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Rexroth Bosch Group

Rexroth IndraControl L Function Modules

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Project Planning Manual

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Purpose of Documentation
This documentation describes the function modules supported by the IndraControl L:

- SERCOS III (CFL01.1-R3), master communication SERCOS III
- SERCOS 2 (CFL01.1-Q2), cross communication SERCOS 2
- SRAM (CFL01.1-Y1), 8 MB SRAM
- PLS (CFL01.1-N1), programmable limit switch
- Fast I/O (CFL01.1-E2), fast inputs/outputs
- DeviceNet/M (CFL01.1-V1), DeviceNet master
- Profibus/M (CFL01.1-P1), PROFIBUS master
- RT Ethernet and PROFIBUS (CFL01.1-TP)

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1 Introduction

1.1 General Notes

Different function modules are provided for the IndraControl L control platform. They provide additional technology functions or fieldbus interfaces. The different function modules are described in this documentation and in the corresponding system descriptions.

To its left, the IndraControl L control is provided with a function module connector that can be used to connect up to four extension modules. Please observe the installation notes in the project planning manual of the used control. The 120-pin connector is a Bosch Rexroth PC104^{Plus} connector where the PCI signals as well as additional system-specific signals are applied. Therefore only the function modules especially developed for the IndraControl L can be connected to this connector.

☞ Please observe that the support of the function modules depends on the control variant. The number of function modules that can be used simultaneously also depends on the control hardware. Observe the project planning manual of the used control.

☞ The support of the function modules depends on the used system and the corresponding firmware version! Please observe the system description of the used firmware!

2 Important Instructions on Use

2.1 Appropriate Use

2.1.1 Introduction

Rexroth products represent state-of-the-art developments and manufacturing. They are tested prior to delivery to ensure operational safety and reliability.

⚠ WARNING **Physical injury and material damage might result from an inappropriate use of the products!**

The products are designed for the use in an industrial environment and may therefore only be used for the intended purpose. If they are not used as intended, situations causing personal injury as well as material damage can occur.

☞ Rexroth disclaims as manufacturer any warranty, liability or damages occurring due to inappropriate use of the products. Furthermore, Rexroth is not paying any compensation. The user is responsible for any risks resulting from inappropriate use of the products.

Before using Rexroth products, the following requirements must be met to ensure appropriate use of the products:

- Anyone handling one of the Rexroth products in any way has to read and understand the respective safety-related guidelines as well as the instructions on intended use.
- Hardware products have to remain in their original state, in other words, no modification regarding the design are allowed. Software products must not be decompiled and their source codes must not be modified.
- Damaged or faulty products must not be implemented or put into operation.
- It must be ensured that the products are installed as specified in the documentation.

2.1.2 Areas of Use and Application

The of the IndraLogic and its function modules from Rexroth are intended for Motion/Logic applications.

☞ The IndraControl and its function modules may exclusively be used with the accessories and add-on components specified in this documentation. Components not named expressly mentioned must neither be mounted nor connected. The same applies to cables and conduits.

The products may only be operated with the expressly stated configurations and component combinations as well as with the software and firmware which is given and specified in the respective functional description.

The IndraControl and its function modules were developed for the single axis as well as for the multiple axes drive tasks and control tasks.

For the application specific use of machine control and visualization terminals, device types with different equipment and different interfaces are available.

Important Instructions on Use

Typical areas of application of the IndraControl and its function modules are:

- Handling systems and assembly systems
- Packaging and food processing machines
- Printing machines and paper converting machines
- Machine tools

The IndraControl and its function modules may only be operated under the assembly conditions and installation conditions, in the specified position of application and under the specified ambient conditions (temperature, degree of protection, humidity, EMC etc.) given in this documentation.

2.2 Inappropriate Use

The application of the IndraControl and its function modules that are not within the specified areas of application or under operating conditions deviating from the operating conditions and technical data specified in the documentation is considered as "inappropriate".

The IndraControl and its function modules may not be used if

- it is exposed to operating conditions that do not fulfill the ambient conditions specified. For instance, operation under water, in case of extreme variations of temperature or in extreme maximum temperatures is not allowed.
- Bosch Rexroth has not explicitly released the intended applications. It is imperative that you also note the information given in the general notes on safety!

3 Safety Instructions for Electric Drives and Controls

3.1 Definitions of Terms

Application Documentation Application documentation comprises the entire documentation used to inform the user of the product about the use and safety-relevant features for configuring, integrating, installing, mounting, commissioning, operating, maintaining, repairing and decommissioning the product. The following terms are also used for this kind of documentation: User Guide, Operation Manual, Commissioning Manual, Instruction Manual, Project Planning Manual, Application Manual, etc.

Component A component is a combination of elements with a specified function, which are part of a piece of equipment, device or system. Components of the electric drive and control system are, for example, supply units, drive controllers, mains choke, mains filter, motors, cables, etc.

Control System A control system comprises several interconnected control components placed on the market as a single functional unit.

Device A device is a finished product with a defined function, intended for users and placed on the market as an individual piece of merchandise.

Electrical Equipment Electrical equipment encompasses all devices used to generate, convert, transmit, distribute or apply electrical energy, such as electric motors, transformers, switching devices, cables, lines, power-consuming devices, circuit board assemblies, plug-in units, control cabinets, etc.

Electric Drive System An electric drive system comprises all components from mains supply to motor shaft; this includes, for example, electric motor(s), motor encoder(s), supply units and drive controllers, as well as auxiliary and additional components, such as mains filter, mains choke and the corresponding lines and cables.

Installation An installation consists of several devices or systems interconnected for a defined purpose and on a defined site which, however, are not intended to be placed on the market as a single functional unit.

Machine A machine is the entirety of interconnected parts or units at least one of which is movable. Thus, a machine consists of the appropriate machine drive elements, as well as control and power circuits, which have been assembled for a specific application. A machine is, for example, intended for processing, treatment, movement or packaging of a material. The term "machine" also covers a combination of machines which are arranged and controlled in such a way that they function as a unified whole.

Manufacturer The manufacturer is an individual or legal entity bearing responsibility for the design and manufacture of a product which is placed on the market in the individual's or legal entity's name. The manufacturer can use finished products, finished parts or finished elements, or contract out work to subcontractors. However, the manufacturer must always have overall control and possess the required authority to take responsibility for the product.

Product Examples of a product: Device, component, part, system, software, firmware, among other things.

Project Planning Manual A project planning manual is part of the application documentation used to support the sizing and planning of systems, machines or installations.

Qualified Persons In terms of this application documentation, qualified persons are those persons who are familiar with the installation, mounting, commissioning and operation of the components of the electric drive and control system, as well as with the hazards this implies, and who possess the qualifications their work requires. To comply with these qualifications, it is necessary, among other things,

1) to be trained, instructed or authorized to switch electric circuits and devices safely on and off, to ground them and to mark them

2) to be trained or instructed to maintain and use adequate safety equipment

3) to attend a course of instruction in first aid

User A user is a person installing, commissioning or using a product which has been placed on the market.

3.2 General Information

3.2.1 Using the Safety Instructions and Passing Them on to Others

Do not attempt to install and operate the components of the electric drive and control system without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation prior to working with these components. If you do not have the user documentation for the components, contact your responsible Bosch Rexroth AG sales partner. Ask for these documents to be sent immediately to the person or persons responsible for the safe operation of the components.

If the component is resold, rented and/or passed on to others in any other form, these safety instructions must be delivered with the component in the official language of the user's country.

Improper use of these components, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, could result in property damage, injury, electric shock or even death.

3.2.2 Requirements for Safe Use

Read the following instructions before initial commissioning of the components of the electric drive and control system in order to eliminate the risk of injury and/or property damage. You must follow these safety instructions.

- Bosch Rexroth AG is not liable for damages resulting from failure to observe the safety instructions.
- Read the operating, maintenance and safety instructions in your language before commissioning. If you find that you cannot completely understand the application documentation in the available language, please ask your supplier to clarify.
- Proper and correct transport, storage, mounting and installation, as well as care in operation and maintenance, are prerequisites for optimal and safe operation of the component.
- Only qualified persons may work with components of the electric drive and control system or within its proximity.
- Only use accessories and spare parts approved by Bosch Rexroth AG.
- Follow the safety regulations and requirements of the country in which the components of the electric drive and control system are operated.
- Only use the components of the electric drive and control system in the manner that is defined as appropriate. See chapter "Appropriate Use".
- The ambient and operating conditions given in the available application documentation must be observed.
- Applications for functional safety are only allowed if clearly and explicitly specified in the application documentation "Integrated Safety Technology". If this is not the case, they are excluded. Functional safety is a safety

concept in which measures of risk reduction for personal safety depend on electrical, electronic or programmable control systems.

- The information given in the application documentation with regard to the use of the delivered components contains only examples of applications and suggestions.

  The machine and installation manufacturers must

  – make sure that the delivered components are suited for their individual application and check the information given in this application documentation with regard to the use of the components,

  – make sure that their individual application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.

- Commissioning of the delivered components is only allowed once it is sure that the machine or installation in which the components are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only allowed if the national EMC regulations for the application are met.
- The instructions for installation in accordance with EMC requirements can be found in the section on EMC in the respective application documentation.

  The machine or installation manufacturer is responsible for compliance with the limit values as prescribed in the national regulations.
- The technical data, connection and installation conditions of the components are specified in the respective application documentations and must be followed at all times.

National regulations which the user must take into account

- European countries: In accordance with European EN standards
- United States of America (USA):
  – National Electrical Code (NEC)
  – National Electrical Manufacturers Association (NEMA), as well as local engineering regulations
  – Regulations of the National Fire Protection Association (NFPA)
- Canada: Canadian Standards Association (CSA)
- Other countries:
  – International Organization for Standardization (ISO)
  – International Electrotechnical Commission (IEC)

3.2.3 Hazards by Improper Use

- High electrical voltage and high working current! Danger to life or serious injury by electric shock!
- High electrical voltage by incorrect connection! Danger to life or injury by electric shock!
- Dangerous movements! Danger to life, serious injury or property damage by unintended motor movements!
- Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric drive systems!
- Risk of burns by hot housing surfaces!

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- Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!
- Risk of injury by improper handling of batteries!
- Risk of injury by improper handling of pressurized lines!

3.3 Instructions with Regard to Specific Dangers

3.3.1 Protection Against Contact With Electrical Parts and Housings

☞ This section concerns components of the electric drive and control system with voltages of **more than 50 volts**.

Contact with parts conducting voltages above 50 volts can cause personal danger and electric shock. When operating components of the electric drive and control system, it is unavoidable that some parts of these components conduct dangerous voltage.

High electrical voltage! Danger to life, risk of injury by electric shock or serious injury!

- Only qualified persons are allowed to operate, maintain and/or repair the components of the electric drive and control system.
- Follow the general installation and safety regulations when working on power installations.
- Before switching on, the equipment grounding conductor must have been permanently connected to all electric components in accordance with the connection diagram.
- Even for brief measurements or tests, operation is only allowed if the equipment grounding conductor has been permanently connected to the points of the components provided for this purpose.
- Before accessing electrical parts with voltage potentials higher than 50 V, you must disconnect electric components from the mains or from the power supply unit. Secure the electric component from reconnection.
- With electric components, observe the following aspects:

  Always wait **30 minutes** after switching off power to allow live capacitors to discharge before accessing an electric component. Measure the electrical voltage of live parts before beginning to work to make sure that the equipment is safe to touch.
- Install the covers and guards provided for this purpose before switching on.
- Never touch electrical connection points of the components while power is turned on.
- Do not remove or plug in connectors when the component has been powered.
- Under specific conditions, electric drive systems can be operated at mains protected by residual-current-operated circuit-breakers sensitive to universal current (RCDs/RCMs).
- Secure built-in devices from penetrating foreign objects and water, as well as from direct contact, by providing an external housing, for example a control cabinet.

High housing voltage and high leakage current! Danger to life, risk of injury by electric shock!

- Before switching on and before commissioning, ground or connect the components of the electric drive and control system to the equipment grounding conductor at the grounding points.

Safety Instructions for Electric Drives and Controls

- Connect the equipment grounding conductor of the components of the electric drive and control system permanently to the main power supply at all times. The leakage current is greater than 3.5 mA.
- Establish an equipment grounding connection with a minimum cross section according to the table below. With an outer conductor cross section smaller than 10 mm^2 (8 AWG), the alternative connection of two equipment grounding conductors is allowed, each having the same cross section as the outer conductors.

Cross section outer conductor	Minimum cross section equipment grounding conductor Leakage current ≥ 3.5 mA	
	1 equipment grounding conductor	2 equipment grounding conductors
1.5 mm^2 (16 AWG)	10 mm^2 (8 AWG)	2 × 1.5 mm^2 (16 AWG)
2.5 mm^2 (14 AWG)		2 × 2.5 mm^2 (14 AWG)
4 mm^2 (12 AWG)		2 × 4 mm^2 (12 AWG)
6 mm^2 (10 AWG)		2 × 6 mm^2 (10 AWG)
10 mm^2 (8 AWG)		-
16 mm^2 (6 AWG)	16 mm^2 (6 AWG)	-
25 mm^2 (4 AWG)		-
35 mm^2 (2 AWG)		-
50 mm^2 (1/0 AWG)	25 mm^2 (4 AWG)	-
70 mm^2 (2/0 AWG)	35 mm^2 (2 AWG)	-
...	...	...

Fig.3-1: Minimum Cross Section of the Equipment Grounding Connection

3.3.2 Protective Extra-Low Voltage as Protection Against Electric Shock

Protective extra-low voltage is used to allow connecting devices with basic insulation to extra-low voltage circuits.

On components of an electric drive and control system provided by Bosch Rexroth AG, all connections and terminals with voltages between 5 and 50 volts are PELV ("Protective Extra-Low Voltage") systems. It is allowed to connect devices equipped with basic insulation (such as programming devices, PCs, notebooks, display units) to these connections.

Danger to life, risk of injury by electric shock! High electrical voltage by incorrect connection!

If extra-low voltage circuits of devices containing voltages and circuits of more than 50 volts (e.g., the mains connection) are connected to Bosch Rexroth AG products, the connected extra-low voltage circuits must comply with the requirements for PELV ("Protective Extra-Low Voltage").

3.3.3 Protection Against Dangerous Movements

Dangerous movements can be caused by faulty control of connected motors. Some common examples are:

- Improper or wrong wiring or cable connection
- Operator errors
- Wrong input of parameters before commissioning
- Malfunction of sensors and encoders
- Defective components
- Software or firmware errors

These errors can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

The monitoring functions in the components of the electric drive and control system will normally be sufficient to avoid malfunction in the connected drives. Regarding personal safety, especially the danger of injury and/or property damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.

