Rexroth

RECO Inline
INTERBUS

Functional Description

SYSTEM200

DOK-CONTRL-R-IL-IBSSYS-AW02-EN-P

Rexroth Indramat

Title RECO Inline INTERBUS

Type of Documentation Functional Description

Document Typecode DOK-CONTRL-R-IL-IBSSYS-AW02-EN-P

Internal File Reference Document Number, 120-0400-B345-02/EN

Purpose of Documentation This documentation serves

- as a general application manual of the RECO Inline modules in combination with INTERBUS applications,
- as project planning aid for the set up of a RECO Inline station,
- as a refrence book.

Record of Revisions

Description	Release Date	Notes
120-0400-B345-02	07/01	First issue

Published by Rexroth Indramat GmbH
Bgm.-Dr.-Nebel-Str. 2 • D-97816 Lohr a. Main

Telephone +49 (0)93 52/40-0 • Tx 68 94 21 • Fax +49 (0)93 52/40-48 85

http://www.boschrexroth.de/

Dept. EP6 (UK)

Dept. EP (CV/NH)

Note This document has been printed on chlorine-free bleached paper.

Contents

1 Integration of RECO Inline into the INTERBUS system

1.1 The INTERBUS System

INTERBUS is a serial bus system for data exchange between control systems (e.g. PLCs, PCs, VME bus computers, robot controllers etc.) and spatially distributed input and output modules that are connected to sensors and actuators (operating and display units, drives etc.).

INTERBUS has a ring structure. This ring structure allows INTERBUS to transmit and receive data simultaneously.

INTERBUS is a single-master system, i.e. all devices of one INTERBUS ring are controlled by one master (e.g. controller board, control terminal).

Starting from the master, all devices are connected to the bus system.

Each device has two separate lines for data transmission: one for forward data transfer and one for return data transfer. This eliminates the need for a return line from the last to the first device that is necessary in a simple ring system. The forward and return lines are routed in one bus cable. From the installation point of view, INTERBUS is therefore comparable to a tree structure as only one cable leads from one device to the next.

In the INTERBUS topology, the individual bus devices are identified by means of their position in the system. There are controller boards, bus terminals and remote bus, installation remote bus as well as local bus devices.

1.2 Example Topology of an INTERBUS System

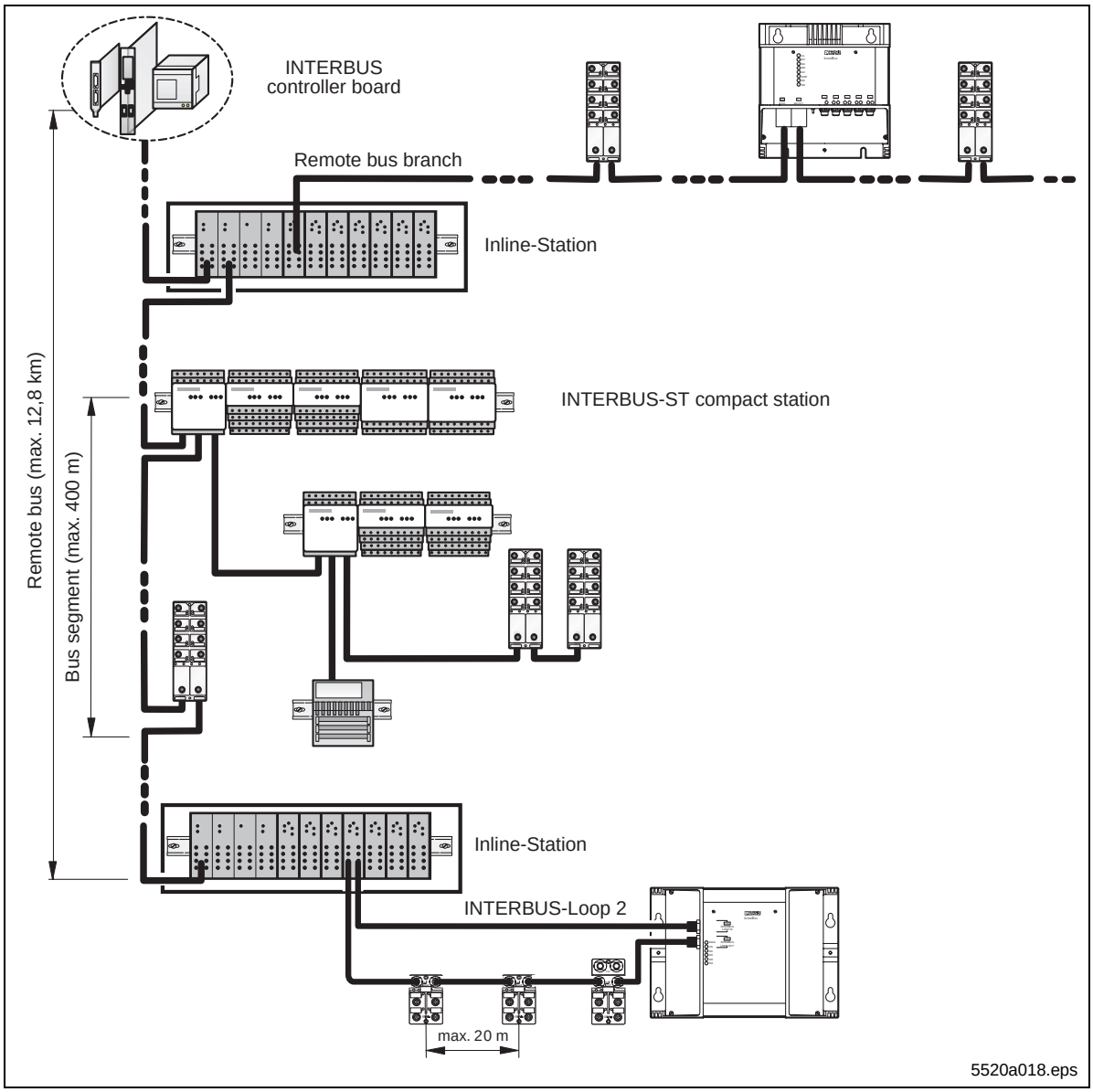


Fig. 1-1: Example INTERBUS system

Controller board

In the INTERBUS network, the controller board takes over the master function.

It controls data traffic in the INTERBUS system, independent of the control or computer system in which it is installed.

Tasks of the controller board:

- Transmitting the output data to the output modules
- Reading the input data from the input modules
- Monitoring INTERBUS
- Sending error messages to the host system
- Displaying diagnostic messages
- Controlling the cyclic I/O protocol

Bus terminal

The first step in setting up a modular I/O station, is to connect a bus terminal to the INTERBUS remote bus. At this bus terminal I/O modules branch off the remote bus and create decentralized local busses.

A bus terminal divides the system into segments, so that single branches can be switched off during operation. Additionally, it supplies logic voltage to the module electronics of the connected I/O modules.

A bus terminal must be supplied with non-interruptible voltage, i. e. if the bus system as a whole is to continue in operation, the voltage must not be disconnected when the subsystem is switched off. The failure of supply voltage at a bus terminal shuts down the system and causes an error message for the bus segment.

Tasks of the bus terminal:

- Coupling the remote and local bus
- Supplying the I/O modules with logic voltage
- Updating the data signal (repeater function)
- Electrical isolation of the individual bus segments
- As of generation 4 (G4), the next remote bus can be switched off as well.
- If required, reporting errors via an electrically isolated alarm output (e.g. sound or light signal)

Remote bus

The remote bus connects the controller board to the remote bus devices, as well as the remote bus devices to each other. Remote bus devices are bus terminals, special I/O modules, or a mixture of both. Each device has a local power supply and is electrically isolated from the next INTERBUS segment.

In the INTERBUS system, the maximum number of remote bus devices is limited to 254.

Installation remote bus

In addition to the data transmission lines, the remote bus can also carry the voltage supply for the connected I/O modules and the sensors (installation remote bus).

Local bus

A local bus is a bus connection branching off a remote bus via a bus terminal and connects the local bus devices to each other.

The bus terminal supplies the connected devices with logic voltage. The switching voltage for the outputs must be connected separately to the output modules.

Local bus devices are I/O devices for the setup of a decentralized substation in the control cabinet. The devices are connected to the remote bus via a bus terminal. Branching is not allowed within the local bus.

The maximum number of local bus devices depends on the bus terminal used.

Remote bus branch

A remote bus branch branches off the remote bus. A branch is connected to the main line of a remote bus via a special bus terminal. The bus terminal permits the branching bus segment to be connected and disconnected.

Bus segment

A bus segment consists of a remote bus device including the I/O modules connected to it. The preceding cable is also part of the segment.

I/O modules

I/O modules connect INTERBUS to the sensors and/or actuators.

ID code

Each INTERBUS module has an ID code, so that controller board or projecting software are able to identify the different modules. The ID code specifies the type of the module (e.g. digital input module).

Length code

The length code specifies the number and representation type of the process data (e.g. bit, nibble, byte, word).

1.3 The INTERBUS Installation System as a Basis of the INTERBUS Systems

Due to a consistent continuation of decentralization the INTERBUS installation system offers expansive rationalization potential for machine and plant constructors. All required standardized functions are available in the INTERBUS modular system. The INTERBUS installation system is based on the Rexroth INDRAMAT product family RECO Inline.

Definition: The installation system

The installation system is a system kit with standardized functions, identical interfaces, and simple connections.

The Product Family of the Installation System

RECO Inline

The product family RECO Inline is a modular automation system integrated into the INTERBUS system. By means of the RECO Inline automation terminals, it is possible to assemble function units tailored to your automation requirements. These units replace the conventional control cabinet designed to create subassemblies.

As the terminals are latched into each other on the mounting rail, the bus connection, the power supply, and the potential distribution of the devices connected to the bus terminal are realized within the RECO Inline station. Therefore, cross wiring is no longer necessary.

The RECO Inline modular system includes automation terminals for all standard functions as e.g. digital and analog input and output terminals, and a timer-counter function terminal.

Characteristics of the Installation System

Standardized functions

The installation system is based on the philosophy of the consistent continuation of decentralization. After decentralization of the I/O points, all standardized functions can now be set up decentrally. The individual function blocks set up with RECO Inline can be assembled in terminal boxes directly in the field. In this way, machines and plants can be set up in a modular design in small, clearly structured groups. Thus, the central control is grouped into smaller, de-centralized units in the machine or plant. All functions are moved out of the control cabinet directly into the field.

Continuous bus system

The whole communication from sensor to control within the INTERBUS installation system takes place via INTERBUS. Using RECO Inline, gateway or link solutions are no longer necessary.

Furthermore, only one projecting and installation software is required for the whole installation system (e.g. system configurator software version 19VRS, and/or CMD for standard controller boards).

Simple connection

The connection of the individual components of the installation system can be shortly described as: “Automation without Wiring”.

Using RECO Inline, work-intensive wiring of the individual terminal points in control cabinet installation is replaced by butt-mounting of the RECO Inline automation terminals. In setting up the RECO Inline station, electric and data circuits are wired automatically.

With RECO Inline, the peripherals are connected by means of connectors with spring tension clamps. These connectors can be coded to reliably avoid any reversals. When an automation terminal must be replaced, the wiring does not have to be removed. It is sufficient to remove the connector from the terminal.

1.4 RECO Inline, a component of the INTERBUS Installation System

Comparison of conventional Control Cabinet Design and RECO Inline

Conventional solution

Up to now, the setup of control cabinets was subassembly-oriented. That means that subassemblies with the same functionality are arranged side by side. For example all input and output modules are placed together, as well as all relays and contactors and the modules of the performance level, the intermediate routing level or the protection system, e.g. fuses and the motor protection. The function, e.g. the activation of a motor, is only brought about by wiring the various subfunctions. This results in a correspondingly high work load for wiring. If an expansion is required, it is work-intensive and prone to errors.

RECO Inline solution

With RECO Inline, a modular system principle is applied. A control cabinet is no longer necessary. The structure of the control box is oriented to function blocks. All subassemblies required to perform a certain function are butt-mounted without any tools, forming a function block. When a function block is within a RECO Inline station, no cross wiring is needed. With RECO Inline, a bar system for the INTERBUS and the supply voltages is automatically set up between the automation terminals of the station.

Characteristics

The characteristics of RECO Inline are as follows:

- Tool-free butt-mounting, simple handling
- Function block-oriented setup of the control box or control cabinet
- Automatic setup of potential groups and electric, data, and safety circuits
- Open, flexible, and modular structure
- 2-slot terminals:

  This terminals permit optimum adaptation to the nominal configuration. They make it possible to set up the station flexibly and at on optimum position without any reserve installation.
- 8-slot terminals:

  With larger stations, these terminals permit a quick and effective station setup.
- Combination of terminal widths for time, position, and price optimum station setup.

Advantages

This principle has the following advantages:

- The space requirement is reduced.
- Work-intensive parallel wiring is reduced. Within a station, voltage and data routing is performed without any additional wiring.
- The modular structure offers the possibility to prepare standard function blocks in advance. Parts of the plant can be operated independent of each other. Thus, pre-tests ca be performed during setup, and all the system can be adapted and expanded.

Example of a RECO Inline System

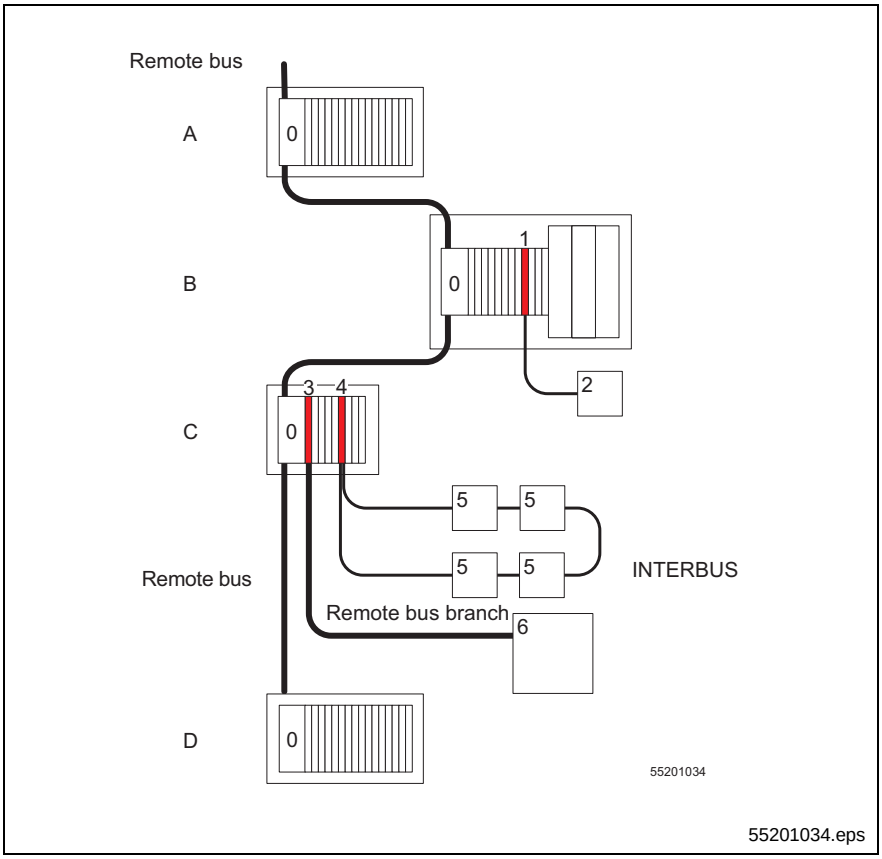


Fig. 1-2: Diagrammatic view of the RECO Inline system

Fig. 1-2 is a diagrammatic view of RECO Inline stations for the realization of various tasks within a system.

Legend ad Fig. 1-2:

A Station with terminals of the low signal level:

B Station with terminals of the low signal and the performance levels.

The marked terminal (1) is an input terminal for connection of a sensor (2).

C Station with terminals of the low signal level, one terminal with remote bus branch (3). The terminal with remote bus branch opens a remote bus branch to which for example another remote bus device (6) is connected.

D Station with terminals of the low signal level

0 Bus terminal

1 Function terminal (here: for connection of a sensor)

2 Sensor

3 Terminal with remote bus branch for connection of a remote bus branch

4 RECO Inline input module

5 Sensor

6 Module of the remote bus branch (here: other remote bus devices)

Product Description

Within the RECO Inline product family, automation terminals are available for input/output functions and special functions.

Automation terminals consist of an electronics socket and one or several connectors for connection of peripherals or supply voltage. In this way, the electronics socket can be replaced without removing a conductor from the connector.

The RECO Inline terminals are connected to the INTERBUS via a bus terminal.

Under observation of the limiting parameters (see chapter “Number of devices” on page 5-1), up to 63 local bus devices can be connected to one bus terminal.

Variations

In the product program, terminals for all automation tasks will be available:

- Bus terminals for connection the RECO Inline station to the remote bus of the INTERBUS
- Terminal with remote bus branch for opening a remote bus branch
- Supply terminals to feed in the supply voltages and to segment the station (with or without fuse)
- Input and output terminals for digital and analog signals
- Function terminals (e.g. counters)

System conditions

The INTERBUS system must be operated under an controller board module with a firmware status of version 4.40 as a minimum requirement. That is to say that you will have to use a generation 4 controller board (G4) that can be operated with this firmware status.

Planning and design

For planning and design, parameterizing and visualizing the system, the CMD software, version 4.40 as a minimum, is available for standard controller boards.

Placement

The RECO Inline terminals (protection degree IP 20) are designed for placement in closed containers. Due to the compact design, RECO Inline terminals can be installed in standard control boxes (of 80 mm height).

Assembly

RECO Inline terminals are latched tool-free into guide rails. When the terminals are latched onto each other, the potential and data routing is set up automatically.

Bus connection

The RECO Inline station is connected to the remote bus via a bus terminal.

The bus is routed through the RECO Inline station by means of the data jumper.

I/O connection

The RECO Inline terminals have connectors to connect 2-, 3- or 4-wire sensors and/or actuators. The conductors are connected by tension spring technology.

Note: For more detailed information, please refer to the individual chapters.

2 Important directions for use

2.1 Appropriate use

Introduction

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

The products may only be used in the manner that is defined as appropriate. If they are used in an inappropriate manner, then situations can develop that may lead to property damage or injury to personnel.

Note: Rexroth Indramat, as manufacturer, is not liable for any damages resulting from inappropriate use. In such cases, the guarantee and the right to payment of damages resulting from inappropriate use are forfeited. The user alone carries all responsibility of the risks.

Before using Rexroth Indramat products, make sure that all the pre-requisites for appropriate use of the products are satisfied:

- Personnel that in any way, shape or form uses our products must first read and understand the relevant safety instructions and be familiar with appropriate use.
- If the product takes the form of hardware, then they must remain in their original state, in other words, no structural changes are permitted. It is not permitted to decompile software products or alter source codes.
- Do not mount damaged or faulty products or use them in operation.
- Make sure that the products have been installed in the manner described in the relevant documentation.

Areas of use and application

The RECO Inline system is a decentralized modular fieldbus-coupled input and output system.

The RECO Inline system by Rexroth Indramat is intended for the cases of use listed below.

- Machine tools
- Transfer systems
- General automation

Note: The RECO Inline system may only be used with the accessories and parts specified in this document. If a component has not been specifically named, then it may not be either mounted or connected. The same applies to cables and lines.

Operation is only permitted in the specified configurations and combinations of components using the software and firmware as specified in the relevant function descriptions.

The typical fields of application of RECO Inline modules are as follows:

- Turning machines
- Milling machines
- Machining centers
- General automation

The RECO Inline system may only be operated under the assembly, installation and ambient conditions as described here (temperature, system of protection, humidity, EMC requirements, etc.) and in the position specified.

2.2 Inappropriate use

Using the RECO Inline system outside of the above-referenced areas of application or under operating conditions other than described in the document and the technical data specified is defined as “inappropriate use".

The RECO Inline system may not be used if

- they are subject to operating conditions that do not meet the above specified ambient conditions. This includes, for example, operation under water, in the case of extreme temperature fluctuations or extreme maximum temperatures or if
- Rexroth Indramat has not specifically released them for that intended purpose. Please note the specifications outlined in the general Safety Instructions!

3 Safety Instructions for Electric Servo Drives and Controls

3.1 Introduction

Read these instructions before the equipment is used and eliminate the risk of personal injury or property damage. Follow these safety instructions at all times.

Do not attempt to install, use or service this equipment without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation of the equipment prior to working with the equipment at any time. If you do not have the user documentation for your equipment contact your local Rexroth Indramat representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the product is resold, rented or transferred or passed on to others, then these safety instructions must be delivered with the product.

WARNING

Inappropriate use of this equipment, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, may result in product damage, personal injury, severe electrical shock or death!

3.2 Explanations

The safety warnings in this documentation describe individual degrees of hazard seriousness in compliance with ANSI:

Warning symbol with signal word	Degree of hazard seriousness The degree of hazard seriousness describes the consequences resulting from non-compliance with the safety guidelines.
 **DANGER**	Bodily harm or product damage will occur.
 **WARNING**	Death or severe bodily harm may occur.
 **CAUTION**	Death or severe bodily harm may occur.

Fig. 3-1: Classes of danger with ANSI

3.3 Hazards by inappropriate use

DANGER

High voltage and high discharge current! Danger to life, risk of severe electrical shock and risk of injury!

DANGER

Dangerous movements! Danger to life and risk of injury or equipment damage by unintentional motor movements!

WARNING

High electrical voltage due to wrong connections! Danger to life, severe electrical shock and severe bodily injury!

WARNING

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

CAUTION

Surface of machine housing could be extremely hot! Danger of injury! Danger of burns!

CAUTION

Risk of injury due to inappropriate handling! Bodily injury caused by crushing, shearing, cutting and mechanical shock or improper handling of pressurized systems!

CAUTION

Risk of injury due to inappropriate handling of batteries!

3.4 General Information

- Rexroth Indramat GmbH is not liable for damages resulting from failure to observe the warnings given in these documentation.
- Order operating, maintenance and safety instructions in your language before starting up the machine. If you find that due to a translation error you can not completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Trained and qualified personnel in electrical equipment:
  Only trained and qualified personnel may work on this equipment or within its proximity. Personnel are qualified if they have sufficient knowledge of the assembly, installation and operation of the product as well as an understanding of all warnings and precautionary measures noted in these instructions.
  Furthermore, they should be trained, instructed and qualified to switch electrical circuits and equipment on and off, to ground them and to mark them according to the requirements of safe work practices and common sense. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The equipment is designed for installation on commercial machinery.

