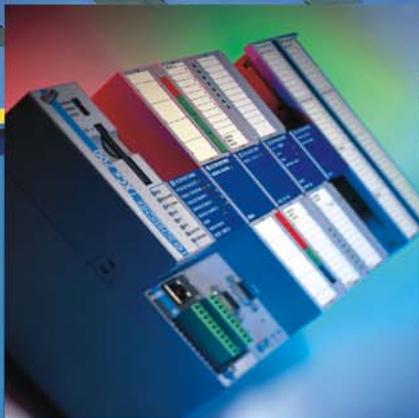


XCx 700



CNC/PLC Automation Systems Performance Version

System Description

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XCx 700 – Multi-Axis Controller...



...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 32 CNC axes simultaneously in 16 NC programs

...synchronize

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

...coordinate

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

...process

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

...transform

any machine kinematics into Cartesian coordinates

...control NC servo drives

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

...connect the sensor / actuator level

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

...communicate

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

...visualize @ Web

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

...warn

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

...diagnose and log

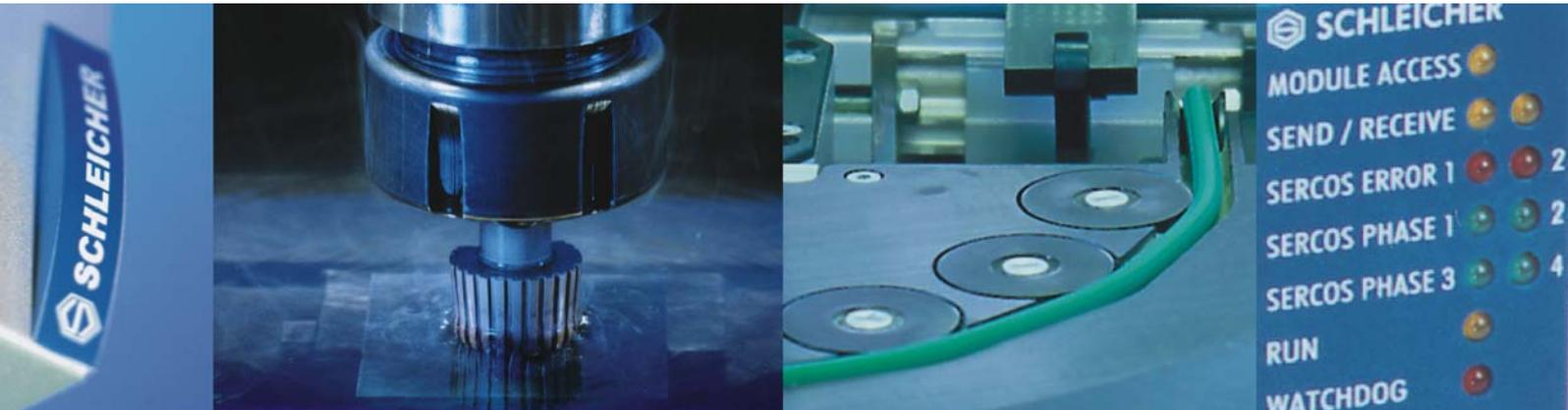
via serial interface or direct to compact flash

...allow

easy updating worldwide via compact flash

Automation Solutions

for machine tools and production machines, robots and handling



Integration

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

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

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

Software

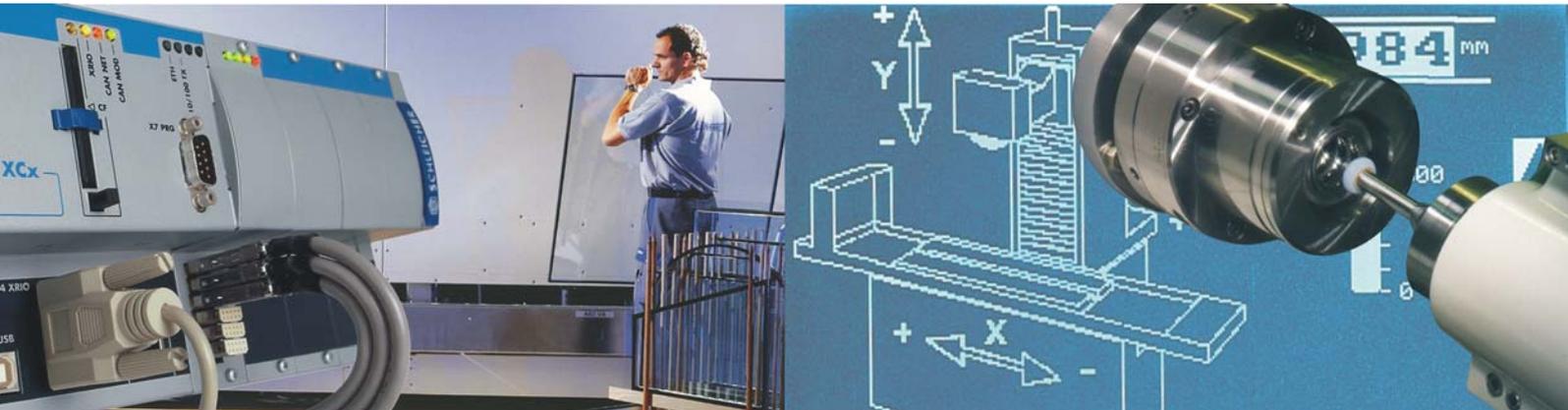
Integration in functionality and software is a fundamental characteristic of Schleicher controllers.

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

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

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

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



Networking

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

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

Concentration

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

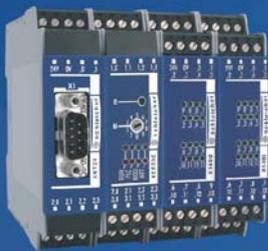


Controllers Compared

Family Ties

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

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



XCx micro

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

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

XCx 300

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

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

XCx 500 / XCx 540

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



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

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

Typology

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

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



XCx 700

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

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

XCx 1100

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

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

ProNumeric

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

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

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

XCx 700



External Details



- 1 The **RS232 interface** (X4) is for serial connection of programming and diagnosis devices, logging printers and barcode readers.
- 2 The three-position **operating mode switch** sets the startup 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.
- 3 The operating system and user program are saved securely 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 is 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. This means that you can save user data, copy it into other controllers, and carry out software updates. You can keep your PLC projects and controller firmware up to date without special tools.
- 4 Eight **status LEDs** indicate activities and the status of internal system bus, CPU, PLC, watchdog, compact flash, Ethernet and CANopen network.
- 5 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. For more on networking see page 12.
- 6 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.
- 7 With **CANopen** (X1) the XCx 700 offers a standard field bus interface for controller networking, connecting drives, valve groups and special devices, and above all setting up additional I/O nodes. Up to 64 bus nodes 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.

Inner Values

Operating System

The PLC and CNC runtime and the optional web server run on the real-time multitasking operating system VxWorks. PLC configuring is carried out with the Windows programming system Multiprog, while the CNC and PLC are started up and operated using the Schleicher-Dialog software.

For more on operating and programming systems see page 62.

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 are displayed in the NC dialog.

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

- Valve control linked to path motion
- Position detection on interrupt signal
- Welding current according to path feedrate
- Call saved motion programs to coordinate smooth movements

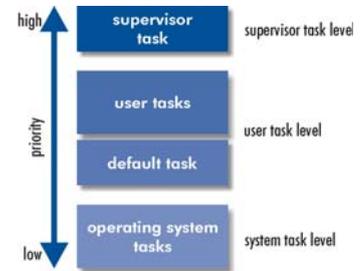
This means that the engineer can use a PLC user program to test the effects of end-user actions on the CNC before they are actually executed, and activate the relevant error messages or warnings.

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.

Multitasking

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



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

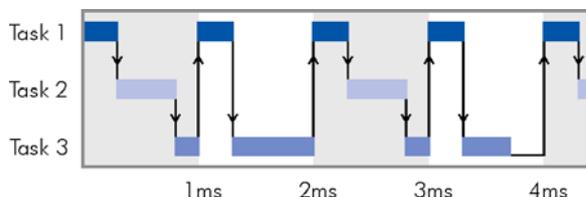
- **Supervisor task** (supervisor task level) detects errors (division by zero, task overrun, etc.) and activates the corresponding operating system task.
- **User and default tasks** (user task level)
 - *Cyclical tasks* execute the programs assigned to them within a defined interval under a defined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



Networking and Visualization

XCx Interconnected

Ethernet networking via TCP/IP is a central element on every XCx 700. In production lines, for example, it may make sense to distribute the tasks to several networked XCx controllers (also from the 300/500/540 series), which are then controlled via one or more operating units. Complex manufacturing processes are much easier to design with this modular and scalable control concept than with centralized architecture.



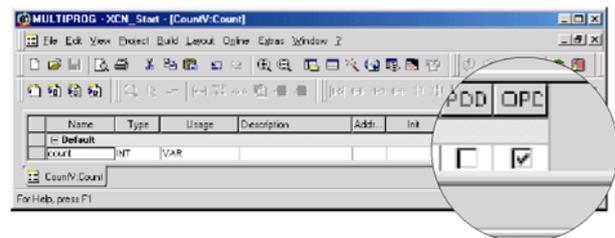
You can connect several controllers directly via global PLC variables, or via a PC network. OPC servers run the communication with standard visualizing and operating programs.

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

OPC Server

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

The OPC server is part of the Multiprog programming system (see page 63) and is installed on the PC together with it. It allows process data exchange between the XCx and e-manufacturing programs such as standard visualization programs and Visual Basic applications.



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

Webserver – One for All



Service Tool in the Controller

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

On-Site or Networked

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

Webserver and Security

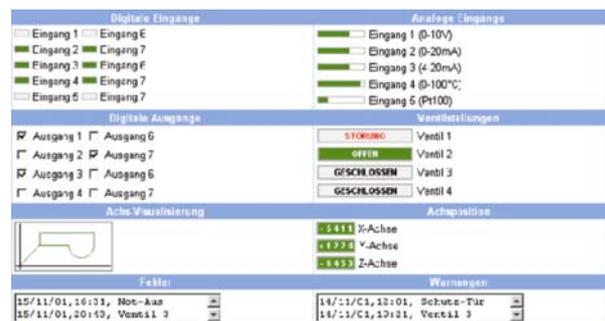
Access control, data security, machine safety – a range of security levels allow web server services to be enabled flexibly. For example, a lockswitch on the machine can be used to block external access completely, while only the lower security levels allow write access to controller variables.

Background

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

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

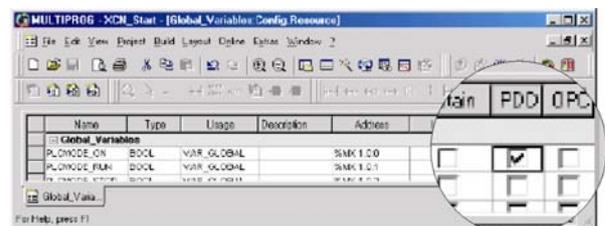
The machine and visualization data is saved on the XCx Compact Flash. Applications (web pages) are transferred by FTP or by copying directly into a special area on the CF. From there the webserver reads the data and applications (HTML, JavaScript, Java) and sends it to the browser. The browser is thus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



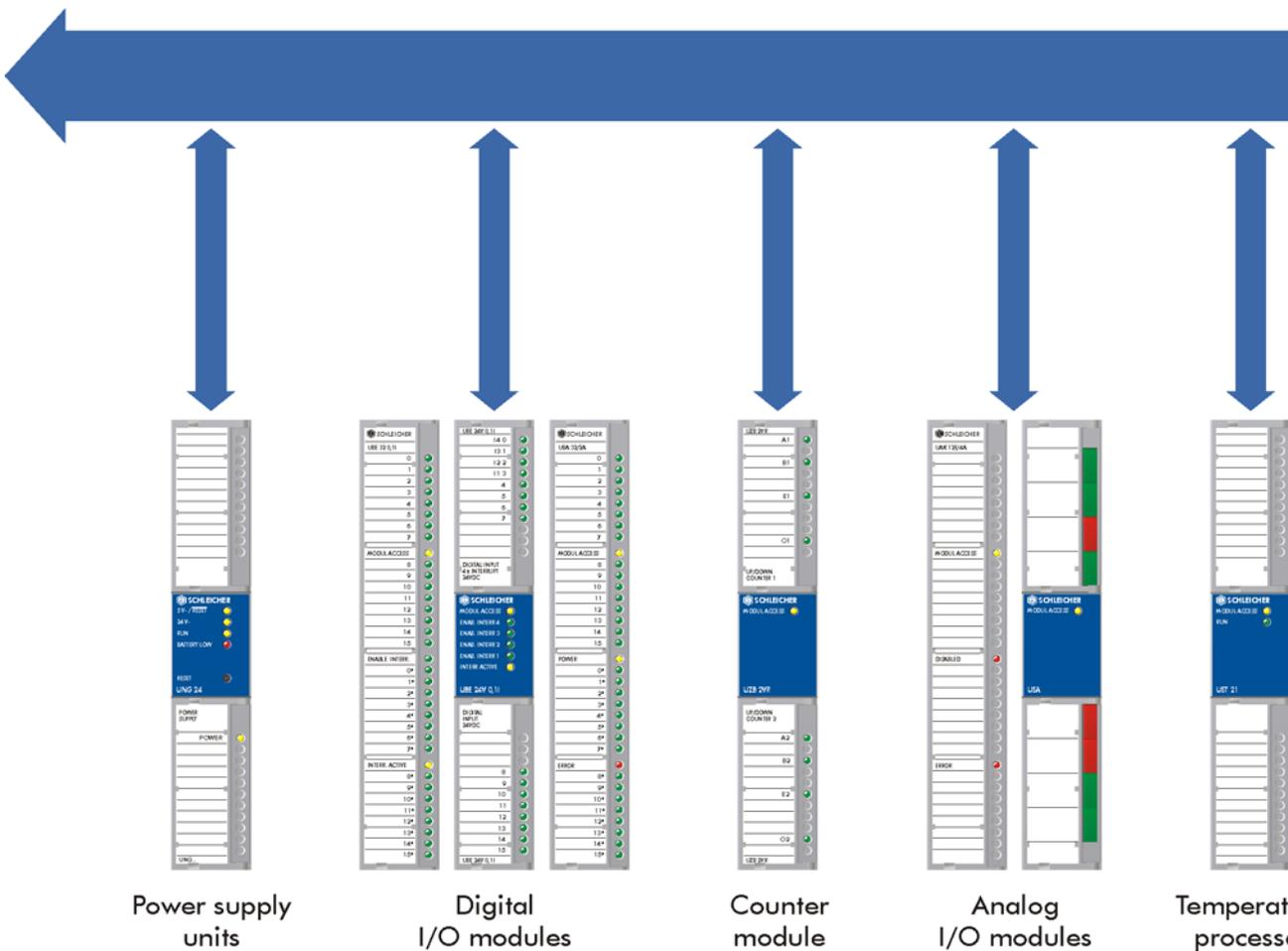
A special Java Applet allows cyclical parameter refresh through bidirectional data exchange between the browser and the controller. This applet supports functions that can be called by the HTML/Javascript language. These functions allow the application to write one or more PLC variable values.

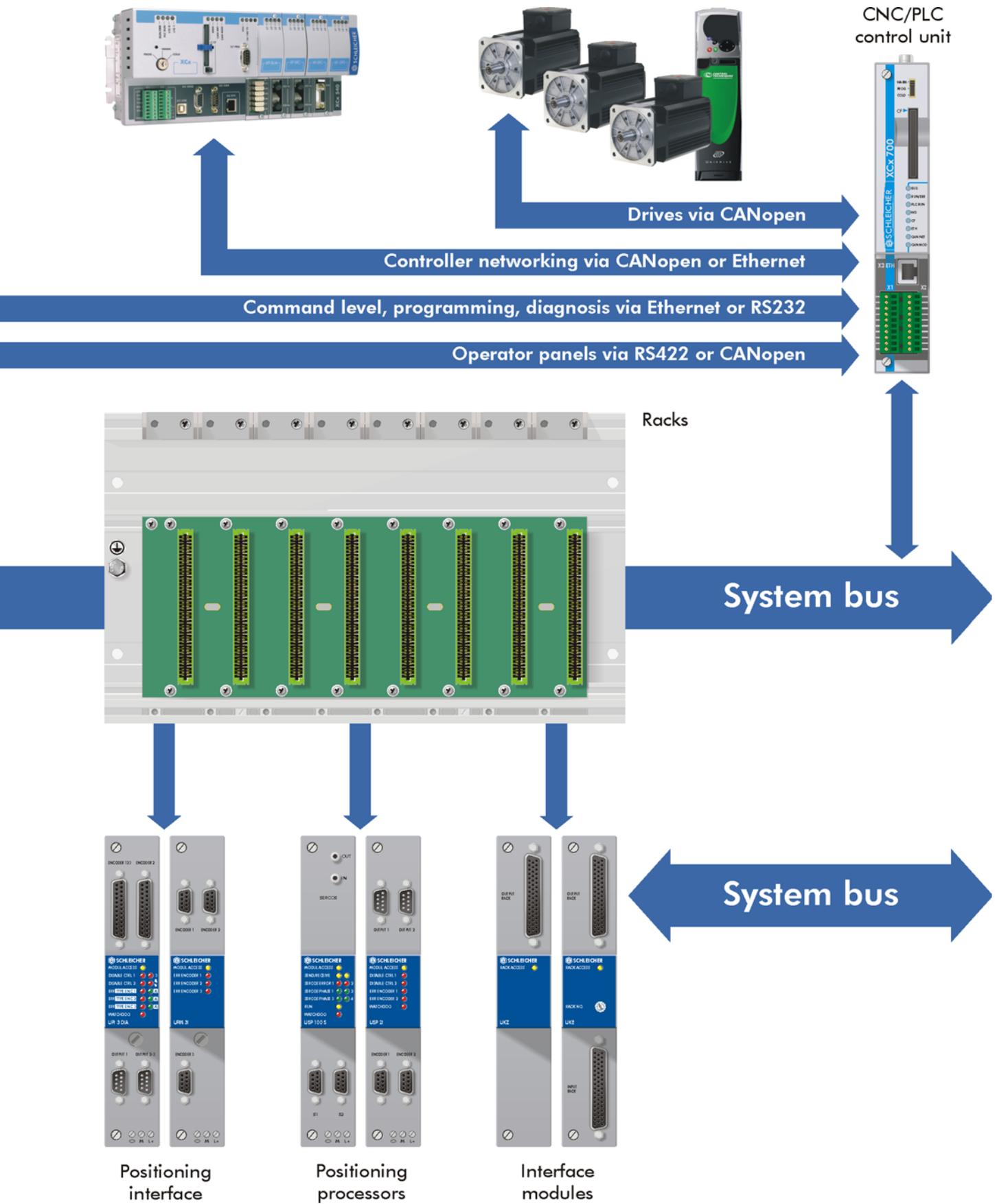
Declaring

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

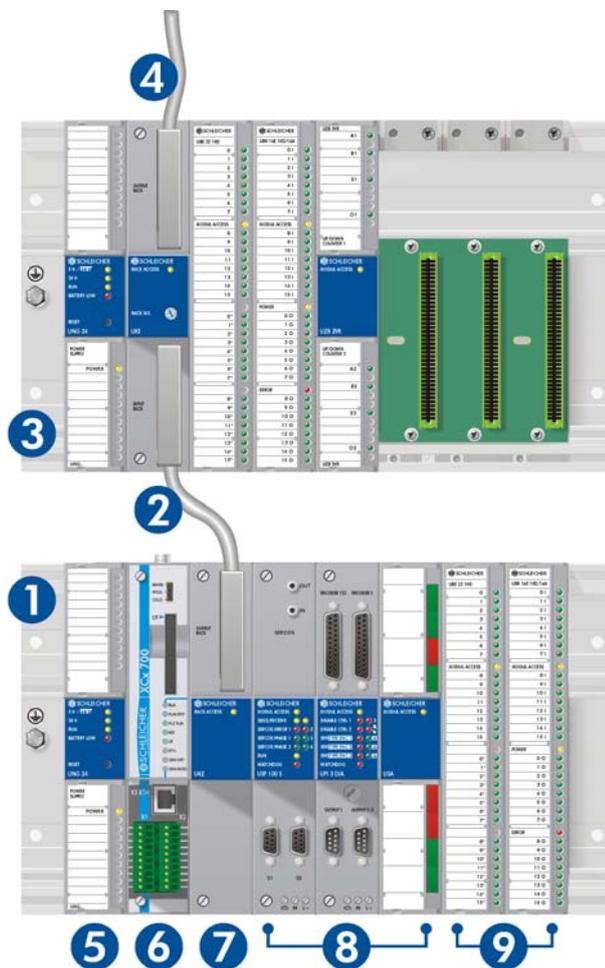


System Overview XCx 700





Controller Structure



Number of Modules

The XCx 700 is a modular automation system where up to 256 modules can be arranged on racks. The automation system must be installed in earthed metal housings (e.g. enclosures).