Dangerous movements! Danger to life, risk of injury, serious injury or property damage!

A **risk assessment** must be prepared for the installation or machine, with its specific conditions, in which the components of the electric drive and control system are installed.

As a result of the risk assessment, the user must provide for monitoring functions and higher-level measures on the installation side for personal safety. The safety regulations applicable to the installation or machine must be taken into consideration. Unintended machine movements or other malfunctions are possible if safety devices are disabled, bypassed or not activated.

To avoid accidents, injury and/or property damage:

- Keep free and clear of the machine's range of motion and moving machine parts. Prevent personnel from accidentally entering the machine's range of motion by using, for example:
  - Safety fences
  - Safety guards
  - Protective coverings
  - Light barriers
- Make sure the safety fences and protective coverings are strong enough to resist maximum possible kinetic energy.
- Mount emergency stopping switches in the immediate reach of the operator. Before commissioning, verify that the emergency stopping equipment works. Do not operate the machine if the emergency stopping switch is not working.
- Prevent unintended start-up. Isolate the drive power connection by means of OFF switches/OFF buttons or use a safe starting lockout.
- Make sure that the drives are brought to safe standstill before accessing or entering the danger zone.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example,
  - mechanically securing the vertical axes,
  - adding an external braking/arrester/clamping mechanism or
  - ensuring sufficient counterbalancing of the vertical axes.

- The standard equipment **motor holding brake** or an external holding brake controlled by the drive controller is **not sufficient to guarantee personal safety**!
- Disconnect electrical power to the components of the electric drive and control system using the master switch and secure them from reconnection ("lock out") for:
  - Maintenance and repair work
  - Cleaning of equipment
  - Long periods of discontinued equipment use
- Prevent the operation of high-frequency, remote control and radio equipment near components of the electric drive and control system and their supply leads. If the use of these devices cannot be avoided, check the machine or installation, at initial commissioning of the electric drive and control system, for possible malfunctions when operating such high-frequency, remote control and radio equipment in its possible positions of normal use. It might possibly be necessary to perform a special electromagnetic compatibility (EMC) test.

3.3.4 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated by current-carrying conductors or permanent magnets of electric motors represent a serious danger to persons with heart pacemakers, metal implants and hearing aids.

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric components!

- Persons with heart pacemakers and metal implants are not allowed to enter the following areas:
  - Areas in which components of the electric drive and control systems are mounted, commissioned and operated.
  - Areas in which parts of motors with permanent magnets are stored, repaired or mounted.
- If it is necessary for somebody with a heart pacemaker to enter such an area, a doctor must be consulted prior to doing so. The noise immunity of implanted heart pacemakers differs so greatly that no general rules can be given.
- Those with metal implants or metal pieces, as well as with hearing aids, must consult a doctor before they enter the areas described above.

3.3.5 Protection Against Contact With Hot Parts

Hot surfaces of components of the electric drive and control system. Risk of burns!

- Do not touch hot surfaces of, for example, braking resistors, heat sinks, supply units and drive controllers, motors, windings and laminated cores!
- According to the operating conditions, temperatures of the surfaces can be **higher than 60 °C** (140 °F) during or after operation.
- Before touching motors after having switched them off, let them cool down for a sufficient period of time. Cooling down can require **up to 140 minutes**! The time required for cooling down is approximately five times the thermal time constant specified in the technical data.

- After switching chokes, supply units and drive controllers off, wait **15 minutes** to allow them to cool down before touching them.
- Wear safety gloves or do not work at hot surfaces.
- For certain applications, and in accordance with the respective safety regulations, the manufacturer of the machine or installation must take measures to avoid injuries caused by burns in the final application. These measures can be, for example: Warnings at the machine or installation, guards (shieldings or barriers) or safety instructions in the application documentation.

3.3.6 Protection During Handling and Mounting

Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!

- Observe the relevant statutory regulations of accident prevention.
- Use suitable equipment for mounting and transport.
- Avoid jamming and crushing by appropriate measures.
- Always use suitable tools. Use special tools if specified.
- Use lifting equipment and tools in the correct manner.
- Use suitable protective equipment (hard hat, safety goggles, safety shoes, safety gloves, for example).
- Do not stand under hanging loads.
- Immediately clean up any spilled liquids from the floor due to the risk of falling!

3.3.7 Battery Safety

Batteries consist of active chemicals in a solid housing. Therefore, improper handling can cause injury or property damage.

Risk of injury by improper handling!

- Do not attempt to reactivate low batteries by heating or other methods (risk of explosion and cauterization).
- Do not attempt to recharge the batteries as this may cause leakage or explosion.
- Do not throw batteries into open flames.
- Do not dismantle batteries.
- When replacing the battery/batteries, do not damage the electrical parts installed in the devices.
- Only use the battery types specified for the product.

☞ Environmental protection and disposal! The batteries contained in the product are considered dangerous goods during land, air, and sea transport (risk of explosion) in the sense of the legal regulations. Dispose of used batteries separately from other waste. Observe the national regulations of your country.

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3.3.8 Protection Against Pressurized Systems

According to the information given in the Project Planning Manuals, motors and components cooled with liquids and compressed air can be partially supplied with externally fed, pressurized media, such as compressed air, hydraulics oil, cooling liquids and cooling lubricants. Improper handling of the connected supply systems, supply lines or connections can cause injuries or property damage.

Risk of injury by improper handling of pressurized lines!

- Do not attempt to disconnect, open or cut pressurized lines (risk of explosion).
- Observe the respective manufacturer's operating instructions.
- Before dismounting lines, relieve pressure and empty medium.
- Use suitable protective equipment (safety goggles, safety shoes, safety gloves, for example).
- Immediately clean up any spilled liquids from the floor due to the risk of falling!

☞ Environmental protection and disposal! The agents (e.g., fluids) used to operate the product might not be environmentally friendly. Dispose of agents harmful to the environment separately from other waste. Observe the national regulations of your country.

3.4 Explanation of Signal Words and the Safety Alert Symbol

The Safety Instructions in the available application documentation contain specific signal words (DANGER, WARNING, CAUTION or NOTICE) and, where required, a safety alert symbol (in accordance with ANSI Z535.6-2006).

The signal word is meant to draw the reader's attention to the safety instruction and identifies the hazard severity.

The safety alert symbol (a triangle with an exclamation point), which precedes the signal words DANGER, WARNING and CAUTION, is used to alert the reader to personal injury hazards.

⚠ DANGER

In case of non-compliance with this safety instruction, death or serious injury **will** occur.

⚠ WARNING

In case of non-compliance with this safety instruction, death or serious injury **could** occur.

⚠ CAUTION

In case of non-compliance with this safety instruction, minor or moderate injury could occur.

NOTICE

In case of non-compliance with this safety instruction, property damage could occur.

4 Connecting and Mounting

4.1 Connecting the Function Modules to the IndraControl

The following applies:

The first module (closest to the IndraControl) has the address "1" (DIP switch S1: 1 and 2 to the left).

The second module has the address "2" (DIP switch S1: 1 to the right, 2 to the left).

Connect the other modules accordingly, also refer to fig. 4-1 "Addressing function modules at the IndraControl " on page 21.

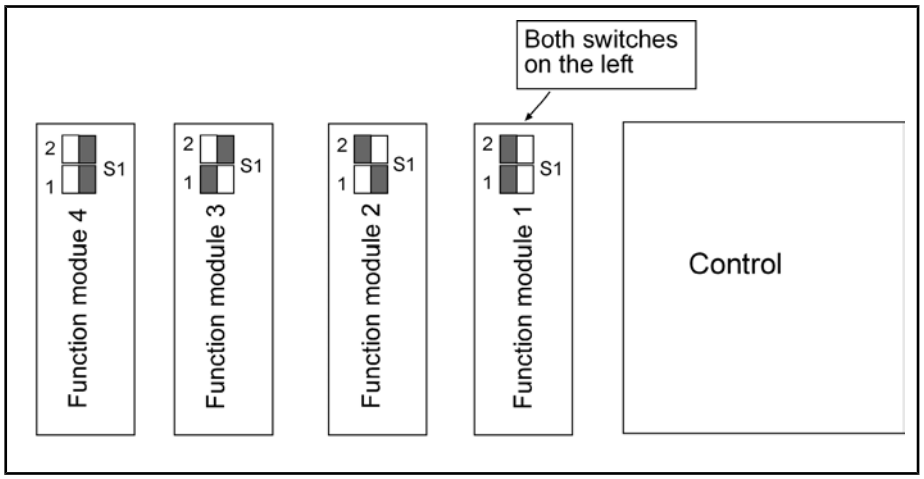


Fig.4-1: Addressing function modules at the IndraControl

☞ Disconnect the control from the power supply to connect a function module.

4.2 Mounting an IndraControl Function Module

NOTICE **Damages due to electrostatic discharges**

Do observe all required precautionary measures when handling electrostatic discharge-sensitive devices! (EN 61340-5-1, EN 61340-5-2)! Only persons who are trained and qualified may mount or replace the module!

☞ Do observe that the mounting rail is grounded. Mounting is only permitted if there is no voltage at the control and at the function module!

Connecting and Mounting

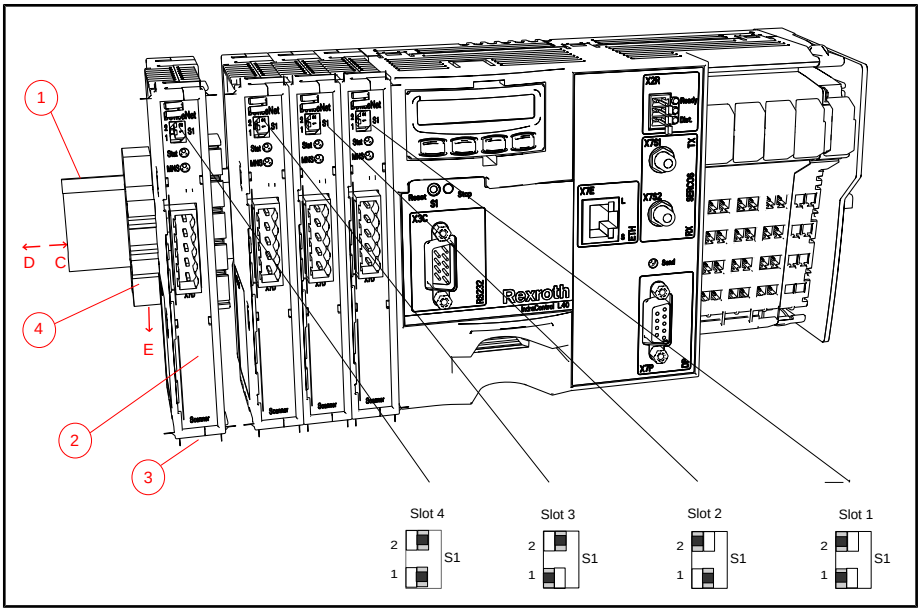


Fig.4-2: View: Function modules

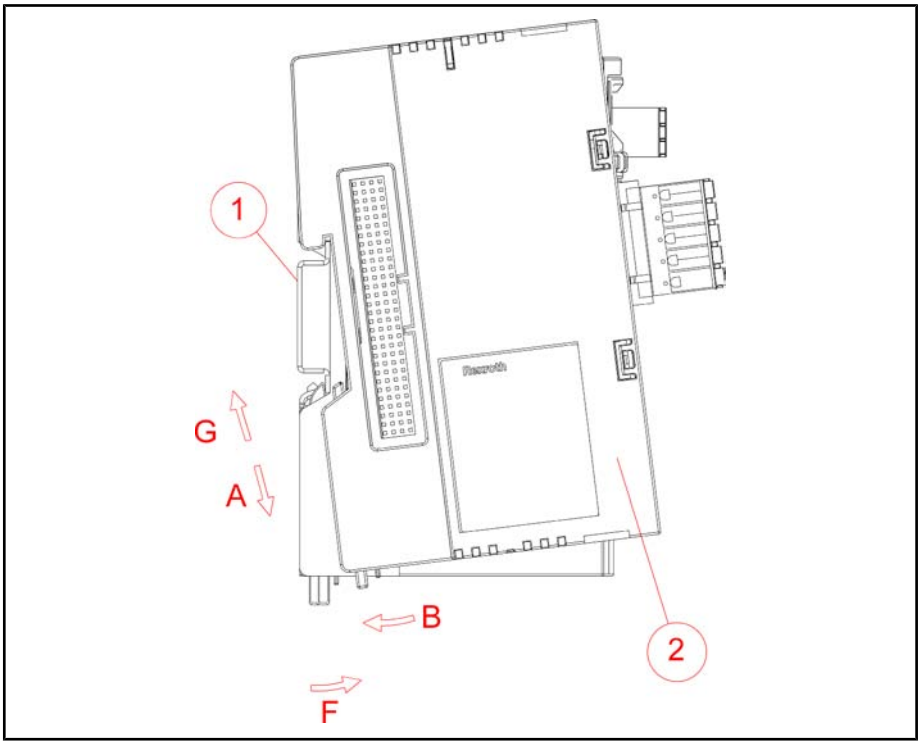


Fig.4-3: Setting slot number

Setting the slot number

The slot number can be set as follows:

Corresponding to the module slot, the slot number has to be set at DIP switch S1 (see fig. 4-2 "View: Function modules" on page 22).

Fitting the function module

The function modules are fit on the left 120-pin female connector of the IndraControl[1] :

- Hang the function module ② on the mounting rail from top (see ①, A in chapter 4.2 "Mounting an IndraControl Function Module" on page 21)

1) *The mounting is described exemplarily for an IndraControl 40.*

- Incline (B) to the mounting rail until the lock ③ snaps in
- Then slide (C) the module on the left 120-pin female connector of the control

If you want to mount further function modules, proceed in the same way and mount them in series.

- Fix the function module with the end clamp ④ on the mounting rail

Demounting the Function Module

The function modules are demounted as follows:

- Remove the end clamp ④.
- Pull the function module to the left (D) away from the control or the neighboring module
- Pull down the mounting rail lock (3) with a screw driver and incline the function module forward (F).

5 General Technical Data

5.1 Overview

To its left, the IndraControl L is provided with a functional module connector that can be used to connect up to four extension modules, depending on the control and configuration. For this, please observe the installation notes of the IndraControl L in the corresponding chapter of the project planning manual.

This 120-pin connector is a Bosch Rexroth PC104^{Plus} connector where the PCI signals as well as additional system-specific signals are applied. In other words, only the function modules especially developed for the IndraControl L can be connected to this connector.