European countries: see directive 89/392/EEC (machine guideline).

- The ambient conditions given in the product documentation must be observed.
- Use only safety features that are clearly and explicitly approved in the Project Planning manual.
  For example, the following areas of use are not allowed: Construction cranes, Elevators used for people or freight, Devices and vehicles to transport people, Medical applications, Refinery plants, the transport of hazardous goods, Radioactive or nuclear applications, Applications sensitive to high frequency, mining, food processing, Control of protection equipment (also in a machine).
- Start-up is only permitted once it is sure that the machine, in which the product is installed, complies with the requirements of national safety regulations and safety specifications of the application.
- Operation is only permitted if the national EMC regulations for the application are met.
  The instructions for installation in accordance with EMC requirements can be found in the INDRAMAT document "EMC in Drive and Control Systems”.
  The machine builder is responsible for compliance with the limiting values as prescribed in the national regulations and specific EMC regulations for the application.

European countries: see Directive 89/336/EEC (EMC Guideline).

U.S.A.: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must consult the above noted items at all times.

- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

3.5 Protection against contact with electrical parts

Note: This section refers to equipment with voltages above 50 Volts.

Making contact with parts conducting voltages above 50 Volts could be dangerous to personnel and cause an electrical shock. When operating electrical equipment, it is unavoidable that some parts of the unit conduct dangerous voltages.

DANGER

High electrical voltage! Danger to life, severe electrical shock and severe bodily injury!

⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.

⇒ Follow general construction and safety regulations when working on electrical installations.

⇒ Before switching on power the ground wire must be permanently connected to all electrical units according to the connection diagram.

⇒ Do not operate electrical equipment at any time if the ground wire is not permanently connected, even for brief measurements or tests.

⇒ Before working with electrical parts with voltage potentials higher than 50 V, the equipment must be disconnected from the mains voltage or power supply.

⇒ The following should be observed with electrical drives, power supplies, and filter components:

Wait five (5) minutes after switching off power to allow capacitors to discharge before beginning work. Measure the voltage on the capacitors before beginning work to make sure that the equipment is safe to touch.

⇒ Never touch the electrical connection points of a component while power is turned on.

⇒ Install the covers and guards provided with the equipment properly before switching the equipment on. Prevent contact with live parts at any time.

⇒ A residual-current-operated protective device (r.c.d.) must not be used on an electric drive! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.

⇒ Equipment that is built into machines must be secured against direct contact. Use appropriate housings, for example a control cabinet.

European countries: according to EN 50178/1998, section 5.3.2.3.

U.S.A: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA) and local building codes. The user of this equipment must observe the above noted instructions at all times.

To be observed with electrical drives, power supplies, and filter components:

DANGER

High electrical voltage! High leakage current! Danger to life, danger of injury and bodily harm from electrical shock!

⇒ Before switching on power for electrical units, all housings and motors must be permanently grounded according to the connection diagram. This applies even for brief tests.

⇒ Leakage current exceeds 3.5 mA. Therefore the electrical equipment and units must always be firmly connected to the supply network.

⇒ Use a copper conductor with at least 10 mm² cross section over its entire course for this protective connection!

⇒ Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. High voltage levels can occur on the housing that could lead to severe electrical shock and personal injury.

European countries: EN 50178/1998, section 5.3.2.1.

USA: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must maintain the above noted instructions at all times.

3.6 Protection by protective low voltage (PELV) against electrical shock

All connections and terminals with voltages between 5 and 50 Volts on INDRAMAT products are protective low voltages designed in accordance with the following standards on contact safety:

- International: IEC 364-4-411.1.5
- EU countries: see EN 50178/1998, section 5.2.8.1.

WARNING

High electrical voltage due to wrong connections! Danger to life, severe electrical shock and severe bodily injury!

⇒ Only equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) may be connected to all terminals and clamps with 0 to 50 Volts.

⇒ Only safely isolated voltages and electrical circuits may be connected. Safe isolation is achieved, for example, with an isolating transformer, an opto-electronic coupler or when battery-operated.

3.7 Protection against dangerous movements

Dangerous movements can be caused by faulty control or the connected motors. These causes are be various such as:

- unclean or wrong wiring of cable connections
- inappropriate or wrong operation of equipment
- malfunction of sensors, encoders and monitoring circuits
- defective components
- software errors

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

The monitors in the drive components make faulty operation almost impossible. Regarding personnel safety, especially the danger of bodily harm and property damage, this alone should not be relied upon to ensure complete safety. Until the built-in monitors become active and effective, it must be assumed in any case that some faulty drive movements will occur. The extent of these faulty drive movements depends upon the type of control and the state of operation.

DANGER

Dangerous movements! Danger to life and risk of injury or equipment damage!

⇒ Personnel protection must be secured for the above listed reason by means of superordinate monitors or measures.

These are instituted in accordance with the specific situation of the facility and a danger and fault analysis conducted by the manufacturer of the facility. All the safety regulations that apply to this facility are included therein. By switching off, circumventing or if safety devices have simply not been activated, then random machine movements or other types of faults can occur.

Avoiding accidents, injury or property damage:

⇒ Keep free and clear of the machine's range of motion and moving parts. Prevent people from accidentally entering the machine's range of movement:

- use protective fences
- use protective railings
- install protective coverings
- install light curtains or light barriers

⇒ Fences must be strong enough to withstand maximum possible momentum.

⇒ Mount the emergency stop switch (E-stop) in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the machine if the emergency stop is not working.

⇒ Isolate the drive power connection by means of an emergency stop circuit or use a start-inhibit system to prevent unintentional start-up.

⇒ Make sure that the drives are brought to standstill before accessing or entering the danger zone.

⇒ Secure vertical axes against falling or slipping after switching off the motor power by, for example:

- Mechanically securing the vertical axes
- Adding an external brake / clamping mechanism
- Balancing and thus compensating for the vertical axes mass and the gravitational force

The standard equipment motor brake or an external brake controlled directly by the servo drive are not sufficient to guarantee the safety of personnel!

⇒ Disconnect electrical power to the equipment using a master switch and secure the switch against reconnection for:

- maintenance and repair work
- cleaning of equipment
- long periods of discontinued equipment use

⇒ Avoid operating high-frequency, remote control and radio equipment near electronics circuits and supply leads. If use of such equipment cannot be avoided, verify the system and the plant for possible malfunctions at all possible positions of normal use before the first start-up. If necessary, perform a special electromagnetic compatibility (EMC) test on the plant.

3.8 Protection against magnetic and electromagnetic fields during operations and mounting

Magnetic and electromagnetic fields generated by current-carrying conductors and permanent magnets in motors represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.

WARNING

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

⇒ Persons with pacemakers, metal implants and hearing aids are not permitted to enter following areas:

- Areas in which electrical equipment and parts are mounted, being operated or started up.
- Areas in which parts of motors with permanent magnets are being stored, operated, repaired or mounted.

⇒ If it is necessary for a person with a pacemaker to enter such an area, then a physician must be consulted prior to doing so. Pacemaker, that are already implanted or will be implanted in the future, have a considerable deviation in their resistance to interference. Due to the unpredictable behavior there are no rules with general validity.

⇒ Persons with hearing aids, metal implants or metal pieces must consult a doctor before they enter the areas described above. Otherwise health hazards will occur.

3.9 Protection against contact with hot parts

CAUTION

Housing surfaces could be extremely hot!
Danger of injury! Danger of burns!

⇒ Do not touch surfaces near the source of heat! Danger of burns!

⇒ Wait ten (10) minutes before you access any hot unit. Allow the unit to cool down.

⇒ Do not touch hot parts of the equipment, such as housings, heatsinks or resistors. Danger of burns!

3.10 Protection during handling and installation

Under certain conditions unappropriate handling and installation of parts and components may cause injuries.

CAUTION

Risk of injury through incorrect handling!
Bodily harm caused by crushing, shearing, cutting and mechanical shock!

⇒ Observe general instructions and safety regulations during handling installation.

⇒ Use only appropriate lifting or moving equipment.

⇒ Take precautions to avoid pinching and crushing.

⇒ Use only appropriate tools. If specified by the product documentation, special tools must be used.

⇒ Use lifting devices and tools correctly and safely.

⇒ Wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.

⇒ Never stay under suspended loads.

⇒ Clean up liquids from the floor immediately to prevent personnel from slipping.

3.11 Battery safety

Batteries contain reactive chemicals in a solid housing. Inappropriate handling may result in injuries or equipment damage.

CAUTION

Risk of injury through incorrect handling!

⇒ Do not attempt to reactivate discharged batteries by heating or other methods (danger of explosion and corrosion).

⇒ Never charge batteries (danger from leakage and explosion).

⇒ Never throw batteries into a fire.

⇒ Do not dismantle batteries.

⇒ Handle with care. Incorrect extraction or installation of a battery can damage equipment.

Note: Environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air and sea transport in the sense of the legal requirements (danger of explosion). Dispose batteries separately from other refuse. Observe the legal requirements given in the country of installation.

3.12 Protection against pressurized Systems

Certain Motors (ADS, ADM, 1MB etc.) and drives, corresponding to the information in the Project Planning manual, must be provided with and remain under a forced load such as compressed air, hydraulic oil, cooling fluid or coolant. In these cases, improper handling of the supply of the pressurized systems or connections of the fluid or air under pressure can lead to injuries or accidents.

CAUTION

Danger of injury when pressurized systems are handled by untrained personnel!

⇒ Do not attempt to disassemble, to open or to cut a pressurized system.

⇒ Observe the operation restrictions of the respective manufacturer.

⇒ Before the disassembly of pressurized systems, lower pressure and drain off the fluid or gas.

⇒ Use suitable protective clothing (for example protective eyewear, safety shoes and gloves)

⇒ Remove any fluid that has leaked out onto the floor immediately.

Note: Environmental protection and disposal! The fluids used in the operation of the pressurized system equipment is not environmentally compatible. Fluid that is damaging to the environment must be disposed of separate from normal waste. Observe the national specifications of the country of installation.

4 Structure of the RECO Inline Terminals

4.1 Basic Structure of the Terminals of the Low Signal Level

Independently of the function and the overall width, a RECO Inline terminal of the low signal level consists of the electronic socket (in short: socket) and the clip-on connector (in short: connector).

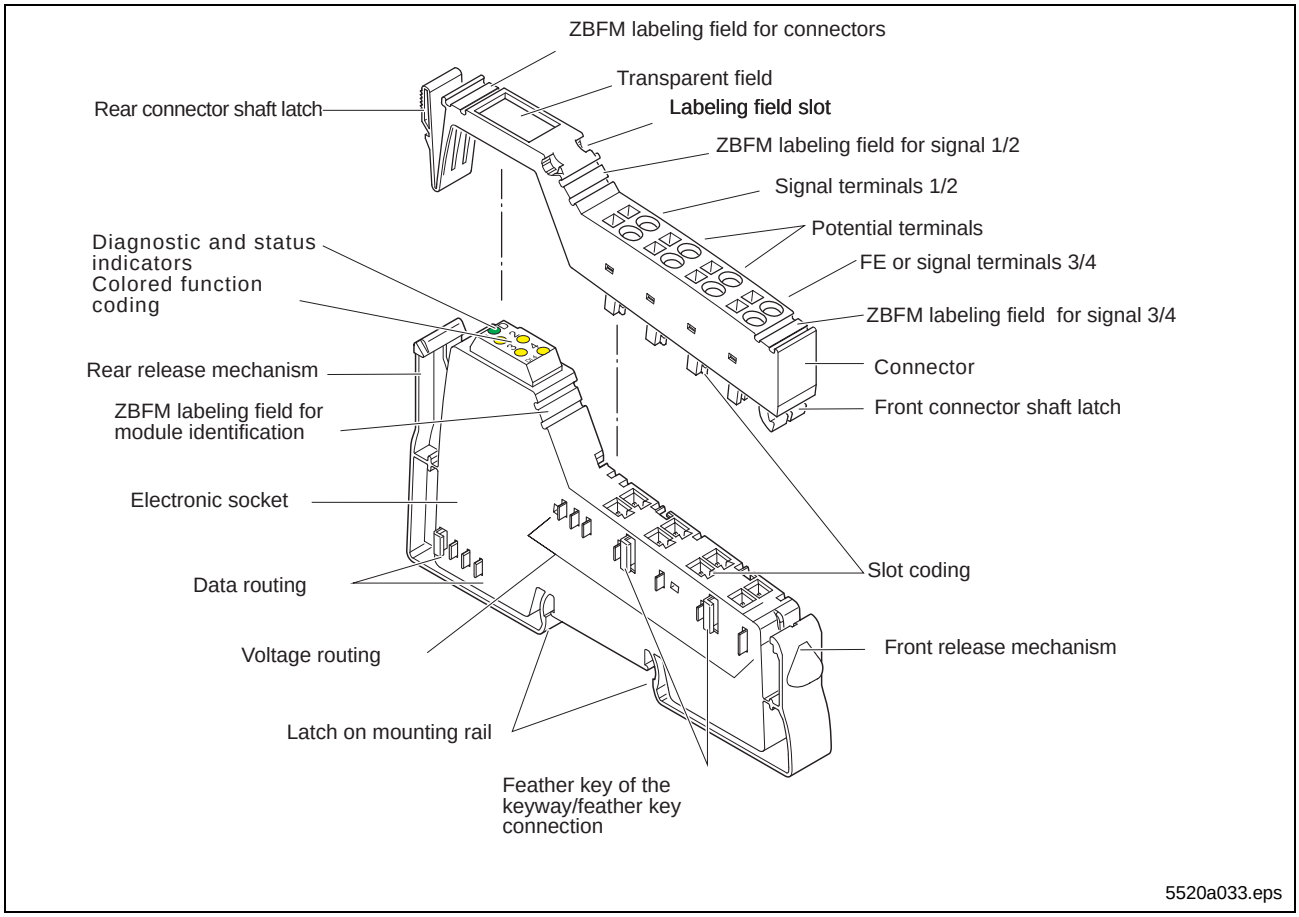


Fig. 4-1: Basic structure of a RECO Inline terminal

The most important of the components shown in Fig. 4-1 are described in the Chapters “Electronic Socket“ on page 4-2 and "Connectors" on page 4-28.

4.2 Electronic Socket

In the electronic socket, there are all the electronic parts of the RECO Inline terminal as well as the voltage and data jumper.

Voltage and data jumper

The voltage and data jumper is arranged in the socket. Thus, the elements of one station are advantageously not restricted to a certain overall height. Accordingly, flat subassemblies as e.g. carrier modules for the reception of contactors can be integrated into the station as well. As all terminals are latched onto the mounting rail, there is a fixed interface between all terminals of the station (see also “Voltage and Data Jumpers” on page 4-12).

On the left side of the module (shown in Fig. 4-1), there are the blade contacts which latch into the springs of the neighboring terminal to the left when mounted into a station.

The type of contacts of the voltage and data jumpers existing in a terminal depends on the function of the terminal (see Chapter “Jumper Contacts of Various Module Groups” on pages 4-22).

When you operate the front and the back releasing mechanism simultaneously, the lock will open and you’ll be able to take out the terminal vertically to the mounting rail (see Chapter “Assembly and Disassembly of RECO Inline Terminals on page 6-12).

Keyway/feather key connection

On the left side of the module (Fig. 4-1), there are the feather keys which on assembly on the mounting rail latch into the keyway of the neighboring left terminal.

Overall widths

As a standard, the electronic sockets for terminals of low signal level are available in terminal widths of 8 connecting points (8-slot) and 2 connecting points (2-slot). Any other dimensions are combinations of the two above basic terminal widths (also refer to Chapter “Housing Dimensions of the Terminals of Low Signal Level” on page 4-34).

Protocol chip

The core element of module electronics is the OPC protocol chip (Optical Protocol Chip, OPC). This chip is characterized as follows:

- Suitable for all applications in the I/O field
- Internal register with a minimum data length of 2 bit and a maximum data length of 32 bit
- Parallel I/O interface, automatic interface identification

  Up to now, you had to identify the last INTERBUS module in order to find out if the next interface was already assigned (RBST jumper with copper technology). With the RECO Inline terminals, this is no longer necessary.
- SUPI-3 chip
  - The functions of the INTERBUS protocol chip used up to now continue to be realized.
  - Extended diagnostic functions, e.g. in case of wire breakage or poor terminal connection
  - Report generator for temporary storage of diagnostic information in the chip, e.g. in case of short voltage failures.

4.3 Terminals with Fuse

The power and segment terminals are available in two versions, with and without fuses.

In terminals with fuse, the existence of voltage and the state of the fuse is monitored and shown on the diagnostic indicators (also refer to Chapter “Indicators on Supply Terminals” on page 4-6).

If there is no fuse, or if it is defect, please put in a fuse resp. replace it.

CAUTION

When replacing a fuse, please observe the following safety notes to protect your own health and the plant!

1. Handle the screw driver with care so that there is no risk of injuring yourself or another person.

2. Remove the fuse at the metal contact. Do not apply the lever at the glass body to avoid breakage.

3. Carefully lift the fuse on one side and remove the fuse by hand. Make sure that the fuse doesn’t fall into the plant!

To replace a fuse, proceed as follows:

Compare the illustrations in Fig. 4-2:

- Flip up the fuse lever (A).
- Place a screw driver behind a **metal contact** of the fuse (B).
- Carefully lever out the metal contact of the fuse (C).
- Remove the fuse by hand (D).
- Snap the new fuse into place (E).
- Press the fuse lever down again until it snaps home (F).

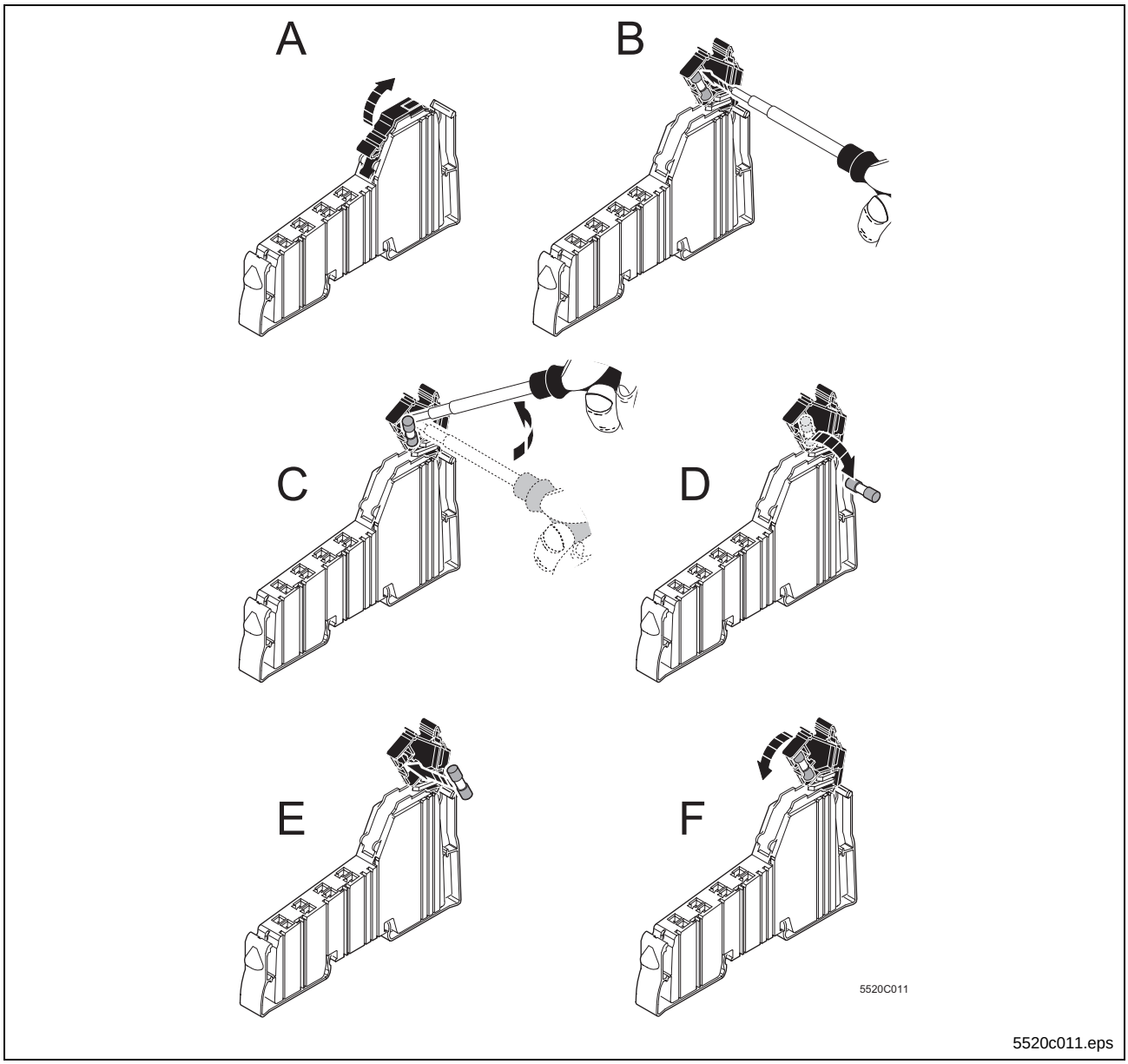


Fig. 4-2: Replacing a fuse

4.4 Diagnostic and Status Indicators

For quick error finding on site, all terminals are equipped with diagnostic and status LEDs.

Diagnosis The diagnostic indications (red/green) provide information about the error type and location. A terminal operates errorlessly if all its green LEDs are lighted.

After error correction, the indicator immediately shows the current state.

Status The status indications (yellow) show the status of the respective input/output and/or of the connected device.

Please refer to the data sheet of the module in question for information on the diagnostic and status indications displayed on a specific terminal.

