimensions (W x H x D)	154 x 125 x 129 mm			274 x 125 x 129 mm		
Weight	1.125 kg			1.85 kg		
Supply voltage	DC 24 V (±20 %, max. 5 % residual ripple)					
Power consumption	Max. 40 W			Max. 40 W		
Isolation (from internal electronics)	X1 (RS422):	yes				
	X2 (digital I/O):	yes				
	X3 USB:	no				
	X4 XRIO (XRIO):	yes				
	X5 CAN (CANopen):	yes				
	X6 ETH (Ethernet):	yes				
	X7 PRG (RS232):	no				
<b>LED displays</b>						
	RUN/ERR	green, on red, on red, flashing off	CPU status Operating voltage OK, no error CPU not running (watchdog) CPU has detected fatal error No operating voltage			
	PLC RUN	yellow, on yellow, flashing off	PLC status PLC running PLC running, but outputs shut down (ready-for-operation relay released) PLC stop			
	I/O 1 I/O 2	yellow, on off	Interrupt input/output Input/output set Input/output not set			
	CF	green, on red, on	Compact Flash CF access access error			
	X RIO	green, on green, flashing red, on yellow, on	RIO direct connection Operational Pre-operational Bus error Frame error			
	CAN NET	green, on green, flashing red, on red, flashing off	CAN network status (only on CAN versions) CAN state operational CAN state pre-operational Bus off CAN error CAN state prepared			
	CAN MOD	green, on green, flashing red, on red, flashing	CAN module status (only on CAN versions) CAN stack initialized Invalid CAN configuration Control unit not ready or serious error Error in controller			
	ETH	green, flashing red, on	Ethernet network network access no network connection			
	10/100 TX	yellow, on off	Ethernet transmission rate 100 Mbit/s 10 Mbit/s			

For general technical data see page 45.

## Drive Module • 4 Axes • SLM protocol XP-SLM



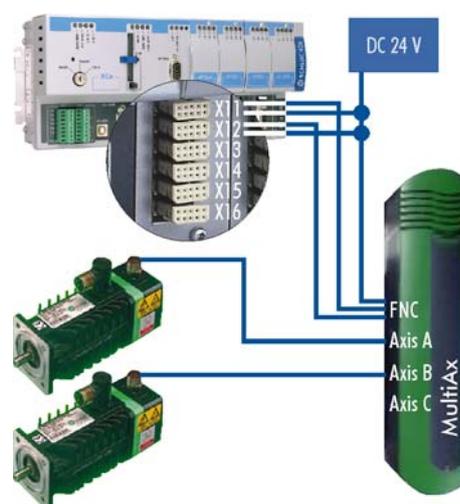
### Serial SLM interface

An SLM interface always connects 3 stations:

- Motion controller (XCN with XP-SLM)
- Converter (e.g. MultiAx)
- Motor (e.g. Unimotor)

### Application example

A MultiAx actuator and two Unimotors are to be connected to an XCN with the SLM drive module XP-SLM. The drives are connected to the controller via connectors X11 and X12. The diagram shows the basic wiring of the drives (without power section).



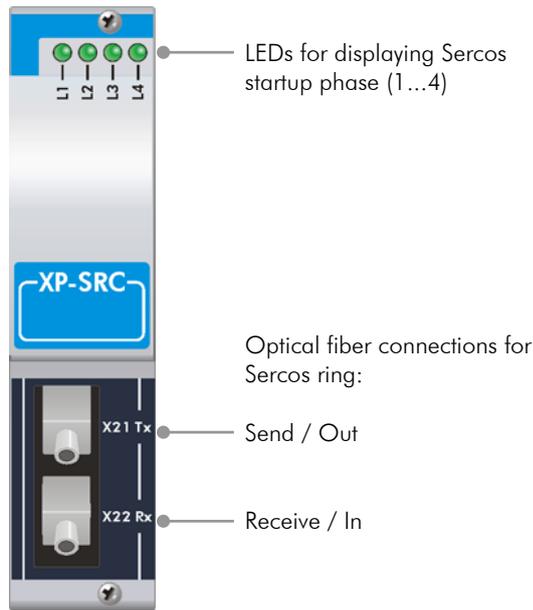
The XP-SLM drive module is a high-speed serial interface with SLM protocol (Speed Loop Motor) for data transfer to and from SLM drives and actuators made by Control Techniques. It allows positioning and position control of 4 independent NC axes. It also provides 2 encoder inputs (for connecting hand-wheels) and 2 interrupt inputs (for connecting tracers). The external power supply can be fed through a 24V power pack or via the drive (e.g. MultiAx from Control Techniques).

Technical data	XP-SLM
Article number	R4.503.0030.0
Number of controllable NC axes, max.	4
Serial SLM interfaces	COM1+, COM1-; COM2+, COM2-; COM3+, COM3-; COM4+, COM4-
Number	4
Physics	Two-wire RS485; 2.5 Mbaud
Protocol	SLM (Speed Loop Motor), through ASIC CT2239-003 from Control Techniques
Hardware enable	HWEN1; HWEN2; HWEN3; HWEN4
Number	4
Switching level	H level = +24 V-EXT - 0.5 V • L level = 1 V
Encoder inputs	A, /A, B, /B, NULL, /NULL
Number	2
Physics	RS422
Interrupt inputs	INT+, INT-
Number	2
Switching level	H level = +11 V to +30 V • L level = -30 V to +5 V
Triggering	Edge triggering
Supply voltage external	+24V-EXT, GND-EXT • 24 V DC ± 20% max. 5% residual ripple
Isolation	By optocouplers
Accessory XP-SLM-K1-3,5	3.5 m connecting cable from the XP-SLM module to the drive (10-strand, Harting connector at one end) • Article no.: R4.506.0010.0
Connections	X11...X16: har-link® 10-pin socket connector (Harting)
For controllers (number)	XCN 540 (4x)

For general technical data see page 45.

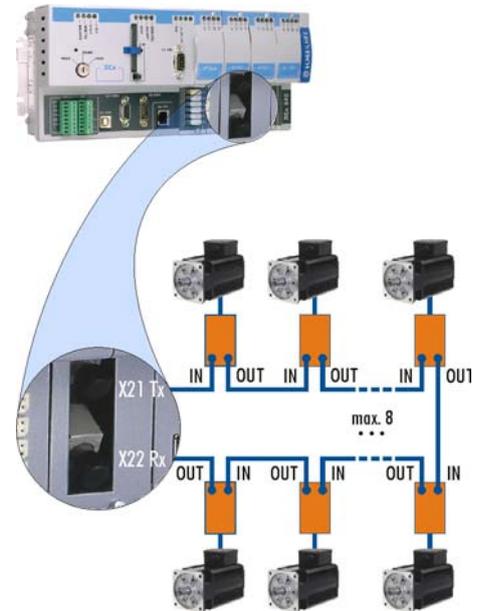
## Drive Module • 2, 4, 6 or 8 Axes • Sercos

## XP-SRC(x)



### Application example

You can connect up to 8 SERCOS drives to an XCN with the SERCOS drive module XP-SRC. The XP-SRC module is the master and the drives are the slaves. The optical fiber is connected as a ring, i.e. each output is connected to an input.