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 the two voltages, DC 24 V and DC 5 V, 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.

Connecting Racks

- 1** Main rack**
- 2** Interface cable* and interface modules
- 3** Extension rack**
**All racks can be used as main or extension racks.
- 4** Interface cable* to next extension rack
*You can use different length interface cables. 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)

Order of Modules

We recommend installing the modules in the following order. They 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.

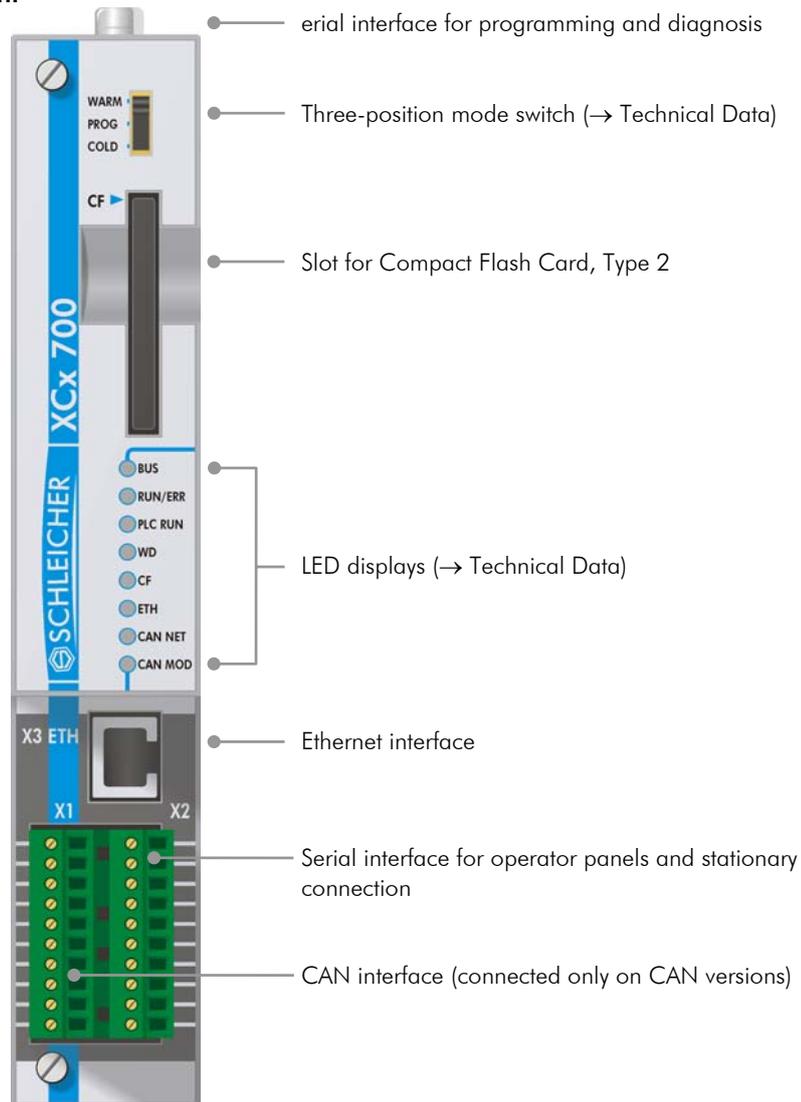
Install the control unit on the main rack.

- 5** Power supply unit
- 6** Control unit
- 7** Interface module
- 8** Intelligent modules
- 9** Digital input/output modules

Installation

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

Front



The XCx 700 is the performance version in the XCx controller family. Its extremely 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.

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 analog input/output modules. Function modules for analog value processing and temperature control, and modules for axle positioning with Sercos interface or analog setpoint interface round off the periphery range.

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.

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.

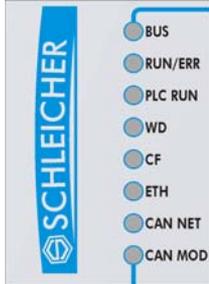
XCS 700	PLC-CPU
XCS 700 C	PLC-CPU with CANopen
XCN 700 E	CNC/PLC control unit, max. 4 axes
XCN 700 CE	CNC/PLC control unit with CANopen max. 4 axes
XCN 700	CNC/PLC control unit, max. 32 axes
XCN 700 C	CNC/PLC control unit with CANopen max. 32 axes

Technical Data	XCS 700	XCS 700 C	XCN 700 E	XCN 700 CE	XCN 700	XCN 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			
Hardware and memory						
CPU	CPU Intel PXA 255 (32 Bit Core, 400 MHz)					
Memory	SD-RAM: 32 MB S-RAM: 1 KB Flash (internal): 4 KB 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					
CNC/PLC properties						
Processing time for 1K PLC instructions	Bit: approx. 0.4 ms Byte / Word / DWord: approx. 0.2 ms					
PLC signal propagation time	1 ms input to output					
Function blocks	Any number of firmware functions and function blocks					
Number of NC axes / subsystems	- / -	- / -	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	VxWorks, multitasking operating system (time-driven / priority-driven)					
Number of user tasks	18					
Task cycle times	Programmable ≥ 1 ms (whole number)					
Memory	Data: max. 16384 KB Programs: 4096 KB					
PLC flags	Retentive: 265 KB Non-retentive: 2048 KB					
Memory management	Dynamic					
Times and counters	Any number programmable from 1 ms ... 290 h (number limited only by memory capacity)					
Software						
PLC operating system	●	●	●	●	●	●
CNC operating system	-	-	●	●	●	●
Configuring	Multiprog (programming environment to IEC 61131-3, incl. OPC server) • (option) ProCANopen (CANopen network configurator) • (option)					
Interfaces						
CANopen (X1)	10-pin plug-in terminal for field bus and drives					
For device	-	●	-	●	-	●
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					
Housing, mounting, power supply						
Internal power supply	DC 24 V (± 20 %, max. 5 % residual ripple)					
Internal power consumption DC 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					

Mode switch

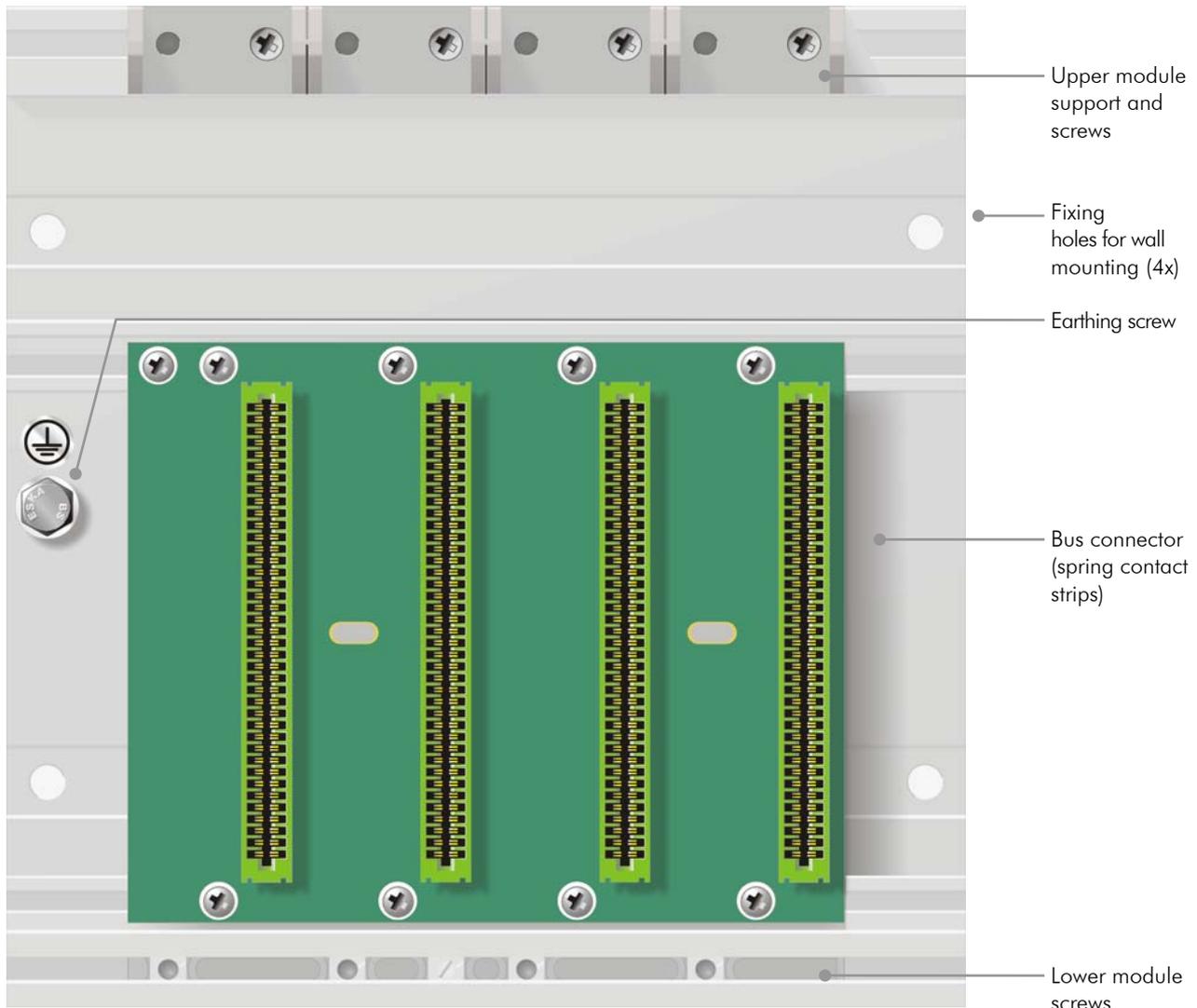
Version	3-position slide switch	
Controller startup behaviour (→ also page 10)	WARM PROG COLD	Default, PLC warmstart, retain variables PLC stop, programming mode PLC cold start, reinitialize retain variables

LED displays



BUS	green, on red, flashing off	Bus access Bus access OK Bus access error / configuration error No bus access (PLC stop)
RUN/ERR	yellow, on green, on red, flashing off	CPU status CPU booting CPU running, operating voltage OK, no error Fatal error: CPU cannot boot CPU defective
PLC RUN	green, on yellow, flashing off	PLC status PLC running PLC running, but outputs shut down (ready-for-operation relay released) PLC stop
WD	red, on off	Watchdog Serious error, operating system stopped Watchdog not activated
CF	green, on red, on off	Compact Flash CF access access error no access to CF
ETH	green, on red, on	Ethernet network access no network connection
CAN NET	green, on green, flashing red, on red, flashing off	CAN network status (only on CAN versions) CAN state operational CAN state pre-operational Bus off CAN error CAN state prepared
CAN MOD	green, on green, flashing red, on red, flashing	CAN module status (only on CAN versions) CAN stack initialized Invalid CAN configuration Control unit not ready or serious error Error in controller

For general technical data see page 66.



The racks hold the XCx 700 modules, and are available in different sizes with 4, 8, 12, 16 and 20 slots.

The racks can be used as main or extension racks. The racks are connected to one another using interface modules and interface cables (→ page 16).

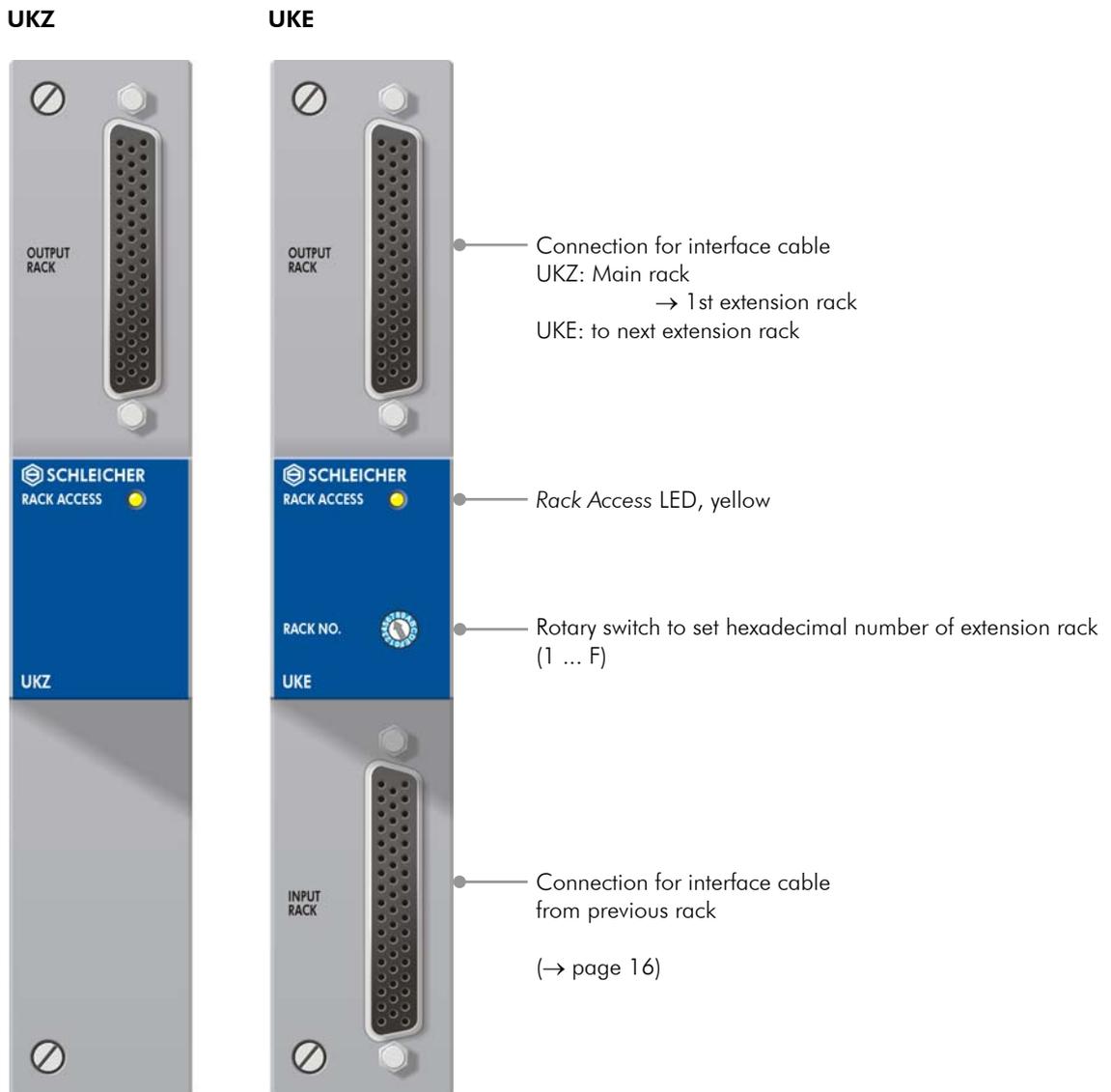
In terms of programming, the UBT 20 rack is treated as a main rack with 16 slots and an extension rack with 4 slots.

Notes:

- Always put the main rack at the bottom.
- Up to 15 expansion racks can be connected directly to the main rack.
- 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.
- The UNG 230A and UNG 115A power supply units require two slots. All other modules require one slot.
- The UBT 4 / 8 / 12 / 16 / 20 racks are designed for wall mounting.
- 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.

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
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				
For general technical data see page 66.					

Interface Module • Main Rack	UKZ
Interface Module • Extension Rack	UKE



UKZ Interface Module

The UKZ interface module is for parallel BUS connection from the main rack to an extension rack. The connection is made at the front using the UKK interface cable (→ page 65).

The extension rack should be above the main rack (or beside it if a UKK 100 interface cable is used).

The UKE interface modules are installed in the extension racks.

UKE interface module

The UKE interface module is for parallel BUS connection from an extension rack to the main rack or to another extension rack. The connection is made at the front using the UKK interface cable (→ page 65).

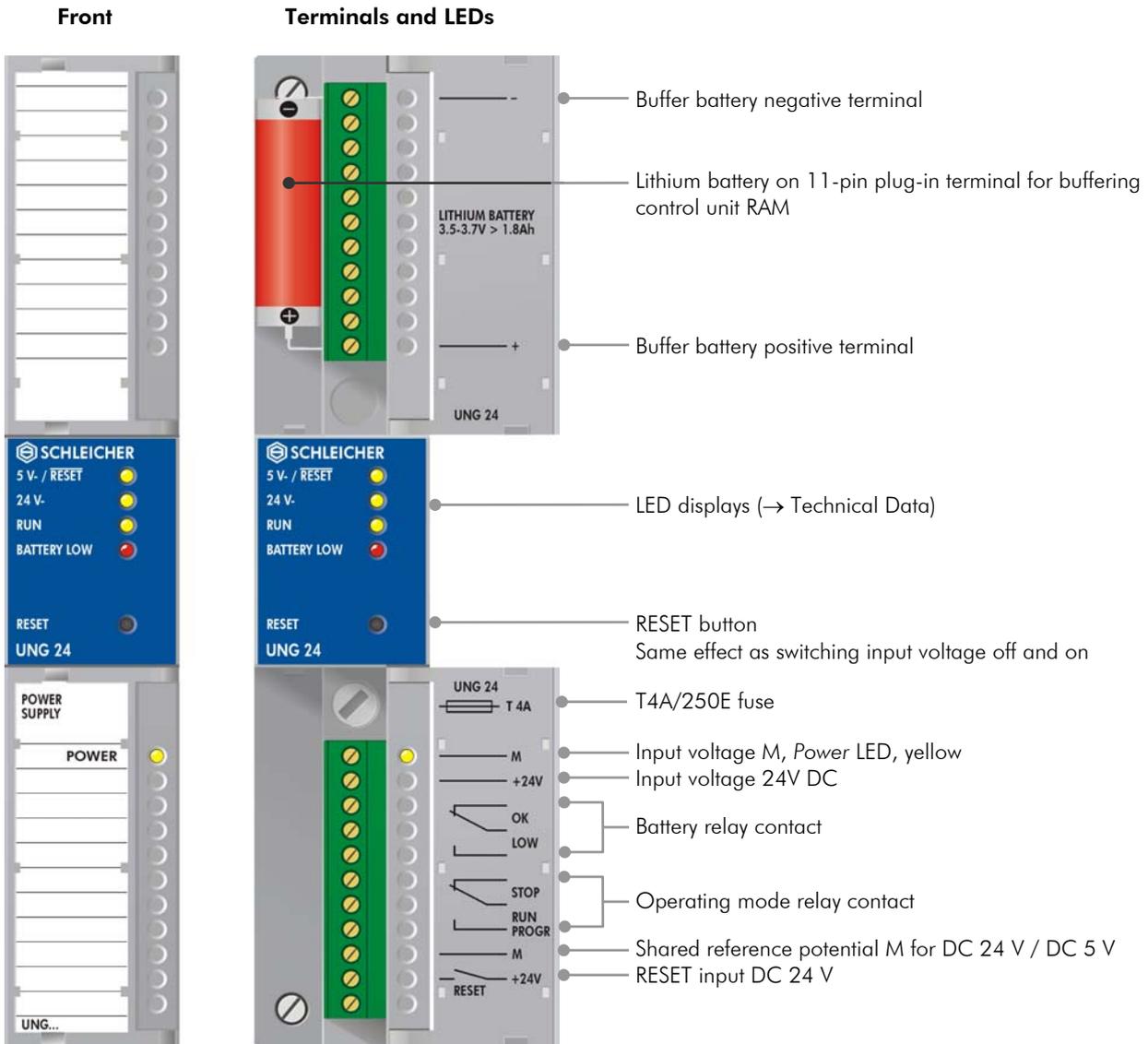
The extension rack should be above the main rack (or beside it if a UKK 100 interface cable is used).