Indicators on the Bus Terminal

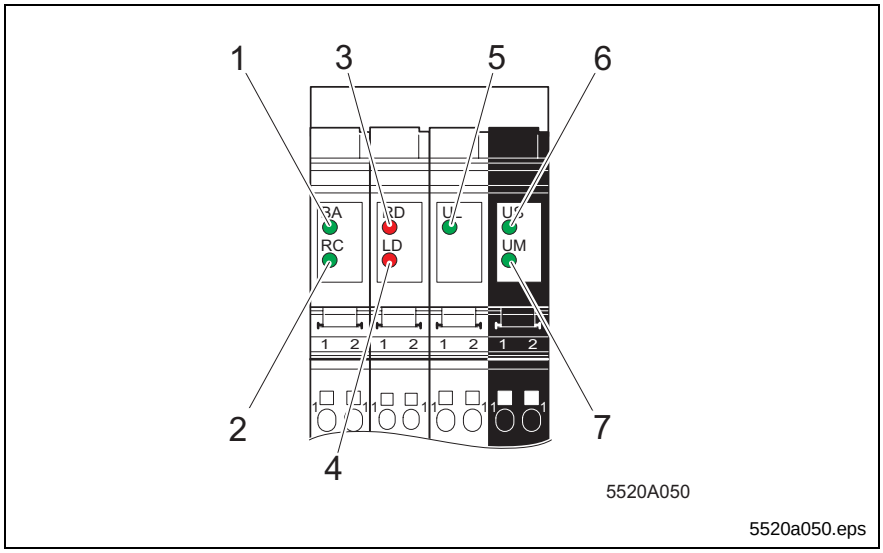


Fig. 4-3: Indicators on the bus terminal R_IBS IL 24 BK-T

Diagnosis The indicators on the bus terminal informs you of the following conditions:

Mode (1)	LED green	Remote bus activated (bus active)
	on:	Data transfer on the INTERBUS activated: (state of the INTERBUS: Run)
	flashing:	ID cycle; no data transfer (state of the INTERBUS: Active)
	off:	No data transfer
RC (2)	LED green	Remote bus connection (Remote Bus Check)
	on:	Incoming remote bus connection set up
	off:	Disturbance of incoming remote bus connection
RD (3)	LED red	Remote bus deactivated (Remote Bus Disabled)
	on:	Next remote bus interface is deactivated
	off:	Next remote bus interface is not deactivated
LD (4)	LED red	Local bus deactivated (Local Bus Disabled)
	on:	Local bus deactivated
	off:	Local bus not deactivated
UL (5)	LED green	Bus terminal supply voltage / logic supply voltage / interface supply voltage
	on:	Supply voltage activated
	off:	Supply voltage not activated
US (6)	LED green	Segment supply voltage
	on:	Segment supply voltage activated
	off:	Segment supply voltage not activated
U_M (7)	LED green	Main supply voltage
	on:	Main supply voltage activated
	off:	Main supply voltage not activated

Fig. 4-4: Diagnostic LED of the bus terminal

Indicators on Supply Terminals

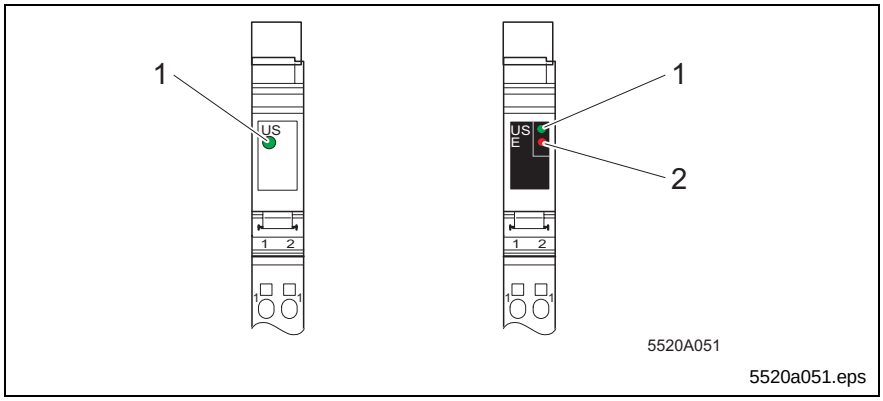


Fig. 4-5: Potential indicators on supply terminals (here: segment terminal without and with fuse)

Diagnosis

The indicators of the supply terminals inform you of the following states:

In terminals with fuse, the green LED indicates that main or segment voltage is activated **before** the fuse. That means that the voltage is applied before the fuse. When the red LED is on as well, the voltage is not applied after the LED!

Power terminal		
U_M (1)	LED green	Supply voltage in the main circuit
	on:	Supply voltage available in the main circuit
	off:	Supply voltage not available in the main circuit
Segment terminal		
US (1)	LED green	Supply voltage in the segment circuit
	on:	Supply voltage available in the segment circuit
	off:	Supply voltage not available in the segment circuit
Additionally in power terminals with fuse		
E (2)	LED red	Status of fuse
	on:	No fuse, or tripped fuse
	off:	Fuse o.k.

Fig. 4-6: Diagnostic LED of the supply terminal

Note: In terminals with fuse, the green LED indicates that main or segment voltage is activated **before** the fuse. That means that the voltage is applied before the fuse when the green LED is on. When the red LED is on as well, the voltage is not applied after the LED!

Indicators on Input/Output Terminals

Electrically, all LEDs of the input/output terminals are in the logic area.

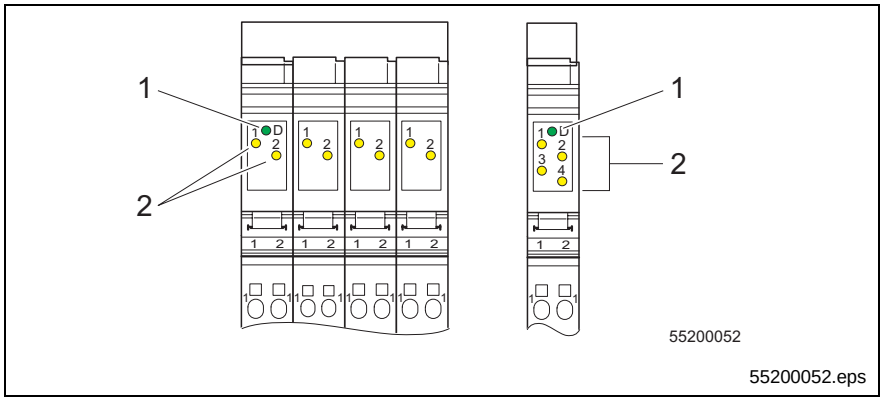


Fig. 4-7: Indicators on input/output terminals

Diagnosis The indicators on the input/output terminals inform you of the following states:

D (1)	LED green	Diagnosis
	on:	INTERBUS is active
	flashing: 0,5 Hz: (slow)	Logic voltage available, INTERBUS not active
	2 Hz: (medium)	Logic voltage available, INTERBUS active, peripheral error
	4 Hz: (quick)	Logic voltage available, Failure of terminal before the flashing module, Terminals after the flashing module are not included in the configuration frame
	off:	Logic voltage not available, INTERBUS not active

Fig. 4-8: Diagnostic LED of input/output terminals

Status The status of the input or output can be seen from the corresponding yellow LED:

1, 2, 3, 4 (2)	LED yellow	Input/output status
	on:	Corresponding input/output is set up
	off:	Corresponding input/output is not set up

Fig. 4-9: Status LED of input/output terminals

Assignment between status LED and input/output

Here, the general assignment principle of a status LED to its input or output is shown.

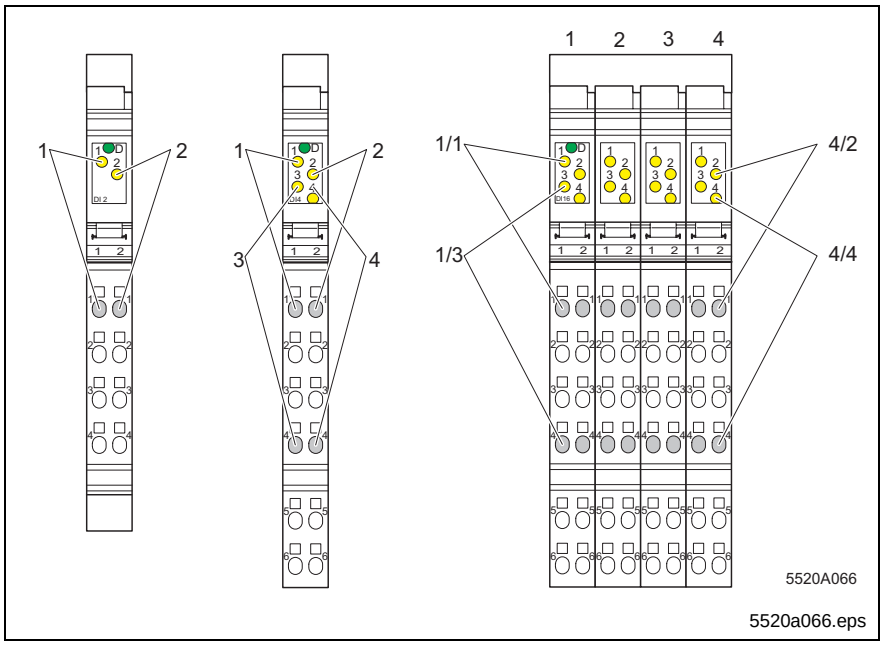


Fig. 4-10: Assignment between status LED and input/output

To understand the numbering principle, please read Chapter “Labeling / Numbering of Terminals” on page 4-32.

With a 8-slot terminal, the LEDs of one slot belong to the terminal points of the slot in question. Each slot can be treated like a 2-slot terminal.

With a 2-slot terminal with 4 inputs or outputs (center illustration in Fig. 4-10), the following LEDs belong to the following terminal points:

LED 1	Terminal point 1.1
LED 2	Terminal point 2.1
LED 3	Terminal point 1.4
LED 4	Terminal point 2.4

In Fig.4-7 and Fig. 4-9, terminal point 4 is assigned to the terminal LED 2. It belongs to terminal point 4 / 2.1 (slot 4 / terminal point 2.1).

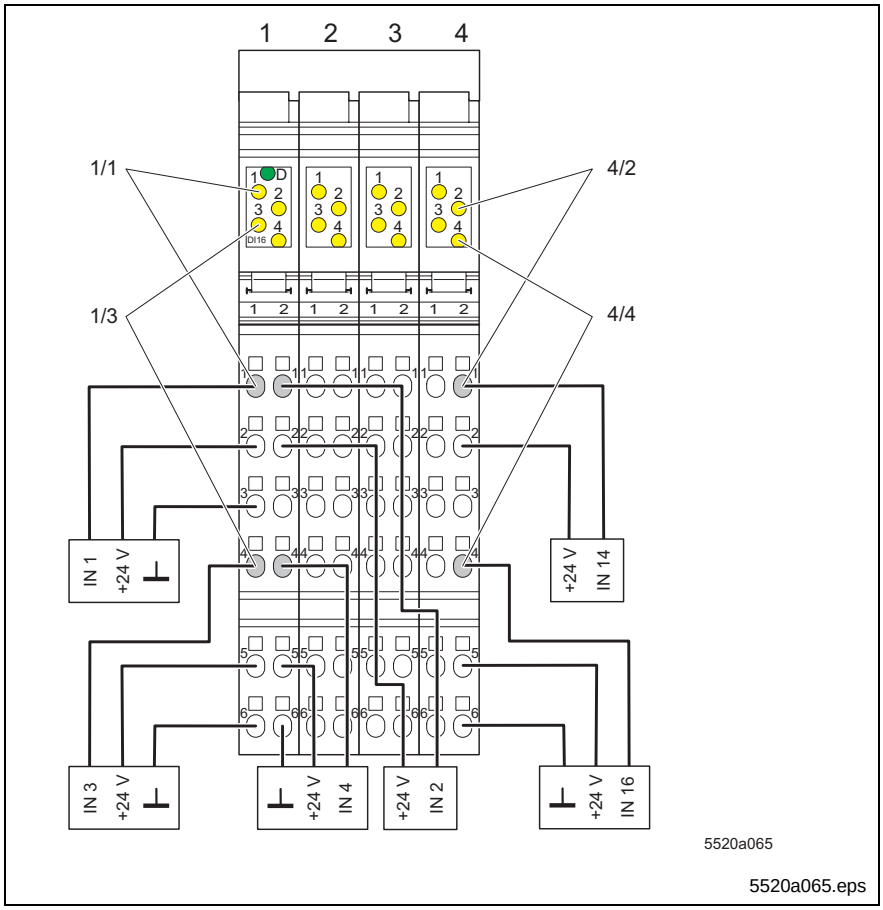


Fig. 4-11: Assignment between status LED and input/output by way of example of a terminal R-IB IL 24 DI 16

For each individual terminal, the assignment is to be found in the data sheet for the respective module.

Error Localization

The diagnostic and status indications of RECO Inline permit unique error localization. An error is indicated in the station. Furthermore, the device in which the error occurred is announced to the control and can be read out by means of SPS interface 19VRS.

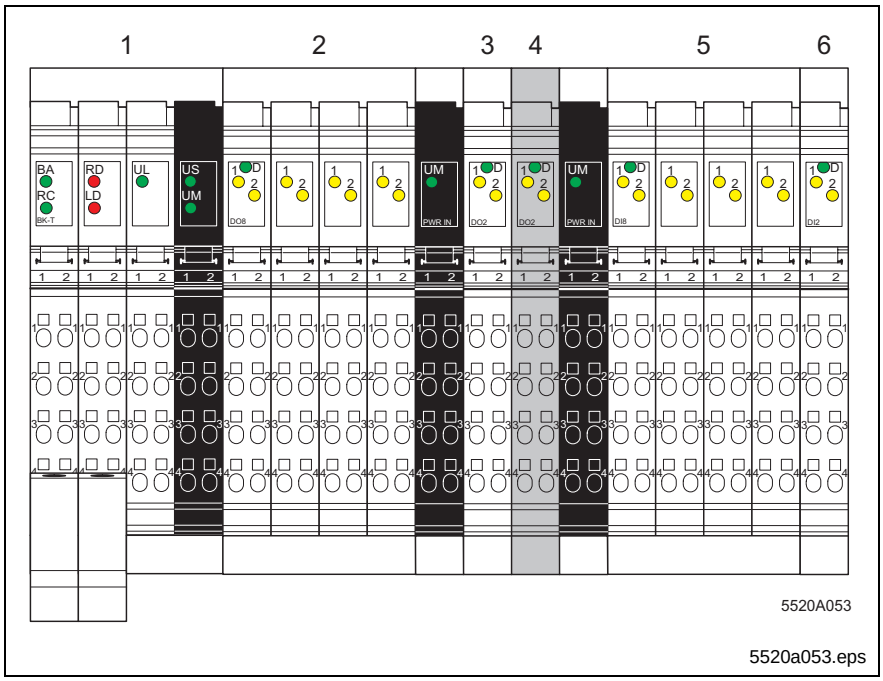


Fig. 4-12: Example station for error localization

Terminals used in the example station:

1	R-IBS IL 24 BK-T	4	R-IB IL 24 DO 2-2A
2	R-IB IL 24 DO 8	5	R-IB IL 24 DI 8
3	R-IB IL 24 DO 2-2A	6	R-IB IL 24 DI 2

The power terminals R-IB IL 24 PWR IN are not numbered as they are no bus devices; accordingly, they do not give error diagnostic indications.

When everything is o.k., the green LEDs on the bus terminal and on the other terminals show a constant light (Fig. 4-7, Fig. A).

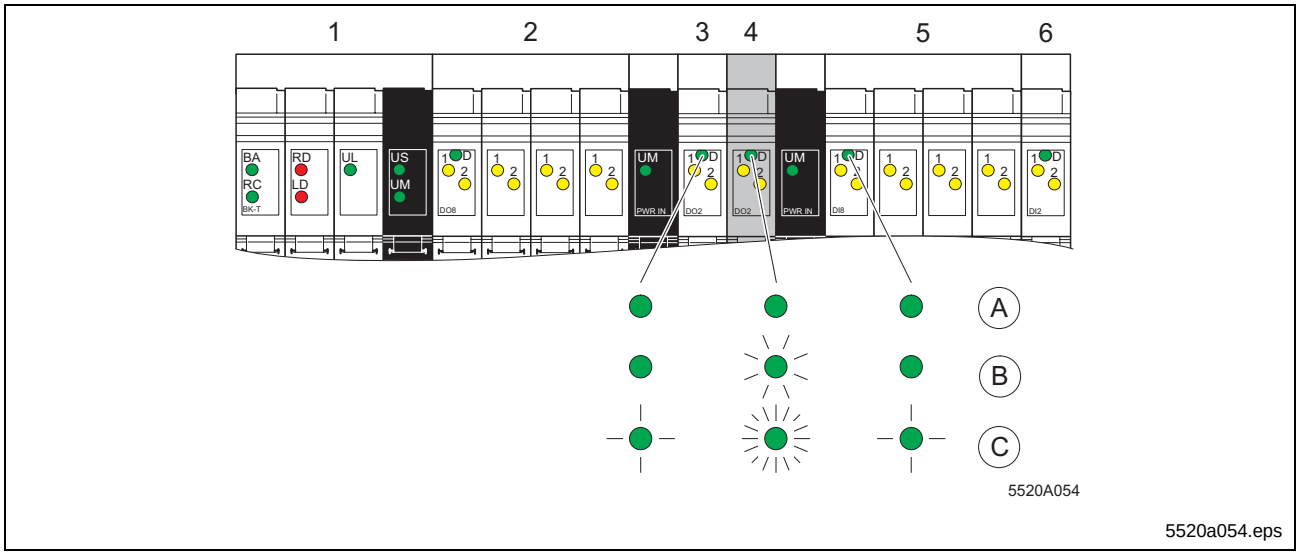


Fig. 4-13: Station with diagnostic indicators

Fig. 4-7 shows a station with potential error states. Peripheral error at terminal 5 and/or bus error between terminal 3 and terminal 4 are considered, as well as the information indicated by the diagnostic indicators of the neighboring modules.

A no error,

B peripheral error

C bus error,

LED on, or flashing at 0,5 Hz / 2 Hz / 4 Hz

(on / slow / medium / fast)

Peripheral error

Error:	Short-circuit at terminal 4 (R-IB IL 24 DO 2)
Effect:	
Control:	Error message to the control (peripheral error)
Bus terminal:	Indications remain unchanged
Terminal 4:	Green LED D flashes at 2 Hz
Other terminals:	remain unchanged

Fig. 4-14: Peripheral error

Bus error

Error:	Incoming bus is interrupted after terminal 2 and before terminal 4
Effect:	
Control:	Error localization can be done by control
Bus terminal:	Red LED LD (local bus disconnected) is on
Terminal 4:	Green LED D flashes at 4 Hz (bus error)
Other terminals:	The green LEDs D of all other terminals flash at 0.5 Hz

Fig. 4-15: Bus error

4.5 Voltage and Data Routing

Arrangement of the voltage and data jumpers

A significant feature of RECO Inline is the voltage routing system integrated in the station.

The electrical connection between the single station devices is made automatically on setup of the station. When the individual station devices latch onto each other, a bus bar is set up for the respective electrical circuit. Mechanically, this contact is achieved by the blade and spring contacts of the neighboring terminals latching into each other.

Thanks to a special segment circuit, the user does not need any additional external transverse potential connection. An emergency stop concept can be integrated into the station.

In one station, two independent electrical circuits have been realized; the logic circuit, and the peripheral circuit.

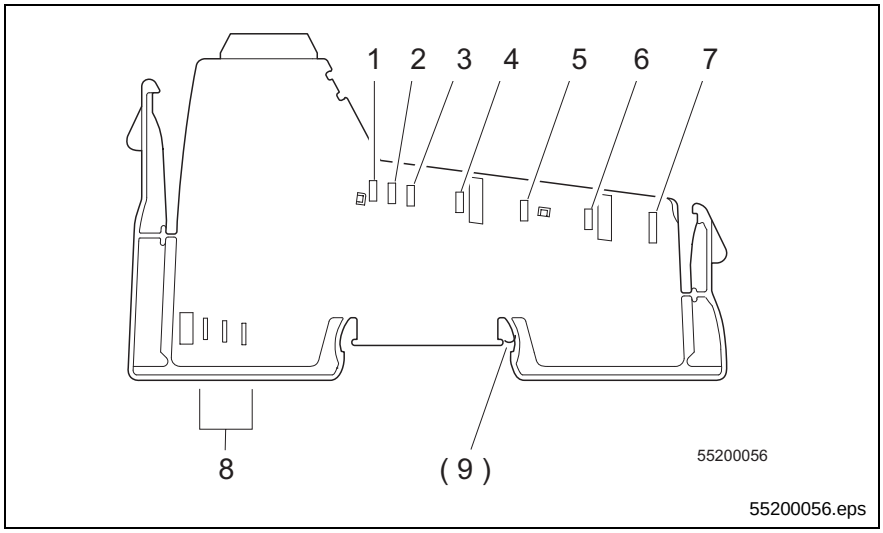


Fig. 4-16: Voltage and data routing

No.	Function		Explanation
Voltage jumpers			
1	7,5 V	U_{L+}	Logic voltage supply for the bus connection
2	24 V	U_{ANA}	Peripheral voltage supply for analog terminals
3	GNDL	U_{L+}	Ground of the logic voltage supply and the peripheral voltage supply for analog terminals
4	24 V	U_{S}	Voltage supply of the segment circuit (if necessary protected from overload) This jumper does not exist in the voltage levels of 120 V and 230 V.
5	24 V	U_{M}	Voltage supply of the main circuit (if necessary protected from overload)
6	GND	GND	Frame of the segment and main voltage supply (zero conductor)
7	FE	FE	Functional earth ground
(9)	(FE spring)		FE contact to the top-hat rail (with bus terminals, power terminals, and segment terminals)
Data jumper			
8			INTERBUS local bus

Fig. 4-17: Voltage and data jumper

For more information on the electrical circuits set up by means of the voltage jumpers U_L , U_{ANA} , U_M and U_S, please refer to Chapter 4.7.

GND This voltage jumper is the ground for the main and the segment circuit.

Note: **Please take note that the voltage jumper GDN carries the total current of the main and the segment circuits. The total current of the main and the segment circuit must not exceed the maximum load capacity of the voltage jumpers of 8 A.**

FE The voltage jumper FE must be connected to an earth terminal via the corresponding connector at the bus terminal. Additionally, it is connected via the FE spring to the earthed mounting rail at each power terminal, and routed through all the terminals.

Data jumper Within a station, the INTERBUS signal is also transmitted via a connection which is automatically set up when the station devices are latched on.

