RIO Field Bus System / microLine PLC

Remote I/O Systems and Controllers

System Description

schleicher
control systems

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RIO / microLine Field Bus Modules

The RIO system provides the connection between the field devices and the controller. RIO's modular structure guarantees made-to-measure application and a high degree of flexibility.

Digital and analog I/O modules and function modules for temperature detection, counter and positioning are available for connecting the periphery. Field device wiring to the I/O modules does not depend on the field bus type. The bus coupler connects the modules to a Profibus-DP, Interbus, DeviceNet or CANopen field bus. This means that you can change the bus system without any effect on the existing wiring.

Up to eight modules can be connected in any combination at one bus node. The internal bus connection and voltage supply are provided by integrated slide contacts. The 24 V supply is provided through external terminals and can be passed from module to module, or fed separately if more current is required. This concept does without lateral connectors and power contacts, allowing a module to be changed easily without removing the other modules. Similarly, special feed, separation and terminator modules are also unnecessary.

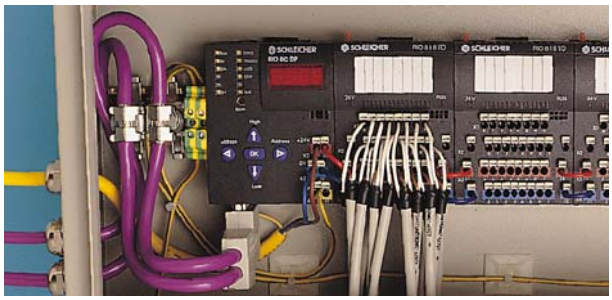
The bus couplers can optionally be supplied with comprehensive functions for on-the-spot commissioning and diagnosis without other aids. With the microLine PLC mini-controller SCHLEICHER also offers a synthesis of bus coupler and powerful PLC, which can undertake data (pre-)processing controller tasks and thus reduce the load on the field bus.

We have digital compact modules with integrated bus coupler for plant-floor applications with relatively few channels.

RIO Modular Field Bus System

Field Bus Is Standard

Periphery connection via field bus has largely superseded conventional parallel cabling for automation – distributed I/O circuitry offers considerable advantages. The field devices, sensors and actuators are wired locally to I/O modules. The signals are forwarded to the controller by the field bus. Long, expensive and confusing cable routes are a thing of the past. Segmentation into individual bus nodes makes it much easier to install and diagnose the system.



The Schleicher RIO (Remote Input Output) system offers a cutting-edge concept for communication between controller and periphery. Modular I/O nodes are installed on the plant floor and networked via the field bus. If required, data (pre-)processing can be carried out directly in the bus node by microLine modules with PLC capabilities and function modules. This reduces the load on the field bus and the higher-level controller.

Modular

Modules form the interface between PLC/CNC or bus coupler and the field. With modules you can adapt flexibly to different tasks and requirements.

- Digital and analog inputs/outputs can be combined as required. The process-specific signal mix is taken up, passed on and output, all according to requirements.
- Modules can be changed quickly and simply.
- Sensors and actuators can be wired independently of the field bus.
- You can change to a different field bus system by just changing the bus coupler.

Remote

Remote on-the-spot connection instead of wiring in the central enclosure has decisive advantages.

- Wiring costs are reduced because cable routes are not required.
- Clarity is increased and maintenance is easier.
- Segmented start-up of plant and machine components is possible.
- Doing without large central units reduces costs.

Networked

RIO is a consistent complete system for various field bus systems for machine-building and plant engineering.

- Profibus-DP
  Communication with remote periphery devices
- Interbus
  Field bus for the sensor/actuator level
- DeviceNet
  Simple device network with CAN technology
- CANopen
  Real-time-capable multi-master network

Intelligent

RIO allows networked automation to use the enormous rationalization potential of remote intelligence.

- The microLine PLC controller and the RIO function modules provide optimally matched controller performance.
- Local data processing results in short reaction times without field bus delay and thus increases precision and reproducibility of results.
- Parallel data processing reduces bus load.
- Intelligent components improve emergency running properties if the field bus fails.

Components in the RIO System

microLine PLC

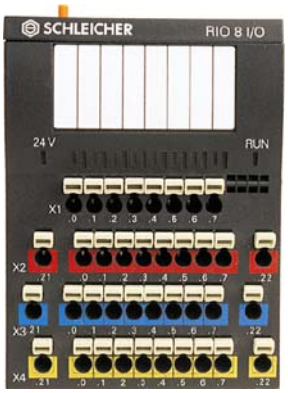
Powerful mini-controller optionally with integrated CANopen bus coupler for data processing within the node.

- PLC programs directly in the bus node
- Multitasking operating system
- Integrated commissioning and diagnosis functions.
- Up to 8 modules can be attached locally
- Expansion with RIO modules via CANopen field bus
- Also available as stand-alone controller without field bus connection

RIO Bus Couplers

The bus coupler connects the modules to Profibus-DP, Interbus, DeviceNet or CANopen field buses.

- 8 RIO I/O modules can be connected in any combination (digital, analog, expert modules)
- Up to 128 digital or 56 analog I/Os can be connected locally
- Field bus diagnosis via LEDs
- BC series with display, keypad and integrated commissioning and diagnosis functions
- EC series as low-cost economy version



Expansion Modules

- **Digital modules** with 4, 8 or 16 input/output channels
- DC 24 V, AC 130/240 V, relay
- Outputs can be connected in parallel, short-circuit-proof and overcurrent-protected

- **Analog modules** with 4 input/output channels for voltage or current
- Short-circuit-proof outputs
- Voltage inputs as differential inputs with ±10 V
- Current inputs single-ended, range 0..20 mA or 4..20 mA

- **Function modules** for temperature, counter and axis control
- Plant-floor data collection and process control
- Configuration memory, paarameterizable via PLC and bus coupler
- Reduced load on field bus
- Reduced load on central controller

Compact I/Os

Digital compact I/Os for bus nodes with few channels.

- Integrated bus coupler for Profibus-DP, Interbus, DeviceNet and CANopen field buses
- Channels isolated from internal bus by optocouplers
- Signal delay of inputs typ. 2 ms (hardware)
- Signal delay of outputs < 100 µs (hardware)
- Max. output current per channel 1 A
- Outputs can be connected in parallel, short-circuit-proof and overcurrent-protected

Well Thought-out – in the Concept ...

The modules establish the PE connection automatically when they engage on a **DIN rail**

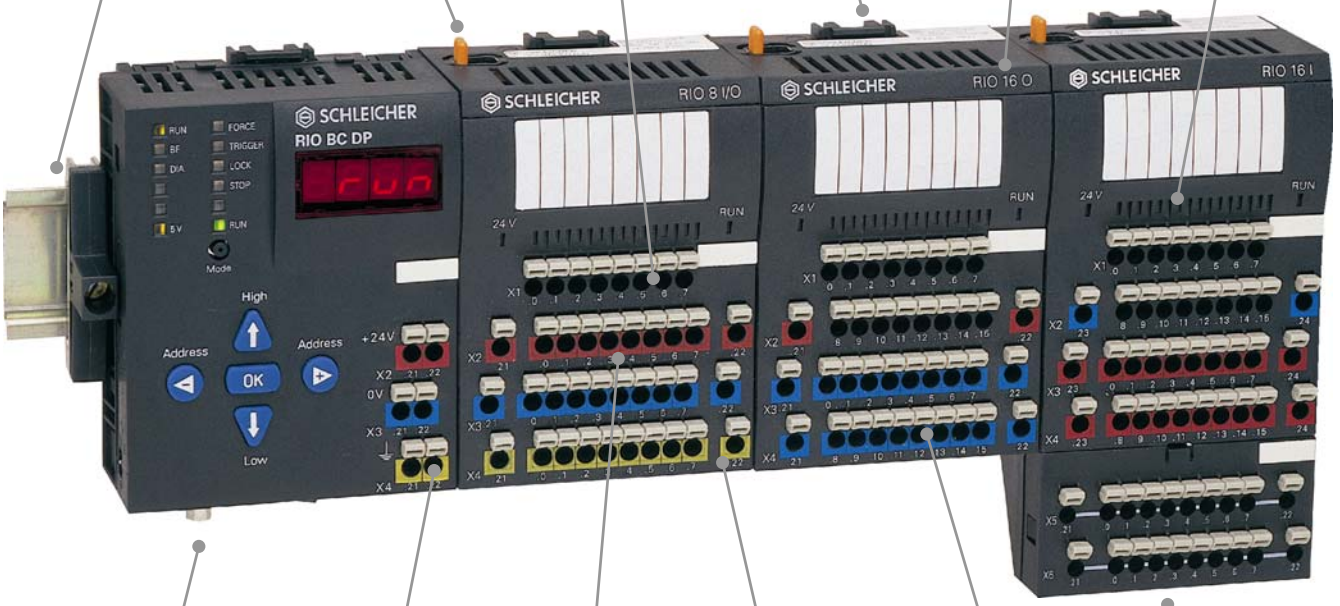
Internal bus connection and voltage supply via **slide contacts** – fast, safe and impossible to lose

Some digital I/O modules have **combination channels** which can be used as inputs or outputs, as required

Low space requirement – up to 16 channels on **69 mm module width**

Eight digital, analog and function modules can be **combined as required** in a bus node

LEDs for external voltage supply and data transmission, **channel monitoring** via LED sequences



Interface for field bus (additional on microLine PLC: two programming and diagnosis interfaces RS232)

Voltage supply can be looped through or provided individually

Four-wire system cuts out additional jumpers

Clear **colour-coding** prevents wiring mistakes

Spring terminals guarantee high dependability – fast, vibration-resistant and maintenance-free

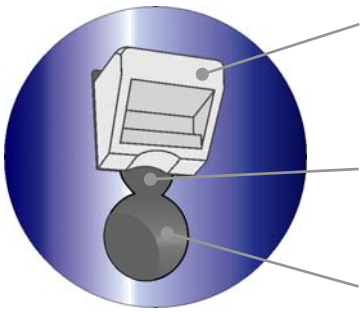
Plug-in **terminal extension** for three-wire or four-wire connection

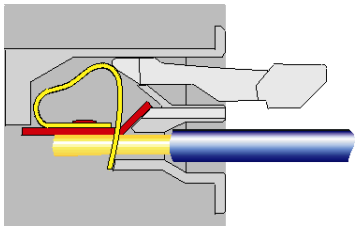
... and in the Detail

Spring-Loaded Clamping Key System

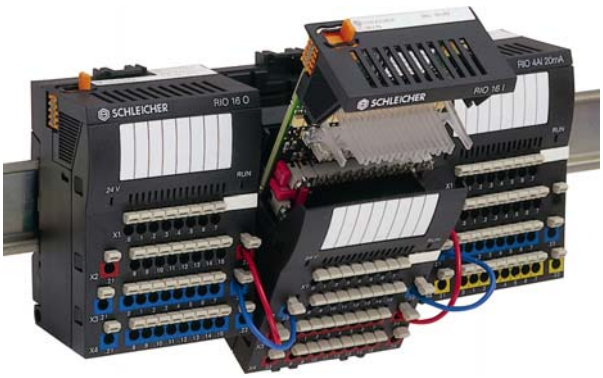
The spring-loaded clamping key system of the terminals on the RIO modules makes for simple fast wiring and thus saves on installation costs.

The spring is pre-tensioned by pressing in the clamping key. The clamping space is open. Insert the cable and push the clamping key up. Finished. The spring terminals guarantee vibration-resistance and constant clamping force. Each terminal is equipped with a measuring point for a test prods with Ø 2 mm. You can find more information on opening and closing the terminal on page 34.





Replacing the Module Electronics



Electronics can be replaced without detaching wiring. So there is no additional work for rewiring and minimized costs through reduced stoppage times. Mechanical coding prevents insertion of incorrect electronics.

LEDs and Display

Bus couplers from the BC series use LEDs and a four-position display to provide data on module status, mode, bus connection and errors.

- Left row of LEDs:
  - RUN – bus coupler processor running
  - 5V – internal power supply works fine
  - Inbetween, bus-specific diagnosis LEDs

- Right row of LEDs
  - FORCE, TRIGGER, LOCK, STOP
    – special commissioning and diagnosis modes
    (→ page 20)
  - RUN – "normal" mode

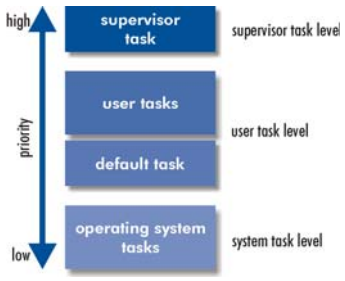
- Display
  - Active operating mode display
  - Number of a selected I/O channel
  - Value of the channel
    (high/low for digital channels,
    voltage or current for analog channels)
  - Setting service functions
    (e.g. user lockout with password)
  - Error messages

On the expansion modules a two-colour LED sequence gives information on module status and switching states of inputs/outputs.

- 24 V – DC 24 V supply voltage connected
- RUN – internal data transfer to bus coupler is running
- Channel LEDs
  - display the channel selected on the bus coupler by lighting yellow
  - on digital modules, also display switching state of channels (high/low) by lighting green

Inner Values

Multitask



In a real-time multitasking operating system the PLC is priority-controlled to optimize computing capacity for each task. A task is made up of program modules and is assigned precisely the amount of time required to process it. This means that valuable performance is not wasted in unnecessary waiting cycles. Furthermore, the tasks are assigned different priorities that ensures they are processed in order of importance.

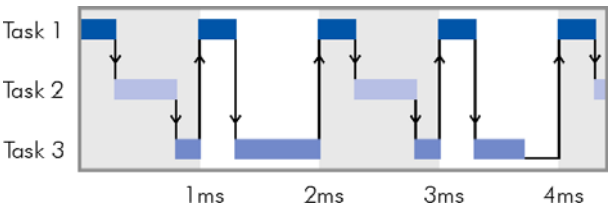
- **Supervisor tasks** (supervisor task level) detect errors (division by zero, task overrun, etc.) and activate the corresponding operating system task.
- **User and default tasks** (user task level)
  - *Cyclical tasks* execute the programs assigned to them within a defined interval under a defined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

Task Priorities

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

Example: PLC program with three tasks

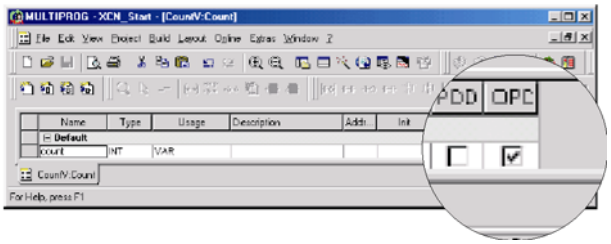
Task 1 • Cycle time 1 ms • Processing time 0.3 ms
Task 2 • Cycle time 2 ms • Processing time 0.5 ms
Task 3 • Cycle time 4 ms • Processing time 1.5 ms



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 64) 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*.

Simply Faster – CANopen PCS

What is "PCS"?

With PDO linking (free assignment of CAN identifiers to individual **P**rocess **D**ata **O**bjects), CANopen creates the possibility of setting up multi-master networks. If, however, the CANopen devices are controlled by a central instance, the CAN identifiers can be restricted to a predefined set, the **P**re-defined **C**onnection **S**et, or PCS. Thus the CAN controller only accepts CAN messages addressed to the respective device. The inputs and outputs on a CANopen device (e.g. the RIO bus coupler) are then available as "communication objects" that can be accessed or sent using the PCS identifiers.

PCS mode offers two decisive advantages:

- The CANopen PCS protocol is easy to implement in a controller or a PC. Configuring is greatly simplified, because within the PCS all CAN identifiers have unambiguous node addresses. This reduces the time and cost involved in setting up simple networks.
- PCS addressing makes the bus couplers insensitive to high bus loading, and ensures very fast I/O communication. With synchronous communication response times of approx. 300 μs are achieved. All four response PDOs are sent within $<$ 1 ms after receipt of a sync (baud rate $=$ 1000 Kbit/s).

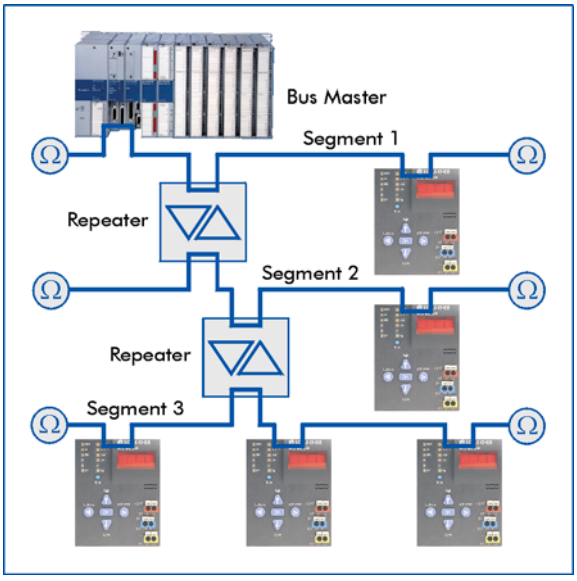
You can find more information on the CANopen bus on page 11.

The Most Important Field Bus

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

The bus topology corresponds to a linear structure with a shielded, twisted-pair line and an active bus terminator at each end. According to the Profibus RS485 specification, up to 32 stations can be connected to each bus segment. If a greater number of Profibus-DP stations is to be operated, the system has to be segmented with repeaters.

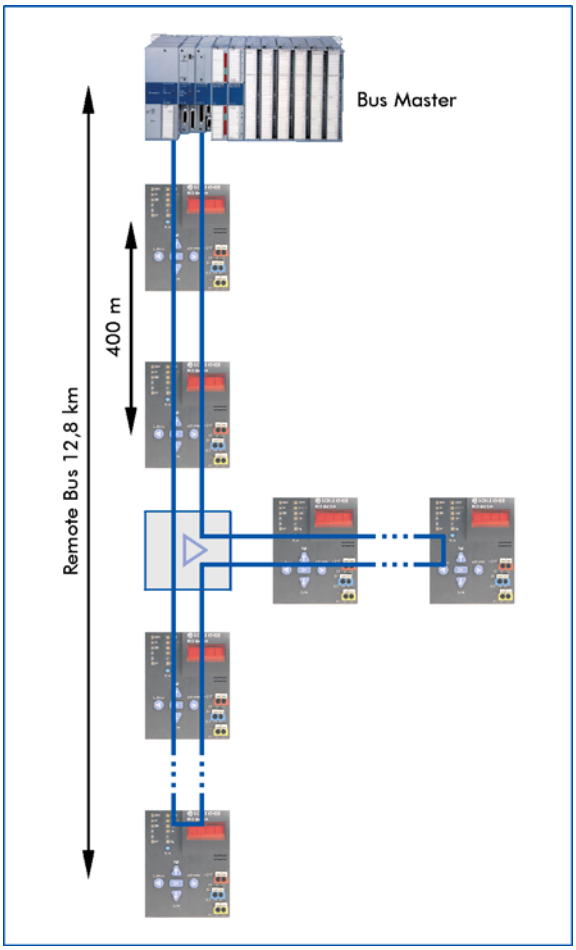
Repeaters connect bus segments electrically and amplify/ refresh the data signals. Repeaters can be used in addition to isolation of bus segments or subsections. Each repeater allows the Profibus system to be extended by an additional full-length bus segment with the full contingent of field devices. Possible bus lengths range from 100 m at 12 MBit/s to 1200 m at 94 KBit/s.



Station-specific data is defined in a standardized equipment master file (GSD), which means that the field bus can be configured by simple plug-and-play. If individual slaves fail or shut off during bus operation the other slaves can still operate.

Interbus was developed as an open field bus system and is standardized in DIN 19258 as a field bus for the sensor/ actuator level. The Interbus topology is a ring system with active bus stations. All stations are connected point-to-point, starting from the master interface. The remote bus version allows distances between stations of up to 400 m and a maximum length of 12.8 km. The local bus version is restricted to 10 m. (The corresponding RIO components are all remote bus stations.) The Interbus transmission rate is up to 2 MBit/s.

Every time you start the master the bus system creates a current list of all the connected stations (slaves). The I/O addresses are assigned by the master in the order in which it finds the slaves. Maximum number of stations is determined by the firmware of the master. The master can diagnose short-circuit and cable break on the I/O modules, as well as failure of a station.



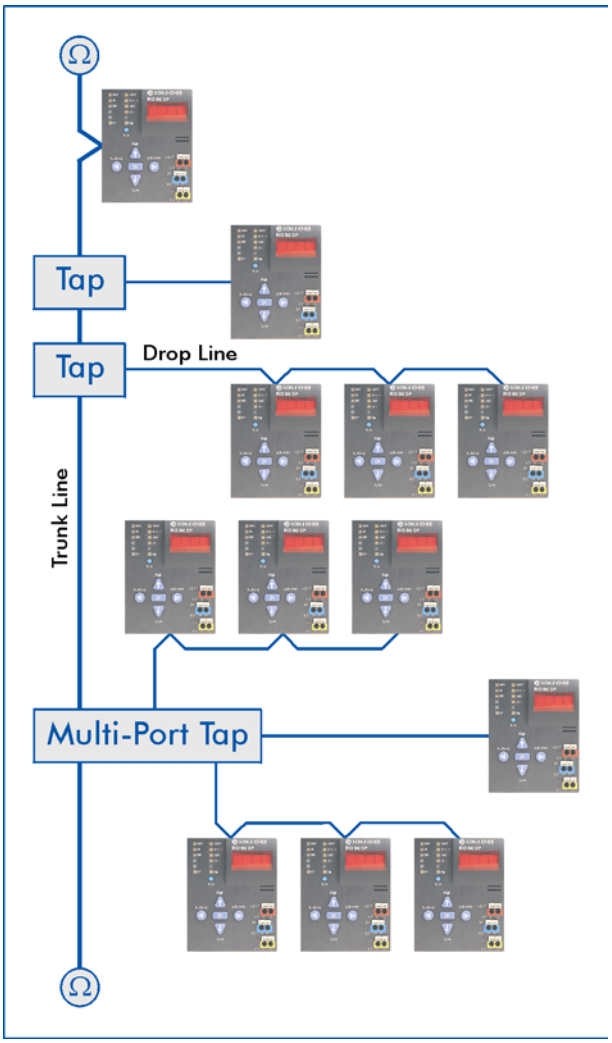
Systems at a Glance

DeviceNet

DeviceNet is a simple network solution. It is based on an open network standard which is internationally recognized and applied. The DeviceNet protocol represents ISO Application Layer 7 and is based on the CAN data transmission protocol. CAN (Controller Area Network) is a data transmission protocol to ISO DIS 11898. It is implemented in integrated circuits and has been marketed globally since 1994 in very large quantities by an international consortium of companies.

