

# XCx 1100 / XCx 700



## CNC/PLC Automation Systems High Performance Versions

### System Description

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# XCx 1100 / XCx 700 – The Multi-axis Controllers...



**... 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 64 CNC axes simultaneously in 32 NC programs

**...synchronize**

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

**...coordinate**

path motions with technology parameters,  
e.g. welding current according to path feed rate

**...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 processes with Sercos, via positioning  
interface modules or via CANopen

**...connect the sensor/actuator level**

with a wide range of digital and analogue I/O modules  
and via field buses

**...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 with  
integrated web server and via OPC server for standard  
visualization software, and also on directly connected  
monitors and terminals

**...alert**

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

**...diagnose and log**

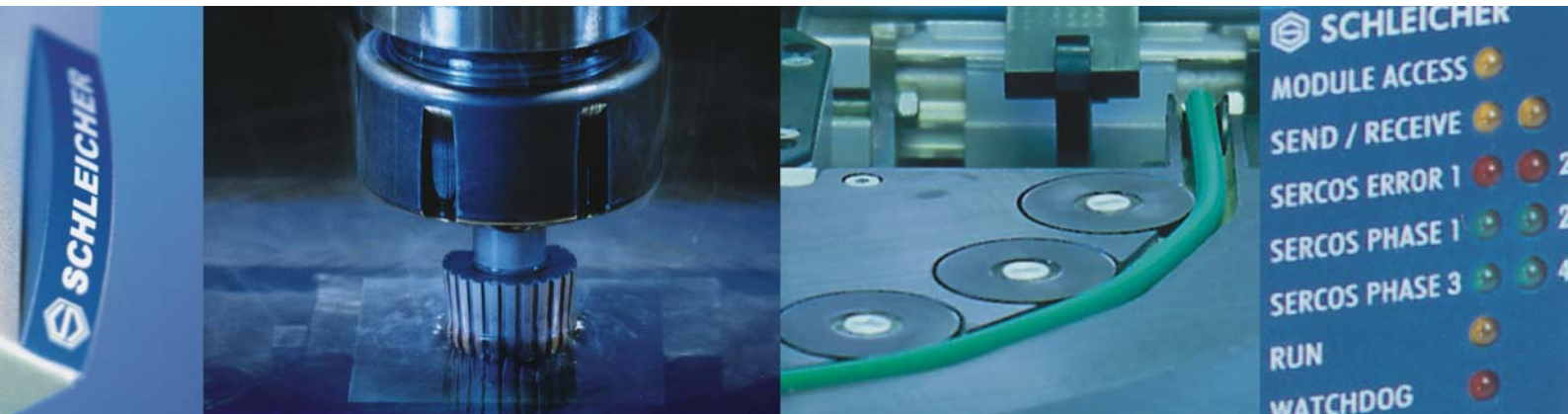
via serial interface or direct to Compact Flash

**...enable**

easy updating worldwide via Compact Flash

# Automation Solutions

for machine tools, production machines, robots and handling



## Integration

Complicated PLC programming of simple axis control? Doing without the convenience of PLC in complex CNC applications? XCx is the answer to these problems. 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:

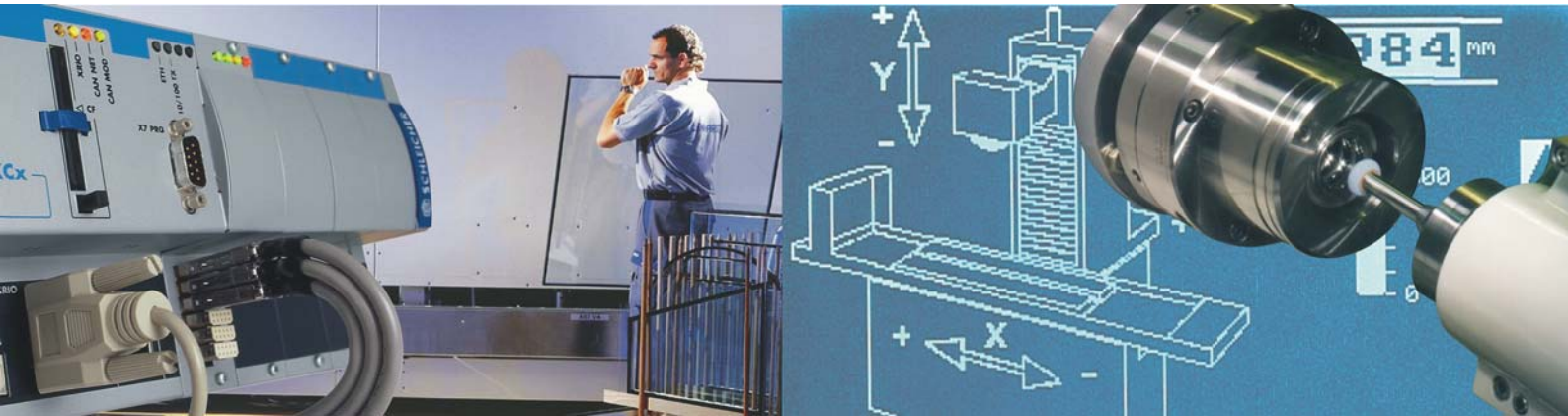
Grinding • Sharpening • Milling • Drilling • Turning • Cutting • Machine edges and profiles • Spring twisting machines • Crane control • Wave soldering systems • Welding, painting and polishing robots • Feed and removal on injection moulding and metal-bending machines • Stacking and palleting • Insertion and mounting work...

## Software

Integration in functionality and software is a fundamental characteristic of Schleicher controllers. The multitasking PLC operating system to IEC 61131-3 enables you to optimally adapt the controller to the process by allowing the fast processing of time-critical functions to be given priority over more time-flexible parts of the program. The Motion Control function block also enables axle movements to be easily parameterized using the PLC. The 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.

The PLC is configured uniformly for all controllers using the Multiprog programming system to IEC 61131-3. This ensures that software modules and program libraries developed by ourselves can be used for all controllers. Multiprog is matched to the resources of the respective controller and so enables efficient programming.

The Schleicher dialog is available for starting up and operating the PLC and CNC. It communicates with the controller via Ethernet. It automatically detects which operating system is on the controller and selects the appropriate input and display masks.



## Networking

XCx controllers are true communication professionals, open in all directions and easy to connect. The controllers can network with each other via Ethernet and so can also deal with processes that are complicated or far away from each other.

The classic CANopen and Profibus-DP field buses as well as the emerging Profinet are not just used for networking. They are also used to an increasing degree for drive control. Communication via Ethernet and TCP/IP is achieved with the help of an OPC server or by using the web server integrated in the controllers that enables visualization and data entry with any standard browser. The parameterizing, diagnostic 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 analogue 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 in industry.

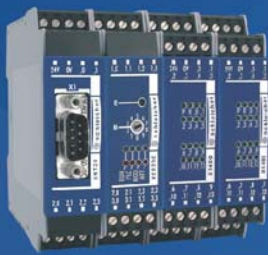


# Comparison of Controllers

## Family Ties

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

of the controllers increase with the requirement and complexity of the manufacturing process. Thanks to the modularity and networking, the XCx grows with the task at hand and provides automation solutions from one source.



## XCx-micro

The range of controllers starts with the **XCx micro** low-cost controller for simple automation tasks and distributed data (pre-)processing. The mini-PLC in a 22.5 mm housing meets the requirements of many machine builders who want to supplement their product range with low-cost and compact versions. The controllers are connected to the field bus via CANopen or Profibus-DP. XCx-micro expansion modules as well as modules from the RIO series can be connected.

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

## XCx 300

The low-cost **XCx 300** is ideal for increasing performance requirements. It is available in different versions as PLC and CNC/PLC. Up to eight expansion modules from the RIO I/O series and, via a coupling module, the XCx-micro series can be directly connected on the DIN rail via the integrated XRIO interface. A free slot allows you to connect drives, additional I/Os or the field bus interface.

- Up to 4 NC axes / 2 subsystems
- Other axes via Motion Control modules
- CNC interpolation cycle from 2 ms
- Interfaces:  
Ethernet, RS232, RS422, XRIO, 2x interrupt, Compact Flash
- Additional interfaces (CANopen, Profibus-DP, Sercos, XRIO) via plug-in card

## XCx 500 / XCx 540

The **XCx 500** is also available as PLC and CNC/PLC versions. The controllers provide a variety of interfaces for unproblematic integration in various production conditions. Digital, analogue 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 supplements the XCx 500 with four expansion slots for additional XRIO nodes, field bus interfaces and drive interfaces.

- Up to 16 NC axes / 8 subsystems
- Other axes via MC modules
- CNC interpolation cycle from 1 ms
- Interfaces:  
CANopen, Ethernet, RS232, RS422, XRIO, 2x interrupt, Compact Flash
- Additional interfaces (Sercos, Profibus-DP, Profinet, XRIO) via plug-in cards (only XCx 540)

## Typology

**XCx** stands for e**X**perienced **C**ontroller. The controllers are available in different versions with the PLC and CNC operating system.



### XCx 700

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

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

### XCx 1100

The **XCx 1100** combines the advantages of the classic controller with those of modern industrial PCs with CPUs up to Intel Core 2 Duo for extremely high performance. The use of passive cooling and Compact Flash or solid state disk instead of a rotating mechanism guarantees reliable operation in rough environments. An interruptible power supply is also unnecessary – VxWorks with embedded Windows XP operating system always starts from a defined condition. The I/Os of the Promodul-U series are available as expansion modules.

- Up to 64 NC axes / 32 subsystems
- Other axes via Motion Control modules
- CNC interpolation cycle from 1 ms
- Interfaces: 3x Ethernet, 2x Sercos III, 4x USB, CANopen, RS232, RS422/RS485, DVI-I
- Additional interfaces (Profinet) via PCIe expansion modules

### ProNumeric

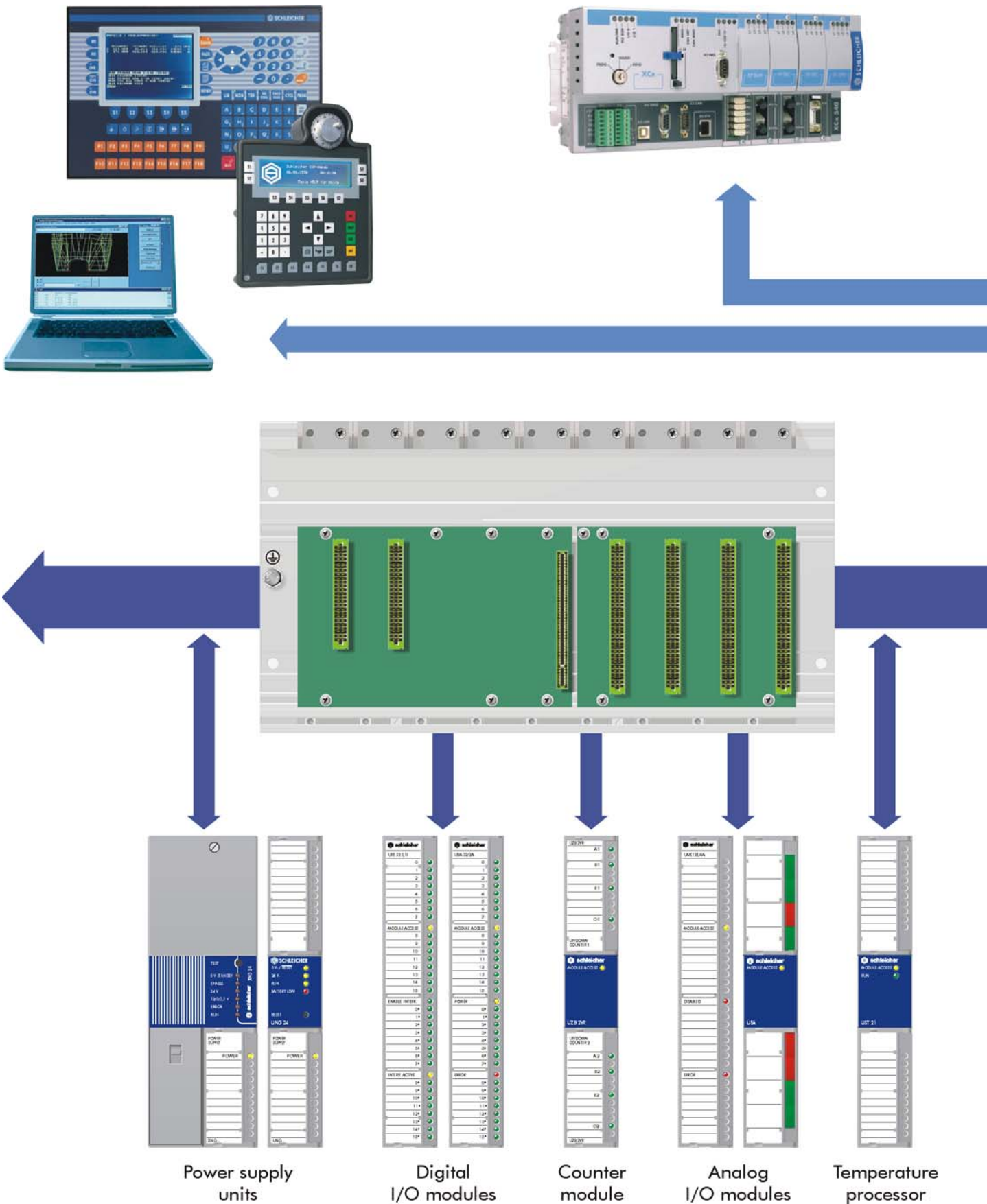
**ProNumeric** is an IPC-based high performance CNC/PLC automation system where even complex applications are easy to operate. It consists of a computer box and a separate operator panel. Four slots for PCI cards allow, for example, multi-axis applications with 64 Sercos drives in up to 32 subsystems.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

The system is available as a pure PLC without CNC functionalities as

#### **ProSyCon.**

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

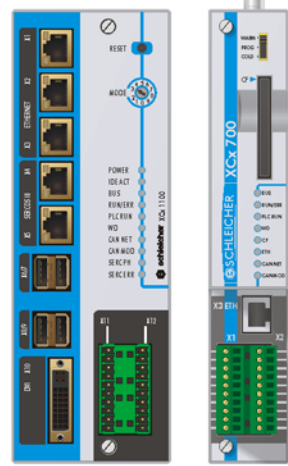
# System Overview XCx 1100 / XCx 700





CNC/PLC Control units

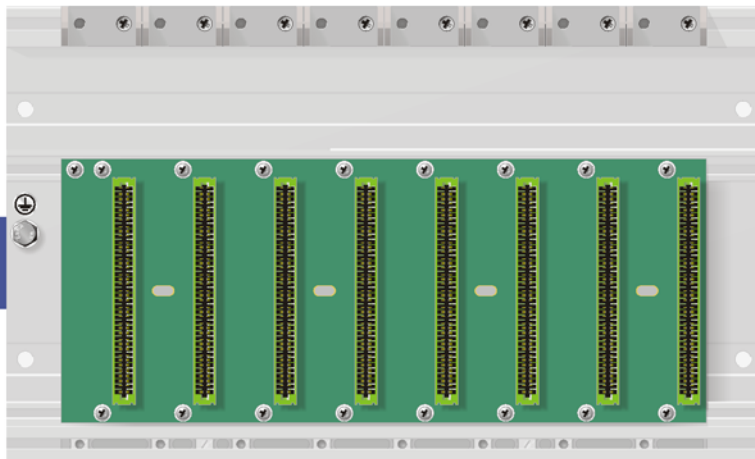
XCx 1100    XCx 700



Digital drives

Field bus, Controller networking

Programming, Visualization, Operating, Diagnosis



Racks  
(Basic and  
Extension)

System bus

System bus



Positioning interface



Positioning processors

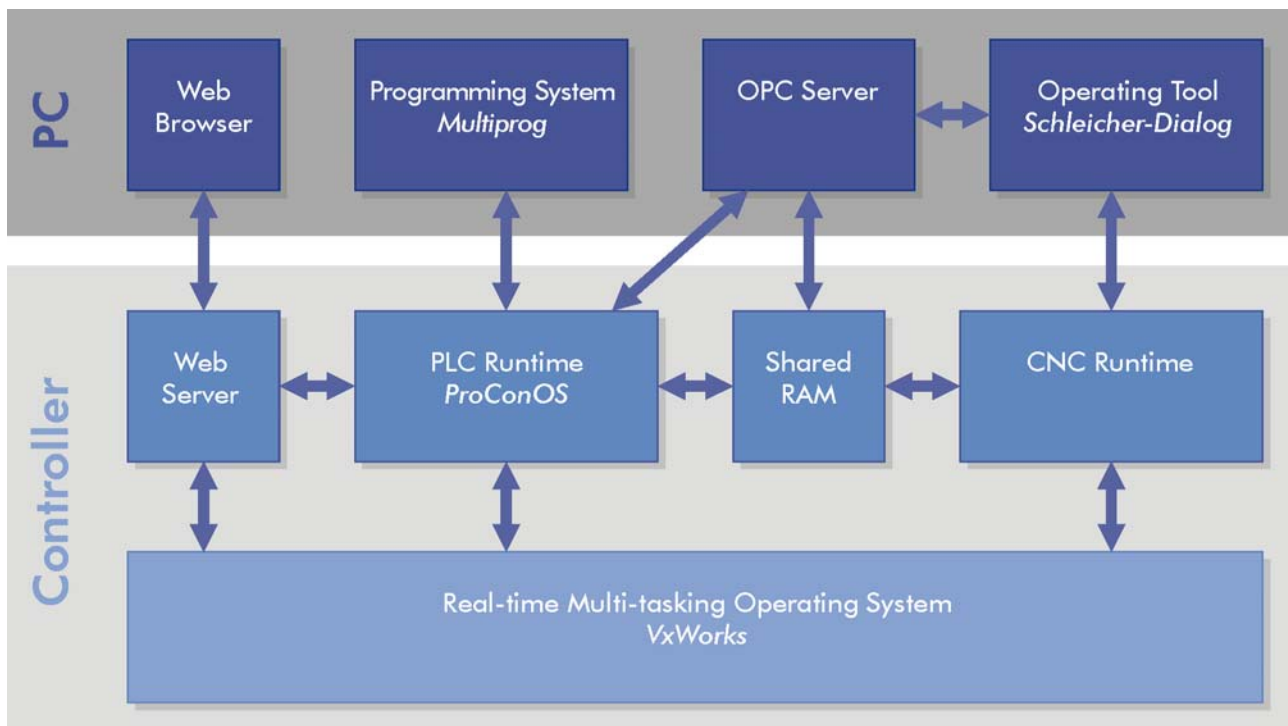


Communication modules



Interface modules

# Controller software



## Controllers with one operating system

The controllers from the XCx micro, XCx 300, XCx 500/540 and XCx 700 series are conventional controllers. Programming, operation and visualization is achieved via external devices such as PCs or terminals.

- The following items run under the **real-time multi-tasking operating system VxWorks** (→ page 12)
  - the **PLC runtime ProConOs** (→ page 11),
  - the **CNC runtime** (→ page 11),
  - the **shared RAM**, a common memory for PLC and CNC (→ page 13),
  - the **web server** (→ page 12).
- The PLC is configured using the **programming system Multiprog** (→ page 14) (including the Motion Control functions, MC).
- The **operating tool Schleicher dialog** enables commissioning and operation of the PLC, MC and CNC. In addition, CNC programs can be created with the integrated editor and loaded in the controller (→ page 14).
- Different devices such as controllers, operator panels or control stations exchange data via the **OPC server** (→ page 15).
- The **web browser** (→ page 12) has read and write access to data that the web server provides.

## Controllers with two operating systems

The XCx 1100 and ProSyCon/ProNumeric controllers (IPC-based computer box with separate operator panel) operate with two operating systems.

- **VxWorks** provides the real-time multi-tasking basis for the controller part (see left).
- **Windows XP embedded** (XCx 1100) or **Windows XP** (ProSyCon/ProNumeric) enable operation and visualization in the familiar Windows environment.
- The **real-time extension VxWin** (→ page 12) interfaces with both operating systems.

# Operating Systems I: PLC & CNC

## PLC runtime system ProConOS

The ProConOS runtime system installed on the XCx controllers provides all the functionalities of a PLC:

- Loading, saving and executing PLC programs
- Debug functions for programming, commissioning and maintenance

The PLC runtime system is matched to the respective controller type enabling fast and efficient work without unnecessary ballast.

ProConOS stands for Programmable Controller Operating System. The PLC runtime system to IEC 61131 uses the VxWorks operating system and supports its pre-emptive multi-tasking. It guarantees the priority structure that ensures the processing of tasks according to their priority. There is sufficient computing time for communication with the programming system, OPC and debug available if no higher priority tasks are present. The temporal behaviour of programmed user tasks can be calculated exactly and the computer capacity can be optimally utilized by assigning the cycle times to the individual tasks.

Each user task has its own settable **watchdog** that provides the necessary monitoring mechanisms for task overrun, runtime errors and changes of operating states.

The **memory** of the runtime system guarantees efficient data management for inputs, outputs, flags and the Schleicher-specific shared RAM.

The boot project and the user program are saved as a zipped archive project in the internal **file system**. Any file with access functions can also be saved for further processing.

Configuration, programming, testing, commissioning and service are supported by many **debug functions**.

These real-time multi-tasking features enable the PLC operating system to optimally match 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 right)

## CNC runtime

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 left). This close meshing of CNC and PLC via the shared RAM 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 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 64 NC axes, the XCx 700 offers parallel program and tool management in several NC subsystems and flexible parameterization of program memory management, tool memory, circle error tolerance and axis-specific interpolation fineness.

- Suitable for extremely fast process/machine controllers
- Interpolates up to 64 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/XCA control units. The number of interpolated NC axes and subsystems varies according to the controller type (→ page 6).

PLC and CNC are started up and operated using the Schleicher dialog software (→ page 14).

# Operating Systems II: Controller & PC

## VxWorks operating system

The VxWorks operating system from the Wind River Systems Company is a real-time multi-tasking operating system that is similar to Unix. It offers all the features of a modern operating system for complex controller applications:

- Absolute real-time features synchronize processes in millisecond cycles
- The multi-tasking kernel with pre-emptive scheduling enables optimal processor utilization
- Proven task switching algorithms guarantee short latencies and a fast interrupt response
- Different file systems including one that is compatible with MS-DOS save and organize programs and data
- Network capabilities support communication over the system restrictions

VxWorks has been transferred to nearly all standard hardware platforms. A great advantage of the VxWorks architecture is its scalability to different systems. From the small XCx micro for simple applications to the large XCx 1100 for complex tasks – every controller has a made-to-measure operating system that prevents performance losses by the ballast of unsupported functions and provides an ideal basis for the software to be set up.

## VxWin real-time expansion

The VxWin single processor system combines the VxWorks real-time operating system with Windows XP(e) on a single CPU and provides a complete solution for all controller tasks including motion control, sequencing control and visualization.

PLC and CNC runtime as well as the web server run under VxWorks, while Windows provides the familiar environment for non-time-critical functions like visualization and operator dialogs.

Both operating systems operate separately from one another, because the memory management unit (MMU) keeps their memory areas separate. This ensures that the non-deterministic behaviour or any instability on the Windows level does not affect the real-time execution of the controller processes under VxWorks.

## Web server

When servicing a machine, the engineer usually has his standard tools such as measuring devices and laptop in his case. But what software needs to 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 web browser on the computer, for example Microsoft Internet Explorer. The rest is done by the controller, or more precisely, the XCx 700 web server.

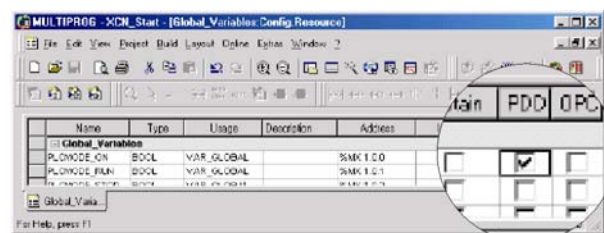
All parameterizing, diagnosis and test functions can be called directly on site, in the local network or on the Internet. Access control, data security, machine safety: a range of security levels allow web server services to be enabled flexibly.

- The main advantage of web server technology is the storage of the complete visualisation application (HTML, JavaScript) on the controller. Additional configuration in an operator panel is not required.
- The web server is integrated in the operating system of the XCx.
- The browser is the "thin client" for data visualization.
- Other visualisation systems must be installed separately on each operating panel. This concept is known as a "fat client".

Normally web technology means single-direction downloading to the browser, and the web page itself is dynamic (animation gifs or flash files). Cyclic parameter refresh is not possible.

Schleicher supplies a special Java Applet to allow 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.

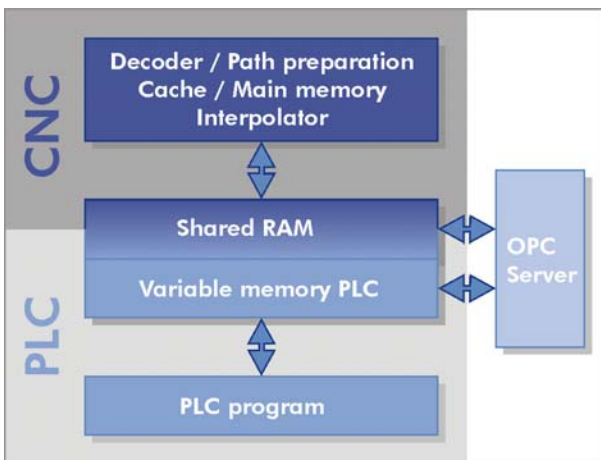
The variables that are to be visualized are marked as PDD (Process Data Directory) in Multiprog during PLC programming. Only these variables are enabled for web visualization, so only they can be read and written by the web server.



# Split and distribute

## Shared RAM

In a feature that is unique in the controller world, the XCx unites complex motion control and logic control in full transparency by directly coupling the CNC functions with the PLC (to IEC 61131-3). 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 can be displayed in the Schleicher dialog operating tool.

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 feed-rate
- Call saved motion programs to coordinate smooth movements

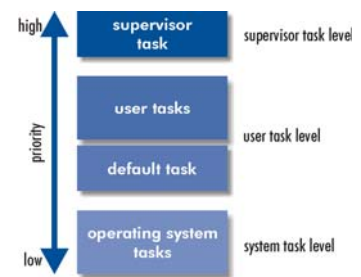
This means that the engineer can use a PLC user program to test the effects of end-user actions on the CNC before they are actually executed, and activate the relevant error messages or warnings.