FE spring This spring makes the FE contact between the bus terminal, the power terminal or segment terminal, and the top-hat rail.

Load capacity The maximum total load capacity through the voltage jumpers is limited. The maximum load capacity is defined for each electrical circuit.

Note: **When the load capacity of the voltage jumpers U_L or U_{ANA} has been reached, a new station must be set up by means of a new bus terminal.**

Note: **When the load capacity of the voltage jumpers U_M, U_S and GND has been reached (total current of U_S and U_M), a new power terminal must be set up.**

Current and voltage distribution

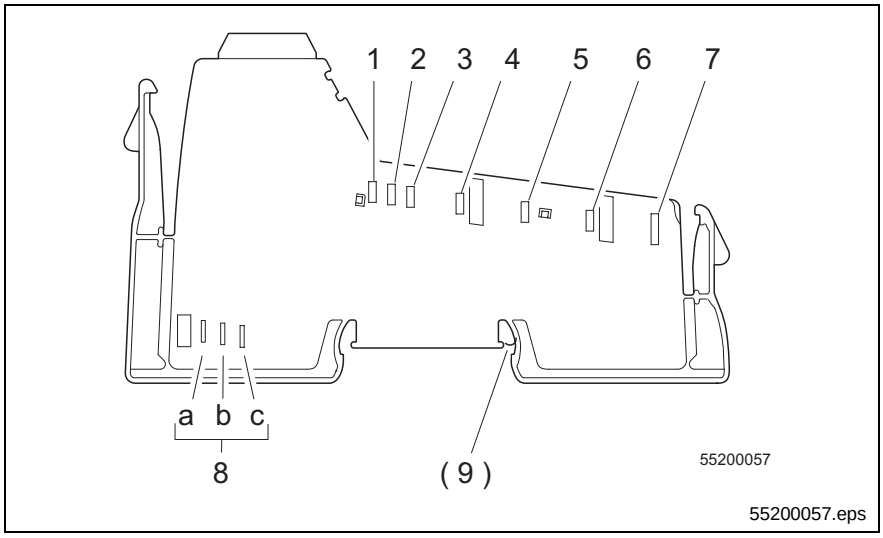


Fig. 4-18: Current and voltage distribution

No.	Function		Voltage on contact no. 6 (GND)		Current
			minimum	maximum	Maximum
Voltage jumpers					
1	7,5 V	U L+	7,0 V DC *	7.87 V DC *	2 A
2	24 V	U ANA	19.2 V DC *	30 V DC *	0.5 A
3	GNDL	U L-	0 V	0 V DC *	2.5 A
4	24 V	US	19.2 V DC *	30 V DC *	8 A
5	24 V	U_M	19.2 V DC *	253 V AC	
6	GND	GND	0 V	0 V	8 A
7	FE	FE	undefined	undefined	undefined
(9)	FE spring				
Data jumper					
8 a	Bus signal				
8 a	Bus signal				
8 c	reserved				

Fig. 4-19: Current and voltage distribution in the voltage and data jumpers

*Contact no. 3 is the reference potential for the logic system. Contact no. 6 is the reference potential for the peripheral equipment.

When no electrical isolation is provided between the logic and the peripheral equipment, both systems have the same potential.

Explanation on the individual contacts

Contact no. 1 The rated output voltage of the power supply unit is 7,5 V ± 5 %. With a current of 2 A, the voltage drop must not exceed 0.6 V. With a connected I/O module, a minimum of 30 mA is to be expected. The maximum tolerable current of the power supply unit is 2 A.

Contact no. 2 With a rated voltage of 24V, the minimum supply voltage is 19.2 V DC:

With a rated voltage of 24V, the maximum supply voltage is 30.0 V DC:

The maximum current is 0.5 A.

Contact no. 3 Contact no. 3 is the reference potential of the logic voltage. Regarding current, the same notes as for contact no. 1 apply.

Contact no. 4 With a rated voltage of 24V, the minimum supply voltage is 19.2 V DC:

With a rated voltage of 24V, the maximum supply voltage is 30.0 V DC:

With a connected power terminal, the maximum current is 8 A.

Contact no. 5 With a rated voltage of 24V, the minimum supply voltage is 19.2 V DC:

With a rated voltage of 230 V, the maximum supply voltage is 253 V AC.

With a connected power terminal, the maximum current is 8 A.

Contact no. 6 Ground potential for the segment and the main circuit.

Contact no. 7 Because of the electrical isolation between FE and the peripheral equipment, the voltage between FE and GND is undefined.

Contacts no. 8 a, b, c The logic signals are on the contacts.

Note: When the limit value for the voltage jumpers U_S, U_M and GND has been reached, a new power terminal must be set. When the limit value of the voltage jumpers U_L or U_{ANA} has been reached, a new bus terminal must be set that opens a new station.

4.6 Electric Circuits within a RECO Inline Station/Provision of supply voltages

Within a RECO Inline station, there are several electric circuits. These circuits are set up automatically when the terminals latch onto each other. Via the voltage jumpers, the voltages of the various electric circuits are made available to the connected terminals.

Please refer to the technical data of Chapter 8 “Technical Data” or to the data sheet of an individual module for information on the electric circuit to which the peripheral equipment of the respective module is connected.

Load capacity of the jumper contacts

The maximum load capacity of the lateral jumper contacts must be observed for each electric circuit.The current carrying capacities of all voltage jumpers are listed in the following paragraphs; a summary is to be found in Fig. 4-19

For the arrangement of the voltage jumpers and information on current and voltage distribution on the voltage jumpers, please refer to Chapter “Voltage and Data Routing” on page 4-12. The connection of the supply voltages is described in the Chapter “Connection of Supply Voltages”.

Regarding the connection of voltages, please observe the notes in the data sheets of the individual modules.

Supply of bus terminals

You **must** connect the supply voltage U_{BK} to the bus terminal. Of this voltage, the voltages for the logic circuit U_L and the supply of the terminals for analog signal U_{ANA} are created internally..

Logic circuit

The logic circuit with the logic voltage U_L starts at the bus terminal and is routed through all terminals of a RECO Inline station.

Function Logic voltage is supplied from the logic circuits to all terminals of the station.

Voltage The voltage in this circuit is 7.5 V.

Availability of U_L The logic voltage U_L is created from the bus terminal supply voltage by the bus terminal.

Load capacity The load capacity is a maximum of 2 A. When this limit has been reached, a new station must be set up by means of a new bus terminal.

The logic voltage is not galvanically isolated from the 24 V input voltage of the bus terminal.

Analog circuit

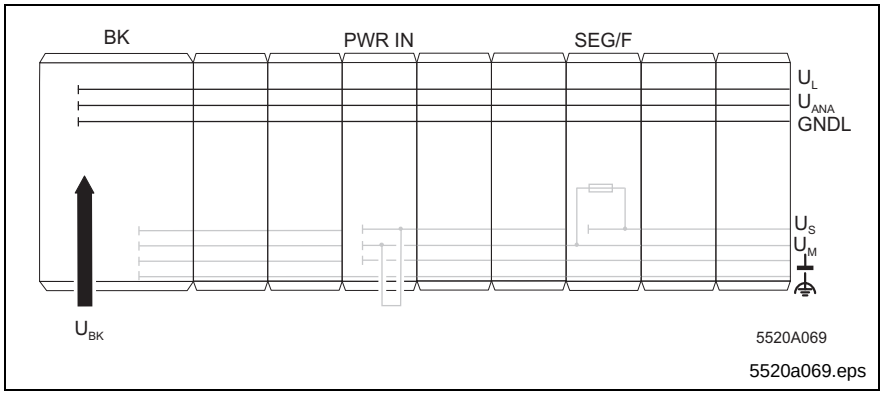
The analog circuit with the voltage supply for the analog terminals (also called analog voltage in the following) U_{ANA} starts at the bus terminal and is routed through all terminals of a RECO Inline station.

Function The peripheral equipment of the terminals for analog signals is supplied from the analog circuit.

Voltage The voltage in this circuit is 24 V.

Availability of U_{ANA} The analog voltage U_{ANA} is created from the bus terminal supply voltage by the bus terminal.

Load capacity The load capacity is a maximum of 0.5 A. When this limit has been reached, a new station must be set up by means of a new bus terminal.



L: BK Bus terminal
PWR IN Power terminal
SEG/F Segment terminal with fuse as an example for a segment terminal

Fig. 4-20: Logic and analog circuits

Main circuit U_M

The main circuit with the main voltage U_M starts at the bus terminal or at a power terminal and is routed through all following terminals to the next power terminal. At the next power terminal, a new circuit is started; its potential is isolated from the foregoing circuit.

Several power terminals can be set within one station.

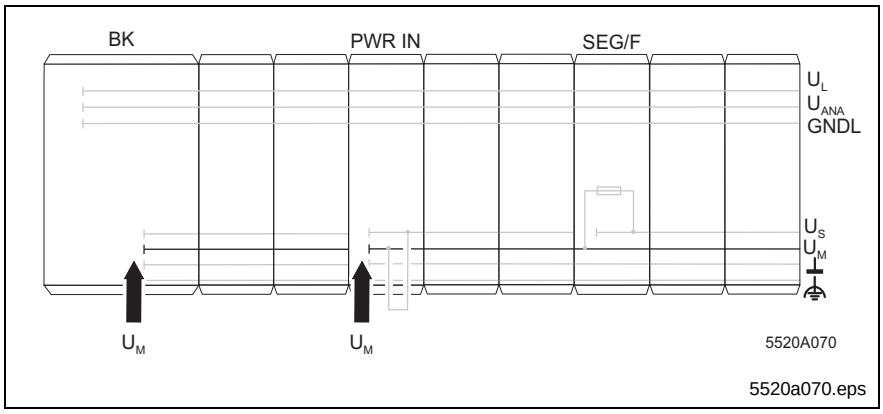
Function Initiator voltage supplies with short-circuit protection of their own, and initiator voltage supplies not requiring protection are supplied from the main circuit. That is to say that all terminals which for example do not have to be isolated from the peripheral voltage in case of emergency stop are supplied from the main circuit.

Within the main circuit, several independent segments can be set up. The main circuit provides the supply voltage for these segments.

Voltage In this circuit, the voltage, considering the isolation from the safety extra-low voltage, must not exceed 250 V AC.

Load capacity

The load capacity is a maximum of 8 A (total current with the segment circuit). When the limit value for the voltage jumpers $U_{M\ and}$ U_S has been reached (total current of U_S and U_M), a new power terminal must be set.



L: BK Bus terminal
PWR IN Power terminal
SEG/F Segment terminal with fuse as an example for a segment terminal

Fig. 4-21: Main circuit

Availability of U_M

In the most simple case, the main voltage U_M can be supplied at the bus terminal.

The main voltage U_M can also be supplied through a power terminal. A power terminal **must** be used in the following cases:

1 Different voltage areas (e.g. 230 V) are to be set up.

2 An electrical isolation is to be set up.

3 The maximum load capacity of a voltage jumper (U_M , U_S or GND, total current of U_S and U_M) has been reached.

Segment circuit

The segment circuit or auxiliary circuit with the segment voltage U_S starts at the bus terminal or a supply terminal (power terminal or segment terminal) and is routed through all following modules up to the next supply terminal.

Function

From the segment circuit, all terminals are supplied which for example are to be separated from the main voltage in case of an emergency stop. This is e.g. applicable for digital input terminals without a short-circuit protection of their own, for digital output terminals, as well as for the auxiliary supply for driving power switchgear and contactors.

You can disconnect and/or fuse the segment circuit by means of the emergency stop or segment terminals. It has the same ground reference as the main circuit. Thus, you can realize within the station emergency stop circuits or differently fused electric circuits without any external cross wiring.

Voltage Voltage in this circuit must not exceed 24 V DC.

Load capacity The load capacity is a maximum of 8 A (total current with the main circuit). When the limit value for a voltage jumper has been reached (total current of U_S and U_M), a new power terminal must be set.

Availability U_S The segment voltage U_S can be provided in various ways:

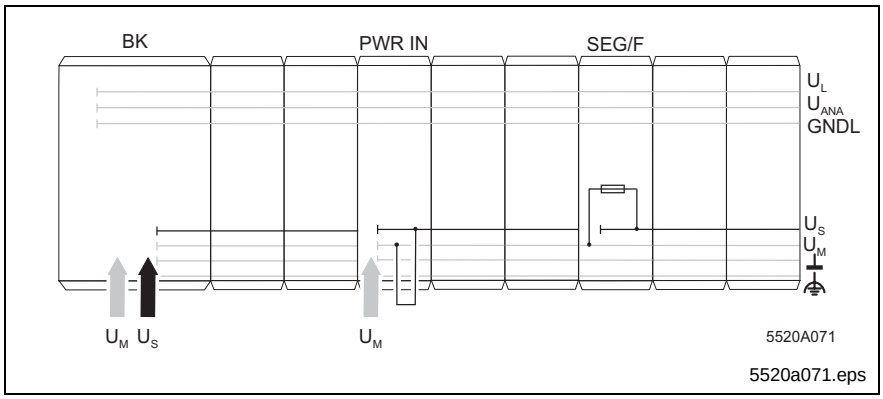
1 You can feed in the segment voltage at the bus terminal or at a power terminal.

2 You can pick off the segment voltage from the main voltage at the bus terminal or at a power terminal by means of a bridge or a connector.

3 You can use a segment terminal with fuse. In this terminal, the segment voltage is automatically picked off from the main voltage.

4 You can use a segment terminal without fuse and pick off the segment voltage from the main voltage by means of a bridge or a connector.

Note: In the 230 V voltage level, no segments can be set up. Here, only the main circuit is used.



L: BK Bus terminal
PWR IN Power terminal
SEG/F Segment terminal with fuse as an example for a segment terminal

Fig. 4-22: Segment circuit

Example for a schematic diagram

Fig. 4-23 shows an example for a schematic diagram. Its segments and their characteristics are described in the following.

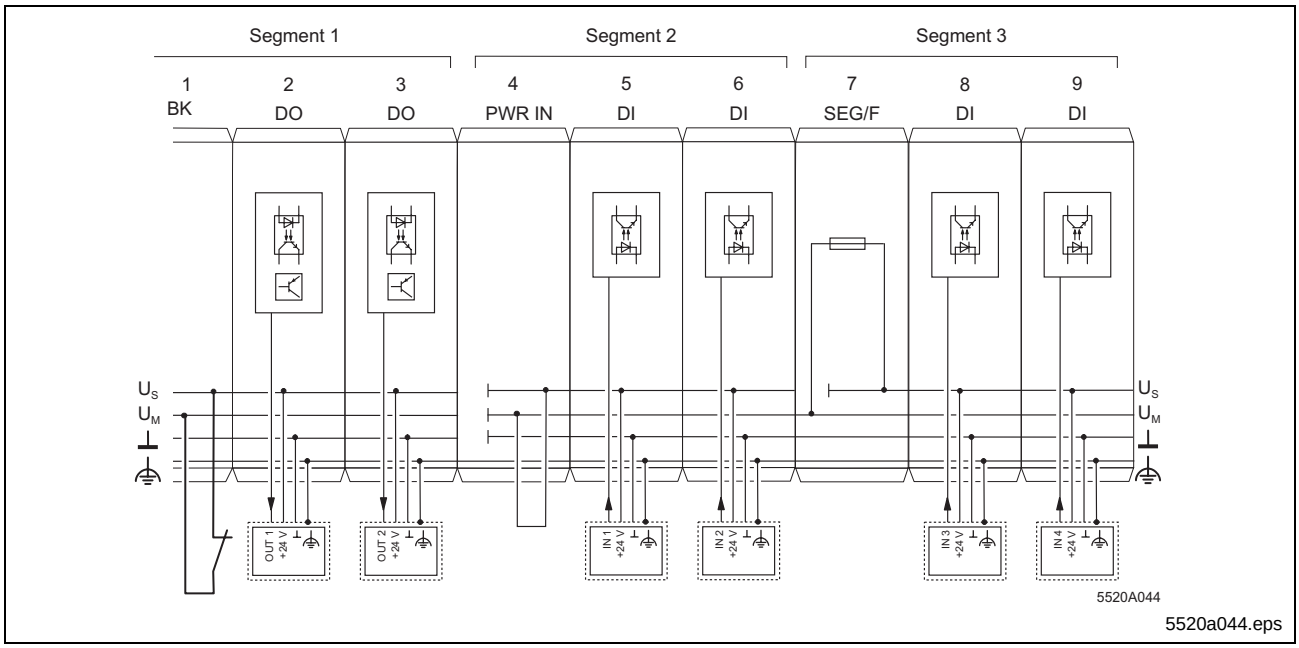


Fig. 4-23: Example for a schematic diagram

No.	Terminal type	Example terminal	Maximum current input of the example terminal at U_S
1	Bus terminal	R-IBS IL 24 BK-T	–
2	Digital output terminal	R-IB IL 24 DO 8	4 A
3	Digital output terminal	R-IB IL 24 DO 2-2A	4 A
4	Power terminal without fuse	R-IB IL 24 PWR IN	–
5	Digital input terminal	R-IB IL 24 DI 8	2 A
6	Digital input terminal	R-IB IL 24 DI 4	1 A
7	Segment terminal with fuse	R-IB IL 24 SEG/F	–
8	Digital input terminal	R-IB IL 24 DI 2	500 mA
9	Digital input terminal	R-IB IL 24 DI 2	500 mA

Fig. 4-24: Example terminals for a schematic diagram

Voltage jumpers:

U_S Voltage jumpers of supply voltage in the segment circuit U_S

U_M Voltage jumpers of supply voltage in the main circuit U_S

⊥ Voltage jumpers GND of supply voltage

Voltage jumpers FE

Segment 1 At the bus terminal (1), the bus terminal supply voltage U_{BK} and the main supply voltage U_M are fed in.

From the bus terminal supply, the supply voltages for the logic system U_L and the supply voltage for the analog terminals U_{ANA} are generated (in the illustration, U_L and U_{ANA} are not considered).

The electrical isolation between the logic and the peripheral equipment is realized by separate feeding in of U_{BK} and $U_{ANA.}$

Segment supply U_s for segment 1 is picked off from the main supply voltage U_M. Here, this is realized by a connector at the respective terminal points of the bus terminal. Accordingly, the digital output terminals (2 and 3) are in a connected segment circuit.

As the two output terminals have a maximum current consumption of 8 A, main voltage U_M must be fed in once more after these two terminals so that the load capacity of the voltage jumpers is not exceeded.

Segment 2 Supply voltage U_M is fed in once more at power terminal (4). At this terminal, the segment voltage U_S for segment 2 is picked off from the main voltage U_M by means of a bridge.

Segment 3 Segment 3 is set up by a segment terminal with fuse (7). In a segment terminal with fuse, the segment voltage is automatically picked off from the main voltage. This segment circuit is fused by an internal fuse. Because of this fuse, this type of circuit is suitable for connecting input terminals without an internal fuse (8 and 9), or for connecting output terminals (not applicable for this segment).

Typical errors and their effects:

1 In this exemplary setup, a short-circuit in input terminal 8 for example would have no effect on the terminals in the first or second segment. Due to the fuse in the segment terminal 7, only the third segment is disconnected.

2 In case of an error in the plant, the digital output terminals 2 and 3 can be connected or disconnected, for example, without any effect on the terminals in the other segments.

4.7 Jumper Contacts of Various Module Groups

Depending on the function of a terminal, there is a different number of jumper contacts.

Jumper contacts of the bus terminal

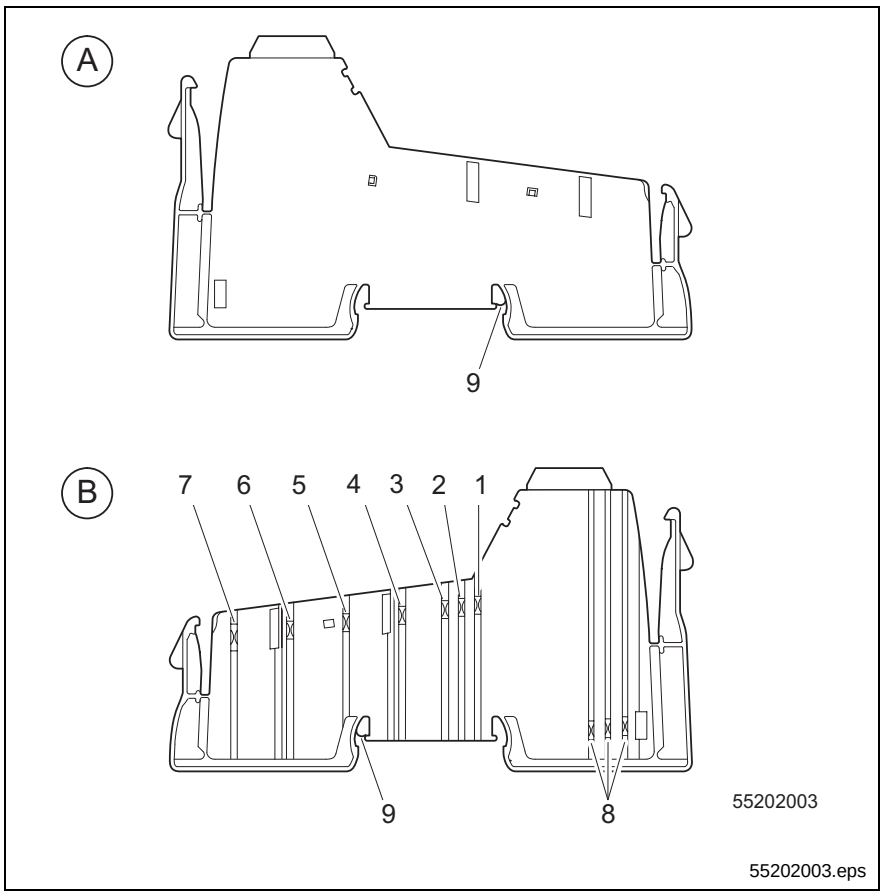


Fig. 4-25: Jumper contacts of the bus terminal and the RECO Inline controller

At the bus terminal and on the side shown in Fig. 4-25 (A), there are no jumper contacts.

The jumper contacts on the peripheral side (B) are all assigned.