The Sercos XP-SRC drive module XP-SRC(x) provides a Sercos ring on which up to 2, 4, 6 or 8 independent Sercos drives can be operated via optical fiber.

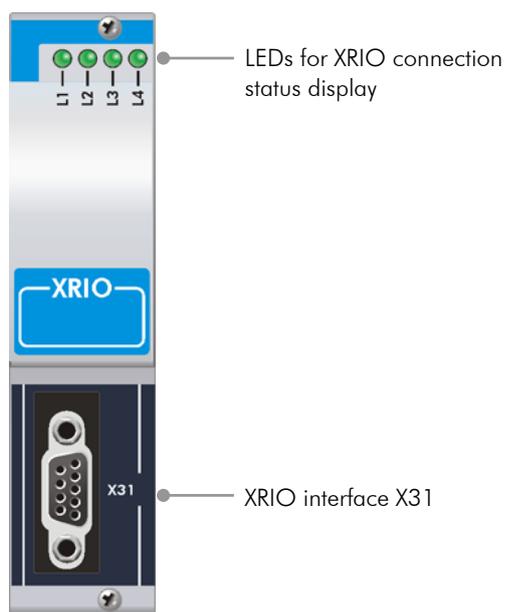
A protocol implemented in the controller allows communication with a Bosch-Rexroth DriveTop interface via the serial PC interface on the XCx. Thus the drive parameters can be easily output, optimized and saved.

Technische Daten	XP-SRC 2	XP-SRC 4	XP-SRC 6	XP-SRC 8
Article number	R4.503.0200.0	R4.503.0230.0	R4.503.0260.0	R4.503.0010.0
Number of controllable NC axes, max.	2	4	6	8
interface	Sercos master to IEC 1491			
Cable type	Plastic optical fiber, 2 / 4 / 8 / 16 MBaud			
Cycle time	1 ... 30 ms			
Controller	Sercon 816			
Displays	4 LEDs (L1 ... L4) for communication			
Connections	X21 Tx: Send / Out X22 Rx: Receive / In Sercos optical fiber connection IN/OUT, F-SMA screw connection to IEC 874-2			
For controllers (number)				
XCN 300	● (1x)	● (1x)	–	–
XCN 540	● (2x)	● (2x)	● (2x)	● (2x)

For general technical data see page 45.

## XRIO Interface Module

XRIO

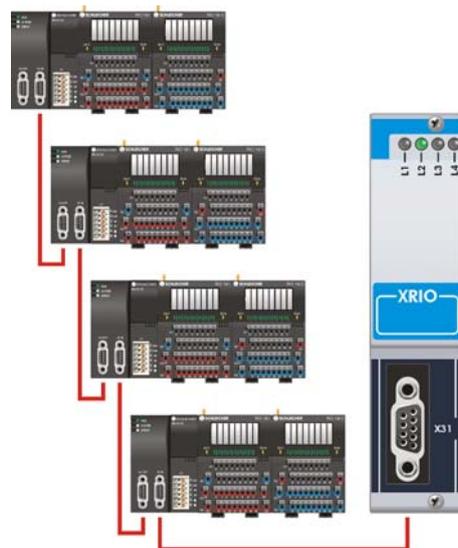


The XRIO interface module provides an additional connection for four interface modules (RIO EC X2 for RIO modules, XBXC for XCx micro modules) each with eight digital or analog I/O modules, in addition to the standard integrated XRIO connection. A high-speed protocol without field bus delay controls the modules via the serial interface.

As well as the integrated XRIO, the XCx 300 can also be provided with one extra XRIO interface, the XCx 540 with three.

### Application example

The XRIO I/O driver interfaces connected modules via the X31 XRIO connector, provides corresponding input and output maps, and refreshes them. The transmission times on the XRIO bus are largely determined by the number of bytes to be sent. A transmit time of 22  $\mu$ s per byte can be taken as a rule of thumb.

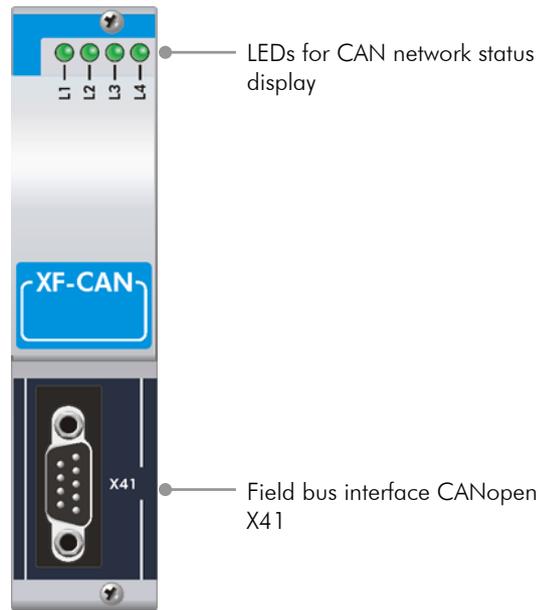


Technical data	XRIO
Article number	R4.503.0130.0
Interface	RS 422, analog Interbus (DIN E 19258)
Protocol	Proprietary Schleicher RIO protocol
Transmission rate	500 KBit/s
Cable length	Max. 10 m (between two connection points)
Displays	1 LED (L2) for communication
Connections	X31: 9-pole subminiature, jack contact
For controllers (number)	XCS 300, XCN 300 E, XCN 300 (1x) XCS 540, XCN 540 E, XCN 540 (3x)

For general technical data see page 45.

## CANopen Field Bus Module

## XF-CANopen



### CANopen basics

CANopen is based on the CAN Application Layer for industrial CAL applications. The CANopen communications profile CiA DS-301 specifies the mechanisms for configuring and communication between devices in real-time environments.

CANopen uses the data transmission layer to ISO 11898 and CAN 2.0 A+B:

- Description of device details via an EDS (Electronic Data Sheet)
- Object-oriented communication with PDOs and SDOs
- Transmission of real-time data as PDO (Process Data Object), sent by all stations, either event-driven or synchronized
- Complex data and low-priority services are transmitted/processed with SDOs (Service Data Objects)
- CANopen configuration managers (or masters) carry out functions such as network management during network start-up. However, they are not necessary for communication between the slaves.
- In theory up to 127 stations are possible on one bus. In practical terms, however, the number of bus stations is restricted by the respective bus topology, and in particular by the type of CAN transceiver modules used.