### 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.

## Multi-tasking

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. The tasks are assigned different priorities to ensure they are processed in order of importance.



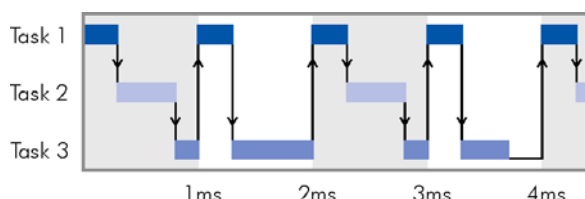
- **Supervisor task** (supervisor task level) detects errors (division by zero, task overrun, etc.) and activates the corresponding operating system task.
- **User and default tasks** (user task level)
  - *Cyclical tasks* execute the programs assigned to them within a defined interval under a defined 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 18 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.

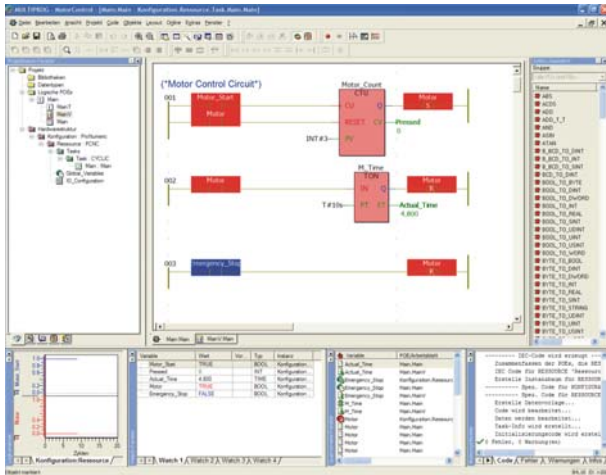
### Example: PLC program with three tasks

- 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



# Programming and Operation

## Multiprog



The Multiprog programming system is a clearly structured, easily operated tool for editing, compiling, debugging, managing and printing PLC applications in all the development phases. The complex structure of the IEC 61131-3 standard is presented clearly.

The programming makes use of high-level language structures. The declaration of variables and user-defined data types as well as the differentiation between global and local data enable symbolic programming that is intuitive to understand and can be applied efficiently.

Choose one of the following programming languages:

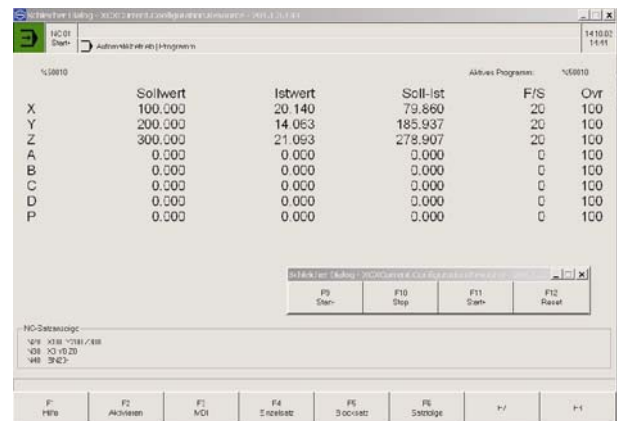
- **Text languages**
  - Instruction list (IL)
  - Structured text (ST)
- **Graphic languages**
  - Function block diagram (FBD)
  - Ladder diagram (LD)

### The main features:

- Supports several PLC systems
- Easy creation of applications for multi-processor and multitasking systems
- Clear project management through a project tree based on the Windows Explorer directory structure
- Edit Wizards for creating programs
- Integrated simulation makes it possible to commission projects without a connected PLC
- Online program modifications without interruption of the PLC shorten the start-up time
- Password protection allows individually adjustable levels for read and write authorization.
- Powerful documentation system with graphic editor, print preview and cross-reference printout
- Context-sensitive help for program, target system, instruction set and function of language elements

## 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 a component of the service pack CD.



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

# Networking and Visualization

## XCx Interconnected

Ethernet networking via TCP/IP is a central element of the controllers. In production lines, for example, it may make sense to distribute the tasks to several networked XCx controllers (the 300/500/540 series also), 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.

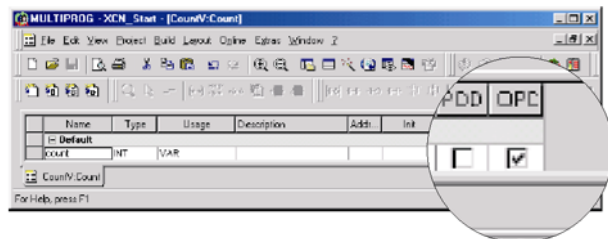
When the XCx is operated directly on a PC via a crosslink cable, you do not have to change the preset IP address. But if you want to operate larger networks, you will have to use the option of assigning individual IP addresses. The IP address is saved on the Compact Flash.

## OPC server

OPC is the standard for manufacturer-independent communication between different devices and programs in automation technology. So for example, the data exchange between a controller and an operator panel is possible with OPC. For this, both devices do not require exact information about the type of the respective communication interface.

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 program is installed together with the Multiprog programming system on a PC. When an OPC client connected with the server is started, the OPC server automatically starts too. As a rule, devices, clients and server are connected by a communication network (e.g. Ethernet TCP/IP). The clients can have read and write access to the devices via the OPC server as a switching centre. It is not important if the data came from the same application, another local process or via a network.

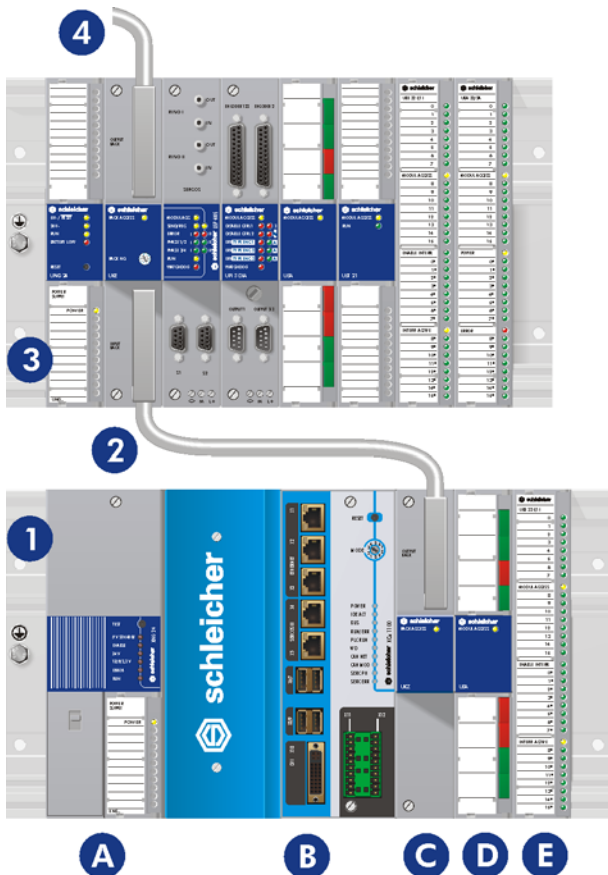


In the variable dialogs on Multiprog, the controller data and variables where the OPC server requires read/write access are simply designated OPC.

# Controller Structure

## Structure

The XCx 1100 and XCx 700 are modular automation systems where up to 256 modules can be arranged on racks. The automation systems must be installed in earthed metal housings (e.g. enclosures).



## Connecting Racks

- 1 **Basic rack\***
- 2 **Interface cable\*\* and interface modules**
- 3 **Extension rack\***
- 4 **Interface cable\*\* to next extension rack**

\* The rack can be used according to the applicable control unit as follows:

- **XCx 1100**
  - XBT as basic rack (→ page 36)
  - UBT as extension rack (→ page 38)
- **XCx 700**
  - UBT as basic rack and extension rack

\*\*There are interface cables with and without a power supply available (→ page 77). Interface cables which also carry power supply can only be used if:

- the rated output of the power supply unit is sufficient
- no power supply unit is fitted on the rack (power supply units must not be operated in parallel)

## Arrangement of modules

The modules must be added from left to right without gaps. The spring contact strips of unused slots should be closed with the supplied empty slot covers during operation. Install the control unit on the basic rack.

- A Power supply unit**
- B Control unit**
- C Interface module**
- D Intelligent modules**  
Analogue and temperature modules, positioning modules, communication modules
- E Digital modules**  
Input/output modules, counter modules

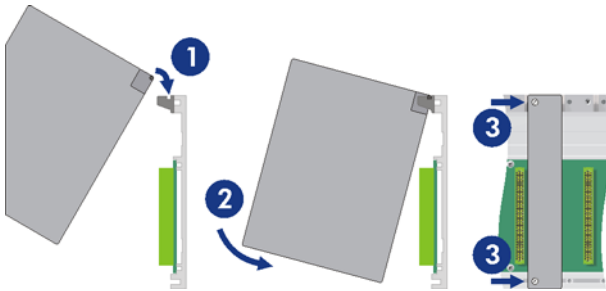
## Number of Modules

The number of modules per rack depends on their power consumption (power loss). The power consumption of all modules must be less than the power supply unit output. Power consumption on DC 24 V and DC 5 V power supplies must be added separately. The overall output of the power supply unit for both voltages must also be considered.

The power consumption of the modules and the output of the power supply unit is listed in the respective "Technical Data" for each module.

## Assembly

The modules are engaged with the top hook on the rack (1), pressed firmly into the contact strips (2) and then fixed with the two screws (top and bottom) (3).



# Control Units



# XCx 1100 Control Unit



## Concept

The XCx 1100 is not a PLC or an IPC in the classic sense but corresponds to the advanced concept of a Programmable Automation Controller (PAC).

It is capable of providing a number of complex automation tasks and scenarios of use for the highest level of performance and an open, modular architecture. Conventional requirements such as control, regulation, operation, diagnosis and reporting are operated by the XCx 1100 on a standard scalable platform.

The XCx 1100 operates with VxWin, the established combination of the VwWorks real-time operating system and Windows XP embedded. VxWorks takes on the real-time component, i.e. control via PLC, CNC and Motion Control functions, while Windows provides the familiar environment for non-time-critical functions like visualisation and operator dialogs:

- NC operator dialogs
- Visualization
- NC program memory
- Diagnosis
- Configuration
- PLC programming
- Manual
- Operational data logging

The operating systems operate separately from one another, because the XCx 1100 memory management unit (MMU) keeps the program memory areas separate. This ensures that instability on the Windows level has no effect on Schleicher firmware (CNC runtime or PLC runtime) running on VxWorks.

## Appearances

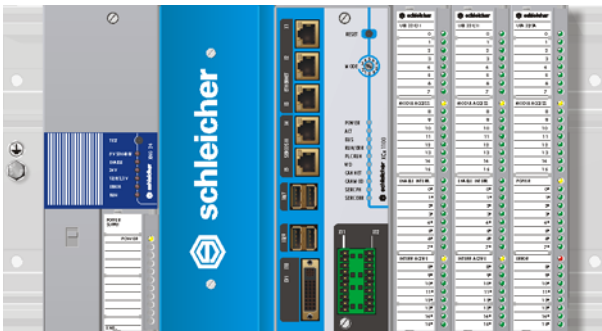
The CPU is a module with a Promodul-U system design. The installation height and depth are designed accordingly. The controller (CPU and heat sink) occupy the width of four standard U-modules in total.

Components that are susceptible to wear, such as fans or hard disks, are dispensed with to achieve the highest possible level of operating safety and the lowest level of maintenance. Waste heat is dissipated using a large heat sink on the left side of the CPU module. Compact Flash or solid state discs are used for storing programs and data.

One XCx 1100 control unit can be connected for each controller configuration. The I/O level is connected through a wide range of digital and analogue input/output modules. Function modules for analogue value processing and temperature control, and modules for axle positioning with Sercos interface or analogue setpoint interface round off the periphery range.

Configuring is carried out with the Windows programming system Multiprog according to IEC 61131-3. It is matched to the resources of the XCx 1100 to ensure easy operation.

The backplane of the rack of the XBT series (→ page 36) has a mechanically separated design. The U-periphery is located to the right of the CPU and the power supply unit is located on the left. This module supplies the CPU and the U bus with the required operating voltages. This slot order must be observed!



Power supply unit

Controller (heat sink | CPU)

Expansion modules

## Inner Values

The XCx 1100 control units are fitted with a PLC operating system and a powerful CNC operating system.

A Windows operating system is also available for visualization, operation and programming.

### PLC

- Operating system: ProConOS
- Programming: Multiprog to IEC 61131-3

### CNC

- Programming: to DIN 66025
- Machine-specific special functions and transformations
- Communication with the PLC via shared RAM

### Windows

- Windows XP embedded

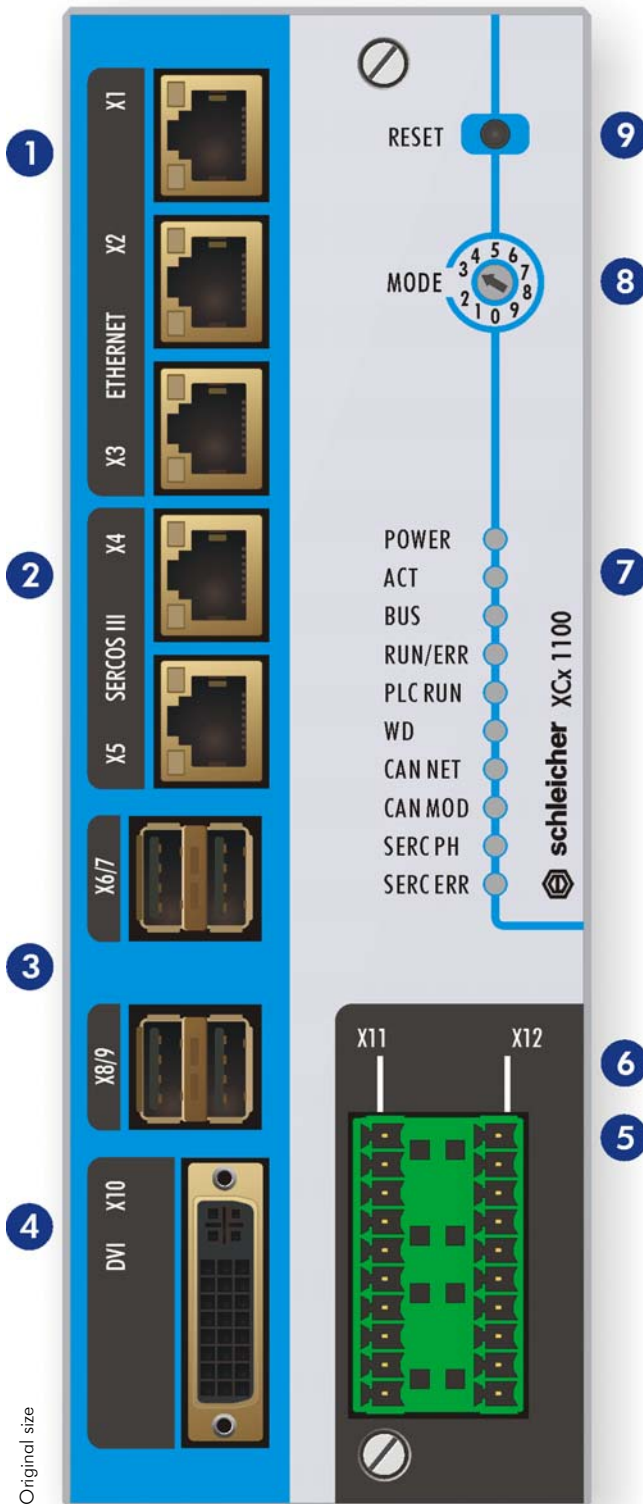
### All control units have:

- An internal Compact Flash memory card
- 3 Ethernet interfaces with integrated Ethernet switch
- 4 USB 2.0 interfaces
- DVI interface
- Serial interfaces
- Integrated web server

### Options:

- Various processor and memory specifications
  - Sercos III
  - CANopen
- (for more details about the versions, see "Technical Data")

# Interfaces


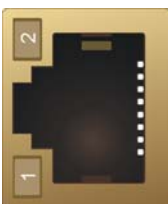


Original size

- 1 IT networking is via **Ethernet** (X1..X3) and TCP/IP with 10/100 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.
- 2 Two **Sercos-III interfaces** (X4/X5) with 10/100 Mbit/s (RJ45) are used to connect intelligent digital drives. The interfaces are only connected for suitably equipped device versions.
- 3 External devices such as a keyboard, mouse, memory stick or printer can be connected via four **USB ports** (X6..X9, USB 2.0, standard A).
- 4 The **monitor interface** (X10) is designed as a DVI-I. Both digital and, via a DVI VGA adapter, analogue monitors can be operated.
- 5 With **CANopen** (X11), the suitably equipped device versions offer a 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 with tens of thousands of I/Os are possible without repeaters. 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.
- 6 The combined **/RS232/422/485 interface** (X12) is for direct connection of operator panels and displays, for example the COP handy, and also for stationary connection of serial devices.
- 7 A total of ten **status LEDs** indicate activities and the state of the internal system bus, CPU, PLC, watchdog, memory media, Sercos network and CANopen network.
- 8 The **operating mode switch** defines the start-up behaviour of the controller after switching on. The 1 (*PROG*) setting means PLC stop, programming mode. 2 (*WARM*) is the default setting (warm start of PLC, retain variables), while 3 (*COLD*) causes a cold start of the PLC and the retain variables are reinitialized. Default initialization and diagnostics can be performed in position 0.
- 9 The **reset button** allows the CPU module to be switched off or reset.

Technical data	XCA 1100	XCA 1100 C	XCA 1110 C
Article number	R4.507.0200.0	R4.507.0210.0	R4.507.0260.0
Controller	CNC/PLC	CNC/PLC	CNC/PLC
<b>Hardware and memory</b>			
CPU	CPU Intel Celeron M 370, 1.50 GHz, 1 MB L2 cache		
Memory			
SD-RAM	512 MB	512 MB	1 GB
S-RAM (buffered)	1 MB	1 MB	1 MB
Compact Flash (internal)	4 GB	4 GB	–
Solid State Drive	–	–	32 GB
Real-time clock	Battery-buffered with calendar and leap year, resolution: 1 s		
Buffering	Supercap min. 3 hours, rechargeable battery, min. 3 months		
<b>CNC/PLC properties</b>			
PLC processing times	for each 1K PLC instruction		
Bit	0.064 ms		
Byte / Word / DWord	0.033 ms		
Integer (Add / Mul)	0.038 ms		
Real (Add)	0.064 ms		
PLC signal propagation time	< 2 ms (for task periods = 1 ms)		
Function blocks	Any number of firmware functions and function blocks		
Number of NC axes / sub-systems	64 / 32		
CNC interpolation cycle from	1 ms		
Block cycle time from	1 ms		
Operating system			
Controller	VxWorks, multi-task operating system (time-driven and priority-driven)		
PLC runtime	ProConOS to IEC 61131-3		
CNC runtime	to DIN 66025, enhanced to standard and special functions		
PC	Windows XP embedded		
Configuring	Multiprog (programming environment to IEC 61131-3, incl. OPC server) • (option) ProCANopen (CANopen network configurator) • (option)		
Number of user tasks	18		
Task cycle times	Programmable $\geq 1$ ms (whole number)		
Real-time memory	32768 kB, adjustable, for operating system (data/program)		
PLC memory			
Program	4096 KB		
Flag retentive	265 KB		
Flag not retentive	2048 KB		
Memory management	Dynamic		
Times and counters	Any number, programmable from 1 ms ... 290 h (number limited only by memory capacity)		
<b>Interfaces</b>			
Ethernet (X1, X2, X3)	RJ45, 10/100 Mbit/s, programming, diagnostics and operator panel interface		
Sercos III (X4, X5)	RJ45, 10/100 Mbit/s, drive interface (Ethernet)		
For device	–	–	–
USB (X6/7, X8/9)	USB 2.0, standard A, interface for mouse, keyboard, memory stick, etc.		
DVI (X10)	DVI-I Single Link, digital monitor interface		
CANopen (X11)	10-pin plug-in terminal for field bus and drives		
For device	–	●	●
RS232 (X12)	on 10-pin plug-in terminal, for stationary connection of serial devices		
RS422/RS485 (X12)	on 10-pin plug-in terminal, serial operator panel interface		

<b>Housing and power supply</b>															
Internal power supply	DC 12 V, DC 5 V, DC 3.3 V														
Internal power consumption	< 40 W														
Isolation (from internal electronics)	<table> <tr> <td>X1, X2, X3 Ethernet:</td> <td>yes</td> </tr> <tr> <td>X4, X5 Sercos III:</td> <td>yes</td> </tr> <tr> <td>X6/7, X8/9 USB:</td> <td>no</td> </tr> <tr> <td>X10 DVI:</td> <td>no</td> </tr> <tr> <td>X11 CAN:</td> <td>yes</td> </tr> <tr> <td>X12 (RS 232)</td> <td>yes</td> </tr> <tr> <td>X12 (RS 422/485)</td> <td>yes</td> </tr> </table>	X1, X2, X3 Ethernet:	yes	X4, X5 Sercos III:	yes	X6/7, X8/9 USB:	no	X10 DVI:	no	X11 CAN:	yes	X12 (RS 232)	yes	X12 (RS 422/485)	yes
X1, X2, X3 Ethernet:	yes														
X4, X5 Sercos III:	yes														
X6/7, X8/9 USB:	no														
X10 DVI:	no														
X11 CAN:	yes														
X12 (RS 232)	yes														
X12 (RS 422/485)	yes														
Weight	2.5 kg														
<b>Operating mode switch</b>															
Version	Rotary switch with 10 positions														
Start-up behaviour of the controller after switching on	<table> <tr> <td>0</td> <td>Default initialisation / diagnostics, start of real-time operating system in safe mode, reset of retentive data memory</td> </tr> <tr> <td>1 (PROG)</td> <td>PLC stop, programming operating mode</td> </tr> <tr> <td>2 (WARM)</td> <td>default, warm start of PLC, retain variables (also position 4..9)</td> </tr> <tr> <td>3 (COLD)</td> <td>Cold start of PLC, reinitialize retain variables</td> </tr> </table>	0	Default initialisation / diagnostics, start of real-time operating system in safe mode, reset of retentive data memory	1 (PROG)	PLC stop, programming operating mode	2 (WARM)	default, warm start of PLC, retain variables (also position 4..9)	3 (COLD)	Cold start of PLC, reinitialize retain variables						
0	Default initialisation / diagnostics, start of real-time operating system in safe mode, reset of retentive data memory														
1 (PROG)	PLC stop, programming operating mode														
2 (WARM)	default, warm start of PLC, retain variables (also position 4..9)														
3 (COLD)	Cold start of PLC, reinitialize retain variables														
<b>Reset button</b>															
Version	Bounce-free oversquare button														
Behaviour after activation	Short button press = reset Long button press = switch off														

LED displays					
Controller	POWER		POWER		
<b>POWER</b> <b>ACT</b> <b>BUS</b> <b>RUN/ERR</b> <b>PLC RUN</b> <b>WD</b> <b>CAN NET</b> <b>CAN MOD</b> <b>SERC PH</b> <b>SERC ERR</b> 		Off green On	Device switched off Device switched on		
		<b>ACT</b>	Off green flashing	<b>IDE (CF) / SATA (SSD) activity</b> No access Access enabled	
		<b>BUS</b>	Off green On red flashing	<b>Bus access</b> No bus access for PLC stop or (real-time) operating system inactive Bus access OK Bus access error / configuration error	
		<b>RUN/ERR</b>	Off green/red Alternately flashing green On red flashing	<b>CPU status</b> CPU faulty or (real-time) operating system inactive (real-time) operating system starts  CPU runs, operating voltage OK, no error fatal error: (Real-time) operating system does not start	
		<b>PLC RUN</b>	Off green On yellow flashing	<b>PLC status</b> PLC stop PLC running PLC running, but outputs shut down (ready-for-operation relay released)	
		<b>WD</b>	Off red On	<b>Watchdog</b> Watchdog did not respond Serious error, operating system stopped	
		<b>CAN NET</b>	Off green On green flashing red On red flashing	<b>CAN network status (only on CAN versions)</b> CAN State Prepared CAN State Operational CAN State Pre-Operational Bus Off CAN error	
		<b>CAN MOD</b>	On green flashing red On red flashing	<b>CAN module status (only on CAN versions)</b> CAN stack initialised invalid CAN configuration Control unit not ready or serious error Error in the controller	
		<b>SERC PH</b>	On red flashing red flashing yellow flashing green flashing green On	<b>SERCOS phases</b> SERCOS phase 0 SERCOS phase 1 SERCOS phase 2 SERCOS phase 3 SERCOS phase 4	
		<b>SERC ERR</b>	Off red On red flashing	<b>SERCOS error</b> No error communication error drive error	
	<b>Ethernet and Sercos III</b> 	<b>1</b>	Off yellow flashing green flashing	<b>Ethernet Link / Activity / Speed</b> No network connection 100 Mbit/s connection active 10 Mbit/s connection active	<b>Sercos III Activity</b> No activity 100 Mbit/s connection active –
			<b>2</b>	Off green On	<b>Duplex</b> No connection or 10 Mbit/s 100 Mbit/s full duplex operation

For general technical data, see page 78

# XCx 700 Control Unit



## Concept

The XCx 700 is the high-performance version in the XCx controller family. Its high performance makes it suitable both for pure PLC requirements and for complex CNC/PLC applications. Networking with Ethernet and TCP/IP ensures fast controller access for programming, diagnosis and operation. The optional CANopen interface realizes axis drives and makes the XCx suitable for application as a subcontroller in factory automation control systems.

The XCx 700 operates with the VxWorks real-time operating system that takes control via the PLC, CNC and Motion Control functionality.

## Appearances

The CPU is a module with a Promodul-U system design. Its dimensions are the same as the expansion modules and so it has only one slot - high performance in a small space.

Apart from the operating mode switch, the controller has no mechanical parts and so achieves a high level of operating safety and is low maintenance. Cooling is passive without fans. Compact Flash cards are used for data storage.

One XCx 700 control unit can be connected for each controller configuration. The I/O level is connected through a wide range of digital and analogue input/output modules. Function modules for analogue value processing and temperature control, and modules for axle positioning with Sercos interface or analogue setpoint interface round off the periphery range.

Configuring is carried out with the Windows programming system Multiprog according to IEC 61131-3. It is matched to the resources of the XCx 700 to ensure easy operation.