No.	Function	
1	7,5 V	U_{L+}
2	24 V	U_{ANA}
3	GNDL	U_{L-}
4	24 V	U_S
5	24 V	U_M
6	GND	
7	FE	
8	Local bus	
9	Capacitive coupling to the function ground	

Fig. 4-26: Jumper contacts of the bus terminals (peripheral side (B))

Jumper contacts of the power terminal for the 24 V area

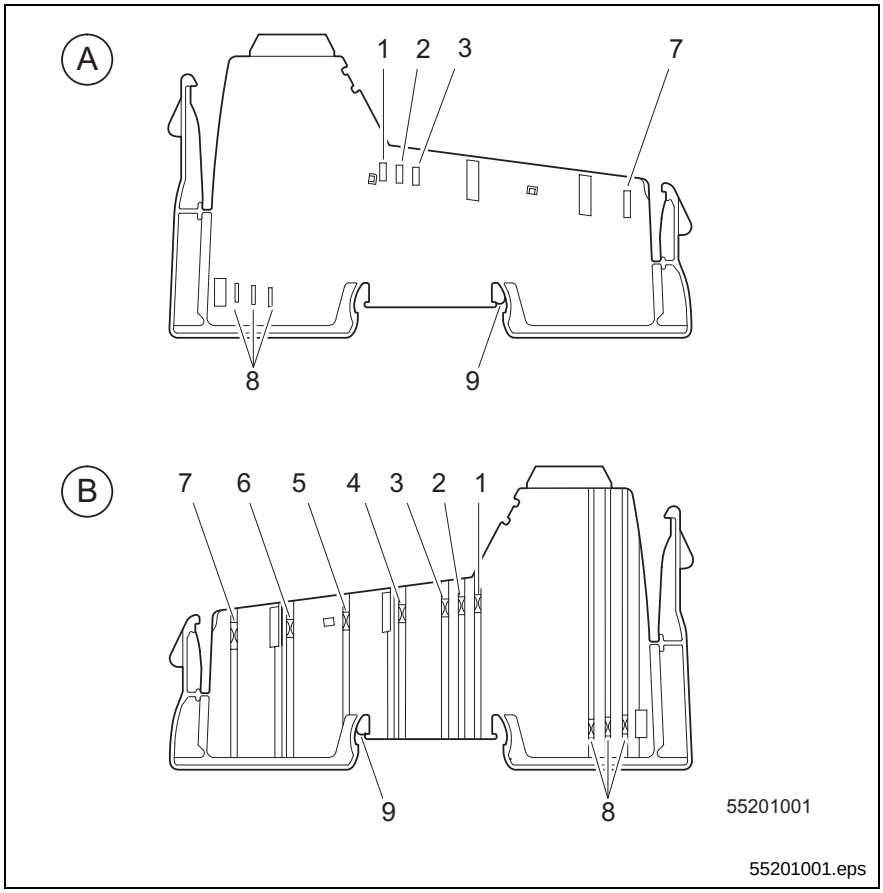


Fig. 4-27: Jumper contacts of the power terminals (24 V)

No.	Function		Bus terminal side (A)	Peripheral side (B)
1	7,5 V	U_{L+}	is connected through	
2	24 V	U_{ANA}	is connected through	
3	GNDL	U_{L-}	is connected through	
4	24 V	U_S	not applicable	assigned
5	24 V	U_M	not applicable	assigned
6	GND		not applicable	assigned
7	FE		used internally	assigned
8	Local bus			
9	Capacitive coupling to the function ground			

Fig. 4-28: Jumper contacts of the power terminals (24 V): Voltages

Jumper contacts of the power terminal for the 120 V and the 230 V area

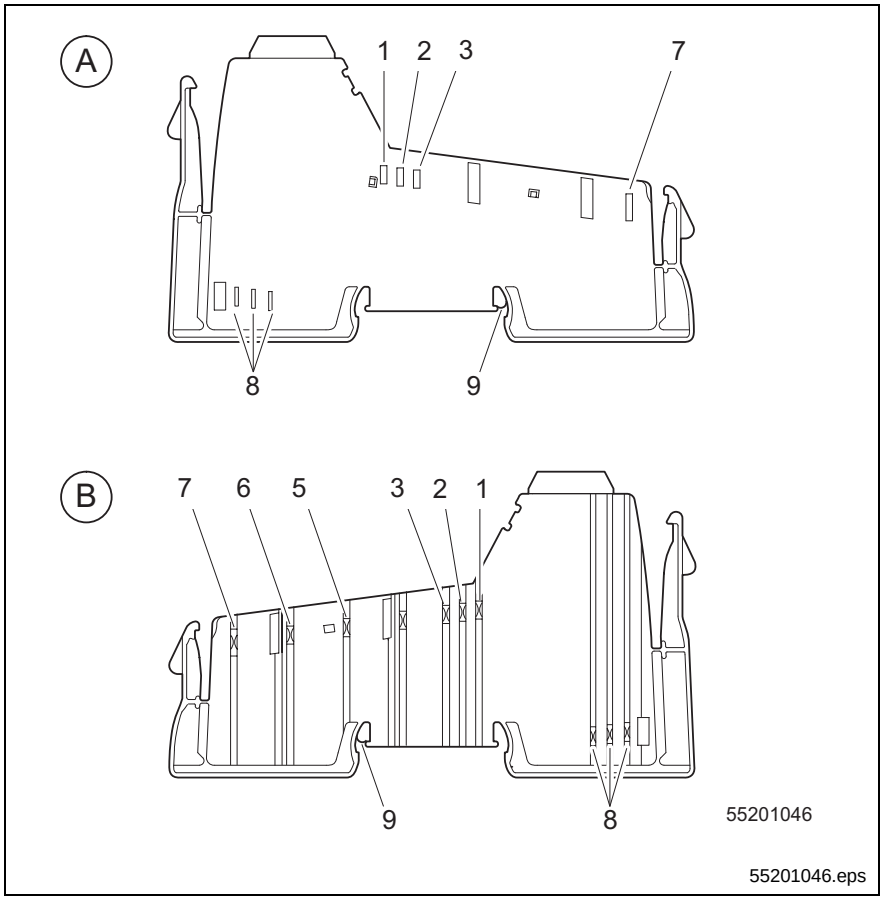


Fig. 4-29: Jumper contacts of the power terminals (120 V/ 230 V)

No.	Function		Bus terminal side (A)	Peripheral side (B)
1	7.5 V	U_{L+}	is connected through	
2	24 V	U_{ANA}	is connected through	
3	GNDL	U_{L-}	is connected through	
4			not applicable	not applicable
5	120 V/230 V	U_M	not applicable	assigned
6	GND		not applicable	assigned
7	FE		used internally	assigned
8	Local bus			
9	Capacitive coupling to the function ground			

Fig. 4-30: Jumper contacts of the power terminals (230 V): Voltages

Jumper contacts of the segment terminals

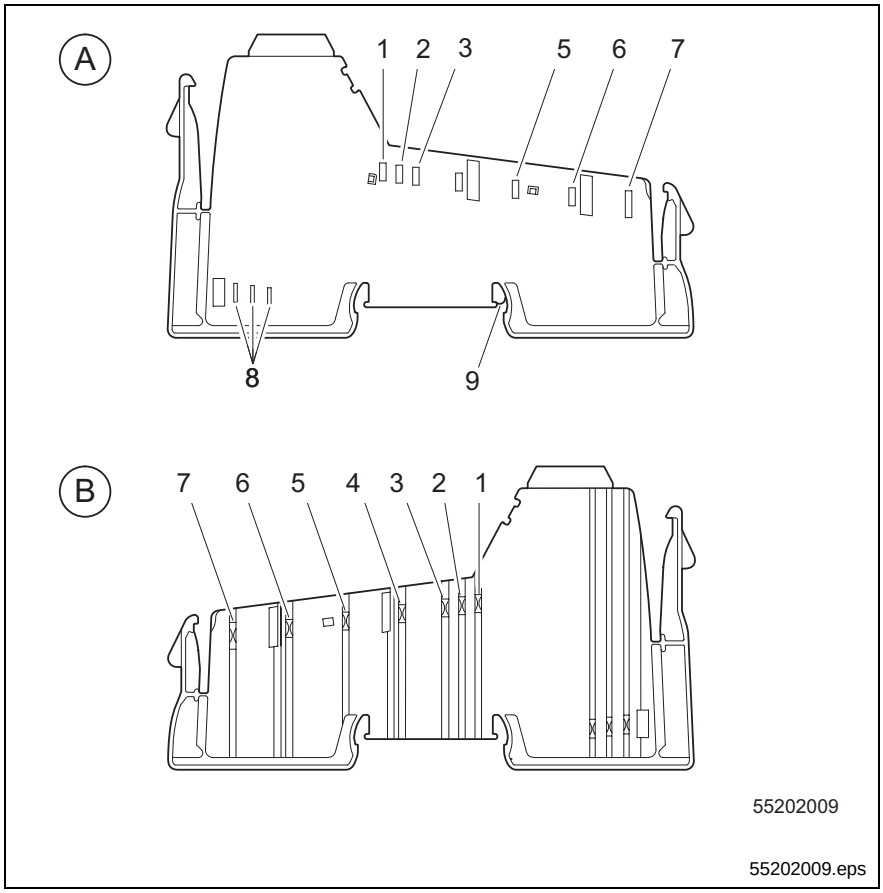


Fig. 4-31: Jumper contacts of the segment terminals (24 V)

No.	Function		Bus terminal side (A)	Peripheral side (B)
1	7.5 V	U_{L+}	is connected through	
2	24 V	U_{ANA}	is connected through	
3	GNDL	U_{L-}	is connected through	
4	24 V	U_S	not applicable	assigned
5	24 V	U_M	assigned	assigned
6	GND		assigned	assigned
7	FE		assigned	assigned
8	Local bus			
9	Capacitive coupling to the function ground			

Fig. 4-32: Jumper contacts of the segment terminals (24 V): Voltages

Jumper contacts of the input and output terminals

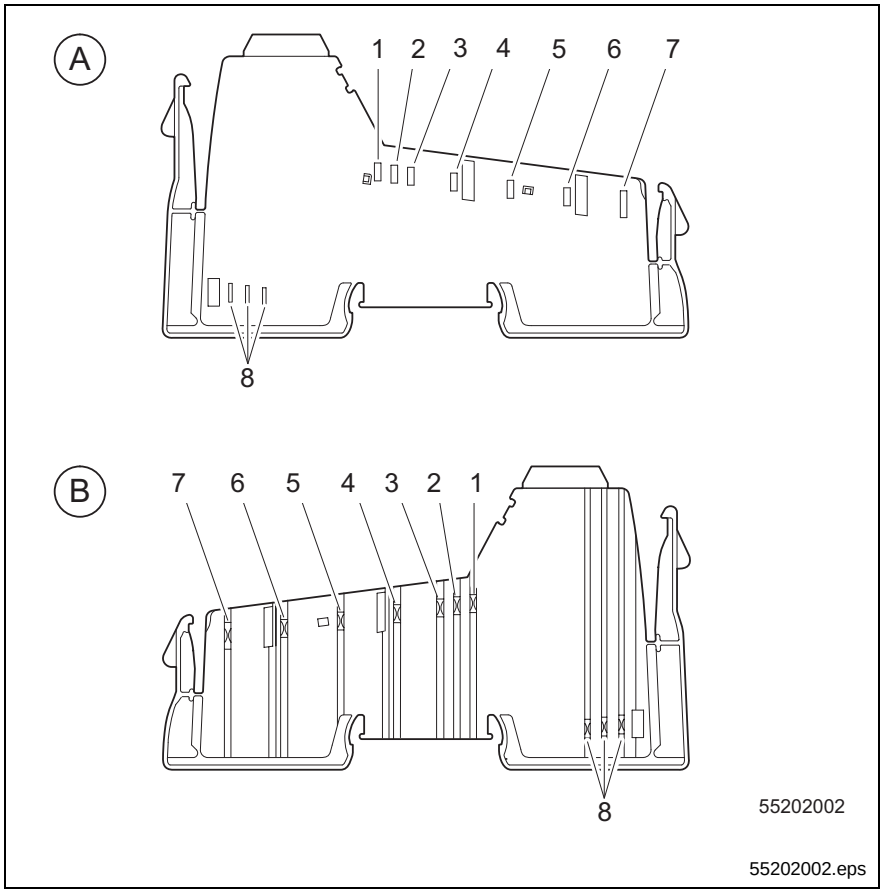


Fig. 4-33: Jumper contacts of the input and output terminals

No.	Function		Bus terminal side (A)	Peripheral side (B)
1	7.5 V	U_{L+}	assigned	assigned
2	24 V	U_{ANA}	assigned	assigned
3	GNDL	U_{L-}	assigned	assigned
4	24 V	U_S	assigned	assigned
5	24 V	U_M	is connected through	
6	GND		assigned	assigned
7	FE		assigned	assigned
8	Local bus			

Fig. 4-34: Jumper contacts of input/output terminals 24 V: Voltages

4.8 Connectors

The connection of the peripheral equipment or the supply voltages is provided in the form of a connector that can be disconnected from the electronic socket.

Advantages

This pluggable connection has the following advantages:

- Easy exchange of electronic module parts for servicing. The wiring does not have to be removed.
- For different requirements, different connectors can be plugged to an electronic socket.

Connector width

Independent of the width of the electronic socket, the connectors have a width of two terminal connections. Accordingly, you must plug 1 connector on a 2-slot socket, 2 connectors on a 4-slot socket, and 4 connectors on a 8-slot socket.

Connector versions

The following connector versions are available:

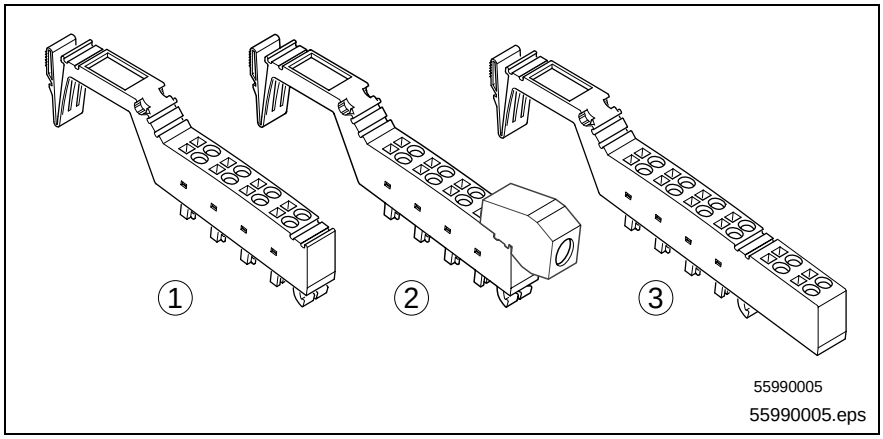


Fig. 4-35: Connector versions of RECO Inline

1 Standard connector

The gray standard connector is used for connecting two signals in 4-wire technology (e.g. digital input/output signals).

The black standard conductor is used for supply terminals. Its neighboring contacts are internally jumpered (see Fig. 4-27: Jumper contacts of the power terminals (24 V) on page 4-25).

2 Shield connector

This gray connector is used for signals connected via shielded lines (e.g. analog input/output signals, high-frequency meter inputs, remote bus line).

The FE and/or shielding connection is not provided through terminal points but through a shield clip.

3 Extended double signal connector

This gray connector is used for connecting four signals in 3-wire technology (e.g. digital input/output signals).

Connector identification

All connectors (excluding shield connectors) are offered with and without color printing. With the color-printed connectors (marked ‘CP’ in the article description), the terminal points are color-coded according to their function.

The signals of the terminal points are identified by the following colors:

Color	Signal at the terminal point
Red	+
Blue	-
Green / yellow	Functional earth ground

Fig. 4-36: Color coding of the terminal points

Interior design of the connectors

CAUTION

The black connector must not be plugged to a terminal that is intended for a double signal connector. Any reversal would lead to a short-circuit between the two signal terminal points (1.4 -2.4)

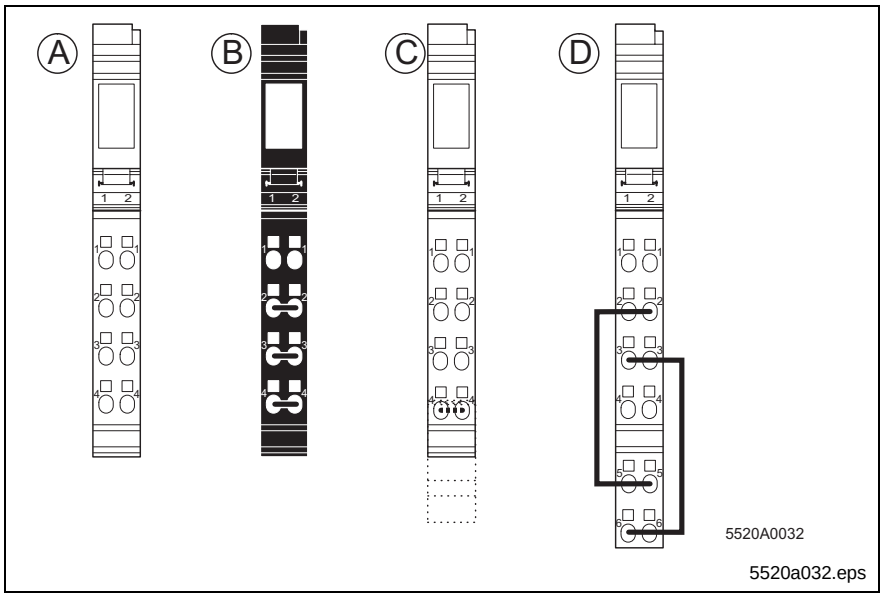


Fig. 4-37: Interior design of the connectors

A Gray connector to the peripheral connection

B Black connector for supply terminals

C Shield connector for analog terminals

D Double signal connector to the peripheral connection

The jumper of terminal points is shown in Fig. 4-37, D.

With the shield connector, the shield connection itself is the jumper, with all other connectors, the jumper is provided by a connection of the terminal points.

Note: To avoid malfunctions, only latch the connector to the terminal it is intended for. The specific data sheet of each module informs you of which connector to use.

Connector coding

You can protect the connector from plugging on to the wrong terminals by coding socket and connector.

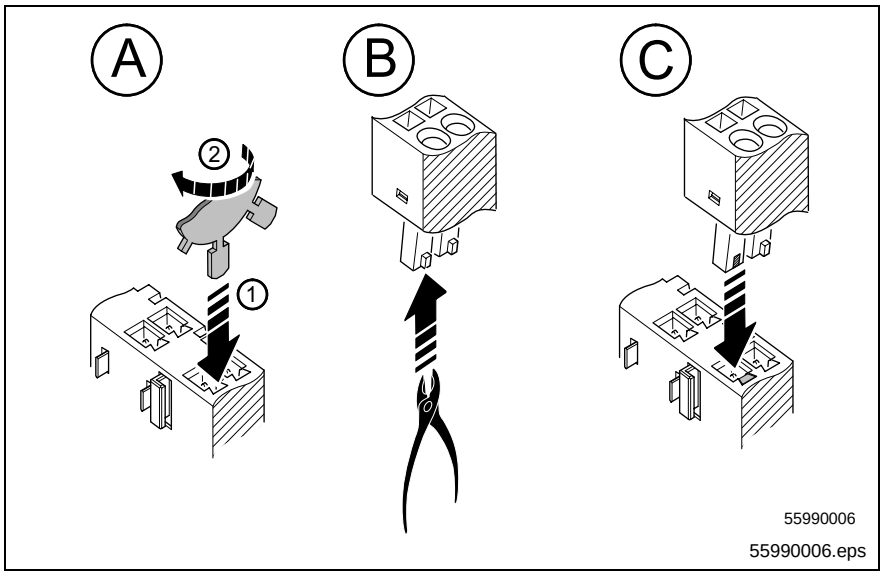


Fig. 4-38: Connector coding

- For this purpose, put a coding profile into the coding keyway in the socket (1) and pull it off the small plate (2) by rotation (Fig. 4-27, Fig. A).
- With nippers, cut the respective coding nose off the connector (Fig. 4-38, Fig. B).

Now, only socket and connector of the same coding fit together (Fig. 4-38, Fig. C).

4.9 Identification of Function and Labeling

Identification of Function

For optical identification of function, the terminals are color-coded (1 in Fig. 4-39: Identification of Function)

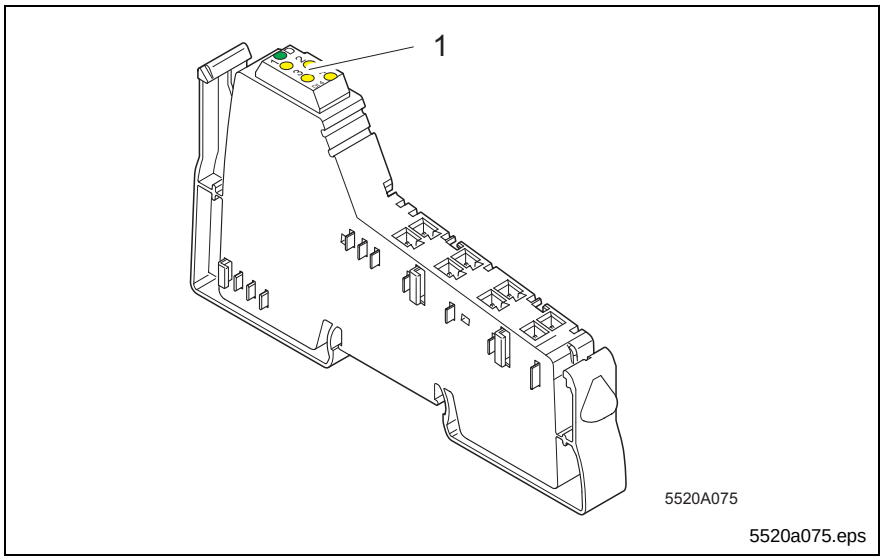


Fig. 4-39: Identification of Function

The functions are identified by the following colors:

Color	Function of the terminal
Gray	Bus terminal
Light blue	digital input 24 V area
Pink	digital output 24 V area
Red	digital relay terminal up to 230-V
Green	analog input
Yellow	analog output
Orange	function terminal
Black	power terminal / segment terminal

Fig. 4-40: Color coding of the terminals

Identification of the connectors

The color coding of the terminal points is described in Fig. 4-41.

Labeling/ numbering of terminals

The numbering of the terminal points is to be illustrated by means of a 8-slot terminal.