The DeviceNet bus topology is linear. Up to 64 stations are connected via an unbranched trunk line with terminating resistors at each end and short drop lines. The cable length depends on the data transmission rate. It ranges from 100 m at 500 KBit/s to 500 m at 125 KBit/s.

Data can be requested cyclically (polling), sent by event control, transmitted cyclically or requested by broadcast.



CANopen

CAN (Controller Area Network) is a multi-master bus system in which all the nodes communicate directly with each other without going through the central master. In this system, known as the broadcasting method, the nodes are not addressed as in other bus systems. Instead, a message from a master is received by all the nodes in the network. Each node decides independently whether to accept the received message. This decision is based on the message identifier, which also defines its priority. High-priority data is sent immediately, lower priority data has to wait until bus capacity is free.

This control of bus access is necessary because by preference the CAN bus operates asynchronously. Process data is sent not in a fixed cycle, but by event control. A message is sent only by a bus station which actually has "something to say", for example because an input value has changed. These two factors, direct and event-controlled communication between nodes, greatly reduce the load on the bus and shorten response times.

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

CANopen defines four types of message, which allow data exchange between the bus nodes. *Network services* control the states of the nodes and the data transmission mechanisms. *Service data objects* (SDO) are used, for example, to configure nodes, set device parameters and load programs. SDOs have low priority and unrestricted length. *Process data objects* (PDO) are used where possible for high-priority transmission of process data. Because their length is restricted to 8 bytes and they allow event-controlled data transmission they provide extremely short response times. *Predefined messages* are used, for example, for synchronization – the simultaneous operation of nodes and their applications.

CAN is based on a linear topology with shielded 2-wire cable and terminating resistors at both ends of the bus. Transmission rates range from 10 kbit/s (>1000 m) to 1 Mbit/s (25 m), depending on the length of the network. Device details are described by the Electronic Data Sheet (EDS), that is used by every standard bus configurator.

microLine PLC

microLine PLC Controller

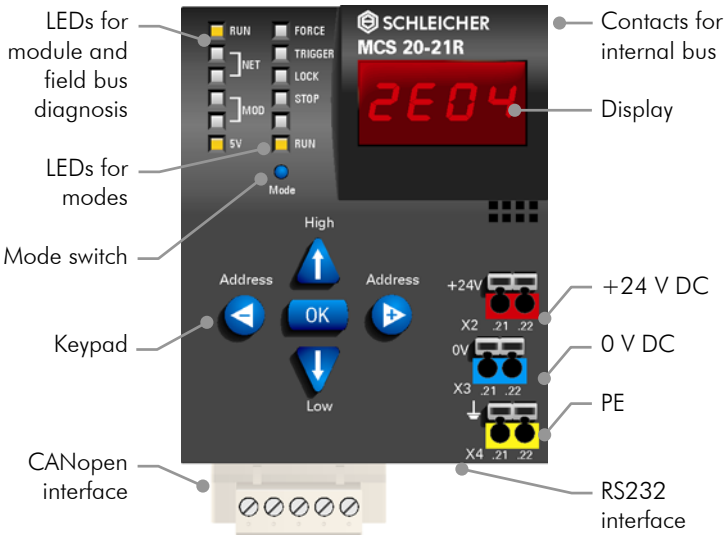
microLine combines the capabilities of a PLC with the functionality of the RIO remote I/O system.

- Powerful PLC with multitasking operating system
- Controllers with CANopen interface and as stand-alone version
- 8 RIO I/O modules can be connected in any combination (digital, analog, function modules)
- Up to 128 digital or 56 analog I/Os can be connected locally
- Remote expansion on CANopen to max. 127 bus nodes
- microLine MCS 20-20R and MCS 20-21R with Multiprog programming system to IEC 61131-3 in Windows environment
- Other MCS software-compatible with Schleicher's Promodul controller series
- All controllers have display, keypad, integrated commissioning and diagnosis functions (→ page 20)
- Connection of additional components for programming, process visualization and terminal mode via two serial RS232 interfaces

Networking in the CANopen field bus allows microLine to show off its full strengths. Here, rather than increasing the performance of a central control system by increasing the clock-pulse rate and the throughput rate of the master PLC, decentralized data processing is carried out in parallel.

- Program memory and computing capacity grow with the number of networked units.
- Local data processing with parallel handling of tasks allows fast reaction times with low bus load. Field bus delay does not interfere with time-critical machine functions.
- The autonomous components have safe emergency running properties. If the field bus should fail, the nodes continue to operate with appropriate emergency control functions – important from the process, economic and safety perspectives.
- The availability and fault-tolerance of the whole system is increased.

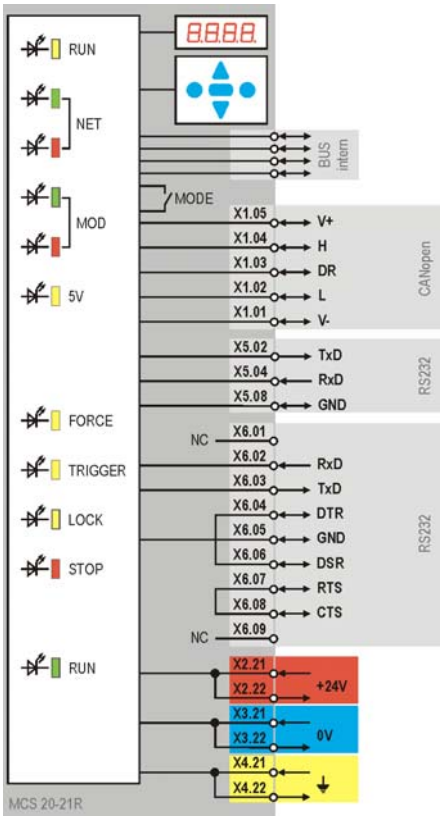
microLine PLC • CANopen • IEC 61131-3 — MCS 20-21R
microLine PLC • IEC 61131-3 — MCS 20-20R

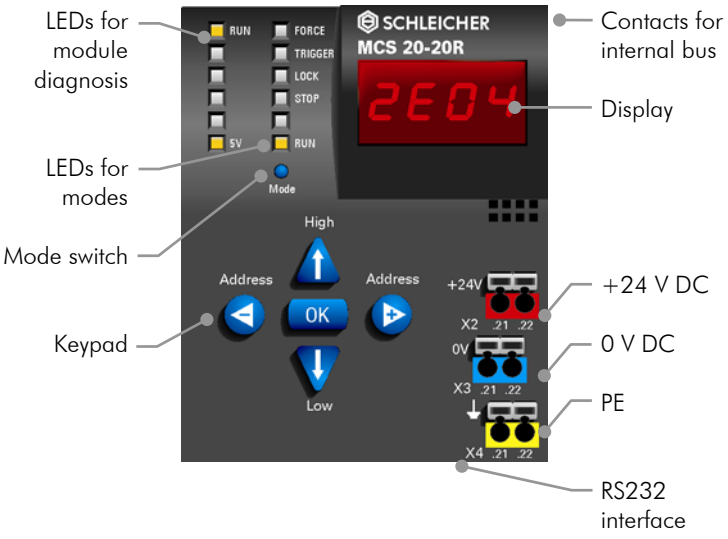


The microLine MCS 20-21R combines bus coupler with PLC. As a bus coupler it combines up to eight digital or analog expansion modules with the CANopen bus. As a PLC it offers intelligence in the field bus and allows decentralized data (pre-)processing.

Configuring is carried out with the Windows programming system Multiprog according to IEC 61131-3, that is matched to the resources of the microLine to ensure simple operation.

Block diagram

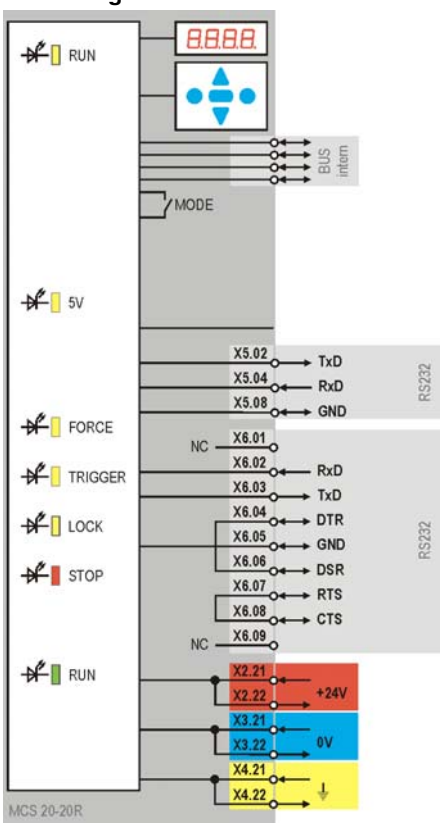


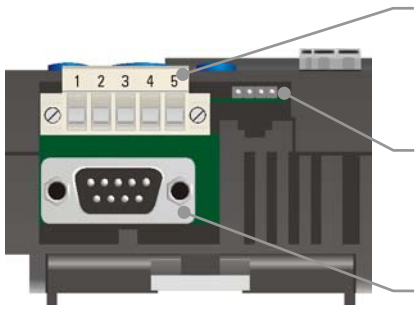


The microLine MCS 20-20R is a stand-alone PLC for on-the-spot data processing in smaller systems. It processes the input/output signals from up to eight expansion modules with 128 digital or 56 analog channels.

Configuring is carried out with the Windows programming system Multiprog according to IEC 61131-3, that is matched to the resources of the microLine to ensure simple operation.

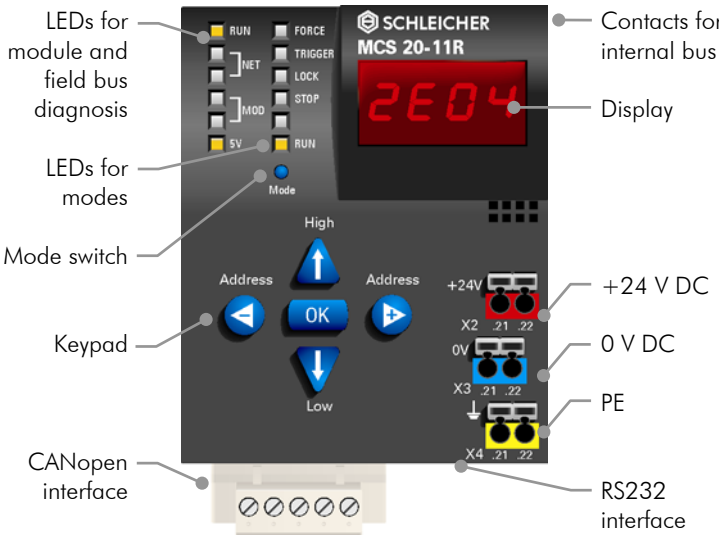
Block diagram



Technical Data	MCS 20-21R	MCS 20-20R
Article number	R5.365.0080.0	R5.365.0070.0
Field bus	CANopen	None
Programming software	Multiprog to IEC 61131-3 (Windows software)	
Hardware and Memory		
CPU	Motorola MC68LC302, 16-bit, 24 MHz	
RAM	512 KB of which approx. 128 KB for PLC programs and 64 KB for retain data	
FLASH memory	1024 KB 512 KB for operating system and 512 KB for PLC programs	
Real-time clock	Battery-buffered with calendar and leap year, resolution: 1 s	
Buffer element	Vanadium pentoxide lithium cell (min. buffer time 3 months)	
Node-ID	Address range 0 ... 127 set via keypad and display	–
Baud rate	125 … 1000 kbaud, set via keypad and display	–
Diagnosis interface	Switch on/off via keypad and display	–
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)	
Power supply to CAN interface	DC 11 ... 30V (meets CAN specification)	–
Power consumption	microLine: < 4 W from external 24 V supply (without modules) Connected modules: max. 5 W via internal 5 V supply	
Number of attachable I/O modules	8	
Interfaces		
	 CANopen Interface Open Style Connector 5-pin (MCS 20-21R only) 1st serial interface RS232 Telefonplug 4-pin Recommended for terminal operation 2nd serial interface RS232 Subminiature 9-pin, plug connector Recommended for programming devices	
PLC Properties		
Processing speed	For 1000 instructions of data type BOOL: 2.62 ms BYTE: 2.77 ms WORD: 1.94 ms DWORD: 2.02 ms	
Function blocks	max. 256	
Operating system	VxWorks, multitasking operating system (time-driven / priority-driven)	
Number of tasks	16	
Task cycle times	Programmable ≥ 2 ms (even-order)	
Memory management	Dynamic	
Max. I/O range internal	64 bytes input data 64 bytes output data	
Times and counters	Any number programmable ≥ 2 ms (Number limited only by memory capacity)	

For general technical data see page 68

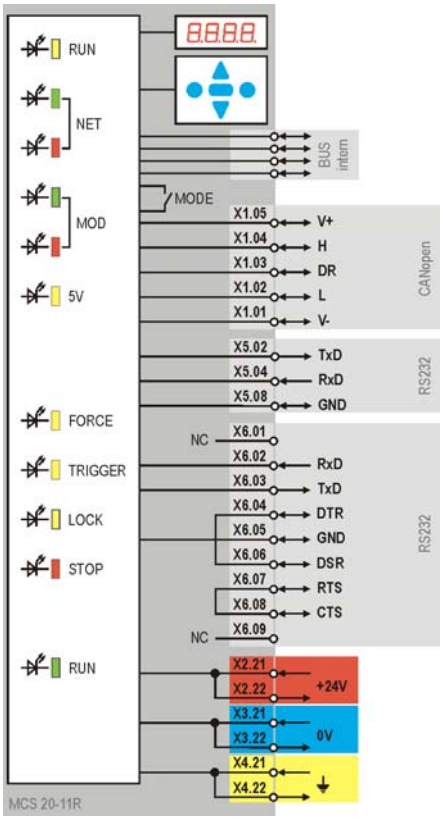
microLine PLC • CANopen — MCS 20-11R
microLine PLC — MCS 20-10R

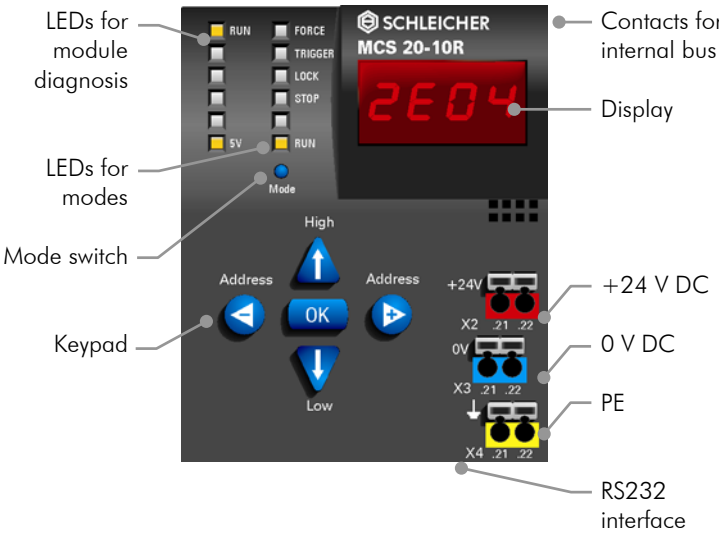


The microLine MCS 20-11R combines bus coupler with PLC. As a bus coupler it combines up to eight digital or analog expansion modules with the CANopen bus. As a PLC it offers intelligence in the field bus and allow decentralized data (pre-)processing.

Configuring is carried out with the DOS programming system Prodoc U1, that is matched to the resources of the microLine to ensure simple operation.

Block diagram

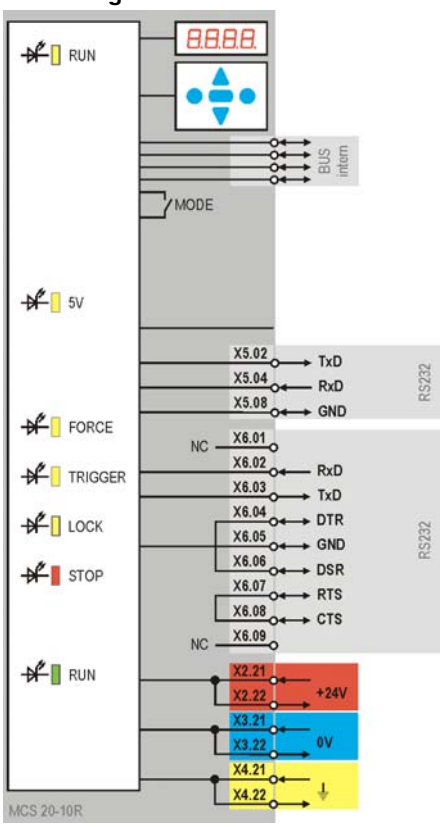


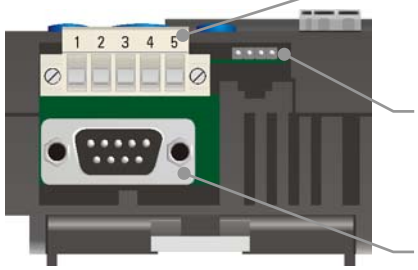


The microLine MCS 20-10R is a stand-alone PLCs for on-the-spot data processing in smaller systems. It processes the input/output signals from up to eight expansion modules with 128 digital or 56 analog channels.

Configuring is carried out with the DOS programming system Prodoc U1, that is matched to the resources of the microLine to ensure simple operation.

Block diagram



Technical Data	MCS 20-11R	MCS 20-10R
Article number	R5.365.0100.0	R5.365.0090.0
Field bus	CANopen	None
Programming software	Prodoc U1 – (DOS software)	
Hardware and Memory		
CPU	Motorola MC68LC302, 16-bit, 24 MHz	
RAM	512 KB of which 410 KB for PLC programs and data	
FLASH memory	1024 KB 512 KB for operating system and 512 KB for PLC programs	
Real-time clock	Battery-buffered with calendar and leap year, resolution: 1 s	
Buffer element	Vanadium pentoxide lithium cell (min. buffer time 3 months)	
Node-ID	Address range 0 ... 127 set via keypad and display	–
Baud rate	125 ... 1000 kbaud, set via keypad and display	–
Diagnosis interface	Switch on/off via keypad and display	–
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)	
Power supply to CAN interface	DC 11 ... 30V (meets CAN specification)	–
Power consumption	microLine: < 4 W from external 24 V supply (without modules) Connected modules: max. 5 W via internal 5 V supply	
Number of attachable I/O modules	8	
Interfaces		
	 CANopen Interface Open Style Connector 5-pin (MCS 20-11R only) 1st serial interface RS232 Telefonplug 4-pin Recommended for terminal operation 2nd serial interface RS232 Subminiature 9-pin, plug connector Recommended for programming devices	
PLC Properties		
Processing speed	1.4 ms for 1000 instructions	
Function blocks	Max. 256; standard functions integrated in operating system	
Operating system	Promodul, multitasking operating system (time-driven / priority-driven)	
Number of tasks	Max. 7	
Task cycle times	Programmable 4 ... 32000 ms	
Memory management	Dynamic	
Global flags	28544 bits + 2048 words	
Max. I/O range internal	64 bytes input data 64 bytes output data	
Times and counters	Any number programmable from 2 ms ... 290 h (number limited only by memory capacity)	

For general technical data see page 68

Bus Couplers

RIO Bus Couplers

The bus coupler connects the expansion modules to Profibus-DP, Interbus, DeviceNet and CANopen field buses.

- 8 RIO I/O modules can be connected in any combination (digital, analog, function modules)
- Up to 128 digital or 56 analog I/Os can be connected locally
- Field bus diagnosis via LEDs
- **BC series** (figure left) with display, keypad and integrated commissioning and diagnosis functions
- **EC series** (figure right) as low-cost economy version without the special BC features

The bus coupler has an internal 5 V power packs to supply voltage to the connected expansion modules up to total output of 5 W. Voltage and internal bus are connected by slide contacts on the modules.

Parameterizing and Diagnosis Functions

The PLC can initiate diagnosis functions in the bus coupler. A function code – with parameters if required – is transmitted to the bus coupler. The bus coupler executes the functions, compounds the diagnostic data (if required) and provides the data to the PLC. There the data can be evaluated and processed in the user program.

Service Functions

BC bus couplers give you the option to carry out service functions via the integrated keypad and the display. For example setting the data transmission rate, displaying the process data width of outputs and setting/deleting the user lockout, with password if required.

During operation you can use the cursor keys to select any channel. The bus coupler display then shows the current high/low state (of a digital channel) or the current voltage or current value (of an analog channel).

Error messages are output as digital code on the BC bus coupler display and flashing code on the RUN LED of the EC bus coupler.

Commissioning and Diagnosis

The integrated functions in BC bus couplers allow simple commissioning and diagnosis of the bus node without other aids such as programming devices. For example, missing input/output wiring can be simulated, process maps analysed after errors, and a preferred shut-off state programmed for plant shut-down. During operation the bus coupler can be used as a multimeter for the inputs/outputs.

Press the mode key to select the mode. Press OK to activate it. Depending on the mode you can then select channels via the keypad and display or enter values.

Overview of Functions

- **RUN** allows digital and analog I/O values to be displayed and FORCE, TRIGGER and LOCK to be set while the system is running.
- **FORCE** allows simulation of sensor inputs and testing of output wiring with and without field bus.
- **TRIGGER** is a trace function for plant diagnosis during operation.
- **LOCK** allows non-volatile definition of the control states of any inputs/outputs (similar to FORCE).
- **STOP** or interruption of the field bus connection switches off all inputs/outputs. A programmed preferred shut-off state is then set.
- **Error messages** are displayed as a four-position code.
- **User lockout** with optional password prevents unauthorized manipulation of the bus coupler.
- **Field bus diagnosis** via bus-specific LEDs.

RUN

During operation the bus coupler in display mode can take on the function of a multimeter. With the left/right keys you can select a channel, which is identified on the expansion module by a yellow LED and appears in the display with module number, type input/output and channel number. If it is a digital channel the high/low state will be displayed. For an analog channel you can read off the voltage in mV, the current in µA or the temperature in °C. The state/value displays are continuously updated until display mode is terminated by pressing OK.