The lower connector on the UKE is for connecting to the main rack, or to an extension rack that is connected to the main rack. The upper connector leads to the next extension device.

Rack No. switch

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

Technical data		UKZ	UKE
Article number		R4.318.0030.0	R4.318.0040.0
Application		On main rack	On extension racks
Number per control system		1	max. 15
Interfacing diagram			
Internal power consumption	DC 5 V	0.5 W	0.5 W
Connection	OUT interface IN interface	1x 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 24/V (→ page 65)	
Weight		0.46 kg	0.48 kg
LED displays			
RACK ACCESS, 1x yellow	on	Controller access to expansion module bus OK	
	off	Control unit in STOP mode or module not activated by user program or no interface cable or module defective	
For general technical data see page 66.			



The UNG 24 switched-mode 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 65). The power supply unit must be installed on the left in the rack (seen from the front).

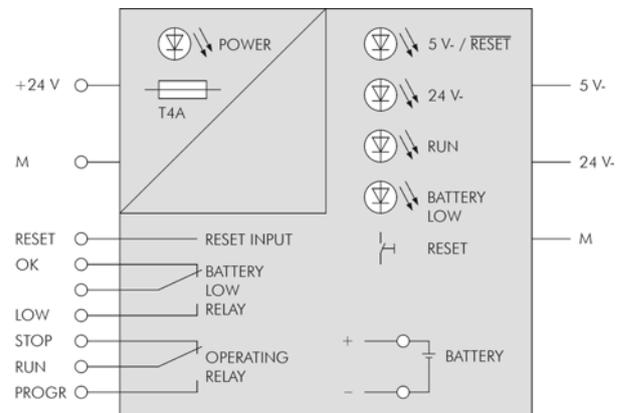
Notes:

- UBA RC output module (→ page 42) and the UST slave temperature processor (→ page 48) 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

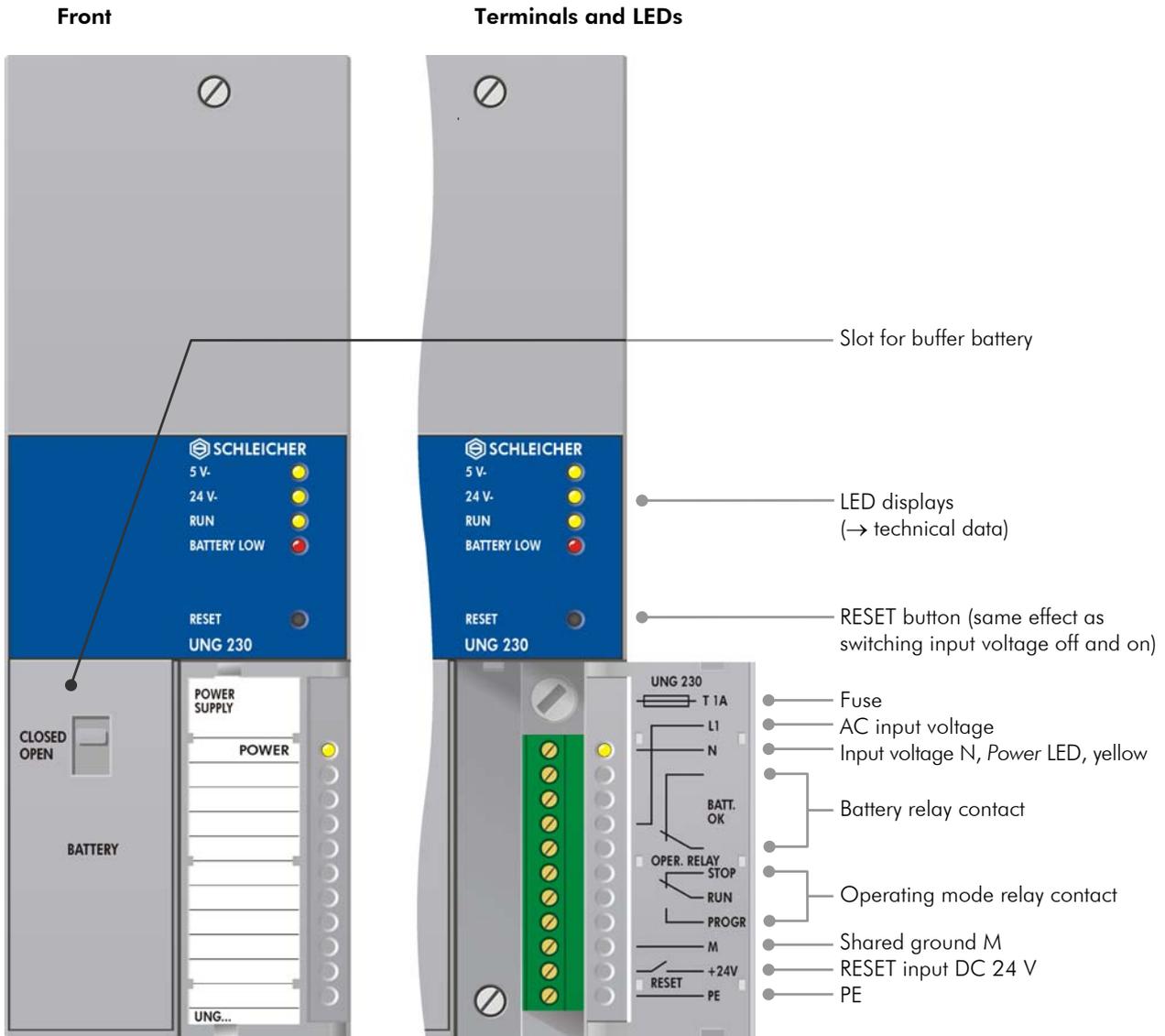


Technical data		UNG 24	
Article number		R4.312.0020.B	
Input voltage		24 V DC \pm 20 % max. 5 % residual ripple	
Power consumption		60 W	
Isolation		no	
Input fuse		T4A/250E fuse	
Output voltage / current		DC 24V / 2A DC 5V / 5A	
Output power	DC 24 V DC 5 V	48 W 25 W	} total output restricted to 50 W
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		Two 11-pin plug-in terminals	
Conductor sizes		Up to 2.5 mm ² (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		Typical 10 mA at 24 V	
Isolation		no	
Operation relay			
Contact type		Changeover contact	
Contact load		AC 230 V / 4 A DC 24 V / 2 A	
Operating state		Activated when operation OK (<i>Run</i> LED)	
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 (<i>Battery Low</i> 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	on	Output voltage DC 5 V OK, RESET input not active
		off	Error in DC 5 V, operation relay off, controller switches to STOP
	24 V-	on	Output voltage 24 V DC OK
		off	Error in DC 24 V, operation relay off, controller switches to STOP
	RUN	on	Operation OK, operation relay on
		off	Error in power supply unit or control unit, operation relay off, controller switches to STOP
	BATTERY LOW	on	Buffer battery empty, battery relay on
		off	Buffer battery OK, battery relay off
	POWER	on	Input voltage OK
		off	No input voltage

For general technical data see page 66.

Power Supply Unit • AC 230 V
Power Supply Unit • AC 115 V

UNG 230A
UNG 115A



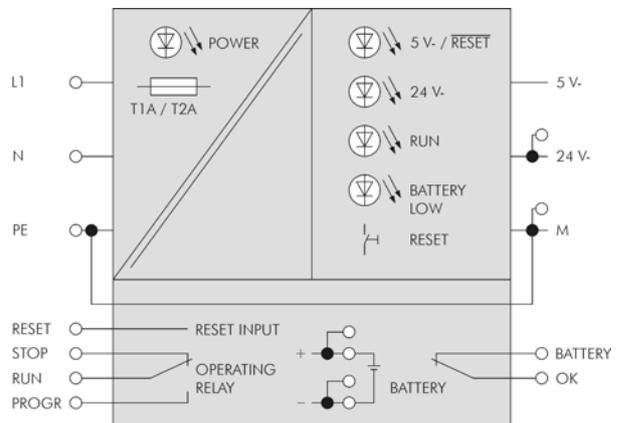
The UNG 230A / UNG 115A primary switched-mode power supply units supply the internal controller voltages (DC 24 V and DC 5 V) for supplying the racks. They are equipped with an OPERATING RELAY, a and a battery compartment for the UNB 115/230 buffer battery for the RAM (→ page 65). The power supply unit must be installed on the left in the rack (seen from the front).

Note: 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

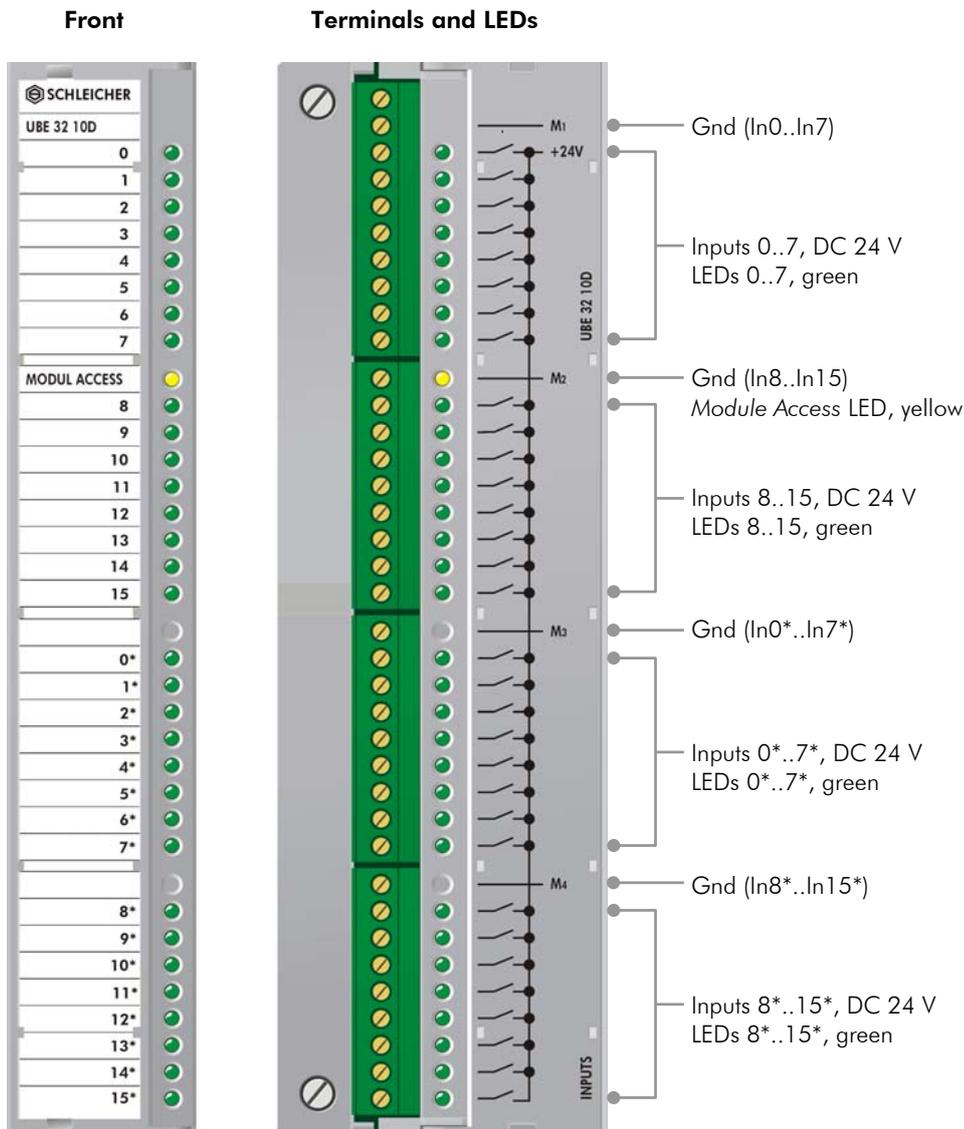


Technical data		UNG 230A	UNG 115A
Article number		R4.312.0030.F	R4.312.0040.F
Input voltage		AC 230 V, 50 ... 60 Hz, ± 15 %	AC 115 V, 50 ... 60 Hz, ± 15 %
Rated power consumption		60 W (230 V / 50 Hz)	60 W (115 V / 50 Hz)
Isolation		yes	yes
Input fuse		T1.0/250E fuse	T2.0/250E fuse
Output voltage / current		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		11-pin plug-in terminal	
Conductor sizes		Up to 2.5 mm ² (stranded with wire-end ferrules)	
Weight		1.25 kg	
RESET input			
input voltage		DC 24 V, max. residual ripple 5 % H level +13 ... +30 V, L level-30 ... +6 V	
Input current		Typical 10 mA at 24 V	
Isolation		no	
Operation relay			
Contact type		Changeover contact	
Contact load		AC 250 V / 4 A DC 24 V / 2 A	
Operating state		Activated when operation OK (<i>Run</i> LED)	
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 (<i>Battery Low</i> LED)	
Buffer battery			
Type		Lithium battery 3.6V / 5.2Ah	
Buffer time		Min. 1 year (at +25 °C and uninterrupted buffering)	
LED displays			
	5 V-	on	Output voltage 5 V DC OK
		off	Error in DC 5 V, operation relay off, controller switches to STOP
	24 V-	on	Output voltage 24 V DC OK
		off	Error in DC 24 V, operation relay off, controller switches to STOP
	RUN	on	Operation OK, operation relay on
		off	Error in power supply unit or control unit, operation relay off, controller switches to STOP
	BATTERY LOW	on	Buffer battery empty, battery relay on
		off	Buffer battery OK, battery relay off
	POWER	on	Input voltage OK
		off	No input voltage

For general technical data see page 66.

32 Inputs • DC 24 V • 1 ms
32 Inputs • DC 24 V • 10 ms

UBE 32 1D
UBE 32 10D



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

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).

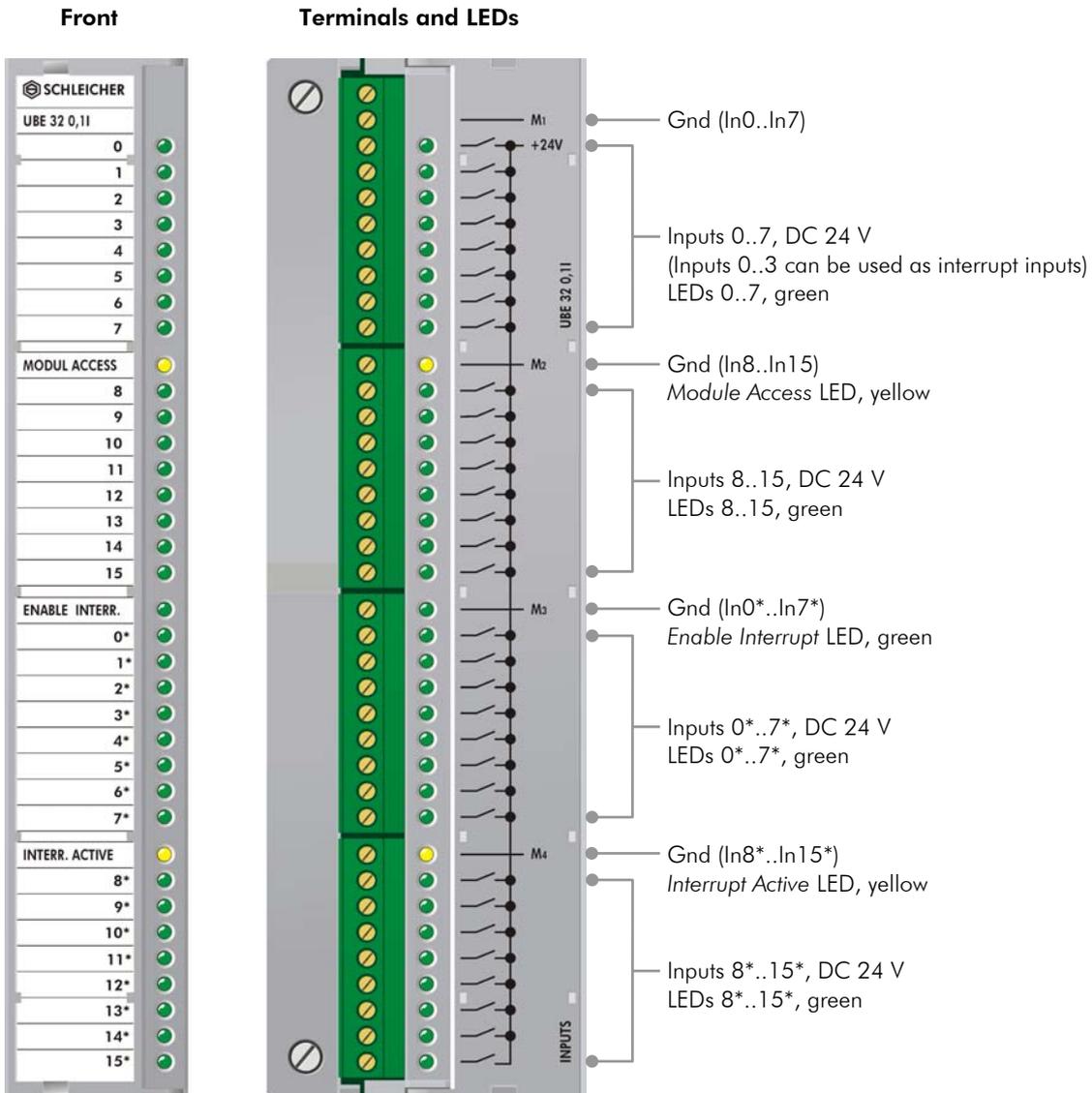
Sensors and reference potential are connected via four plug-in terminals on the front. The LEDs beside the front flap of the module are assigned to the facing plug-in terminals. When they are on they indicate H level on the sensors. You can label the sensors on the front flap.