☞ The single function modules are not supported by every system! For information on which function modules are supported by the used system, please refer to the particular system-specific manual.

☞ Please observe that the hardware support of the function module depends on the firmware version of the system.

Voltage supply

The function modules are supplied from the internal voltage of the IndraControl L.

Current and power consumption

Please find the current and power consumption in the respective chapters of the functions module.

5.2 Ambient Conditions

Ambient Conditions	In operation	Storage / Transport
Max. surrounding air temperature	+5 up to +55 °C	-25 °C to +70 °C
Relative humidity	RH-2; 5 % to 95 % according to DIN EN 61131-2, non-condensing.	
Air pressure	Up to 2,700 m above MSL according to DIN 60204	Up to 3,000 m above MSL according to DIN 60204
Mechanical strength	Max. vibration: Frequency range: 10 up to 150 Hz Excursion: 0.075 mm for 10 to 57 Hz Acceleration: 1 g for 57 to 150 Hz acc. to EN 60068-2-6	Max. shock: 15 g according to EN 60 068-2-27, no disturbance of the function

Fig.5-1: Ambient Conditions

NOTICE **Danger of destruction by overheating!**

Ensure a surrounding air temperature of less than 55 °C.

☞ The surrounding air must be free from acids, alkaline solutions, corrosive agents, salts, metal vapors, and other electrically conductive contaminants in high concentrations.

The ambient air must be dust-free. Housings and installation compartments must at least comply with degree of protection IP 54 according to DIN VDE 0470-1.

5.3 Standards Used

The following standards were applied for the IndraControl L system:

Standard	Meaning
DIN EN 60 204-1	Electrical equipment of machines
DIN EN 61,131-2	Programmable logic controllers Equipment and tests requirements
DIN EN 60,529	Degrees of protection (including housings and installation compartments)
UL 508	Industrial Control Equipment

Fig.5-2: Used standards

☞ The IndraControl L system as well as the additionally available function modules and the Inline terminals correspond to the CE requirements!

☞ Systems with the IndraControl L that are used in residential areas (housing, business and commercial areas as well as small-sized enterprises) require a single approval by an authority or a testing agency. In Germany, such single approvals are issued by the ”Regulierungsbehörde für Telekommunikation und Post (RegTP)” (German Regulatory Authority for Telecommunications and Posts).

UL/CSA Certified

c UL US LISTED

The IndraControl L systems are certified acc. to

- **UL508** (Industrial Control Equipment) and
- **C22.2 no. 142-M1987** (CSA)

However, there can be combinations or stages of expansions with limited or missing certification. Therefore verify the certification by using the UL label on the device.

☞ To guarantee an UL/CSA-compliant operation, the following conditions have to be fulfilled:

- Use only insulated copper wire suitable for at least 60/75°C.

5.4 Compatibility Test

All Rexroth controls and drives are developed and tested according to the latest state-of-the-art of technology.

As it is impossible to follow the continuing development of all materials (e. g. lubricants in machine tools) which may interact with our controls and drives, it

cannot be completely ruled out that any reactions with the materials used by Bosch Rexroth might occur.

For this reason, before using the respective material a compatibility test has to be carried out for new lubricants, cleaning agents etc. and our housings / our housing materials.

6 SERCOS III (CFL01.1-R3)

6.1 General Information

With the SERCOS III (CFL01.1-R3) function module you can realize a further SERCOS III fieldbus interface. The module can be used for establishing a master communication for drives and other I/O field devices and and for cross-communication between several IndraControl L controls.

The function module can be ordered under the parts number R911170008.

New features from SERCOS 2:

- The connection via Ethernet CAT5 cable instead of fiber optics
- A higher data rate, 100 Mbauds

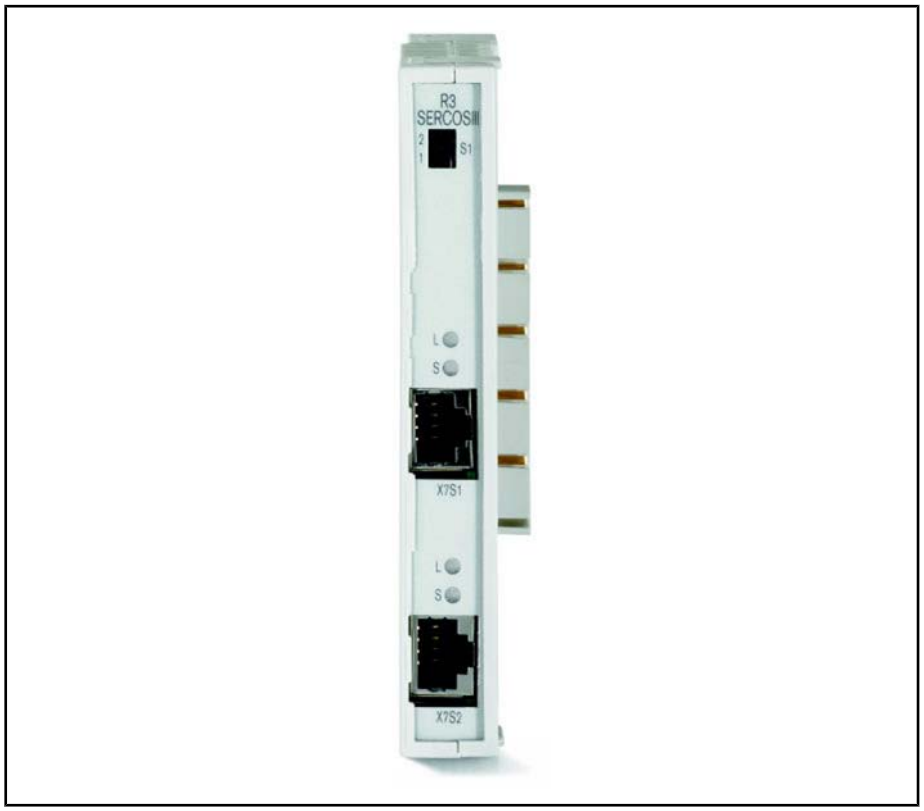
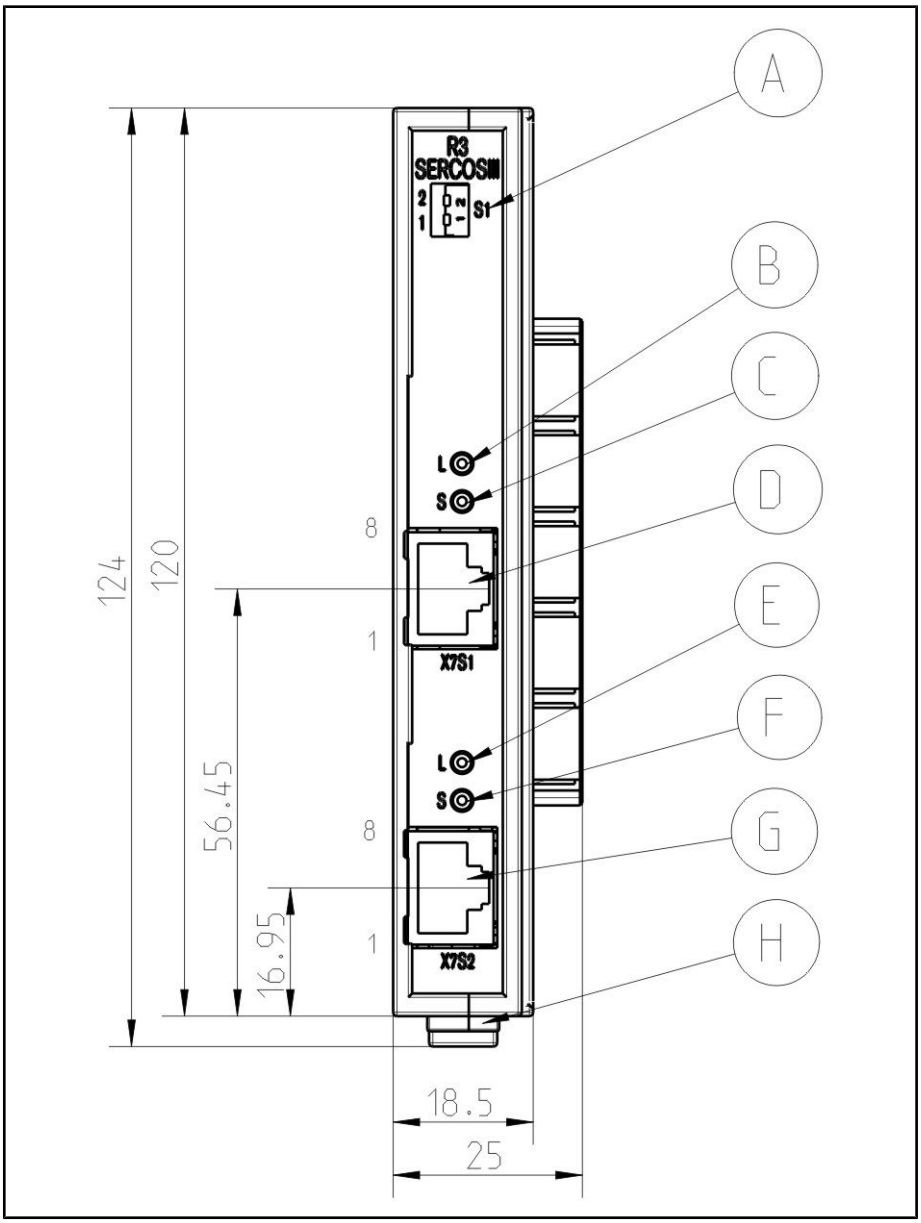


Fig.6-1: SERCOS III module

SERCOS III (CFL01.1-R3)

6.2 View



A	S1, switch for slot number
B	Indicator (PORT1) LINK, green
C	Indicator (PORT1) ACTIVITY, yellow
D	X7S1, PORT1 – SERCOS III interface (RJ45)
E	Indicator (PORT2) LINK, green
F	Indicator (PORT2) ACTIVITY, yellow
G	X7S2, PORT2 – SERCOS III interface (RJ45)
H	Mounting rail interlock

Fig.6-2: SERCOS III module

6.3 Interfaces

X7S1, X7S2
SERCOS III Interface

Pin	Meaning
1	TX+ Transmitted data plus
2	TX- Transmitted data minus
3	RX- Received data plus
6	RX- Received data minus
Housing	Shield

Fig.6-3: Pin assignment of connectors X7S1, X7S2

Bosch Rexroth recommends the use of an STP cable of category 5, cat5 (standard Ethernet cable).

Housing: Shield; requirements for the cable: cat5, double shielded

☞ Cable fixing during installation is required!

For further descriptions please refer to the particular system-specific manual.

6.4 LED Display

Group indicators: This port is intended for the programming device network!

LED	Status
L (link)	Lights: Link to network is available Doe not light: No connection to network
S (send)	Lights: Data packets are sent. Doe not light: No data is sent

Fig.6-4: Status of LEDs "L" and "S"

6.5 Current and Power Consumption

Consumption	Current consumption	Power consumption
from 3.3 V:	270 mA	0.9 W
from 5 V:	230 mA	1.15 W
Total power consumption	-	2,05

Fig.6-5: Current and power consumption

7 SERCOS 2 (CFL01.1-Q2)

7.1 General

With the SERCOS 2 (CFL01.1-Q2) function module SERCOS 2 drives can be connected to an IndraControl that is equipped with an Onboard SERCOS III interface.

With the SERCOS 2 (CFL01.1-Q2) function module a further SERCOS 2 interface can be realized. The module can be used for establishing a master communication for drives and for cross-communication between several IndraControl L controls.

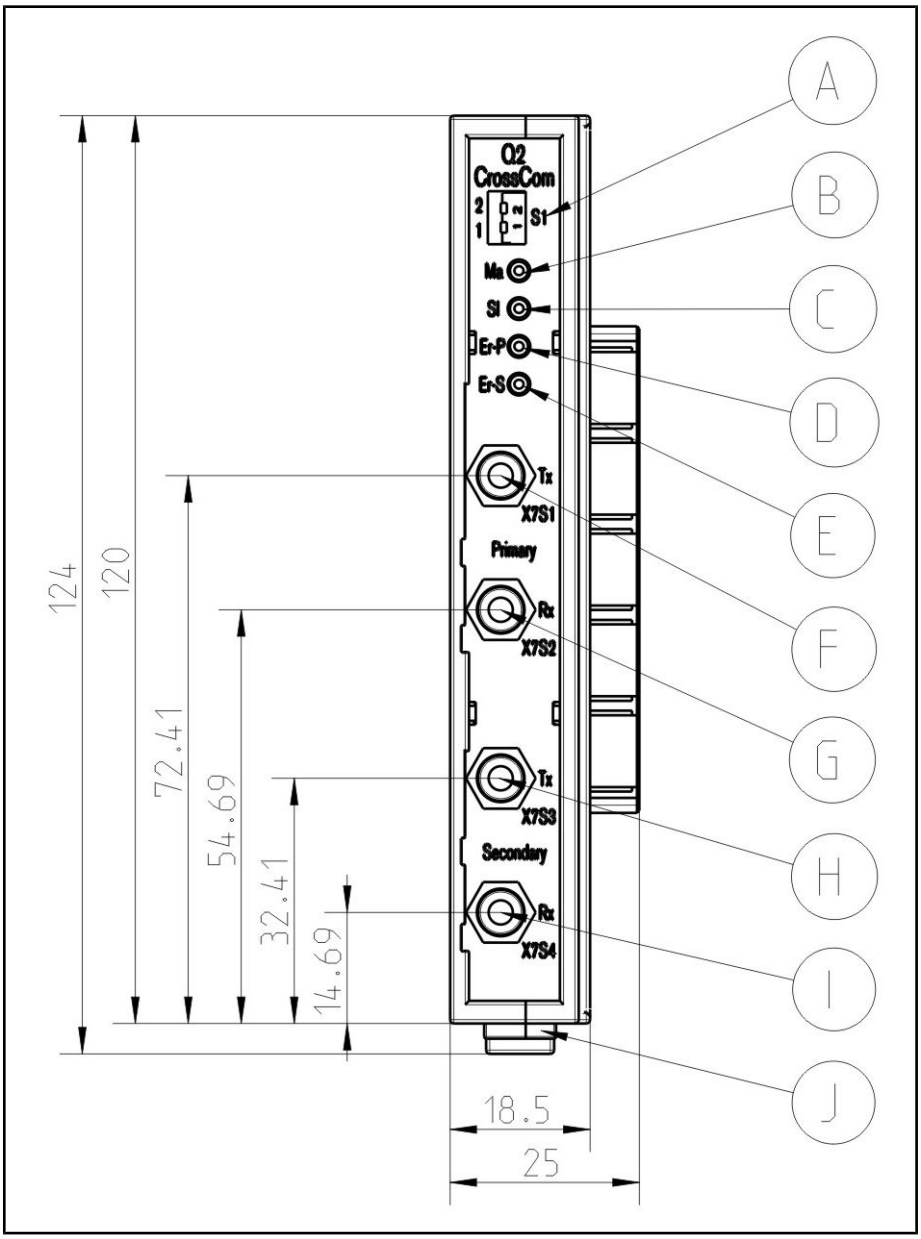
The function module can be ordered under the parts number: R911170009.