FORCE

FORCE allows simulation of sensor inputs and testing of output wiring with and without field bus, by forcing the state of individual I/O channels. Like in display mode, the required channel is selected with the left/right keys and displayed on the expansion module and the display. Then a state or value is assigned to the channel using the high/low keys. Digital channels can be set to high or low. For analog channels the input/output value can be altered in steps of in 100 mV or 100 µA. You can display the FORCE state of a selected channel by pressing OK. FORCE mode overrides control states which have been set using LOCK. When you quit FORCE mode all the channels are reset.

TRIGGER

TRIGGER is a function for plant diagnosis during operation. After it has been activated, the digital process map – the control states of all digital inputs/outputs – is written in a buffer each time a signal changes. In order to evaluate this log after an error has occurred, a condition is defined for a selected channel. When it has been met diagnosis stops and the recorded values can be examined. This condition is the transition of a channel from low to high or high to low.

Functions on the BC Bus Coupler

It is simply set with the high/low keys. Any number of inputs/outputs can be defined as trigger channels with OR operations (the first fulfilled trigger condition ends the recording). The trigger function only works when RUN has been re-activated. If the trigger condition occurs during operation, the buffer is no longer overwritten and the last 20 process maps can be read out. The last recorded process map is displayed first, as yellow LEDs on the expansion modules. With the left key you can move back up to 20 steps. You can move forward with the right key. The high/low key switches between input display and output display. The set trigger conditions are retained until the bus coupler is switched off.

LOCK

In LOCK mode you can permanently set the control state of individual digital or analog I/O channels. After the required channel has been selected with the left/right keys, you can set the switching state of a digital channel with the high/low keys. If you have selected an analog voltage or current channel the input/output value will be increased/reduced by 100 mV or 100 µA every time you press one of the keys. Unlike FORCE, the LOCK settings will be permanently stored in the bus coupler when you exit LOCK mode. This makes LOCK mode suitable for setting default values for system start.

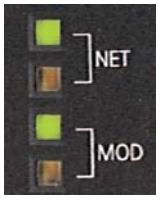
STOP

In STOP mode all the inputs/outputs are switched off. All inputs/outputs are switched to zero and are no longer refreshed. Inputs are no longer sent to the PLC. If a parameterizing function was previously used to set a preferred shut-off state for individual expansion modules it will now be adopted. Channels whose control state has been set with LOCK will not be overridden by the preferred shut-off state. This means that you can increase operational safety by setting failsafe behaviour for the whole module or individually for each channel.

Error Messages

Error messages are output as four-digit code in the BC bus coupler display. On the economy bus couplers of the EC series the error messages are displayed by a varying number of flashes of the RUN LED. These messages relate, for

example, to interruption of internal data transmission through an open slide contact or an error in the 24 V voltage supply of a module. If a specified node configuration saved in the bus coupler does not match the actual configuration when the module is powered up a message will also be generated. Other messages relate to interruption of the field bus and violation of the bus coupler user lockout.



Field Bus Diagnosis

There are LEDs for simple field bus diagnosis on bus couplers of both the BC and EC series.

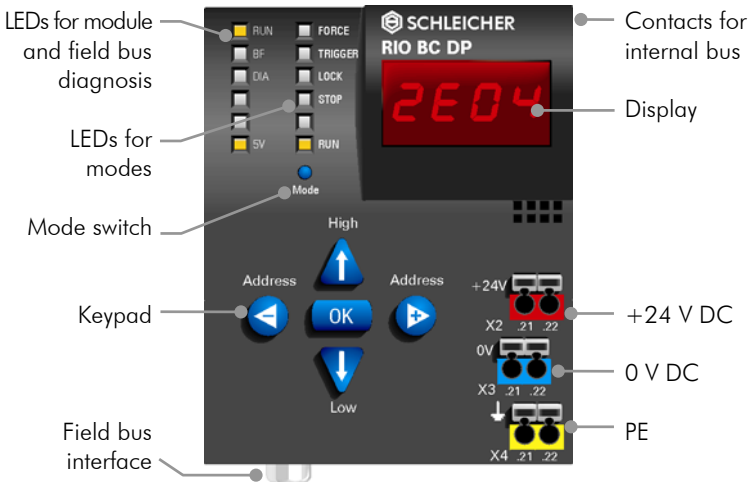
User Lock-Out

Some of the functions which are available via the bus coupler keypad have direct effects on the controlled plant. They must therefore be protected against unauthorized operation. The concept for the user lockout is based on two security levels:

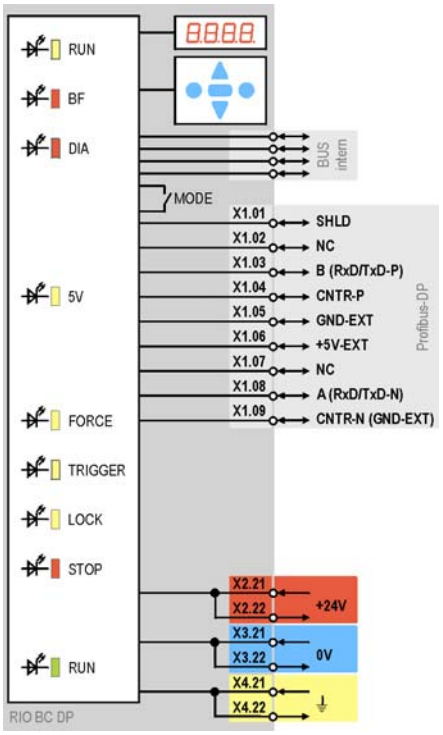
Level 1 is activated automatically as soon as user data is exchanged between the bus coupler and the control unit – normally when the plant is started up. When it is active only diagnosis functions are available. If personnel have to intervene in the control states using the FORCE and LOCK functions, the level 1 lockout can be deactivated using a simple service function. If the level 1 lockout is violated an error code appears in the display.

Level 2 can be activated by the PLC, through a diagnosis code which defines a password. This password is stored in non-volatile form in the bus coupler. When it is switched on again the level 2 lockout is activated automatically. This level also allows the diagnosis functions to be used, but the FORCE and LOCK functions are only available after a service function has been used to enter the password. If the level 2 lockout is violated an error code also appears.

Bus Coupler • BC • Profibus-DP — RIO BC DP



Block diagram



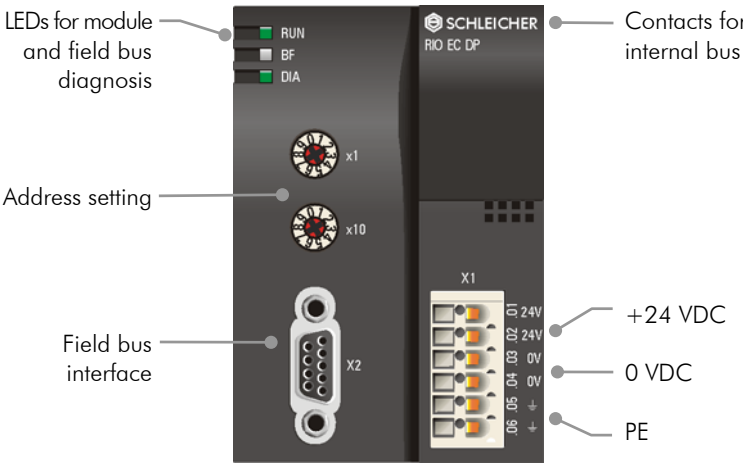
The RIO BC DP Standard bus coupler combines the digital, analog and function modules with the Profibus-DP. A bus node comprises the bus coupler and up to eight expansion modules with 128 digital or 56 analog channels.

The bus coupler automatically sets the correct baud rate up to 12 Mbaud and supports advanced Profibus-DP diagnosis. In order to achieve compatibility with various PLC standards you can use the byte-swap function to swap the two bytes of a data word.

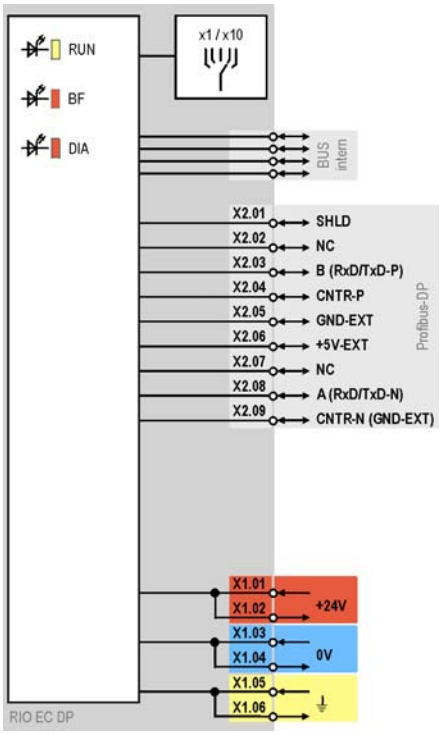
As the standard bus coupler, the RIO BC DP offers not only run mode but also other modes for commissioning, diagnosis and comprehensive service functions. These are operated via the keypad and display. On controllers with limited address space the diagnosis range can be switched off. This reduced the data width for transmission by 4 bytes.

Technical Data	RIO BC DP
Article number	R5.363.0060.0
Field bus	Profibus-DP
Bus connection	1x subminiature, 9-pin, socket connector
Slave address	Address range 0 ... 126, set via keypad and display
Baud rate	Up to 12 Mbaud, setting automatic
Diagnosis interface	Switch on/off via keypad and display
Max. I/O range internal	64 bytes input data 64 bytes output data
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	Bus coupler: 5 W from external 24 V supply Connected modules: max. 5 W via internal 5 V supply
Number of attachable I/O modules	8
For general technical data see page 68	

Bus Coupler • EC • Profibus-DP — RIO EC DP



Block diagram



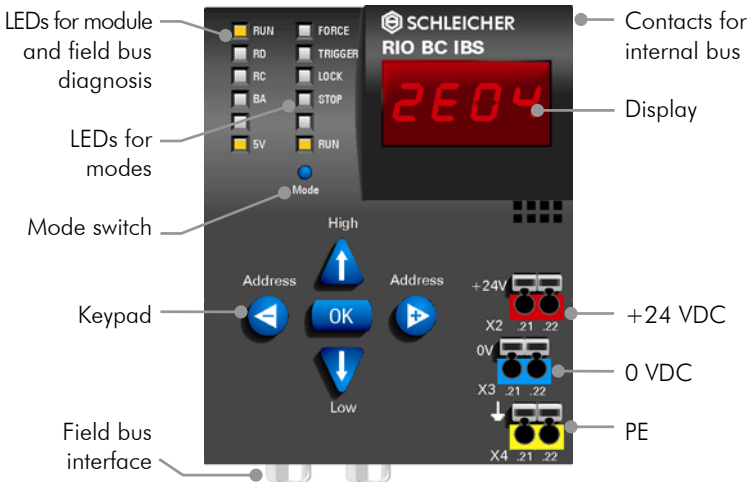
The RIO EC DP Economy bus coupler combines the digital, analog and function modules with the Profibus-DP. A bus node comprises the bus coupler and up to eight expansion modules with 128 digital or 56 analog channels.

The bus coupler automatically sets the correct baud rate up to 12 Mbaud and supports advanced Profibus-DP diagnosis. In order to achieve compatibility with various PLC standards you can use the byte-swap function to swap the two bytes of a data word.

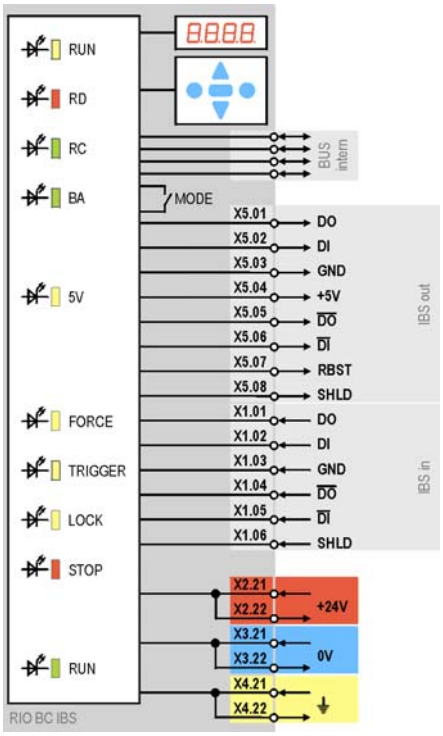
As an Economy bus coupler, the RIO EC DP allows you to create an inexpensive bus node. It can be replaced with a BC bus coupler with advanced service and diagnosis functions. You merely have to adapt the master project with the corresponding equipment master file (GSD).

Technical Data	RIO EC DP
Article number	R5.363.0130.0
Field bus	Profibus-DP
Bus connection	1x subminiature, 9-pin, socket connector
Slave address	Address range 0 ... 99, setting via rotary switches
Baud rate	Up to 12 Mbaud, setting automatic
Max. I/O range internal	64 bytes input data 64 bytes output data
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	Bus coupler: 5 W from external 24 V supply Connected modules: max. 5 W via internal 5 V supply
Number of attachable I/O modules	8
For general technical data see page 68	

Bus Coupler • BC • Interbus — RIO BC IBS



Block diagram



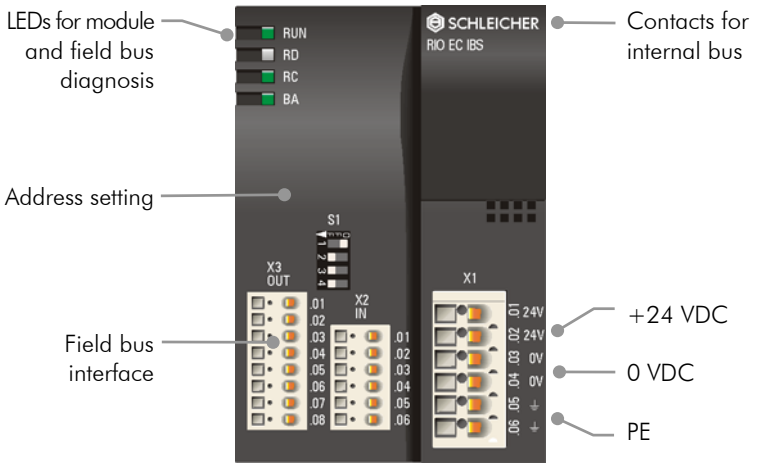
The RIO BC IBS Standard bus coupler combines the digital, analog and function modules with the Interbus. A bus node comprises the bus coupler and up to eight expansion modules with 128 digital or 56 analog channels.

In order to achieve compatibility with various PLC standards you can use the byte-swap function to swap the two bytes of a data word.

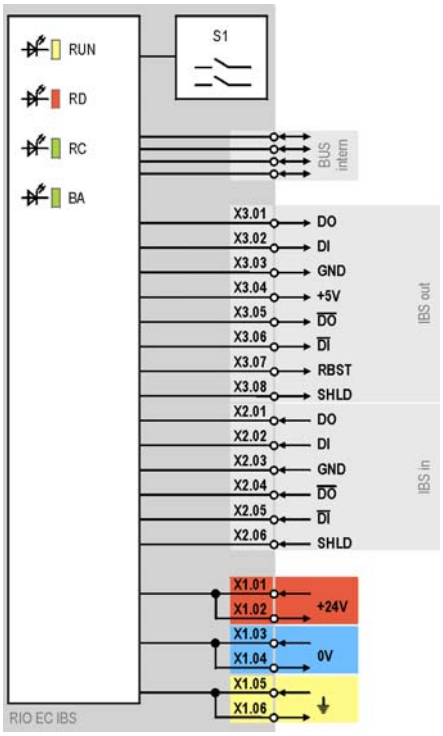
As the standard bus coupler, the RIO BC IBS offers not only run mode but also other modes for commissioning, diagnosis and comprehensive service functions. These are operated via the keypad and display. On controllers with limited address space the diagnosis range can be switched off. This reduced the data width for transmission by 4 bytes.

Technical Data	RIO BC IBS
Article number	R5.363.0080.0
Field bus	Interbus
Bus connection	2x subminiature, 9-pin, plug and socket connector
Baud rate	500 KBaud
Diagnosis interface	Switch on/off via keypad and display
Max. I/O range internal	64 bytes input data 64 bytes output data
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	Bus coupler: 5 W from external 24 V supply Connected modules: max. 5 W via internal 5 V supply
Number of attachable I/O modules	8
For general technical data see page 68	

Bus Coupler • EC • Interbus — RIO EC IBS



Block Diagram



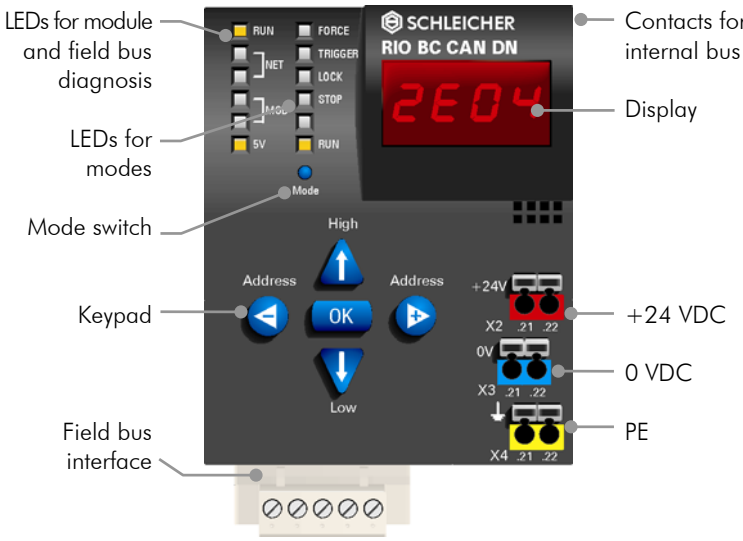
The RIO EC IBS Economy bus coupler combines the digital, analog and function modules with the Interbus. A bus node comprises the bus coupler and up to eight expansion modules with 128 digital or 56 analog channels.

In order to achieve compatibility with various PLC standards you can use the byte-swap function to swap the two bytes of a data word. On controllers with limited address space the diagnosis range can be switched off. This reduced the data width for transmission by 4 bytes.

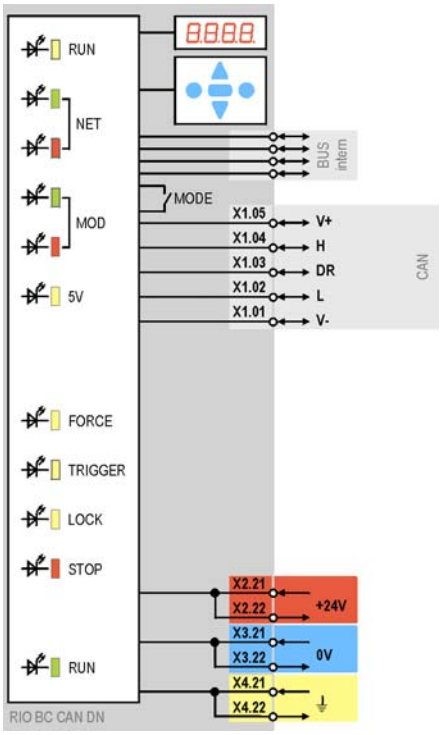
As an Economy bus coupler, the RIO EC IBS allows you to create an inexpensive bus node. It can be replaced with a BC bus coupler with advanced service and diagnosis functions, without any other alterations.

Technical Data	RIO EC IBS
Article number	R5.363.0150.0
Field bus	Interbus
Bus connection	Input 6-pin, output 8-pin, detachable spring-loaded terminals
Baud rate	500 KBaud
Diagnosis interface	Switch on/off via DIP switches
Max. I/O range internal	64 bytes input data 64 bytes output data
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	Bus coupler: 5 W from external 24 V supply Connected modules: max. 5 W via internal 5 V supply
Number of attachable I/O modules	8
For general technical data see page 68	

Bus Coupler • BC • DeviceNet — RIO BC CAN DN



Block diagram



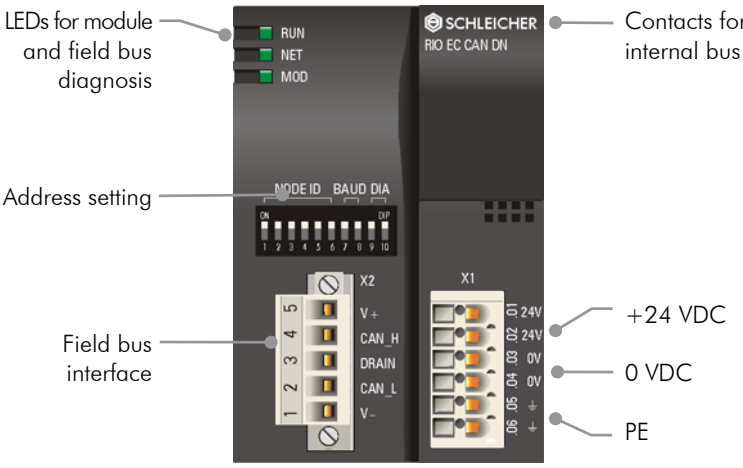
The RIO BC CAN DN Standard bus coupler combines the digital, analog and function modules with the DeviceNet field bus. A bus node comprises the bus coupler and up to eight expansion modules with 128 digital or 56 analog channels.

In order to achieve compatibility with various PLC standards you can use the byte-swap function to swap the two bytes of a data word.

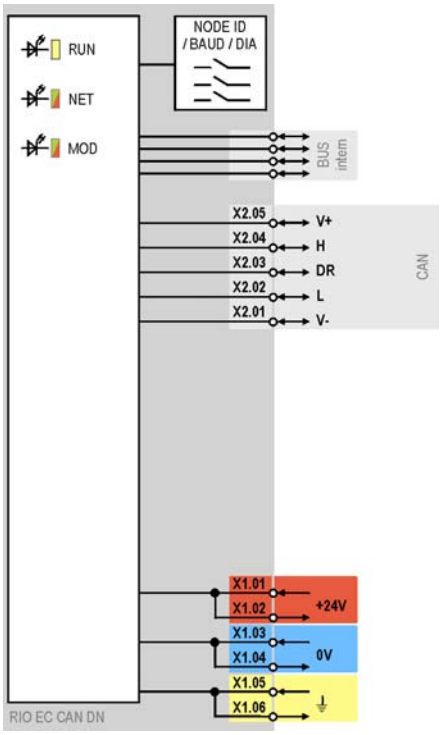
As the standard bus coupler, the RIO BC CAN DN offers not only run mode but also other modes for commissioning, diagnosis and comprehensive service functions. These are operated via the keypad and display. On controllers with limited address space the diagnosis range can be switched off. This reduced the data width for transmission by 4 bytes.