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

The module is suitable for 2-wire initiators.

Technical data		UBE 32 1D	UBE 32 10D
Article number		R4.314.0120.E	R4.314.0090.E
Number of inputs/outputs		32, in 4 groups of 8 inputs	
Internal power consumption	DC 5 V	0.1 W	
Connection		One 10-pin and three 9-pin plug-in terminals	
Conductor sizes		Up to 2.5 mm ² (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 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		
LED displays			
INPUTS, 32x green	on	H level of sensors	
MODULE ACCESS, 1x yellow	on	Controller access to module OK	
	off	Control unit in STOP mode or module not programmed by user program or module defective	
For general technical data see page 66.			

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.

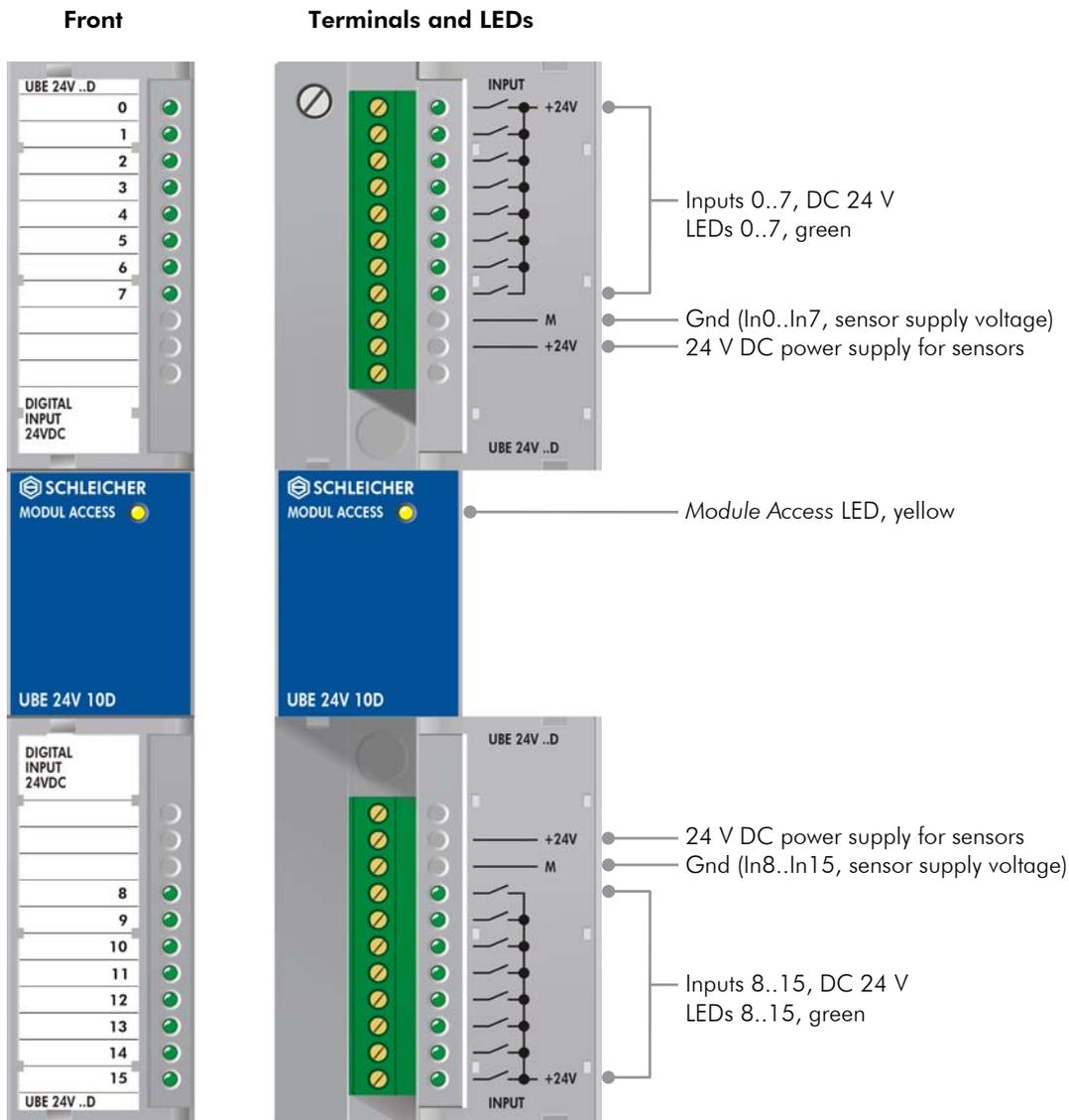
The module is suitable for 2-wire initiators.

An interrupt signal in inputs 0 to 3 interrupts processing of the user program in the cyclical task and starts the user program of the event task assigned to the input (event 1 bis 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
Number of inputs/outputs		32, in 4 groups of 8 inputs The first four inputs in the first group are interrupt inputs
Internal power consumption	DC 5 V	0.1 W
Connection		One 10-pin and three 9-pin plug-in terminals
Conductor sizes		Up to 2.5 mm ² (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, 1x yellow	on	Controller access to module OK
	off	Control unit in STOP mode or module not programmed by user program or module defective
ENABLE INTERR, 1x green	on	One or both edges of the four interrupts enabled by interrupt mask
	off	No interrupt enable programmed in interrupt mask
INTERR ACTIVE, 1x yellow	short on	At least one interrupt (all four signals OR-linked) on system bus
	on	Missing interrupt reset

For general technical data see page 66.

16 Inputs • DC 24 V • 1 ms	UBE 24V 1D
16 Inputs • DC 24 V • 10 ms	UBE 24V 10D



The input modules have 16 inputs for DC 24 V with green status display.

The inputs are isolated from the control electronics and from one another by optocouplers in 2 groups of 8 inputs each. They are positive-switching with input signal delay of 1 ms (UBE 24V 1D) or 10 ms (UBE 24V 10D).

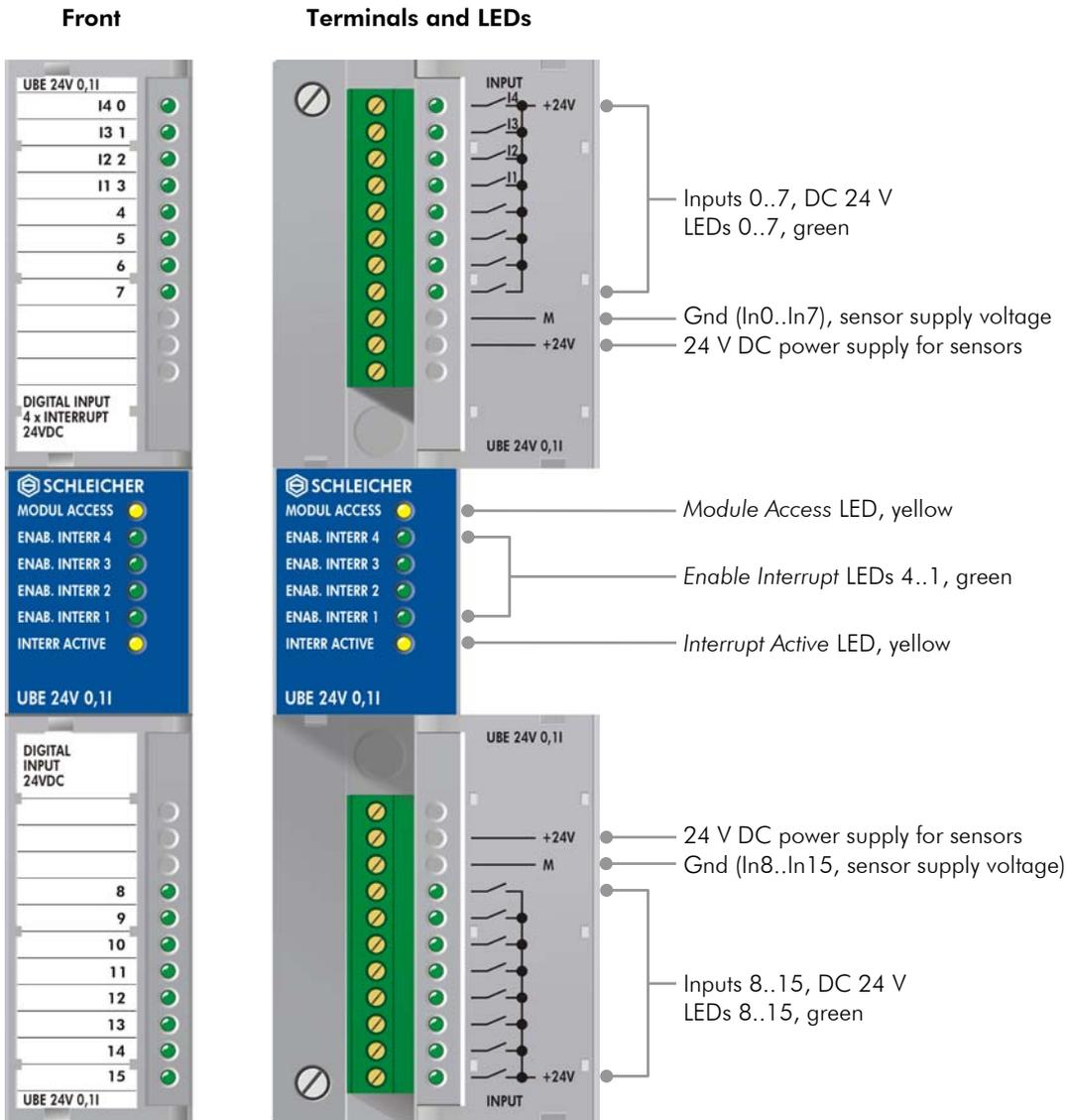
Sensors and reference potential are connected via two 11-pin plug-in terminals on the front. The LEDs beside the front flap of the module are assigned to the facing plug-in terminals. When they are on they indicate H level on the sensors. You can label the sensors on the front flaps.

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

The module is suitable for 2-wire initiators.

Technical data		UBE 24V 1D	UBE 24V 10D
Article number		R4.314.0020.0	R4.314.0010.0
Number of inputs/outputs		16, in 2 groups of 8 inputs	
Internal power consumption	DC 5 V	0.2 W	
Connection		Two 11-pin plug-in terminals	
Conductor sizes		Up to 2.5 mm ² (stranded with wire-end ferrules)	
Weight		0.45 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	1 ms	10 ms	
Simultaneity	100 %		
Isolation	By optocouplers, both groups from one another and from bus		
LED displays			
INPUTS, 16x green	on	H level of sensors	
MODULE ACCESS, 1x yellow	on	Controller access to module OK	
	off	Control unit in STOP mode or module not programmed by user program or module defective	
For general technical data see page 66.			

16 Inputs • DC 24 V • 0.1 ms • Interrupt-Capable **UBE 24V 0,11**



The input module provides 16 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 2 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 two 11-pin 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.

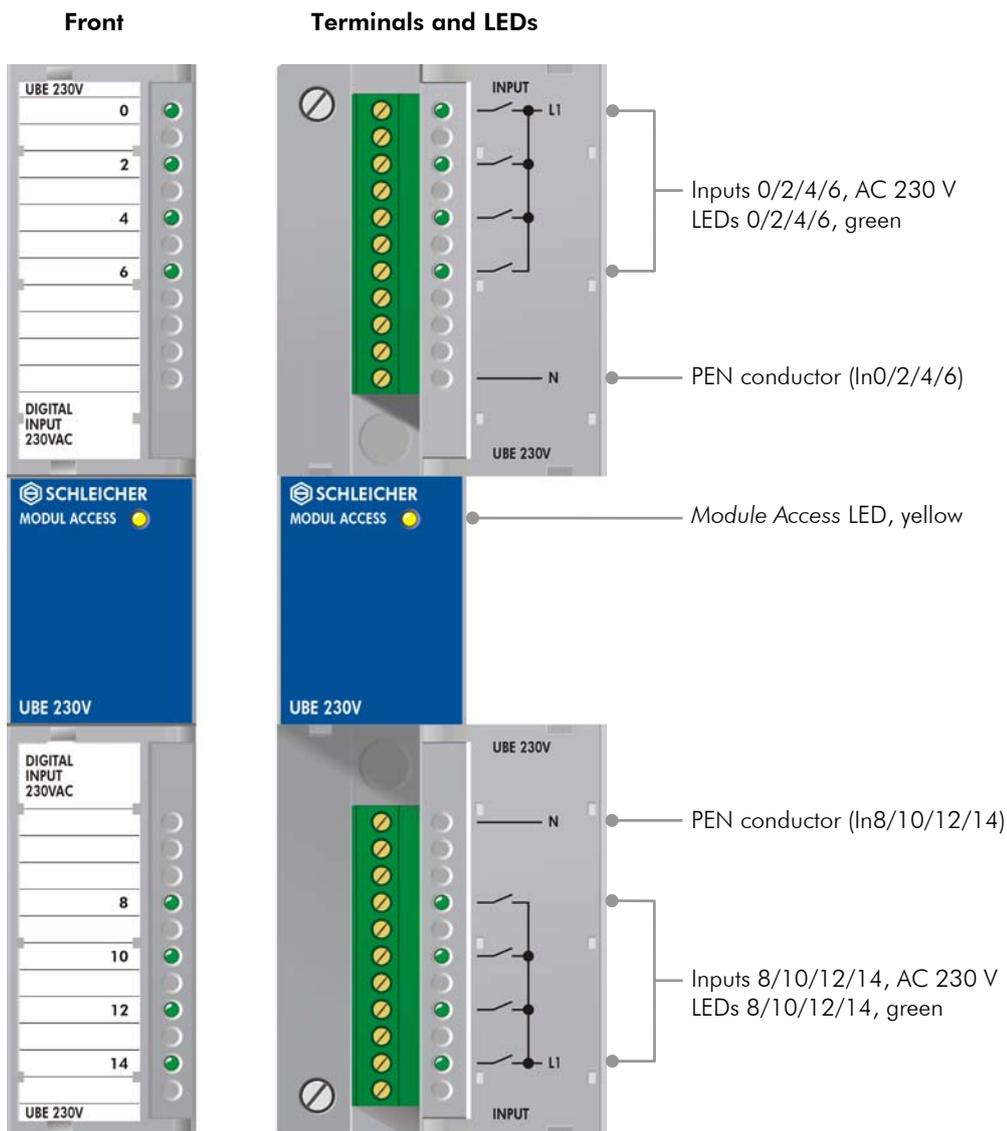
The module is suitable for 2-wire initiators.

An interrupt signal in inputs 0 to 3 interrupts processing of the user program in the cyclical task and starts the user program of the event task 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 24V 0,11
Article number		R4.314.0060.0
Number of inputs/outputs		16, in 2 groups of 8 inputs The first four inputs in the first group are interrupt inputs
Internal power consumption	DC 5 V	0.1 W
Connection		Two 11-pin plug-in terminals
Conductor sizes		Up to 2.5 mm ² (stranded with wire-end ferrules)
Weight		0.45 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, both groups from one another and from bus
LED displays		
INPUTS, 16x green	on	H level of sensors
MODULE ACCESS, 1x yellow	on	Controller access to module OK
	off	Control unit in STOP mode or module not programmed by user program or module defective
ENABLE INTERR x, 4x green	on	Enable one or both edges of interrupts 1/2/3/4 by interrupt mask
	off	No interrupt 1/2/3/4 enable programmed in interrupt mask
INTERR ACTIVE, 1x yellow	short on	At least one interrupt (all four signals OR-linked) on system bus
	on	Missing interrupt reset

For general technical data see page 66.

8 Inputs • AC 230 V UBE 230V



The input module has 8 inputs for DC 24 V with green status display.

The inputs are isolated from the control electronics and from one another by optocouplers in 2 groups of 4 inputs each.

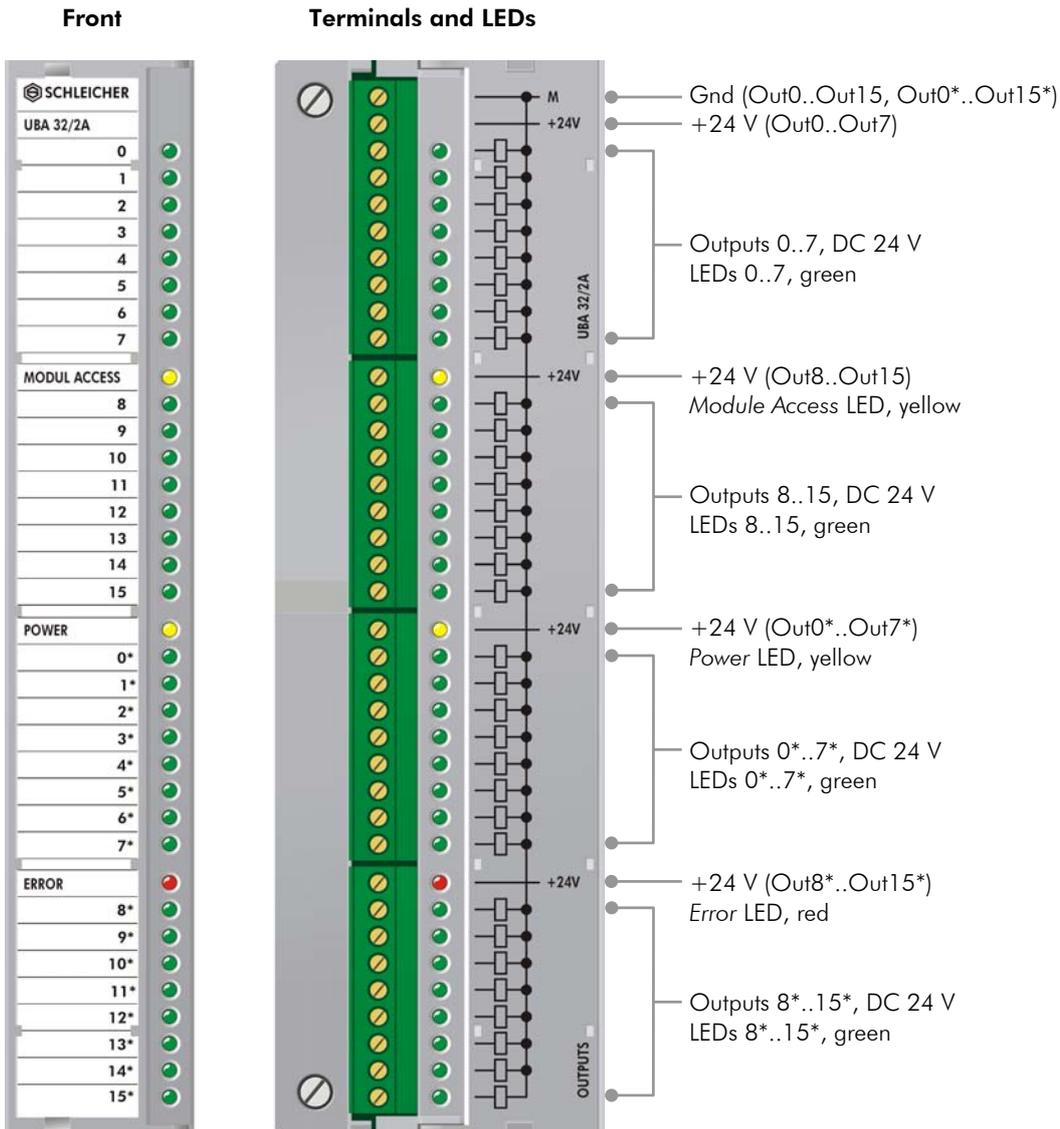
Sensors and reference potential are connected via two 11-pin plug-in terminals on the front. The LEDs beside the front flap of the module are assigned to the facing plug-in terminals. When they are on they indicate H level on the sensors. You can label the sensors on the front flap.