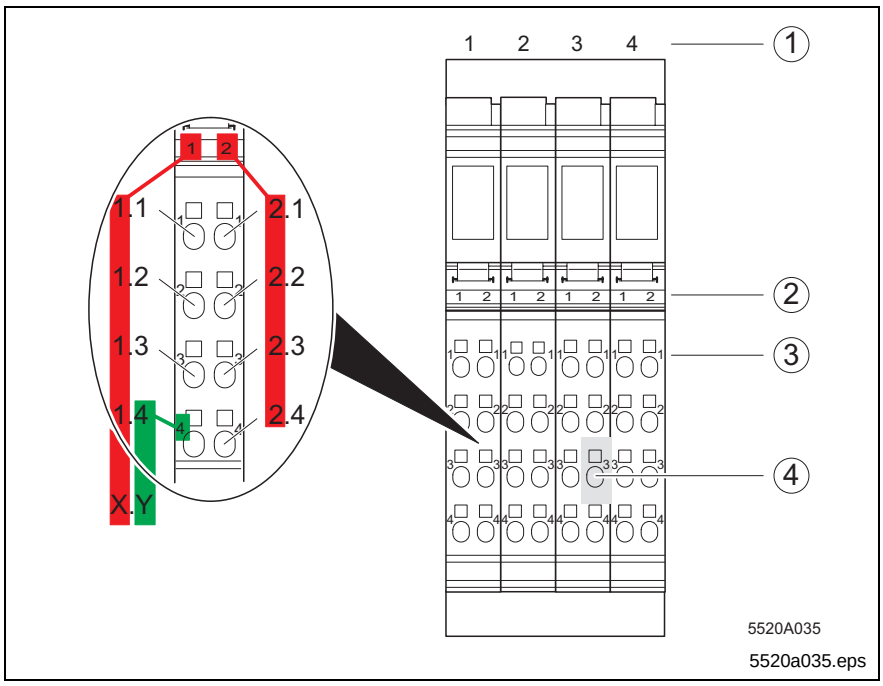


Fig. 4-41: Numbering of terminals

Slot/Connector

The slots (connectors) on a socket are numbered consecutively (1 in Fig. 4-41). These numbers are **not** listed on the terminal.

Terminal point

On each connector, the Terminal points are marked by X, Y.

It is to be found above the Terminal point series (2 in Fig. 4-41).

Y is the number of the terminal point of one series. It is to be found directly at the terminal point series (3 in Fig. 4-41).

Accordingly, the exact location of a connection is determined by slot and terminal point. Thus, the following numbering is applicable for the connection shaded in gray (4 in Fig. 4-41): Slot 3 terminal point 2.3.

Additional labeling

In addition to the above labeling of the terminal, you can label the slots, terminal points and connections with zack marker strips (ZBFMs) and labeling fields.

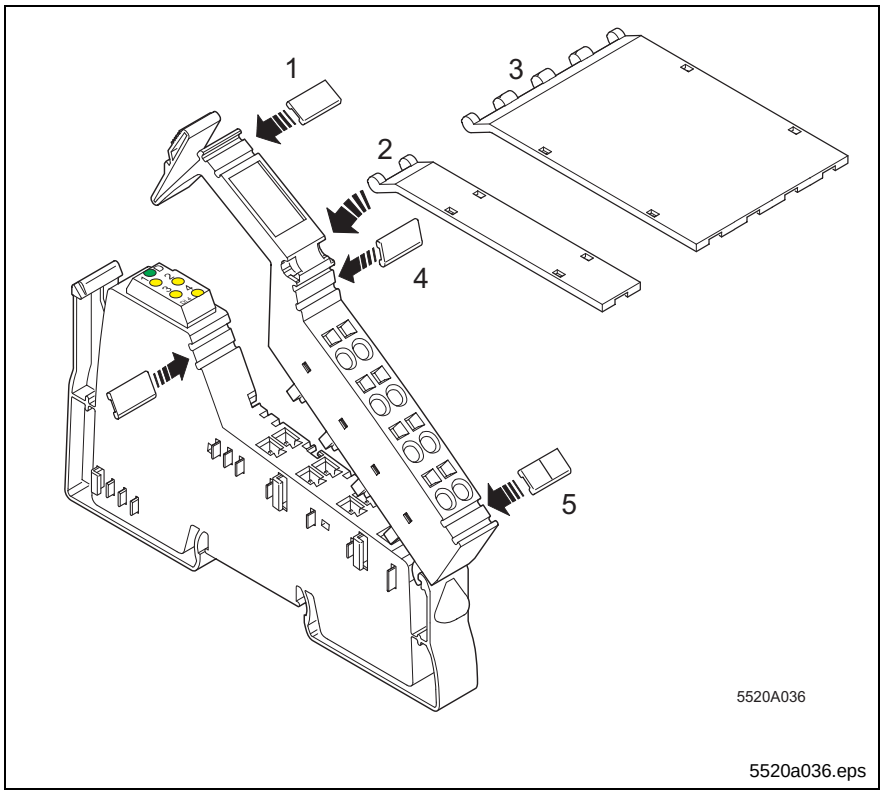


Fig. 4-42: Labeling

There are various methods for labeling slots and terminal points:

1 You can label each connector individually with zack marker strips.

2 / 3 As an option, you can use a large labeling field. This labeling field is available in two widths, either as labeling field over one connector (2) or as labeling field over four connectors (3). On this field, you can label each channel individually with flow text. In the upper connector head, there is a keyway for the reception of this labeling field. The labeling field can be folded up and down. A light catch at both end positions allows the labeling field to keep its position.

4 / 5 You can label each signal with zack marker strips. With double signal connectors, the upper keyway (4) is provided for labeling the signals 1/2, and the bottom keyway (5) for the signals 3/4.

6 The electronic socket offers the possibility to label each slot individually with zack marker strips. With a set connector, this labeling is hidden.

You can uniquely assign connector and slot by the labeling at the connector and on the electronic socket.

4.10 Housing Dimensions of the Terminals of Low Signal Level

Nowadays, small I/O stations are often used in standard 80 mm switchboxes. The design of the RECO Inline terminals allows for use in this type of switchbox.

The housing dimensions of a terminal are defined by the dimensions of the electronic socket and of the connector.

The electronic sockets of the low signal level terminals are available in three building widths (12,2 mm, 24,4 mm and 48,8 mm).

One, two or four connectors of a width of 12.2 mm are plugged on.

With plugged-on connector, each terminal has a depth of 71.5 mm. The height of the terminal depends on the type of connector used. Three different connector types are available:

2-slot housing

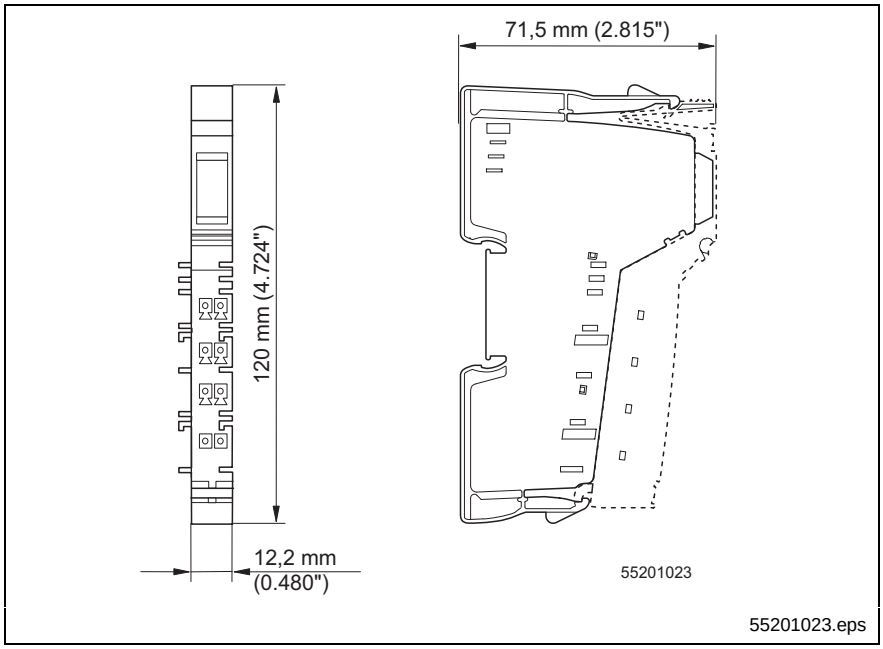


Fig. 4-43: Dimensions of the electronic sockets (2-slot housing)

4-slot housing

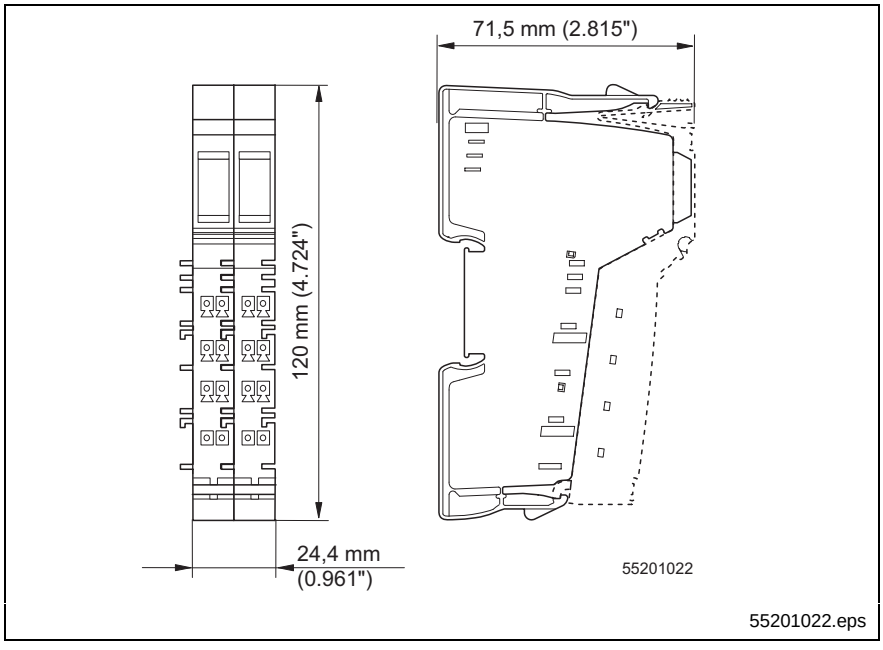


Fig. 4-44: Dimensions of the electronic sockets (4-slot housing)

8-slot housing

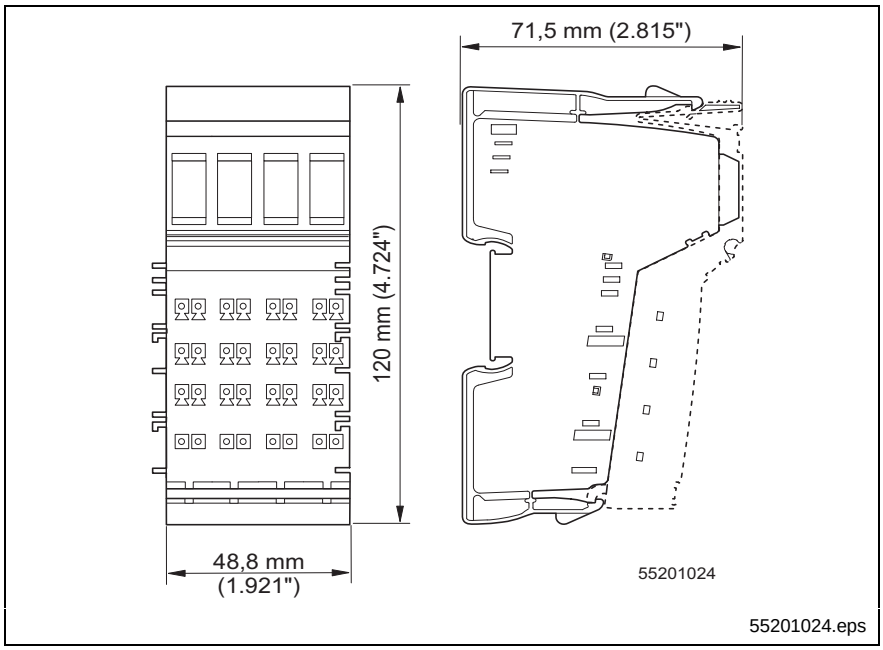
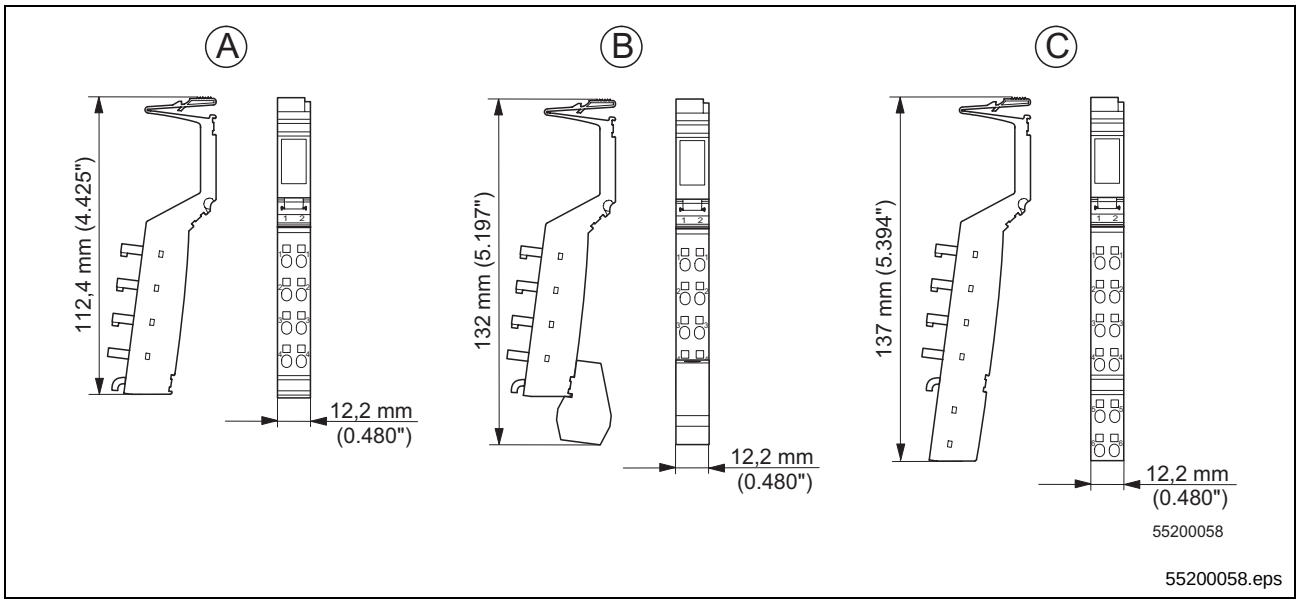


Fig. 4-45: Dimensions of the electronic sockets (8-slot housing)

Connector



L: A Standard connector
B Shield connector
C Extended double signal connector

Fig. 4-46: Dimensions of the connectors

The connector depth is irrelevant as it has no effect on the overall module depth.

4.11 Block Diagrams

The specific data sheets of the modules contain the internal block diagrams of the modules. They show the significant functional elements of the modules.

By way of example, Fig. 4-47 shows a block diagram.

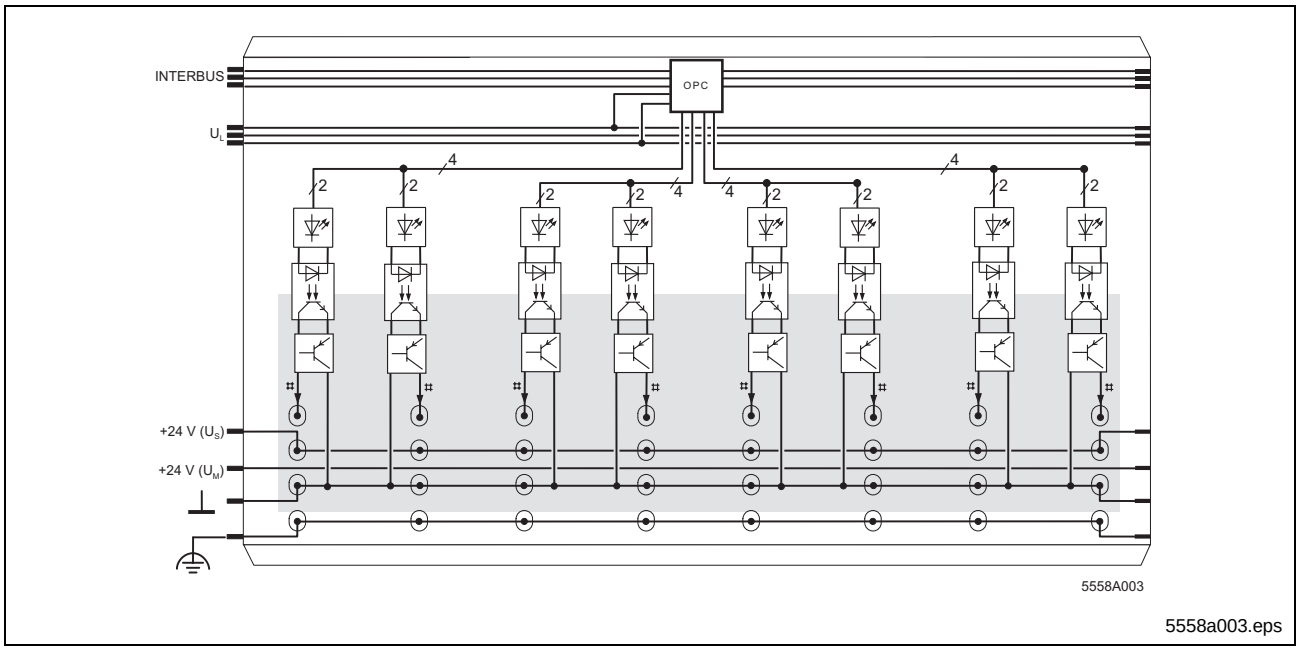


Fig. 4-47: Example: Block diagram of the module R-IB IL 24 DO 8

In this block module, the following symbols and representations are used:

INTERBUS
This title refers to the three data jumpers of the INTERBUS local bus.

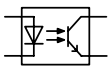
U_L
This title refers to the following voltage jumpers:
- Logic voltage (U_{L+}),
- Grounded logic voltage (U_{L-}),
- Supply voltage for analog terminals

U_S
Segment voltage +24 V

U_M
Main voltage + 24 V

OPC
Protocol chip / total bus interfacing


LED; diagnostic and status indicators on the terminals


Optocoupler


Transistor

Digital output

Isolated area

Ground

Functional earth ground

Terminal connection

Voltage or data jumpers with lateral jumper contacts

Line(s); x gives the number of lines

Please refer to Chapter 12 “Explanation of Abbreviations and Symbols” for an overview of all representations and symbols used in the block diagrams.

4.12 Voltage Concept

The potentials of the incoming and the next bus terminal are isolated from each other and of the electronic system of the station. The shield of the incoming bus terminal is connected to FE via a Y capacitor. The shield of the next bus terminal is directly connected to FE.

Capacitively, FE and FE form two individual potential groups.

The bus terminal does not have an electrical isolation for the logic voltage supply of the I/O modules. The separate feeding devices for logic and peripheral voltage supply provide for an easy setup of galvanically isolated areas.

The peripheral connection of analog modules is always electrically isolated from the 24 V supply of the bus terminal. Here, the 24 V supply of the bus terminal is only connected through and is available again after the analog terminal.

Electrical isolations can be set up for example by feeding in a new 24 V supply by means of a power terminal. In this, the supplying 24 V power supply units on the low voltage side may not be connected to each other.

In Fig. 4-47, an electrical isolation is shown. A connection between GND (-) of supply voltage and function earth ground may only be realized at one point in the station (see Fig. 4-48) If the ground of the supply voltage at the bus terminal was connected to the function earth ground as well, the electrical isolation would be cancelled again.

Electrically isolated areas within the station in Fig. 4-48.«

1 Bus logic of the station

2 Peripheral equipment (outputs)

3 Peripheral equipment (inputs)

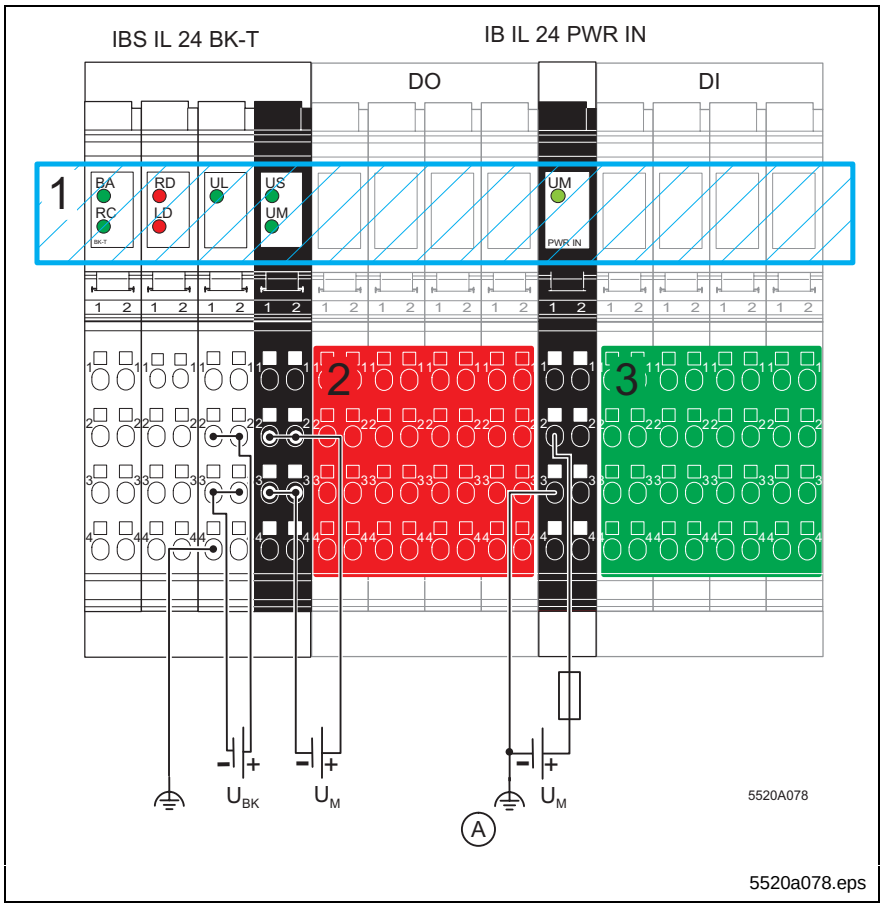


Fig. 4-48: Design of electrical isolations

In the bus terminal, the power terminal, and the segment terminal, the electronics system is capacitatively coupled to FE

For information on the electrical isolations in the individual terminals, please refer to Chapter 5.