Technical Data	RIO BC CAN DN
Article number	R5.363.0010.0
Field bus	DeviceNet
Bus connection	1x open style connector 5-pin
Node-ID	Address range 0 ... 63, set via keypad and display
Baud rate	up to 500 kbaud, set via keypad and display
Diagnosis interface	Switch on/off via keypad and display
Max. I/O range internal	64 bytes input data 64 bytes output data
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power supply to CAN interface	DC 11 ... 30V (meets CAN specification)
Power consumption	Bus coupler: 5 W from external 24 V supply Connected modules: max. 5 W via internal 5 V supply
Number of attachable I/O modules	8
For general technical data see page 68	

Bus Coupler • EC • DeviceNet — RIO EC CAN DN



Block diagram



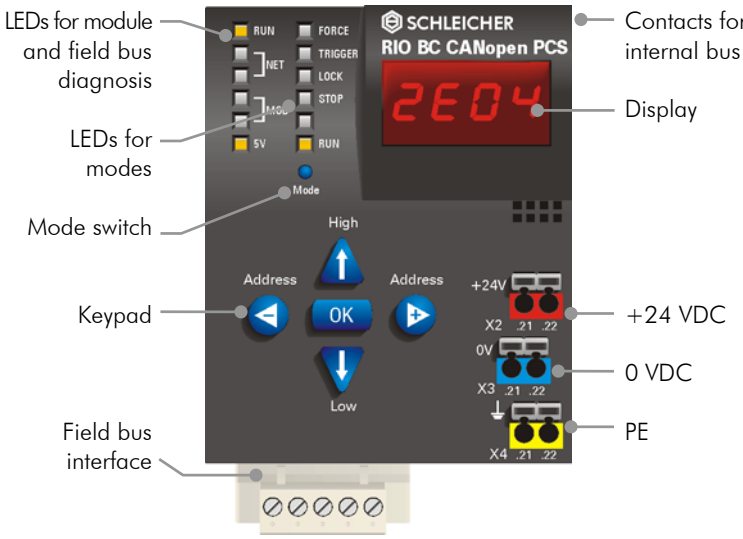
The RIO EC CAN DN Economy bus coupler combines the digital, analog and function modules with the DeviceNet field bus. A bus node comprises the bus coupler and up to eight expansion modules with 128 digital or 56 analog channels.

In order to achieve compatibility with various PLC standards you can use the byte-swap function to swap the two bytes of a data word. On controllers with limited address space the diagnosis range can be switched off. This reduced the data width for transmission by 4 bytes.

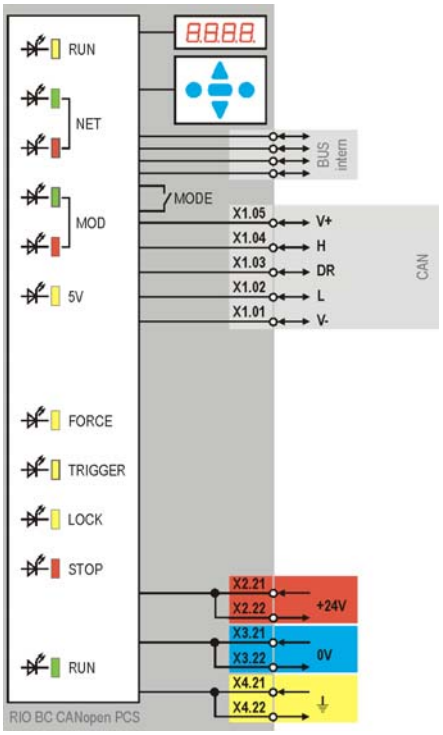
As an Economy bus coupler, the RIO EC CAN DN allows you to create an inexpensive bus node. It can be replaced with a BC bus coupler with advanced service and diagnosis functions, without any other alterations.

Technical Data	RIO EC CAN DN
Article number	R5.363.0100.0
Field bus	DeviceNet
Bus connection	1x open style connector 5-pin
Node-ID	Address range 0 ... 63, setting via DIP switches
Baud rate	Up to 500 Kbaud, setting via DIP switches
Diagnosis interface	Switch on/off via DIP switches
Max. I/O range internal	64 bytes input data 64 bytes output data
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power supply to CAN interface	DC 11 ... 30V (meets CAN specification)
Power consumption	Bus coupler: 5 W from external 24 V supply Connected modules: max. 5 W via internal 5 V supply
Number of attachable I/O modules	8
For general technical data see page 68	

Bus Coupler • BC • CANopen — RIO BC CANopen PCS



Block diagram



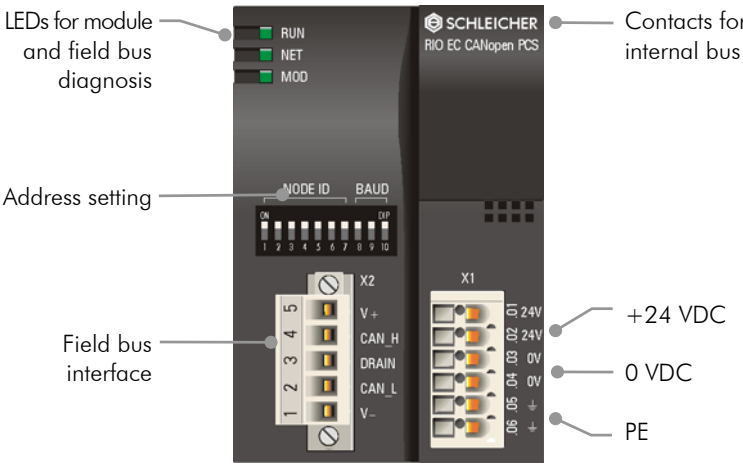
The RIO BC CANopen PCS Standard bus coupler combines the digital, analog and function modules with the CANopen field bus. A bus node comprises the bus coupler and up to eight expansion modules with 128 digital or 56 analog channels. For special features of CANopen PCS → page 9.

In order to achieve compatibility with various PLC standards you can use the byte-swap function to swap the two bytes of a data word.

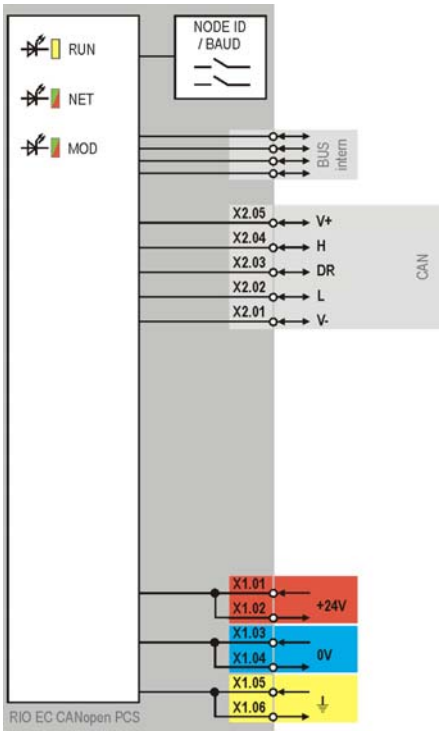
As the standard bus coupler, the RIO BC CANopen offers not only run mode but also other modes for commissioning, diagnosis and comprehensive service functions. These are operated via the keypad and display. On controllers with limited address space the diagnosis range can be switched off. This reduced the data width for transmission by 4 bytes.

Technical Data	RIO BC CANopen PCS
Article number	R5.363.0050.0
Field bus	CANopen
Bus connection	1x open style connector 5-pin
Node-ID	Address range 0 ... 127, set via keypad and display
Baud rate	up to 1000 kbaud, set via keypad and display
Diagnosis interface	Switch on/off via keypad and display
Max. I/O range internal	64 bytes input data 64 bytes output data
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power supply to CAN interface	DC 11 ... 30V (meets CAN specification)
Power consumption	Bus coupler: 5 W from external 24 V supply Connected modules: max. 5 W via internal 5 V supply
Number of attachable I/O modules	8
For general technical data see page 68	

Bus Coupler • EC • CANopen — RIO EC CANopen PCS



Block diagram



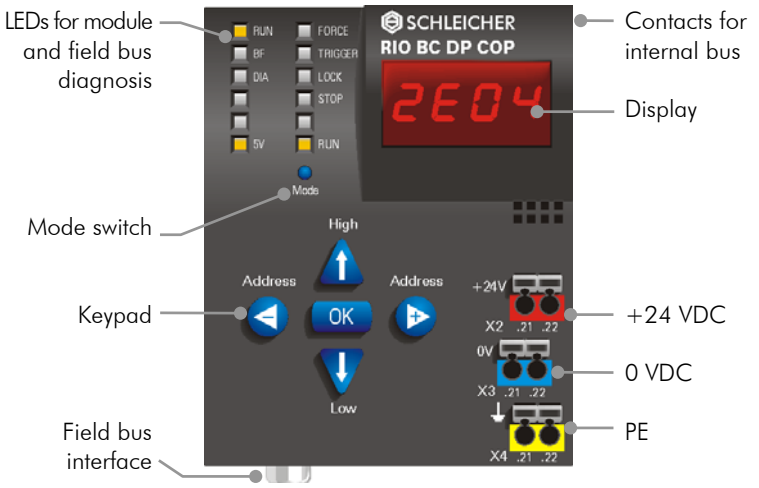
The RIO EC CANopen PCS Economy bus coupler combines the digital, analog and function modules with the CANopen field bus. A bus node comprises the bus coupler and up to eight expansion modules with 128 digital or 56 analog channels. For special features of CANopen PCS → page 9.

In order to achieve compatibility with various PLC standards you can use the byte-swap function to swap the two bytes of a data word.

As an Economy bus coupler, the RIO EC CANopen allows you to create an inexpensive bus node. It can be replaced with a BC bus coupler with advanced service and diagnosis functions, without any other alterations.

Technical Data	RIO EC CANopen PCS
Article number	R5.363.0120.0
Field bus	CANopen
Bus connection	1x open style connector 5-pin
Node-ID	Address range 0 ... 127, setting via DIP switches
Baud rate	Up to 1000 Kbaud, setting via DIP switches
Max. I/O range internal	64 bytes input data 64 bytes output data
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power supply to CAN interface	DC 11 ... 30 V (meets CAN specification)
Power consumption	Bus coupler: 5 W from external 24 V supply Connected modules: max. 5 W via internal 5 V supply
Number of attachable I/O modules	8
For general technical data see page 68	

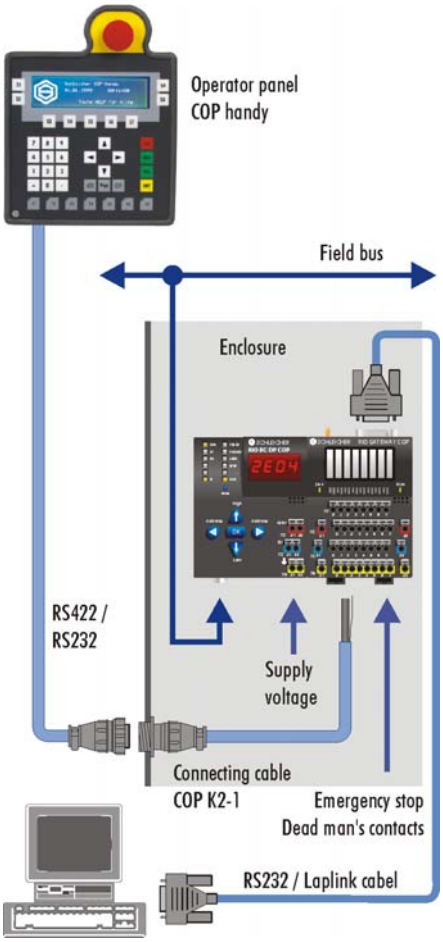
Bus Coupler • BC • Operator Panels — RIO BC xxx COP



There are special bus couplers and a gateway for operating COP operator panels via Profibus-DP, Interbus, DeviceNet and CANopen field buses. The COP bus couplers have the same technical features as the standard bus couplers in the BC series, with the following exceptions:

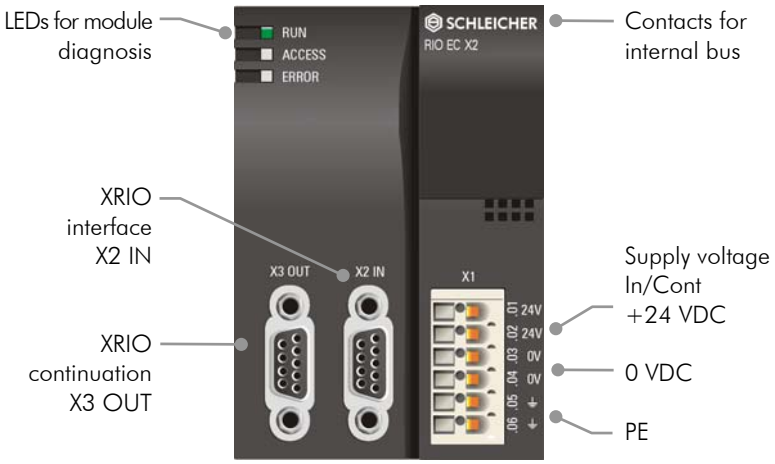
- You can only connect one other module, the RIO GATEWAY COP, to the COP bus coupler (→ page 54).
- The startup and diagnosis functions of the standard bus couplers in the BC series (→ page 20) are not implemented.

Application example



Technical Data	RIO BC DP COP	RIO BC IBS COP	RIO BC CAN DN COP	RIO BC CANopen COP
Article number	R5.363.0070.0	R5.363.0090.0	R5.363.0020.0	R5.363.0040.0
Field bus	Profibus-DP	Interbus	DeviceNet	CANopen
Other technical data	→ page 22	→ page 24	→ page 26	→ page 28
Number of attachable I/O modules	1 (RIO GATEWAY COP)			
For general technical data see page 68				

Bus Coupler • EC • XRIO — RIO EC X2



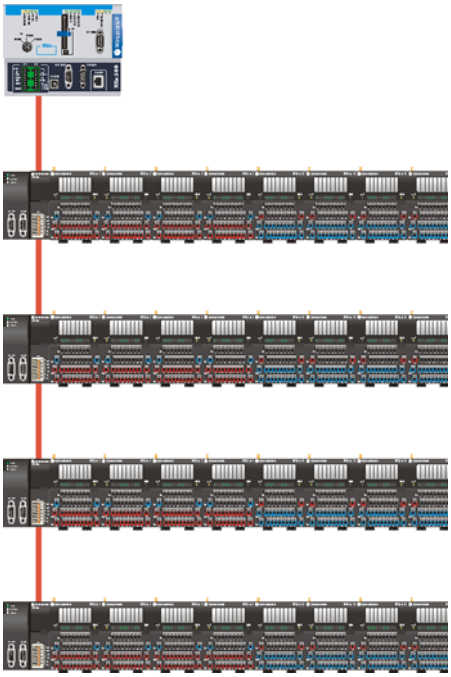
The RIO EC X2 bus coupler connects the XRIO interface on Schleicher XCx 500/540 to modules in the RIO I/O series. The XCx bus coupler has the same technical features as the economy bus couplers in the EC series.

A bus station comprises the bus coupler and up to 8 RIO I/O expansion modules with 128 digital or 56 analog channels. The I/O modules are connected on the DIN rail on the coupler. The internal bus is created by slide contacts.

For further information on XCx controllers please refer to the system descriptions and operating manuals (→ page 67).

Application example

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



Technical data	RIO EC X2
Article number	R5.363.0160.0
Interface	XRIO
Bus connection	2x subminiature 9-pin connector
Max. I/O range internal	64 bytes input data / 64 bytes output data
Supply voltage external	DC 24 V (± 20 %, max. 5 % residual ripple)
Power consumption	Bus coupler: 5 W from external 24 V supply connected modules: max. 5 W via internal 5 V supply
Number of attachable I/O modules	8
Cable length	Max. 10 m (between two connecting points)
For general technical data see page 68	

Expansion Modules

RIO Expansion Modules

Digital and analog modules with various numbers of channels and practical functionality are available for connecting the periphery. Up to eight modules can be connected in any combination at one bus node.

The internal bus connection and voltage supply are provided by integrated slide contacts. The 24 V supply is provided through external terminals and can be passed from module to module, or fed separately if more current is required.

Wiring is by the vibration-proof spring-loaded clamping key system. The modules can be augmented with a terminal extension with two additional jumper levels.

Digital I/O Modules

with 4, 8 or 16 channels detect and switch control and position signals from the process level:

- DC 24 V, AC 130/240 V, relay
- Input/output channels isolated from internal bus
- Combination channels can be used as inputs or outputs
- Outputs can be connected in parallel, short-circuit-proof and overcurrent-protected

Analog I/O Modules

detect 4-channel measured values and pass position signals to the process level:

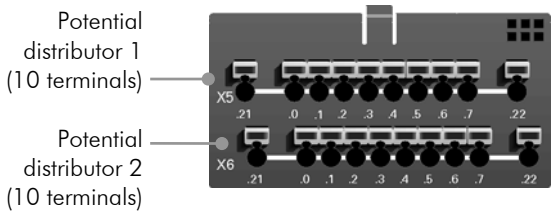
- Voltage inputs as differential inputs with ±10 V
- Current inputs as single-ended inputs, range 0/4..20 mA
- Sampling rate 2 ms
- Short-circuit-proof outputs ±10 V or 0..20 mA

RIO Function Modules

The function modules for temperature, counter and axis control allow data processing to take place directly in the bus node.

- High-frequency data collection
- Reduced load on field bus
- Reduced load on central PLC

Terminal Extension — RIO KE 16



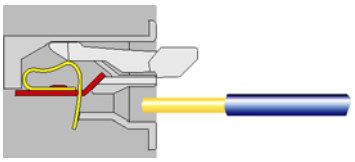
The RIO KE 16 Terminal Extension can be plugged onto any expansion module. It offers two additional jumper levels for potential distribution. This means that all modules can be connected to four-wire systems.

Technical Data	RIO KE 16
Article number	R5.368.0020.0
Number of inputs/outputs	2 distributors (isolated) each with 10 terminal connections
Input/output current per terminal	max. 8 A
For general technical data see page 68	

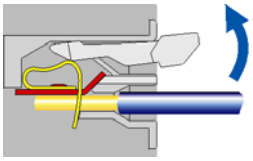
Spring-Loaded Clamping Key System

The spring-loaded clamping key system of the terminals on the RIO modules makes for simple fast wiring. The spring is pre-tensioned by pressing in the clamping key. The clamping space is open. Insert the cable and push the clamping key up. Finished. The spring terminals guarantee vibration-resistance and constant clamping force.

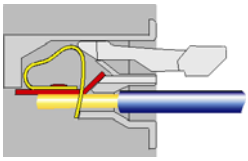
To close the terminal



Insert cable

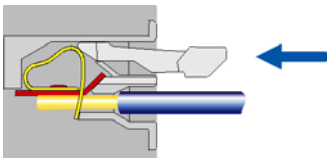


Push clamping key up

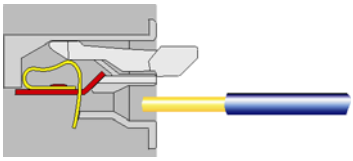


Finished

To open the terminal

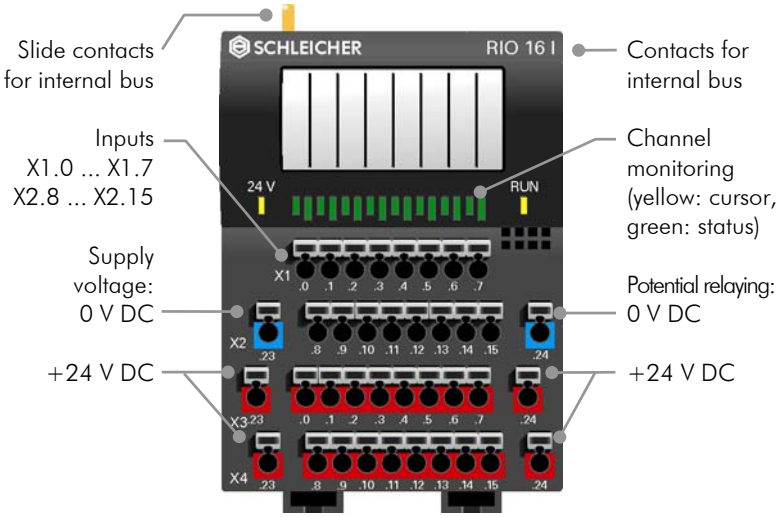


Push in clamping key

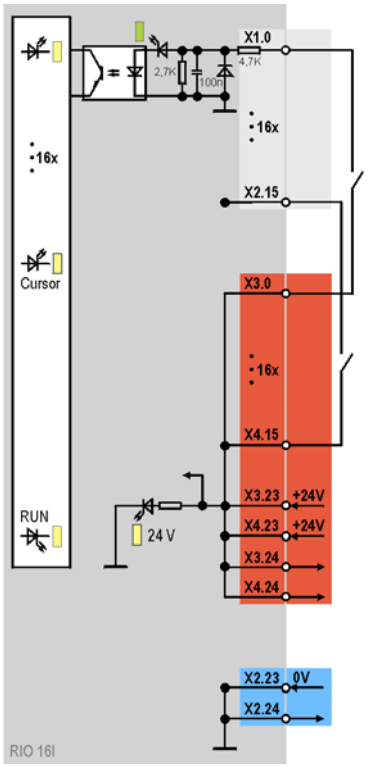


Remove cable

Digital • 16 Inputs • DC 24 V — RIO 16I



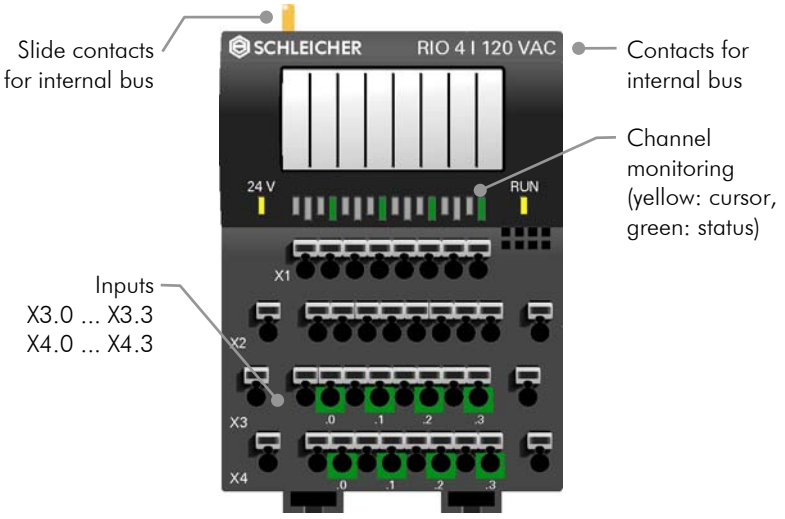
Block diagram



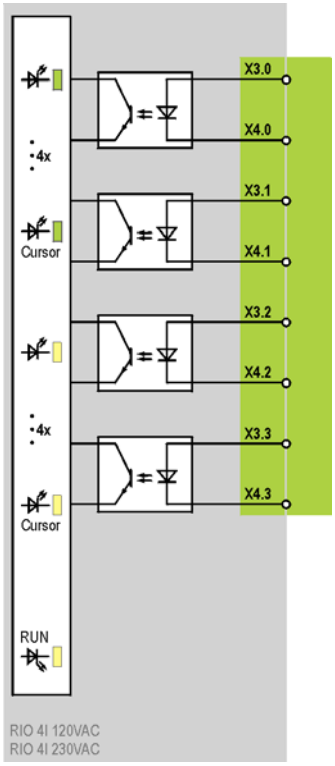
The RIO 16I digital module provides 16 input channels for binary DC signals with 24 V level. The bus coupler outputs the data via the internal slide bus and passes it, isolated, to the higher-level controller as a process map. The signal state of each channel can be read on an LED. Additional jumper levels can be created with the pluggable terminal extension.