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

The module is suitable for 2-wire initiators.

Technical data		UBE 230V
Article number		
Number of inputs/outputs	8, in 2 groups of 4 inputs	
Internal power consumption	DC 5 V	0.2 W
Connection	Two 11-pin plug-in terminals	
Conductor sizes	Up to 2.5 mm ² (stranded with wire-end ferrules)	
Weight	0.48 kg	
Inputs		
Input circuit		
Input voltage	AC 220 to 240 V, 50 to 60 Hz	
Switching level	H level 166 ... 264 V L level 0 ... 83 V	
Input current	8 mA	
Input signal delay	20 ms	
Simultaneity	100 %	
Isolation	By optocouplers, both groups from one another and from bus	
LED displays		
INPUTS, 8x green	on	H level of sensors
MODULE ACCESS, 1x yellow	on	Controller access to module OK
	off	Control unit in STOP mode or module not programmed by user program or module defective
For general technical data see page 66.		

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.

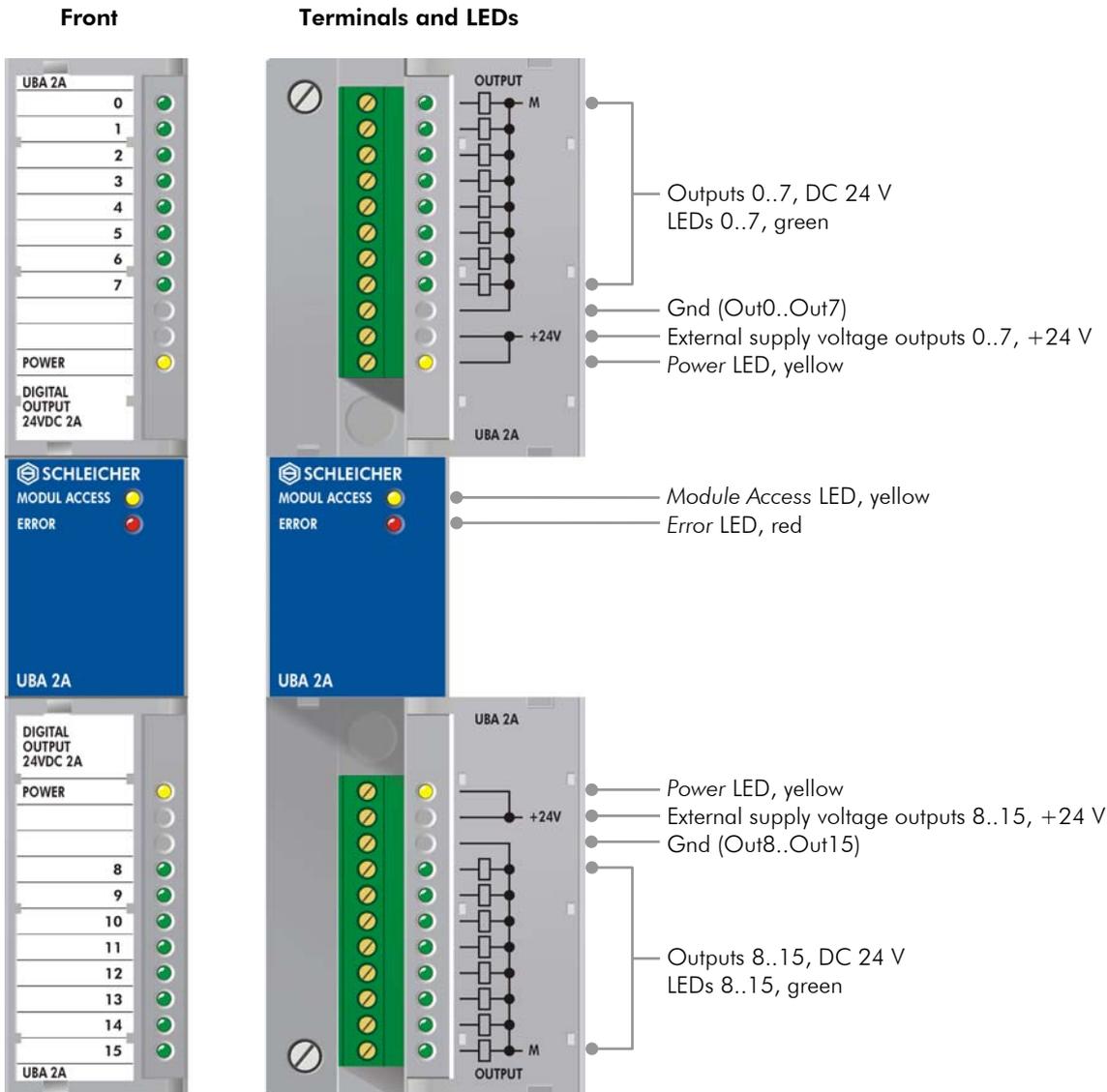
Loads and output supply voltage are connected via plug-in terminals on the front. The LEDs beside the front flap of the module are assigned to the facing plug-in terminals. When on they indicate H level on the output signals and the connected supply voltage. You can label the sensors on the front flaps.

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
Number of inputs/outputs		32, in 4 groups of 8 outputs
Internal power consumption	DC 5 V	0.9 W
Connection		One 10-pin and three 9-pin plug-in terminals
Conductor sizes		Up to 2.5 mm ² (stranded with wire-end ferrules)
Weight		0.54 kg
Outputs		
Output circuit		
Supply voltage	24 V DC ± 20 % max. residual ripple 5 %	
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. 0.5Hz at 2A max. 10 Hz at 0.5A	
Isolation	By optocouplers	
LED displays		
OUTPUTS, 32x green	on	H level of outputs
MODULE ACCESS, 1x yellow	on	Controller access to module OK
	off	Control unit in STOP mode or module not programmed by user program or module defective
POWER LED, 1x yellow	on	External supply voltage for outputs OK
	off	No external supply voltage for outputs
ERROR LED, 1x red	on	Overcurrent monitoring triggered, message to control unit
	off	Overcurrent monitoring OK
For general technical data see page 66.		

16 Outputs • DC 24 V • 2 A UBA 2A



The output module has 16 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.

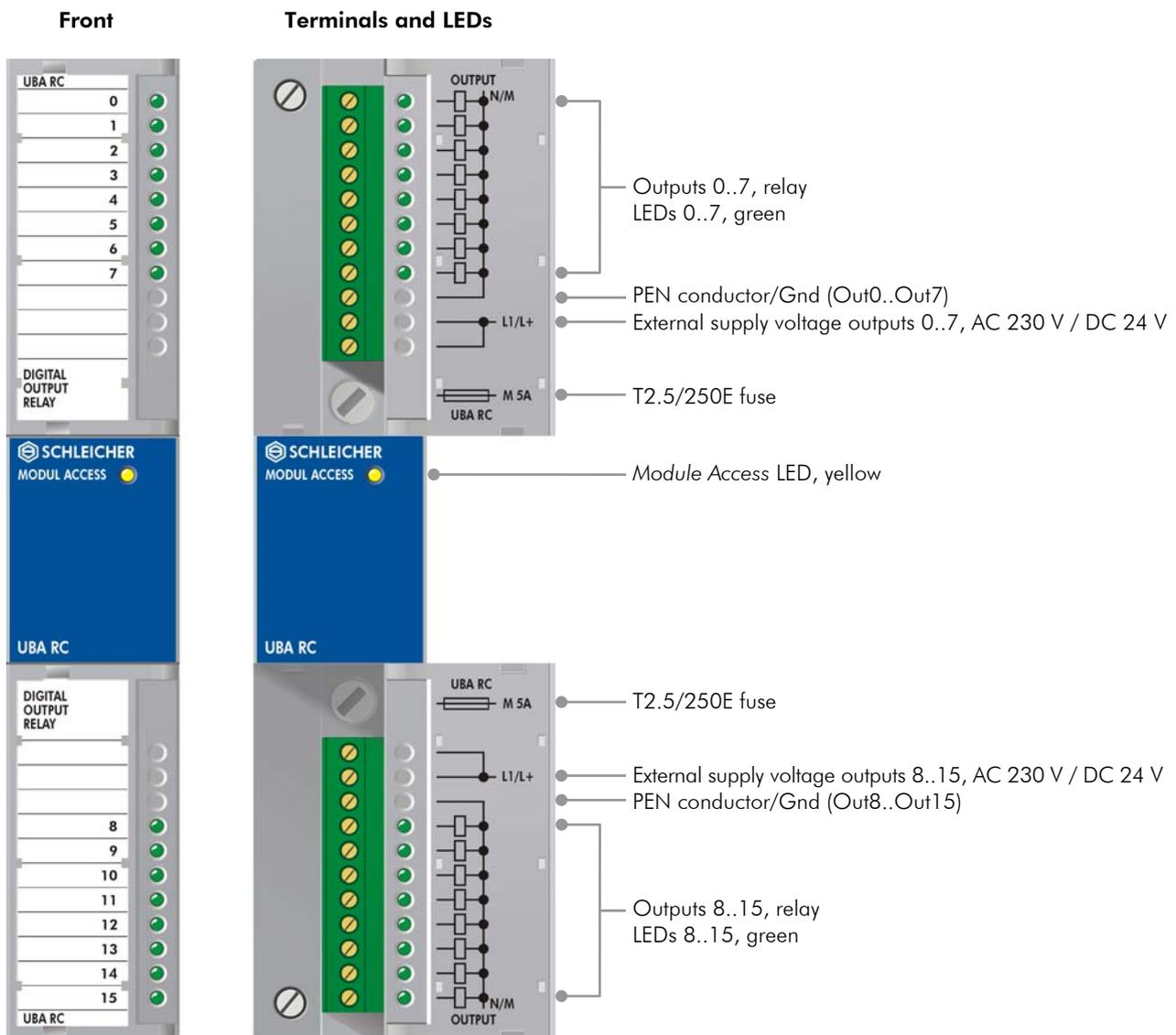
Loads and output supply voltage are connected via two 11-pin plug-in terminals on the front. The LEDs beside the front flap of the module are assigned to the facing plug-in terminals. When on they indicate H level on the output signals and the connected supply voltage. You can label the sensors on the 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 2A
Article number		R4.314.0070.0
Number of inputs/outputs		16, in 2 groups of 8 outputs
Internal power consumption	DC 5 V	0.6 W
Connection		Two 11-pin plug-in terminals
Conductor sizes		Up to 2.5 mm ² (stranded with wire-end ferrules)
Weight		0.46 kg
Outputs		
Output circuit		
Supply voltage	24 V DC ± 20 % max. residual ripple 5 %	
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	
Suppressor circuit	Reflected output voltage –7.5 ... –15 V	
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	Yes, by optocouplers	
LED displays		
OUTPUTS, 16x green	on	H level of outputs
MODULE ACCESS, 1x yellow	on	Controller access to module OK
	off	Control unit in STOP mode or module not programmed by user program or module defective
POWER LED, 2x yellow	on	External supply voltage for outputs OK (groupwise)
	off	No external supply voltage for outputs (groupwise)
ERROR LED, 1x red	on	Overcurrent monitoring triggered, message to control unit
	off	Overcurrent monitoring OK
For general technical data see page 66.		

16 Relay Outputs • AC 250 V / 4 A • DC 24 V / 2 A UBA RC



The output module provides 16 relay outputs with make contacts, for switching loads up to AC 250 V / 4 A or DC 24 V / 2 A per contact, with green status display. The module is equipped with an RC suppressor circuit for the contacts.

The inputs are isolated from the control electronics by relays and from one another by optocouplers in 2 groups of 8 inputs each.

Loads and output supply voltage are connected via two 11-pin 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.

Technical data		UBA RC
Article number	R4.314.0050.0	
Number of inputs/outputs	16 relay outputs, make contacts, in 2 groups of 8 outputs	
Internal power consumption	DC 24 V	4.5 W
	DC 5 V	0.3 W
Connection	Two 11-pin plug-in terminals	
Conductor sizes	Up to 2.5 mm ² (stranded with wire-end ferrules)	
Weight	0.57 kg	

Outputs

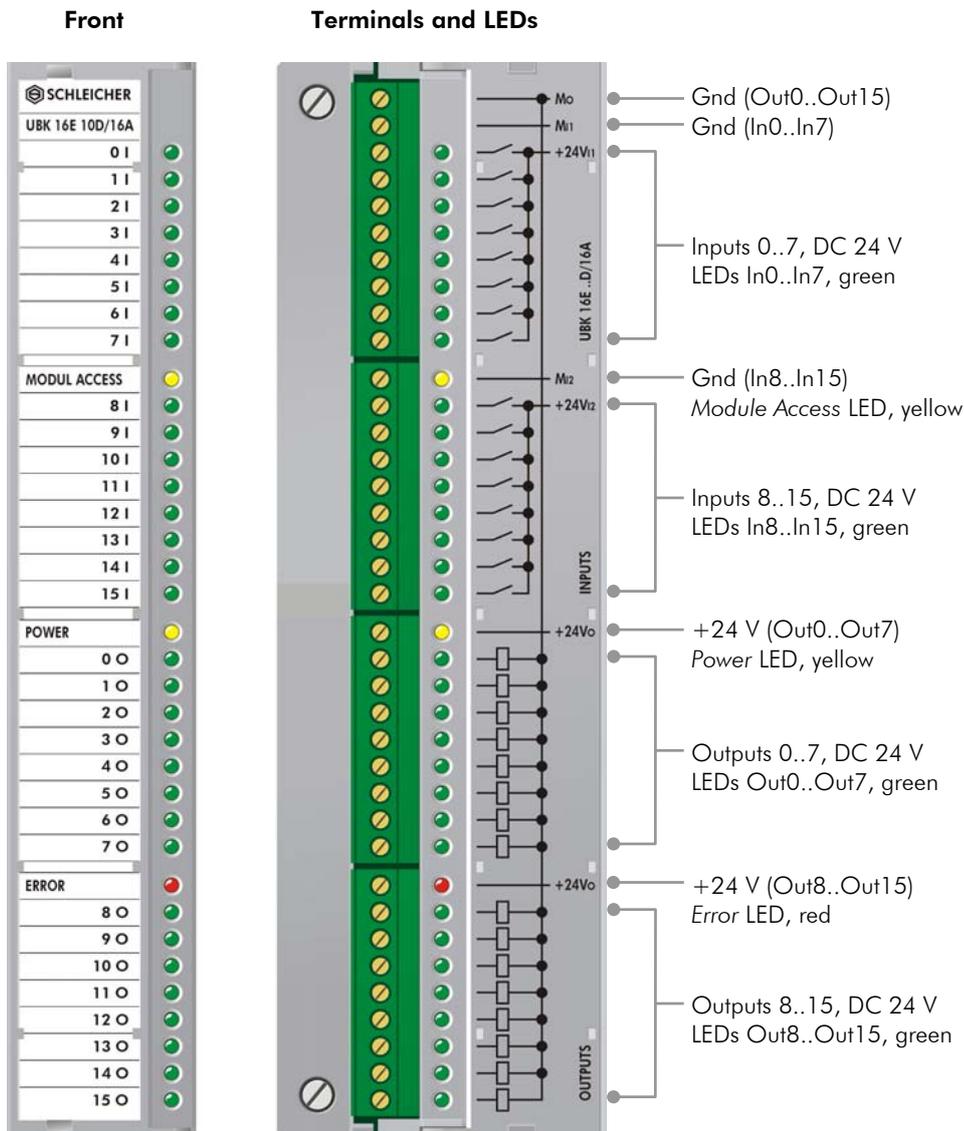
Output circuit	
Load capability	250 V AC / 4 A continuous load per contact with ohmic load, inductive load not permissible 24 V DC / 2 A continuous load per contact with ohmic load, inductive load not permissible
Current per group	Max. 5 A, continuous load
Protection	Each group with M5.0/250E fuse
On delay	Typical 10 ms
Off delay	Typical 15 ms
Permissible switching frequency	Max. 1.6 Hz
Mechanical service life	30 x 10 ⁶ switching cycles
Suppressor circuit	RC combination (100 Ohm; 0.1 μF)
Parallel connection of outputs	Yes
Isolation	By relays

LED displays

OUTPUTS, 16x green	on	H level of outputs
MODULE ACCESS, 1x yellow	on	Controller access to module OK
	off	Control unit in STOP mode or module not programmed by user program or module defective

For general technical data see page 66.

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



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.

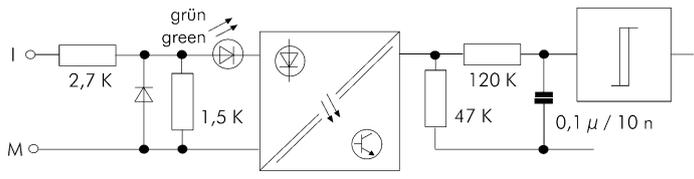
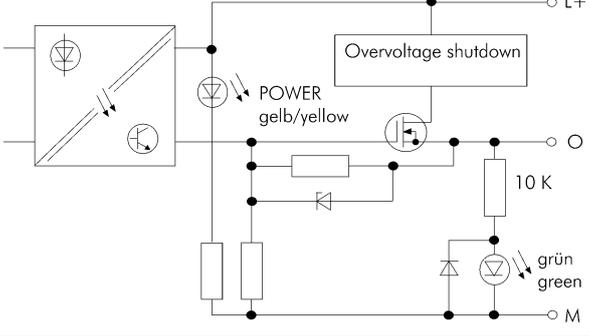
Each output is protected against inductive peaks on circuit interruption.

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.