Ring SERCOS 2 drives must be connected to the primary ring of the function module via fiber optic conductors.

Fig.7-1: SERCOS 2 module

SERCOS 2 (CFL01.1-Q2)

7.2 View



A	S1, switch for slot number
B	Ma, indicator of the cross communication MASTER mode
C	SI, indicator of the cross communication SLAVE mode
D	Er-P, primary ring error
E	Er-S, secondary ring error
F	X7S1, FO transmitter of the primary ring (SERCOS transmitter)
G	X7S2, FO receiver of the primary ring (SERCOS receiver)
H	X7S3, FO transmitter of the secondary ring (SERCOS transmitter)
I	X7S4, FO receiver of the secondary ring (SERCOS receiver)
J	Mounting rail interlock

Fig.7-2: Cross communication function module

☞ Fasten finger tight of the connecting cables!

☞ Cable fixing during installation is required!

☞ Please note that the function module is supported from the CML40.1 control starting from index 108. If the function module is used together with CML40.1, check the index on the type plate and contact the Bosch Rexroth Service, if necessary. For further descriptions please refer to the particular system-specific manual.

7.3 Interfaces

FO connections X7S1 = transmitter connection of the primary ring

X7S2 = receiver connection of the primary ring

7.4 LED Display

Distortion indicator With the distortion indicators of the CFL01.1-Q2 (red LED "Er-P"), error primary circuit, the quality of the optical receive signal can be checked. This LED is called: error primary circuit.

Group indicators: LED "Ma" (green) indicates an active SERCOS 2 master communication.

7.5 Current and Power Consumption

Consumption	Current consumption	Power consumption
from 3.3 V:	150 mA	0.5 W
from 5 V:	360 mA	1.8 W
Total power consumption	-	2.3 W

Fig.7-3: Current and power consumption

8 SRAM Module (CFL01.1-Y1)

8.1 General Information

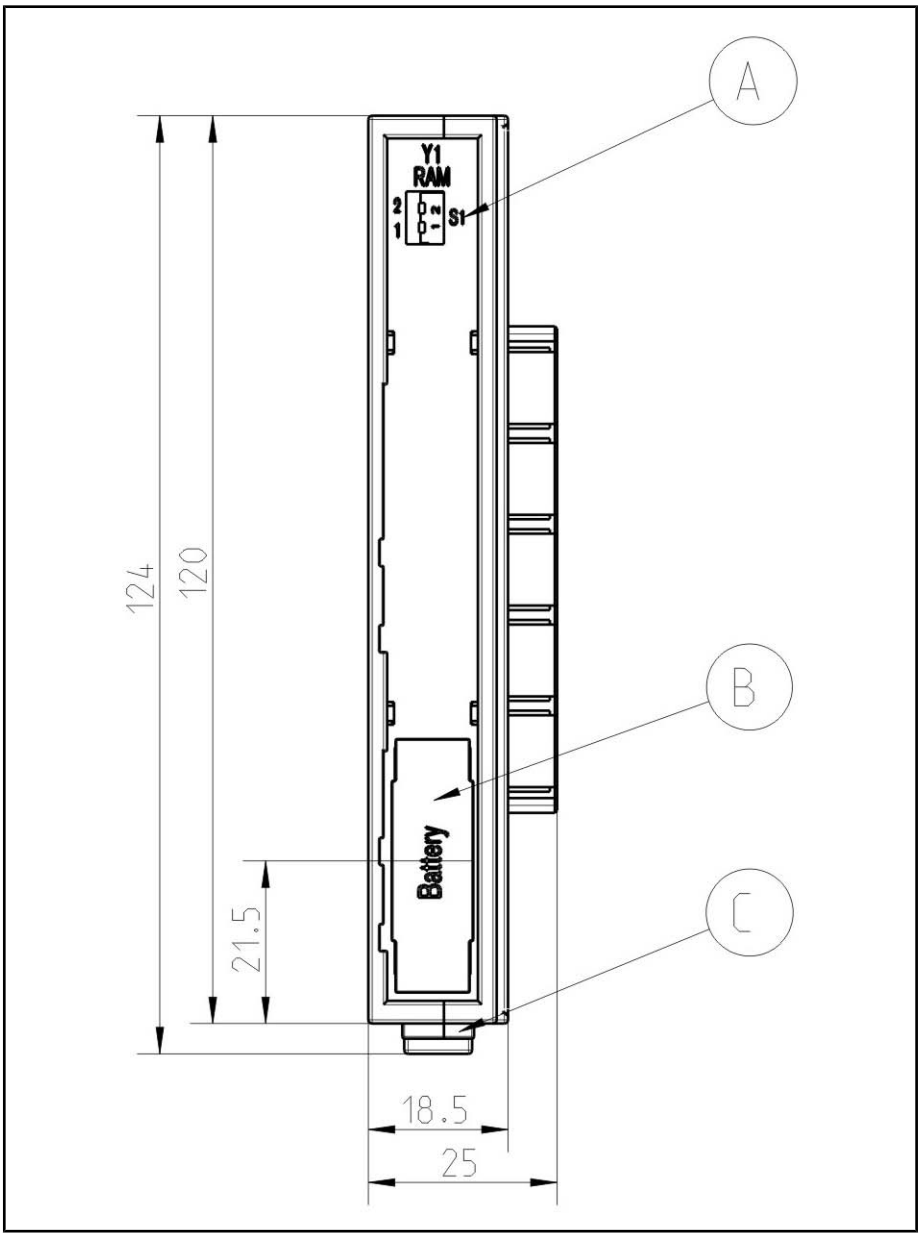
The function module provides 8 Mbyte battery buffered memory. This additional remanent memory is required for operating the IndraMotion MTX CNC control system with an IndraControl L40. Furthermore, this memory can be used for filing kinematic programs in the IndraMotion MLC system

The function module can be ordered under the parts number R911170007.

Fig.8-1: 8 MB SRAM module

SRAM Module (CFL01.1-Y1)

8.2 View



A S1, switch for slot number
B Battery case
C Top-hat rail interlock
Fig.8-2: Function module: SRAM

8.3 Current and Power Consumption

Consumption	Current consumption	Power consumption
from 3.3 V:	300 mA	1.0 W
Total power consumption	-	1.0 W

Fig.8-3: Current and power consumption

8.4 Battery

8.4.1 General Information

The battery inserted in the module is automatically activated with the first commissioning and buffers then the data of the storage module for several years.

Min. buffer time: 5 years (typically) at 25 °C surrounding air temperature

The control software monitors the battery and sends a warning if the battery capacity decreases.

In this case, you should exchange the battery immediately:

8.4.2 Battery exchange

Removing the battery

Open the battery case when the control is switched on and pull the battery with the plastic strap out of the housing.

☞ Data loss when control is switched off!
Ensure that the control is switched on during battery exchange.

☞ Dispose the battery immediately and properly.

Inserting the battery

Insert the new battery (see fig. 8-4 "Insert new battery" on page 39) and lock the battery cover in place.

Battery type: Exclusively use the following battery type: CR2450

Spare batteries: Please order spare batteries under CAP01.1-B2.

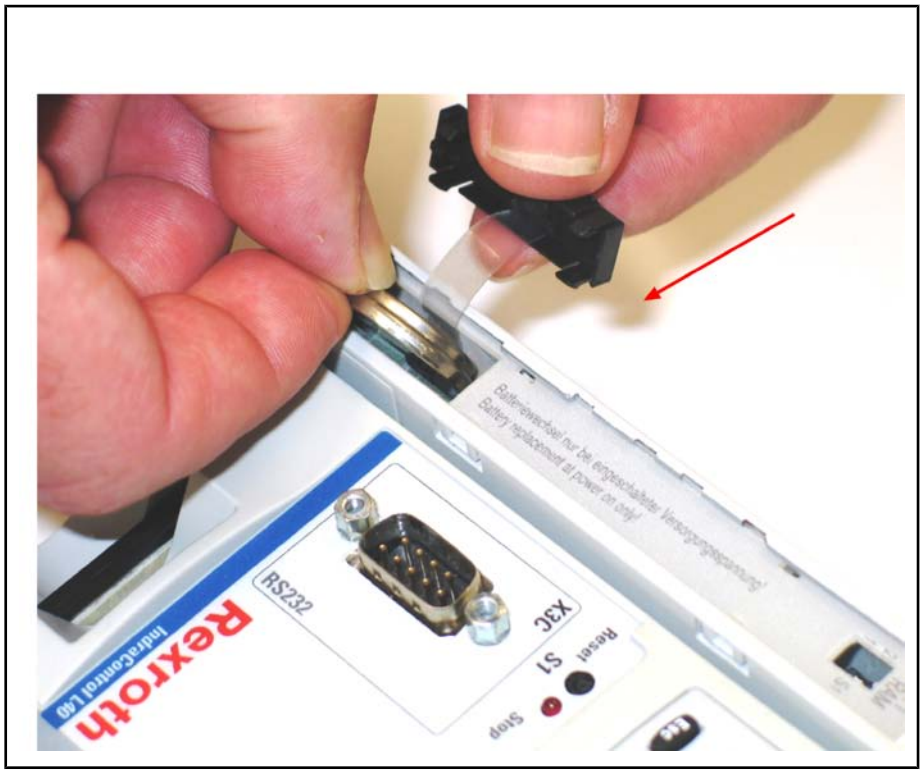


Fig.8-4: Insert new battery

SRAM Module (CFL01.1-Y1)

⚠ WARNING **Batteries can cause fire, explosions or chemical burn.**

Do not load, remove, destroy, burn or heat batteries over 100 °C. Dispose old batteries immediately and properly. Keep away from children!

9 PLS (CFL01.1-N1)

9.1 General Information

With the function module PLS (CFL01.1-N1) programmable limit switch, a fast programmable limit switch can be implemented with cycle times of 125 µs min. The parameterization is specified in the System Description Manual of the MLC.

The function module can be ordered under the parts number R911170012 .

In total and depending on the system, up to four programmable limit switches can be connected to an IndraControl.

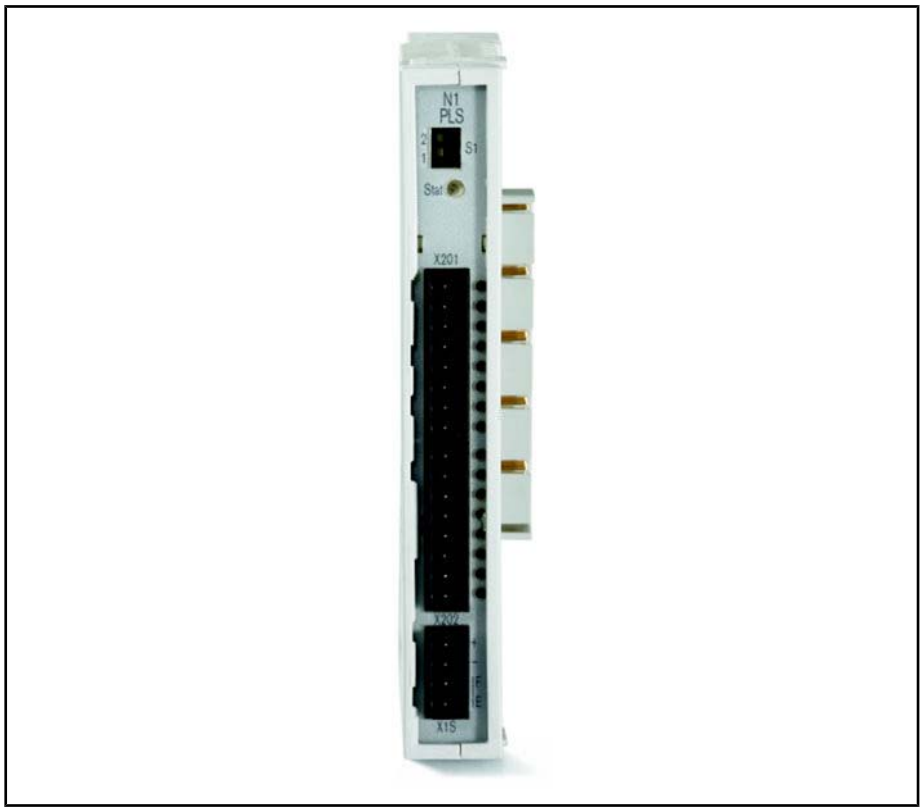
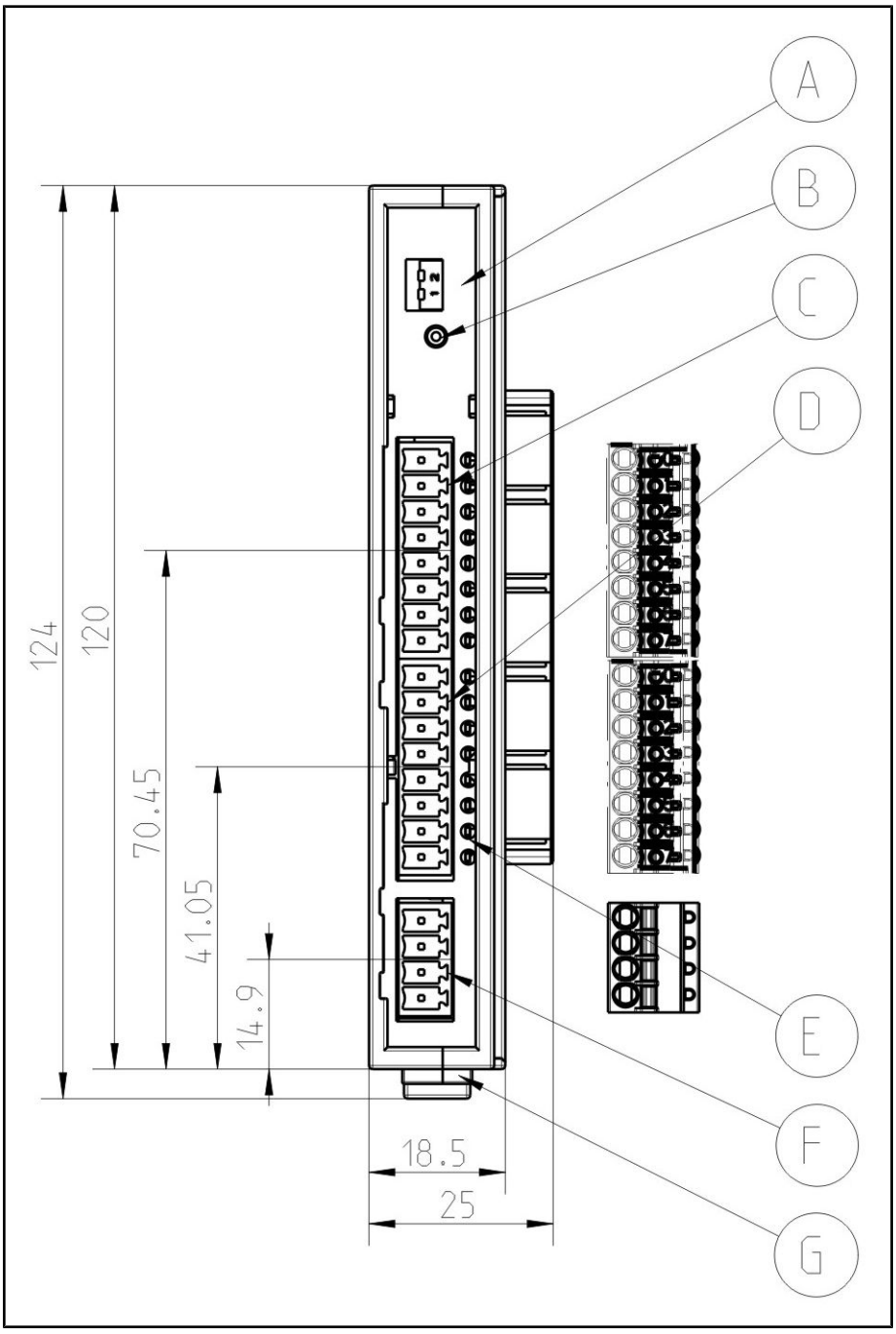