The operating system of the controller, important configuration files, the PLC program (boot project and PLC source) and the files required for CNC operation are stored on the internal Compact Flash card. Access to the CF card is indicated by the CF LED.

User data can be saved, copied to other controllers and software updates can be performed via the external CF card on the front of the controller. You can keep your PLC projects and controller firmware up to date without special tools. The CF card can be removed or inserted when the controller is switched on (hot pluggable) but the following specifications must be observed:

- The CF card must only be removed when:
  - No access occurs (CF LED must be off)
  - The controller is in STOP mode
- The CF card must only be inserted when:
  - The controller is in STOP mode

## Inner Values

The control units are equipped with a PLC operating system (XCS 700) or with an additional high-performance CNC operating system (XCN 700). The control units can be equipped with or without a CANopen field bus as required.

### PLC

- Operating system: ProConOS
- Programming: Multiprog to IEC 61131-3

### CNC

- Programming: to DIN 66025
- Machine-specific special functions and transformations
- Communication with the PLC via shared RAM

### All control units have:

- a removable Compact Flash memory card
- Ethernet interface
- Serial interfaces
- Integrated web server

## Versions

The controller is available in two pure PLC versions and four PLC/CNC versions, with and without CANopen interfacing. Each version has one Ethernet interface, two RS232 and one RS422/485. The operating system (PLC/CNC) is a component of the control unit.

XCS 700	PLC-CPU
XCS 700 C	PLC-CPU with CANopen
XCN 700 E	CNC/PLC controller, max. 4 axes
XCN 700 CE	CNC/PLC control unit with CANopen□ max. 4 axes
XCN 700	CNC/PLC controller, max. 32 axes
XCN 700 C	CNC/PLC control unit with CANopen□ max. 32 axes

For more details about the versions, see "Technical Data".

# Interfaces



Original size

- 1 With **CANopen** (X1) the suitably equipped device versions offer 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 with tens of thousands of I/Os are possible without repeaters. 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.
- 2 The combined **RS422/RS232 interface** (X2) is for direct connection of operator panels and displays, for example the COP handy, and also for stationary connection of serial devices.
- 3 IT networking is via **Ethernet** (X3) and TCP/IP with 10 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.
- 4 Eight **status LEDs** indicate activities and the status of internal system bus, CPU, PLC, watchdog, Compact Flash, Ethernet and CANopen network.
- 5 The operating system and user program are saved permanently on an internal **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 web server are also available directly on the controller. A second Compact Flash card can be inserted in the slot on the front and removed again during operation.
- 6 The three-position **operating mode switch** sets the start-up behaviour of the controller. 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.
- 7 The **RS232 interface** (X4) is for serial connection of programming and diagnosis devices, logging printers and barcode readers.

Technical data	XCx 700	XCx 700 C	XCx 700 E	XCx 700 CE	XCx 700	XCx 700 C
Article number	R4.506.0080.0	R4.506.0070.0	R4.506.0030.0	R4.506.0040.0	R4.506.0060.0	R4.506.0050.0
Controller	PLC		CNC/PLC			
<b>Hardware and memory</b>						
CPU	CPU Intel PXA 255 (32 Bit Core, 400 MHz)					
Memory	SD-RAM 32 MB S-RAM (buffered) 1 MB Flash (internal) 4 MB Compact Flash (internal) 32 MB					
Real-time clock	Battery-buffered with calendar and leap year, resolution: 1 s					
Buffering	Supercap min. 3 hours, battery in UNG					
Compact Flash (type 2, external)	For operating system and user data 16 MB to 4 GB					
<b>CNC/PLC properties</b>						
PLC processing times	for each 1K PLC instruction					
Bit	0.4 ms					
Byte / Word / DWord	0.2 ms					
PLC signal propagation time	1 ms input to output					
Function blocks	Any number of firmware functions and function blocks					
Number of NC axes / sub-systems	- / -	- / -	4 / 2	4 / 2	32 / 16	32 / 16
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	Controller VxWorks, multi-task operating system (time-driven and priority-driven) PLC runtime ProConOS to IEC 61131-3 CNC runtime to DIN 66025, enhanced to standard and special functions					
Number of user tasks	18					
Task cycle times	Programmable $\geq 1$ ms (whole number)					
Memory	Data max. 16384 KB program 4096 KB					
PLC flags	retentive 265 KB not 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>						
CANopen (X1) For device	10-pin plug-in terminal for field bus and drives					
	-	●	-	●	-	●
RS232 (X2)	on 10-pin plug-in terminal, for stationary connection of serial devices					
RS422/RS485 (X2)	on 10-pin plug-in terminal, operator panel interface					
Ethernet (X3)	RJ45, 10 Mbit/s, networking					
RS232 (X4)	Subminiature 9-pin plug connector, programming and diagnosis interface					

<b>Housing and power supply</b>		
Internal power supply	DC 24 V ( $\pm 20\%$ , max. 5 % residual ripple)	
Internal power consumptionDC 24 V	max. 6 W	
Isolation (from internal electronics)	X1 (CAN):	yes
	X2 (RS232):	yes
	X2 (RS422/RS485):	yes
	X3 (Ethernet):	yes
	X4 (RS232):	no
Weight	0.42 kg	
<b>Operating mode switch</b>		
Version	3-position slide switch	
Start-up behaviour of the controller after switching on	WARM	default, warm start of PLC, retain variables
	PROG	PLC stop, programming mode
	COLD	Cold start of PLC, reinitialize retain variables

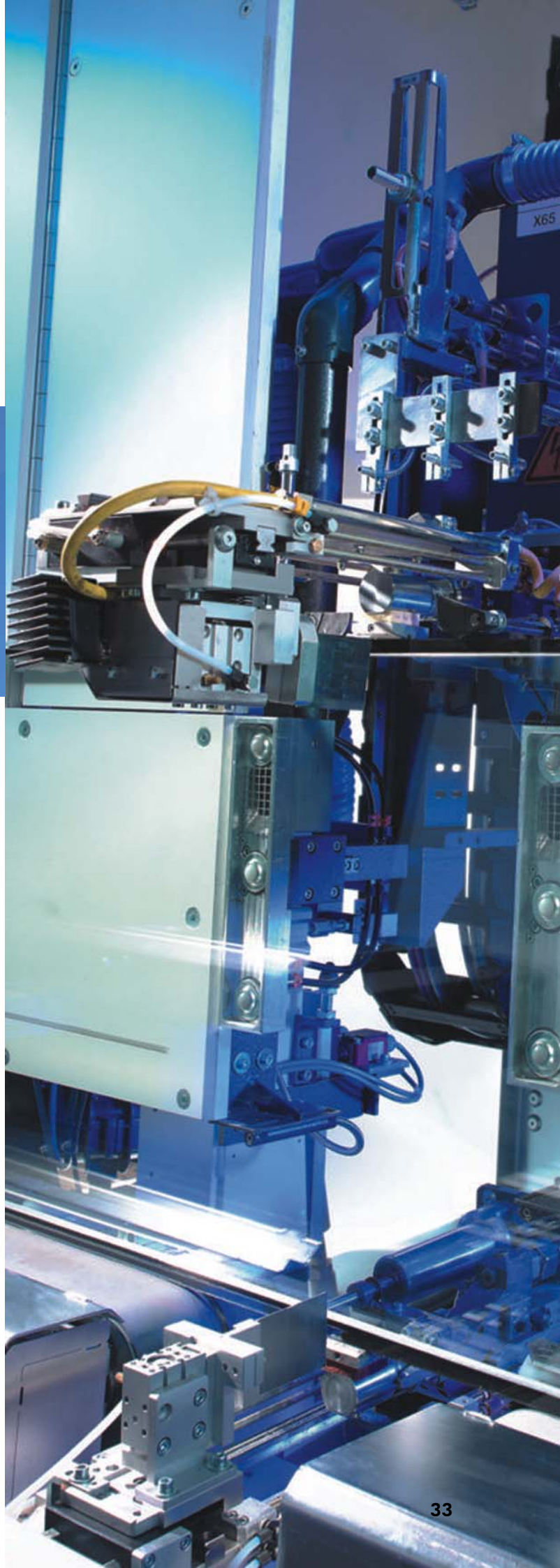
**LED displays**



<p><b>BUS</b></p> <p>green      Off               On red         flashing</p> <p><b>RUN/ERR</b></p> <p>yellow     Off               On green      On red         flashing</p> <p><b>PLC RUN</b></p> <p>green      Off               On yellow     flashing</p> <p><b>WD</b></p> <p>red         Off               On</p> <p><b>CF</b></p> <p>green      Off               On red         On</p> <p><b>ETH</b></p> <p>green      On red         On</p> <p><b>CAN NET</b></p> <p>green      Off               On green      flashing red         On red         flashing</p> <p><b>CAN MOD</b></p> <p>green      On green      flashing red         On red         flashing</p>	<p><b>Bus access</b></p> <p>No bus access (for PLC stop) Bus access OK Bus access error/ configuration error</p>
	<p><b>CPU status</b></p> <p>CPU faulty CPU booting CPU running, operating voltage OK, no error Fatal error: CPU can not boot</p>
	<p><b>PLC status</b></p> <p>PLC stop PLC running PLC running, but outputs shut down (ready-for-operation relay released)</p>
	<p><b>Watchdog</b></p> <p>Watchdog does not respond Serious error, operating system stopped</p>
	<p><b>Compact Flash</b></p> <p>No access to the CF Access to the CF Access error</p>
	<p><b>Ethernet network</b></p> <p>Network access No network connection</p>
	<p><b>CAN network status (only on CAN versions)</b></p> <p>CAN State Prepared CAN State Operational CAN State Pre-Operational Bus Off CAN error</p>
	<p><b>CAN module status (only on CAN versions)</b></p> <p>CAN stack initialised invalid CAN configuration Control unit not ready or serious error Error in the controller</p>

For general technical data, see page 78

# Expansion Modules



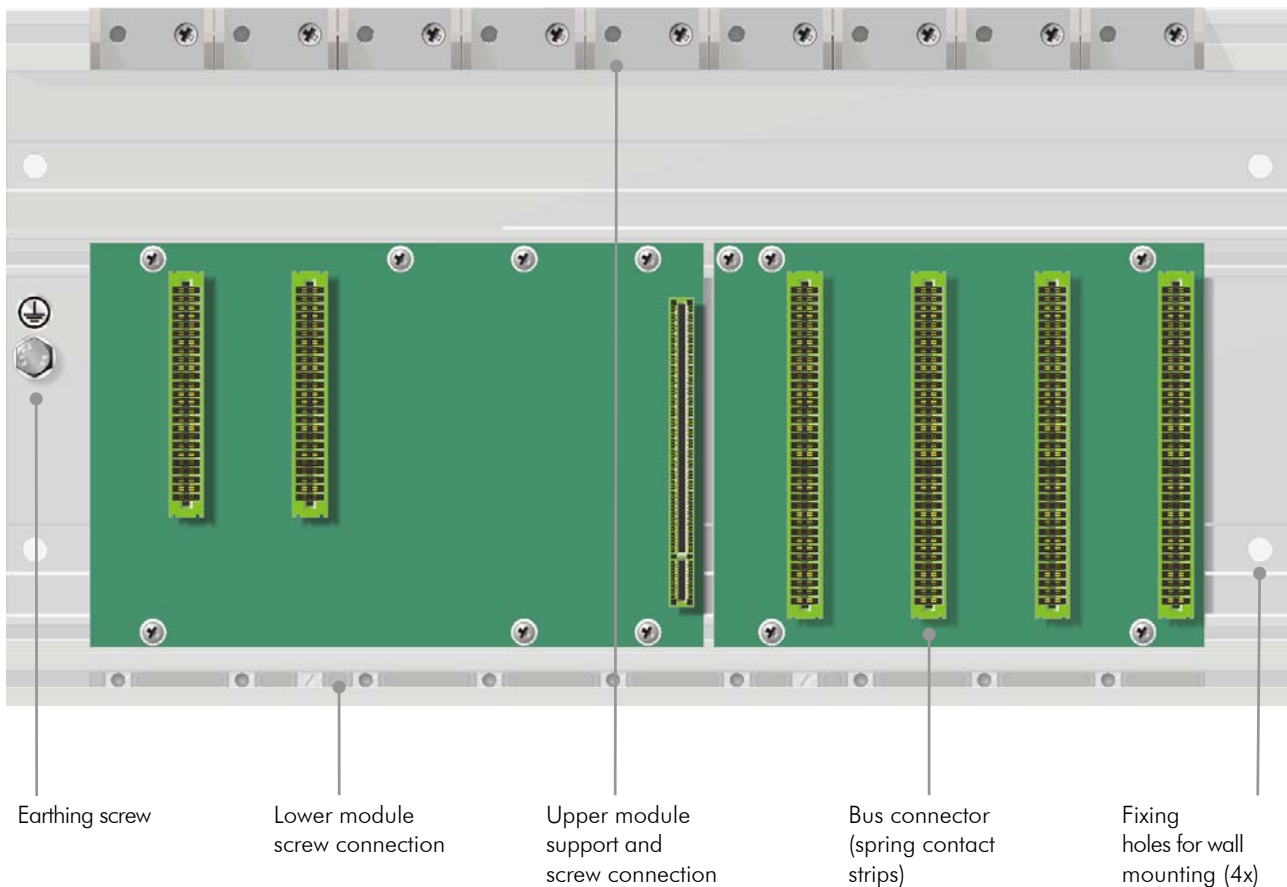
# The Modules

The control units can be operated with a number of components, power supplies and expansion modules. In the following overview, the availability of the modules is listed for different controllers. Observe the following:

- 11 = XCx 1100
- 7 = XCx 700
- U = Promodul-U
- = available for the respective controller
- \* = Use only as an extension rack for a basic rack XBT
- \*\* = Use only on extension racks

Module	Order no.	Available for			Page	
		11	7	U		
<b>Racks</b>						
XBT 3	R4.507.0010.0	•			Basic rack, NT, CPU and 3 slots	36
XBT 4	R4.507.0030.0	•			Basic rack, NT, CPU and 4 slots	36
XBT 7	R4.507.0020.0	•			Basic rack, NT, CPU and 7 slots	36
XBT 11	In preparation	•			Basic rack, NT, CPU and 11 slots	36
XBT 15	In preparation	•			Basic rack, NT, CPU and 15 slots	36
UBT 4	R4.311.0010.0	•*	•	•	Basic rack/expansion rack, 4 slots	38
UBT 8	R4.311.0020.0	•*	•	•	Basic rack/expansion rack, 8 slots	38
UBT 12	R4.311.0030.0	•*	•	•	Basic rack/expansion rack, 12 slots	38
UBT 16	R4.311.0040.0	•*	•	•	Basic rack/expansion rack, 16 slots	38
UBT 20	R4.311.0050.0		•	•	Basic rack, 20 slots	38
<b>Interface modules</b>						
UKZ	R4.318.0030.0	•	•	•	Interface module for basic rack	40
UKE	R4.318.0040.B	•	•	•	Interface module for expansion rack	40
<b>Power supply units</b>						
XNG 24	R4.507.0100.0	•			Power supply unit 24 V, 2 unit width	42
UNG 24	R4.312.0020.B	•**	•	•	Power supply unit 24 V, 1 unit width	44
UNG 230A	R4.312.0030.F	•**	•	•	Power supply unit 230 V, 2 unit width	46
UNG 115A	R4.312.0040.F	•**	•	•	Power supply unit 115 V, 2 unit width	46
<b>Digital I/O modules</b>						
UBE 32 1D	R4.314.0120.E	•	•	•	32 inputs, 1 ms input delay	48
UBE 32 10D	R4.314.0090.E		•	•	32 inputs, 10 ms input delay	48
UBE 32 0,1I	R4.314.0100.E	•	•	•	32 inputs, 4 interrupts, 0.1 ms input delay	50
UBA 32/2A	R4.314.0080.D	•	•	•	32 DC 24 V / 2 A semiconductor outputs	52
UBK 16E 1D/16A	R4.314.0130.E	•	•	•	16 inputs, 1 ms input delay / 16 outputs	54
UBK 16E 10D/16A	R4.314.0110.E		•	•	16 inputs, 10 ms input delay / 16 outputs	54
<b>Counter modules</b>						
UZB 2VR	R4.315.0010.B	•	•	•	2 counters, 24 V input voltage	56
UZB 2VR/5V	R4.315.0040.B	•	•	•	2 counters, 5 V input voltage	56

Module	Order no.	Available for			Page	
		11	7	U		
<b>Analogue and temperature modules</b>						
USA 8/1	R4.315.0090.F	•	•	•	Analogue processor, 8 Slots for USA modules	58
USA E1/1	R4.315.0100.0	•	•	•	Interface module, 1 voltage input	60
USA E1/2.1	R4.315.0120.0	•	•	•	Interface module, 1 current input	60
USA E1/6	R4.315.0140.0	•	•	•	Interface module, 1 resistance temp. measurement Pt100	60
USA E1/7	R4.315.0150.0	•	•	•	Interface module, 1 thermo-element input Fe-CuNi	60
USA A1/1	R4.315.0110.B	•	•	•	Interface module, 1 voltage output	60
USA A1/2	R4.315.0130.0	•	•	•	Interface module, 1 current output	60
UST 2	R4.315.0170.0		•	•	Temperature module, 8 inputs	62
UST 21	R4.315.0180.0		•	•	Temperature module, 8 inputs, adaptive control	62
<b>Positioning modules</b>						
USP 200S	R4.315.0300.0	•	•	•	Sercos master, 1 ring, 8 axes, kinematics function	64
USP 400S	R4.315.0330.0	•	•		Sercos master, 2 rings, 16 axes	64
USP 2I	R4.315.0020.0	•	•	•	Positioning processor, 2 axes, incremental encoder	66
USP 2A	R4.315.0030.0	•	•	•	Positioning processor, 2 axes, absolute encoder SSI	66
UPI 2 DIA	R4.318.0180.B		•	•	Positioning interface, 2 axes	68
UPI 3 DIA	R4.318.0160.B	•	•	•	Positioning interface, 3 axes	68
UPM 3I	R4.315.0080.B		•	•	Position detection, 3 channels, incremental encoder	70
UPM 4A	R4.315.0060.C		•	•	Position detection, 4 channels, absolute encoder	70
UPM 4U	R4.315.0310.C		•	•	Position detection, 4 channels, ultrasound encoder	70
<b>Communication Modules</b>						
USK DIM	R4.318.0170.0	•	•	•	Interbus-S master	72
USK DPM	R4.318.0370.0	•	•		Profibus-DP master	74
USK DPS	R4.318.0360.0	•	•		Profibus-DP slave	74
<b>Accessories</b>						
UBT LA	R4.318.0120.0	•	•	•	Empty slot covers for UBT	
UKK 24	R4.318.0020.0	•	•	•	Cable UKZ ↔ UKE, without power supply	77
UKK 24V	R4.318.0060.0	•	•	•	Cable UKZ ↔ UKE, with voltage supply	77
UNB 115/230	R4.318.0050.0	•	•	•	Buffer battery for UNG 230A/115A	77
UNB 24	R4.318.0130.0	•	•	•	Buffer battery for UNG 24	77
UST	R4.315.0160.F		•	•	Temperature control (spare part for UST 2 / UST 21)	

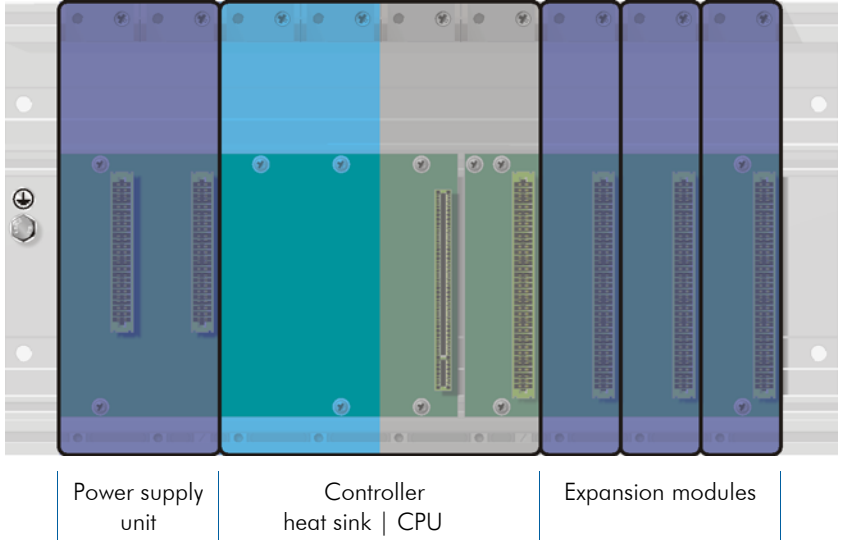


The XBT racks are used as basic racks for the XCx 1100 control unit. The racks of the UBT series can be used as expansion racks (→ page 38). Interface modules (→ page 40) and interface cables are used for the connection (→ page 77).

- There are basic racks with different numbers of slots for the power supply, CPU and expansion modules available:
  - XBT 3 NT, CPU + 3 expansion slots
  - XBT 4 NT, CPU + 4 expansion slots
  - XBT 7 NT, CPU + 7 expansion slots
  - XBT 11 NT, CPU + 11 expansion slots
  - XBT 15 NT, CPU + 15 expansion slots
- for use with the XCx 1100 control unit
- designed for wall mounting
- Modules plug in with screw fixing
- Connecting screw for protective ground

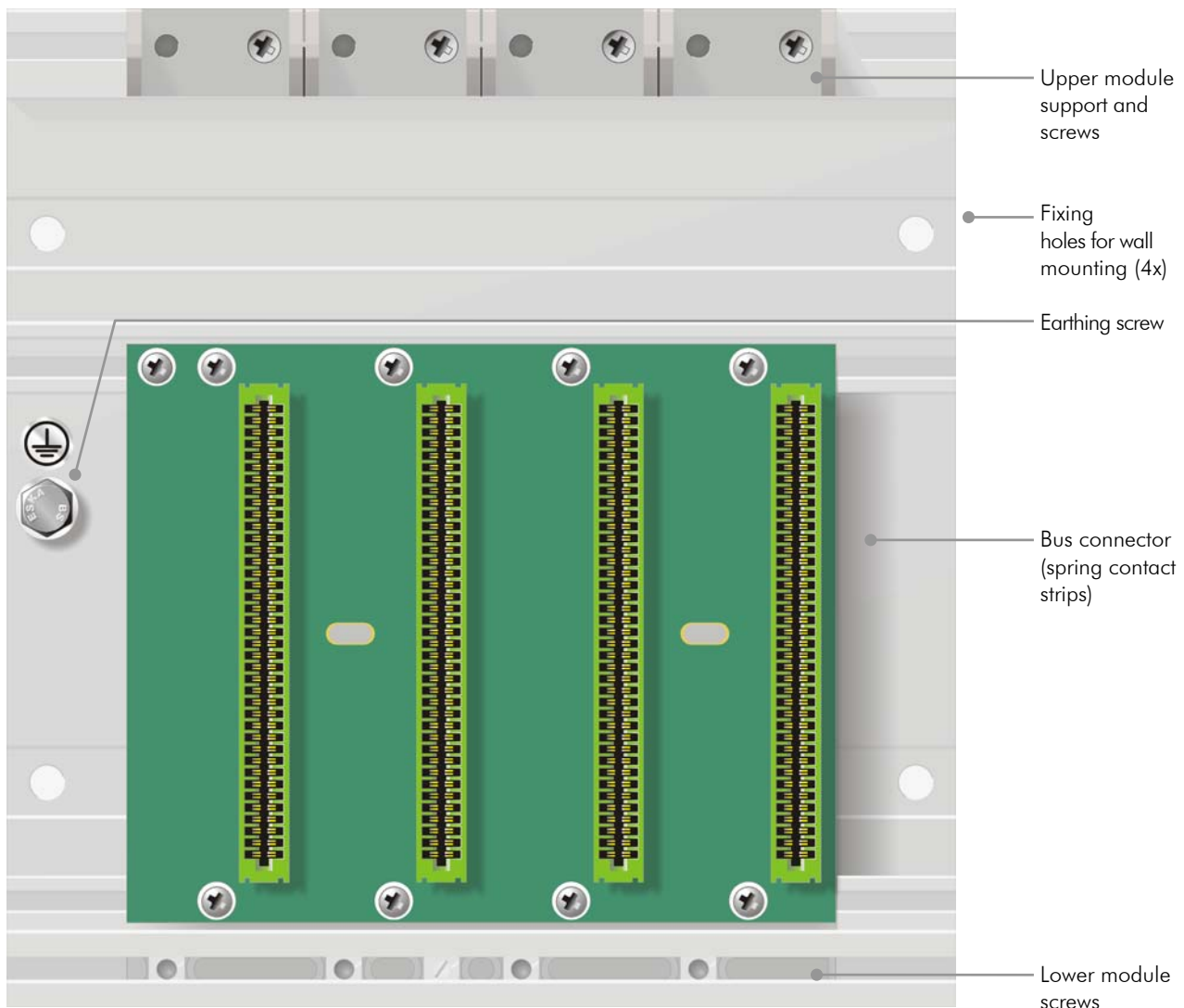
#### Notes:

- Up to 15 expansion racks of the UBT series can be connected directly to the basic device.
- If extension racks are used, the basic rack must always be at the bottom.
- The modules are screwed onto the rack.
- The slot order is defined (power supply, control unit, expansion module) (→ Technical Data).
- The spring contact strips of unused slots should be closed with the supplied empty slot covers during operation.

Technical data	XBT 3	XBT 4	XBT 7	XBT 11	XBT 15
Article number	R4.507.0010.0	R4.507.0030.0	R4.507.0020.0	In preparation	In preparation
For controllers*	11	11	11	11	11
Number of slots	6 + 3	6 + 4	6 + 7	6 + 11	6 + 15
Dimensions (W x H x D in mm)	368 x 200 x 18	404 x 200 x 18	510 x 200 x 18	652 x 200 x 18	794 x 200 x 18
Weight	1.40 kg	1.55 kg	2.00 kg	2.60 kg	3.20 kg
Mechanical structure	Extruded aluminium profile				
Fixing holes	Diameter 7 mm				
Protective earth (PE)	M 6 earthing screw in extruded profile				
Protection type for full / partial configuration	IP 20 / IP 00 to EN 60529				
Slot order The backplane on a rack of the XBT series has a mechanically separated design. The expansion module) are located to the right of the CPU (XCx 1100) and the power supply unit is located on the left. This slot order must be observed!	 <p>The diagram illustrates the slot order for the XBT series racks. It shows a side view of the rack with three main sections highlighted: a purple section on the left for the Power supply unit, a teal section in the middle for the Controller heat sink and CPU, and a grey section on the right for Expansion modules. Below the diagram, labels identify these sections: 'Power supply unit', 'Controller heat sink   CPU', and 'Expansion modules'.</p>				

General technical data, see page 78

\* 11 = XCx 1100, 7 = XCx 700



The UBT racks are used as basic modules for the control unit XCx 700 as well as the expansion racks for both controllers (XCx 1100 / XCx 700). Interface modules (→ page 40) and interface cables are used for the connection (→ page 77).