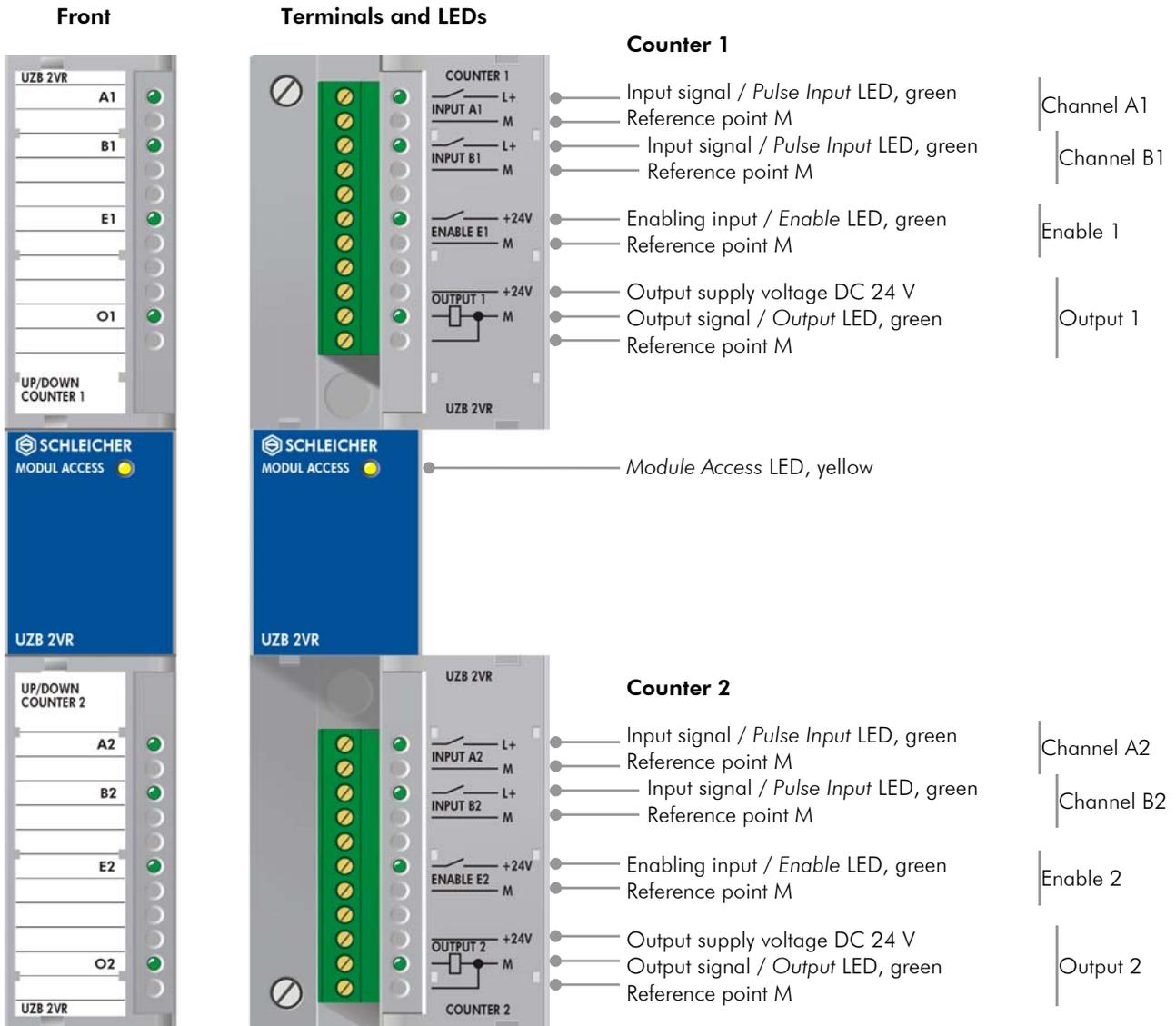
The plug-in terminals may be connected and removed during operation.

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

Technical data		UBK 16E 1D/16A	UBK 16E 10D/16A
Article number		R4.314.0130.E	R4.314.0110.E
Number of inputs/outputs		16 inputs, in 2 groups of 8 16 outputs, in 2 groups of 8	
Internal power consumption	DC 5 V	0.6 W	
Connection		One 10-pin and three 9-pin plug-in terminals	
Conductor sizes		Up to 2.5 mm ² (stranded with wire-end ferrules)	
Weight		0.5 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 8 mA at 24 V input voltage		
Input signal delay	1 ms	10 ms	
Simultaneity	100 %		
Isolation	By optocouplers, both groups from one another, from outputs and from bus		
Outputs			
Output circuit			
Supply voltage	24 V DC ± 20 % max. residual ripple 5 %		
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, all outputs from bus		
LED displays			
INPUTS/OUTPUTS, 32x green	on	H level of inputs/outputs	
MODULE ACCESS, 1x yellow	on	Controller access to module OK	
	off	Control unit in STOP mode or module not programmed by user program or module defective	
ERROR LED, 1x red	on	Overcurrent monitoring triggered, message to control unit	
	off	Overcurrent monitoring OK	

For general technical data see page 66.

2 Counters • 24 V Input Voltage • max. 100 kHz **UZH 2VR**
2 Counters • 5 V Input Voltage • max. 100 kHz **UZH 2VR/5V**



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.

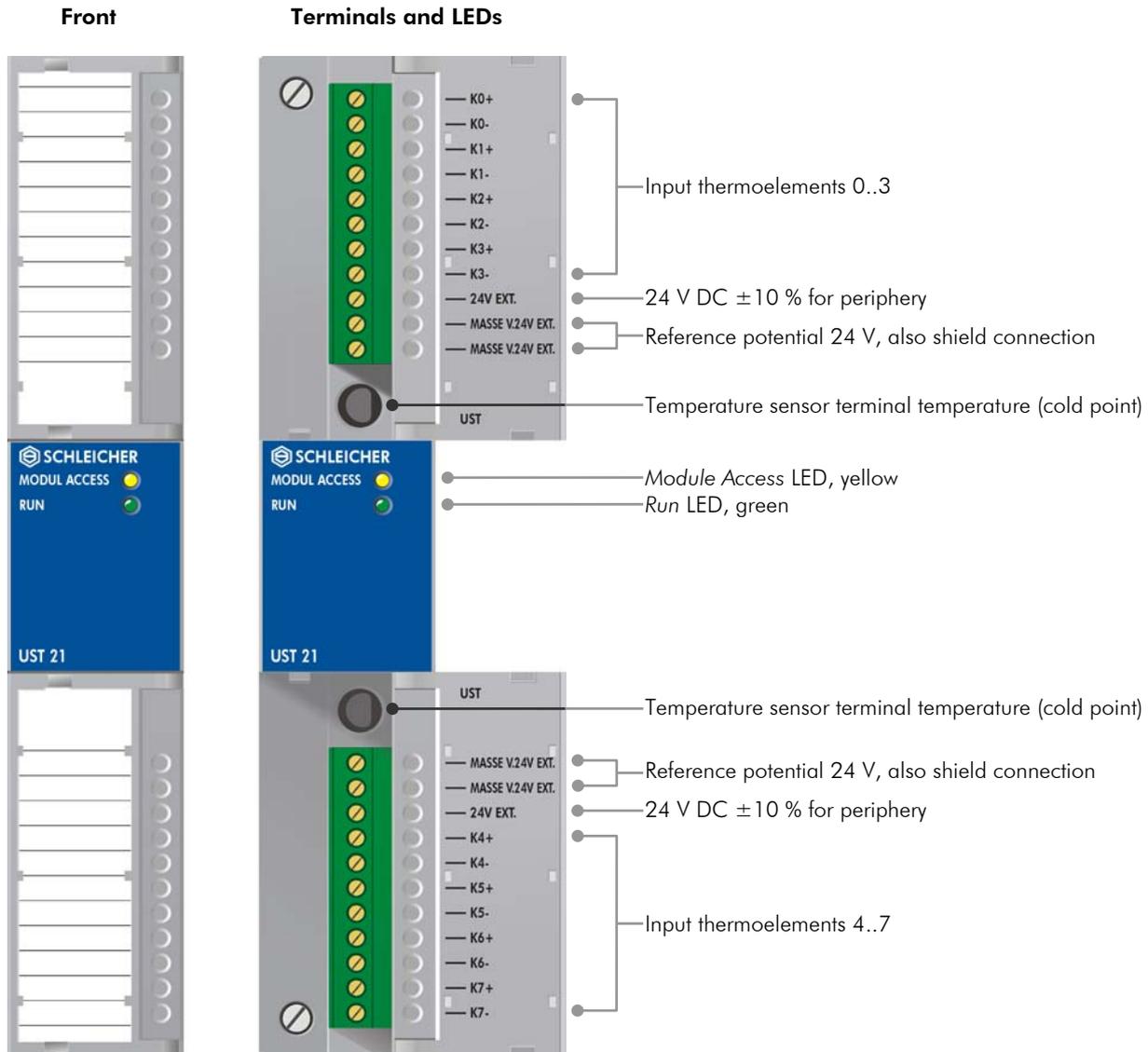
Technical data		UZH 2VR	UZH 2VR/5V
Article number		R4.315.0010.B	R4.315.0040.B
Number of counters		2 (identical counters, input/output data relates to a single counter)	
Counter direction		Up/down	
Range		0 to 65 535	
Counting frequency		max. 100 kHz	
Internal power consumption	DC 5 V	0.6 W	
Connection		Two 11-pin plug-in terminals	
Conductor sizes		Up to 2.5 mm ² (stranded with wire-end ferrules)	
Weight		0.51 kg	
Inputs			
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		Typical 7.2 mA at 24 V	Typical 6.5 mA at 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		Typical 7.2 mA at 24 V	Typical 11 mA at 5 V
Input signal delay, enabling input		0.2 ms	
Reference point		M	
Isolation		Optocouplers (also between A1, B1 and E1)	
Outputs			
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	
LED displays			
INPUTS, 4x green	on	H level of channel inputs and internal/external enable	
ENABLE, 2x green	on	H level of external enabling inputs	
OUTPUTS, 2x green	on	H level of output signal O1, O2	
MODULE ACCESS, 1x yellow	on	Controller access to module OK	
	off	Control unit in STOP mode or module not programmed by user program or module defective	
For general technical data see page 66.			

8 Inputs for Thermoelements

UST 2

8 Inputs for Thermoelements • Adaptive Control

UST 21



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

The analog 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.

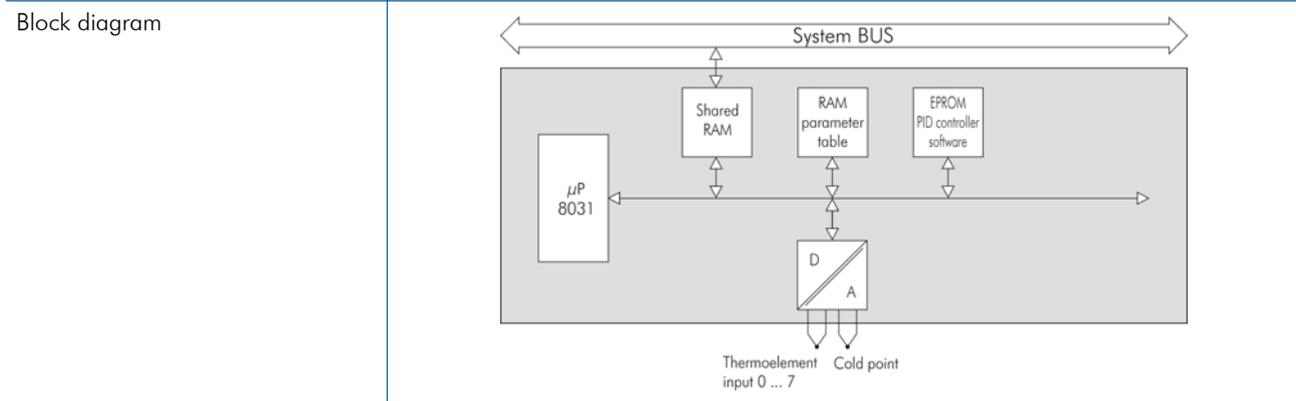
Eight thermoelement inputs for Fe-CuNi or NiCr-Ni can be connected directly to the UST slave temperature processor. They detect the actual values that are compared with the digital set values received from the control unit via the shared RAM. On the basis of the control parameters of the integrated software-PID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

The control parameters of the integrated software-PID controller and the assignment of the manipulated variables to the outputs are sent by the user program to the UST 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
Number of inputs/outputs	8 analog inputs for thermoelements, 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	Two 11-pin plug-in terminals	
Conductor sizes	Up to 2.5 mm ² (stranded with wire-end ferrules)	
Isolation	Groupwise (channel 0 ... 3, 4 ... 7)	
Weight	0.67 kg	



Thermoelements

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

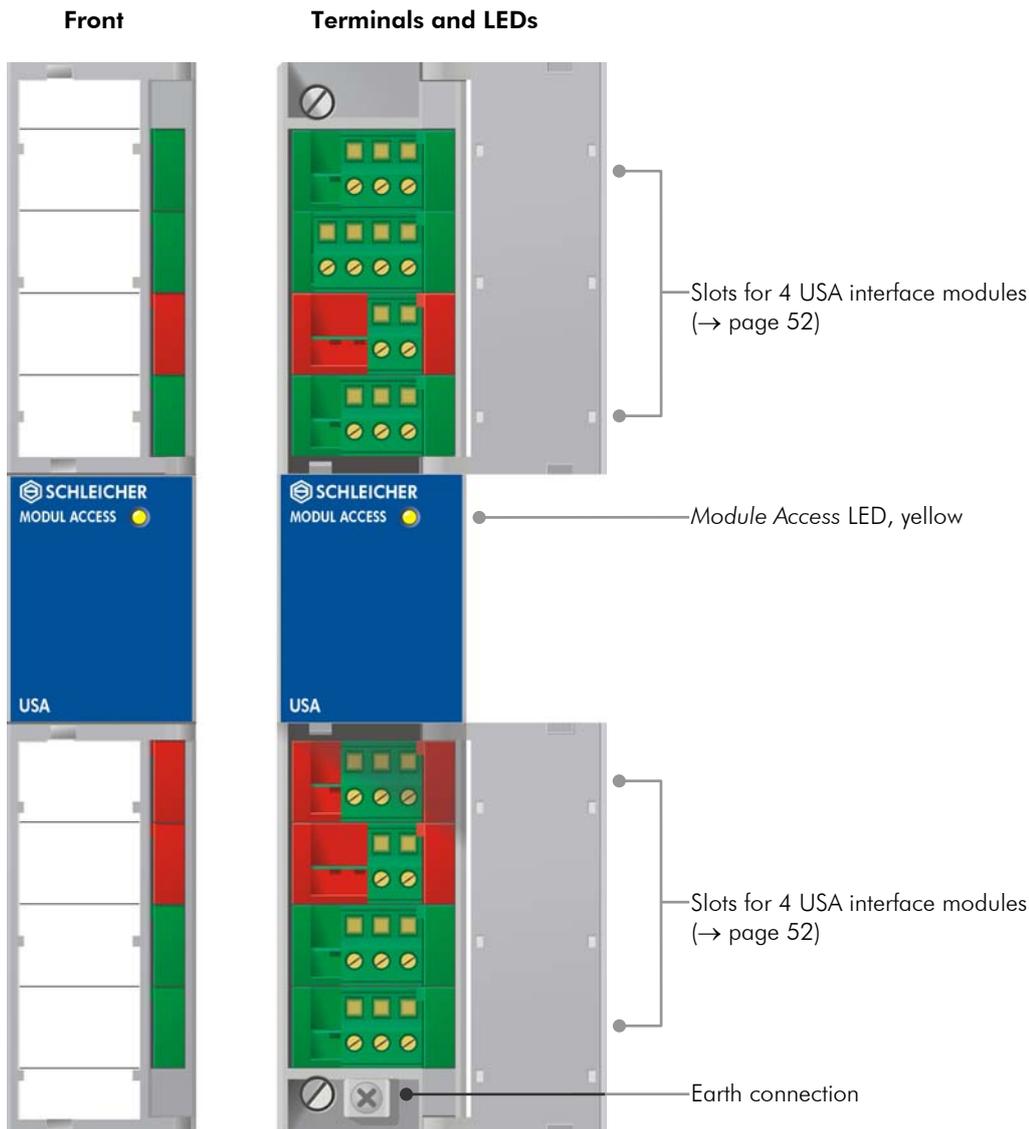
Converter data

Control parameters	Normed	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 controllers	

LED displays

MODULE ACCESS, 1x yellow	on	Controller access to module OK
	off	Control unit in STOP mode or module not programmed by user program or module defective
RUN, 1x green	on	Flashing, module microprocessor OK
	off	Control unit reset

For general technical data see page 66.



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

The analog processor has its own microprocessor, which converts the analog 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 mA , Pt 100 et al.)
- Isolation between the digital and analog parts of the slave analog processor

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

Shared RAM

The user software identifies the analog values from the slave analog 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.

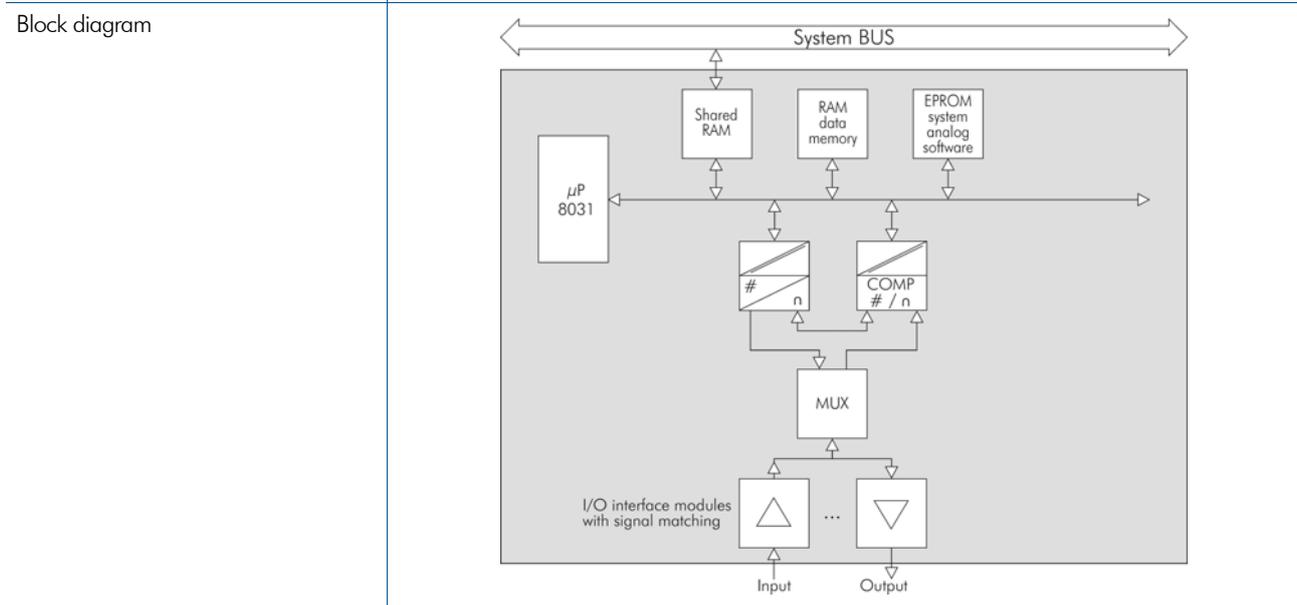
Synchronization

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 analog 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 52).