5 RECO Inline Product Groups

5.1 Bus Terminal and Terminal with Remote Bus Branch

Bus terminal

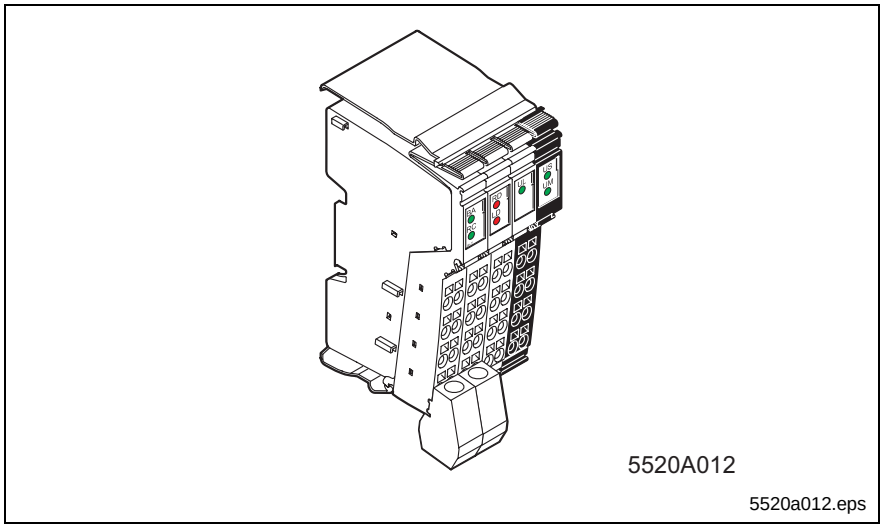


Fig. 5-1: The bus terminal R-IBS IL 24 BK-T

The bus terminal connects the RECO Inline station to the INTERBUS remote bus. It achieves the necessary bus signal matching and the power supply of the connected station components.

The bus terminal is available for the connection of lines in copper technology.

Number of devices

The maximum number of devices which can be connected to a bus terminal is defined by the following limiting parameters::

1 In the INTERBUS, the maximum number of devices is limited to 512.

2 Up to 63 devices can be connected to a RECO Inline bus terminal.

3 A bus terminal in the logic range is able to supply a maximum current of 2 A, and of 0.5 A for the analog range.

4 The load capacity of the voltage jumpers is limited. For the limiting parameters for the voltage jumpers, please refer to the chapter “Current and Voltage Distribution” on page 4-15.

When projecting a RECO Inline station, observe the current consumption of each device at the individual voltage jumpers! It is listed in each module-specific data sheet, in the spreadsheet “R-IL List of Devices” on page 9-3, and in the Planning and Design Support (see “Examples for Project Planning” on page 10-1).

Note: Observe limiting parameters!

⇒ The possible number of connectable devices depends on the particular setup of the station concerned. None of the above limiting parameters must be exceeded!

Interface identification

The devices can be a terminal with remote bus branch or input/output terminal. The corresponding configuration of the next interface of the bus terminal as a remote bus or local bus interface takes place by automatic identification of the terminal once it has latched on.

Functions

The bus terminal plate constitutes the head of a RECO Inline station. It connects the modules of a RECO Inline station to the INTERBUS remote bus.

From the fed in supply voltage U_{BK}, the bus terminal creates the logic voltage U_L for the connected devices. In addition, it makes the supply voltage of the connected analog terminals U_{ANA} available.

Main voltage U_M and segment voltage U_S can be fed in via the bus terminal. In this case, the bus terminal provides for the supply of the connected devices with U_M and U_S. Main supply and segment supply have to be secured externally.

As an alternative, the main supply U_M and the segment supply U_S can be provided via a power terminal and/or a segment terminal (see chapter “Power Terminals” on page 5-7).

Furthermore, the bus terminal makes it possible to disconnect or reconnect the connected station from resp. to the network via the user software.

At the bus terminal, the voltage and data routing of the RECO Inline station starts.

Housing

The bus terminal is located in a 8-slot housing. Connector and socket can be disconnected.

End plate

The mechanical end plate is supplied together with the bus terminal. The end plate is the end cover of a RECO Inline station; it must generally be placed behind the last terminal of the station.

This plate does not have any electrical function. It protects the station from ESD pulses and the user from dangerous contact voltages.

Connections

The bus terminals have terminal points for connecting the following lines:

- INTERBUS remote bus lines
- Bus terminal supply voltage U_{BL}; this voltage is used to generate the logic voltage U_L and the analog terminal supply voltage U_{ANA}.
- Supply of the peripheral equipment supply voltages for the main circuit U_M and the segment circuit U_S
- Functional earth ground (FE)

For detailed information on the circuits, please refer to the chapter “Voltage and Data Routing” on page 4-13 and in the chapter “Circuits Within a RECO Inline Station and Provision of Supply Voltages” on page 4-17.

For connection of the lines, please observe the notes in the chapter “Assembly/Disassembly of RECO nline Terminals and Connection of Lines” on page 6-1, as well as the information in the module-specific data sheet.

Connection technique

Connect lines with a connection cross-section of 0.2 mm^2 to 1.5 mm^2, depending on the current load, to the tension spring connector.

Protection

The bus terminal has elements for protection from polarity reversal and transient overvoltage for U_{BK}, U_M and U_S.

Indicators

The diagnostic indicators of the bus terminals provide information on the state of the station and on the question whether the supply voltages are available at the output side or not (see chapter “Indicators on the Bus Terminals” on page 4-5).

Coupling to the functional earth ground (FE))

The shield of the incoming bus interface is connected to FE via a Y capacitor. The shield of the next bus terminal is directly connected to FE. Moreover, U_{BK}, U_M, U_S and GND are capacitively coupled to the functional earth ground FE in the terminal.

Grounding

Grounding is implemented when the terminal is latched onto the grounded mounting rail via the FE spring on the bottom side of the terminal. This spring is connected to the voltage jumper FE and with the terminal points for an FE connection (see additional grounding).

Mandatory additional grounding

The bus terminal must be grounded via the FE connector to ensure reliable grounding of the station even if the FE spring is soiled or damaged. To achieve this, the terminal points for the FE connector must be connected to a grounded PE terminal (see chapter “Grounding Concept of RECO Inline” on page 6-5).

Load capacity of the jumper contacts

The maximum load capacity of the lateral jumper contacts is listed in Fig. 4-18 on page 4-15.

Electrical isolation

The various potential ranges within a bus terminal are illustrated in the following Figures.

Note: Fig. 5-2 to Fig. 5-4 show the electrical isolation in the bus terminal. Here, the internal circuit elements are not essential. They are illustrated in the module-specific data sheet.

Note: In Fig. 5-2 to Fig. 5-4, the graphic symbols are not explained as they are not relevant in the representation of the electrical isolations. For the explanation of graphic symbols, please refer to the respective data sheet or to chapter 11, “Frequently Used Symbols”.

Electrical isolation of the incoming/next bus

The potentials of the incoming and the next remote bus interface are isolated from each other and from the remaining electronic system of the station.

Electrical isolation FE/FE capacitive

Capacitively, FE and FE form two individual potential groups.

Electrical isolation other

Further electrical isolations depend on how the supply voltages are made available.

1 Feeding in of the bus terminal supply U_{BK} and the peripheral equipment supply U_M/U_S from separate power supply units:

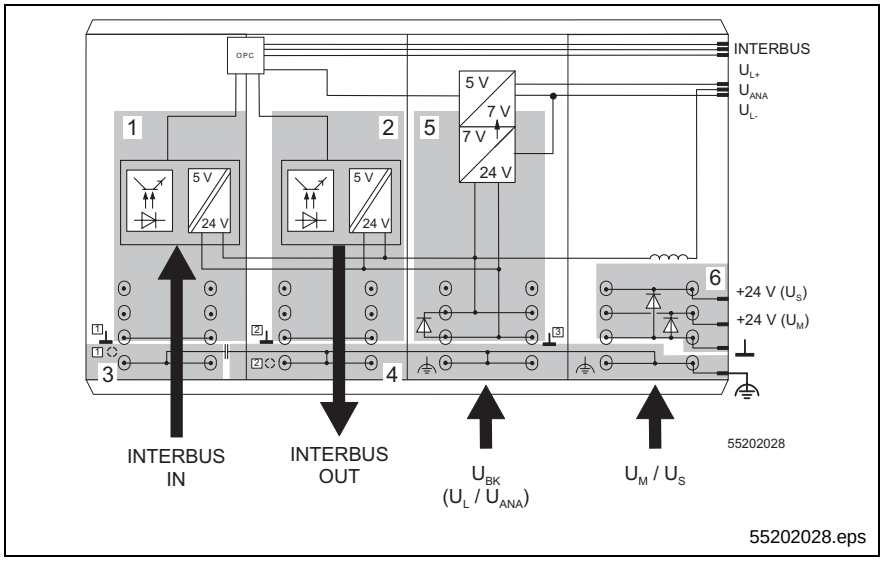


Fig. 5-2: Electrical isolation in the bus terminal (separate power supply units)

Potential ranges:

1 Incoming remote bus

2 Next remote bus

3 Function earth (FE) capacitive

4 Functional earth ground (FE)

5 Bus terminal supply voltage U_{BK} with provision of the logic voltage U_L and supply of the analog terminals U_{ANA}

6 Peripheral voltages U_M and U_S

This isolation can also be achieved by providing the voltage supply U_M/U_S via a power terminal from an independent power supply unit.

2 Feeding in of the bus terminal supply U_{BK} and the peripheral equipment supply U_M/U_S from one power supply unit:

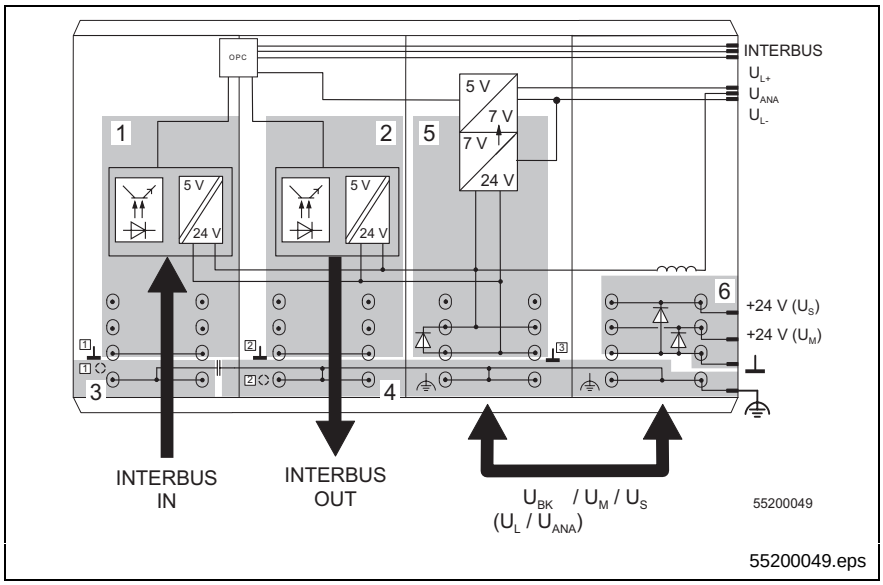


Fig. 5-3: Electrical isolation in the bus terminal (one power supply unit)

Potential ranges:

1 Incoming remote bus

2 Next remote bus

3 Function earth (FE) capacitive

4 Functional earth ground (FE)

5 Range of the bus terminal supply U_{BK} with provision of logic voltage U_L and supply of the analog terminals U_{ANA} **not isolated** from the peripheral voltages U_M and U_S

Electrical isolation Digital terminal

The isolation of the peripheral connection of a digital terminal from the logic voltage is warranted only if U_{BK} and U_M /U_S are provided from isolated power supply units.

Electrical isolation Analog terminal

The peripheral connection of an analog terminal is always electrically isolated from the 24 V supply of the bus terminal/power terminal.

Here, the 24 V supply is only connected through and is available again after the analog terminal.

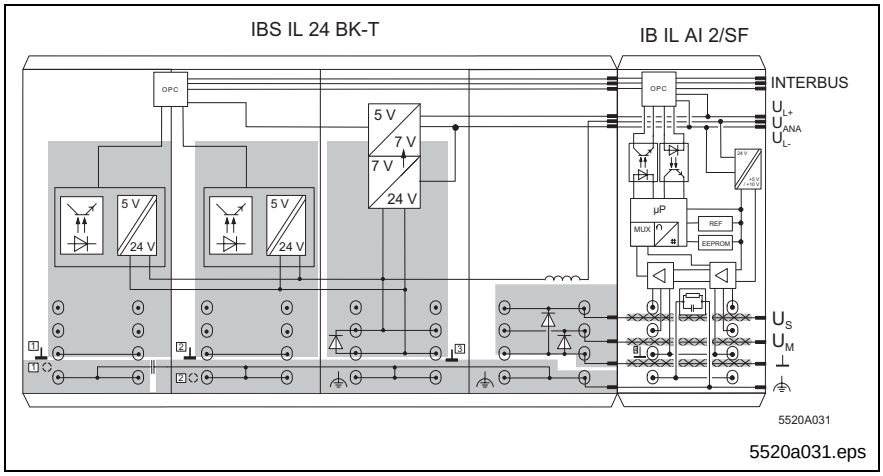


Fig. 5-4: Electrical isolation between bus terminal and analog terminal

In the analog terminal, the voltage jumpers, represented in shaded lines, are not used. Accordingly, the electrical isolation between the 24 V supply of the bus terminal/power terminal and the peripheral connection of the analog terminal supplied from the analog circuit U_{ANA} has been realized.

Terminal with remote bus branch

This terminal is not an independent terminal. It can only be placed directly behind a bus terminal or a control terminal.

Via this terminal, a remote bus branch can be branched off from the RECO Inline station. Accordingly, also devices located at a distance can be integrated, e.g. indicator and key panels, motor switches or sensor/actuator boxes.

The modules of the remote bus branch are not counted as modules of the RECO Inline station. A remote bus branch can have additional branches. A maximum of 16 bus levels (i.e. 15 branches) is admissible.

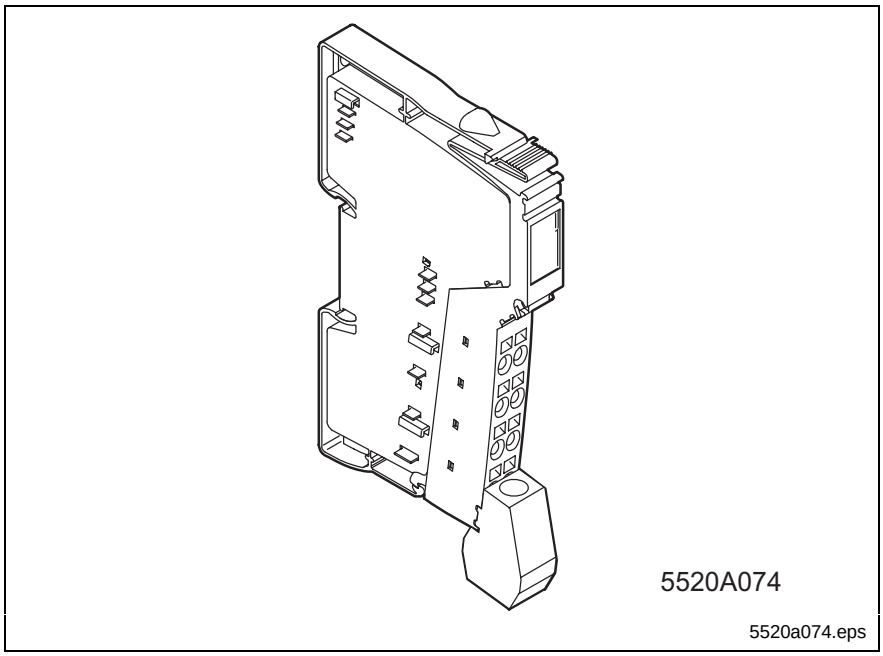


Fig. 5-5: The terminal with remote bus branch R-IB IL 24 RB-T

5.2 Supply terminals

The power terminal and the segment terminal are provided to supply the station with peripheral voltage. Here, the segment terminal is a supplement to the power terminal. It permits the setup of new segments within station.

Alternatively, the following variation is available:

- Simple power/segment terminal

Note: **Protect the voltage supply!**

⇒ Protect the supply voltage with external fuse, independent of the supply terminal used.

CAUTION

Do not replace terminals with the station being live!

⇒ De-energize the entire station before you remove a terminal from the station. Reconnect the voltage only after you have set up the entire station.

Power terminal

The peripheral voltage is supplied to the voltage jumpers inside the station via a power terminal. You may use several power terminals in one station. In this way, the electrical isolations between different electric circuits and the setup of areas with different voltages within the station (e.g. 24 V DC and 230 V AC) are realized.

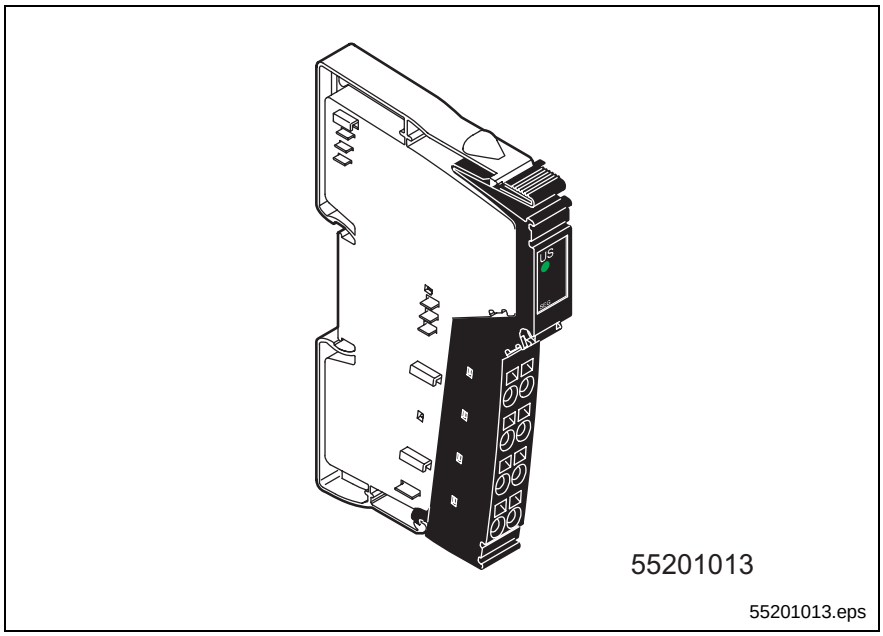


Fig. 5-6: Example of a power terminal: R-IB IL 24 PWR IN

Power terminals without fuse are available.

Power terminal without fuse

If power terminals without fuse are used, the main circuit is not protected via an internal fusible cutout. The 24-V supply must be protected by an external fuse.

Note: Neither a power terminal without fuse nor a power terminal with fuse can protect the segment circuit. It can only be protected via a segment terminal with fuse.

Housing (low-signal level)

The power terminal of the low-signal level is located in a 2-slot housing. Connector and socket can be disconnected.

Connections

The power terminal is provided with terminal points for supplying the supply voltage for the main circuit U_M and the segment circuit U_S.

Detailed information on the circuits can be found in the chapter entitled “Voltage and Data Routing” on page 4-13. Detailed information on the supply voltages can be found in the chapter entitled “Electric Circuits and Voltage Supply Within a RECO Inline Station” on page 4-17.

Connection method (low-signal level)

Connect lines with a connection cross-section of 0.2 mm^2 to 1.5 mm^2, depending on the current load, to the tension spring connector.

Indicators

The UM diagnostic indicator informs on whether the supply voltage in the main circuit U_M is applied to the output side (chapter entitled "Indicators on the Supply Terminals" on page 4-7).

If the terminal concerned is one with a fuse, the E indicator also indicates the state of the fuse in the main circuit (see chapter entitled “Indicators on the Supply Terminals” on page 4-7).

Coupling to functional earth ground (FE)

In the terminal, U_S and GND are capacitively coupled to the functional earth ground (FE).

Grounding

Grounding is implemented when the terminal is latched onto the grounded mounting rail via the FE springs on the bottom side of the terminal. These springs are connected to the voltage jumper FE and to the terminal points for an FE connection (see additional grounding).

When being latched to the preceding module, the power terminal is also connected to the FE voltage jumper of the station.

Load capacity of the jumper contacts

The maximum load capacity is listed in Fig. 4-18: Current and voltage distribution.

Electrical isolation

The power terminal provides for the setup of electrically isolated voltage ranges within a station.

Voltage ranges

Low-signal-level terminals are available for various voltage ranges. Depending on the power terminal, the operating voltage is 24 V DC, 120 V AC, or 230 V AC.

CAUTION

Set up different voltage ranges by means of new power terminals!

⇒ If you intend to use different voltage ranges within one station, you must use a new power terminal for each range.

WARNING

Dangerous contact voltage!

⇒ If you remove the power terminal, the metal contacts are freely accessible.

If a 120-V or a 230-V power terminal is used, dangerous contact voltage must be expected. It is absolutely necessary to de-energize the station before you remove a terminal!

Any failure to observe this warning may be detrimental to your health and may even cause dangerous injuries.

Voltage jumper U_M /U_S

The power terminal interrupts all voltage jumpers of the previous terminal and implements a new setup of the voltage jumpers for the main circuit U_M, the segment circuit U_S and the reference potential of the supply voltage GND.

This principle is shown in Fig. 5-7 which is a schematic diagram of a section of a RECO Inline station..