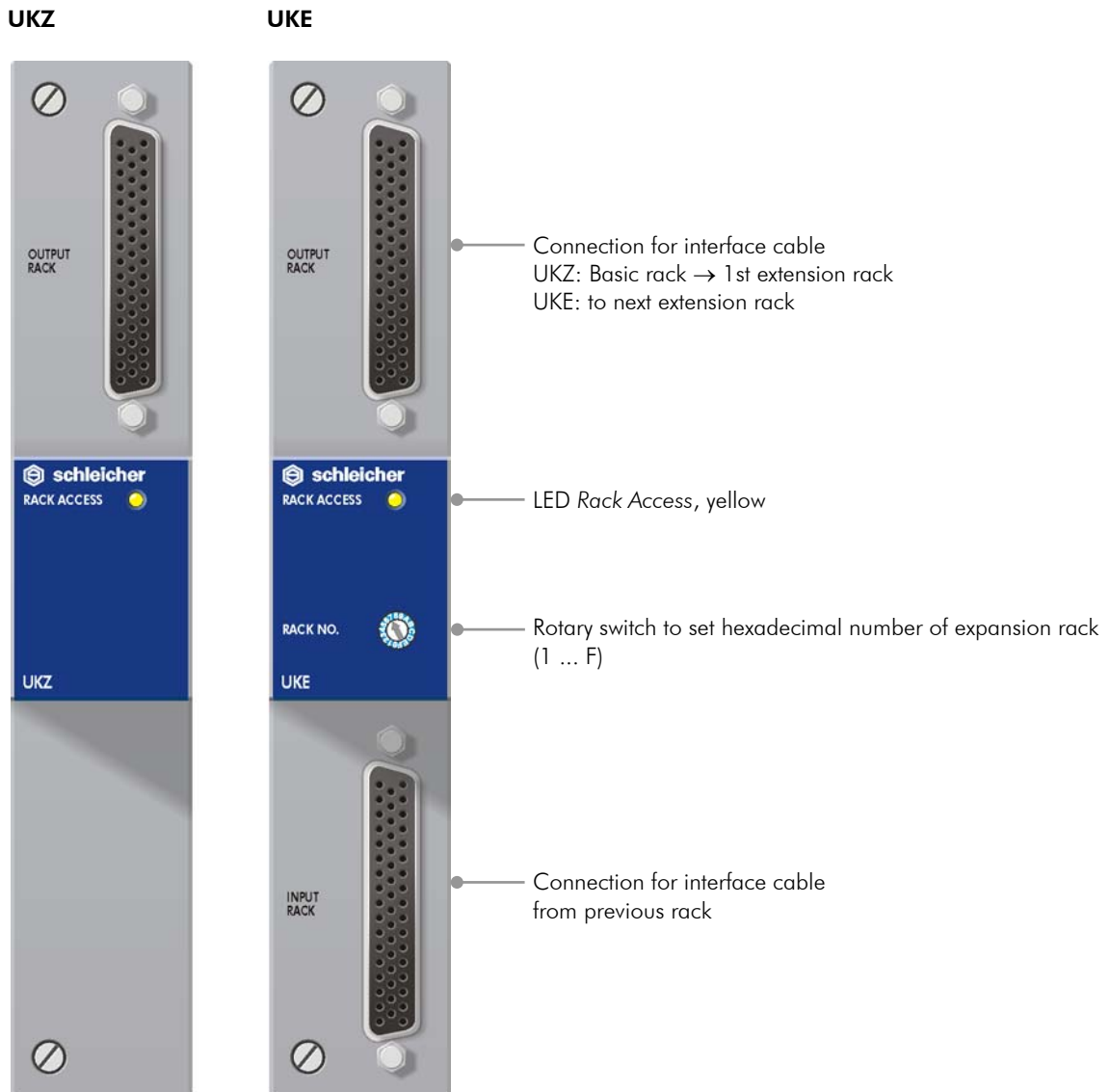
- There are racks with different numbers of slots available:
  - UBT 4 4 slots
  - UBT 8 8 slots
  - UBT 12 12 slots
  - UBT 16 16 slots
  - UBT 20 20 slots
- For use with control unit XCx 700 (as basic and expansion racks)
- For use with control unit XCx 1100 (as expansion rack)
- designed for wall mounting
- Modules plug in with screw fixing
- Connecting screw for protective ground

#### Notes:

- Up to 15 expansion racks of the UTB series can be connected directly to the basic device.
- If extension racks are used, the basic rack must always be at the bottom.
- The modules are screwed onto the rack.
- The first slot (on the left when seen from the front) is reserved for the power supply unit. The other slots can be used for any required module.
- Numbering of slots on the rack starts at the left with 0 (0-3, 0-7, etc.)
- The spring contact strips of unused slots should be closed with the supplied empty slot covers during operation.
- In terms of programming, the UBT 20 rack is treated as a main rack with 16 slots and an extension rack with 4 slots.

Technical data	UBT 4	UBT 8	UBT 12	UBT 16	UBT 20
Article number	R4.311.0010.0	R4.311.0020.0	R4.311.0030.0	R4.311.0040.0	R4.311.0050.0
For controllers*	11 / 7	11 / 7	11 / 7	11 / 7	7
Number of slots	4	8	12	16	20
Dimensions (W x H x D in mm)	190 x 200 x 18	332 x 200 x 18	474 x 200 x 18	616 x 200 x 18	759 x 200 x 18
Weight	0.75 kg	1.30 kg	1.90 kg	2.50 kg	3.10 kg
Mechanical structure	Extruded aluminium profile				
Fixing holes	Diameter 7 mm				
Protective earth (PE)	M 6 earthing screw in extruded profile				
Protection type for full / partial configuration	IP 20 / IP 00 to EN 60529				
General technical data, see page 78	* 11 = XCx 1100, 7 = XCx 700				

Interface module • Basic rack	<b>UKZ</b>
Interface module • Extension Rack	<b>UKE</b>



### UKZ Interface Module

The interface module UKZ is used on the basic rack. It is used for parallel bus coupling of the basic rack with the expansion rack. The connection is made at the front using the UKK interface cable (→ page 77).

The basic rack must be at the bottom.

The UKE interface modules are installed in the expansion racks.

### UKE interface module

The UKE interface module is used on the expansion racks. It is used for the parallel bus coupling of the first extension rack with the basic rack or with another extension rack. The connection is made at the front using the UKK interface cable (→ page 77).

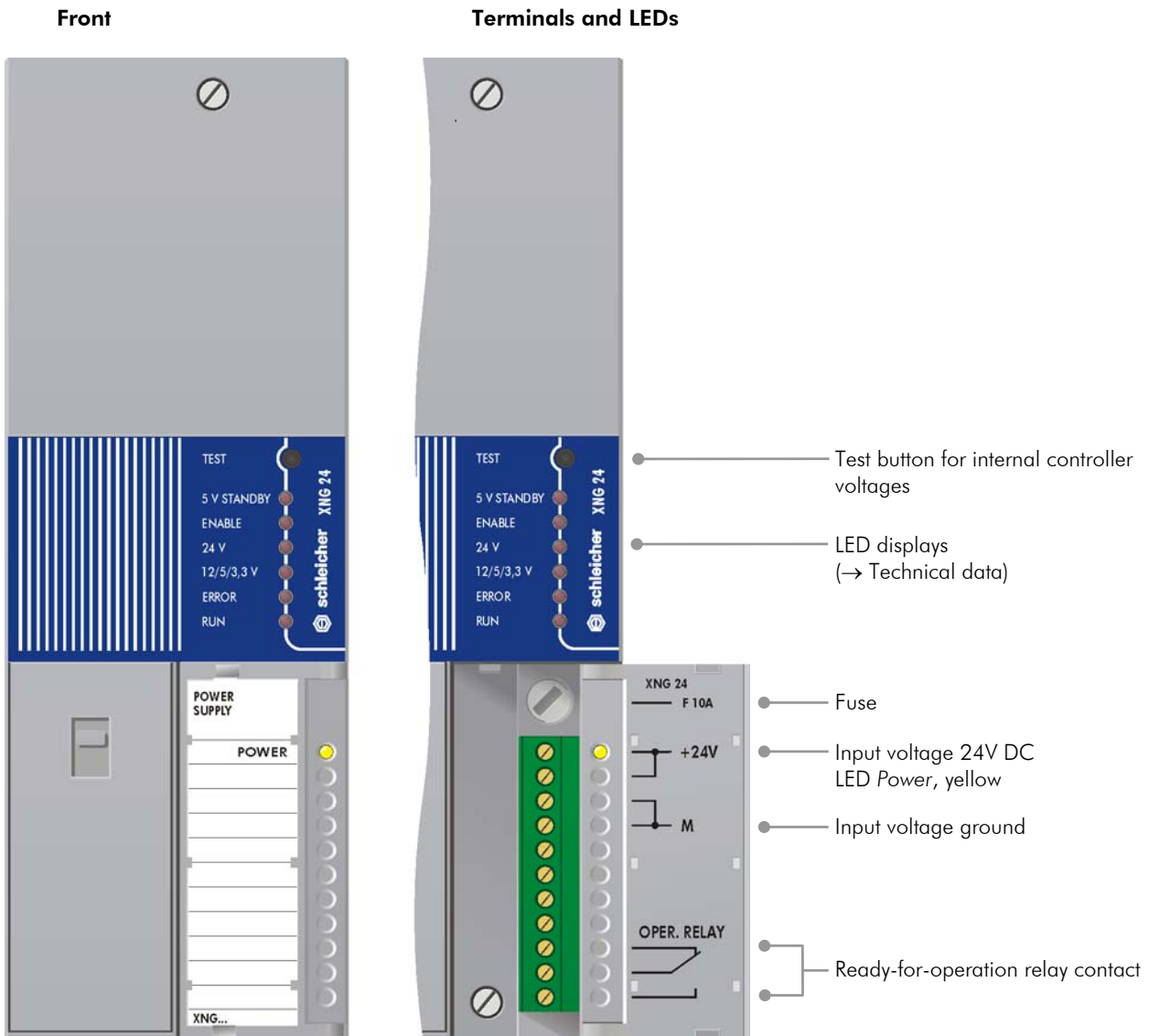
The extension rack must be above the central rack.

### Operating element Rack No.

The hex switch is used to set the extension rack address. The basic rack is assigned to address 0. On extension racks, you can select any address from 1 to F.

Technical data		UKZ	UKE
Article number		R4.318.0030.0	R4.318.0040.B
For controllers*		11 / 7	11 / 7
Application		on basic rack	on extension rack
Number per control system		1	max. 15
Interfacing diagram			
Internal power consumption DC 5 V		0.5 W	0.5 W
Connection system	OUT interface IN interface	1x D-subminiature 50-pin. socket connector –	1x subminiature 50-pin socket connector 1x subminiature 50-pin socket connector
Address setting		–	Via hex switch 1 ... F
Connecting cable		UKK 24; UKK 24V (→ page 77)	
Weight		0.46 kg	0.48 kg
<b>LED displays</b>			
RACK ACCESS	Off yellow On	Control unit in STOP mode or module not accessed by user program or interface cable missing or module faulty Faulty control unit access to the bus of the extension module	
General technical data, see page 78			* 11 = XCx 1100, 7 = XCx 700

## Power Supply Units • DC 24 V XNG 24



The XNG 24 power supply provides the internal controller voltages (DC 24V, DC 12V, DC 5V and DC 3.3V) for supplying the rack. It is equipped with a ready-for-operation relay (OPERATING RELAY).

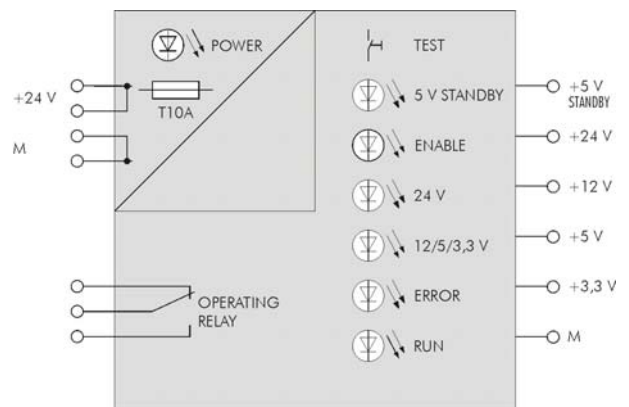
**Notes:**

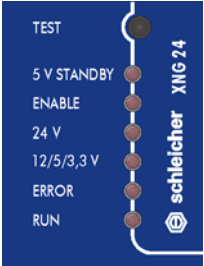

- The power supply must only be used on racks of the XBT series.
- Power supply units must not be operated in parallel (for use of power supply units on racks → page 16).

**Controls**

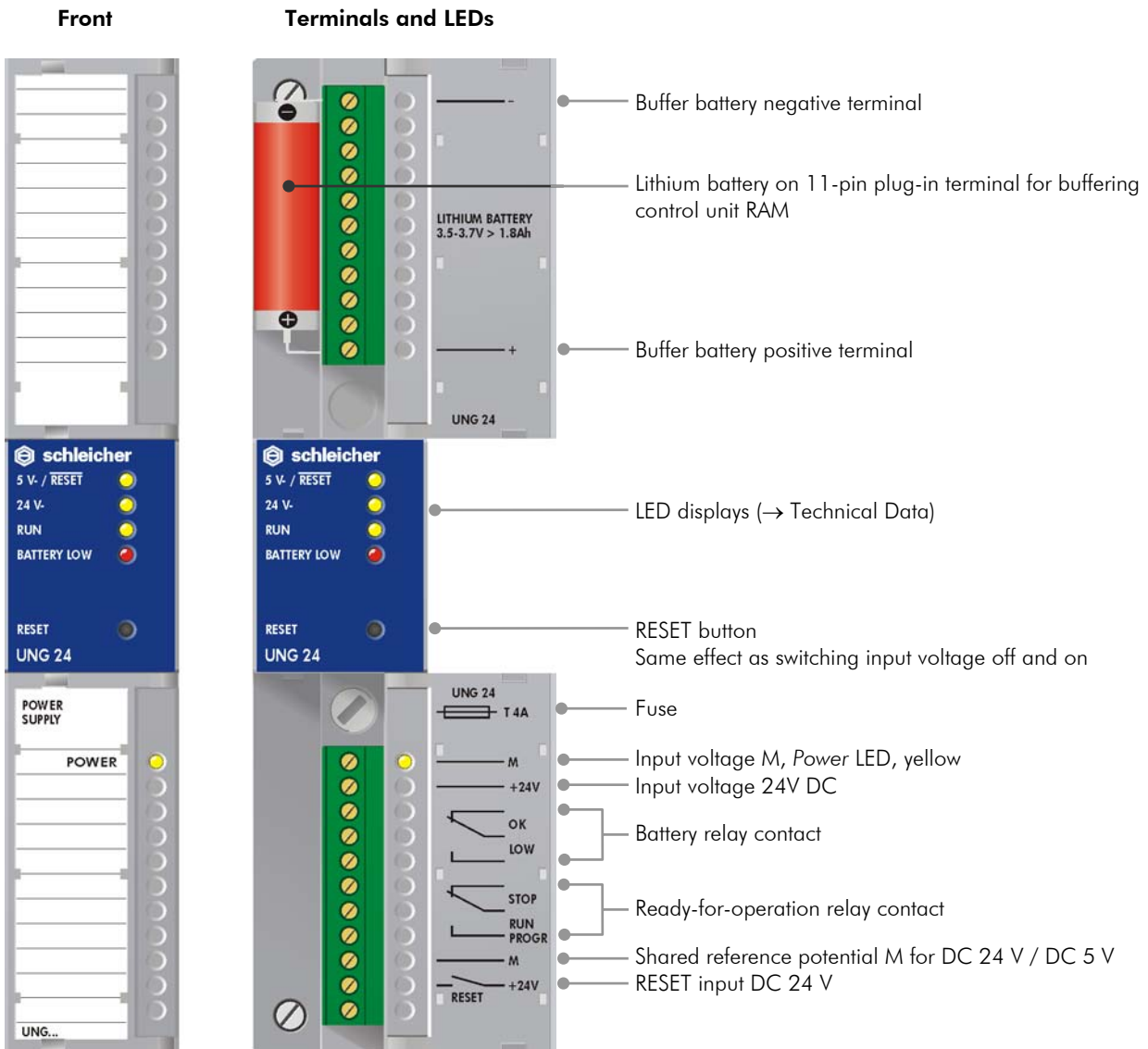
The TEST button switches on internal controller voltages independent of the control unit.

**Block diagram**



Technical data		XNG 24		
Article number	R4.507.0100.0			
For controllers*	11			
Input voltage	24 V DC ± 20 % max. 5 % residual ripple			
Power consumption	< 200 W			
Isolation	no			
Input fuse	Fuse F10A/250V			
Output voltage / current	DC 24V / 2A DC 12V / 5A DC 5V / 10A DC 3,3V / 12A DC 5V STANDBY / 1A			
Output power	Total power <150 W			
Short-circuit shutdown	yes, DC 24V (DC 12V, DC 5V, DC 3.3V, DC 5V STANDBY overcurrent-protected)			
Output voltage monitoring	yes, undervoltage			
Thermal overload protection	yes			
No-load operation	yes			
Parallel operation with other power supply units	no			
Connection system	11-pin plug-in terminal			
Conductor sizes	Up to 2.5 mm <sup>2</sup> (stranded with wire-end ferrules)			
Weight	1.0 kg			
Ready-for-operation relay				
Contact type	Changeover contact			
Contact load	DC 24 V / 2 A			
Operating state	Activated for PLC run (LED Run)			
LED displays				
	5 V STANDBY	Off	Fault DC 5V STANDBY	
		yellow	On	Output voltage DC 5V STANDBY fault-free
	ENABLE	Off	Switch off command of control unit, output voltages switched off	
		yellow	On	Switch on command of control unit, output voltages switched on
	24 V	Off	Fault DC 24V, error message at control unit	
		yellow	On	Output voltage DC 24V fault-free
	12/5/3.3 V	Off	Fault in output voltage DC 12V, DC 5V, DC 3,3V, error message at control unit	
		yellow	On	Output voltages DC 12V, DC 5V, DC 3.3V fault-free
ERROR	Off	Overload at DC 24V, self-maintaining		
	red	On	Current input DC 24V fault-free	
RUN	Off	PLC on STOP, ready-for-operation relay switched off		
	yellow	On	PLC on RUN, ready-for-operation relay switched	
	POWER	Off	Input voltage not available	
		yellow	On	Input voltage available
General technical data, see page 78			* 11 = XCx 1100, 7 = XCx 700	

## Power Supply Units • DC 24 V UNG 24



The UNG 24 power supply unit supplies the internal controller voltages (DC 24 V and DC 5 V) for supplying the racks. It is equipped with an OPERATING RELAY, a relay for contact output of the charge in the buffer battery (BATTERY LOW) and a UNB 24 buffer battery for the RAM (→ page 77). The power supply unit must be installed on the left in the rack (seen from the front).

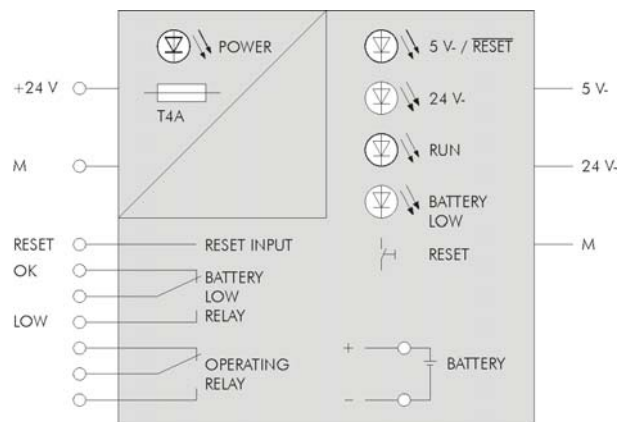
**Notes:**

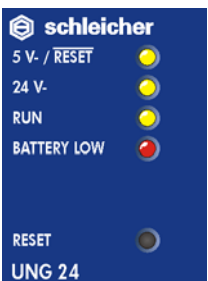
- The power supply must only be used on racks of the UBT series.
- The slave temperature processor UST (→ page 62) must not be operated with the UNG 24.
- Power supply units must not be operated in parallel (for use of power supply units on racks → page 16).

**Controls**

RESET button / external input RESET: RESET is the same as switching the power off and on again. The effect depends on the position of the control unit mode switch.

**Block diagram**

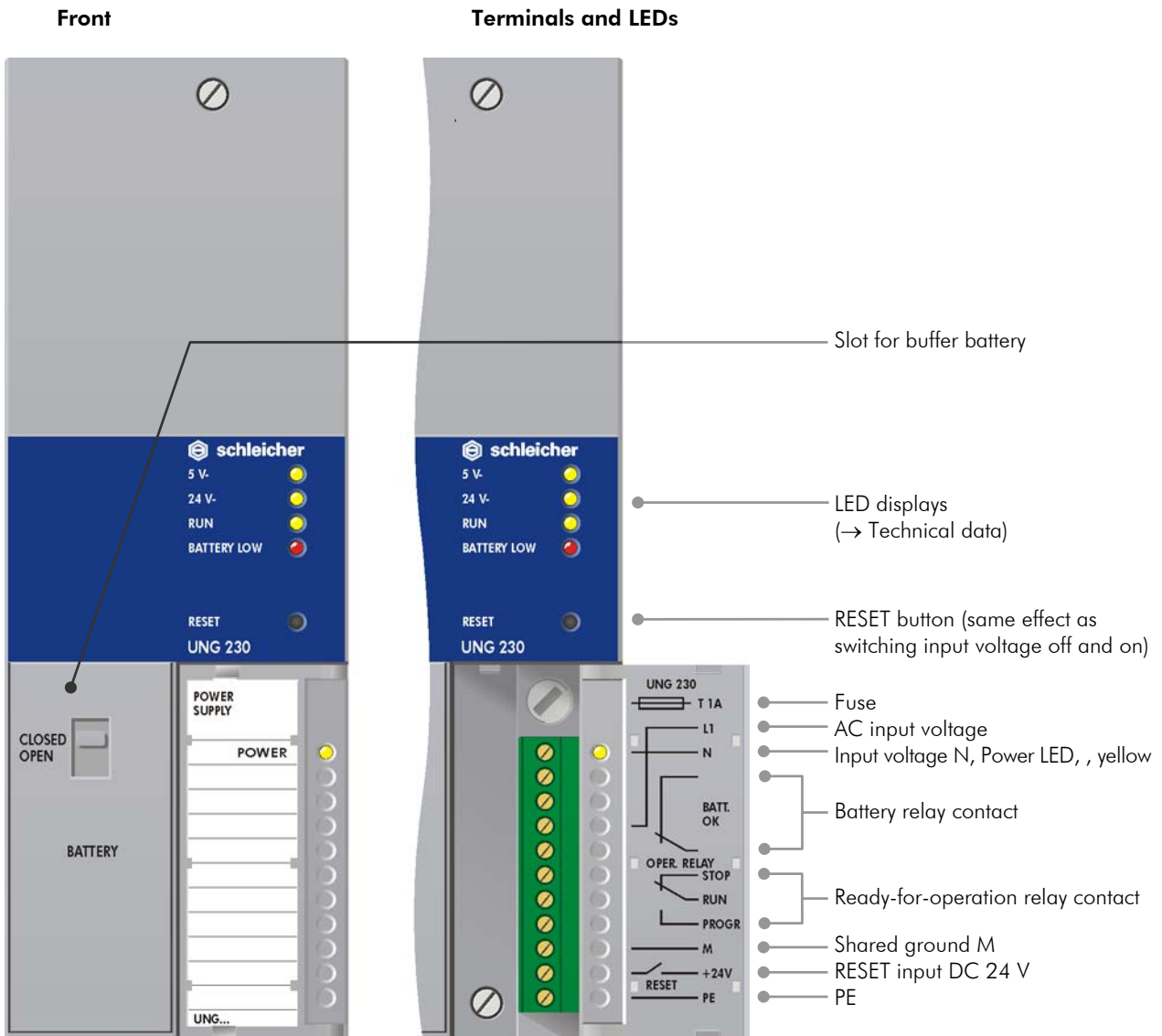


Technical data		UNG 24		
Article number	R4.312.0020.B			
For controllers*	7 (on basic and extension rack) / 11 (on extension rack)			
Input voltage	24 V DC ± 20 % max. 5 % residual ripple			
Power consumption	60 W			
Isolation	no			
Input fuse	T4A/250V fuse			
Output voltage / current	DC 24V / 2A DC 5V / 5A			
Output power	DC 24 V DC 5 V	48 W 25 W	} Total output restricted to 50 W	
Short-circuit shutdown	yes (DC 5 V permanently short-circuit-proof))			
Output voltage monitoring	yes, overvoltage and undervoltage			
Thermal overload protection	yes			
No-load operation	yes			
Parallel operation with other power supply units	no			
Connection system	Two 11-pin plug-in terminals			
Conductor sizes	Up to 2.5 mm <sup>2</sup> (stranded with wire-end ferrules)			
Weight	1.2 kg			
RESET input				
Input voltage	DC 24 V, max. residual ripple 5 % H level +13 ... +30 V, L level -30 ... +6 V			
Input current	typ. 10 mA for 24 V			
Isolation	no			
Ready-for-operation relay				
Contact type	Changeover contact			
Contact load	AC 230 V / 4 A DC 24 V / 2 A			
Operating state	Activated for PLC run (LED Run)			
Battery state relay				
Contact type	Changeover contact			
Contact load	AC 230 V / 4 A DC 24 V / 2 A			
Operating state	Activated when battery discharged (Battery Low LED)			
Buffer battery				
Type	Lithium battery 3.6V / 1.9Ah			
Buffer time	Min. ½ year (at +25 °C and uninterrupted buffering)			
LED displays				
	5 V- / RESET	Off	Fault DC 5 V, operation relay switched off, controller goes to STOP	
		yellow	On	Output voltage DC 5 V fault-free, RESET input inactive
	24 V-	Off	Fault DC 24 V, operation relay switched off, controller goes to STOP	
		yellow	On	Output voltage DC 24 V fault-free
	RUN	Off	PLC on STOP, ready-for-operation relay switched off	
		yellow	On	PLC on RUN, ready-for-operation relay switched
BATTERY LOW	Off	Buffer battery fault-free, battery relay switched off		
	red	On	Buffer battery empty, battery relay switched	
POWER	Off	Input voltage not available		
	yellow	On	Input voltage available	

General technical data, see page 78

\* 11 = XCx 1100, 7 = XCx 700

<b>Power Supply Units • AC 230 V</b> <b>Power Supply Units • AC 115 V</b>	<b>UNG 230A</b> <b>UNG 115A</b>
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The UNG 230A / UNG 115A power supply units supply the internal controller voltages (DC 24 V and DC 5 V) for supplying the racks. They are equipped with an OPERATING RELAY and a battery compartment for the UNB 115/230 buffer battery for the RAM (→ page 77). The power supply unit must be installed on the left in the rack (seen from the front).