Technical Data	RIO 16I
Article number	R5.364.0010.0
Number of inputs/outputs	16 inputs binary
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Data width	1 bit per channel I/O
Power consumption	0.25 W (without input current) from external 24 V supply 0.275 W from internal 5 V supply
Connection system	Two-wire (with RIO KE 16 terminal extension: four-wire)
Inputs	
Switching level	H level +15 ... +30 V L level –30 ... +5 V
Input current	min. H level (+15V): I ≥ 2.5 mA max. L level (+5V): I ≤ 0.7 mA typ. (+24 V): I = 4.5 mA
Isolation	Each channel individually isolated from internal bus by optocouplers
Signal delay	Typical 100 µs (hardware)
For general technical data see page 68	

Digital • 4 Inputs • AC 120 V — RIO 4I 120 VAC
Digital • 4 Inputs • AC 230 V — RIO 4I 230 VAC



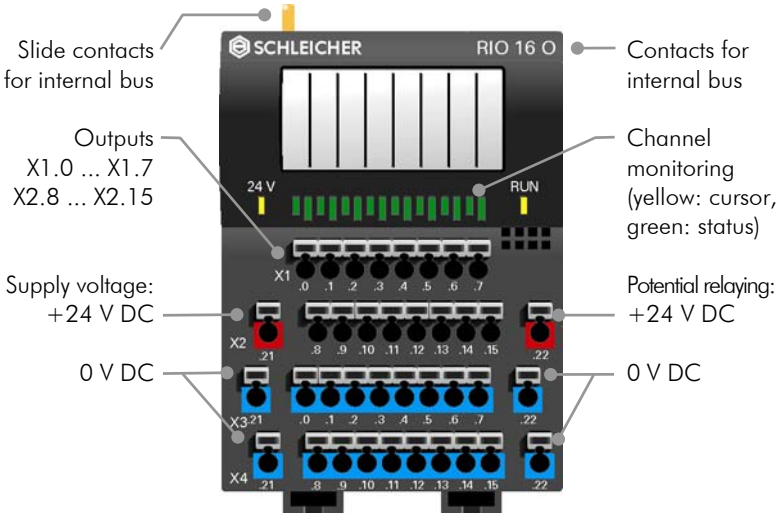
Block diagram



Digital modules RIO 4I 120 VAC and RIO 4I 230 VAC provide 4 input channels for binary AC signals with 120 V or 230 V level. The bus coupler outputs the data via the internal slide bus and passes it, isolated, to the higher-level controller as a process map. The signal state of each channel can be read on an LED. Additional jumper levels can be created with the pluggable terminal extension.

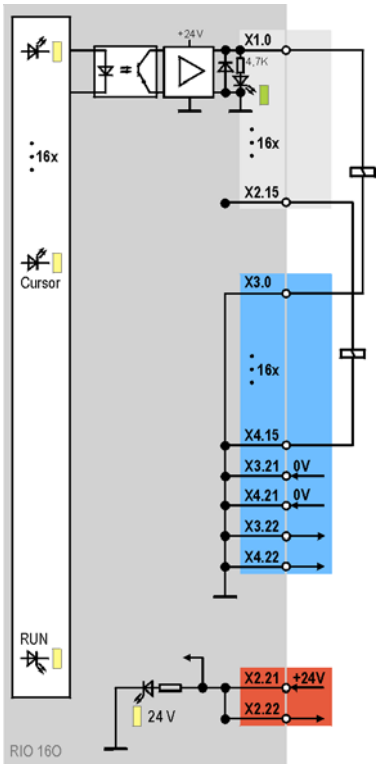
Technical Data	RIO 4I 120 VAC	RIO 4I 230 VAC
Article number	R5.364.0100.0	R5.364.0110.0
Number of inputs/outputs	4 inputs binary	
Data width	1 bit per channel I/O	
External supply voltage	none	
Power consumption	None from external 24 V supply 0.2 W from internal 5 V supply	
Connection system	Two-wire (with RIO KE 16 terminal extension: four-wire)	
Inputs		
Switching level	H level AC 74 ... 132 V L level AC 0 ... 20 V	H level AC 159 ... 253 V L level AC 0 ... 40 V
Input current	min. H level AC 74 V): I ≥ 5 mA max. L level (AC 20 V): I ≥ 2.3 mA	min. H level AC 159 V): I ≥ 5 mA max. L level (AC 40 V): I ≥ 2.3 mA
Isolation	Each channel individually isolated from internal bus by optocouplers	
For general technical data see page 68		

Digital • 16 Outputs • DC 24 V — RIO 16O



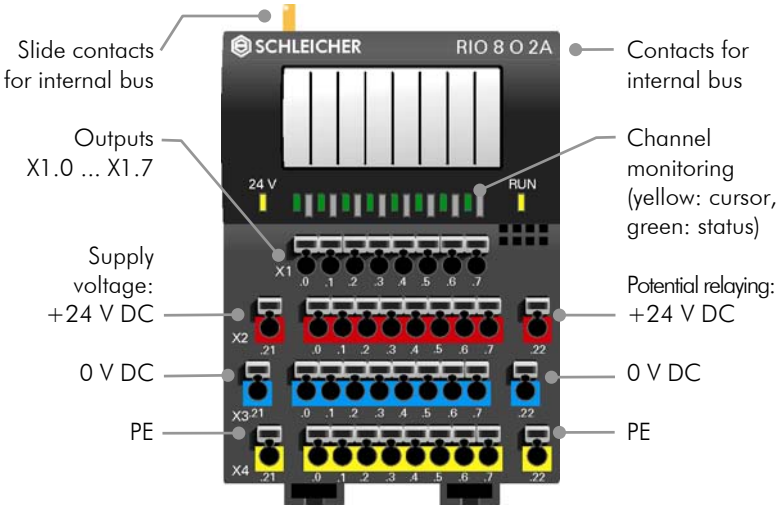
The RIO 16O digital module provides 16 output channels for binary position signals with 24 V level. The channels are isolated from the internal bus and are short-circuit-proof and overcurrent-protected. The maximum output current per channel is 1 A. If more current is required the outputs can be connected in parallel in groups of four. The signal state of each channel can be read on an LED. Additional jumper levels can be created with the pluggable terminal extension.

Block diagram

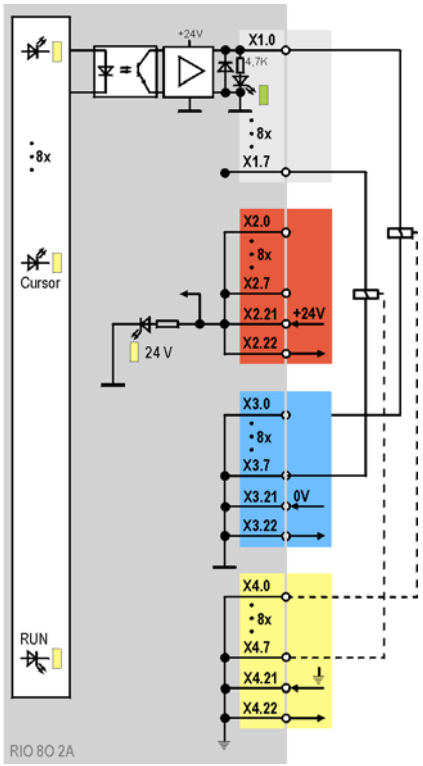


Technical Data	RIO 16O
Article number	R5.364.0020.0
Number of inputs/outputs	16 outputs binary
Data width	1 bit per channel I/O
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	0.25 W (without load current) from external 24 V supply 0.325 W from internal 5 V supply
Connection system	Two-wire (with RIO KE 16 terminal extension: four-wire)
Outputs	
Switching level	H level: supply voltage -0.5 V (I_L < 1 A) L level: ≤ 1 V (I_L = 0 A)
Output current per output	Max. 1 A, short-circuit-proof and overcurrent-protected, can be connected in parallel: 0-3, 4-7, 8-11, 12-15
Total current for whole module	Max. 8 A
Simultaneity	50%
Free-wheeling diode	Integrated
Isolation	Each channel individually isolated from internal bus by optocouplers
Signal delay	<100 µs (hardware)
For general technical data see page 68	

Digital • 8 Outputs • DC 24 V • 2A — RIO 8O 2A



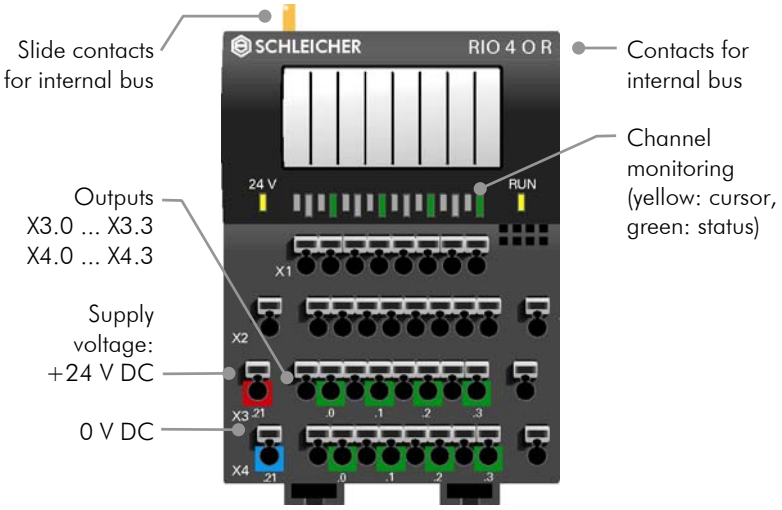
Block diagram



The RIO 8O 2A digital module provides 8 output channels for binary position signals with 24 V level and a current carrying capacity of 2 A. The channels are isolated from the internal bus and are short-circuit-proof and overcurrent-protected. The signal state of each channel can be read on an LED. The four-wire connection system makes it easy to realize complex output wiring without additional jumpers.

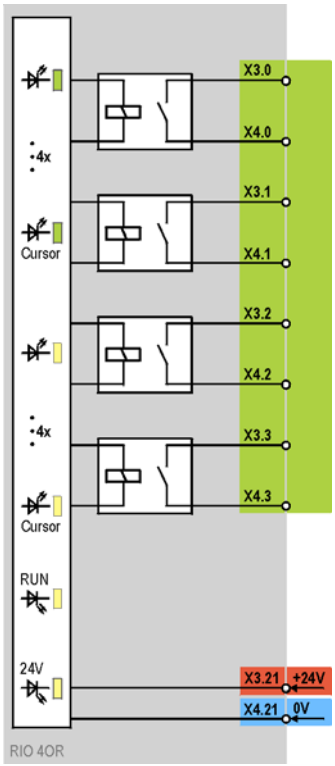
Technical Data	RIO 8O 2A
Article number	R5.364.0140.0
Number of inputs/outputs	8 outputs binary
Data width	1 bit per channel I/O
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	0.25 W (without load current) from external 24 V supply 0.325 W from internal 5 V supply
Connection system	Four-wire
Outputs	
Switching level	H level: supply voltage -0.5 V (I_L < 1 A) L level: ≤ 1 V (I_L = 0 A)
Output current per output	Max. 2 A, short-circuit-proof and overcurrent-protected
Total current for whole module	Max. 8 A
Simultaneity	50%
Free-wheeling diode	Integrated
Isolation	Each channel individually isolated from internal bus by optocouplers
Signal delay	<100 µs (hardware)
For general technical data see page 68	

Digital • 4 Outputs Relay • AC/DC 24..240 V • 5 A — RIO 4O R



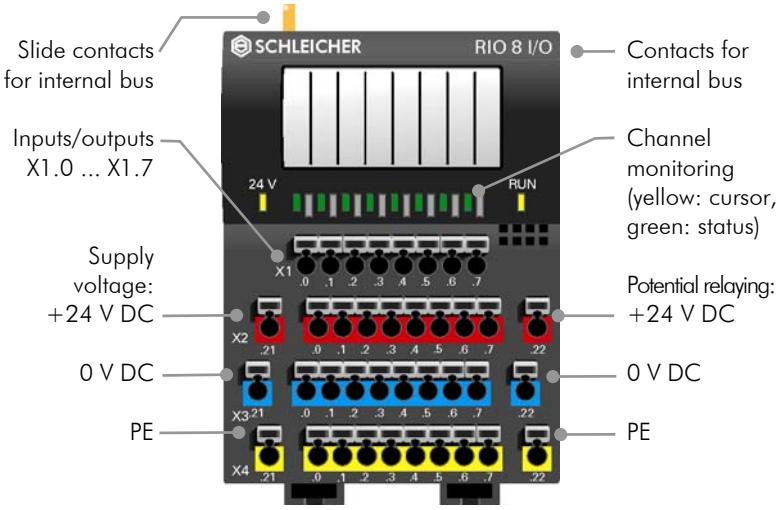
The RIO 4O R digital module provides 4 relay outputs with NO contacts. The channels are isolated from the internal bus by relay contacts. They switch loads up to 5 A for individual channels in AC or DC range of 24 to 240 V. The signal state of each channel can be read on an LED. Additional jumper levels can be created with the pluggable terminal extension.

Block diagram

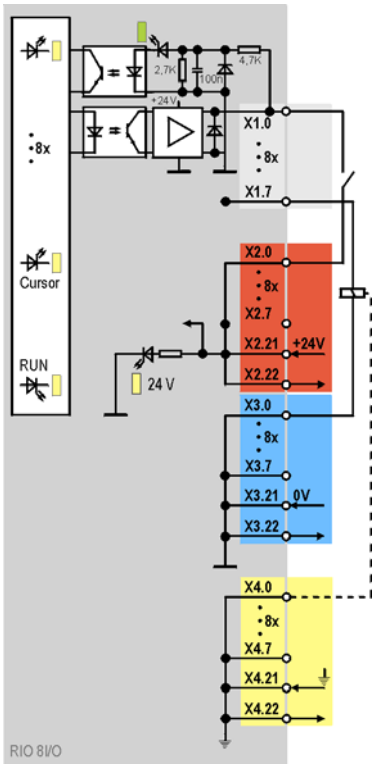


Technical Data	RIO 4O R
Article number	R5.364.0030.0
Number of inputs/outputs	4 outputs relay, NO contact
Data width	1 bit per channel I/O
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	2 W from external 24 V supply 0.25 W from internal 5 V supply
Connection system	Two-wire (with RIO KE 16 terminal extension: four-wire)
Outputs	
Output current per output	Max. 5 A
Total current for whole module	Max. 12 A
Minimum contact load	AC/DC 5 V / 10 mA
Rated operating voltage	AC/DC 24 ... 240 V
Utilization category	AC-15 U_e AC 230 V, I_e 3 A DC-13 U_e AC 24 V, I_e 2 A (acc. to IEC 60947-5-1)
Permissible switching frequency	≤ 3600 switching cycles/h
Mechanical service life	30 x 10^6 switching cycles
Electrical service life	0.12 x 10^6 switching cycles AC-15 (20/2 A, AC 250 V, cosφ = 0.3)
Simultaneity	100%
Free-wheeling diode	Integrated
Isolation	Each channel individually isolated from internal bus by relay contact
Signal delay	<100 µs (hardware)
For general technical data see page 68	

Digital • 8 Inputs/Outputs • DC 24 V — RIO 8I/O



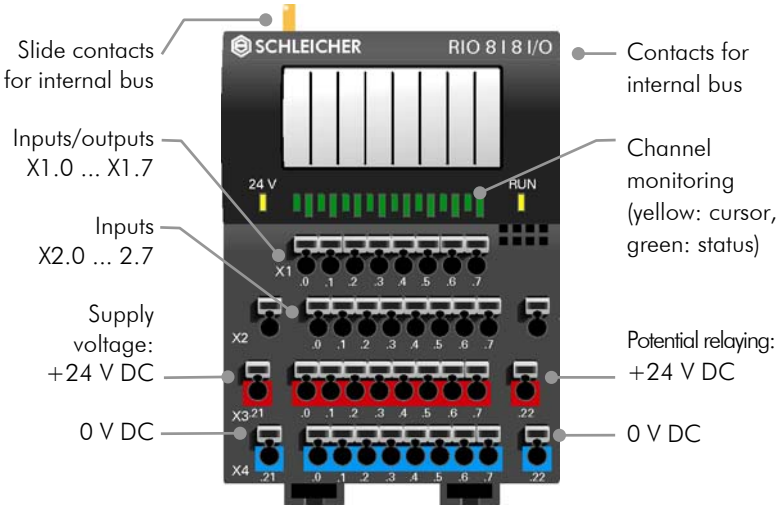
Block diagram



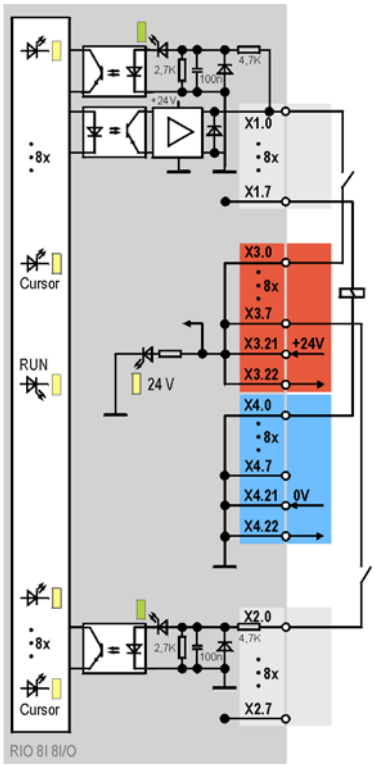
The RIO 8I/O digital module provides 8 combination channels with four-wire connection system for binary DC signals with 24 V level. Each combination channel can be used as input or output as required. The respective assignment is detected automatically by the module. The channels are isolated from the internal bus. The signal state of each channel can be read on an LED. The maximum output current per channel is 1 A. If more current is required the outputs can be connected in parallel in groups of four.

Technical Data	RIO 8I/O
Article number	R5.364.0130.0
Number of inputs/outputs	8 combination channels binary, can each be used as input or output
Data width	1 bit per channel I/O
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	0.25 W (without input current/load current) from external 24 V supply 0.325 W from internal 5 V supply
Connection system	Four-wire
Inputs	
Switching level	H level +15 ... +30 V L level –30 ... +5 V
Input current	min. H level (+15V): I ≥ 3.6 mA max. L level (+5V): I ≤ 1.2 mA typ. (+24 V): I = 6.1 mA
Isolation	Each channel individually isolated from internal bus by optocouplers
Signal delay	<100 µs (hardware)
Outputs	
Switching level	H level: supply voltage -0.5 V (I_L < 1 A) L level: ≤ 1 V (I_L = 0 A)
Output current per output	Max. 1 A, short-circuit-proof and overcurrent-protected, can be connected in parallel: 0-3, 4-7
Total current for whole module	Max. 8 A
Simultaneity	100%
Free-wheeling diode	Integrated
Isolation	Each channel individually isolated from internal bus by optocouplers
Signal delay	<100 µs (hardware)
For general technical data see page 68	

Digital • 8 Inputs • 8 Inputs/Outputs • DC 24 V — RIO 8I 8I/O



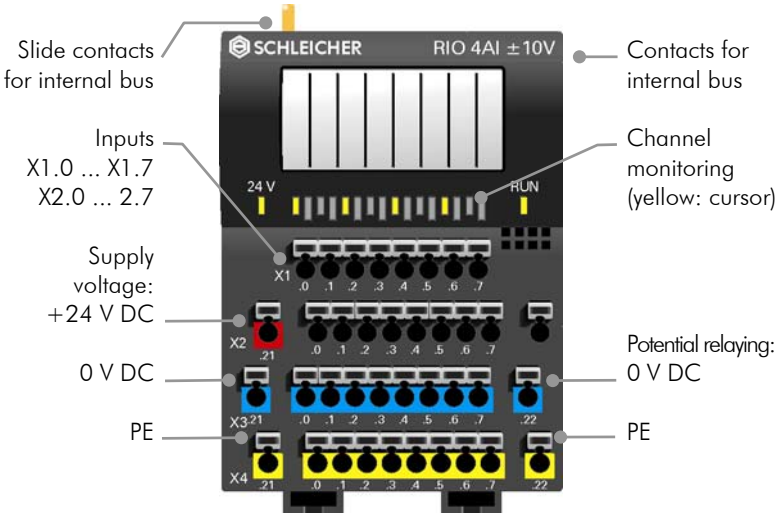
Block diagram



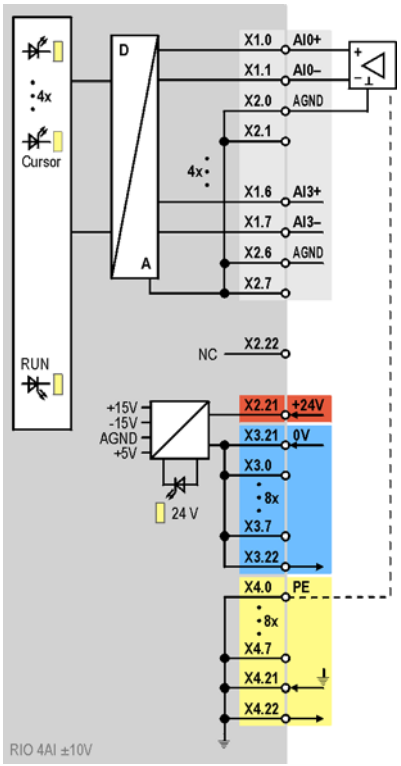
The RIO 8I 8I/O digital module provides 8 inputs and 8 combination channels. Each combination channel can be used as input or output as required. The respective assignment is detected automatically by the module. The channels are isolated from the internal bus. The signal state of each channel can be read on an LED. The maximum output current per channel is 1 A. If more current is required the outputs can be connected in parallel in groups of four. Additional jumper levels can be created with the pluggable terminal extension.