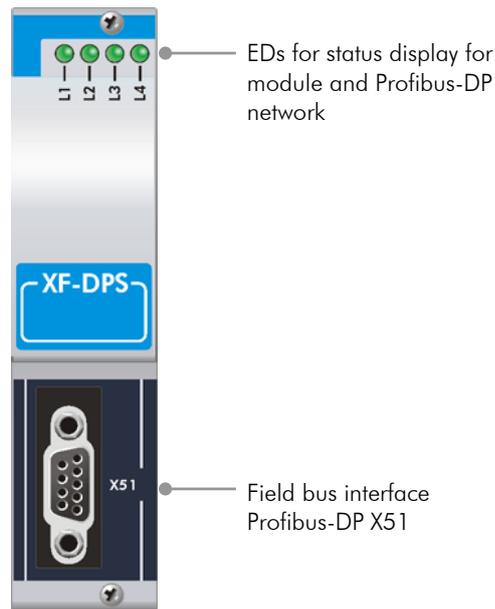
With the XF-CAN field bus module you can connect devices that support the CANopen standard to the controller system. This provides a field bus interface for controller networking, connecting drives, valve groups and special devices, and setting up additional I/O nodes.

Technical data	XF-CANopen
Article number	R4.503.0110.0
interface	CAN 2.0 A+B, acc. to ISO/DIS 11519-1, ISO/DIS 11989
Protocol	CANopen
Transmission rate	1 MBit/s (at max. 40 m), 50 KBit/s (at max. 1000 m)
Number of stations	max. 64
Displays	2 LEDs (L3, L4) for network status
Connections	X41: 9-pole subminiature connector
For controllers (number)	XCx 300 (all versions) (1x)

For general technical data see page 45.

## Profibus-DP Field Bus Module • Slave

## XF-DPS



### Profibus basics

Profibus is an open and internationally standardized field bus, whose technology (in various versions) is developed by the Profibus user organization. Profibus-DP (distributed periphery) has been specially designed for speed-optimized communication with remote periphery sensor and actuator devices and conforms to EN 50170.

The bus topology is a linear structure comprising a shielded 2-wire cable with active bus terminator at both ends. According to the Profibus RS485 specification, up to 32 stations can be connected per bus segment. To operate a greater number of Profibus-DP stations, the system must be segmented with repeaters.

The station-specific data is defined in a standardized equipment master file, allows easy application of plug-'n'-play. If individual slaves fail or are shut off during bus operation the others continue to operate.

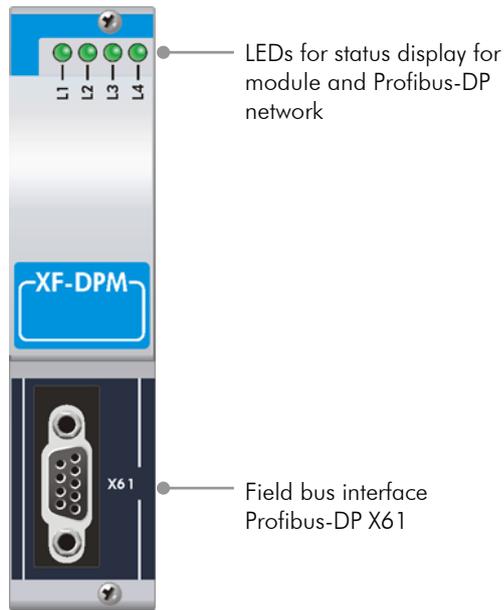
Using the XF-DPS field bus module makes the XCx into a slave in a Profibus-DP network. Parallel operation with the CANopen field bus is possible.

Technical data	XF-DPS
Article number	R4.503.0280.0
Interface	Profibus-DP slave
Transmission rate	12 MBit/s (at max. 100 m) to 94 KBit/s (at max. 1200 m)
Number of stations	Max. 32 per bus segment, additional segments using repeaters
Displays	4 LEDs (L1 ... L4) for module and network status
Connections	X51: 9-pole subminiature, jack contact
For controllers (number)	XCx 300 (all versions) (1x) XCx 540 (all versions) (4x)

For general technical data see page 45.

## Profibus-DP Field Bus Module • Master

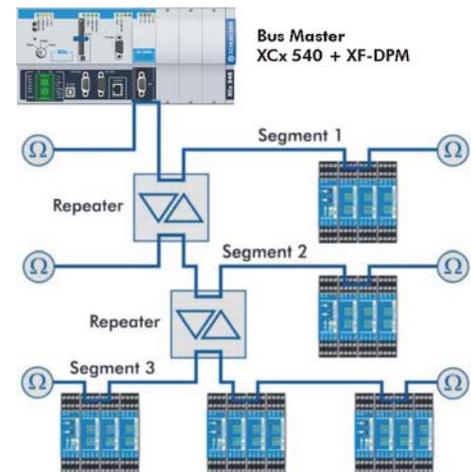
## XF-DPM



Using the XF-DPM field bus module makes the XCx into a class-1-master in a Profibus-DP network. Parallel operation with the CANopen field bus is possible.

### Application example

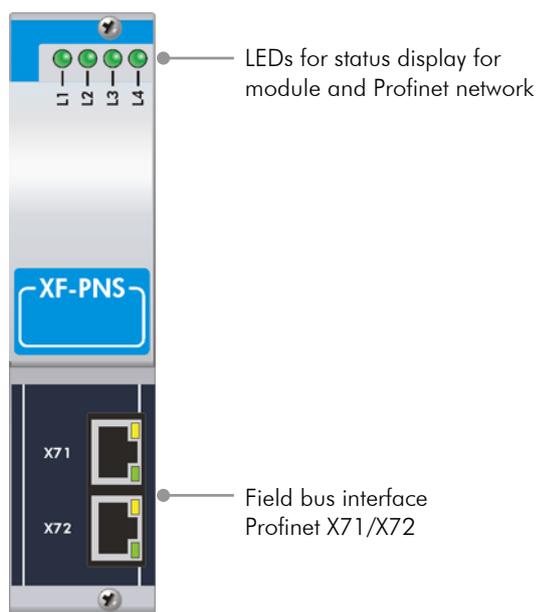
XCx 540 with XF-DPM field bus module as a bus master. The bus topology is a linear structure comprising a shielded 2-wire cable with active bus terminator at both ends. According to the Profibus RS485 specification, up to 32 stations can be connected per bus segment. To operate a greater number of Profibus-DP stations, the system must be segmented with repeaters.