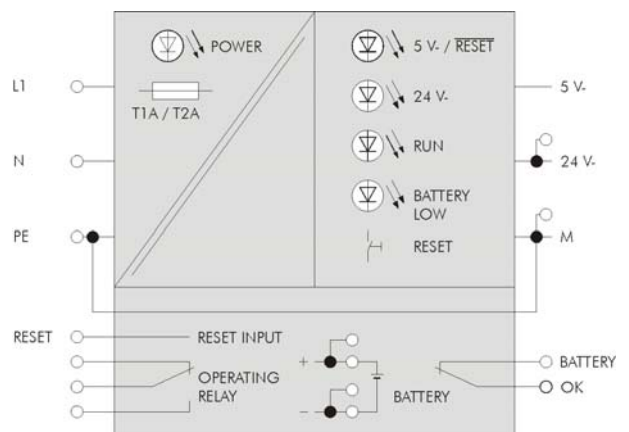
**Notes:**

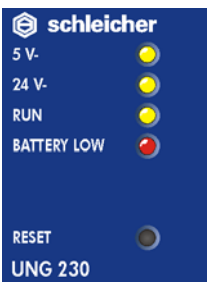
- The power supply must only be used on racks of the UBT series.
- Power supply units must not be operated in parallel (for use of power supply units on racks → page 16).

**Controls**

RESET button / external input RESET: RESET is the same as switching the power off and on again. The effect depends on the position of the control unit mode switch.

**Block diagram**



Technical data		UNG 230A	UNG 115A
Article number		R4.312.0030.F	R4.312.0040.F
For controllers*		7 (on basic and extension rack) / 11 (on extension rack)	
Input voltage		AC 230 V, 50 ... 60 Hz, ± 15 %	AC 115 V, 50 ... 60 Hz, ± 15 %
Rated power consumption		60 W (230 V / 50 Hz)	60 W (115 V / 50 Hz)
Isolation		yes	yes
Input fuse		T1,0/250V fuse	T2,0/250V fuse
Output voltage / current		DC 24V / 2A DC 5V / 5A	
Output power	DC 24 V DC 5 V	48 W 25 W	} Total output restricted to 50 W
Short-circuit shutdown		yes (DC 5 V permanently short-circuit-proof))	
Output voltage monitoring		Yes, overvoltage and undervoltage	
Thermal overload protection		yes	
No-load operation		yes	
Parallel operation with other power supply units		no	
Connection system		11-pin plug-in terminal	
Conductor sizes		Up to 2.5 mm <sup>2</sup> (stranded with wire-end ferrules)	
Weight		1.25 kg	
<b>RESET input</b>			
Input voltage		DC 24 V, max. residual ripple 5 % H level +13 ... +30 V, L level -30 ... +6 V	
Input current		typ. 10 mA for 24 V	
Isolation		no	
<b>Ready-for-operation relay</b>			
Contact type		Changeover contact	
Contact load		AC 250 V / 4 A DC 24 V / 2 A	
Operating state		Activated for PLC run (LED Run)	
<b>Battery state relay</b>			
Contact type		Changeover contact	
Contact load		AC 230 V / 4 A DC 24 V / 2 A	
Operating state		Activated when battery discharged (Battery Low LED)	
<b>Buffer battery</b>			
Type		Lithium battery 3.6V / 5.2Ah	
Buffer time		Min. 1 year (at +25 °C and uninterrupted buffering)	
<b>LED displays</b>			
	5 V-	Off yellow On	Fault DC 5 V, operation relay switched off, controller goes to STOP Output voltage DC 5 V fault-free
	24 V-	Off yellow On	Fault DC 24 V, operation relay switched off, controller goes to STOP Output voltage DC 24 V fault-free
	RUN	Off yellow On	PLC on STOP, ready-for-operation relay switched off PLC on RUN, ready-for-operation relay switched
	BATTERY LOW	Off red On	Buffer battery fault-free, battery relay switched off Buffer battery empty, battery relay switched
	POWER	Off yellow On	Input voltage not available Input voltage available

General technical data, see page 78

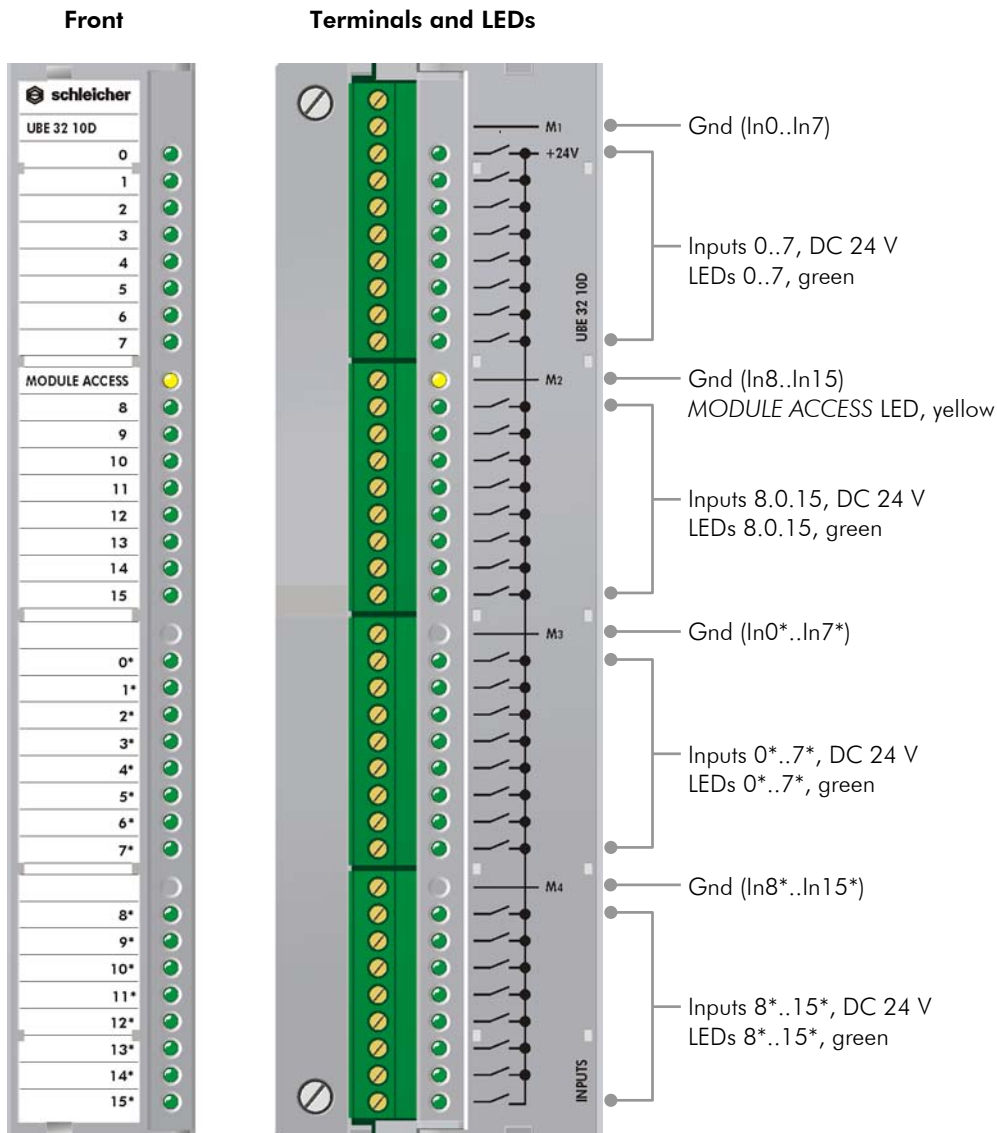
\* 11 = XCx 1100, 7 = XCx 700

32 Inputs • DC 24 V • 1 ms

UBE 32 1D

32 Inputs • DC 24 V • 10 ms

UBE 32 10D



The input modules have 32 inputs for DC 24 V with green status display.

The plug-in terminals may be connected and removed during operation.

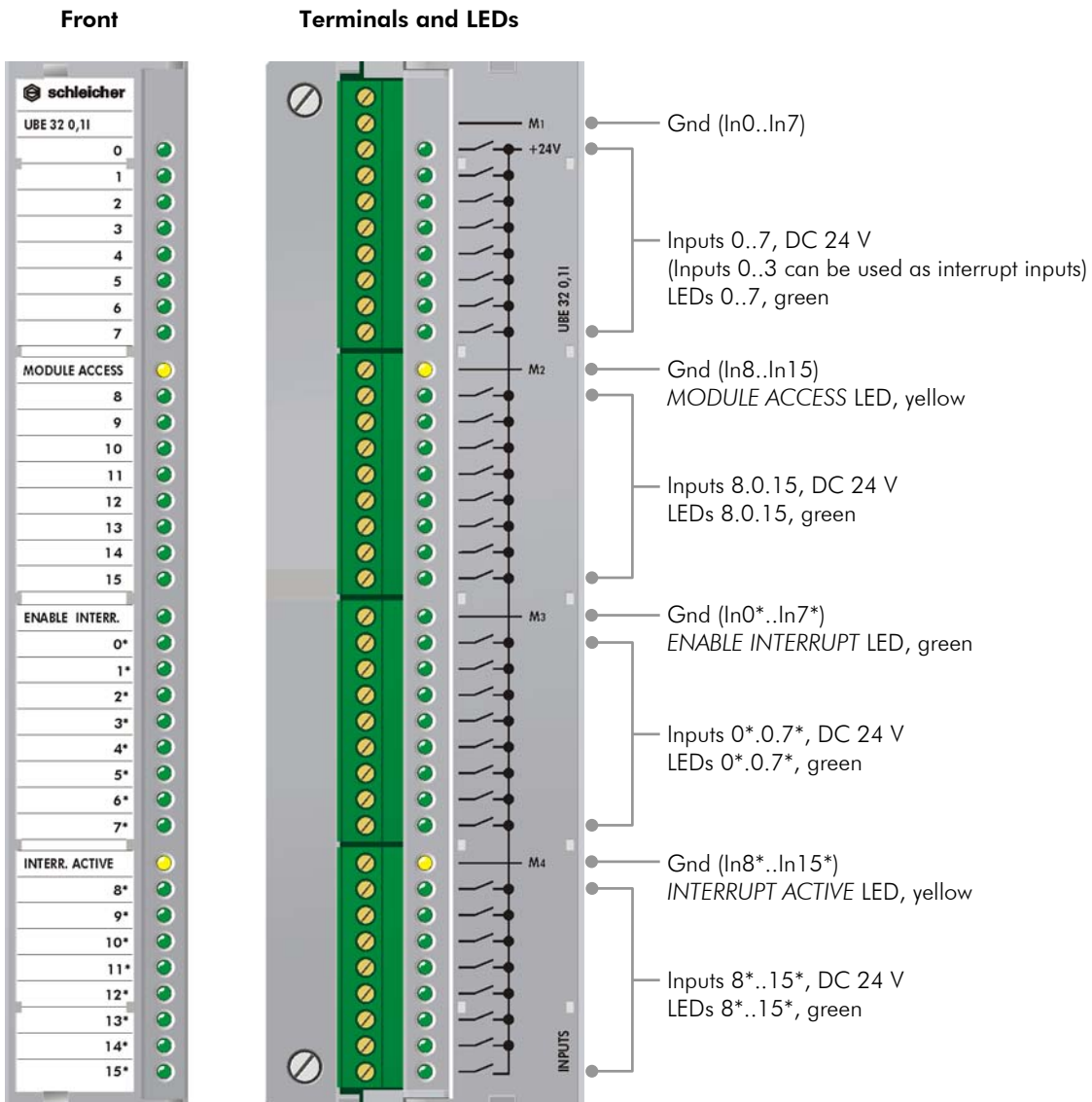
The inputs are isolated from the control electronics and from one another by optocouplers in 4 groups of 8 inputs each. They are positive-switching with input signal delay of 1 ms (UBE 32 1D) or 10 ms (UBE 32 10D).

The modules are suitable for 2-wire initiators.

Sensors and reference potential are connected via four plug-in terminals on the front. The LEDs beside the front flap of the module are assigned to the facing plug-in terminals. When they are on they indicate H level on the sensors. You can label the sensors on the front flap.

Technical data		UBE 32 1D	UBE 32 10D
Article number		R4.314.0120.E	R4.314.0090.E
For controllers*		11 / 7	7
Number of inputs/outputs		32 inputs in 4 groups of 8 inputs	
Internal power consumption	DC 24 V DC 5 V	– 0.1 W	
Connection system		One 10-pin and three 9-pin plug-in terminals	
Conductor sizes		Up to 2.5 mm <sup>2</sup> (stranded with wire-end ferrules)	
Weight		0.47 kg	
<b>Inputs</b>			
Input circuit			
Input voltage	24 V DC, max. residual ripple 5 %		
Switching level	H level +13 ... +30 V L level –30 ... +6 V		
Input current	Typical 8 mA at 24 V input voltage		
Input signal delay	Typical 1 ms		Typical 10 ms
Simultaneity	100 %		
Isolation	By optocouplers, all four groups from one another and from bus		
<b>LED displays</b>			
INPUTS (32x)	green	On	H level of sensors
MODULE ACCESS		Off	Control unit in STOP mode, Module not programmed or faulty
		yellow On	Fault-free control unit access to the module
General technical data, see page 78			* 11 = XCx 1100, 7 = XCx 700

**32 Inputs • DC 24 V • 0.1 ms • interrupt-capable** **UBE 32 0,11**



The input module provides 32 inputs for 24 V DC with green status display. The first four are also interrupt inputs.

The inputs are isolated from the control electronics and from one another by optocouplers in 4 groups of 8 inputs each. They are positive-switching with an input signal delay of 0.1 ms.

Sensors and reference potential are connected via four plug-in terminals on the front. The LEDs beside the front flap of the module are assigned to the facing plug-in terminals. When they are on they indicate H level on the sensors. You can label the sensors on the front flap.

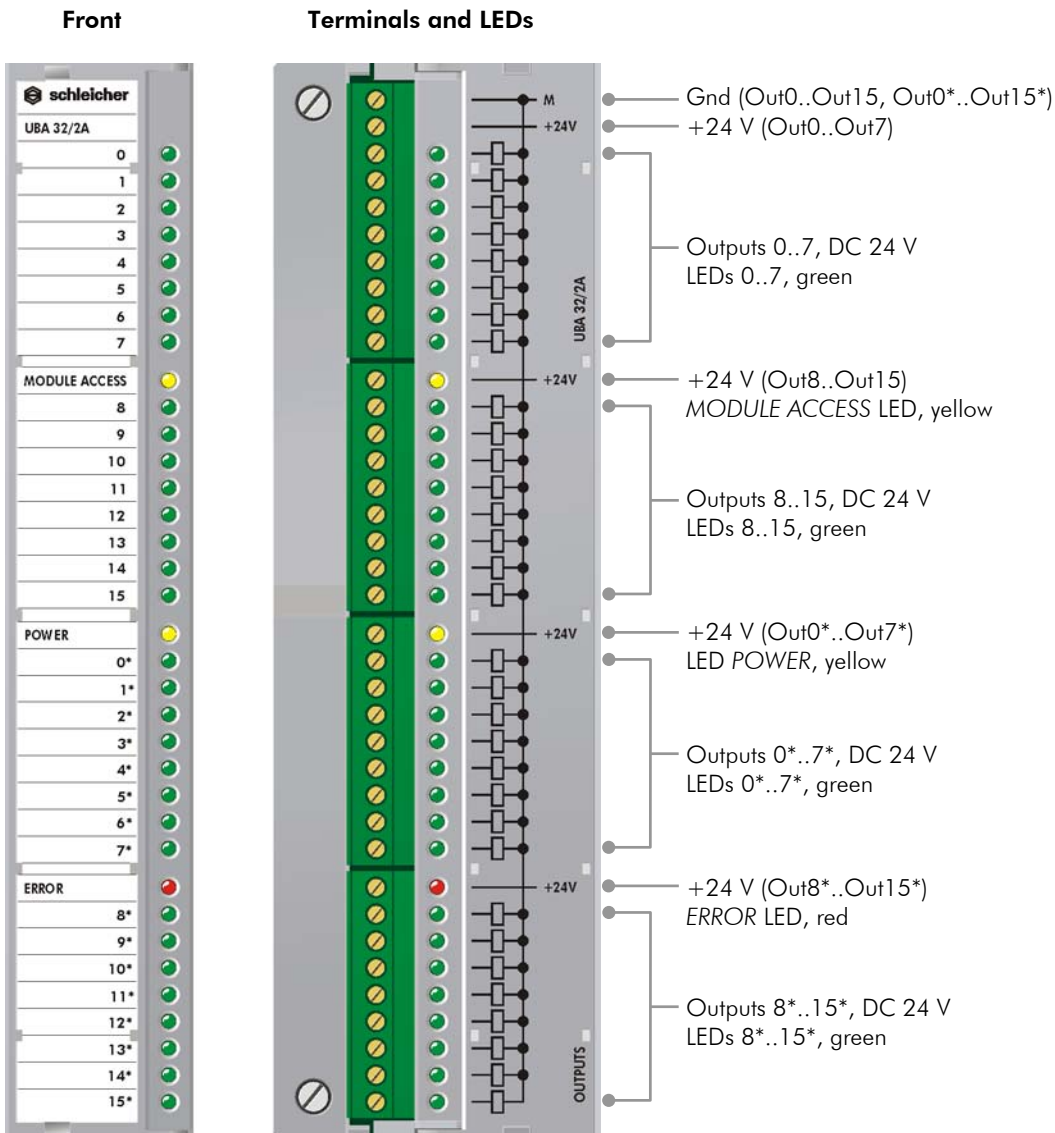
The plug-in terminals may be connected and removed during operation.

The module is suitable for 2-wire initiators.

An interrupt signal in inputs 0 to 3 interrupts processing of the user program in the cyclical task and starts the user program Eventtask assigned to the input (event 1 to event 4). After it has been processed the user program restarts where it stopped in the cyclical task.

Technical data		UBE 32 0,11
Article number	R4.314.0100.E	
For controllers*	11 / 7	
Number of inputs/outputs	32 inputs in 4 groups of 8 inputs The first four inputs in the first group are interrupt inputs	
Internal power consumption	DC 24 V	–
	DC 5 V	0.1 W
Connection system	One 10-pin and three 9-pin plug-in terminals	
Conductor sizes	Up to 2.5 mm <sup>2</sup> (stranded with wire-end ferrules)	
Weight	0.47 kg	
Inputs		
Input circuit		
Input voltage	24 V DC, max. residual ripple 5 %	
Switching level	H level +13 ... +30 V L level –30 ... +6 V	
Input current	Typical 10 mA at 24 V input voltage	
Input signal delay	Typical 0.1 ms	
Simultaneity	100 %	
Isolation	By optocouplers, all four groups from one another and from bus	
LED displays		
INPUTS (32x)	green On	H level of sensors
MODULE ACCESS	Off	Control unit in STOP mode, Module not programmed or faulty
	yellow On	Fault-free control unit access to the module
ENABLE INTERR. off	green on	No interrupt enable programmed in the interrupt mask Release of one or both edges of the four interrupts by the interrupt mask
INTERR. ACTIVE flashing	yellow, yellow On	At least one interrupt (all four signals OR-linked) on system bus Missing interrupt reset
General technical data, see page 78		* 11 = XCx 1100, 7 = XCx 700

## 32 Outputs • DC 24 V • 2 A UBA 32/2A



The output module has 32 semiconductor outputs for DC 24 V / 2 A with green status display.

The outputs are isolated from the control electronics by means of optocouplers.

Reverse voltage protection prevents destruction of the components if incorrect supply voltage polarity is connected.

The outputs are short-circuit-proof with overcurrent monitoring in groups of 8 channels. When it triggers, the respective output group shuts down, the ERROR LED on the front is activated and a message is sent to the control unit. The message can be processed in the user program.

Each output is protected against inductive peaks on circuit interruption.

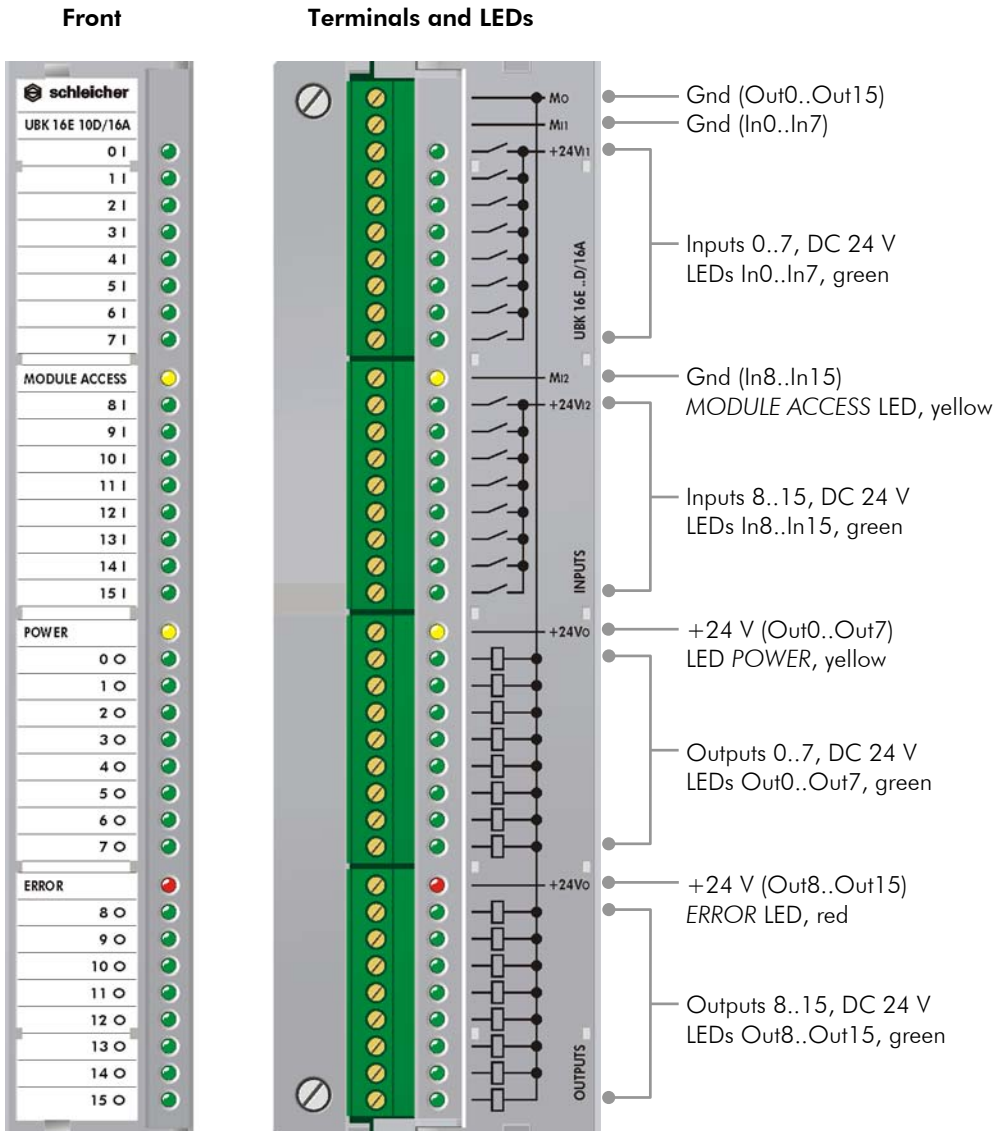
Loads and output supply voltage are connected via plug-in terminals on the front. The LEDs beside the front flap of the module are assigned to the facing plug-in terminals. When on they indicate H level on the output signals and the connected supply voltage. You can label the sensors on the front flaps.

The plug-in terminals may be connected and removed during operation.

The output supply voltage is fed in on the +24 V terminals.

Technical data		UBA 32/2A
Article number		R4.314.0080.D
For controllers*		11 / 7
Number of inputs/outputs		32 outputs, in 4 groups of 8 outputs
Internal power consumption	DC 24 V DC 5 V	– 0.9 W
Connection system		One 10-pin and three 9-pin plug-in terminals
Conductor sizes		Up to 2.5 mm <sup>2</sup> (stranded with wire-end ferrules)
Weight		0.54 kg
Outputs		
Output circuit		
Supply voltage	24 V DC ± 20 % max. 5 % residual ripple	
Switching level	H level    Supply voltage – xU (xU ≤ 0.3 V) L level    ≤ 3 V	
Output current	Max. 2 A, continuous operation max. 5 A, lamp load	
Output current per group	Max. 8 A, continuous operation	
Protection	Electronic overcurrent monitoring by group, trigger current 9 ... 11 A	
Short-circuit monitoring	Electronic	
Parallel connection of outputs	no	
Switching frequency	With ohmic load:    max. 10 Hz With inductive load: Max. 0.5 Hz at 2 A max. 10 Hz at 0.5 A	
Isolation	By optocouplers	
LED displays		
OUTPUTS (32x)	green On	H level of outputs
MODULE ACCESS	Off	Control unit in STOP mode, Module not programmed or faulty
	yellow On	Fault-free control unit access to the module
POWER	Off	No external supply voltage of outputs
	yellow On	External supply voltage of outputs available
ERROR	Off	Fault-free function of overcurrent monitoring
	red On	Overcurrent monitoring triggered, message to control unit
General technical data, see page 78		* 11 = XCx 1100, 7 = XCx 700

<b>16 Inputs / 1 ms • 16 Outputs DC 24 V / 2 A</b>	<b>UBK 16E 1D/16A</b>
<b>16 Inputs / 10 ms • 16 Outputs DC 24 V / 2 A</b>	<b>UBK 16E 10D/16A</b>



The input/output modules have 16 inputs for 24 V DC and 16 semiconductor outputs for 24 V DC / 2 A, with green status display.