Technical Data	RIO 8I 8I/O
Article number	R5.364.0120.0
Number of inputs/outputs	8 inputs and 8 binary combination channels, which can each be used as input or output
Data width	1 bit per channel I/O
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	0.25 W (without input current/load current) from external 24 V supply 0.325 W from internal 5 V supply
Connection system	Two-wire (with RIO KE 16 terminal extension: four-wire)
Inputs	
Switching level	H level +15 ... +30 V L level –30 ... +5 V
Input current	Min. H level (+15V): I ≥ 2.5 mA / 3.6 mA * Max. L level (+5V): I ≤ 0.7 mA / 1.2 mA * Typ. (+24 V): I = 4.5 mA / 6.1 mA * * for combination channels
Isolation	Each channel individually isolated from internal bus by optocouplers
Signal delay	<100 µs (hardware)
Outputs	
Switching level	H level: supply voltage -0.5 V L level: ≤ 1 V
Output current per output	Max. 1 A, short-circuit-proof and overcurrent-protected, can be connected in parallel: 0-3, 4-7
Total current for whole module	Max. 8 A
Simultaneity	100%
Free-wheeling diode	Integrated
Isolation	Each channel individually isolated from internal bus by optocouplers
Signal delay	<100 µs (hardware)
For general technical data see page 68	

Analog • 4 Inputs • ±10V — RIO 4AI ±10V



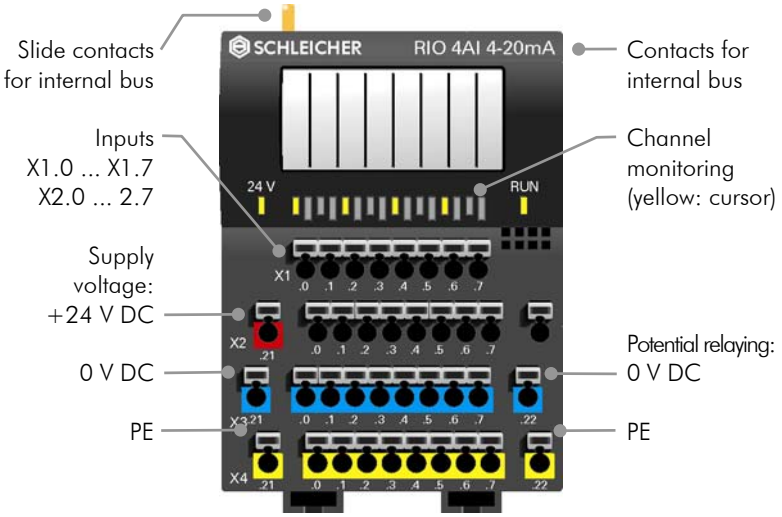
Block diagram



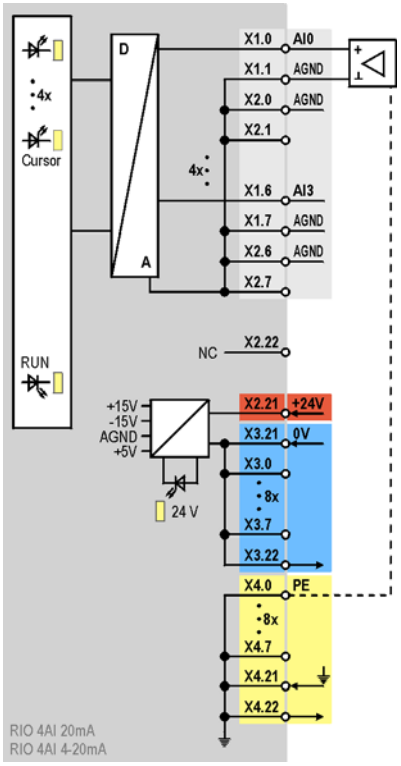
The RIO 4AI ±10V analog module provides 4 differential input channels with four-wire connection system for DC signals in the range –10 V to +10 V. The analog signals are digitalized with 12 bits within 2 s. The bus coupler outputs the binary data via the internal slide bus and passes it, isolated, to the higher-level controller as a process map.

Technical Data	RIO 4AI ±10V
Article number	R5.364.0040.0
Number of inputs/outputs	4 inputs (differential)
Data width	2 bytes per channel I/O
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	3.6 W from external 24 V supply 0.325 W from internal 5 V supply
Connection system	Four-wire
Inputs	
Input range	–10 ... +10 V
Resolution	12-bit / 4.88 mV
Conversion time	2 ms
Input current	–15 ... +15 µA
Input resistance	1 MΩ
Maximum total error	±40 mV ±0.35% from measured value
Isolation	From internal bus
For general technical data see page 68	

Analog • 4 Inputs • 0...20 mA — RIO 4AI 20mA
Analog • 4 Inputs • 4...20 mA — RIO 4AI 4-20mA



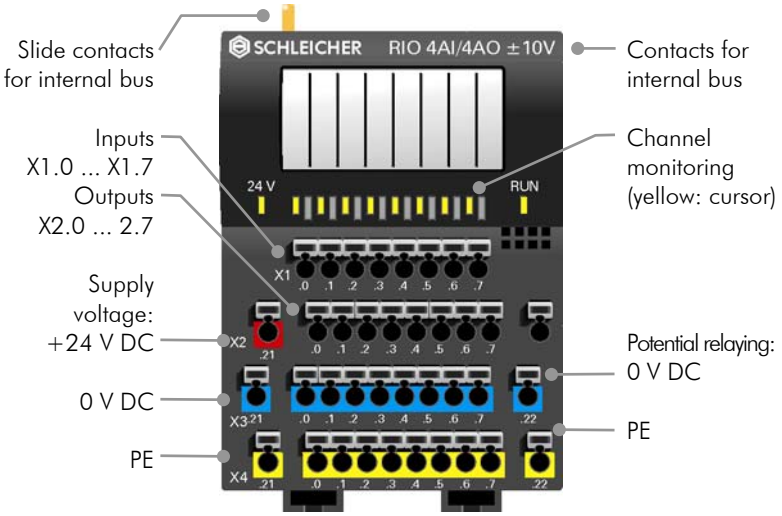
Block diagram



The RIO 4AI 20mA and RIO 4AI 4-20mA analog modules provide 4 single-ended input channels for input currents of 0 to 20 mA and 4 to 20 mA. The 4 mA system allows reliable detection of cable breaks. The data format of the modules can be set for use with a S5/S7 controller using a service code via the bus coupler or PLC. The bus coupler outputs the binary data via the internal slide bus and passes it, isolated, to the higher-level controller as a process map.

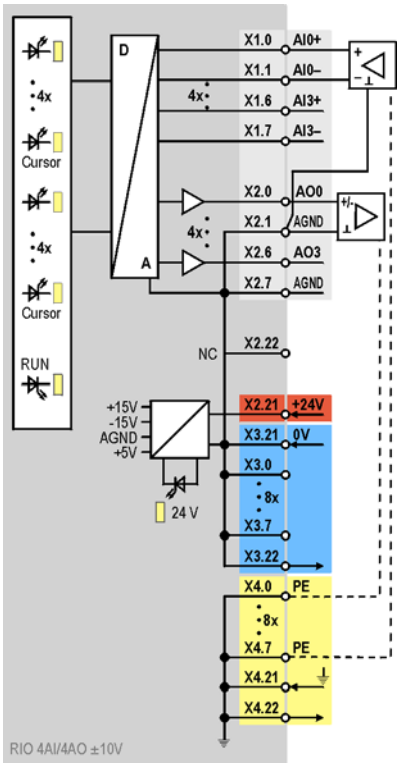
Technical Data	RIO 4AI 20mA	RIO 4AI 4-20mA
Article number	R5.364.0050.0	R5.364.0060.0
Number of inputs/outputs	4 inputs (single-ended)	
Data width	2 bytes per channel I/O	
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)	
Power consumption	3.6 W from external 24 V supply 0.325 W from internal 5 V supply	
Connection system	Three-wire (with RIO KE 16 terminal extension: four-wire)	
Inputs		
Input range	0 ... 20 mA	4 ... 20 mA
Resolution	12-bit / 4.88 µA	11-bit / 7.81 µA
Conversion time	2 ms	
Input load	100 Ω, acceptable continuous load 200 mW	
Permissible continuous input current	±40 mA	
Permissible continuous input voltage	±4 V	
Channel crosstalk	–74 dB (f < 100 Hz)	
Maximum total error	±40 µA ±0.35% from measured value	
Isolation	From internal bus	
For general technical data see page 68		

Analog • 4 Inputs • 4 Outputs • ±10V — RIO 4AI/4AO ±10V



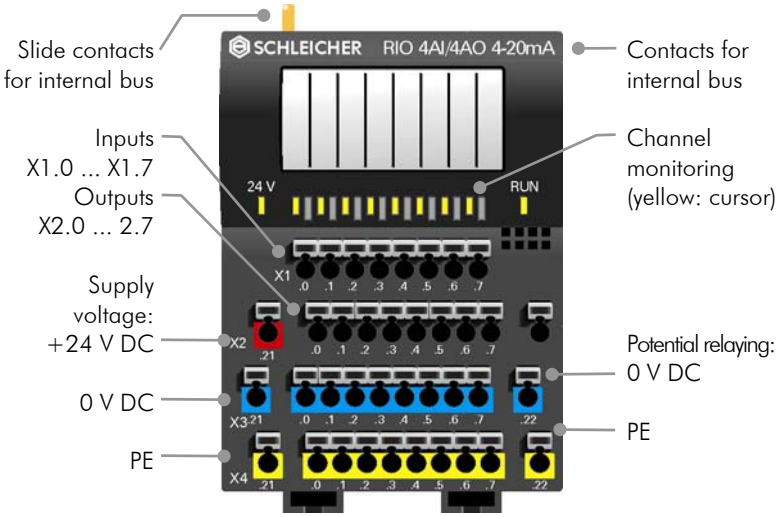
The RIO 4AI/4AO ±10V analog module provides 4 differential input channels and 4 output channels for DC signals in the range –10 V to +10 V. The inputs are four-wire, the outputs three-wire. The analog input and output signals are digitalized with 12 bits within 2 s.

Block diagram

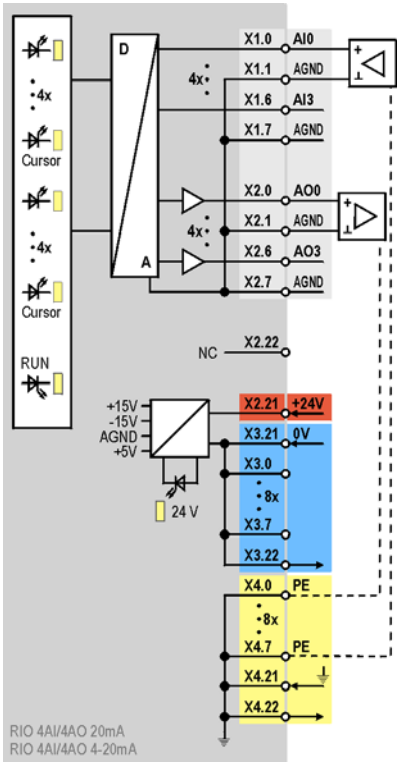


Technical Data	RIO 4AI/4AO ±10V
Article number	R5.364.0070.0
Number of inputs/outputs	4 inputs (differential), 4 outputs
Data width	2 bytes per channel I/O
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	4.3 W (analog outputs max. loaded) from external 24 V supply 0.325 W from internal 5 V supply
Connection system	Four-wire
Inputs	
Input range	–10 ... +10 V
Resolution	12-bit / 4.88 mV
Conversion time	2 ms
Input current	–15 ... +15 µA
Input resistance	1 MΩ
Isolation	From internal bus
Outputs	
Output range	–10 ... +10 V
Resolution	12-bit / 4.88 mV
Refresh rate	2 ms
Output current	–10 ... +10 mA
Short-circuit current / duration	20 mA / ∞
Isolation	From internal bus
For general technical data see page 68	

Analog • 4 Inputs • 4 Outputs • 0...20 mA — RIO 4AI/4AO 20mA
Analog • 4 Inputs • 4 Outputs • 4...20 mA — RIO 4AI/4AO 4-20mA



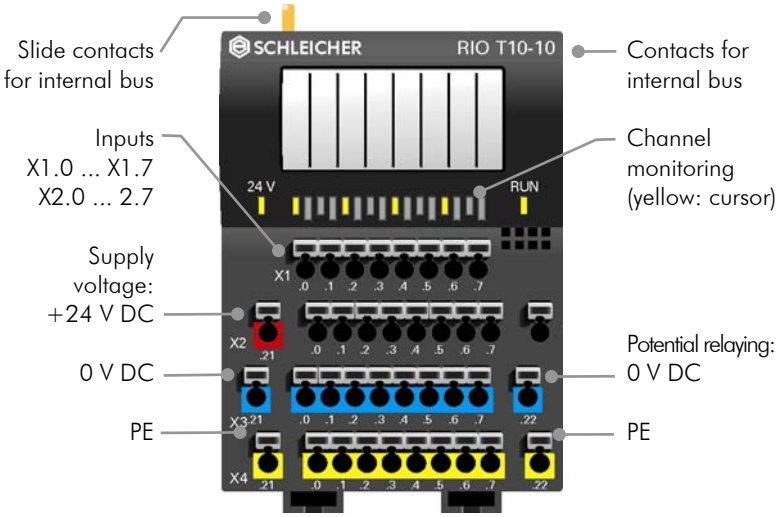
Block diagram



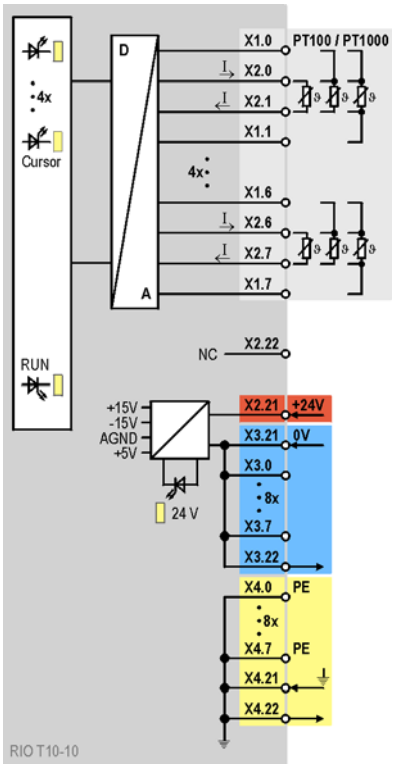
The RIO 4AI/4AO 20mA and RIO 4AI/4AO 4-20mA analog modules provide 4 single-ended input channels for input currents of 0 to 20 mA and 4 to 20 mA, and 4 output channels. The 4 mA system allows reliable detection of cable breaks. The data format of the modules can be set for use with a S5/S7 controller using a service code via the bus coupler or PLC. The inputs and outputs are isolated from the internal bus.

Technical Data	RIO 4AI/4AO 20mA	RIO 4AI/4AO 4-20mA
Article number	R5.364.0080.0	R5.364.0090.0
Number of inputs/outputs	4 inputs (single-ended), 4 outputs	
Data width	2 bytes per channel I/O	
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)	
Power consumption	3.6 W from external 24 V supply 0.325 W from internal 5 V supply	
Connection system	Three-wire (with RIO KE 16 terminal extension: four-wire)	
Inputs		
Input range	0 ... 20 mA	4 ... 20 mA
Resolution	12-bit / 4.88 µA	11-bit / 7.81 µA
Conversion time	2 ms	
Input load	100 Ω, acceptable continuous load 200 mW	
Permissible continuous input current	±40 mA	
Perm. continuous input voltage	±4 V	
Channel crosstalk	–74 dB (f < 100 Hz)	
Outputs		
Output range	0 ... 20 mA	0 mA; 4 ... 20 mA
Resolution	12-bit / 4.88 µA	10-bit / 15.625 µA
Refresh rate	2 ms	
Output load	0 ... 500 Ω	
Short-circuit current / duration	20 mA / ∞	
Output voltage	0 ... 10 V	
For general technical data see page 68		

Temperature ModulePT100/PT1000 RIO T10-10



Block diagram



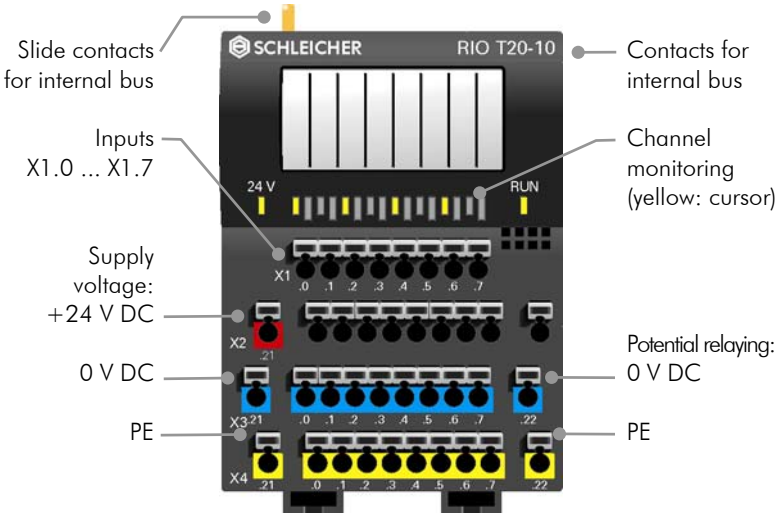
The RIO T10-10 expert module allows temperature measuring in the important industrial range of -100 °C to +450 °C. It provides four inputs for standard PT100 and PT1000 platinum shunts. Using the sensor resistance the module automatically recognizes the type of sensor, so external configuring is unnecessary. The choice of 2-wire, 3-wire or 4-wire connection systems allows precision to be matched to requirements.

Each measuring channel has its own current terminals for supplying the shunt. The measuring current is generated from a central source in the module and distributed to the individual channels by a multiplexer. So current only flows through the shunt when the channel is being measured. This reduces self-heating of the shunt and associated measuring error.

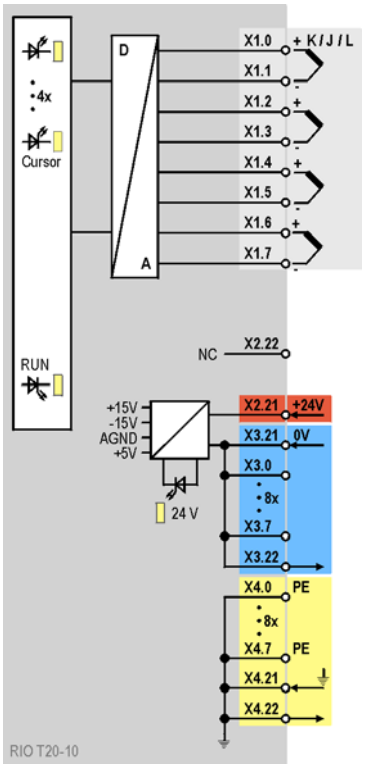
Digitalization via a 16-bit converter achieves a resolution of < 0.1 °C. Linearization of the resistance/temperature curve guarantees typical absolute precision of ±1 °C.

Technical Data	RIO T10-10
Article number	R5.364.0230.0
Number of inputs/outputs	4 inputs, self-tuning for Pt100 / Pt1000
Data width	10 bytes per module
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	3.8 W (including load current 4 x Pt100) from external 24 V supply 0.325 W from internal 5 V supply
Connection system	Two, three or four-wire
Inputs	
Temperature sensor	Pt100 / Pt1000
Measuring range	–100 ... +450 °C
Measuring accuracy	Typ. < ±1 °C, max. ±0.3 °C ±0.25% from measured value
Linearization	8-bit
A/D converter	16-bit
Resolution	< 0.1°C
Measuring time	<100ms
Isolation	Each channel isolated from internal bus by optocouplers
For general technical data see page 68	

Temperature ModuleK, J, L — RIO T20-10



Block diagram



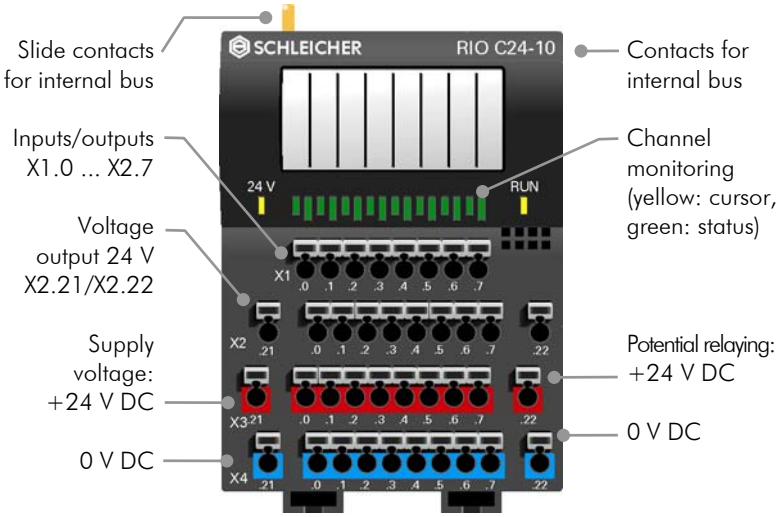
The RIO T20-10 expert module allows temperature measuring in the range of -200 to +1369 °C. It provides four inputs for type K, J and L thermo-elements. In combination with the RIO KE 16 terminal extension it can be connected using two-wire, three-wire or four-wire systems.