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



Converter data	
Conversion principle	SAR
Resolution	1-bit signed (4095 steps)
Conversion rate	8 ms for all 8 channels
Linearization	For Pt 100

LED displays		
MODULE ACCESS, 1x yellow	on off	Controller access to module OK Control unit in STOP mode or module not programmed by user program or module defective

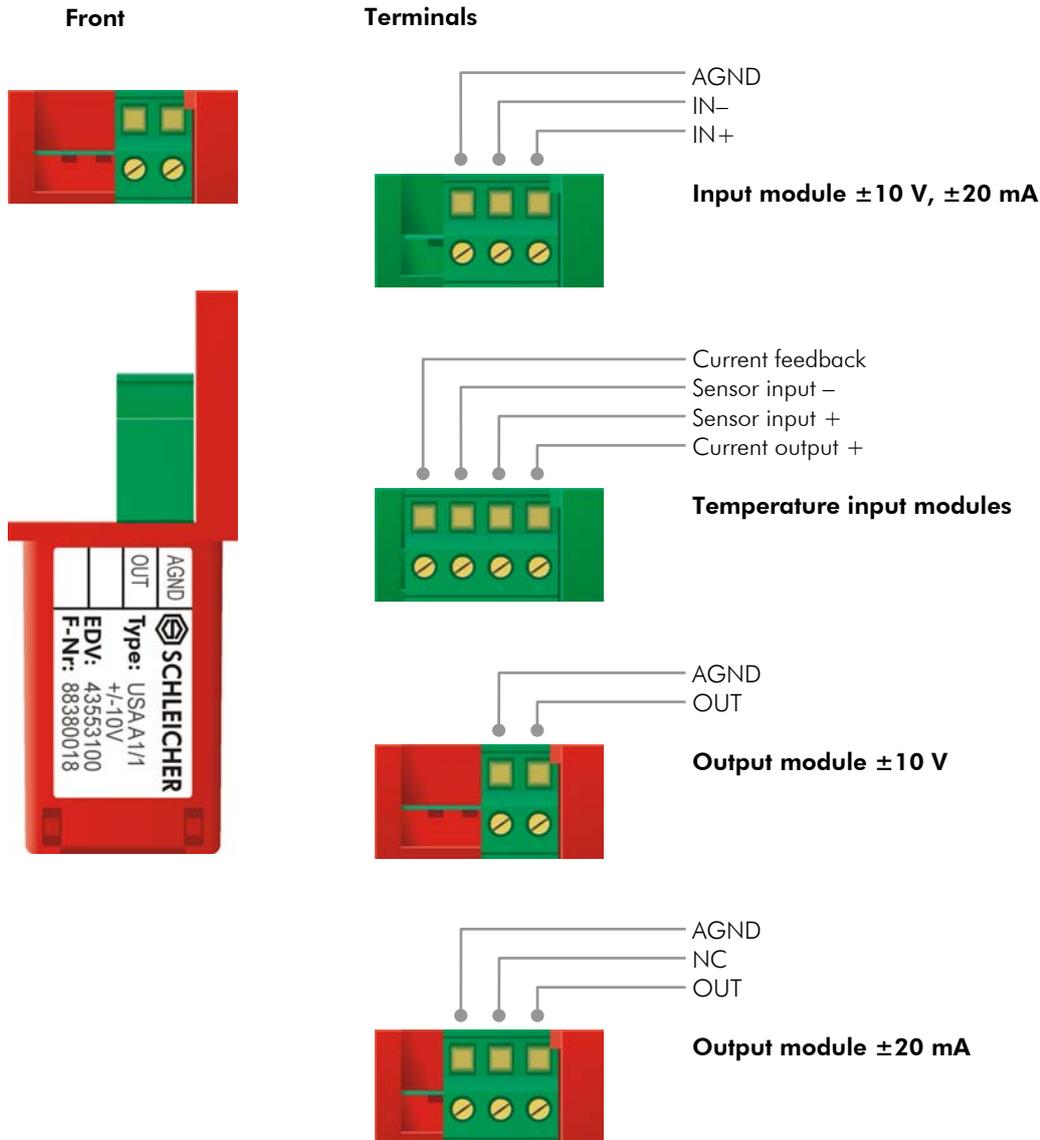
For general technical data see page 66.

USA Interface Modules • Input Modules

USA Ex/x

USA Interface Modules • Output Modules

USA Ax/x



The plug-in interface modules are used to match the external analog signals to the internal signal level of the USA analog processor.

Eight interface modules can be plugged in on the front of the analog 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

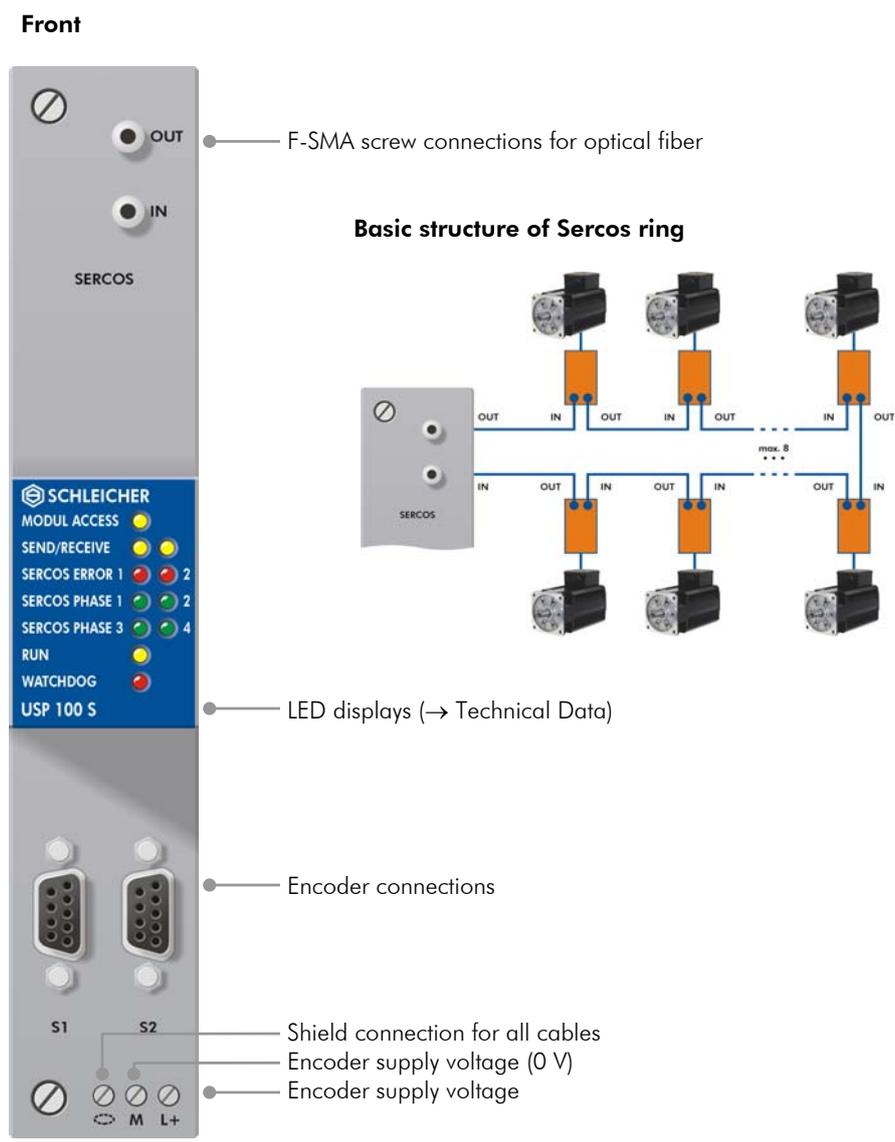
The following interface modules are available:

Type	Function	Range
Input modules		
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	Thermoelement Fe-CuNi	$-147 \dots +880\text{ }^\circ\text{C}$
Output modules		
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
Number of inputs/outputs	1 voltage input	1 current input	1 resistance temperature measuring 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 at current 20 mA; input resistance (burden) = 0.125 Ω	-	-	Max. output current 20 mA; output voltage short-circuit-proof at short-circuit current 125 mA	-
Internal power consumption DC 24 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 analog processor	8	8	8	8	8	3
Maximum current for +15 V / -15 V	63.0 / 66.0 mA					
Weight	0.02 kg					

For general technical data see page 66.

Positioning Processor • Sercos Master • 8 Axes **USP 100 S**



The USP 100 S positioning processor provides the XCn control system with a SERCOS interface. 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 100 S module can operate up to 8 SERCOS controllers.

Up to 64 NC axes can be driven using a controller configuration with an XCn control unit and 8 USP 100 S modules. Each SERCOS ring is synchronized with the XCn 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.

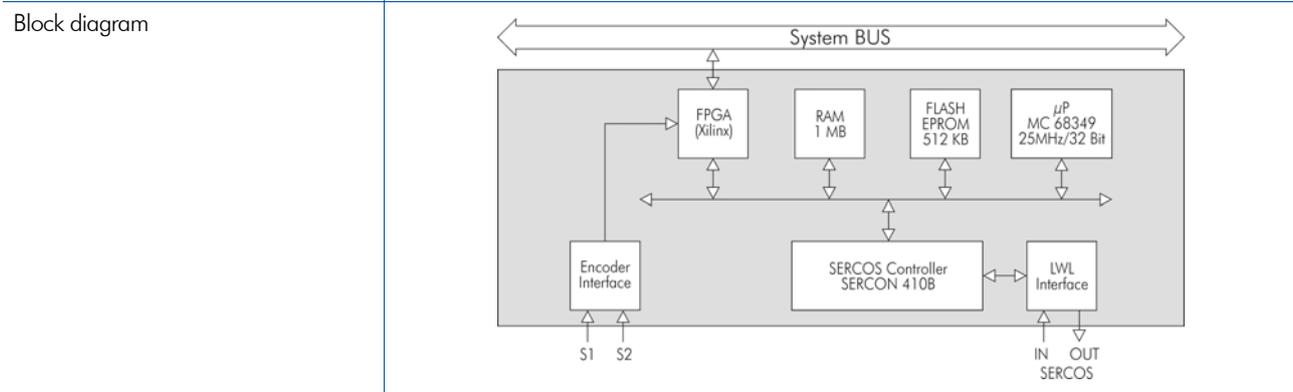
Synchronized digital data exchange makes the USP 100 S module ideal for manipulators, high-performance CNC machines and robots.

The module has two F-SMA connections for optical fibre (standardized IEC 874-2 connection) and two 9-pin sub-miniature connections for handwheel/encoder.

DriveTop interface

A protocol implemented in the controller allows communication with a Bosch-Rexroth DriveTop interface via the serial PC interface on the XCx 700. Thus the drive parameters can be easily output, optimized and saved.

Technical data		USP 100 S
Article number		R4.315.0270.0
Number of controllable axes		8
Processor		MC 68349 25MHz, 32 Bit
Memory		1 MB RAM, 512 KB FLASH-EPROM
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 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

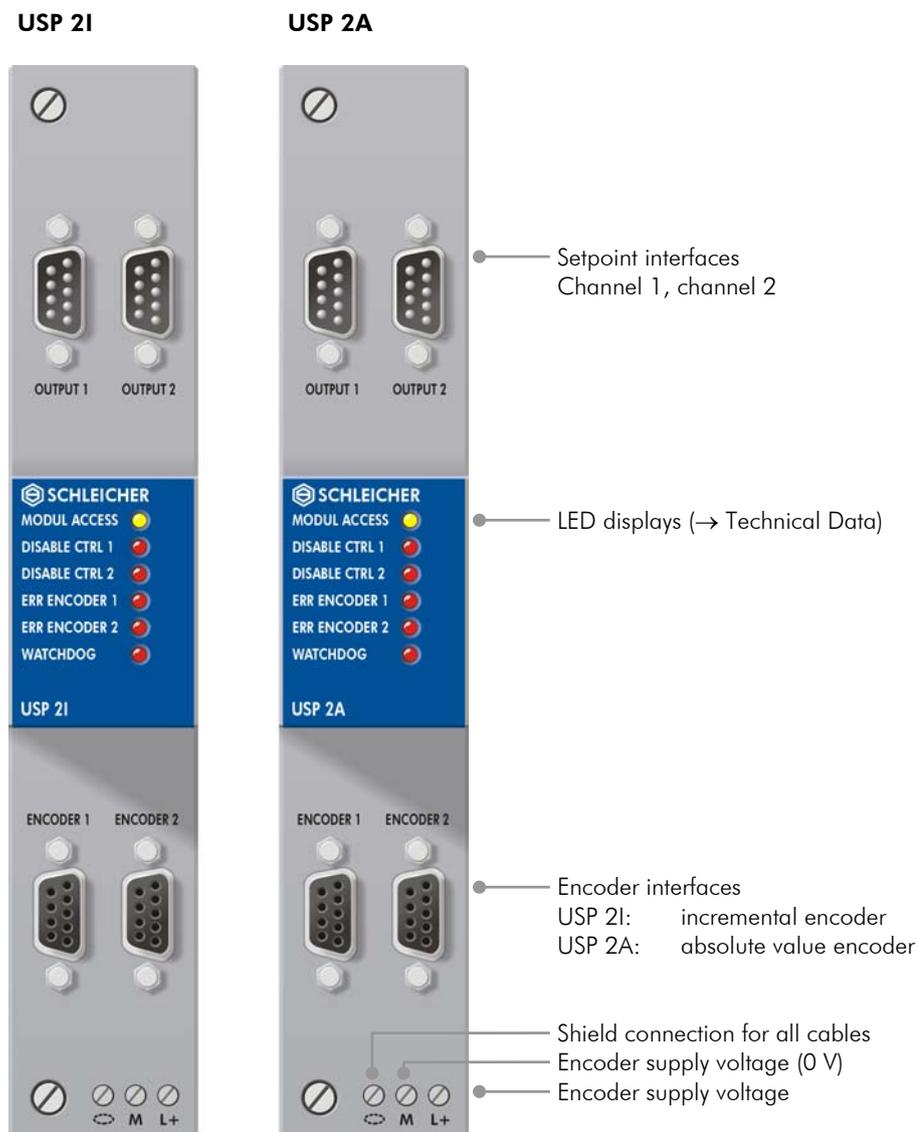


Position controller data	
Travel range	± 1 m at 0.1 μm resolution ± 10 m at 1 μm resolution ± 100 m at 10 μm resolution
Velocity	1 mm/min ... 300 m/min
Acceleration	1 mm/s ² ... 100 m/s ²
SERCOS cycle time	0.5 ms ... 4 ms (adjustable in 0.5 ms steps)

LED displays			
	MODUL ACCESS	on	Controller access to module OK
		off	Control unit in STOP mode or module not programmed by user program or module defective
	SEND / RECEIVE	on	Send / receive active
	SERCOS ERROR 1	on	Software error
	SERCOS ERROR 2	on	Hardware error; LED indicates distortion of the received optical signal. The brightness gives an indication of the degree of distortion. Causes: Optical fibre bent or broken, connection dirty.
	SERCOS PHASE 1/2/3/4	on	SERCOS run-up phase 1/2/3/4
	WATCHDOG	on	Error; controller lock activated for all axes, error message sent to control unit
		off	Controller access to module OK within cycle time

For general technical data see page 66.

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 remotepage modules on the system bus. Data communication with the control unit is via a dual-port RAM (shared RAM).

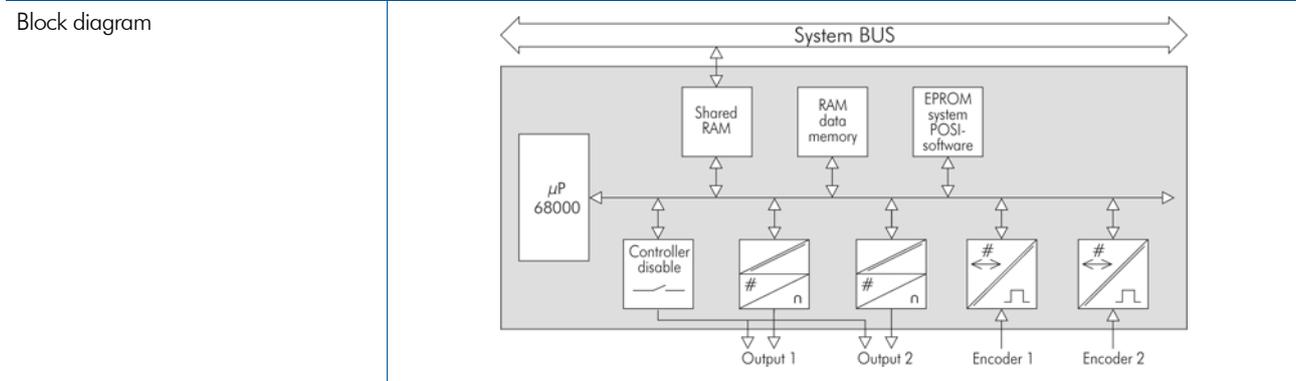
In connection with the XCN 700 CNC control unit they allow you to create high-velocity contouring control. The control unit can control up to 32 USP 2I / USP 2A modules (but if other types of remotepage module are also used, this number is reduced correspondingly).

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
Number of controllable axes	2 (max. 8 USP per control unit)	
Internal power consumption	DC 24 V: 2.3 W / DC 5 V: 1.5 W	
Connection	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 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-; Not for clock pulse+ / clock pulse-
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-bit
Shunt	1 kOhm
Isolation	yes; but not OUTPUT 1 / OUTPUT 2

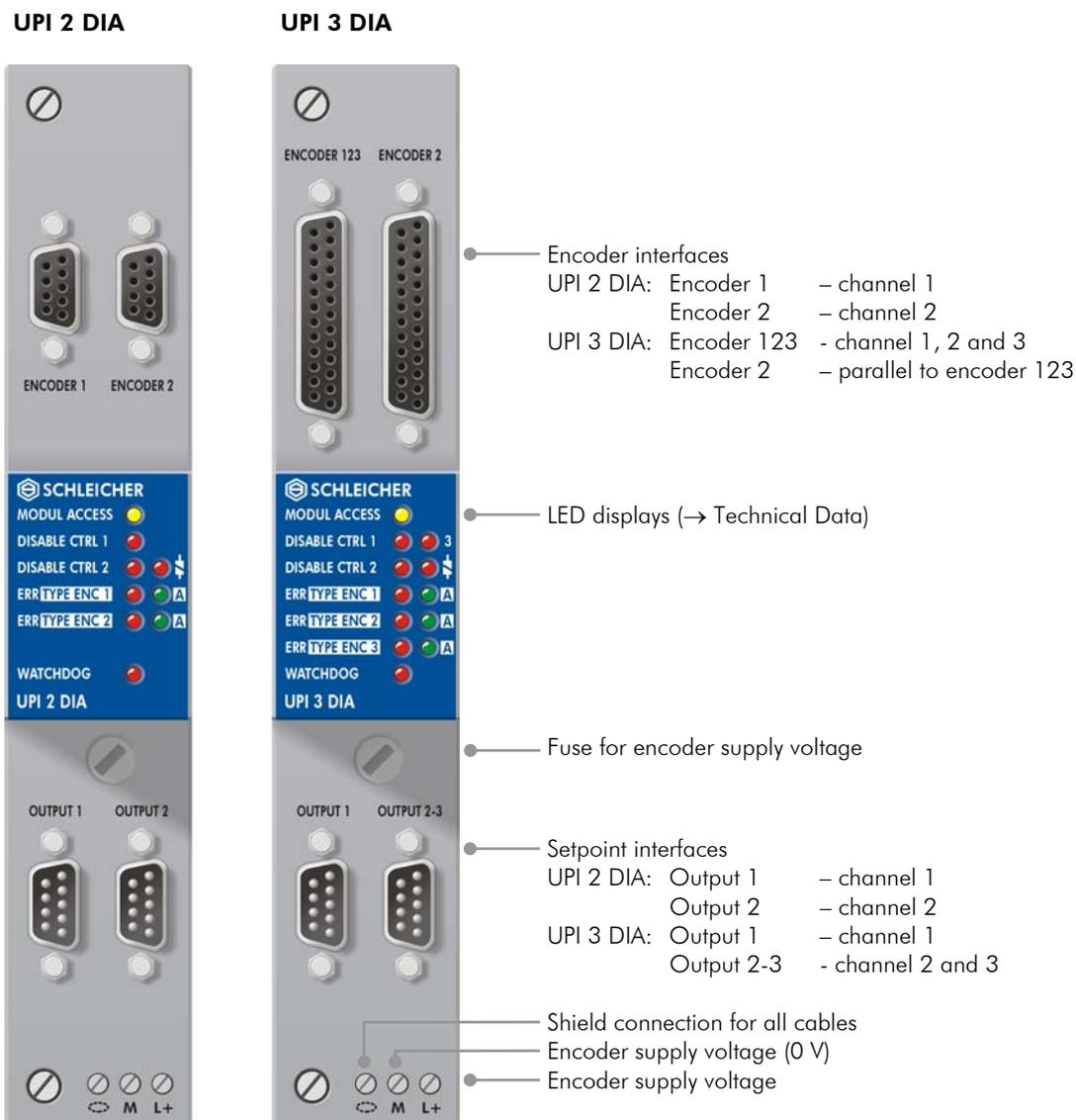
Position controller data	
Travel range	± 1 m at 0,1 μm resolution ± 10 m at 1 μm resolution ± 100 m at 10 μm resolution ± 1000 m at 100 μm resolution
Position control cycle	2 ms
Velocity	1 mm/min ... 300 m/min
Acceleration	1 mm/s² ... 100 m/s²

LED displays identical for USP 21 and USP 2A

LED Display	State	Description
SCHLEICHER MODUL ACCESS	on	Controller access to module OK
	off	Control unit in STOP mode or module not programmed or module defective
DISABLE CTRL 1 DISABLE CTRL 2	on	Controller disable on and desired speed = 0 V for axis 1 and 2
	off	Controller disable off for axis 1 and 2
ERR ENCODER 1 ERR ENCODER 2	on	Interruption (cable break) of one or more encoder signals for axis 1/2
	off	
WATCHDOG	on	Microprocessor monitoring activated; control unit outputs error message and controller disable is activated on axes 1 and 2.