The inputs and outputs are isolated from the control electronics and from one another by optocouplers in 2 groups of 8 inputs each. The outputs are positive-switching with input signal delay of 1 ms (UBK 16E 1D/16A) or 10 ms (UBK 16E 10D/16A).

Reverse voltage protection prevents destruction of the components if incorrect supply voltage polarity is connected on the outputs.

The outputs are short-circuit-proof with overcurrent monitoring in groups of 8 channels. When it triggers, the respective output group shuts down, the ERROR LED on the front is activated and a message is sent to the control unit. The message can be processed in the user program.

Each output is protected against inductive peaks on circuit interruption.

The sensors, loads and reference potentials are connected via plug-in terminals on the front. The LEDs beside the front flap of the module are assigned to the facing plug-in terminals. When they are on they indicate H level on the sensors. You can label the sensors on the front flap.

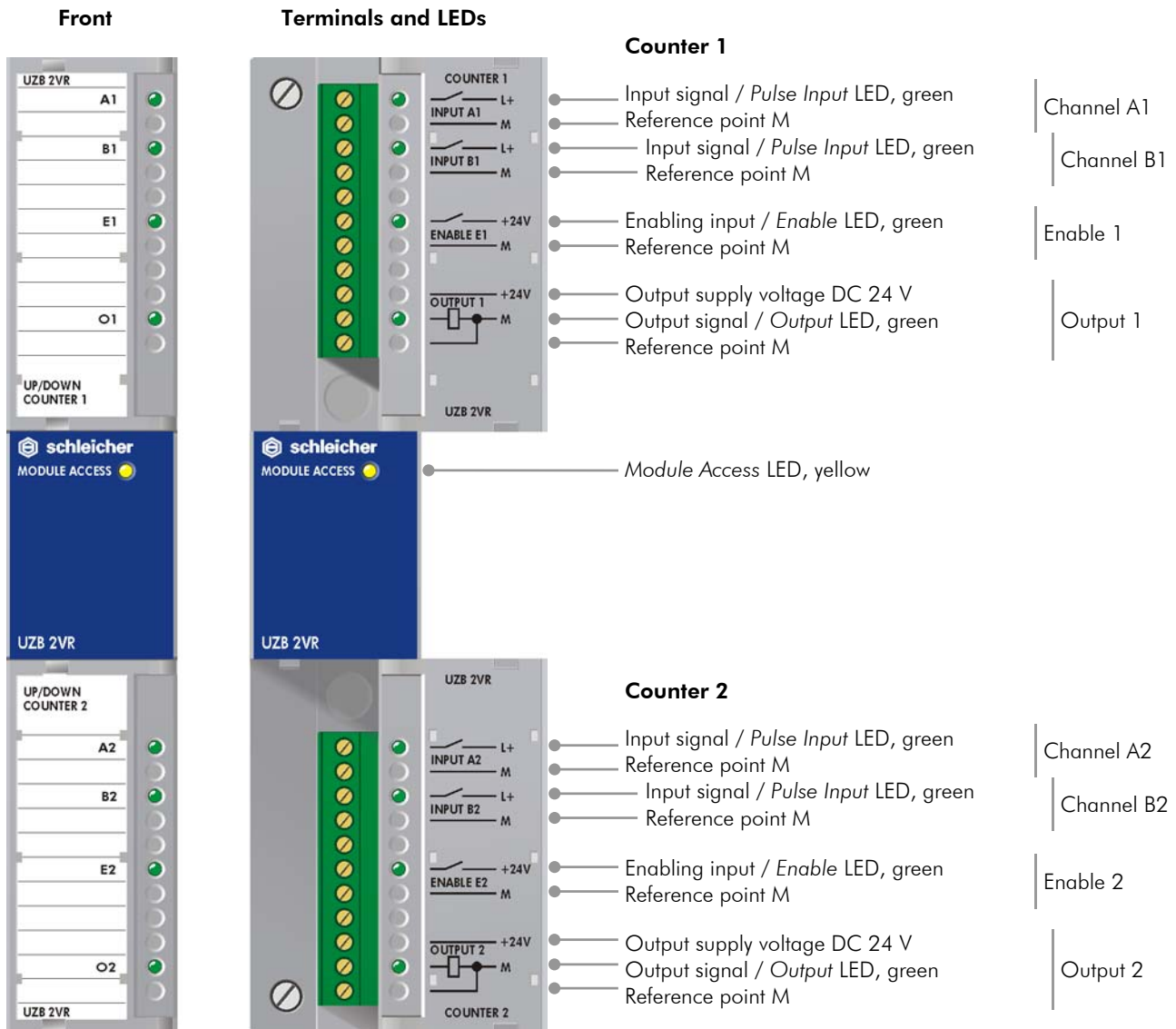
The module inputs are suitable for 2-wire initiators.

The plug-in terminals may be connected and removed during operation.

The output supply voltage is fed in on the +24 V terminals.



<b>2 counters • 24 V input voltage • max. 100 kHz</b>	<b>UZH 2VR</b>
<b>2 counters • 5 V input voltage • max. 100 kHz</b>	<b>UZH 2VR/5V</b>



The UZH counter modules with 2 bidirectional counters are used in conjunction with incremental encoders to detect fast counter pulses. Modules are available with 24 V and 5 V input voltage.

The modules provide two independent up/down counters with a maximum input frequency of 100 kHz and a counting range from 0 to 65535. They function as combined bit/word modules on the system bus.

The counter set values are specified via the user program and loaded into the counter module. When the set counter value is reached, an isolated hardware output on the counter module is set and an interrupt signal sent to the control unit. With this signal outputs can be controlled independently of the control unit cycle time. This produces short response times. The hardware output on the counter is reset with a new set value or via the user program. It can also be blocked by the user program.

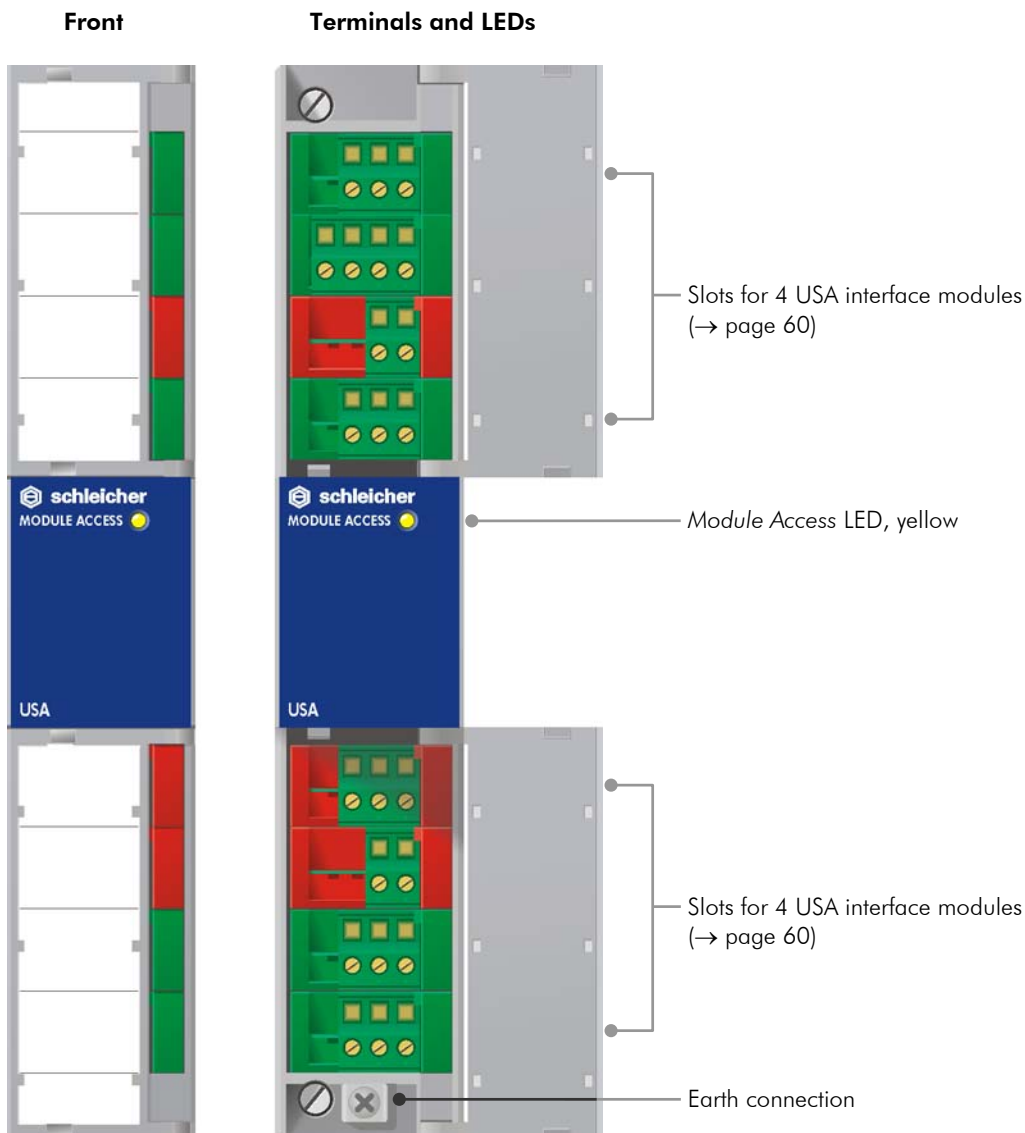
The counter actual value can be read and altered by the control unit. If counter actual values are compared in the PLC program for controlling bit outputs, the maximum error in relation to the comparison value is the number of pulses in one cycle.

The operating mode of the counter module can be altered by the PLC. The following modes are possible:

- Bidirectional, isolated, without zero pulse, with doubling or quadrupling of position encoder pulses.
- Unidirectional, isolated (position encoders with static direction signal are not permissible).

Permanent enable (input E1/E2) is mandatory with pulse doubling and quadrupling.

Technical data		UZZ 2VR	UZZ 2VR/5V
Article number		R4.315.0010.B	R4.315.0040.B
For controllers*		11 / 7	11 / 7
Number of counters		2 (identical counters, input/output data relates to a single counter)	
Counter direction		Up/down	
Range		0 to 65 535	
Counting frequency		maximum 100 kHz	
Internal power consumption	DC 24 V DC 5 V	– 0.6 W	
Connection system		Two 11-pin plug-in terminals	
Conductor sizes		Up to 2.5 mm <sup>2</sup> (stranded with wire-end ferrules)	
Weight		0.51 kg	
<b>Inputs</b>			
Position detection isolated, bidirectional mode		Incremental encoder with rectangular signals 1:1, 2 channels offset electrically by 90°, no zero pulse	
Input signals		3 (channel A1, channel B1, enable E1)	
Input voltage		24 V DC ± 10% max. residual ripple 5 %	5 V DC ± 10% max. residual ripple 5 %
Switching level		H level +13 ... +30 V L level – 0 ... + 4 V	H level +3,4 ... +6.7 V L level –0,7 ... +0.4 V
Input current		typ. 7.2 mA for 24 V	typ. 6.5 mA for 5 V
Input signal delay, enabling input		0.2 ms	
Reference point		M	
Isolation		Optocouplers (also between A1, B1 and E1)	
Position detection isolated, unidirectional mode		Incremental encoder with rectangular signals (position encoders with static direction signal are not permissible).	
Input signals		2 (channel A1 up or channel B1 down, enable E1)	
Input voltage		24 V DC ± 10% max. residual ripple 5 %	5 V DC ± 10% max. residual ripple 5 %
Switching level		H level +13 ... +30 V L level – 0 ... + 4 V	H level +3,4 ... +6.7 V L level –0,7 ... +0.4 V
Input current		typ. 7.2 mA for 24 V	typ. 11 mA for 5 V
Input signal delay, enabling input		0.2 ms	
Reference point		M	
Isolation		Optocouplers (also between A1, B1 and E1)	
<b>Outputs</b>			
Output signals		2 (O1, O2)	
Supply voltage		24 V DC ± 20% max. residual ripple 5 %	
Output voltage		H level Supply voltage – xU (xU ≤ 0.5 V) L level ≤ 5 mV	
Output current		max. 0.4 A	
Isolation		Optocouplers	
<b>LED displays</b>			
INPUTS (4x)	green On	H level of channel inputs and internal/external enable	
RELEASES (2X)	green On	H level of external enabling inputs	
OUTPUTS (2X)	green On	H level of output signal O1, O2	
MODULE ACCESS	Off	Control unit in STOP mode, Module not programmed or faulty	
	yellow On	Fault-free control unit access to the module	
General technical data, see page 78		* 11 = XCx 1100, 7 = XCx 700	



The USA slave analogue processor provides eight analogue channels that can be freely configured as input or output. Each channel can be adapted for the external analogue signal by plug-in interface modules. You can arrange the interface modules in any combination you require.

The analogue processor has its own microprocessor, which converts the analogue values without involving the control unit.

The module also contains:

- A shared RAM for data exchange with the system bus.
- A RAM data memory
- An EPROM memory for the operating software and the control algorithm
- Converters: one 12-bit A/D and one 12-bit D/A
- An 8-channel multiplexer
- 8 slots for electrical adaptation to the process signals ( $\pm 10\text{ V}$ ,  $20\text{ mA}$ , Pt 100 et al.)
- Isolation between the digital and analogue parts of the slave analogue processor

USA slave analogue processors operate as combined word input/output modules on the system bus.

### Shared RAM

The user software identifies the analogue values from the slave analogue processor by the 16 shared RAM words. The values of the 8 I/O channels are in the first 8 words. The following 8 words contain channel configuration information, for example input, output, conversion.

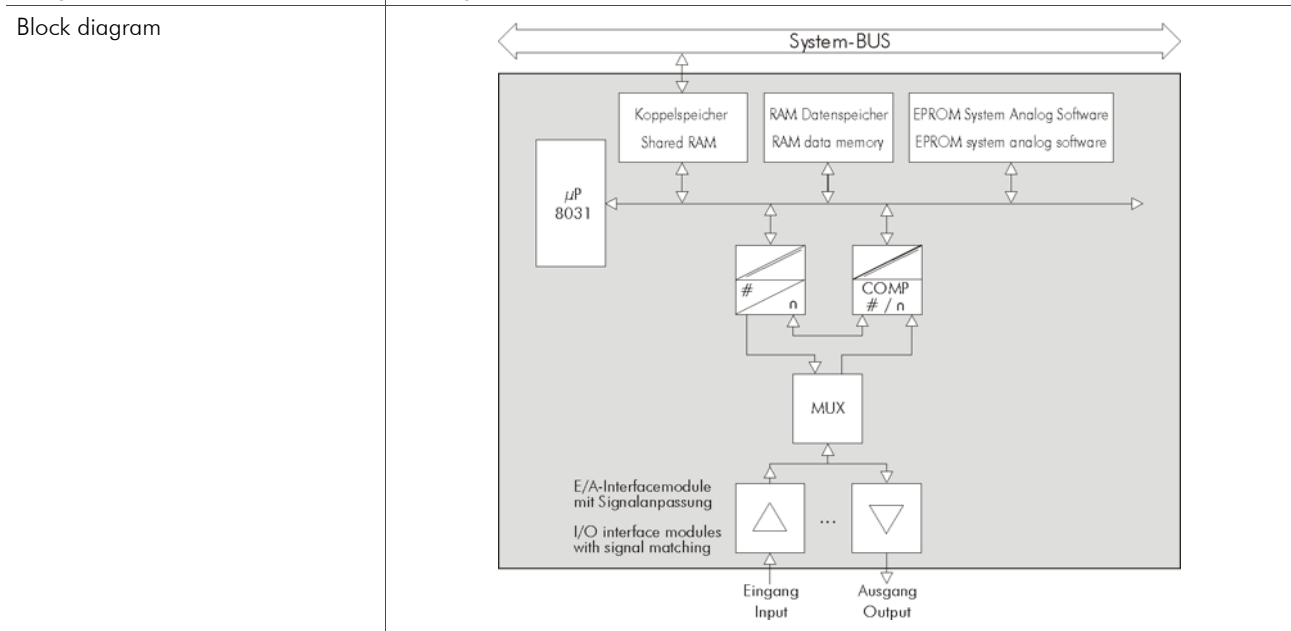
### Synchronisation

The user program reads and loads the shared RAM cells in a contiguous program section. The RAM is blocked for approx. 2 ms after access to the uppermost word. During this time the internal processor converts the values and saves them in the shared RAM.

### Interface modules

Eight interface modules can be plugged in on the front of the slave analogue processor (even when module is powered up). These interface modules adjust the I/O signal level to the internal level. These modules are ordered separately ( $\rightarrow$  page 60).

<b>Technical data</b>		<b>USA 8/1</b>
Article number	R4.315.0090.F	
For controllers*	11 / 7	
Number of inputs/outputs	8 slots for USA interface modules	
Processor	8031	
Program memory	8 Kbytes	
Shared RAM	16 words	
Internal power consumption DC 24 V (without interface modules) DC 5 V	2.5 W 1.2 W	
Connection system	Plug-in terminals on the interface modules	
Conductor sizes	Up to 2.5 mm <sup>2</sup> (stranded with wire-end ferrules)	
Interface module configuration	Any configuration	
Isolation	yes	
Weight	0.52 kg	



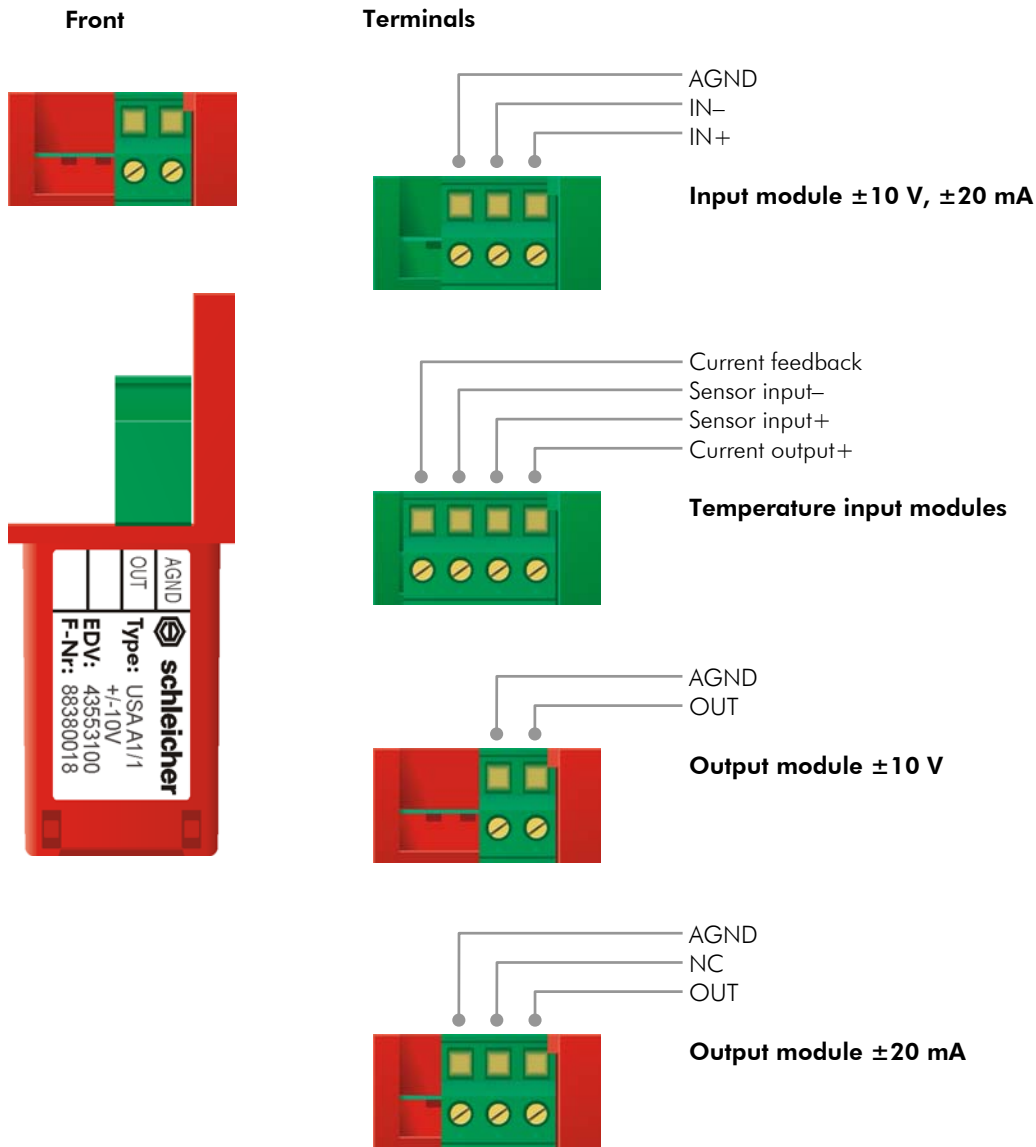
<b>Converter data</b>	
Conversion principle	SAR
Resolution	11-bit signed (4095 steps)
Conversion rate	8 ms for all 8 channels
Linearization	For Pt 100

<b>LED displays</b>		
MODULE ACCESS	Off yellow On	Control unit in STOP mode, Module not programmed or faulty Fault-free control unit access to the module

General technical data, see page 78

\* 11 = XCx 1100, 7 = XCx 700

<b>USA Interface Modules • Input Modules</b> <b>USA Interface Modules • Output Modules</b>	<b>USA Ex/x</b> <b>USA Ax/x</b>
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The plug-in interface modules are used to match the external analogue signals to the internal signal level of the USA analogue processor.

Eight interface modules can be plugged in on the front of the analogue processor (even when module is powered up).

The colour of the plastic housing of the interface module designates the I/O category:

- Green for input modules
- Red for output modules

The following interface modules are available:

Type	Function	Range
<b>Input modules</b>		
USA E1/1	Voltage	$\pm 10\text{ V}$
USA E1/2.1	Current	$\pm 20\text{ mA}$
USA E1/6	Resistance temperature measurement Pt100	$-127 \dots +882\text{ }^\circ\text{C}$
USA E1/7	Thermo element Fe-CuNi	$-147 \dots +880\text{ }^\circ\text{C}$
<b>Output modules</b>		
USA A1/1	Voltage	$\pm 10\text{ V}$
USA A1/2	Current	$\pm 20\text{ mA}$

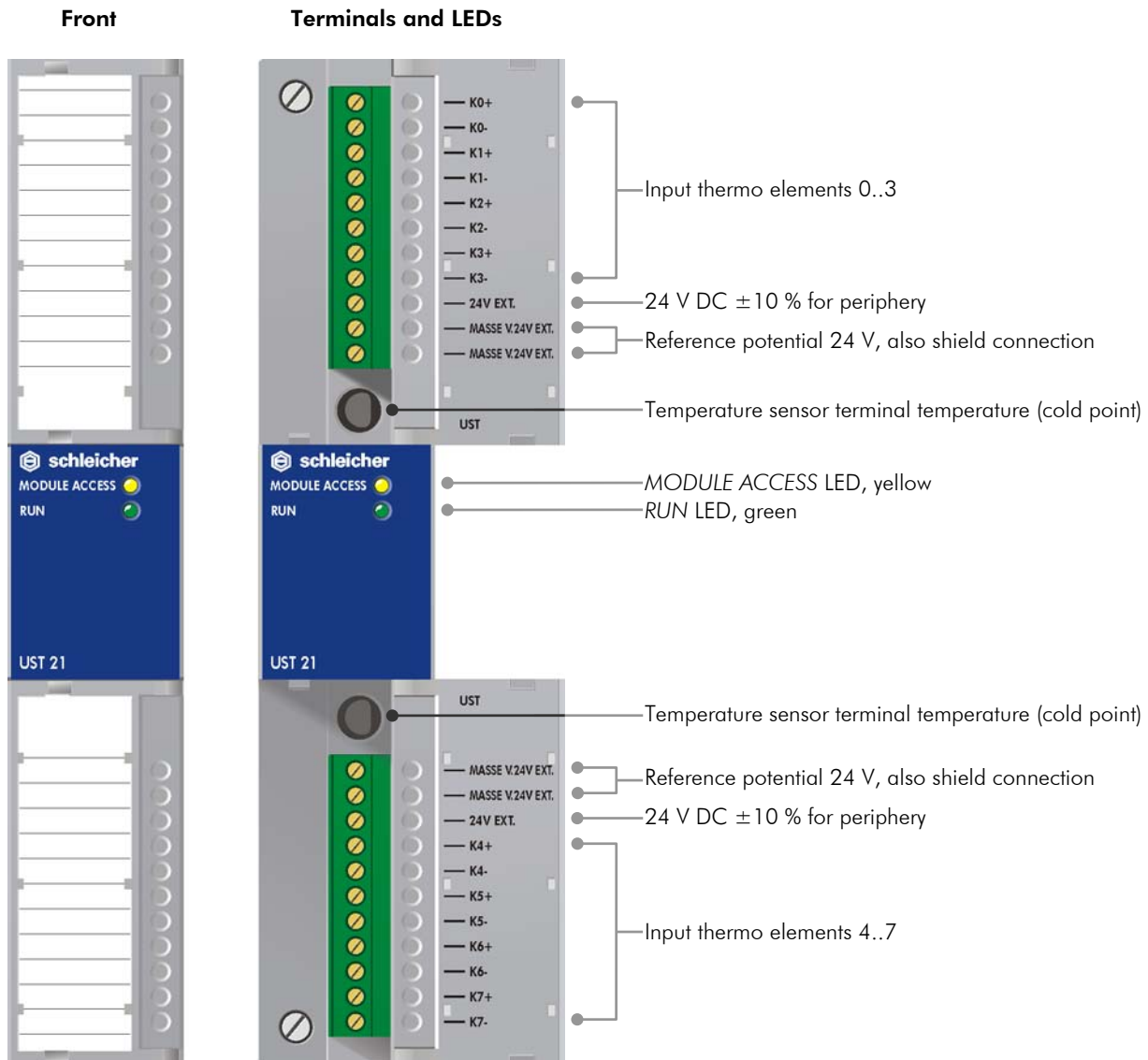
Technical data	USA E1/1	USA E1/2.1	USA E1/6	USA E1/7	USA A1/1	USA A1/2
Article number	R4.315.0100.0	R4.315.0120.0	R4.315.0140.0	R4.315.0150.0	R4.315.0110.0	R4.315.0130.0
For controllers*	11 / 7	11 / 7	11 / 7	11 / 7	11 / 7	11 / 7
Number of inputs/outputs	1 voltage input	1 current input	1 resistance temperature measurement Pt100	1 thermo element input Fe-CuNi	1 voltage output	1 current output
Housing colour	green	green	green	green	red	red
Range	±10 V	±20 mA	-127 ... +882 °C	-147 ... +880 °C	±10 V	±20 mA
Resolution	11-bit signed (4095 steps)					
1 LSB	4.88 mV	10 µA	0.5 °C	0.5 °C	4.88 mV	10 µA
Max. linearization error	–	–	±1 °C at 25 °C	±1 °C at 25 °C	–	–
Details	Internal resistance ≥ 20 kΩ	Input voltage drop max. 2.5 mV for a current of 20 mA; current resistance (burden) = 0.125 Ω	–	–	max. output current 20 mA; output voltage short-circuit proof at short-circuit current of 125 mA	–
Internal power consumption DC 24 V DC 5 V	0.24 W –	0.24 W –	0.08 W –	0.04 W –	0.06 W –	0.54 W –
Current input for +15 V / –15 V	7.5/7.5 mA	1.6/1.9 mA	3.5/1.5 mA	7.5/7.5 mA	7.5/7.5 mA	21.0/21.0 mA
Max. number per USA analogue processor	8	8	8	8	8	3
Maximum current for +15 V / –15 V	63.0 / 66.0 mA					
Weight	0.02 kg					
General technical data, see page 78				* 11 = XCx 1100, 7 = XCx 700		

## 8 Inputs for Thermo elements

UST 2

## 8 Inputs for Thermo elements • Adaptive Control

UST 21



UST slave temperature processors are intelligent processor units for detecting and monitoring 8 temperatures.