Parameterization of characteristic curves, used channel number, required resolution and controller-specific numeric format are all handled via the bus coupler.

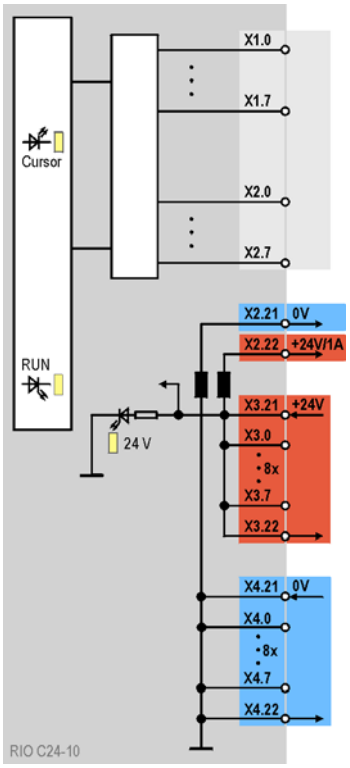
Digitalization via a 24-bit converter achieves a resolution of < 0.1 °C. Linearization of the resistance/temperature curve guarantees typical absolute precision of ±1 °C.

Technical Data	RIO T20-10
Article number	R5.364.0240.0
Number of inputs/outputs	4 inputs for thermoelements K, J, L
Data width	10 bytes per module
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	2.9 W from external 24 V supply 0.325 W from internal 5 V supply
Connection system	Two-wire (with RIO KE 16 terminal extension: four-wire)
Inputs	
Thermoelements (alloy)	K (NiCr-Ni), J (Fe-CuNi) and L (Fe-CuNi)
Measuring range	K: –200 ... +1369 °C J: –200 ... +1200 °C L: –199 ... +900 °C
Measuring accuracy	Typ. < ±1 °C, max. ±0.3 °C ±0.25% from measured value
Linearization	8-bit
A/D converter	24-bit
Resolution	0.1°C
Measuring time	<100 ms
Isolation	Each channel isolated from internal bus by optocouplers
For general technical data see page 68	

Counter Module — RIO C24-10



Block diagram



The RIO C24-10 expert module provides up to 4 mutually independent up/down counters. They count clock pulse signals. Other inputs can be used to control counting, alter the counting direction and reset the counter. The counter value is compared with up to two thresholds. If the value exceeds or falls below the threshold the outputs switch.

- Choice of two 32-bit counters or four 16-bit counters
- Counting range 0 to 2^{32}-1 or 0 to 2^{16}-1
- Counting frequency up to 200 kHz
- 32-bit counter has comparison with two threshold values
- 16-bit counter has comparison with one threshold value
- 24 V DC inputs / outputs
- Counting controlled via gate signal
- Two clock generators can be connected per counter (up/down)

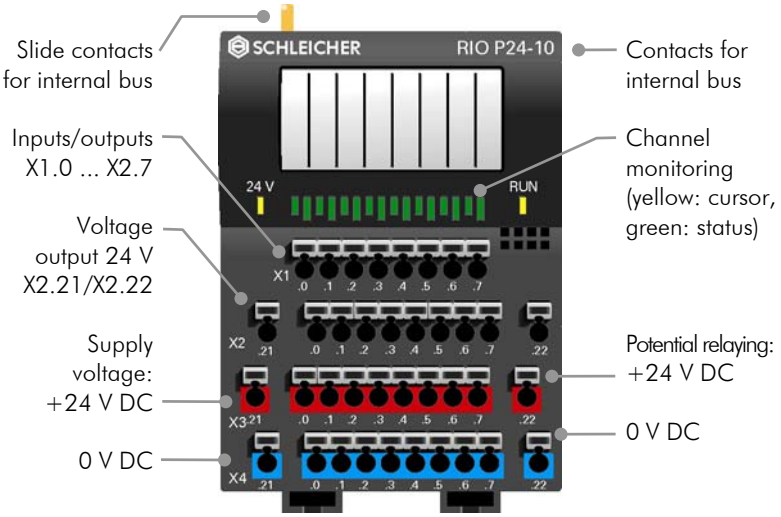
The counter module can handle five different input types:
- *Clock pulse+* (incrementer pulses, counter is incremented on rising signal edge)
- *Clock pulse-* (decrementer pulses, counter is decremented on rising signal edge)
- *Gate* (as long as the gate signal is active, the counter is active)
- *Direction* (as long as the direction signal is active, the counter direction is reversed)
- *Reset* (as long as the reset signal is active, the counter is reset)

Each counter has three inputs. The first two are connected to *Clock pulse+* and *Gate* enable, the third to one of the remaining types (*Clock pulse-*, *Direction*, *Delete*). The result is three input combinations, which make optimal use of the available channels and cover all the usual applications.

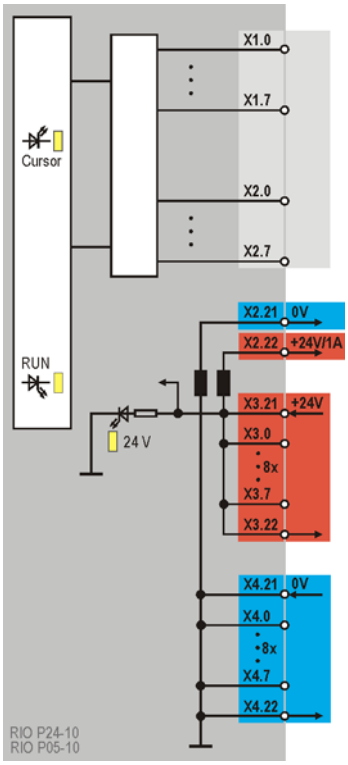
The counter module is configured by a PLC via the bus coupler, or directly by the microLine PLC. This means it can easily be adapted for its application.

Technical Data	RIO C24-10
Article number	R5.364.0170.0
Number of inputs/outputs	12 inputs, 4 outputs
Number of counters / counter width	2 x 32-bit or 4 x 16-bit
Data width	10 bytes at 2 x 32 bit or 4 x 16 bit 6 bytes at 1 x 32 bit or 2 x 16 bit
Method	Once to end value (min. or max. value)
Counting frequency	Max. 200 KHz, interference suppression settable 200 Hz, 2 KHz, 20 KHz, 200 KHz
Range	0 ... 2^{32}–1 or 0 ... 2^{16}–1
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	0.25 W (without input current/load current) from external 24 V supply 1.1 W from internal 5 V supply
Inputs	
Switching level	H level +15 ... +30 V L level –30 ... +5 V
Input current	Min. H level (+15 V) ≥ 3.5 mA Max. L level (+5 V) ≤ 1.0 mA Typ. (+24 V) = 7.5 mA
Simultaneity	100%
Signal delay	<1 µs (hardware)
Isolation	Each channel isolated from internal bus by optocouplers
Outputs	
Switching level	H level: supply voltage – 0.5 V L level ≤ 1 V
Output current per output	Max. 1 A, short-circuit-proof and overcurrent-protected
Total current for whole module	Max. 4 A
Simultaneity	100%
Free-wheeling diode	Integrated
Signal delay	<300 µs (hardware)
Isolation	Each channel isolated from internal bus by optocouplers
Voltage supply for fast encoder (terminals X2.21 / X2.22)	DC 24 V / max. 1 A
For general technical data see page 68	

Positioning Module • counter inputs 24 V — RIO P24-10
Positioning Module • counter inputs 5 V — RIO P05-10



Block diagram



The RIO P24-10 and RIO P05-10 expert modules provide two independent up/down counters with 24 V (RIO P24-10) or 5 V (RIO P05-10), each of which can control one axis. They count pulses from incremental encoders and the value is compared with two thresholds. Counting can be controlled via other inputs.

- Two 32-bit actual value counters for position detection
- Counting frequency up to 200 kHz
- Evaluation of incremental encoder inputs A, B and N (zero signal)
- High positioning accuracy direction sensing through 4-fold edge evaluation of tracking signals
- Comparison with two thresholds
- Evaluation of two limit switches
- 24 V DC inputs / outputs

These features make the RIO P24-10 positioning module suitable for:

- Homing
  The home position is marked by a limit switch. The zero signal of the axis can also be evaluated.
- Positioning
  Evaluation of incremental encoder inputs A and B allows the axis to move quickly to the pre-shutdown point and then slowly to the shutdown point.

Each of the two counters on the module has five inputs:

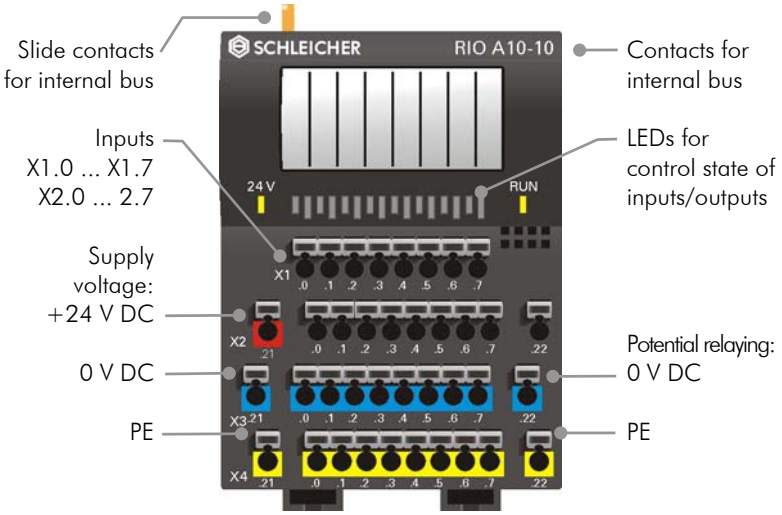
- Three tracking signals *A*, *B* and *N* (zero signal)
- Limit switch *End+* (reached by incrementing)
- Limit switch *End-* (reached by decrementing)

The axis is controlled by three counter outputs, each of which can be configured in two ways depending on the axis drive.

The positioning module is configured by a PLC via the bus coupler, or directly by the microLine PLC. This means it can easily be adapted for its application.

Technical Data	RIO P24-10	RIO P05-10
Article number	R5.364.0200.0	R5.364.0190.0
Number of inputs/outputs	10 inputs, 6 outputs	
Number of counters / axes	2	
Data width	10 bytes with 2 axes 6 bytes with 1 axis	
Method	Periodic (Max → Min or Min → Max)	
Counting frequency	Max. 200kHz	
Width	32-bit	
Range	-2^{31} ... $2^{31}-1$	
Edge evaluation	4-fold	
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)	
Power consumption	0.25 W (without input current/load current) from external 24 V supply 1.25 W from internal 5 V supply	
Inputs		
Switching level	H level +15 ... +30 V L level –30 ... +5 V	H level +3 ... +5 V L level –5 ... +0.8 V
Input current	Min. H level (+15 V) ≥ 3.5 mA Max. L level (+5 V) ≤ 1.0 mA Typ. (+24 V) = 7.5 mA	Typ. (+5 V) = 9.5 mA
Simultaneity	100%	
Signal delay	<1 µs (hardware)	
Isolation	Each channel isolated from internal bus by optocouplers	
Outputs		
Switching level	H level: supply voltage – 0.5 V L level ≤ 1 V	
Output current per output	Max. 1 A, short-circuit-proof and overcurrent-protected	
Total current for whole module	Max. 6 A	
Simultaneity	100%	
Signal delay	<300 µs (hardware)	
Isolation	Each channel isolated from internal bus by optocouplers	
Voltage supply for fast encoder (terminals X2.21 / X2.22)	DC 24 V / max. 1 A	
For general technical data see page 68		

Axis Interface — RIO A10-10



The ROI A10-10 axis interface allows you to control a position-controlled axis by means of an actual value system and an analog setpoint output. It sends the encoder actual value to the controller and generates an analog output voltage from the speed setpoint of the PLC/CNC. It also has a number of digital inputs/outputs that are directly sent to or controlled by the PLC/CNC. The axis interface has no intelligence of its own (e.g. position controller or similar). It merely provides interfaces.

The RIO A10-10 is designed to be used directly on the PLC, because the standard field buses demonstrate non-deterministic behaviour. The SCHLEICHER microLine and XCx controllers are suitable.

Interfaces:

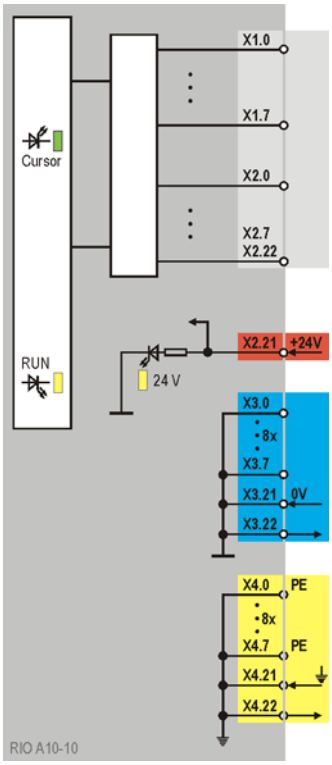
- Incremental/absolute encoder interface (similar to RS422).
  If an incremental encoder is connected, the encoder actual value supplied to the controller is generated by an up/down counter counting the encoder pulses. If an absolute value encoder is connected, the encoder supplies the actual value directly.
- Inputs for limit switch, reference cam, servo amplifier ready (digital, 24 V)
- Output for controller enable (digital, 24 V)
- Analog output (±10 V).
  A corresponding analog output voltage is generated from the speed setpoint supplied by the controller.
- Freely configurable combination input/output (digital, 24 V)

The module possesses limited functionalities of its own. The analog output and the controller enable can be shut down without involving the PLC/CNC. You can set the events (ready, limit switch, cable break, etc.) that lead to shutdown. The watchdog function deactivates the module if the internal bus is interrupted for more than 80 ms; all outputs are shut down. The encoder actual value remains valid and the incremental encoder signals continue to be processed.

You can alter the module configuration via the controller:

- Encoder type (incremental/absolute)
- Zero signal processing
- Code, data length and clock rate of actual value encoder
- Delete actual value
- Monitor ready, limit switch and cable break

Block diagram

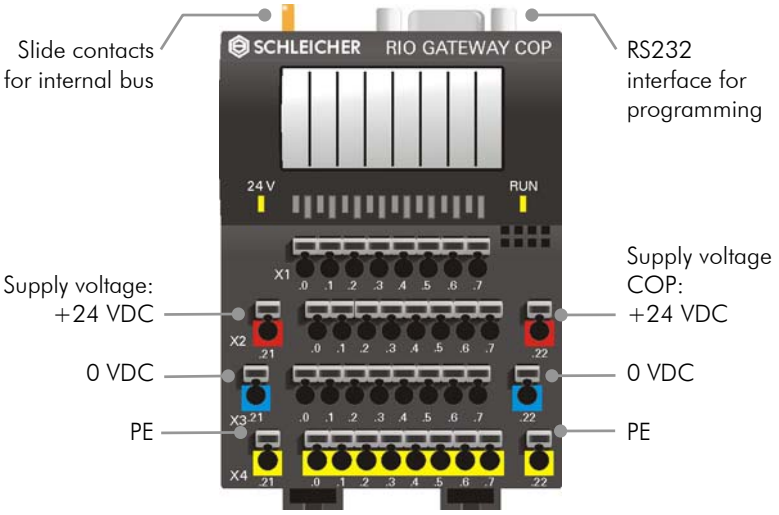


Encoder types

Incremental encoder	
Signals	A, /A, B, /B, NULL, /NULL
Method	Periodic (max → min or min → max)
Counting frequency	Up to 500 kHz
Width	32-bit
Range	-2^{31} ... $2^{31}-1$
Flank evaluation	4-fold
Absolute value encoder	
Signals	A, /A, CLOCK, /CLOCK, GNDCLOCK
Protocol	SSI
Coding	Gray, binary
Data length	24 / 21 / 13 bits
Clock pulse	100 / 200 / 500 / 1000 KHz
Adaptation	Evaluation of A, A/ detects whether CLOCK, /CLOCK and A, /A are correctly connected or inverted. Inversions are corrected in the module.

Technical data	RIO A10-10
Article number	R5.364.0150.0
Number of inputs/outputs	10 digital inputs, 3 digital outputs, 1 digital input/output, 1 analog output
Number of controllable axes	1
Supply voltage external	DC 24 V (±20%, max. 5% residual ripple)
Power consumption	2.1 W from external 24 V supply 0.35 W from internal 5 V supply
Digital inputs 24 V	
Switching level	H level: +30 V L level: +5 V
Input current	Min. H level (+11 V) ≥ 2.0 mA Max. L level (+5 V) ≤ 2.0 mA Typ. (+24 V) = 8.5 mA Max. (+30 V) ≤ 15 mA
Simultaneity	100%
Signal delay	<250 µs (hardware)
Isolation	Each channel isolated by optocouplers from internal bus, analog output, encoder signals
Digital outputs 24 V	
Switching level	H level: supply voltage -0.5 V L level: ≤ 1 V
Output current per output	0.5 A, short-circuit-proof and overcurrent-protected
Simultaneity	100%
Free-wheeling diode	Integrated
Signal delay	< 300 µs (hardware)
Isolation	Each channel isolated by optocouplers from internal bus, analog output, encoder signals
Digital inputs similar to RS422	
Differential input voltage	Typical 2.6 ... 4.8 V Worst case 3.2 ... 4.6 V
Input current	5 ... 15 mA
Isolation	Each channel isolated from internal bus by optocouplers
Digital output RS422	
Differential output voltage	> 2 V
Isolation	From internal bus by optocouplers
Analog output	
Output voltage	–10 ... +10 V
Load impedance	≥ 1000 Ω
Output current	≤ 10 mA, short-circuit-proof, short-circuit current 40 mA
Resolution	16-bit
Zero error	< 10 mV
Overall error	< 100mV
Isolation	From internal bus by optocouplers
For general technical data see page 68	

Gateway for Operator Panels — RIO GATEWAY COP



The RIO GATEWAY COP module provides the interface between the COP operator panel and the COP bus coupler. The operator panel is connected by a 16-pin adapter cable (COP K2-1) to terminal rows X1, X2, X3 and the power supply. Configured operator dialogs can be loaded from a PC to the operator panel via the RS232 interface (9-pin subminiature connector) on the top of the module. The RIO GATEWAY COP can only be operated with a COP bus coupler (→ page 30).

Note

For further information on COP gateway and bus couplers please refer to the "COP handy / COP touch" manual (→ page 67).

Technical data	RIO GATEWAY COP	
Article number	R5.364.0180.0	
Inputs/outputs	X1.0 ... X1.7 X2.0 ... X2.7 X3.0 ... X3.7	RS422 / RS232 from COP Enabling button / Emergency stop COP Dead man's contacts / Emergency stop
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)	
For general technical data see page 68		

Compact I/O

RIO Compact I/O

Our digital compact modules with integrated bus coupler are ideal for plant-floor applications with relatively few channels. This allows cost-effective connection of binary signals to the higher-level controller even where a modular bus node with I/O modules and a bus coupler is not cost-effective due to the low number of channels.

The Compact series includes modules with 8 or 16 input/output channels for the following field buses:

- Profibus-DP
- Interbus
- DeviceNet
- CANopen

The bus-specific connections and controls are on top of the module to save space. This means that, like the modular I/O modules, the whole front is available for clear wiring and terminal labelling. The module electronics is fed via the integrated power pack from the external 24 V supply.

Shared features of the Compact I/Os

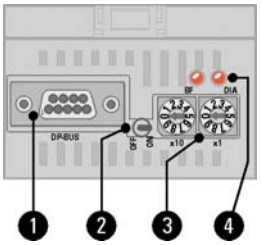
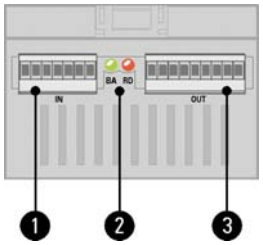
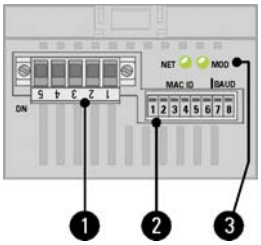
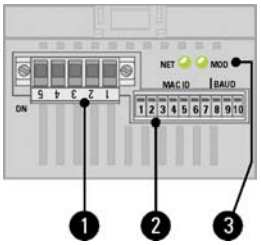
- Input/output channels isolated from internal bus
- Combination channels can be used as inputs or outputs as required
- Output current per channel up to 1 A
- Outputs can be connected in parallel in groups, short-circuit-proof and overcurrent-protected

Wiring is by the vibration-proof spring-loaded clamping key system. The modules can be augmented with a terminal expansion with two additional jumper levels, to allow four-wire connection.