Fig.9-1: Module: Programmable limit switch

PLS (CFL01.1-N1)

9.2 View



A	S1, switch for slot number
B	Stat, status display
C	X2O1, digital outputs
D	X2O1, digital outputs
E	Status LED of the outputs
F	X1S, load supply of the outputs
G	Mounting lock

Fig.9-2: Programmable limit switch function module

PLS (CFL01.1-N1)

9.3 Interfaces

Output connector X2O1 connection	Output connector X2O2 connection
Output 0	Output 0
Output 1	Output 1
Output 2	Output 2
Output 3	Output 3
Output 4	Output 4
Output 5	Output 5
Output 6	Output 6
Output 7	Output 7

Fig.9-3: Output connectors X2O1 and X2O2

Feeder connector X1S connection
24 V (+)
GND (–)
FE
FE

Fig.9-4: Feeder connector X1S

☞ For terminal connectors use copper wire only.

☞ The function module has to be grounded with two 1.5 mm^2 conductors at the FE plug and socket connections. These conductors must have a length of maximum 1 m.

The functional earth (FE) is used for discharging disturbances. It is not provided as a protection against electric shock for persons.

9.4 LED Display

The status LED shows three states:

Status LED	Meaning
Green	Supply voltage available.
Red	Short-circuit or overload
Off	Supply voltage of the control is missing.

Fig.9-5: States of the status LED

Light-emitting diodes indicating the current status of the outputs are arranged besides the output terminals. They are connected on the "Quiet" side and thus do not indicate the current output voltage.

PLS (CFL01.1-N1)

9.5 Current and Power Consumption

Consumption	Current consumption	Power consumption
from 3.3 V:	100 mA	0.33 W
from 5 V:	300 mA	1.5 W
Total power consumption	-	1.83 W

Fig.9-6: Current and power consumption

9.6 Wiring Assembly

Wiring the Assembly

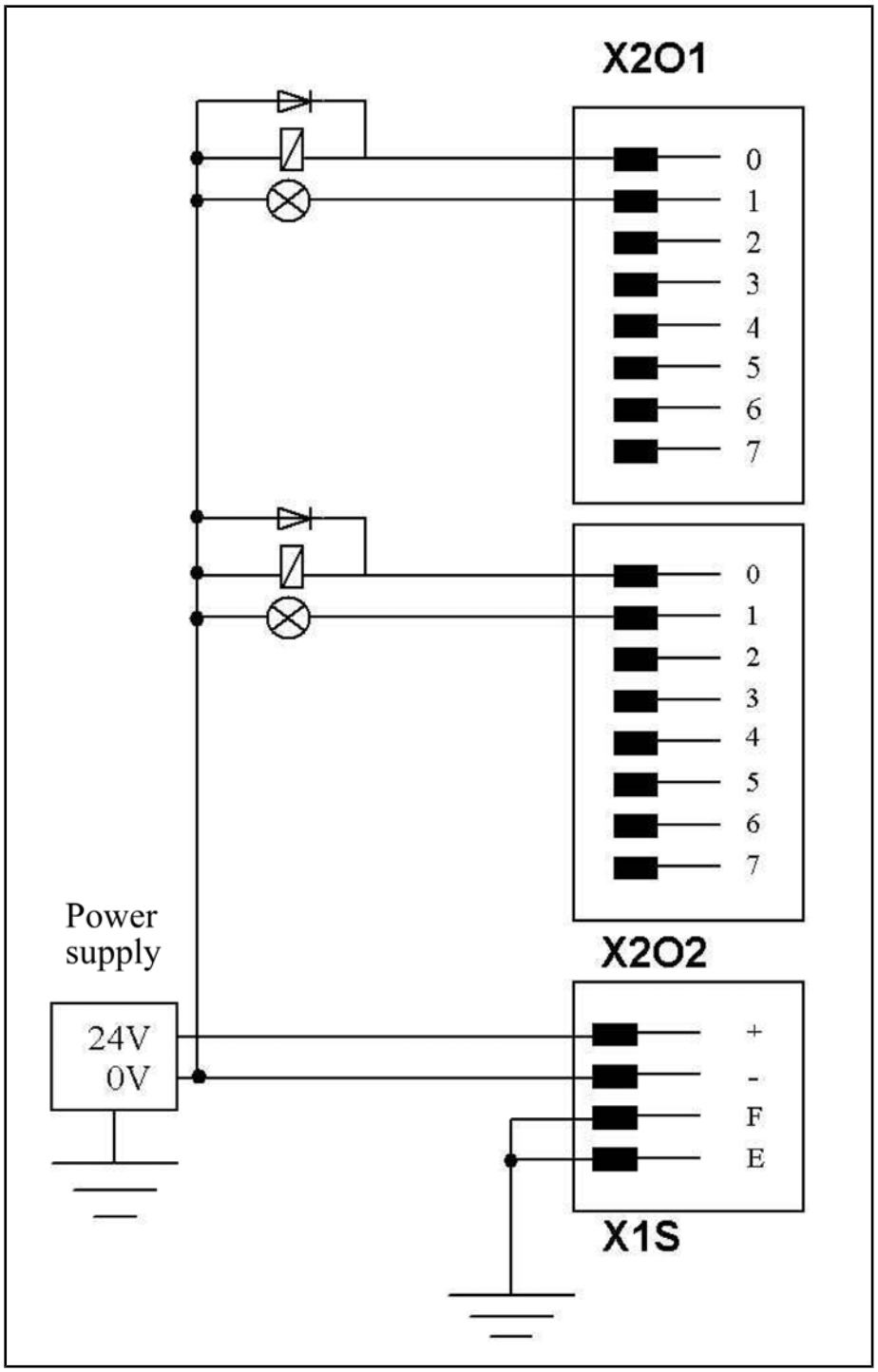


Fig.9-7: Wiring the Assembly

PLS (CFL01.1-N1)

⚠ WARNING **Destruction of the assembly by improper connection!**

- Avoid polarity reversal with simultaneous short-circuit of the output lines.
- Avoid polarity reversal with simultaneous connection of externally polarized suppressor diodes.
- Do not apply an external voltage greater than the supply voltage

9.7 Technical Data

9.7.1 Overview

Each function module "Programmable limit switch" that is also named PLS function module (**P**rogrammable **L**imit **S**witch), is provided with the following characteristics:

- 16 outputs
- 2 MINI COMBICON plug and socket connections each with 8 outputs (X2O1 and X2O2)
- 1 MINI COMBICON plug and socket connection with power supply and functional earth ground
- LEDs:
  - LED state display for each output
  - LED status display "Powerfail " and "Overload"
- Current per output is 250 mA when nominal voltage is 24 V and 100% simultaneity (see note)

☞ The maximum current drain per output is limited to 500 mA. However, the total of all output currents must not exceed 4 A.

9.7.2 Digital Outputs

Number of outputs	16
Connection method	1-wire connection
Output type	• Semiconductor outputs, non-saving • Protected, with automatic restart • Current-carrying
Electrical isolation to the logic supply	Yes
Output voltage, nominal value	24 V

PLS (CFL01.1-N1)

Rated output current: Nominal value Maximum value acc. to DIN EN 61131-2 Signal 1 Signal 0 (leakage current) UL rating: - General purpose - Tungsten	 0.5 A ≤ 0.6 A 2 mA to 0.6 A ≤ 0.5 mA 0.5 A 5 W
Parallel connection of outputs	Yes, but only within one half byte (0-3;4-7 etc.)
Maximum total current of outputs	4 A
Output delay time (ohmic load)	< 100 µs
Contactor size (at 1 Hz) (inductive load)	SG1 (6.2 W)
Lamp load (at 8 Hz)	5 W
Overload protection: - typical current level, causing switch-off - minimum current level, causing switch-off - automatic restart with reduced load	 1.2 A 0.6 A After approx. 10 ms
Display overload	Red status LED for all 16 outputs
Voltage reduced on circuit interruption in the nominal operating mode	Electronically limited to (V_{ext} – 50 V) Typ. 26 V
Reverse voltage protection	Ensured without connected load
Supply voltage according to EN 61131-2	24 VDC
Open-circuit current consumption from 24 V	Typ. 50 mA
Cable length (unshielded)	< 100 m

Fig.9-8: Digital outputs: Technical Data

9.7.3 Protection from GND Breakage

If the GND line to the function module breaks, a leakage current of up to 25 mA per output might flow. In the case of parallel connected outputs the current multiplies accordingly.

Thus, there will be no reliable protection from GND breakage.

9.7.4 Peripheral Voltage X1S

The following values of the peripheral voltage comply with DIN EN 61131-2:

Nominal value	24 VDC
Tolerances	-15 % / +20 % (without residual ripple)
Residual ripple	±5 %
U_{max}	30 V

PLS (CFL01.1-N1)

U_{min}	19.2 V
Current consumption	4 A max.

Fig.9-9: Peripheral voltage X1S1 according to DIN EN 61131-2

9.7.5 Connection of Inductive Loads

Interference levels may cause malfunctions of the installation. Line breaks, unplugging a connector for inductive load (e.g. magnetic valves, contactors) or volitional interrupting cause very high interference levels. These levels can spread by galvanic, inductive or capacitive coupling in the system and potentially lead to malfunction of the system or other systems. To damp this interference level, a corresponding suppressor element (free-wheeling diodes, varistors, RC elements) has to be installed directly on the inductive load. A suppressor circuit must be used, especially if a switch is provided in series to the inductive load, e.g. for safety interlocks.

All standard suppressor elements can be used.

9.7.6 External Power Supply Unit

The power supply unit must be safety-separated according to DIN EN 50 178, section 5.2.18.1. Transformers must be designed with safety separation according to DIN EN 60 742.

If these requirements are complied with, the 24 V supply voltage is rated as safety-separated extra-low voltage according to DIN EN 50 178, section 5.2.8.1. This voltage is designed either as safety extra low voltage SELV[1)] without grounding
of the reference conductor or as protective extra-low voltage PELV[2)] with grounding
of the reference conductor.

A three-phase power supply unit with simple full-bridge rectification is sufficient. The ripple voltage content must not exceed 5 %.

One of the following conditions must be fulfilled by all supply lines of the 24 V power supply:

- be laid such that they are isolated from lines carrying higher voltages

  or

- be insulated to a particularly high degree, with the insulation having to be designed for the highest voltage present (see EN 60 204-1: 1997, section 14.1.3.

Any peripherals, such as digital sensors and actuators, which are connected to the interfaces of the function module, also have to comply with the criteria of safety-separated circuits.

9.8 EMI shielding

9.8.1 General Information

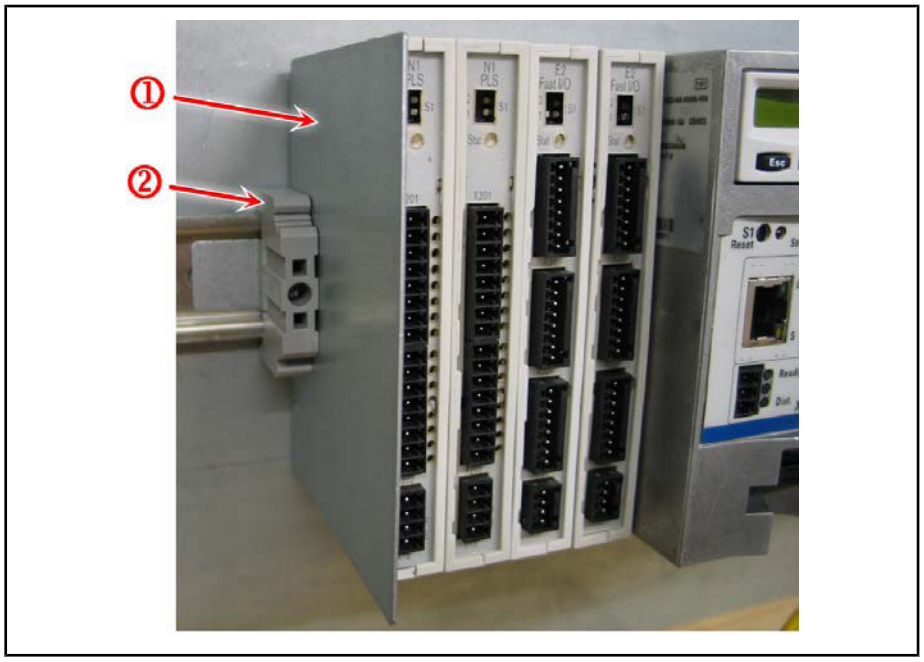
The EMI shielding is to be mounted if the programmable limit switch function module is used in noisy environment. This recommendation applies to programmable limit switch modules that are plugged in the 3rd or 4th slot at the left side of the function module bus.