The analogue temperature values are converted to digital values by an A/D converter operating according to the principle of successive approximation. That means that the measured values are continuously detected and compared. Conversion is activated by the user program. Thus the conversion rate is specified by the user program.

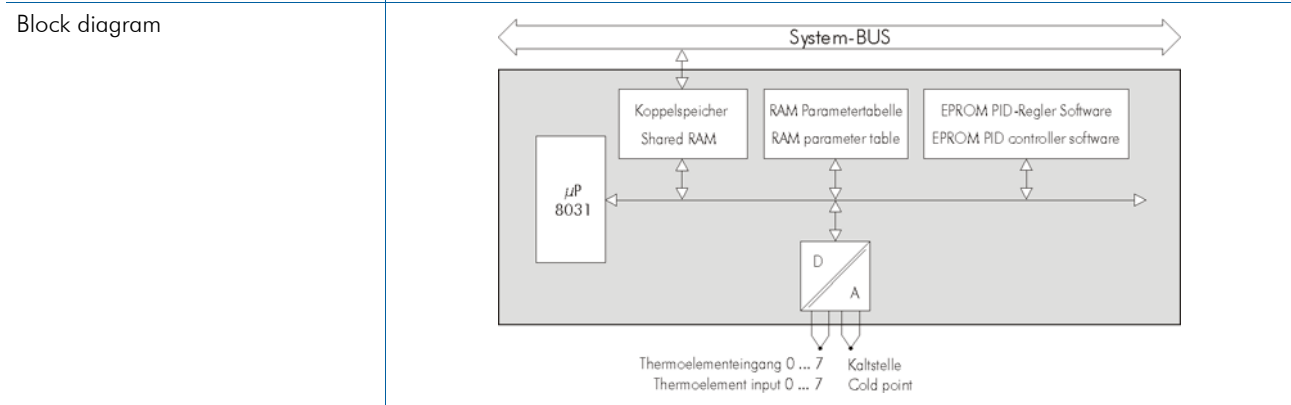
Eight thermo element inputs for Fe-CuNi or NiCr-Ni can be connected directly to the UST slave temperature processor. They detect the actual values that are compared with the digital set values received from the control unit via the shared RAM. On the basis of the control parameters of the integrated software-PID controller the manipulated variables are calculated from the system deviation and sent to the control unit via the shared RAM.

The control parameters and the assignment of the manipulated variables to the outputs are sent by the user program to the **UST 2** slave temperature processor via the shared RAM. The **UST 21** also has an algorithm for automatically determining and optimizing the control parameters (adaptive control).

Data communication with the control unit is via a dual-port RAM (shared RAM).

UST slave temperature processors operate as combined word input/output modules on the system bus.

Technical data	UST 2	UST 21
Article number	R4.315.0170.0	R4.315.0180.0
For controllers*	7	7
Number of inputs/outputs	8 analogue inputs for thermo elements, in 2 groups of 4 outputs	
Processor	8031	
Shared RAM	Dual-port RAM 2K x 16 Bit	
Internal power consumption DC 24 V DC 5 V	3.12 W 1.5 W	
Connection system	Two 11-pin plug-in terminals	
Conductor sizes	Up to 2.5 mm <sup>2</sup> (stranded with wire-end ferrules)	
Isolation	Group-wise (channel 0 ... 3, 4 ... 7)	
Weight	0.67 kg	



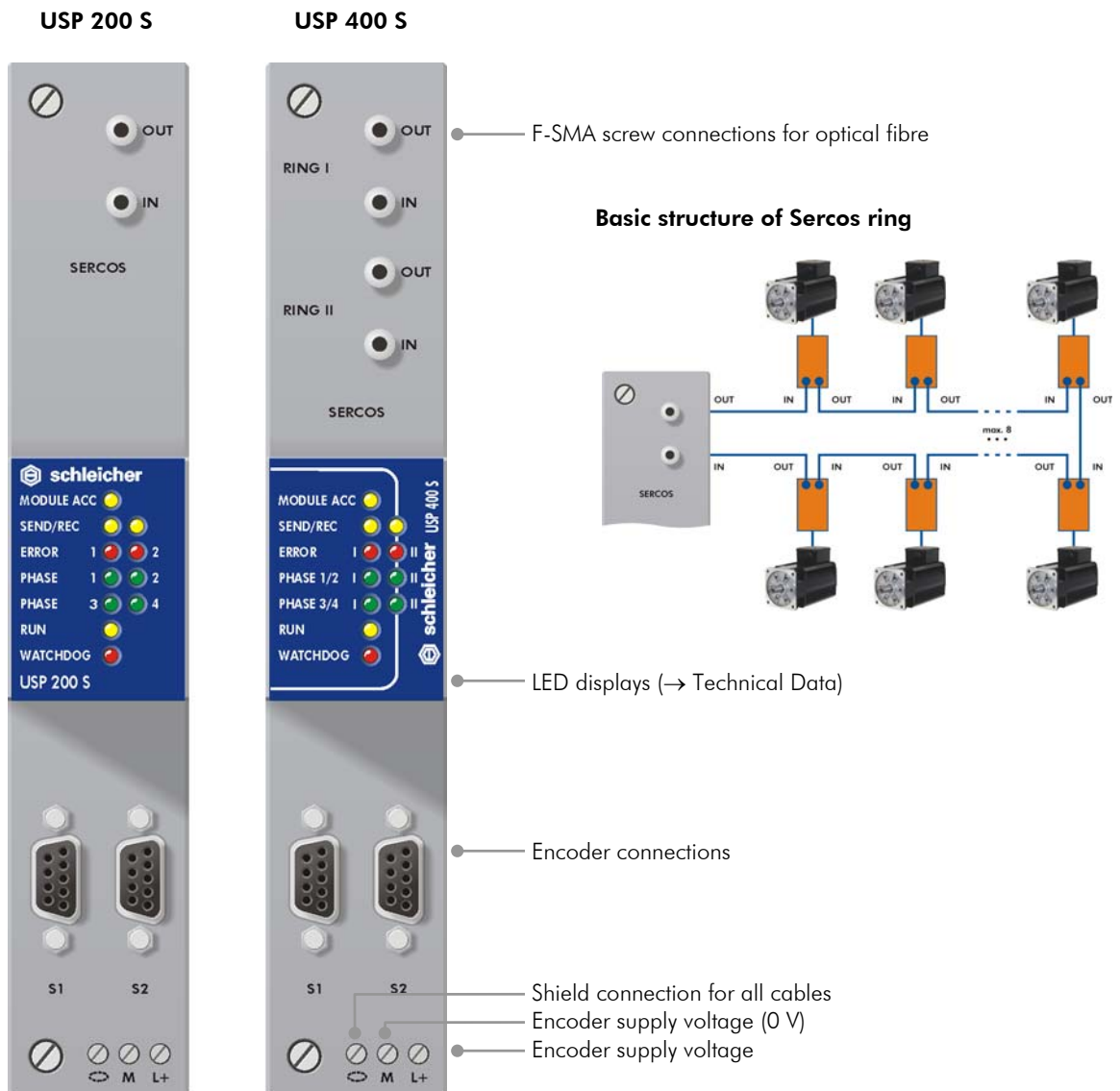
Thermo elements		
Type	Temperature range	Resolution
B (Pt30%Rh-Pt6%Rh)	0 ... + 1589.7 °C	1.525 °C
J (Fe-CuNi)	-180.9 ... + 541.0 °C	0.266 °C
K (NiCr-NiAl)	-105.3 ... + 713.7 °C	0.357 °C
N (NiCrSi-NiSi)	-175.9 ... + 831.7 °C	0.445 °C
R (Pt13%Rh-Pt)	0 ... + 1579.9 °C	1.281 °C
S (Pt10%Rh-Pt)	0 ... + 1439.8 °C	1.408 °C
T (Cu-CuNi)	-112.1 ... + 362.4 °C	0.298 °C

Converter data		
Control parameters	Standardised	Adaptive
Conversion principle	Successive approximation	
Resolution	12 bit unsigned (0.1 °C)	
Conversion rate	8 ms for all 8 channels	
Converter connection	Two-wire	
Terminal temperature	Compensated by two cold points	
Controller	8 integrated software PID controller	

LED displays		
MODULE ACCESS	Off yellow On	Control unit in STOP mode, Module not programmed or faulty Fault-free control unit access to the module
RUN	Off green, flashing	Reset of control unit Fault-free function of the module microprocessor

General technical data, see page 78 \* 11 = XCx 1100, 7 = XCx 700

Positioning Processor • Sercos Master • 1 Ring • 8 Axes	USP 200 S
Positioning Processor • Sercos Master • 2 Ring • 16 Axes	USP 400 S



With the USP 200 S / 400 S positioning processors, SERCOS interfaces are available in the XCA 1100 und XCN 700 CNC controller systems. SERCOS is a standardized IEC 1491 field bus for real-time communication in the CNC field. Standardization means that all SERCOS-capable drives from any manufacturer can be operated in a ring. As a master, the USP 200 S can operate up to 8 SERCOS controllers in a ring and the USP 400 S can operate up to 16 SERCOS controllers in two rings.

Each SERCOS ring is synchronized with the XCx system clock. A communication cycle time can be selected between 0.5 ms and 2 ms, depending on the number of axes and the operating mode. Digital optical fibre connection transmits 2 or 4 Mbit/s, and is insensitive to interference even over long distances.

Synchronized digital data exchange makes the USP modules ideal for manipulators, high-performance CNC machines and robots.

The F-SMA connections for optical fibre (USP 200 S: 2x / USP 400 S: 4x) are standardized to IEC 874-2. The modules also have two 9-pin subminiature connections for handwheel/encoder.

#### DriveTop interface


A protocol implemented in the controller allows communication with a Rexroth DriveTop interface via Ethernet or the serial PC interface on the XCx. Thus the drive parameters can be easily output, set and saved. DriveTop is supported by the Schleicher dialog start-up tool. The tool searches for the DriveTop installation on the PC and enables access to the DriveTop.

Technical data	USP 200 S	USP 400 S
Article number	R4.315.0300.0	R4.315.0330.0
For controllers*	11 / 7	11 / 7
Number of controllable axes	8	16
Processor	Motorola Cold Fire CF5307, 45 MHz (internal 90 MHz)	
Memory	Flash 2 MByte (1 M x 16 Bit) SDRAM 32 MByte (16 MByte mirrored), 2 x 48LC8M16-75 (set up as 8 M x 32 Bit) SRAM 512 KByte (1 x 4 MBit , 256 K x 16 Bit)	
SERCOS chip	1 x SERCON816	2 x SERCON816
CPLD	1 x XC95144XL	
Buffering	none	
Input signal voltage	Typical 2.6 V ... 4.8 V (5.0 ... 15 mA) worst case 3.2 V ... 4.6 V (6.3 ... 15 mA)	
Internal power consumption DC 24 V DC 5 V	– 4 W	
Sercos ring - optical fibre connection IN / OUT	F-SMA screw connections acc. to IEC 874-2	
Encoder connection S1 / S2	9-pin subminiature, jack contact	
Isolation	Between encoder connection and bus	
Weight	0.5 kg	

### Position controller data

Travel range	± 1 m for 0.1 µm resolution ± 10 m for 1 µm resolution ± 100 m for 10 µm resolution
Velocity	1 mm/min ... 300 m/min
Acceleration	1 mm/s <sup>2</sup> ... 100 m/s <sup>2</sup>
SERCOS cycle time	0.5 ms ... 4 ms (adjustable in 0.5 ms steps)

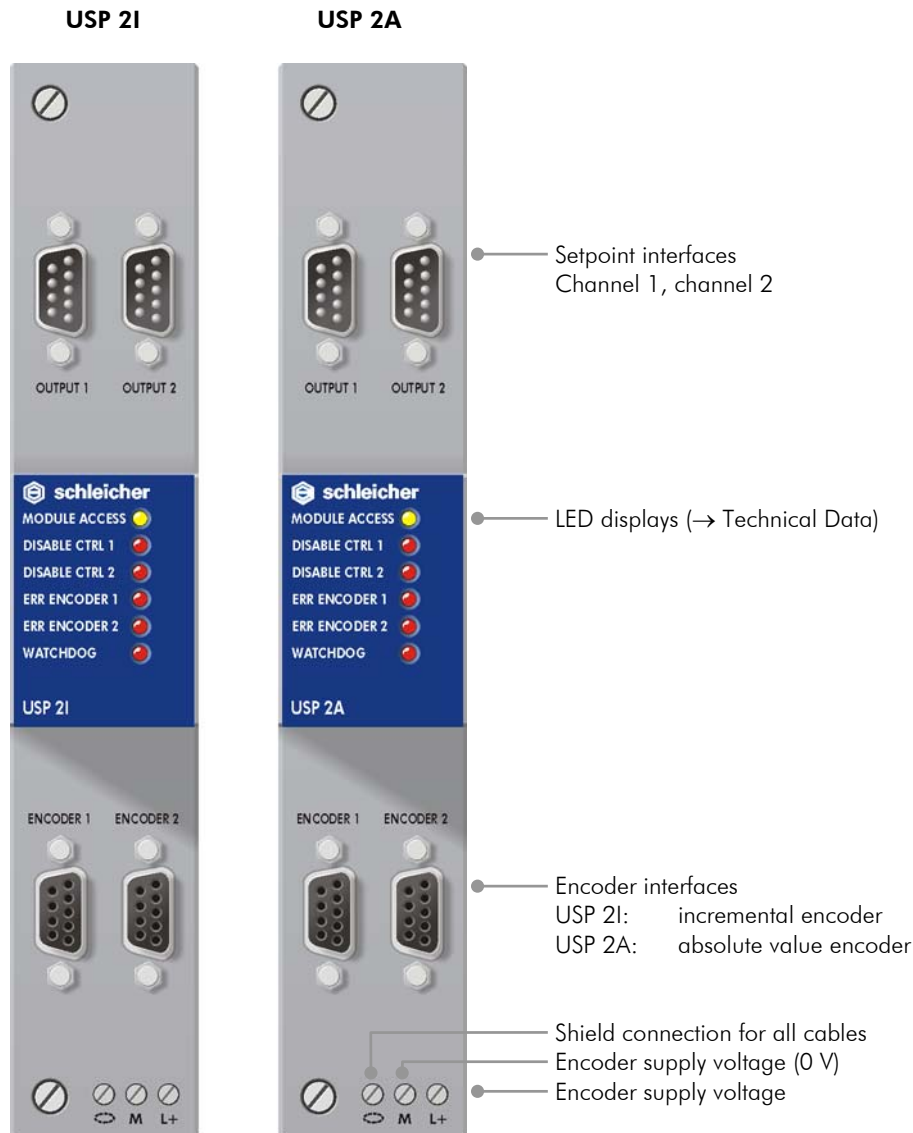
### LED displays

	MODULE ACC	Off	Control unit in STOP mode, module not programmed or faulty	
		yellow	On	Fault-free access; the LED can also flash or flicker, each flash indicates one CPU access
	SEND/REC	yellow	On	Send / receive active
	ERROR 1	red	On	USP 200 S: Software error USP 400 S: Software or hardware error (ring I)
	ERROR 2	red	On	USP 200 S: Hardware error USP 400 S: Software or hardware error (ring II) LED indicates the distortion of the received optical signal. The brightness gives an indication of the degree of distortion. Causes: Optical fibre bent or broken, connection dirty.
	PHASE 1/2	green	On	USP 200 S: SERCOS start-up phase 1/2 USP 400 S: SERCOS start-up phase 1+2 (ring I)
	PHASE 3/4	green	On	USP 200 S: SERCOS start-up phase 3/4 USP 400 S: SERCOS start-up phase 3+4 (ring II)
	RUN	yellow	On	Module running
	WATCHDOG	Off	Fault-free control unit access to the module within the cycle time	
		red	On	Fault; controller lock activated for all axes, error message sent to control unit

General technical data, see page 78

\* 11 = XCx 1100, 7 = XCx 700

Positioning Processor • 2 Axes • Incremental Encoder	USP 2I
Positioning Processor • 2 Axes • Absolute Encoder SSI	USP 2A



The USP 2I / USP 2A slave positioning processors are intelligent processing units for position control and positioning of two independent axes.

The USP 2I and USP 2A differ only in the type of inputs for the position measuring system. The USP 2I is designed for incremental encoders, the USP 2A for absolute value encoders.

USP 2I / USP 2A operate as remote page modules on the system bus. Data communication with the control unit is via a dual-port RAM (shared RAM).

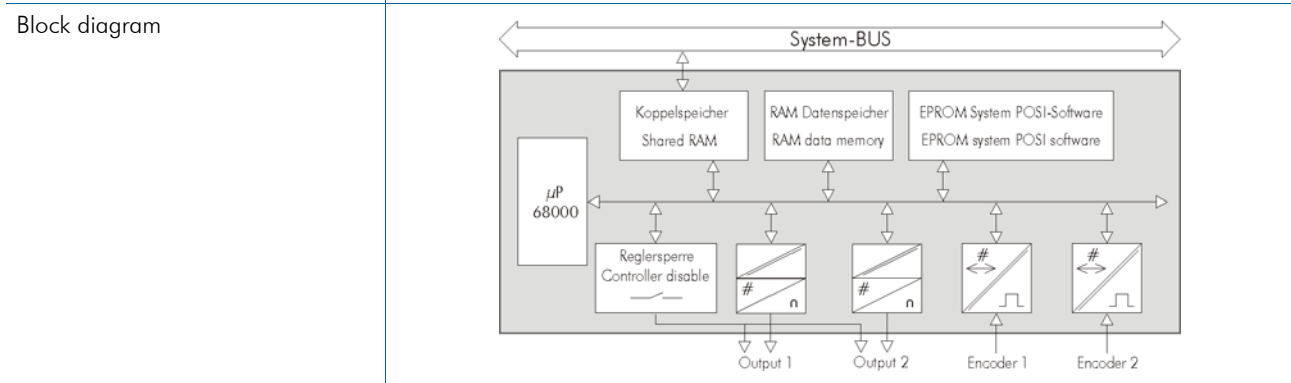
In connection with the CNC control units, they allow you to create high-velocity contouring control. The control units can control a max. 8 modules USP 2I / USP 2A.

### Position control functions

The modules provide the following position control functions:

- Proportional control with drift compensation
- Precontrol
- Monitoring exact positioning
- Following-error
- Tracer function
- Measuring circuit monitoring

Technical data	USP 21	USP 2A
Article number	R4.315.0020.0	R4.315.0030.0
For controllers*	11 / 7	11 / 7
Number of controllable axes	2 (max. 8 USP per control unit)	
Internal power consumption DC 24 V DC 5 V	2.3 W 1.5 W	
Connection system	Encoder: subminiature 9-pin connector / Outputs: subminiature, 9-pin connector	
Weight	0.58 kg	



Encoder inputs		
Position detection	Incremental position encoder 2 sets of pulses offset by 90°, 1 zero pulse	Absolute position encoder encoder Synchronous serial transmission
Pulse frequency / clock pulse freq.	max. 1 MHz	≤ 190 kHz
Signal inputs	6 (channel A, B, 0, /A, /B, /0, TTL-level)	2 (data+, data-)
Transmission time	–	Approx. 150 µs
Input load	270 ohms	270 ohms
Isolation	Yes; but not ENCODER 1 / ENCODER 2	Yes, for data+ / data-; no, for clock+ / clock-
Input signal voltage	Typical: 2.6 V ... 4.8 V (5.0 ... 15 mA)   worst case: 3.2 V ... 4.6 V (6.3 ... 15 mA)	
Encoder supply voltage	Depending on encoder 5... 24 V external supply	

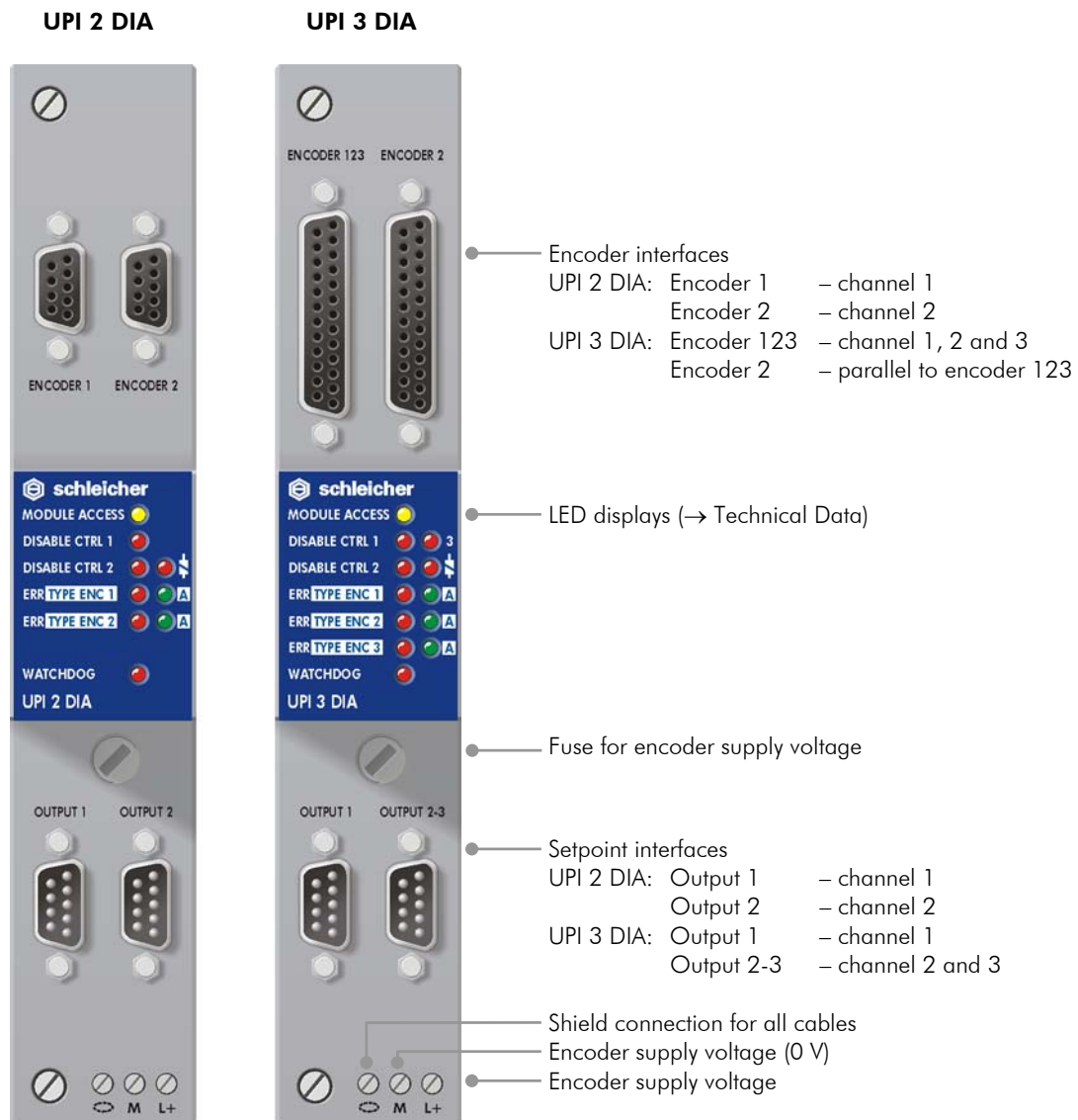
Setpoint outputs	
Setpoint output voltage / current	±10 V / ±10 mA
Resolution	16 bits
Shunt	1 kOhm
Isolation	yes; but not OUTPUT 1 / OUTPUT 2

Position controller data	
Travel range	± 1 m for 0.1 µm resolution ± 10 m for 1 µm resolution ± 100 m for 10 µm resolution ± 1000 m for 100 µm resolution
Position control cycle	2 ms
Velocity	1 mm/min ... 300 m/min
Acceleration	1 mm/s <sup>2</sup> ... 100 m/s <sup>2</sup>

LED displays (identical for USP 21 and USP 2A)			
	MODULE ACCESS	Off yellow On	Control unit in STOP mode, Module not programmed or faulty Fault-free control unit access to the module
	DISABLE CTRL x	Off red On	Controller lock off for axis 1 and 2 Controller lock on and desired speed = 0 V for axis 1 and 2
	ERR ENCODER x	red On	Interruption (cable break) of one or more encoder signals for axis 1/2
	WATCHDOG	red On	Microprocessor monitoring activated; control unit outputs error message and controller disable is activated on axes 1 and 2

General technical data, see page 78 \* 11 = XCx 1100, 7 = XCx 700

<b>Positioning Interface • 2 Axes</b> <b>Positioning Interface • 3 Axes</b>	<b>UPI 2 DIA</b> <b>UPI 3 DIA</b>
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The UPI 2 DIA and UPI 3 DIA are positioning interfaces for position detection and set value output for 2 or 3 independent NC axes. You can use incremental or absolute positioning transducers (encoders). Set value output  $\pm 10\text{ V}$  is provided for analogue servo amplifiers. The positioning interfaces can be used on PLC and CNC control units.