Technical data	XF-DPM
Article number	R4.503.0310.0
Interface	Profibus-DP master
Transmission rate	12 MBit/s (at max. 100 m) to 94 KBit/s (at max. 1200 m)
Number of stations	Max. 32 per bus segment, additional segments using repeaters
Displays	3 LEDs (L1, L3, L4) for module and network status
Connections	X61: 9-pole subminiature, jack contact
For controllers (number)	XCx 300 (all versions) (1x) XCx 540 (all versions) (4x)

For general technical data see page 45.

## Profinet Field Bus Module • Slave XF-PNS



### Profinet basics

The basic approach of Profinet is the application of the object model on automation technology. For this purpose, machines, plants and their parts are divided into technological modules, each of which comprises mechanical, electrical/electronic and application software. The functionality of the technological module is encapsulated in Profinet components, which can be accessed over universally defined interfaces. The components can be combined over their interfaces according to the modular principle and interconnected to applications.

The Profinet communication model defines a vendor-independent standard for communication on Ethernet. It uses TCP/IP and COM/DCOM, the most common standards of the PC world. It provides direct access from the office world to the automation level and vice versa (vertical integration).

The integration of existing field bus systems (e.g. Profibus or CANopen) in Profinet is implemented using proxies. These assume a proxy function for all the devices connected to the field bus. This means that when rebuilding or expanding plants, the entire spectrum of devices can be implemented unchanged.

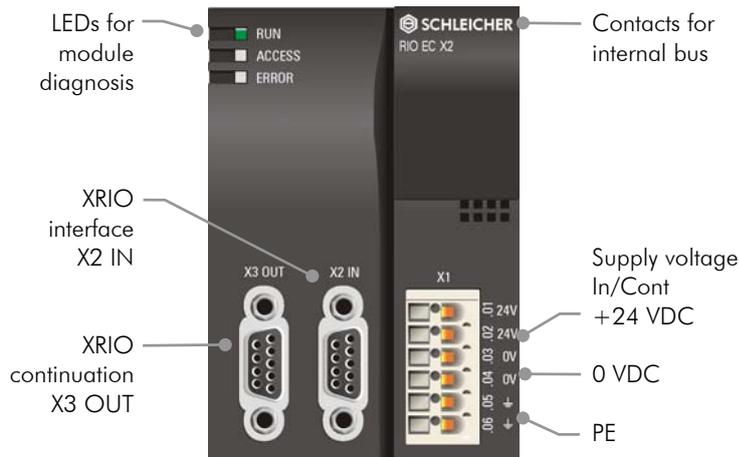
Using the interface module XF-PNS XCx controllers can be integrated in networks with higher-level Profinet controllers for distributed operation. Real-time data exchange between master and slave as well as slave and master is done using configurable arrays.

Technical data	XF-PNS
Article number	R4.503.0340.0
Interface	Profinet slave
Transmission rate	100 MBit/s
Displays	4 LEDs (L1 ... L4) for module and network status
Connections	X71, X72: 2x RJ45
For controllers (number)	XCx 540 (all versions) (4x)

For general technical data see page 45.

## XRIO Bus Coupler • RIO bus nodes

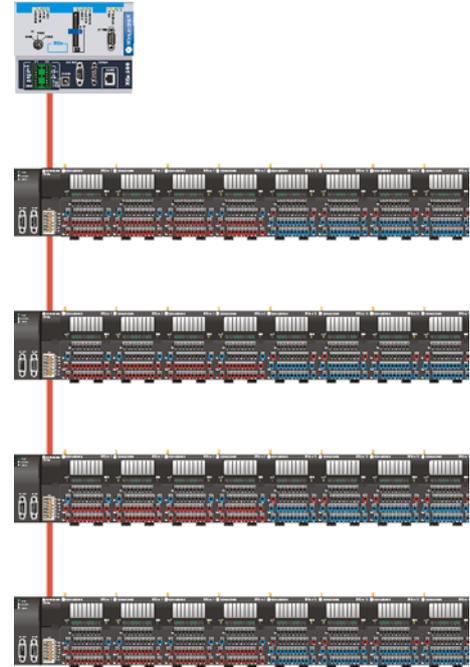
## RIO EC X2



### Application example

The RIO EC X2 bus coupler allows you to cascade four bus nodes, each with up to 8 I/O modules.

For more application examples → page 18.



The RIO EC X2 bus coupler connects the XRIO interface on the XCx 500/540 to digital, analog and function modules in the RIO I/O series. Via the X2RIO coupling module (→ page 40) you can also connect expansion modules from the XCx micro series. (The XCx 300 has an integrated bus coupler; an additional XRIO interface is available as an optional expansion module.)

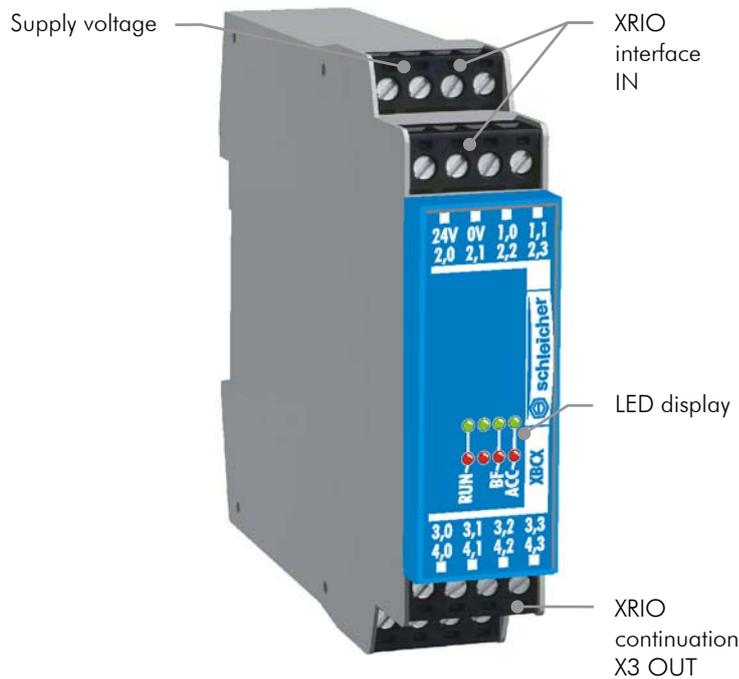
A bus node comprises the bus coupler and up to 8 I/O expansion modules with 128 digital or 56 analog channels. The I/O modules are connected on the DIN rail on the coupler. The internal bus is created by slide contacts. For more information on the RIO system please refer to the RIO system description and operating manuals (→ page 44).