Bus Interfaces

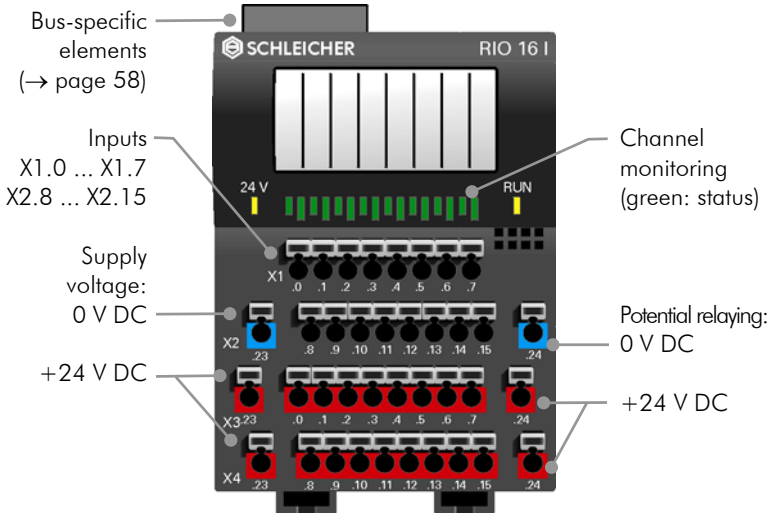
All the field bus-specific connections and controls are on the top of the compact module housing

- Terminals/connectors for field bus connection
- Setting switches for module address, baud rate and module diagnosis
- LEDs for simple field bus diagnosis

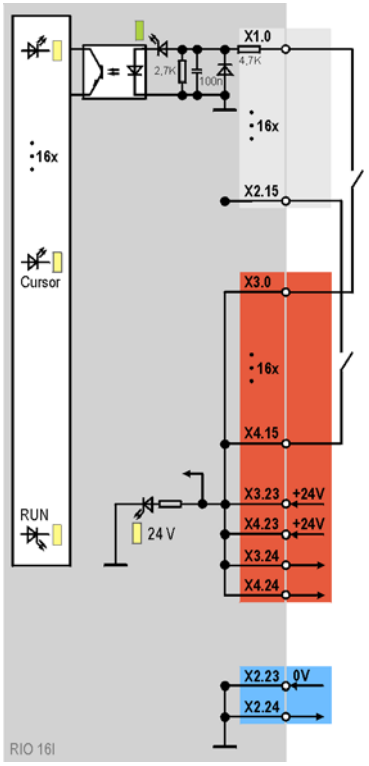
	Profibus-DP	Interbus	DeviceNet	CANopen
				
Bus connection	❶ Subminiature, 9-pin, socket connector	❶ Screw terminal, 6-pole, input ❸ Screw terminal, 8-pole, output	❶ Open style connector 5-pin	❶ Open style connector 5-pin
Settings	❸ Rotary switch for slave address, address range 0 ... 99 ❷ Toggle switch for logical shut-off of station Set baud rate up to 12 MBaud automatic	Baud rate fixed 500 KBaud	❷ DIP switches for - MAC-ID (address range 0 ... 63) - Baud rate (up to 500 KBaud)	❷ DIP switches for - MAC-ID (address range 0 ... 127) - Baud rate (up to 1000 KBaud)
Displays	❹ Field bus diagnosis	❷ Field bus diagnosis	❸ Field bus diagnosis	❸ Field bus diagnosis

Digital • 16 Inputs • DC 24 V — RIO 16I xx

Profibus-DP • Interbus • DeviceNet • CANopen



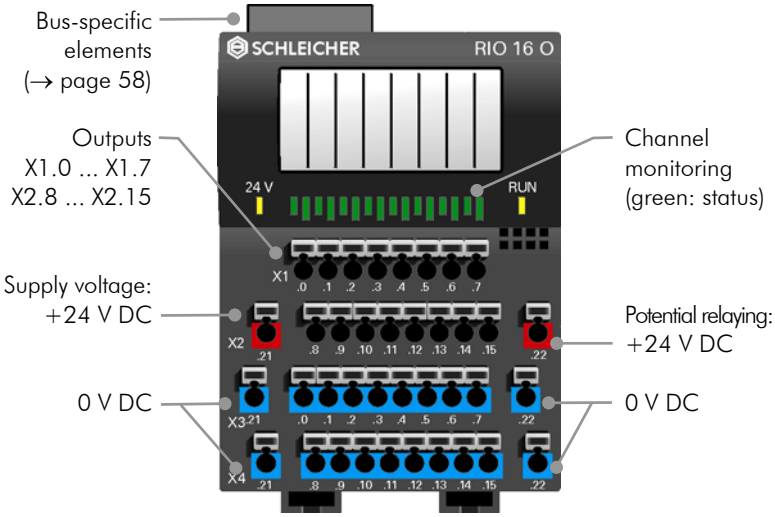
Block diagram



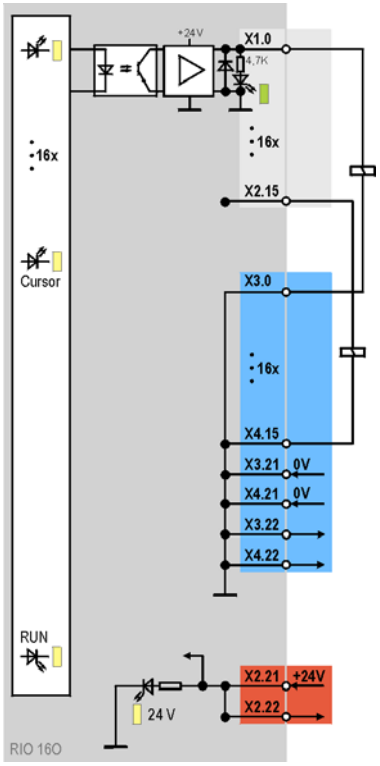
The RIO 16I xx digital compact module provides 16 input channels for binary DC signals with 24 V level. The integrated bus coupler connects the module to Profibus-DP, Interbus, DeviceNet or CANopen field buses. The field bus, module and channel statuses are signalled by LEDs. Additional jumper levels can be created with the pluggable terminal extension.

Technical Data RIO 16I	DP	IBS	CAN DN	CANopen
Article number	R5.362.0030.0	R5.362.0040.0	R5.362.0010.0	R5.362.0020.0
Field bus	Profibus-DP	Interbus	DeviceNet	CANopen
Number of inputs/outputs	16 inputs binary			
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)			
Data width	1 bit per channel I/O			
Connection system	Two-wire (with RIO KE 16 terminal extension: four-wire)			
Inputs				
Switching level	H level +15 ... +30 V L level –30 ... +5 V			
Input current	Min. H level (+15V): I ≥ 2.5 mA Max. L level (+5V): I ≤ 0.7 mA Typ. (+24 V): I = 4.5 mA			
Isolation	Each channel individually isolated from internal bus by optocouplers			
Signal delay	Typical 100 µs (hardware)			
For general technical data see page 68				

Digital • 16 Outputs • DC 24 V — RIO 16O xx
Profibus-DP • Interbus • DeviceNet • CANopen



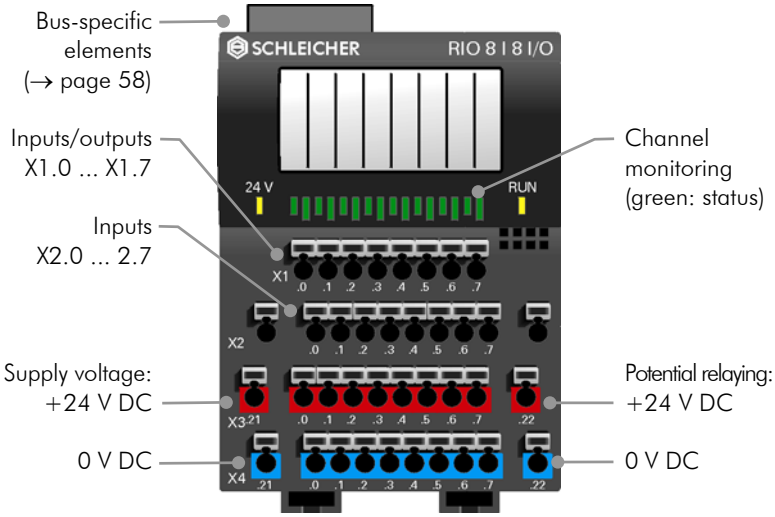
Block diagram



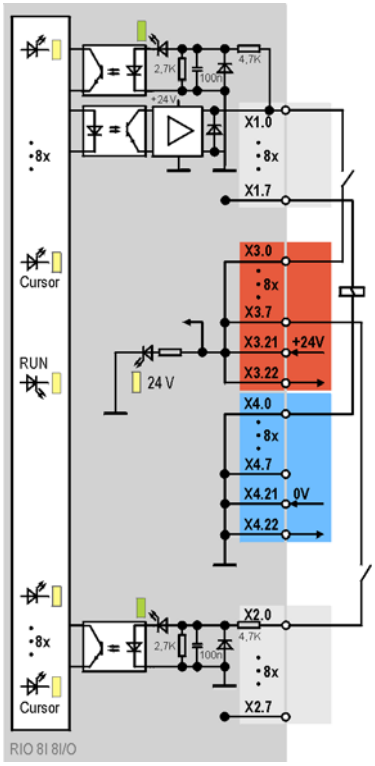
The RIO 16O xx digital compact module provides 16 output channels for binary position signals with 24 V level. The integrated bus coupler connects the module to Profibus-DP, Interbus, DeviceNet or CANopen field buses. The channels are isolated from the internal bus and are short-circuit-proof and overcurrent-protected. The field bus, module and channel statuses are signalled by LEDs. Additional jumper levels can be created with the pluggable terminal extension.

Technical Data RIO 16O	DP	IBS	CAN DN	CANopen
Article number	R5.362.0070.0	R5.362.0080.0	R5.362.0050.0	R5.362.0060.0
Field bus	Profibus-DP	Interbus	DeviceNet	CANopen
Number of inputs/outputs	16 outputs binary			
Data width	1 bit per channel I/O			
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)			
Connection system	Two-wire (with RIO KE 16 terminal extension: four-wire)			
Outputs				
Switching level	H level: supply voltage -0.5 V (I_L < 1 A) L level: ≤ 1 V (I_L = 0 A)			
Output current per output	Max. 1 A, short-circuit-proof and overcurrent-protected, can be connected in parallel in groups: 0-3, 4-7, 8-11, 12-15			
Output current per group	Max. 2 A			
Total current for whole module	Max. 4 A			
Simultaneity	100% at max. 0.25 A per channel			
Free-wheeling diode	Integrated			
Isolation	Each channel individually isolated from internal bus by optocouplers			
Signal delay	<100 µs (hardware)			
For general technical data see page 68				

Digital • 8 Inputs • 8 Inputs/Outputs • DC 24 V — RIO 8I 8I/O xx
Profibus-DP • Interbus • DeviceNet • CANopen



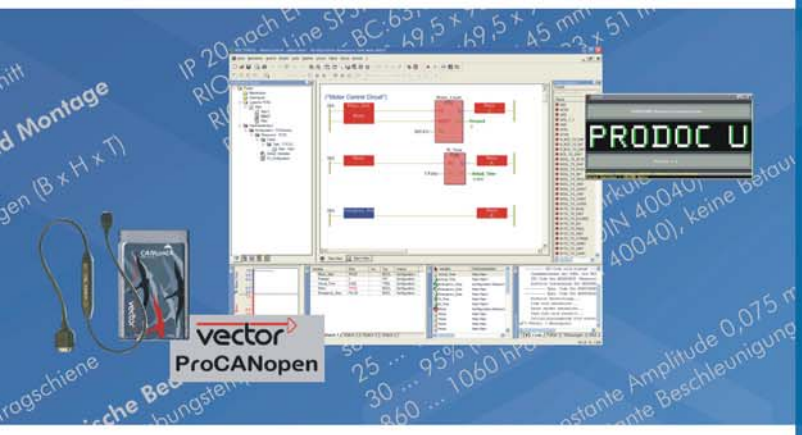
Block diagram



The RIO 8I 8I/O xx digital compact module provides 8 inputs and 8 combination channels. Each combination channel can be used as input or output as required. The respective assignment is detected automatically by the module. The integrated bus coupler connects the module to Profibus-DP, Interbus, DeviceNet or CANopen field buses. The field bus, module and channel statuses are signalled by LEDs. Additional jumper levels can be created with the pluggable terminal extension.

Technical Data RIO 8I 8I/O	DP	IBS	CAN DN	CANopen
Article number	R5.362.0110.0	R5.362.0120.0	R5.362.0090.0	R5.362.0100.0
Field bus	Profibus-DP	Interbus	DeviceNet	CANopen
Number of inputs/outputs	8 inputs and 8 binary combination channels, which can each be used as input or output			
Data width	1 bit per channel I/O			
External supply voltage	DC 24 V (±20%, max. 5% residual ripple)			
Connection system	Two-wire (with RIO KE 16 terminal extension: four-wire)			
Inputs				
Switching level	H level +15 ... +30 V L level –30 ... +5 V			
Input current	Min. H level (+15V): I ≥ 2.5 mA / 3.6 mA * Max. L level (+5V): I ≤ 0.7 mA / 1.2 mA * Typ. (+24 V): I = 4.5 mA / 6.1 mA * * for combination channels			
Isolation	Each channel individually isolated from internal bus by optocouplers			
Signal delay	<100 µs (hardware)			
Outputs				
Switching level	H level: supply voltage -0.5 V L level: ≤ 1 V			
Output current per output	Max. 1 A, short-circuit-proof and overcurrent-protected, can be connected in parallel in groups: 0-3, 4-7			
Total current for whole module	Max. 4 A			
Simultaneity	100% at max 0.5 A per channel			
Free-wheeling diode	Integrated			
Isolation	Each channel individually isolated from internal bus by optocouplers			
Signal delay	<100 µs (hardware)			
For general technical data see page 68				

Annex



Software

- Multiprog
- Prodoc U1
- ProCANopen
- GSD/EDS files

Accessories

- Cables and connectors
- Small parts
- Operating manuals
- System descriptions

Technical Data

- General technical data
- Dimensions

Programming System to IEC 61131-3 — Multiprog

Configuring the microLine MCS 21-20R and MCS 20-20R is carried out with the Windows programming system Multiprog according to IEC 61131-3. It is matched to the resources of the microLine 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.

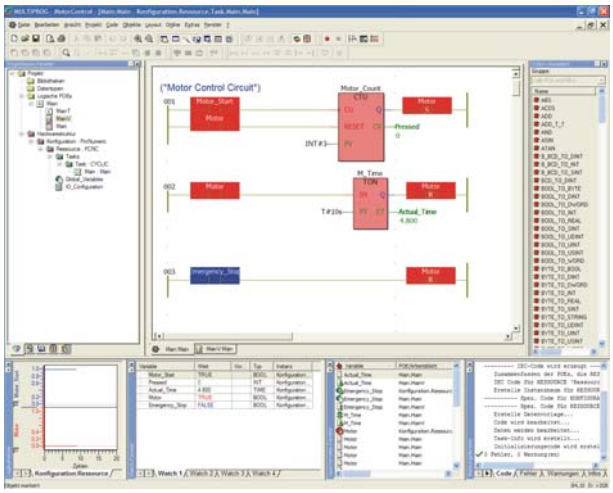
- Text languages
  - Structured text (ST)
  - Instruction list (IL)
- Graphic languages
  - Function block diagram (FBD)
  - Ladder diagram (LD)
  - Sequential function chart (SFC)

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 8).

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, documentations and service informations

Programming Software — Prodoc U1

Prodoc-U 1 is the configuring and documentation software for the MCS 20-11R and MCS 20-10R microLine PLCs.

The practical user interface in Prodoc U1 has pop-up menus and windows operated by mouse or keyboard, for fast selection of instructions. Incorrect entries are detected by a validity check and displayed in the editor. Search functions, search/replace, block processing of existing structures and direct switching between editing and online make for fast programming.

The software runs on DOS or in the Windows DOS box, and is compatible with Prodoc U5, the configuring software for Schleicher Promodul controllers.

The most important functions:

- Editors for various languages: instruction list with macros (macro-IL), function block diagram (FBD), ladder diagram (LD), sequential function chart (SFC).
  microLine's multi-tasking capability means that the languages can be mixed as required for the task or programming style.
- Large programs can be subdivided
- Programming with absolute or symbolic identifiers
- Predefined variables (tasks, programs, inputs/outputs, flags, ...)
- Variable editor
- Organization of function block libraries
- Communication with the PLC via serial interface
- Online mode with powerflow representation
- Program backup and restore
- Comprehensive print options for programs, variables, etc.
- Approx. 3 MB required on hard disk

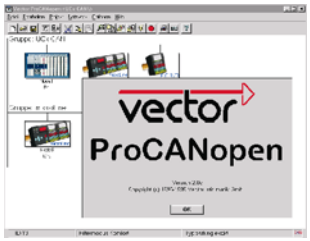
Prodoc U1	
Article number	R4.320.0220.0
Contents	2 diskettes
Operating system	DOS 4.0 and higher, or DOS window in Windows 3.x, 9x/ME, NT, 2000, XP
Systemvoraussetzungen	PC 486, 66 MHz, 640 KB RAM (560 KB free), 3 MB hard disk, RS232 interface, disk drive 3,5"

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)

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

RIO GSD/EDS files

Free downloads from www.schleicher-electronic.com:

- GSD equipment master files for configuring Profibus-DP
- Electronic Data Sheet EDS for configuring DeviceNet/CANopen

Cables, Connectors, Small Parts

Article number	Designation	Comment
RN.114.2401.0	End clamp	To fix RIO modules on DIN rails
R5.368.0060.0	Profibus interface connector	9-pole subminiature connector, without terminating resistor
R5.368.0070.0	Profibus interface connector	9-pole subminiature connector, with terminating resistor
RV.083.3303.0	Interbus interface connector	9-pole subminiature, jack contact
RV.083.3304.0	Interbus interface connector	9-pole subminiature connector
RN.114.1401.0	Laplink cable	Cable microLine – PC, 2x 9-pole subminiature, jack contact
R5.368.0030.0	MCS K1-2	Cable LCT05 operator panel – microLine
R5.368.0040.0	MCS K2-2	Cable UTE2 operator panel – microLine
R5.368.0080.0	MCS K3-2	Cable HBG K6 adapter – microLine
R5.368.0050.0	MCS K5-2	Cable COP BT operator panel – microLine
R6.251.0130.0	COP K2-1	Cable for RIO Gateway COP

Operating Manuals

Article number	Designation
R4.322.2270.0	XCx micro Controller
R4.322.2290.0	XCx micro Expansion Modules
R4.322.2140.0	XCx 300 / 500 / 540
R4.322.2220.0	XCx 700
R4.322.1920.0	microLine PLC IEC 61131-3 [1)]
R4.322.1710.0	microLine PLC [2)]
R4.322.1850.0	RIO Bus Couplers BC / EC
R4.322.1730.0	RIO Expansion Modules
R4.322.1830.0	RIO Compact I/O
R4.322.1800.0	RIO Documentation Package
R4.322.1610.0	Commissioning Field Bus Systems
R4.322.1530.0	COP handy / COP touch
R4.322.1070.0	EMC Guidelines

[1)] for MCS 20-20R / MCS 20-21R

[2)] for MCS 20-10R / MCS 20-11R

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

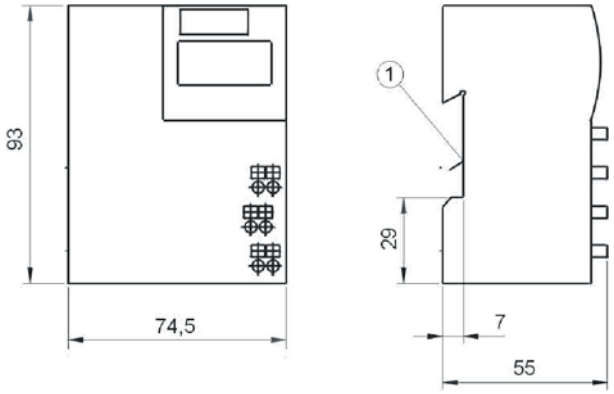
The system descriptions can be downloaded from the products pages at **www.schleicher-electronic.com**.

Technical Data

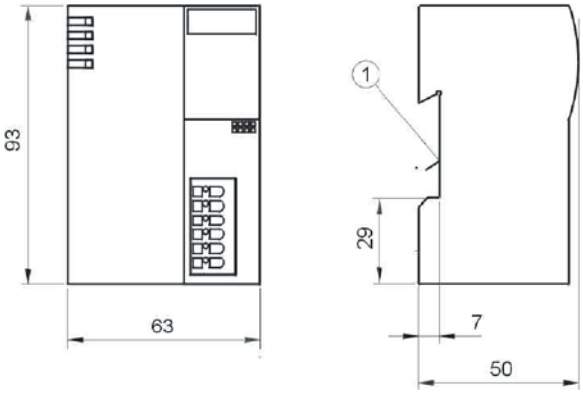
Electrical data		
Supply voltage	24 V DC ± 20% max. 5% residual ripple	
Connection system		
Sensors / actuators		Spring terminal
Field bus	Profibus-DP: Interbus: DeviceNet / CANopen:	Subminiature, 9-pin Screw terminals Open style connector
Supply voltage		Spring terminal
Cable cross-section	Finely stranded 0.14 … 1.5 mm^2, single-core 0.5 … 2.5 mm^2	
Housing and installation		
Housing	PA 6.0 GF20 black	
Type of protection	IP 20 to EN 60529	
Rail	DIN rail EN 50022-35	
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	30 … 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 IEC 68-2-6)	
Electromagnetic compatibility		
Electrostatic discharge	EN 61000-4-2: 4 kV contact discharge	
Electromagnetic fields	EN 61000-4-3: field intensity 10 V/m, 80 … 1000 MHz	
Burst	EN 61000-4-4: 2 kV on DC supply lines, 1 kV on I/O signal and serial interface lines	
Interference emissions	EN 55011: Limit Category A, Group 1	

Dimensions

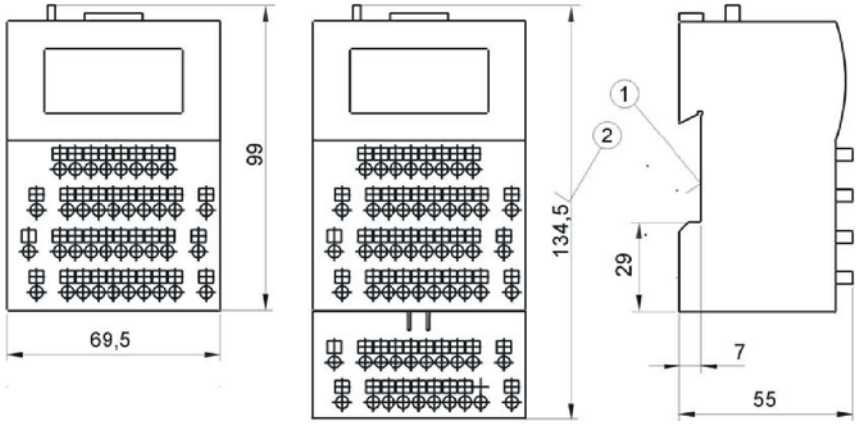
Bus Couplers BC
microLine PLC



Bus Couplers EC



Expansion Modules
Compact I/O



(1) For DIN rail EN 50022-35
(2) Hight incl. terminal extension

Notes

Always There for You

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

Desire and Reality

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

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

Service and Solutions

If you so wish, our specialists will of course also complete configuring and startup and service the installed system. We will help you on site 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, you can use 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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