The integrity of the encoder signals is monitored: Only those signals whose inverse is also present will be used (interference blanking). Errors, cable break and skew (temporal displacement of signal and inverse) are displayed, and stop the axis. This means that encoder problems do not cause unknown incorrect positioning. The encoder signal monitoring circuit can detect cable break and insufficient encoder signal quality at input frequencies up to 100 kHz.

### Axis positioning

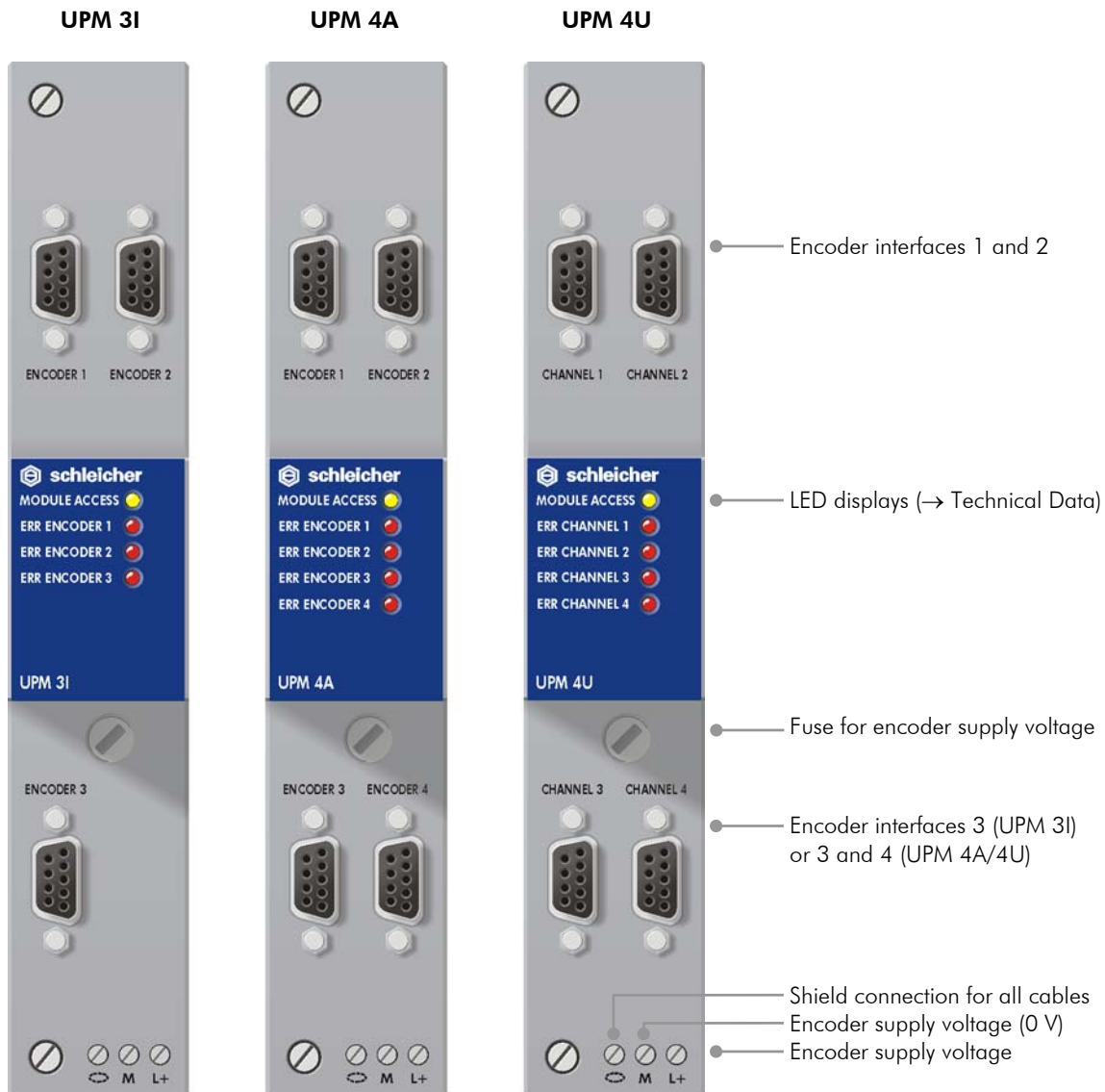
The incremental or absolute position actual value is detected by a position encoder and evaluated as actual value in the control unit. The position setpoint is calculated in the control unit from the entered set coordinates, taking the acceleration and deceleration value and the speed. This calculated value (set speed) is output via a 12-bit D/A converter as the speed setpoint ( $\pm 10\text{ V}$ ). The set speed controls the power converter of the axis drive with speed control.

### Controller enable and controller disable

If a fault occurs (e.g. cable break) the relay contacts assigned to the axes are activated.

Technical data		UPI 2 DIA	UPI 3 DIA
Article number		R4.318.0180.B	R4.318.0160.B
For controllers*		7	11 / 7
Number of controllable axes		2	3
Input signal voltage		Typical 2.25 V ... 3.75 V (5.0 ... 15 mA) worst case 2.75 V ... 3.55 V (6.3 ... 15 mA)	
Setpoint output voltage / current		±10 V / ±10 mA	
Internal power consumption DC 24 V DC 5 V		5.5 W (when switched on max. 9.7 W for approx. 50 ms) 1 W	
Encoder supply voltage		Depending on encoder 5.3... 24 V external supply	
Fuse		T1.6 A (for encoder supply voltage)	
Connection system	Encoders Setpoints, Enables	Subminiature 9-pin connector Subminiature 9-pin connector	Subminiature 25-pin connector Subminiature 9-pin connector
Connecting lines	Encoders Setpoints, Enables	Cable to Heidenhain rules 5-core, shielded, 0.25 mm <sup>2</sup>	
Isolation	Encoders Setpoints Enables	connected to one another; isolated from bus, enabling outputs, setpoint outputs connected to one another; isolated from bus, enabling outputs and encoders connected to one another; isolated from bus, encoders and setpoint outputs	
Weight		0.48 kg	
<b>Encoder inputs incremental</b>			
Encoder inputs		A, /A, B, /B, zero, /zero (/ = inverted signal)	
Max. encoder / counting frequency		150 kHz / 600 kHz (after internal pulse quadrupling)	
Max. travel velocity		36 m/min at 1 µm resolution, 10 ms positioning cycle	
<b>Encoder inputs absolute</b>			
Encoder inputs		Measured value, /measured value	
Output to encoder		Clock pulse, /clock pulse (similar to RS422)	
Clock rate		Programmable: 156, 312 or 624 kHz	
Encoder code		Programmable: grey, binary	
Data format		Programmable: 21 / 25 bits	
<b>Setpoint outputs</b>			
Resolution		12 bits	
Enabling outputs		Potential-free relay contacts, switching voltage DC 24 V / 100 mA, permanently short-circuit-proof	
<b>LED displays</b> for UPI 3 DIA (where data for UPI 2 DIA differs it is given in <i>italics</i> )			
	MODULE ACCESS	Off yellow On	Control unit in STOP mode, Module not programmed or faulty Fault-free control unit access to the module
	DISABLE CTRL x	Off red On	Controller lock off for axis 1/2/3 ( <i>axis 1/2</i> ) Controller lock on and desired speed = 0 V for axis 1/2/3 ( <i>axis 1/2</i> )
	RELAY OFF		As LED DISABLE CTRL x
	ERR TYPE ENC x	Off red On	Processing OK for six encoder signals or the absolute encoder signals for axis 1/2/3 ( <i>axis 1/2</i> ) Interruption (cable break) of one or more encoder signals for axis 1/2/3 ( <i>axis 1/2</i> )
	A	Off green On	"Incremental encoder" mode "Absolute value encoder" mode or "digital servo" mode for the corresponding axis
	WATCHDOG	Off red On	Control unit access to module OK within cycle time No control unit access to the UPI within the cycle time; control unit outputs error message and controller disable is activated on axis 1/2/3 ( <i>Axis 1/2</i> ).

Position Detection • 3 Channels • Incremental Encoder	<b>UPM 3I</b>
Position Detection • 4 Channels • Absolute Encoder	<b>UPM 4A</b>
Position Detection • 4 Channels • Ultrasound encoder	<b>UPM 4U</b>



The UPM 3I/4A/4U position detection modules are used for incremental, absolute and ultrasound position detection.

### UPM 3I

The UPM 3I provides three independent channels for incremental position encoders. The signals are isolated from the control electronics by optocouplers. The direction of rotation of the three position encoders are detected and sent to three fast counters. The axes are monitored for cable break and short-circuit.

### UPM 4A

The UPM 4A provides position encoding for four independent channels with synchronous serial/absolute position encoders. The signals are isolated from the control electronics by means of optocouplers. The position encoder actual values are processed and made available in words,

which are used for data traffic between the control unit and the module. Clock pulse frequency, conversion time and cable length in a fixed relationship to each other (see technical data). The axes are monitored for cable break and short-circuit. The clock rate of the interface and code switching (binary/grey) can be set by the user program.

### UPM 4U

The UPM 4U has four independent channels for digital transsonar position encoders. The signals are isolated from the control electronics by means of optocouplers. The position encoder actual values are processed and made available in words, which are used for data traffic between the control unit and the module. The measuring time and measurement length have a fixed relationship to each other. The maximum measuring time is defined by the encoder length (see Technical Data).

Technical data	UPM 3I	UPM 4A	UPM 4U
Article number	R4.315.0080.B	R4.315.0060.C	R4.315.0310.C
For controllers*	7	7	7
Number Axes / modules	3 / max. 2 UPM per XCx	4 / max. 2 UPM per XCx	4 / max. 2 UPM per XCx
Internal power consumption DC 24 V DC 5 V	– 1.1 W	0.5 W 1.1 W	0.5 W 1.1 W
Connection system	3 subminiature 9-pin connectors	4 subminiature 9-pin connectors	4 subminiature 9-pin connectors
Weight	0.47 kg	0.43 kg	0.43 kg
Block diagram			

Encoder inputs							
Position detection	Incremental position encoder 2 sets of pulses offset by 90°, 1 zero pulse	Absolute position encoder, synchronous serial transmission			Transsonar position encoder		
Pulse frequency / clock pulse frequency	max. 250 kHz	156 ... 624 kHz, set by software			–		
Relationship between measurement data and encoder data	–	Clock signal frequency	Conversion time	Cable length	Measuring time	Measurement length	Word width
		156 kHz	160 μs				18 bit
		312 kHz	80 μs	300 m	28 ms	18.35 m	17 bit
		624 kHz	40 μs	100 m	14 ms	9.17 m	16 bit
				50 m	7 ms	4.58 m	16 bit
					3.5 ms	2.29 m	16 bit
					1.75 ms	1.14 m	
Range	+32767 ... –32768, can be extended by software to double word (32 bit)	25 bits			–		
Signal inputs	6 (channel A, B, 0, /A, /B, /O, TTL-level)	2 (data+, data–)			2		
Input load	200 ohms	270 ohms			270 ohms		
Signal outputs	–	2 (clock+, clock–)			TTL-level		
Isolation	By optocouplers	Yes, for data+ / data–; No for clock+ / clock– Yes, for control electronics / encoder			Yes, for data+ / data–; No, for clock+ / clock– Yes, for control electronics / encoder		
Encoder supply voltage	Encoder-dependent (DC 5 ... 24 V external supply)						
Fuse	F1.6/250V	T2/250V			T2/250V		

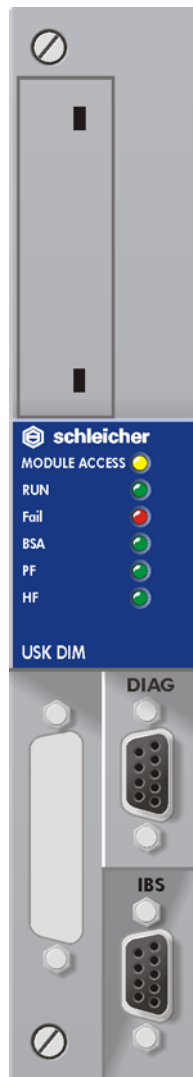
**LED displays** for UPM 4A / UPM 4U (where data for UPM 3I differs, it is given in *italics*)

 MODULE ACCESS ERR ENCODER 1 ERR ENCODER 2 ERR ENCODER 3 ERR ENCODER 4  UPM 4A	MODULE ACCESS	Off	Control unit in STOP mode, Module not programmed or faulty	
		yellow	On	Fault-free control unit access to the module
	ERR ENCODER x	Off	Processing OK for encoder signals for axis 1/2/3/4 (axis 1/2/3)	
		red	On	Interruption (broken cable) of one or more encoder signals for axis 1/2/3/4 (axis 1/2/3)

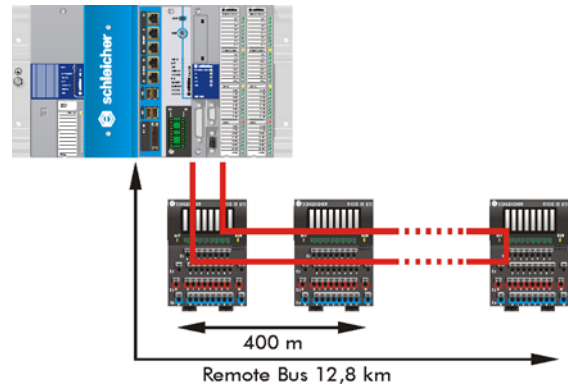
General technical data, see page 78

\* 11 = XCx 1100, 7 = XCx 700

**Interbus-S master** **USK DIM**



**Basic structure of the Interbus**



LED displays (→ Technical Data)

Diagnosis interface RS 232 C

Interbus-S interface RS 422

The USK DIM module is a slave CPU of the XCx system that is operated as an Interbus-S master.

A maximum of 64 slaves can be connected to an USK DIM. The number of input words and output words (16 bit) must not exceed 128.

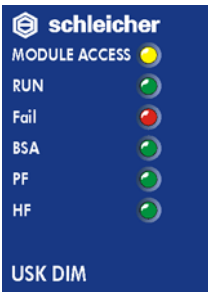
An USK DIM can manage 1024 input bits and 1024 output bits in total. Any number of USK DIMs can be connected to the XCx that each operate a separate bus.

The F201 function block manages the remote page of the USK DIM, so that the PLC programmer does not have to access the remote page of the Interbus-S module.



Interbus was developed as an open field bus system and is standardized in DIN 19258 as a field bus for the sensor/ actuator level. The Interbus topology is a ring system with active bus stations. All stations are connected point-to-point, starting from the master interface. The remote bus version allows for distances of up to 400 m between stations and a maximum extension of up to 12.8 km. The local bus version is limited to 10 m. The Interbus transfer speed is 2 Mbit/s.

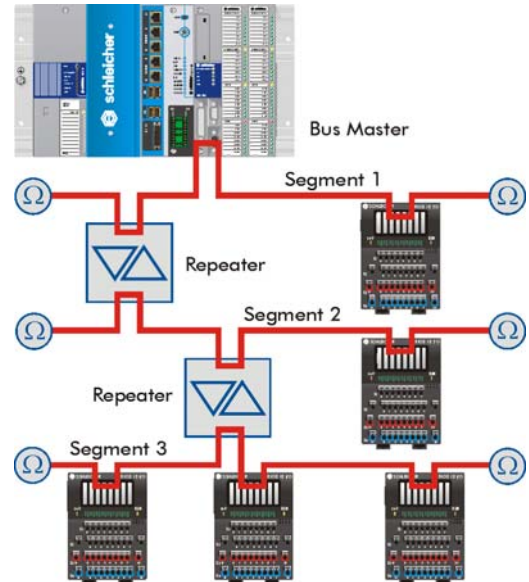
Every time you start the master the bus system creates a current list of all the connected stations (slaves). The I/O addresses are assigned by the master in the order in which it finds the slaves. Max. number of stations is determined by the firmware of the master (see left). Cable breakages or short-circuits at the I/O modules can also be diagnosed as station failure in the master.

Technical data		USK DIM	
Article number		R4.318.0170.0	
For controllers*		11 / 7	
Internal power consumption	DC 24 V DC 5 V	– 1.25 W	
Connection system		2x subminiature, 9-pin, socket connector	
Controller		MC 68332 with Interbus-S chip IPMS	
Shared memory for system bus		Dual port RAM 1 Kbyte	
Weight		0.45 kg	
Interfaces			
Diagnosis interface (DIAG)		RS232C serial, non-floating, baud rate 9.6 kBit/s	
Interbus-S interface (IBS)		RS422, serial, isolated, baud rate 500 kBit/s	
Interbus-S connection cable		min. 5-core (shielded), shielded on both sides to shield rail /protective earth rail, cable length max. 400 m between two slaves	
LED displays			
	MODULE ACCESS	Off	Control unit in STOP mode, module not programmed or faulty
		yellow On	The F201 or the operating system accesses the remote page of the USK DIM.
	RUN	green flashing	Ready
		On	Bus cycles running
	Fail	Off	No error
		red 2x flashing, 1x pause	Remote bus error (e.g. cable breakage or faulty slave)
		3x flashing, 1x pause	Peripheral bus error
		4x flashing, 1x pause	Controller error (not possible for USK DIM)
	On continuously	Watchdog or hardware error	
BSA	green On	Bus segment switched off (not possible for USK DIM)	
PF	green On	Module error	
HF	green On	PLC stop	
General technical data, see page 78			* 11 = XCx 1100, 7 = XCx 700

Profibus-DP master	USK DPM
Profibus-DP slave	USK DPS



Basic structure of the Profibus-DP



LED displays (→ Technical Data)

Profibus-DP interface RS 485

Both USK modules extend the controller system by a Profibus-DP bus interface to IEC 61158 type 3. The modules are slave CPUs of the XCx system. USK DPM is operated as a Profibus-DP class 1 master, USK DPS as a Profibus-DP slave.

The data transfer rate (up to 12 Mbit/s) is set automatically. The configuration of the extended Profibus diagnosis and the slave address are set via the ProConOS.ini operating system file and the Hilscher Sycon configurator.

The station-specific data for the slave module is defined in a standardized equipment master file, allowing easy application of plug-'n'-play.



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 be able to operate more stations, the system must be expanded with additional repeaters with full cable length and the maximum field devices that can be connected. The possible bus lengths are 100 m at 12 Mbit/s up to 1200 m at 94 kBit/s. If individual slaves fail or are shut off during bus operation the others continue to operate.

Technical data	USK DPM	USK DPS
Article number	R4.318.0370.0	R4.318.0360.0
For controllers*	11 / 7	11 / 7
Internal power consumption DC 24 V DC 5 V	– 2.5 W	
Connection system	1x D-subminiature 9-pin. socket connector	
Bus interface	Profibus-DP according to IEC 61158 Type 3	
Weight	0.55 kg	

### Interfaces

Profibus-DP interface	RS485, serial, isolated, baud rate up to 12 kBit/s
Profibus-DP connection cable	5-wire twisted, shielded, shield connected on both sides to shield rail/protective earth rail, active bus terminator at both ends, cable length per segment max. 1200 m

### LED displays (identical for USK DPM and USK DPS)

	MODULE ACCESS	Off	Control unit in STOP mode, module not programmed or faulty
		yellow On	Fault-free access; the LED can also flash or flicker, each flash indicates one CPU access
	BF	red On green On yellow cyclic flashing	No bus connection (bus fail) Bus connection active Bus connection active, but no process data exchange
	DIA		Not used
	SYS	yellow acyclic flashing green cyclic flashing green acyclic flashing green On	Hardware error Ready for bus connection but (still) no bus connection active Error in bus connection Bus connection active
	COM	yellow On red On	Cyclic data exchange active Error in bus connection

General technical data, see page 78

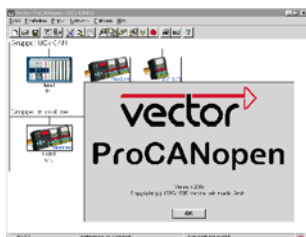
\* 11 = XCx 1100, 7 = XCx 700

<b>CNC Software Options</b>	
<b>Article number</b>	<b>Designation</b>
R4.320.0350.0	NERTHUS 6-AXES
R4.320.0460.0	CNC 03 • NC subsystems
R4.320.0620.0	CNC 06 KOOR • Coordinate transformation
R4.320.0430.0	CNC 08 SSK • Lead screw compensation
R4.320.0450.0	CNC 09 • Nerthus freeform interpolation
R4.320.0440.0	CNC 10 • OCI freeform interpolation
R4.320.0510.0	CNC 14 REV • Reverse processing

<b>Programming System to IEC 61131-3</b>		<b>Multiprog 4.x</b>
Article number	R4.320.0640.0	
Contents	CD 1: Programming software, OPC server CD 2: Service Pack (see below)	
Operating system	Windows 2000/XP/Vista	

<b>Utilities and Updates</b>		<b>Service Pack</b>
Article number	R4.320.0590.0	
Contents	1 CD: Controller software for all Schleicher controllers, add-ons, Schleicher dialog, documentation and service information	

## **CANopen Network Configuration 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

<b>ProCANopen</b>	
Article number	R4.320.0500.0
Operating system	Windows 95 or higher, PCMCIA slot (min. type I) for CANcardY operation required
<b>CANcardY</b>	
Article number	R4.321.0020.0
Type	Single CANopen interface, PCMCIA card

## Cable

UKK interface cables are used for connecting interface modules  
UKZ ↔ UKE or UKE ↔ UKE (→ pages 16 and 40).

Technical data	UKK 24	UKK 24V
Article number	R4.318.0020.0	R4.318.0060.0
Including line for extension device power supply	no	yes*
Connection system	2x subminiature 50-pin connector with slide lock	
Cable	Transparent PVC, shielded, 50 x 0.14 mm <sup>2</sup> , flexible	
Cable diameter	12.7 mm	
Length	0.24 m	0.24 m
Weight	0.2 kg	0.2 kg

\* Use only if no power supply unit on extension rack.

## Buffer Batteries

The batteries are inserted in the UNG 24 or UNG 230A/115A power supplies for buffering the RAM in the control unit.

Technical data	UNB 24	UNB 115/230
Article number	R4.318.0130.0	R4.318.0050.0
Use in power supplies	UNG 24	UNG 115/230
Type	Lithium battery 3.6V / 1.9Ah	Lithium battery 3.6V / 5.2Ah
Buffer time (at +25 °C and uninterrupted buffering)	Min. ½ year	Min. 1 year

## Operating Manuals

Article number	Designation
R4.322.2140.0	XCx 300 / 500 / 540
R4.322.2220.0	XCx 700
R4.322.2390.0	XCx 1100
R4.322.1610.0	Commissioning field bus systems
R4.322.2090.0	CNC Programming for XCx and ProNumeric
R4.322.1070.0	EMC Guidelines

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

## System Descriptions

	Designation
	XCx micro system description
	XCx 300 / 500 / 540 system description
	XCx 1100 / 700 system description
	RIO Field Bus System / microLine PLC system description

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

## Technical data

### Housing and installation

Dimensions (W x H x D)	XCx 1100 Control Unit:	142.0 x 200 x 150 mm (modular spacing 4)		
	XNG 24, UNG 230/115 power supply units:	71.0 x 200 x 150 mm (modular spacing 2)		
	All other modules:	35.5 x 200 x 150 mm (modular spacing 1)		
	XBT racks:	Slots	Dimensions	
	Widths differ according to number of slots	6 + 3 6 + 4 6 + 7 6 + 11 6 + 15	368 x 200 x 18 mm 404 x 200 x 18 mm 510 x 200 x 18 mm 652 x 200 x 18 mm 794 x 200 x 18 mm	
UBT racks:	Slots	Dimensions		
	Widths differ according to number of slots	4 8 12 16 20	190 x 200 x 18 mm 332 x 200 x 18 mm 474 x 200 x 18 mm 616 x 200 x 18 mm 759 x 200 x 18 mm	
	Installation position			Vertical, free air circulation

### Climatic conditions

Ambient operating temperature	0 ... +55 °C (category KV to DIN 40040)
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

### Mechanical strength

Vibration	10 ... 57 Hz constant amplitude 0.075 mm 57 ... 150 Hz constant acceleration 1 g (to DIN EN 60068-2-6)
Shock	Sinusoidal half-wave 15 g / 11 ms (to DIN EN 60068-2-27)
Free fall	Fall height 1 m (with original packaging) (to DIN EN 68-2-32)

### Electrical safety

Protection class	Class I, basic insulation and PE terminal (to IEC 60536)
Protection type	IP 00 (to EN 60529)
Clearance/creepage distance	Between electrical circuits and objects as well as between decoupled electrical circuits, corresponding to overload category II, contamination level 2(DIN EN 61131-2)
Test voltage	AC 350 V / 50 Hz for device rated voltage DC 24 V AC 1350 V / 50 Hz for device rated voltage AC 230 V

### Electromagnetic compatibility

Electrostatic discharge	8 kV air discharge, 4 kV contact discharge (to EN 61000-4-2)
Electromagnetic fields	Field intensity 10 V/m, 80 ... 1000 MHz (to EN 61000-4-3)
Rapid transients (bursts)	2 kV on AC/DC supply lines, 1 kV on I/O signal lines (to EN 61000-4-4)
Interference emissions	Limit category A, Group 1 (to EN 55011)

# Always There for You



In cooperative contact with the customer we can, on request, establish all components necessary for providing reliable and efficient automation: from the requirement analysis to the development of guiding ideas and their realization in intelligent applications, all the way to commissioning, servicing and training.

## **Desire and Reality**

Are you looking for clever solutions for complex tasks? Do you have special requirements for hardware, software, controllers and modules? Test Us! We develop solutions for you and with you. Our expertise with controllers and your practical experience in the day-to-day production result in functional and efficient automation solutions.

## **Service and Solutions**

If you so wish, our specialists will of course also complete configuring and start-up and service the installed system. We will help you on site with integrating our components in your existing system and support you with the low-cost and efficient use of your 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 and options of our products for your application.

## **Questions and Answers**

If you would like to know more, please call our expert 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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