For general technical data see page 66.

Positioning Interface • 2 Axes Positioning Interface • 3 Axes	UPI 2 DIA UPI 3 DIA
--	--------------------------------------



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 analog 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.

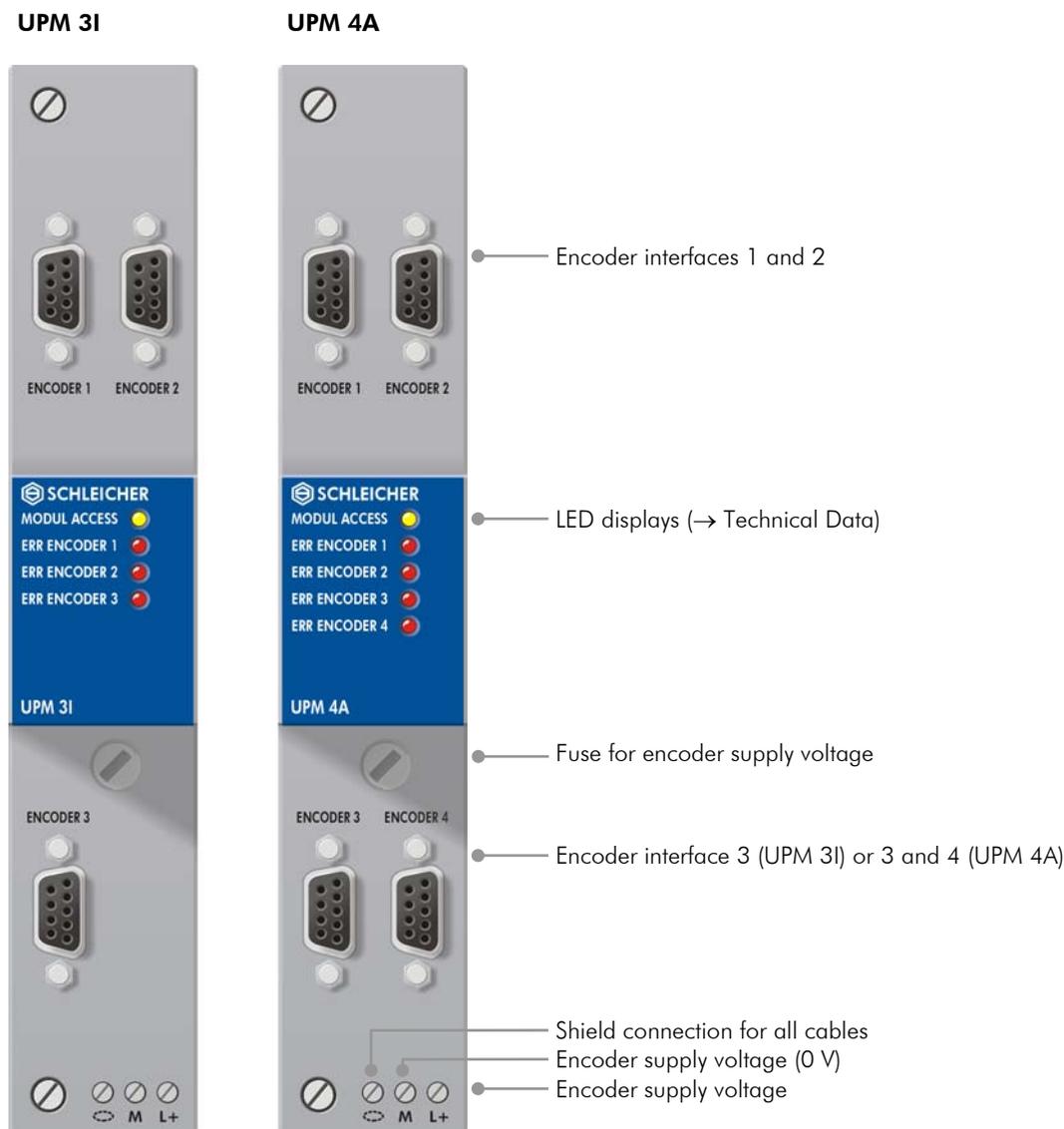
Controller enable and controller disable

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	
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	Encoder Setpoints, enabling outputs	Subminiature 9-pin connector Subminiature 9-pin connector	Subminiature 25-pin connector Subminiature 9-pin connector	
Connecting lines	Encoder Setpoints, enabling outputs	Cable to Heidenhain rules 5-core, shielded, 0.25 mm ²		
Isolation	Encoder Setpoints Enabling	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		
Encoder inputs incremental				
Encoder inputs		A, /A, B, /B, zero, /zero (/ = inverted signal)		
Max. encoder frequency / counting frequency		150 kHz / 600 kHz (after internal pulse quadrupling)		
Max. travel velocity		36 m/min at 1 μm resolution, 10 ms positioning cycle		
Encoder inputs absolute				
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 bit		
Setpoint outputs				
Resolution		12-bit		
Enabling outputs		Potential-free relay contacts, switching voltage DC 24 V / 100 mA, permanently short-circuit-proof		
LED displays for UPI 3 DIA (where data for UPI 2 DIA differs it is given in <i>italics</i>)				
	MODULE ACCESS	on	Controller access to module OK	
		off	Control unit in STOP mode or module not programmed by user program or module defective	
	DISABLE CTRL x	on	Controller disable on and desired speed = 0 V for axis 1/2/3 (<i>Axis 1/2</i>)	
		off	Controller disable off for axis 1/2/3 (<i>Axis 1/2</i>)	
	 RELAY OFF		As LED DISABLE CTRL x	
	ERR TYPE ENC x	on	Interruption (cable break) of one or more encoder signals for axis 1/2/3 (<i>Axis 1/2</i>)	
		off	Processing OK for the six encoder signals or the absolute encoder signals for axis 1/2/3 (<i>Axis 1/2</i>)	
	 A	on	Absolute Encoder or Digital Servo mode for the corresponding axis	
		off	Incremental Encoder mode	
	WATCHDOG	on	No control unit access to UPI 3DIA within cycle time; control unit outputs error message and controller disable is activated on axis 1/2/3 (<i>Axis 1/2</i>).	
	off	Controller access to module OK within cycle time		
				

For general technical data see page 66.

Position Detection • 3 Channels • Incremental Encoder	UPM 3I
Position Detection • 4 Channels • Absolute Encoder	UPM 4A



UPM 3I and UPM 4A position detection modules provide position detection with incremental or serial/absolute encoders.

UPM 3I

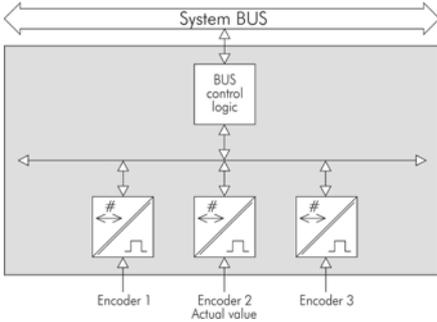
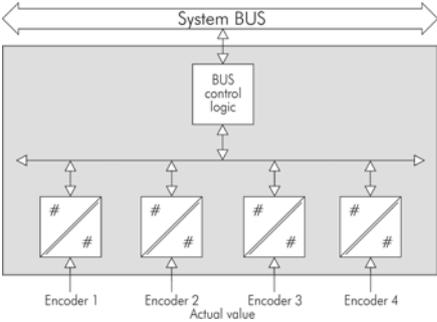
The UPM 3I provides three independent channels for incremental position encoders. The signals are isolated from the control electronics by optocouplers. The direction of rotation of the three position encoders are detected and sent to three fast counters. The axes are monitored for cable break and short-circuit.

UPM 4A

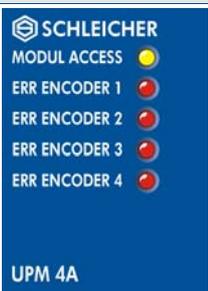
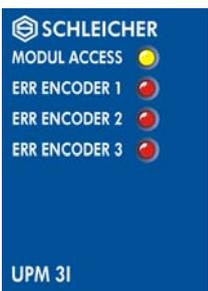
The UPM 4A provides position encoding for four independent channels with synchronous serial/absolute position encoders. The signals are isolated from the control electronics by means of optocouplers.

The position encoder actual values are processed and made available in words, which are used for data traffic between the control unit and the UPM 4A position detection module.

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.

Technical data	UPM 3I	UPM 4A
Article number	R4.315.0080.B	R4.315.0060.C
Number of axes	3 (max. 2 UPM per control unit)	4 (max. 2 UPM per control unit)
Internal power consumption	DC 24 V: 1.1 W	DC 24 V: 0.5 W / DC 5 V: 1.1 W
Connection	3 subminiature 9-pin connectors	4 subminiature 9-pin connectors
Weight	0.47 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									
Pulse frequency / clock pulse freq.	Max. 250 kHz	156 ... 624 kHz, set by software									
Connection between clock pulse frequency, conversion time and cable length		<table border="1"> <tr> <td>156 kHz</td> <td>160 μs</td> <td>300 m</td> </tr> <tr> <td>312 kHz</td> <td>80 μs</td> <td>100 m</td> </tr> <tr> <td>624 kHz</td> <td>40 μs</td> <td>50 m</td> </tr> </table>	156 kHz	160 μs	300 m	312 kHz	80 μs	100 m	624 kHz	40 μs	50 m
156 kHz	160 μs	300 m									
312 kHz	80 μs	100 m									
624 kHz	40 μs	50 m									
Range	+32767 ... -32768, can be extended by software to double word (32 Bit)	25-bit									
Signal inputs	6 (channel A, B, 0, /A, /B, /0, TTL-level)	2 (data+, data-)									
Transmission time	–	40 ... 160 μs (see above)									
Input load	200 ohms	270 ohms									
Signal outputs	–	2 (clock pulse+, clock pulse-)									
Isolation	By optocouplers	Yes for data+ / data- Not for clock pulse+ / clock pulse- Yes for control electronics / encoder									
Encoder supply voltage	Encoder-dependent (DC 5 ... 24 V external supply)										
Fuse	F1,6/250C fuse	F2/250C fuse									

LED displays for UPM 4A (where data for UPM 3I differs it is given in <i>italics</i>)				
 <p>UPM 4A</p>	MODULE ACCESS	on off	Controller access to module OK Control unit in STOP mode or module not programmed by user program or module defective	
	 <p>UPM 3I</p>	ERR ENCODER x	on off	Interruption (cable break) of one or more encoder signals for axis 1/2/3/4 (Axis 1/2/3) Processing OK for encoder signals for axis 1/2/3/4 (Axis 1/2/3)

For general technical data see page 66.

PLC Operating System

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

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

The PLC operating system is a component of all XCS 700 and XCN 700 control units.

PLC and CNC are started up and operated using the Schleicher-Dialog software (→ page 64).

CNC Operating System

The CNC operating system to DIN 66025 gives the XCx 700 a broad additional spectrum of standard and special functions. A complete PLC operating system to IEC 61131-3 is integrated (see above). This close meshing of CNC and PLC via the shared RAM (→ page 11) allows you to interpolate technology parameters with path motion.

The CNC software on the XCx 700 is based on SCHLEICHER's proven CNC tools. As well as the standard CNC functions it also includes special algorithms, for example for robot control and synchronous axes. N-dimensional freeform interpolation with the Online-Curve-Interpolator (OCI) offers enormous gains in handling and machining efficiency through smooth motion and quick, steady acceleration. For up to 32 NC axes the XCx 700 offers parallel program and tool management in several NC subsystems and flexible parameterizability of program memory management, tool memory, circle error tolerance and axis-specific interpolation fineness.

- Suitable for extremely fast process/machine controllers
- Interpolates up to 32 NC axes
- NC axes are positioned precisely, interpolated and transformed
- Support for virtual line shafts and electronic cams
- Processes several NC programs in parallel (option)
- NC axes can be shared by several NC subsystems
- Circle, helix and freeform interpolation
- 3-D contour grinding cycles
- Optimized robot motions
- Data reduction and path optimization with Nerthus software (option)
- Online Curve Interpolator (OCI) (option)

The CNC operating system is a component of all XCN control units. The number of interpolated NC axes and subsystems varies according to the controller type (→ page 17).

PLC and CNC are started up and operated using the Schleicher-Dialog software (→ page 64).

CNC Software Options

Article number	Designation
R4.320.0350.0	NERTHUS 6-AXES
R4.320.0460.0	CNC 03 • NC subsystems
R4.320.0620.0	CNC 06 KOOR • Coordination transformation
R4.320.0430.0	CNC 08 SSK • Leadscrew compensation
R4.320.0450.0	CNC 09 • Nerthus freeform interpolation
R4.320.0440.0	CNC 10 OCI • OCI freeform interpolation
R4.320.0510.0	CNC 14 REV • Reverse processing

Programming System to IEC 61131-3

Multiprog

Configuring is carried out with the Windows programming system Multiprog according to IEC 61131-3. It is matched to the resources of the XCx 700 to ensure easy operation. This means you have a clearly structured, easily operated tool for editing, compiling, debugging, managing and printing PLC applications in all the development phases.

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

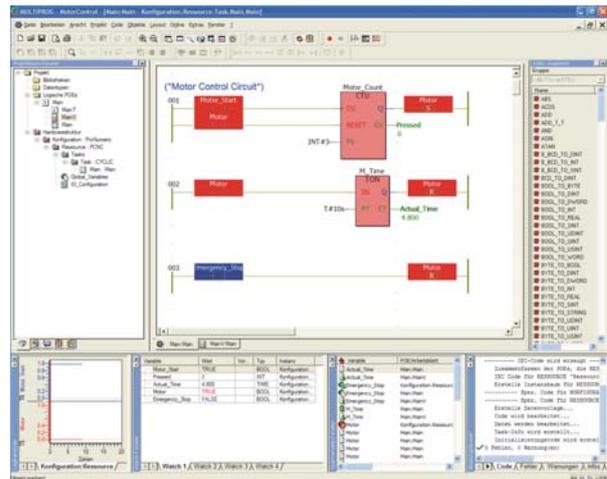
- Text languages
 - Structured text (ST)
 - Instruction list (IL)
- Graphic languages:
 - Function block diagram (FBD)
 - Ladder diagram (LD)
 - Sequential function chart (SFC)

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

An OPC server is included in the Multiprog package (→ page 12).

The main features:

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

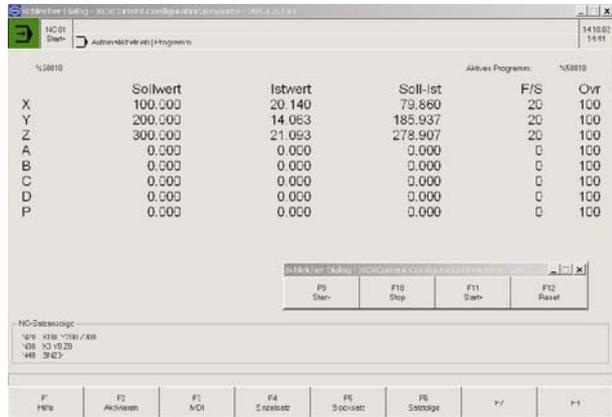


Multiprog 4.0	
Article number	R4.320.0640.0
Contents	CD 1: Programming software, OPC server CD 2: Service Pack (see below)
Operating system	Windows 95/98/ME/NT4.0 (SP5 and later)/2000/XP
System requirements	Pentium PC 133 MHz, 32 MB RAM, 80 MB hard disk capacity, graphics 800 x 600 pixels / 256 colours,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

Utilities and Updates		Service Pack
Article number	R4.320.0590.0	
Contents	1 CD: Controller software for all Schleicher controllers, AddOns, Schleicher-Dialog (→ page 64), documentations and service informations	

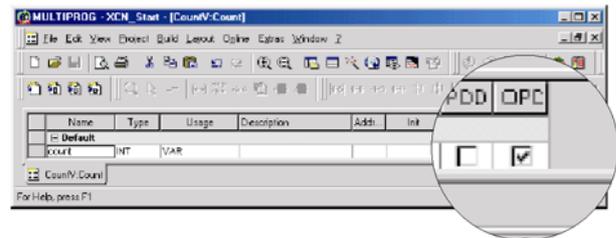
Startup and Operation Schleicher-Dialog

The Schleicher-Dialog PC tool is available for starting up and operating the XCx 700. It communicates with the controller via Ethernet. It is included in the Service Pack CD (→ page 63).



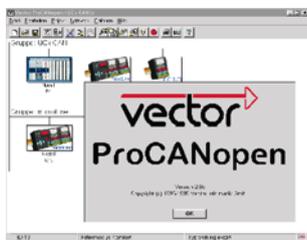
The program automatically detects which operating system is on the controller (pure PLC or CNC/PLC) and selects the appropriate input and display masks:

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



In the variable dialogs on Multiprog the controller data and variables where the OPC server requires read/write access are simply designated OPC (→ page 12).

CANopen Network Configuring Software ProCANopen



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

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

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

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

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

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

Cable

UKK interface cables are used for connecting interface modules
UKZ ↔ UKE or UKE ↔ UKE (→ pages 16 and 22).

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	2x subminiature 50-pin connector with slide lock	
Cable	Transparent PVC, shielded, 50 x 0.14 mm ² , 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 used to buffer the control unit RAM (→ pages 24 and 26).

Technical data	UNB 24	UNB 115/230
Article number	R4.318.0130.0	R4.318.0050.0
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
R4.322.1610.0	Commissioning Field Bus Systems
R4.322.2090.0	CNC Programming for XCx and ProNumeric
R4.322.1070.0	EMC Guidelines

The operating manuals can be downloaded from the products pages at www.schleicher-electronic.com.

System Descriptions

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

The system descriptions can be downloaded from the products pages at www.schleicher-electronic.com.

Technical Data

Housing and installation

Dimensions (W x H x D)	UNG 230 / UNG 115 power supply units:	71.0 x 200 x 150 mm	
	All other modules:	35.5 x 200 x 150 mm	
	Racks:	Slots	Dimensions
	Widths differ according to number of slots	4	190 x 200 x 18 mm
		8	332 x 200 x 18 mm
		12	474 x 200 x 18 mm
		16	616 x 200 x 18 mm
		20	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)
Burst	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

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

Desire and Reality

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

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

Service and Solutions

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

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

Theory and Practice

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

Question and Answer

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

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