Technical data	RIO EC X2
Article number	R5.363.0160.0
Interface	XRIO
Bus connection	2x subminiature 9-pin connector
Max. I/O range internal	64 bytes input data / 64 bytes output data
Supply voltage external	DC 24 V (± 20 %, max. 5 % residual ripple)
Power consumption	Bus coupler: 5 W from external 24 V supply connected modules: max. 5 W via internal 5 V supply
Number of attachable I/O modules	8
Cable length	Max. 10 m (between two connecting points)

For general technical data see page 45.

## XRIO Bus Coupler • XCx micro bus nodes

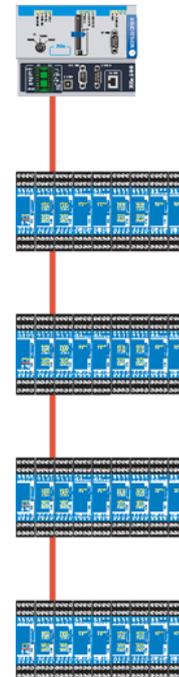
**XBCX**



### Application example

The XBCX bus coupler allows you to cascade four bus nodes, each with up to 8 I/O modules.

For more application examples → page 18.



The XBCX bus coupler connects XCx micro expansion modules to XCx controllers. A bus node comprises the bus coupler and up to eight expansion modules with 112 digital or 16 analog channels. This allows you to harness the full performance of the XCx micro for XCx controllers.

For more information on the XCx micro system please refer to the system description and operating manual (→ page 44).

Technical data	XBCX
Article number	In preparation
Interface	XRIO
Transmission rate	500 kBit/s
Bus connection	4x 4-pin plug-in terminal
Max. I/O range internal	64 bytes input data / 64 bytes output data
Supply voltage external	DC 24 V (± 20 %, max. 5 % residual ripple)
Power consumption	Bus coupler: 5 W from external 24 V supply connected modules: max. 5 W via internal 5 V supply
Number of attachable I/O modules	8
Cable length	Max. 10 m (between two connecting points)

For general technical data see page 45.

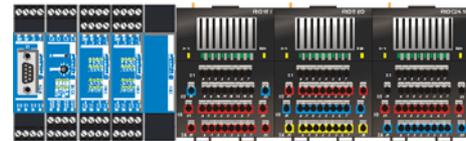
## Coupling Module • RIO Modules <> XCx micro

**X1RIO**



### Application example

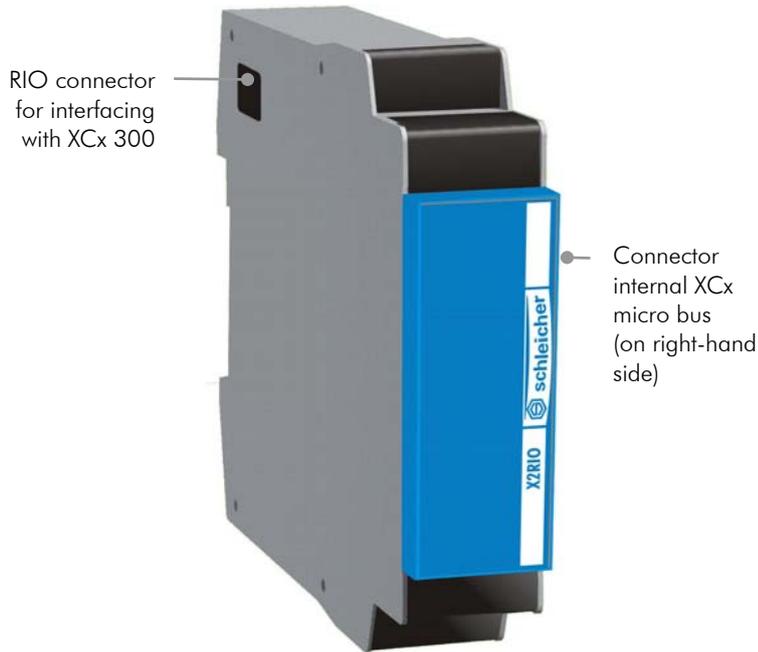
The X1RIO coupling module provides connection between XCx micro and RIO expansion modules (→ page 19).



The X1RIO module interfaces the XCx micro modules with all RIO expansion modules. The module has no electronic components and requires no power supply.

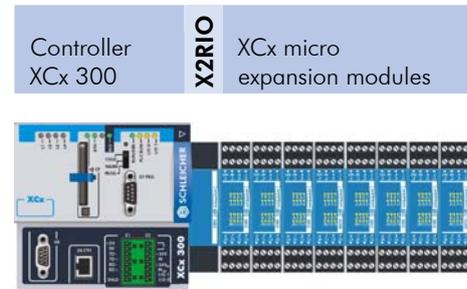
Technische Daten	X1RIO
Artikelnummer	R4.390.0020.0
Interface	Internal controller bus
Supply voltage external	Passive module, no supply voltage
Number of attachable I/O modules	Overall a bus node comprises up to eight expansion modules (XCx micro or RIO)
For general technical data see page 45.	

**Coupling Module • XCx 300 / RIO <=> XCx micro** **X2RIO**



**Application example**

The X2RIO coupling module provides connection between the XCx 300 or RIO modules and XCx micro expansion modules (→ page 19).



The X2RIO module interfaces between the XCx 300 or RIO modules and XCx micro expansion modules. The module has no electronic components and requires no power supply.

Technical data	X2RIO
Article number	R5.363.0160.0
Interface	Internal controller bus
Supply voltage external	Passive module, no supply voltage
Number of attachable I/O modules	Overall a bus node comprises up to eight expansion modules (XCx micro or RIO)
For general technical data see page 45.	

## PLC Operating System

The real-time multi-tasking properties of the IEC 61131-3 operating system allow you to optimally adapt the controller to the process.

- Suitable for ultra-fast process controllers
- Constant cycle times
- Event tasks and cyclical tasks
- Extremely short reaction time for sporadic events via interrupt I/Os
- Supports wide range of field bus and drive interfaces
- Visualization via integrated OPC server (V.1.0a Specification)
- Option of synchronized CNC functions (see below)

The PLC operating system is a component of all XCS and XCN control units.

PLC and CNC are started up and operated using the Schleicher-Dialog software (→ page 43).

## CNC Operating System

The CNC operating system to DIN 66025 gives the XCx controllers a broad additional spectrum of standard and special functions. A complete PLC operating system to IEC 61131-3 is integrated (see above). This close meshing of CNC and PLC via the shared RAM (→ page 17) allows you to interpolate technology parameters with path motion.