1) *Safety Extra Low Voltage = SELV*

2) *Protective Extra Low Voltage = PELV*

9.8.2 Mounting Instruction for the End Clamp

1. Mount the EMI shielding 1 next to the last function module.
2. Fix the EMI shielding 2 with the end clamp.



① EMI shielding
② End clamp

Fig.9-10: Programmable limit switch modules with EMI shielding and end clamp

10 Fast I/O (CFL01.1-E2)

10.1 General Information

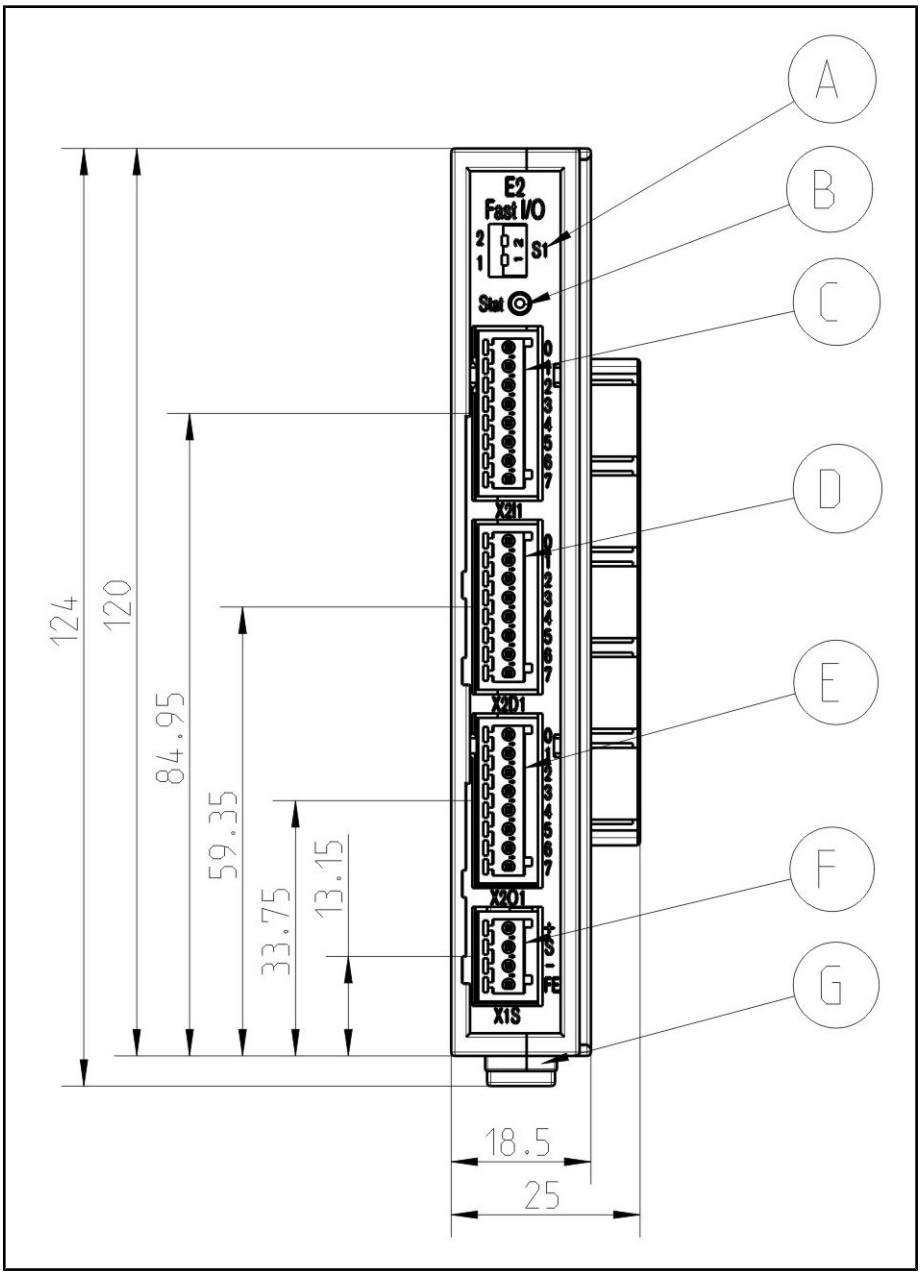
The Fast I/O function module serves for the acquisition of fast inputs signals or for the output of fast output signals that are not sufficient for the the timing at the Inline Bus I/Os (turnaround typ. 5 ms). The module features eight input channels, eight output channels and 8 channels that can be configured as input or output channels. The typical input delay is 45 µs, the typical output delay is 70 µs.

The module can be ordered under the parts number R911170365.

Fig. 10-1: Fast I/O module

Fast I/O (CFL01.1-E2)

10.2 View



A	S1, switch for slot number
B	Stat, status display of the function module
C	X2I1, digital inputs
D	X2D1, digital inputs/outputs
E	X2O1, digital outputs
F	X1S, power supply and FE
G	Mounting rail interlock

Fig.10-2: Fast I/O function module

10.3 Pin Assignment

Input connector X2I1 connection	Input/output connector X2D1 connection	Output connector X2O1 connection
Input 0	Input/output 0	Output 0
Input 1	Input/output 1	Output 1
Input 2	Input/output 2	Output 2
Input 3	Input/output 3	Output 3
Input 4	Input/output 4	Output 4
Input 5	Input/output 5	Output 5
Input 6	Input/output 6	Output 6
Input 7	Input/output 7	Output 7

Fig. 10-3: Input and output connectors X2I1, X2D2 and X2O1

Feeder connector X1S connection
24 V (+)
S (sensor supply)
GND (–)
FE

Fig. 10-4: Feeder connector X1S

☞ For terminal connectors use copper wire only.

☞ The function module has to be grounded with one 0.5 mm^2 conductors at the FE plug connections. The conductor may have a maximum length of 0.5 m.

The FE functional earth ground is used for discharging disturbances. It is not provided as a protection against electric shock for persons.

10.4 LED Display

The status LED shows three states:

Stat.-LED	Meaning
Green	Supply voltage available. Assembly is ready for operation.
Red	No supply voltage. Short-circuit or overload at one or several outputs. PCI interface defective (assembly defective). Watchdog error (assembly is not addressed by the system).
Off	Supply voltage of the control is missing.

Fig. 10-5: States of the status LED

Fast I/O (CFL01.1-E2)

10.5 Wiring the assembly

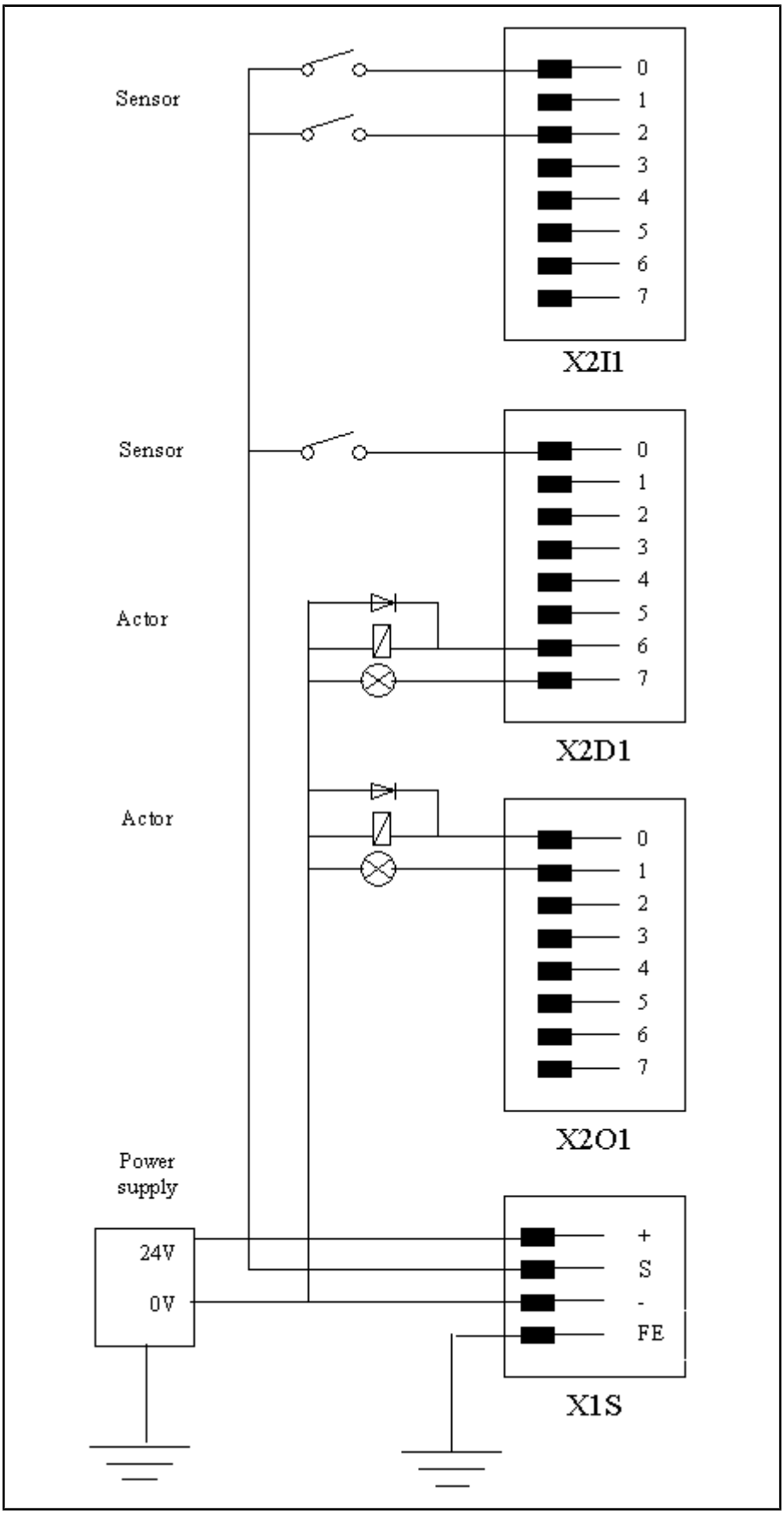


Fig.10-6: Wiring the Assembly

NOTICE **Destruction of the assembly by improper connection!**

- Avoid polarity reversal with simultaneous short-circuit of the output lines.
- Avoid polarity reversal with simultaneous connection of externally polarized suppressor diodes.
- Do not apply an external voltage greater than the supply voltage
- Do not connect sensors to an external voltage. Sensors are to be supplied from the sensor supply (X1S).

NOTICE **Damages on the component by overload and by incorrect mounting and removing of the spring terminal!**

- If the maximum permissible current consumption of the function module is exceeded, components of the module can be destructed
- Removing and inserting the spring terminals under electrical voltage can damage the electrical contacts

10.6 Current and Power Consumption

Consumption	Current consumption	Power consumption
from 3.3 V:	90 mA	0.3 W
Total power consumption	-	0.3 W

Fig. 10-7: Current and power consumption

10.7 Technical Data

10.7.1 Overview

Properties

Each Fast I/O function module is equipped as follows:

- 8 inputs
- 8 inputs/outputs (selectable bit by bit)
- 8 outputs
- 3 MICRO COMBICON spring terminals with always 8 outputs and 8 inputs (X2I1, X2D1 and X2O1)
- 1 MICRO COMBICON spring terminal with power supply and functional earth ground
- LED status display "Powerfail" and "Overload"
- current per output is 500 mA when nominal voltage is 24 V
- Delay times of the inputs 0 → 1 typ. 40 µs, 1 → 0 typ. 45 µs
- Delay times of the inputs 0 → 1 typ. 70 µs, 1 → 0 typ. 70 µs

10.7.2 Digital Inputs and Outputs

Digital inputs X2I1, X2D1

Number of inputs	16 (8 of the 16 can be selected bit by bit as input or output)
Connection method	1-wire connection
Input types	Type 1, according to EN 61131-2

Fast I/O (CFL01.1-E2)

Electrical isolation to the logic supply	Yes
Reverse voltage protection	Yes
Input voltage: Nominal value for "0" Nominal value for "1"	 -3 V to +5 V 11 V to 30 V
Input current: Nominal value for "0" Nominal value for "1"	 < 2.5 mA 2.8 mA to 6 mA
Delay time: for "0" after "1" for "1" after "0"	 Typ. 40 µs, max. 50 µs Typ. 45 µs, max. 55 µs
Cable length (unshielded)	< 100 m
Sensor supply (connection "S") Output voltage, nominal value Nominal current (total) Short-circuit protection, overcurrent protection	 24 V 0.2 A Typ. 1.2 A

Fig.10-8: Digital inputs: Technical Data

Digital outputs X2O1, X2D1

Number of outputs	16 (8 of the 16 can be selected bit by bit as input or output)
Connection method	1-wire connection
Output type	• Semiconductor outputs, non-saving • Protected, with automatic restart • Current-carrying
Electrical isolation to the logic supply	Yes
Output voltage, nominal value	24 V
Rated output current: Nominal value Maximum value acc. to DIN EN 61131-2 Signal 1 Signal 0 (leakage current) UL rating: - General purpose - Tungsten	 0.5 A ≤ 0.6 A 2 mA to 0.6 A ≤ 0.5 mA 0.5 A 5 W
Parallel connection of outputs	Yes, but only within one half byte (0-3;4-7 etc.)
Maximum total current of outputs	4 A

Fast I/O (CFL01.1-E2)

Output delay time (ohmic load) for "0" after "1" for "1" after "0"	 Typ. 70 µs, max. 95 µs Typ. 70 µs, max. 75 µs
Contactor size (at 1 Hz) (inductive load)	SG1 (6.2 W)
Lamp load (at 8 Hz)	5 W
Overload protection: - typical current level, causing switch-off - minimum current level, causing switch-off - automatic restart with reduced load	 1.2 A 0.6 A After approx. 10 ms
Display overload	Red start LED for all 16 outputs
Voltage reduced on circuit interruption in the nominal operating mode	Electronically limited to (V_{ext} – 50 V) Typ. 26 V
Reverse voltage protection	Ensured without connected load
Supply voltage according to EN 61131-2	24 V DC
Open-circuit current consumption from 24 V	Typ. 20 mA
Cable length (unshielded)	< 100 m

Fig.10-9: Digital outputs: Technical Data

10.7.3 Connection of Inductive Loads

Interference levels may cause malfunctions of the installation. Line breaks, unplugging a connector for inductive load (e.g. magnetic valves, contactors) or volitional interrupting cause very high interference levels. These levels can spread by galvanic, inductive or capacitive coupling in the system and potentially lead to malfunctions of the installation or other installations. To damp this interference level, a corresponding suppressor element (free-wheeling diodes, varistors, RC elements) are provided directly at the inductive load. A suppressor circuit must be used, especially if a switch is provided in series to the inductive load, e.g. for safety interlocks.