The CNC software on the XCx is based on Schleicher's proven CNC tools. As well as the standard CNC functions it also includes special algorithms, for example for robot control and synchronous axes. N-dimensional freeform interpolation with the Online-Curve-Interpolator (OCI) offers enormous gains in handling and machining efficiency through smooth motion and quick, steady acceleration. For up to 6 NC axes the XCN offers parallel program and tool management in several NC subsystems and flexible parameterizability of program memory management, tool memory, circle error tolerance and axis-specific interpolation fineness.

- Suitable for extremely fast process/machine controllers
- Interpolates up to 16 NC axes
- NC axes are positioned precisely, interpolated and transformed
- Support for virtual line shafts and electronic cams
- Processes several NC programs in parallel (option)
- NC axes can be shared by several NC subsystems
- Circle, helix and freeform interpolation
- 3-D contour grinding cycles
- Optimized robot motions
- Data reduction and path optimization with Nerthus software (option)
- Online Curve Interpolator (OCI) (option)

The CNC operating system is a component of all XCN control units. The number of interpolated NC axes and subsystems varies according to the controller type (→ pages 24 and 27).

PLC and CNC are started up and operated using the Schleicher-Dialog software (→ page 43).

## CNC Software Options

Article number	Designation
R4.320.0350.0	NERTHUS 6 AXES
R4.320.0460.0	CNC 03 • NC subsystems
R4.320.0620.0	CNC 06 COOR • coordinates transformation
R4.320.0430.0	CNC 08 SSK • leadscrew compensation
R4.320.0450.0	CNC 09 • Nerthus freeform interpolation
R4.320.0440.0	CNC 10 OCI • OCI freeform interpolation
R4.320.0510.0	CNC 14 REV • reverse processing

## Programming System to IEC 61131-3 Multiprog

Configuring is carried out with the Windows programming system Multiprog according to IEC 61131-3. It is matched to the resources of the XCx to ensure easy operation. This means you have a clearly structured, easily operated tool for editing, compiling, debugging, managing and printing PLC applications in all the development phases.

You can choose from five programming languages, which can be mixed as required for the task or programming style.

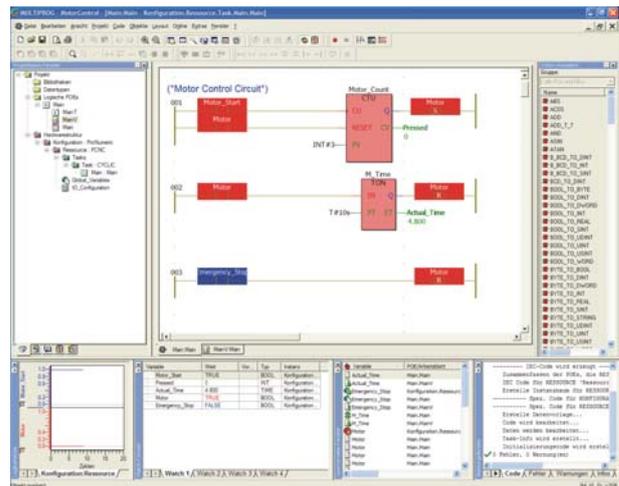
- Text languages
  - Structured text (ST)
  - Instruction list (IL)
- Graphic languages
  - Function block diagram (FBD)
  - Ladder diagram (LD)
  - Sequential function chart (SFC)

Multiprog is based on modern 32-bit Windows technology. It can be used with a mouse or via a keyboard and is easy to use thanks to tools like zoom, scroll, special toolbars, drag & drop, a shortcut manager and dockable windows. The complex structure of the IEC 61131-3 standard is presented simply and clearly. The clear structure of the Multiprog user interface makes it easy to operate.

An OPC server is included in the Multiprog package (→ page 14).

The main features:

- Easy creation of applications for multitasking systems
- Integrated simulation makes it possible to test projects offline (without a connected PLC)
- Clear project management through a project tree based on the Windows Explorer directory structure
- Easy-to-use Edit Wizards for creating programs
- Powerful documentation system with graphic editor, print preview and cross-reference printout
- Context-sensitive help for program, target system, instruction set and language elements

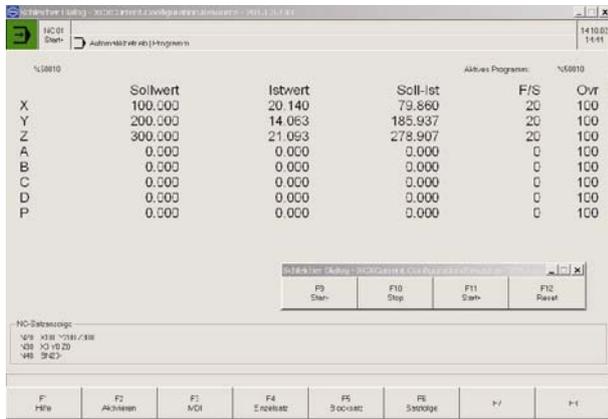


<b>Multiprog 4.0</b>	
Article number	R4.320.0640.0
Contents	CD 1: Programming software, OPC server CD 2: Service Pack (see below)
Operating system	Windows 95/98/ME/NT4.0 (SP5 and later)/2000/XP
System requirements	Pentium PC 133 MHz, 32 MB RAM, 80 MB hard disk capacity, graphics 800 x 600 pixels / 256 colours, RS232 interface optional, mouse recommended

<b>Utilities and Updates</b>		<b>Service Pack</b>
Article number	R4.320.0590.0	
Contents	1 CD: Controller software for all Schleicher controllers, AddOns, Schleicher-Dialog (→ page 43), documentations and service informations	

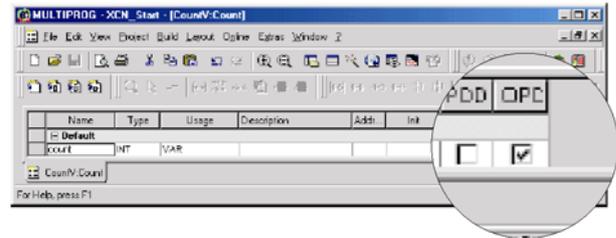
**Startup and Operation Schleicher-Dialog**

The Schleicher-Dialog PC tool is available for starting up and operating the XCx. It communicates with the controller via Ethernet. It is included in the Service Pack CD (→ page 42).