All standard suppressor elements can be used.

10.7.4 Protection from GND Breakage

If the GND line to the function module breaks, a leakage current of up to 25 mA per output might flow. In the case of parallel connected outputs the current multiplies accordingly.

Thus, there will be no reliable protection from GND breakage.

10.7.5 Peripheral Voltage X1S

The following values of the peripheral voltage comply with DIN EN 61131-2:

Nominal value	24 VDC
Tolerances	-15 % / +20 % (without residual ripple)
Residual ripple	±5 %
U_{max}	30 V

Fast I/O (CFL01.1-E2)

U_{min}	19.2 V
Current consumption	4 A max.

Fig.10-10: Peripheral voltage according to DIN EN 61131-2

10.7.6 External Power Supply Unit

The power supply unit must be safety-separated according to DIN EN 50 178, section 5.2.18.1. Transformers must be designed with safety separation according to DIN EN 60 742.

If these requirements are complied with, the 24 V supply voltage is rated as safety-separated extra-low voltage according to DIN EN 50 178, section 5.2.8.1. This voltage is designed either as safety extra low voltage SELV[1)] without grounding
of the reference conductor or as protective extra-low voltage PELV[2)] with grounding
of the reference conductor.

A three-phase power supply unit with simple full-bridge rectification is sufficient. The ripple voltage content must not exceed 5 %.

All 24 V voltage supply lines have to

- be laid such that they are isolated from lines carrying higher voltages

  or

- be especially insulated. The insulation must be designed for the highest possible voltage, see EN 60 204-1: 1997, section 14.1.3.

Any peripherals, such as digital sensors/actuators, which are connected to the interfaces of the function module, also have to comply with the criteria of safety-separated circuits.

1) *Safety Extra Low Voltage = SELV*

2) *Protective Extra Low Voltage = PELV*

11 DeviceNet Master (CFL01.1-V1)

11.1 General Information

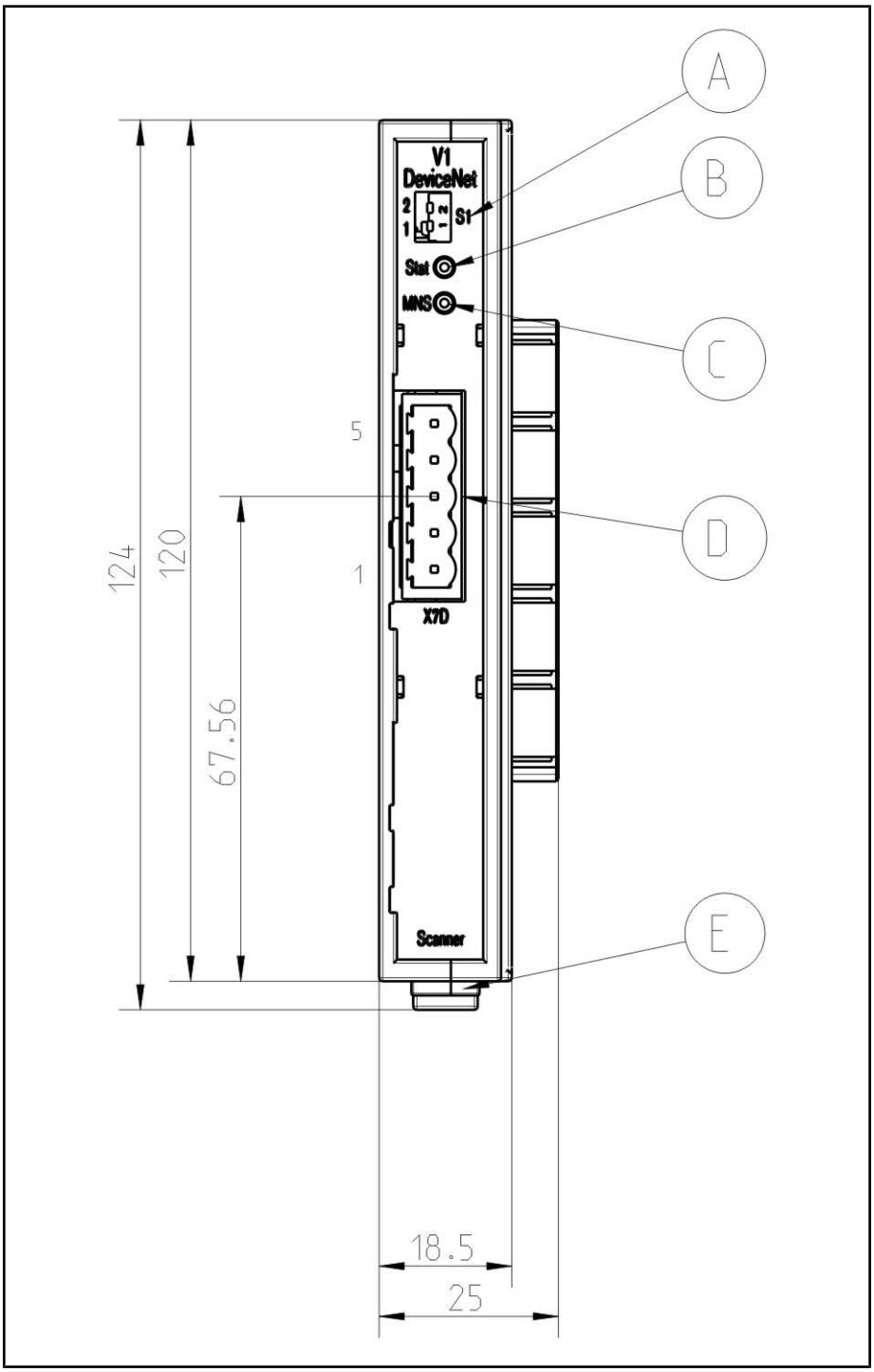
The DeviceNet master function module features the DeviceNet master functionality. With this module further independent DeviceNet networks can be set in the master mode.

The module can be ordered under the parts number R911170001.

Fig.11-1: DeviceNet master module

DeviceNet Master (CFL01.1-V1)

11.2 View



A	S1, switch for slot number
B	Stat, status display of the function module
C	MNS, module/network status
D	X7D, DeviceNet connector
E	Mounting rail interlock

Fig.11-2: DeviceNet master module

11.3 Pin Assignment

X7D
DeviceNet interface

Pin	Meaning
1	V –
2	CAN_L
3	Shield
4	CAN_H
5	V +

Fig.11-3: Pin assignment of the X7D connector

☞ For terminal connectors use copper wire only.

☞ Cable fixing during installation is required!

For further descriptions please refer to the particular system-specific manual.

11.4 LED Display

The meaning of the indicator elements (two LEDs) are listed in the following table:

LED	Color	Status	Flash frequency	Description
Stat.	Red	Flashing	slowly, 1 Hz	Device is in boot load mode and is waiting for a firmware download.
		Flashing	fast, 5 Hz	Firmware is loaded.
		acyclically flashing	3 times, fast, with 5 Hz 8 times, slowly, 0.5 Hz to 1 Hz	Hardware error detected. The device has to be exchanged, please contact Bosch Rexroth.
	green	cyclically flashing	fast, 5 Hz	No configuration error, device is online and ready for the fieldbus communication; attempt to establish a connection, but fieldbus device not yet found.
		acyclically flashing	3 times, fast, with 5 Hz 8 times, slowly, 0.5 Hz to 1 Hz	**During switching on:** no configuration, device has to be configured. **In operation:** critical firmware, like e. g. timeout
		Statically on	-	Device has established at least one configured connection.
	Off	-	-	Device has no power supply.

DeviceNet Master (CFL01.1-V1)

LED	Color	Status	Flash frequency	Description
MNS	green	Statically on	-	Device is online, connections are established. The device is connected to another master. The device has established a connection to a slave.
		Flashing	slowly, 1 Hz	Device is online, no connections are established. No configuration. Device has terminated the address verification, but no connection is established to another device.
	Red			Device has no access to the bus, because of bus error. Double addressing detected.
	Off	-	-	Device is not online, address verification is not terminated. Device has no power supply.

Fig.11-4: Meaning of the light emitting diodes at the DeviceNet master function module

11.5 Current and Power Consumption

Consumption	Current consumption	Power consumption
from 3.3 V:	400 mA	1.4 W
from 24 V (DeviceNet voltage):	55 mA	1.4 W
Total power consumption	-	2.8 W

Fig.11-5: Current and power consumption

12 PROFIBUS Master (CFL01.1-P1)

12.1 General Information

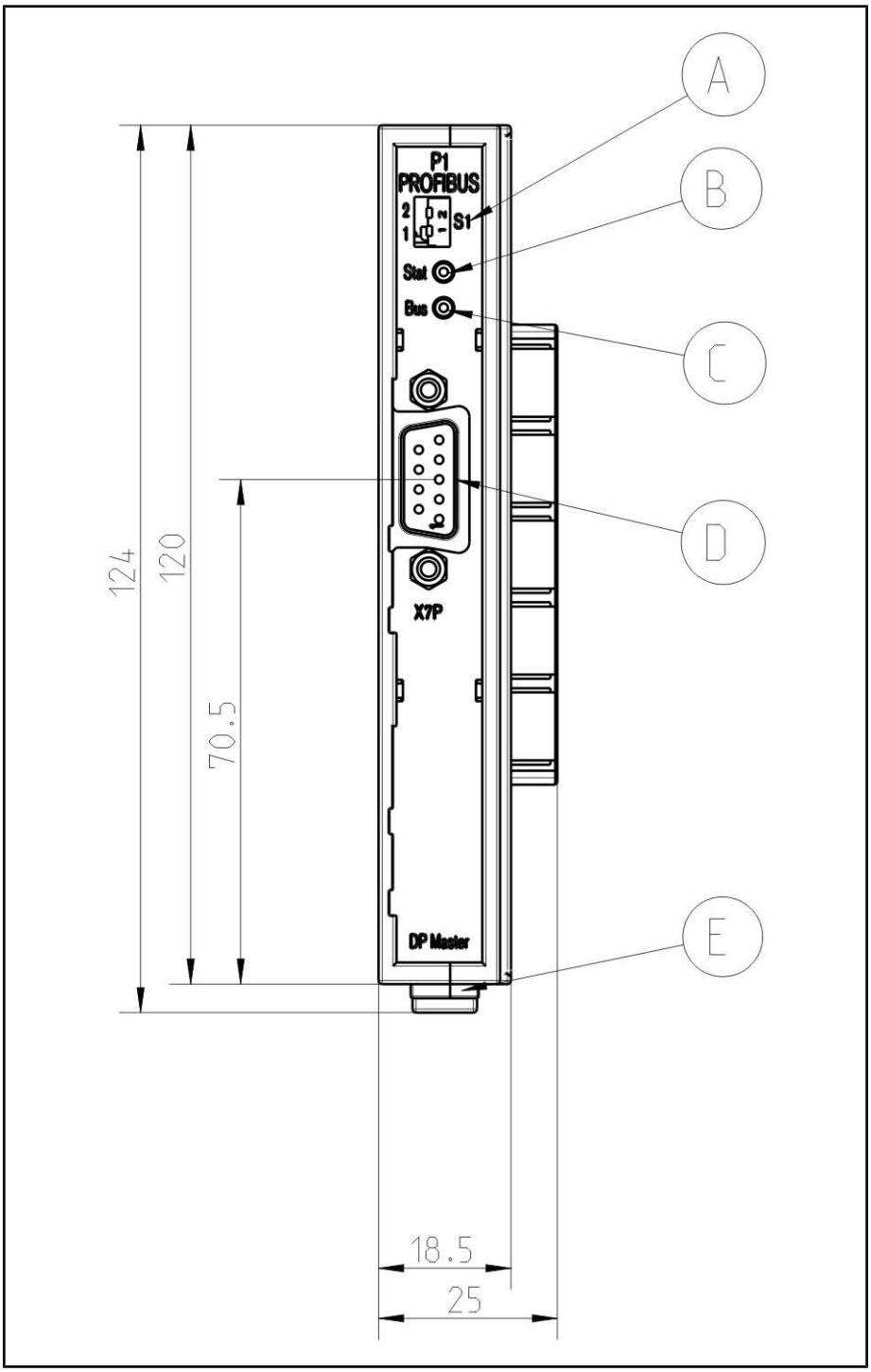
The function module features a PROFIBUS DP master or DP slave functionality. With this module further independent DP networks can be set in the master mode. As DP slave the module can be connected to an superordinated control.

The module can be ordered under the parts number R911170005.

Fig. 12-1: Module PROFIBUS master

PROFIBUS Master (CFL01.1-P1)

12.2 View



A	S1, switch for slot number
B	Stat, status display of the function module
C	Bus, DP status
D	X7P, PROFIBUS DP connector
E	Mounting rail interlock

Fig.12-2: Function module PROFIBUS DP master

Cable fixing during installation is required!

For further descriptions please refer to the particular system-specific manual.

12.3 Interfaces

X7D
PROFIBUS interface
D-Sub female connector, 9-pin

Pin	Meaning
1	n. c.
2	n. c.
3	RxD / TxD – P
4	CNTR – P
5	DGND
6	VP
7	n. c.
8	RxD / TxD – N
9	n. c.

Fig. 12-3: Pin assignment of the 9-pin female connector X7D

12.4 LED Display

The meaning of the indicator elements (two LEDs) are listed in the following table:

LED	Color	Status	Flash frequency	Description
Stat.	Red	Flashing	slowly, 1 Hz	Device is in boot load mode and is waiting for a firmware download.
		Flashing	fast, 5 Hz	Firmware is loaded.
		acyclically flashing	3 times, fast, with 5 Hz 8 times, slowly, 0.5 Hz to 1 Hz	Hardware error detected. The device has to be exchanged, please contact Bosch Rexroth.
	green	cyclically flashing	fast, 5 Hz	No configuration error, device is online and is ready for fieldbus communication; attempt to establish a connection, but fieldbus device not yet found.
		acyclically flashing	3 times, fast, with 5 Hz 8 times, slowly, 0.5 Hz to 1 Hz	**During switching on:** no configuration, device has to be configured. **In operation:** critical firmware, like e. g. timeout
		Statically on	-	Device has established at least one configured connection.
	Off	-	-	Device has no power supply.