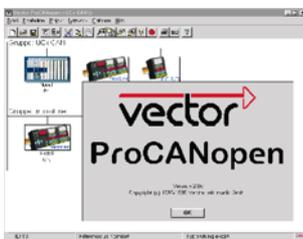
The program automatically detects which operating system is on the controller (pure PLC or CNC/PLC) and selects the appropriate input and display masks:

- Setting dialogs for access authorization, CNC system, program, CAN network, PLC/NC options, OPC variables
- Manual or automatic operation of CNC controller
- CNC programming with NC editor, R parameters, tool data, zero point offset
- Error Messages in the active error buffer and logbook



In the variable dialogs on Multiprog the controller data and variables where the OPC server requires read/write access are simply designated OPC (→ page 14).

**CANopen Network Configuring Software ProCANopen**



The ProCANopen program allows convenient configuring of the CANopen network on a PC under Windows. ProCANopen is suitable for systems with a central controller (master-slave architecture) as well as for

systems with distributed intelligence (several PLCs, industrial PC, other intelligent nodes).

To operate it you need a PCMCIA card (CANcardY, see below).

The network topology is depicted graphically. When you set up a new project you select the required devices (nodes) from a list which contains the EDS (Electronic Data Sheet) files of all available devices. You can then combine and configure the network nodes by dialog control or graphically. You can use the scan function to read in and reconfigure an existing network.

- ProCANopen covers the following tasks:
- Depicting and configuring network topology and addressing
  - Configuring network master
  - Configuring global network variables
  - Configuring all field bus devices and control devices
  - Documenting configuration

ProCANopen	
Article number	R4.320.0500.0
Operating system	Windows 95 or higher
System requirements	Pentium-PC 133 MHz, 20 MB free hard disk capacity, PCMCIA-Slot (min. type I) for operating the CANcardY, CD drive for installation
CANcardY	
Article number	R4.321.0020.0
Type	Single CANopen interface, PCMCIA card

## Operating Manuals

Article number	Designation
R4.322.2270.0	XCx micro Controller
R4.322.2290.0	XCx micro Expansion Modules
R4.322.2140.0	XCx 300 / 500 / 540
R4.322.2220.0	XCx 700
R4.322.1920.0	microLine IEC 61131-3 <sup>1)</sup>
R4.322.1850.0	RIO Bus Couplers BC / EC
R4.322.1730.0	RIO Expansion Modules
R4.322.1830.0	RIO Compact I/O
R4.322.1800.0	RIO Documentation Package
R4.322.1610.0	Commissioning Field Bus Systems
R4.322.2090.0	CNC Programming for XCx and ProNumeric
R4.322.1070.0	EMC Guidelines

<sup>1)</sup> for MCS 20-20R / MCS 20-21R

The operating manuals can be downloaded from the products pages at [www.schleicher-electronic.com](http://www.schleicher-electronic.com).

## System Descriptions

	Designation
	XCx micro
	XCx 300 / 500 / 540
	XCx 700
	RIO Field Bus System / microLine PLC

The system descriptions can be downloaded from the products pages at [www.schleicher-electronic.com](http://www.schleicher-electronic.com).

## Technical Data

### Housing and installation

Housing XCx Controllers Coupling modules XCx micro Coupling modules RIO	Galvanized steel / powder-coated, back drawn aluminium profile Polycarbonat Makrolon 6265 PA 6.0 GF20 black (RIO EC X2)
Installation	On 35 mm DIN rail EN 50022-35 (XCx 300 / 500 / 540 / coupling modules) or screwed to carrier board (XCx 500 / 540 only) Controllers: any orientation Coupling modules: vertical orientation

### Climatic conditions

Ambient operating temperature	0 ... +55 °C (category KV to DIN 40040), free air circulation Restriction to 0 ... +45°C using XF-DPS and XF-DPM modules
Storage temperature	-25 ... +70 °C (category HS to DIN 40040)
Relative humidity	10 ... 95 % (category F to DIN 40040), no condensation
Air pressure in operation	860 ... 1060 hPa

### Electrical safety

Protection type	IP 20 to EN 60529 (CF slot IP 00)
Clearance/creepage distance	DIN EN 61131-2 between electrical circuits and objects as well as between decoupled electrical circuits, corresponding to overload category II, contamination level 2
Test voltage	350 V AC / 50 Hz for device rated voltage 24 V DC

### Electromagnetic compatibility

Electrostatic discharge	EN 61000-4-2: 8 kV air discharge, 4kV contact discharge
Electromagnetic fields	EN 61000-4-3: field intensity 10V/m, 80 ... 1000 MHz
Burst	EN 61000-4-4: 2kV on DC supply lines 1kV on I/O signal lines
Surge	EN 61000-4-5: 1 kV CM and 0.5 kV DM on DC supply lines 0.5 kV CM and 0.5 kV DM on DC I/O signal lines
Interference emissions	EN 55011: Limit category A, Group 1

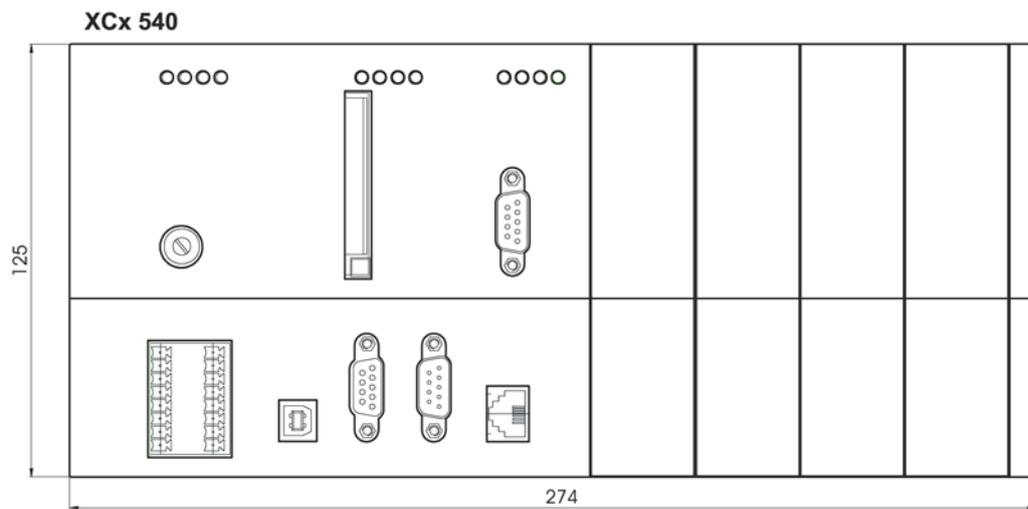
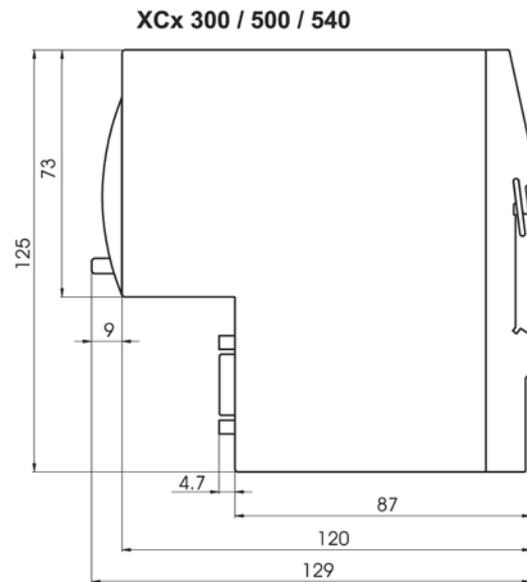
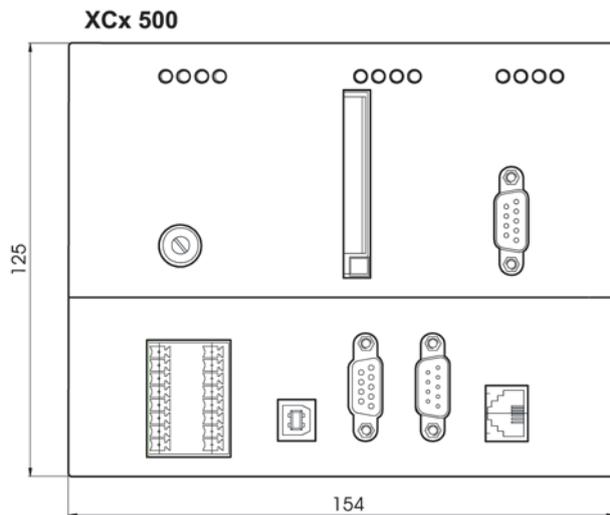
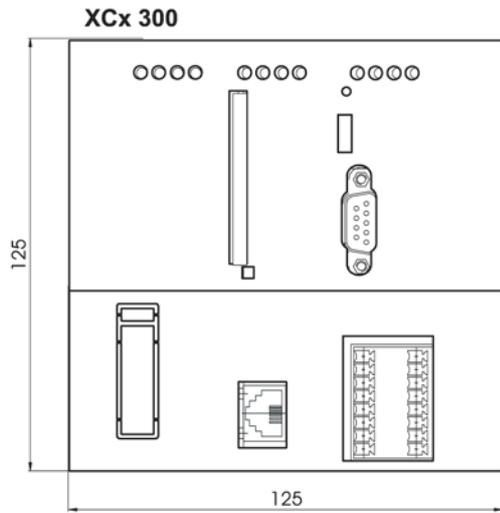
### Mechanical strength

Vibration	Acc. to DIN EN 60068-2-6 10 ... 57 Hz constant amplitude 0.075 mm 57 ... 150 Hz constant acceleration 1 g
Shock	Acc. to DIN EN 60068-2-27, sinusoidal half-wave 15 g / 11 ms
Free fall	Acc. to DIN EN 60068-2-32, fall height 1 m (with original packaging)

### Interrupt inputs/outputs (on connector X2)

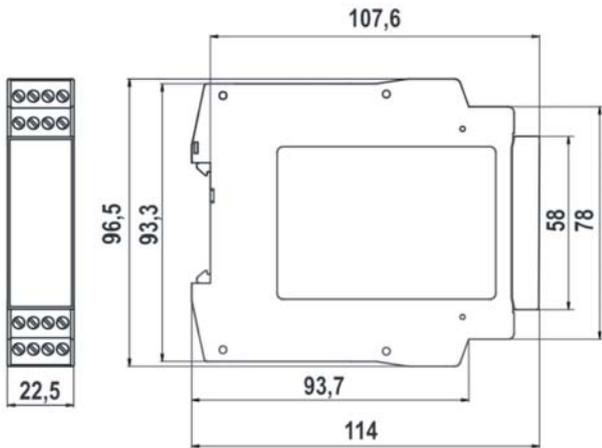
	Inputs	Outputs
Number	2	2
Voltage	DC 24 V	DC 24 V
Switching level	H level = +11 V ... +30 V L level = -30 V ... +5 V	H level $\geq$ +24V-EXT - 0,5 V L level $\leq$ 1 V
Input/output current	min. H level (+11 V) $\geq$ 2 mA max. L level (+5 V) $\leq$ 2 mA typ. (+24 V) 8 mA max. (+30 V) $\leq$ 15 mA	max. 500 mA, General Purpose
Signal delay	<100 ns (hardware)	<300 $\mu$ s (hardware)
Triggering	Edge triggering	-

## Controller Dimensions

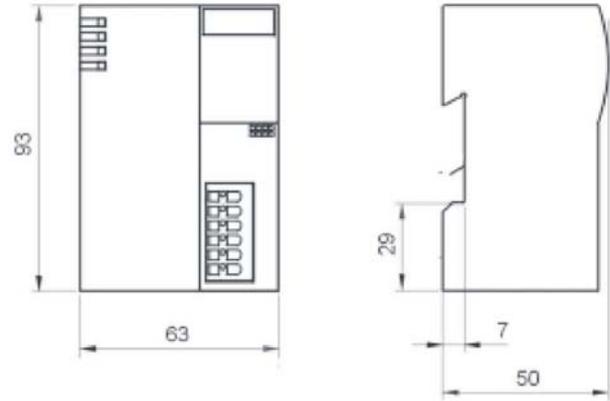


**Coupling Modules Dimensions**

**Bus coupler XBCX**  
Coupling modules X1RIO / X2RIO



**Bus coupler RIO EC X2**



# Notes



# Always There for You

Schleicher stands for more than just convincing products. We also tailor them to your needs in perfect engineering solutions.

## **Desire and Reality**

Do you have special requirements not covered by the range of modules presented here? Do you need special interfaces for digital or analog field peripherals, different voltage levels, input signals or output currents? Are you looking for suitable I/O interfaces for your field buses or networks?

As an innovative medium-sized company, we are in a position to respond to your requests and manufacture customized devices, even in small numbers.

## **Service and Solutions**

If you so wish, our specialists will of course also complete configuring and startup and service the installed system.

We help you on-the-spot with integrating our components in your existing system and developing solutions for specific tasks. With our know-how we can assist you to make the most cost-effective and efficient use of your plant, machines and systems.

## **Theory and Practice**

Decades of practical expertise and experience and cooperation with our customers flow into our training programmes, where you can learn how to exploit the features of our products for your application.

## **Question and Answer**

If you would like to know more, please call our competent hotline: tel. +49 30 33005-304. You can also find operating manuals, service information, example applications and other documentation round the clock on the Schleicher website.

[www.schleicher-electronic.com](http://www.schleicher-electronic.com)

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