PROFIBUS Master (CFL01.1-P1)

LED	Color	Status	Flash frequency	Description
Bus	green	Statically on	-	- Device is online, connections are established. - The device is connected to another master. - The device has established a connection to a slave.
		Flashing	slowly, 1 Hz	- Device is online, no connections are established. - No configuration. - Device has terminated the address verification, but no connection is established to another device.
	Red			- Device has no access to the bus, because of bus error. - Double addressing detected.
	Off	-	-	- Device is not online, address verification is not terminated. - Device has no power supply.

Fig.12-4: Meaning of the light emitting diodes at the Profibus master function module

12.5 Current and Power Consumption

Consumption	Current consumption	Power consumption
from 3.3 V:	500 mA	1.65 W
Total power consumption	-	1.65 W

Fig.12-5: Current and power consumption

13 RT-Ethernet and PROFIBUS (CFL01.1-TP)

13.1 General Information

The function module features a Real-Time Ethernet and PROFIBUS DP master or PROFIBUS DP slave functionality. According to the configuration different Ethernet protocols can be executed on the module together with PROFIBUS DP. Possible Ethernet protocols are for example PROFINET RT, EtherNet/IP or Standard TCP/IP.

The function module can be ordered under the parts number R911170832.

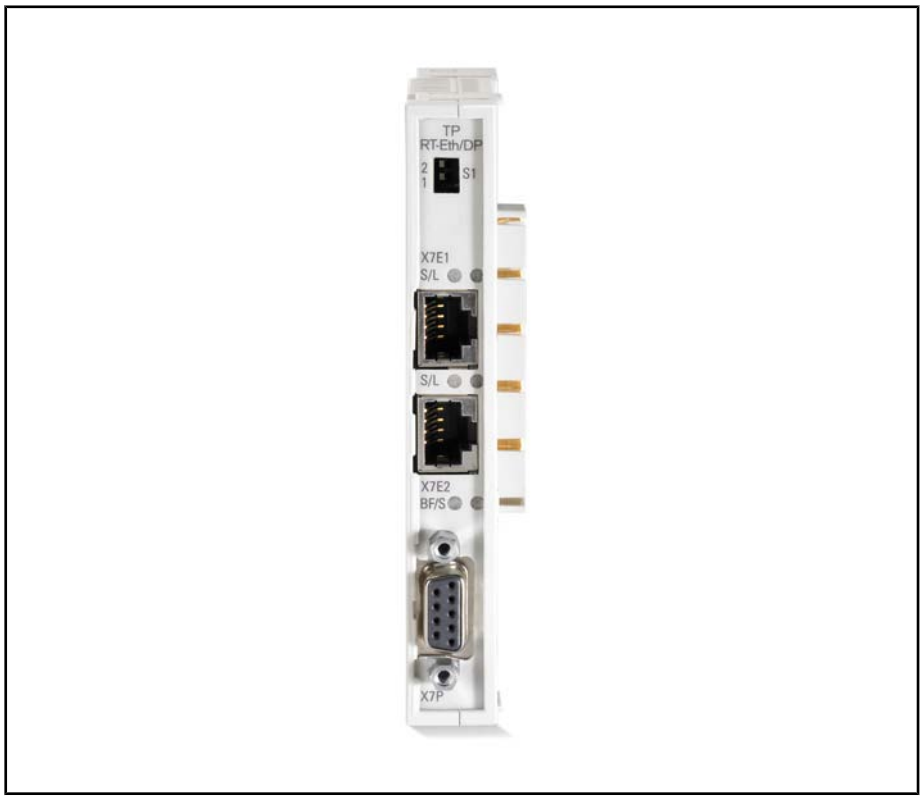
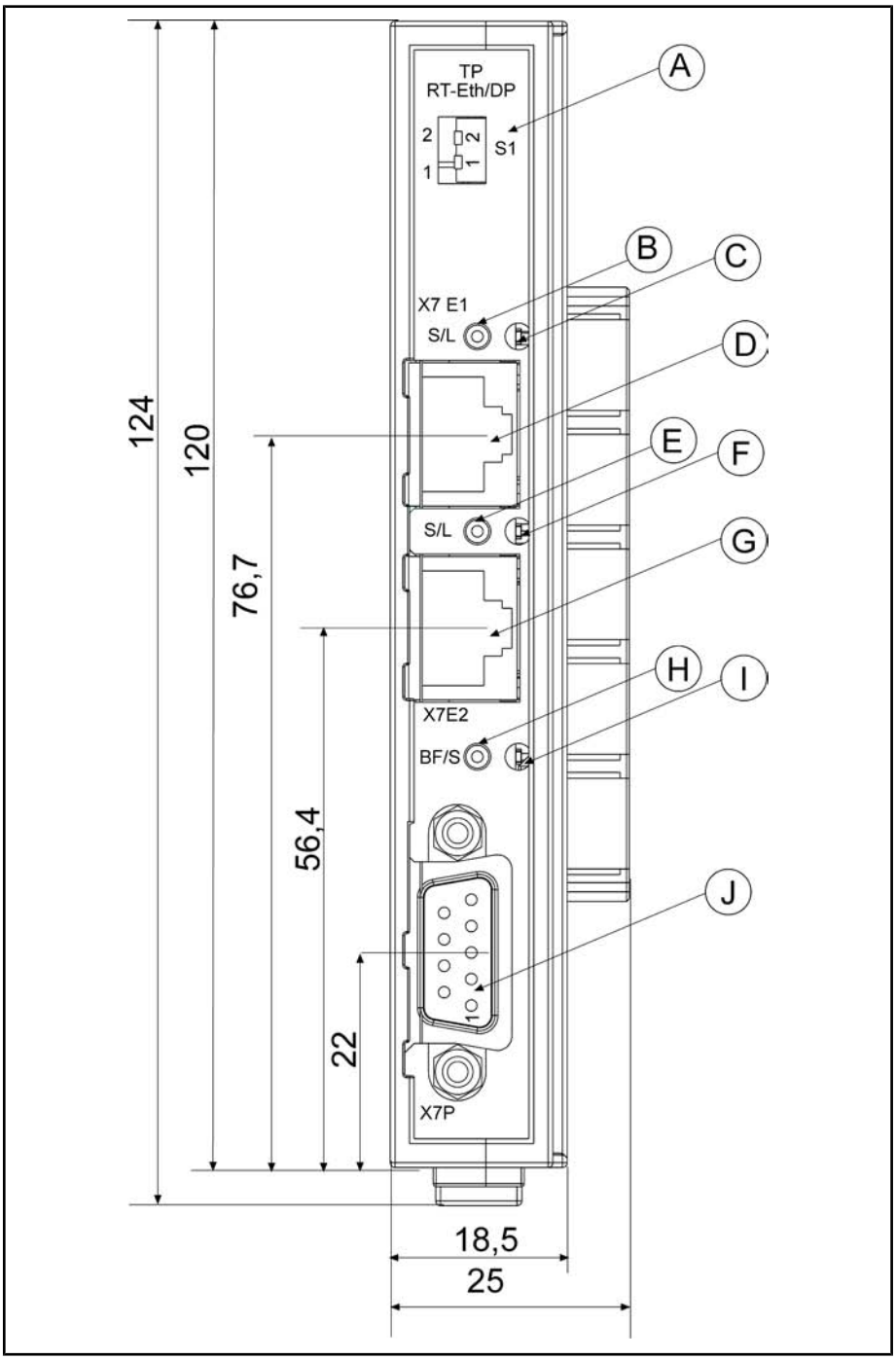


Fig. 13-1: Module RT-Ethernet and PROFIBUS

RT-Ethernet and PROFIBUS (CFL01.1-TP)

13.2 View



A	S1, switch for slot number
B	S, status display ETH-Port 1
C	L, link display Eth-Port 1
D	X7E1, Eth RJ-45 female connector Port 1
E	S, status display ETH-Port 2
F	L, link display Eth-Port 2
G	X7E2, Eth RJ-45 female connector Port 2
H	BF, bus error indicator DP-Port
I	S, status display DP-Port
J	X7P, Profibus DP female connector

Fig.13-2: Function module RT-Ethernet and Profibus

13.3 Pin Assignment

X7E1/2 Ethernet interfaces

Pin	Meaning
1	TD+
2	TD-
3	RD+
4	Reserved
5	Reserved
6	RD-
7	Reserved
8	Reserved

Fig. 13-3: Pin assignment of RJ45 female connector X7E1/2

X7P PROFIBUS DP interfaces

Pin	Meaning
1	n. c.
2	n. c.
3	RxD/TxD-P
4	CNTR-P
5	DGND
6	VP
7	n. c.
8	RxD/TxD-N
9	n. c.

Fig. 13-4: Pin assignment of the 9-pin Sub-D female connector X7P

☞ Cable fixing during installation is required!

Use only copper wire.

For further descriptions and possible settings please refer to the particular system-specific manual.

13.4 LED Display

LED Eth	Color	Status	Description
L	green	On	Ethernet connection detected
		Off	No Ethernet connection
S	yellow	Flashing	Ethernet data traffic
		Off	No Ethernet data traffic

Fig. 13-5: Ethernet LED

RT-Ethernet and PROFIBUS (CFL01.1-TP)

LED DP	Color	Status	Description
S	green	On	Bus communication
		acyclically	No configuration
		cyclically	Configured
		Off	Bus communication stopped
BF	Red	On	No DP connection
		Flashing	Slave diagnostics
		Off	No bus error

Fig.13-6: LED DP

14 Ordering Information

14.1 Type Designation Code Function Modules: Type Designation Code

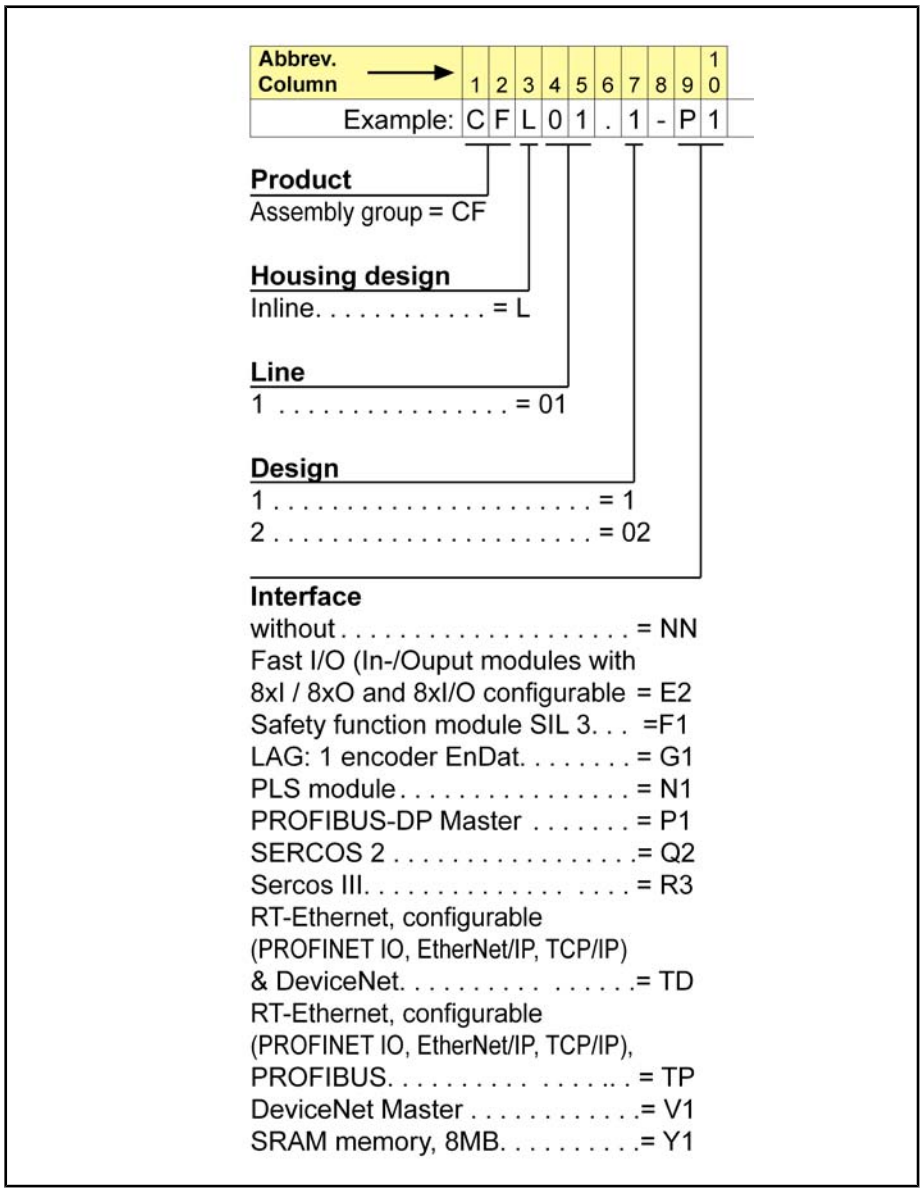


Fig.14-1: Type designation code of the function modules CFL01

Ordering Information

14.2 Rexroth Function Modules

14.2.1 Order Code and Parts Number

Order code	Parts number	Description
CFL01.1-Y1	R911170007	8 MB SRAM
CFL01.1-V1	R911170001	DeviceNet master
CFL01.1-P1	R911170005	PROFIBUS master
CFL01.1-R3	R911170008	SERCOS III
CFL01.1-Q2	R911170009	SERCOS 2
CFL01.1-E2	R911170365	PLS programmable limit switch
CFL01.1-N1	R911170012	Fast I/O
CFL01.1-TP	R911170832	RT-EtherNet (PROFINET RT or EtherNet/IP) and PROFIBUS

Fig.14-2: Order code function modules

15 Service and Support

Our service helpdesk at our headquarters in Lohr, Germany and our worldwide service will assist you with all kinds of enquiries. You can reach us **around the clock - even on weekend and on holidays**.

	Helpdesk	Service Hotline Worldwide
Phone	**+49 (0) 9352 40 50 60**	Outwith Germany please contact our sales/service office in your area first. For hotline numbers refer to the sales office addresses on the Internet.
Fax	**+49 (0) 9352 40 49 41**	
E-mail	service.svc@boschrexroth.de	
Internet	http://www.boschrexroth.com You will also find additional notes regarding service, maintenance (e.g. delivery addresses) and training.	

Preparing Information

For quick and efficient help please have the following information ready:

- Detailed description of the fault and the circumstances
- Information on the type plate of the affected products, especially type codes and serial numbers
- Your phone, fax numbers and e-mail address so we can contact you in case of questions.

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