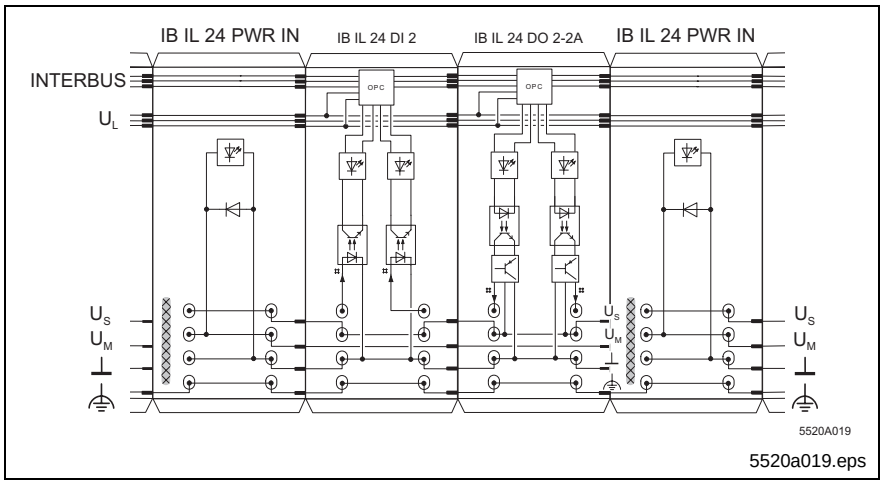


Fig. 5-7: Example: Interruption/setup of the voltage jumpers by means of the power terminal

For detailed information on the circuits, please refer to chapter “Electrical Isolation - and Data Routing" on page 4-13.

For detailed information on supply voltages, please refer to the chapter “Electric Circuits within a RECO Inline Station and Provision of the Supply Voltages” on page 4-17.

Segment Terminal

Segment terminals may be used in the 24-V range only.

Segment terminals with fuse are available.

The segment terminal with fuse automatically provides the connection between the main circuit and the segment circuit.

Within the main circuit, the segment terminal permits setting up a partial circuit (segment circuit), which allows power outputs, digital actuators and sensors to be supplied separately.

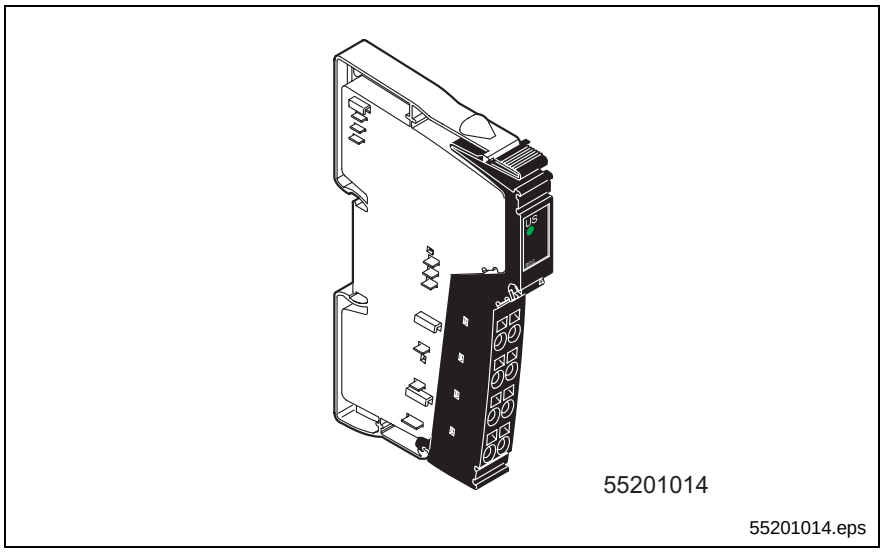


Fig. 5-8: Example of a segment terminal: R-IB IL 24 SEG/F

Segment terminal with fuse

Segment terminals with fuse protect the segment circuit U_S.

Housing

The segment terminal is located in a 2-slot housing. If segment terminals with fuse are used, the electronic socket contains a fuse lever. Connector and socket can be disconnected.

Connections

A segment terminal with fuse does not require any connections for a voltage supply. It can use the corresponding terminal points as a pick-off for test purposes.

For detailed information on the circuits, please refer to the chapter “Voltage and Data Routing” on page 4-13 and in the chapter “Electrical Circuits Within a RECO Inline Station and Provision of Supply Voltages” on page 4-17.

Connection technique

Connect lines with a connection cross-section of 0.2 mm^2 to 1.5 mm^2 to the tension spring connector.

Indicators

The U_S diagnostic indicator informs on whether the supply voltage in the segment circuit U_S is applied to the output side (see chapter entitled "Indicators on the Supply Terminals" on page 4-7). If the terminal concerned is one with a fuse, the E indicator also indicates the state of the fuse in the segment circuit (see chapter “Indicators on the Supply Terminals” on page 4-7).

Coupling to the functional earth ground (FE)

In the terminal, U_S and GND are capacitively coupled to the functional earth ground (FE).

Grounding

Grounding is implemented when the terminal is latched onto the grounded mounting rail via the FE springs on the bottom side of the terminal. These springs are connected to the FE voltage jumper and to the terminal points for an FE connector (also see “Mandatory Additional Grounding” on page 6-5).

When being latched to the preceding module, the segment terminal is also connected to the FE voltage jumper of the station.

Load capacity of the jumper contacts

The maximum load capacity of the lateral jumper contacts is listed in Fig. 4-19 on page 4-15.

No electrical isolation

A segment terminal does not establish an electrical isolation between two peripheral voltage ranges. To achieve this, a power terminal must be used.

Voltage ranges

Segment terminals are available only for the 24 V DC voltage range.

U_M

The voltage jumper for the main circuit U_M is not interrupted in the segment terminal. From this voltage jumper, the potential for the segment circuit U_S is tapped at the segment terminal.

U_S

The segment terminal interrupts the segment circuit U_S in the voltage jumper of the previous module.

This principle is shown in Fig. 5-9 which is a schematic diagram of a section of a station.

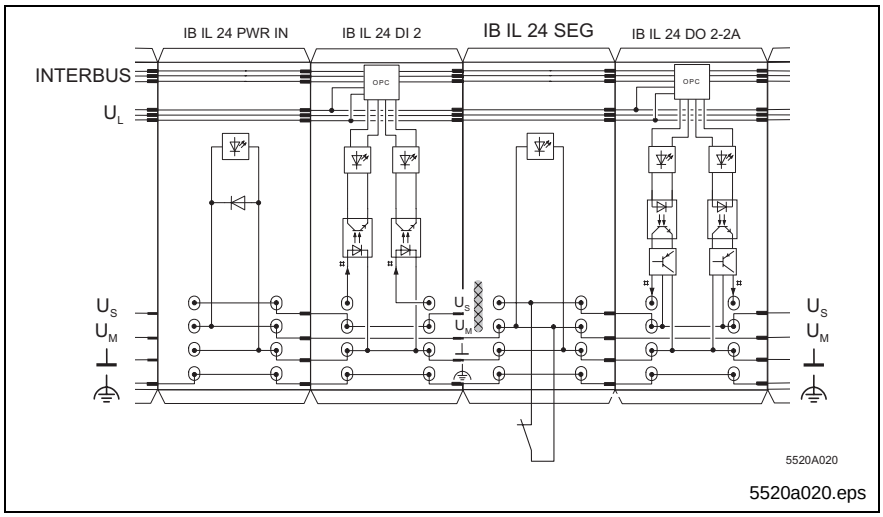


Fig. 5-9: Example: Interruption/setup of the voltage jumper U_S by means of the segment terminal

The area marked in shaded lines marks the place where a voltage jumper is interrupted. Here, the segment voltage is tapped from the main voltage via a switch.

5.3 Input/output terminals

General Information on Terminals for Analog and Digital Signals

On low signal level, terminals with various functions are available. Among others, there are the following terminals: Input and output terminals for analog and digital signals, counter terminals.

These terminals are available in various sizes. Using these modules, you can set up the station in a modular fashion according to your requirements.

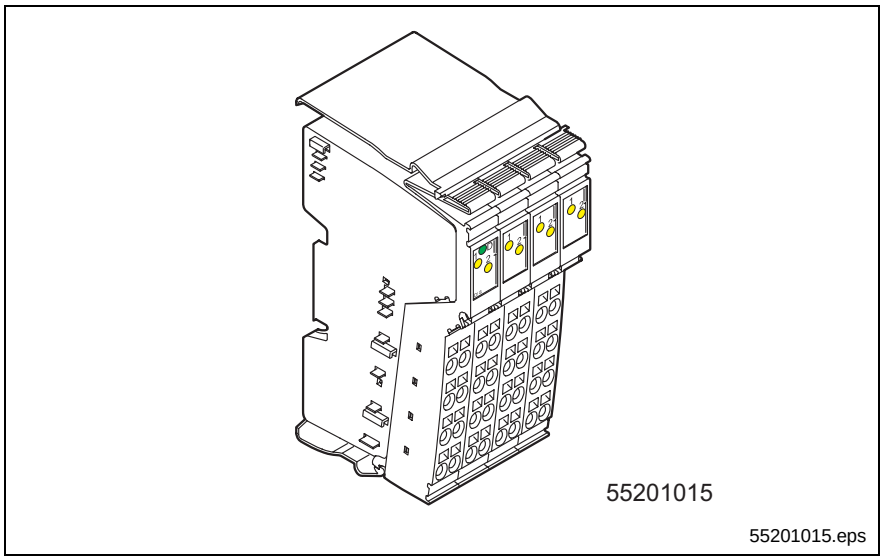


Fig. 5-10: Example of a digital input terminal R-IB IL 24 DI 8

Housing

Depending on the width of the socket and the design of the connector, the following input/output terminals are available:

Connector	Maximum connection method	Housing width		
		2-slot	4-slot	8-slot
Standard connector	Two 4-wire connections	2 x DI 2 x DO		8 x DI 8 x DO
Shield connector	For connection method see the module-specific data sheets	2 x AI 1 x AO 2 x AO 2 x TEMP	1 x AO	
Extended double signal connector	Four 3-wire connections	4 x DI 4 x DO		16 x DI 16 x DO

Fig. 5-11 : Input/output terminals

Legend:

DI / DO = Digital input / output

AI / AO = Analog input / output

Connections

Depending on their design, the input/output terminals are provided with terminal points for the connection of two-, three- and 4-wire sensors and actuators.

Connection technique

Connect lines with a connection cross-section of 0.2 mm^2 to 1.5 mm^2 to the tension spring connector.

An exception to this are equalizing lines for thermal elements. For these lines, a connection cross-section of 0.13 mm^2 or more is admissible.

Protection

The system is protected against overload centrally in the power terminal with fuse, or this protection must be provided by the user. Choose the capacity of the previous fuse so that it will not exceed the maximum load current. For the maximum permissible load current of an I/O terminal, please refer to the module-specific data sheet.

Indicators

The diagnostic and status indicators of the terminals inform on the bus as well as on the state of the inputs and outputs (see the chapter entitled "Indicators on the Input/Output Modules" on page 4-8).

The LEDs are provided in the logic section of the terminals.

Coupling to the functional earth ground (FE)

In the terminal, there is no coupling to the functional earth ground (FE).

Grounding

Grounding is implemented via the FE voltage jumper when the module is latched to the previous terminals.

Additional grounding

It is not necessary to provide additional grounding via these terminals.

Load capacity of the jumper contacts

The maximum load capacity of the lateral jumper contacts is listed in Fig. 4-19 on page 4-15.

No electrical isolation

These terminals cannot be used to establish electrical isolation. To achieve this, a power terminal must be used.

Voltage ranges

Low-signal-level terminals are available for various voltage ranges. Depending on the power terminal, the operating voltage is 24 V DC, 120 V AC, or 230 V AC.

CAUTION

If you intend to use different voltage ranges within one station, you must use a new power terminal for each range.

Power losses

Power loss of the electronics (P_{EL})

The electronics power loss of a terminal is calculated by means of the formula in the module-specific data sheet. The calculated value must not exceed the housing power loss.

Power loss of the housing (P_{HOU})

The housing power loss is the maximum permissible power loss. This maximum power loss is listed in the module-specific data sheet.

Within the permissible operating temperature range, the housing power loss can be dependent on or independent of the ambient temperature.

If the housing power loss is dependent on the ambient temperature, the reliability of an operating point must be determined.

Reliability of an operating point

Depending on the housing and the electronics power loss at a certain current, the maximum temperature can be determined at which the terminal can be operated at this given current.

Examples for the calculation of this values you will find in chapter 10-2 Examples for Calculation of Power Losses and Operating Points.

Terminals for analog signals

Shielding

The connectors of the analog terminals are provided with a special shield connector for shielding of the lines.

Parameterization

The terminals for analog signals work without any parameterization in a predetermined configuration.

Some terminals, however, can also be parameterized to different configurations via the INTERBUS output data words. To see whether a certain analog terminal can be configured, and for the assignment of the output data words, please refer to the module-specific data sheet.

Data formats

The measured values and the corresponding output values of the terminals for analog signals can be represented in different data formats, depending on the terminal used and on its configuration. For these formats, please refer to the respective module-specific data sheet.

Diagnosis in the input data word

In analog input terminals, the overrange identification is realized in all measuring ranges.

In the range of 4 mA to 20 mA, wire breakage is signaled as well.

Also with terminals for the connection of thermal elements, wire breakage is signaled.

Extended diagnosis

Some data formats support an extended diagnosis. To see whether extended diagnosis is available for a certain terminal, please refer to the respective module-specific data sheet.

For the potential fault messages, see Fig. 5-12: Error messages of analog input terminals .

Code (hex)	Fault:
8001	Out of measuring range (figure remains under range)
8002	Wire breakage
8004	Invalid measured value
8020	Reserved
8010	Invalid configuration
8040	Module defect
8080	Out of measuring range (figure exceeds range)

Fig. 5-12: Error messages of analog input terminals

5.4 Function Terminals

Function terminals are available for the following requirements:

- Counting (R-IB IL CNT)

5.5 Example for the Structure of a RECO Inline station

In Fig. 5-13, the product groups described in the chapters 5.1 to 5.3 are combined in an example for a RECO Inline station.

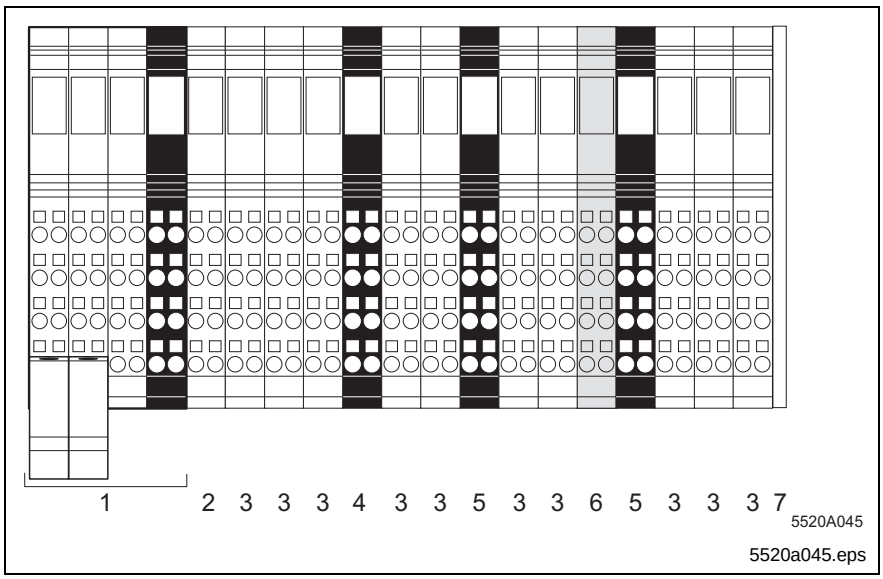


Fig. 5-13 : Example station comprising the basic elements

No.	Description of the automation terminals
1	Bus terminal or control terminal
2	Terminal with remote bus branch for connecting a remote bus branch
3	Input/output terminal / function terminal
4	Power terminal (supply terminal)
5	Segment terminal (supply terminal)
6	Output terminal relay terminal
7	End plate
	Terminals for the power level

Fig. 5-14 : Basic elements of a RECO Inline station

6 Mounting of RECO Inline Terminals and Connection of Lines

6.1 Mounting Instructions

Replacing of terminals

CAUTION

Do not replace terminals with the station being live!

⇒ De-energize the entire station before you remove a terminal from the station or before you install a terminal in the station! Reconnect the voltage only after you have set up the entire station.

Placement of the terminals for analog signals

A high current through the voltage jumpers U_M and U_S results in heating of the voltage jumpers, and thus in an increase of the temperature inside the terminals. To keep the current through the voltage jumpers of the analog terminals as low as possible, please observe the following instruction:

Note: **Set up all analog terminals with a main circuit of their own!**

⇒ If this is impossible in your concrete case and you have to set up analog terminals in a main circuit together with other terminals, place the analog terminals behind all other terminals at the end of the main circuit.

6.2 Mounting and dismounting RECO Inline Modules

You can set up a RECO Inline station by butt-mounting the individual components. You do not require any tools. When the components are butt-mounted, the potential and bus signal connection (voltage and data routing) between the individual components of the station is established automatically.

The modules must be mounted perpendicular to the mounting rail. This ensures simple installation and removal even with confined space conditions.

Once the station has been set up, individual terminals can be subsequently replaced by being pulled out or plugged in without any additional tools.

Mounting rail

All RECO Inline terminals are mounted on a 35-mm standard mounting rail.

End clamp / CLIPFIX

Attach end clamp to either side of the RECO Inline station. These end clamps ensure correct fixing of a RECO Inline station on the mounting rail and are, in addition, provided as lateral termination elements. These end clamps are supplied together with the bus terminal; accordingly, you need not order them separately.

End plate

The mechanical termination of a RECO Inline station must be the end plate. This plate does not have any electrical function. It protects the station from ESD pulses and the user from dangerous contact voltages.

The end plate is supplied with bus terminal and does not have to be ordered separately.

Assembly

Proceed as follows to latch on a terminal Fig. 6-1:

- First latch on the electronic socket, which is required to set up the station, perpendicular to the mounting rail (Fig. 1).

Note: Ensure that **all** feather keys and keyways of neighboring terminals are interlocked (Fig. 2).

The keyway/feather key connection connects neighboring terminals to each other and ensures that the voltage jumper is set up securely.

- Then fit the connectors onto the pertinent sockets.

First insert the front connector shaft latch in the forward latch-off mechanism (Fig. 3).

Then press the connector towards the socket until it clicks into place in the rear latch-off mechanism (Fig. 4).

Note: The grooves provided in the electronic socket are not continued in the connector. To latch on an electronic socket, there may be no connector to the left of it. If necessary, the latter must be removed.

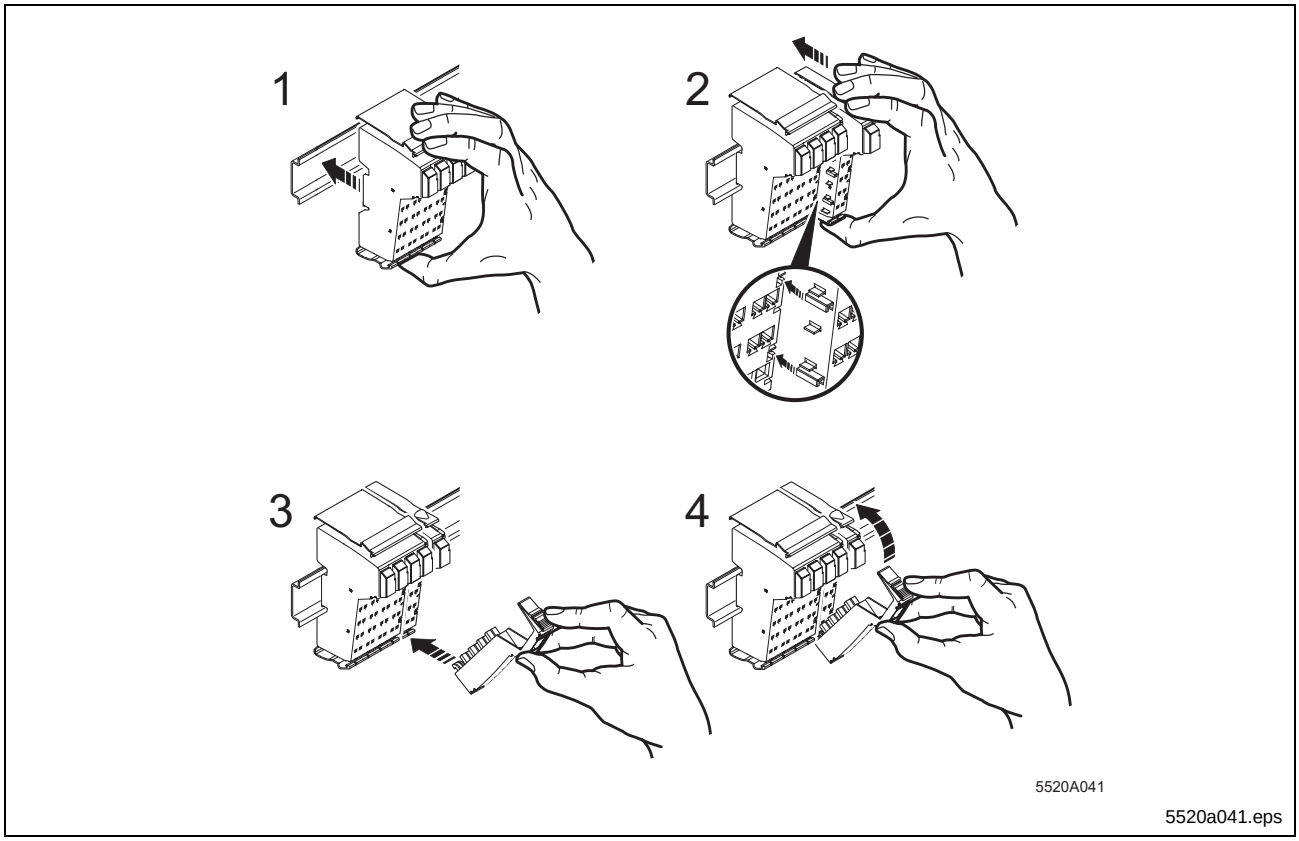


Fig. 6-1: Latching of a terminal

Dismounting

To remove a terminal, proceed as follows (Fig. 6-2): First remove the labeling field, if any (1 in Fig. 1)

Note: If a terminal is provided with several connectors, all connectors of the terminal must be removed The sections below describe the removal of a dual terminal.

Lever out the connector of the terminal to be removed by pressing on the rear connector shaft latch (2 in Fig. 1).

- Remove the connector (Fig. 2).
- Remove the adjacent connectors of the neighboring terminal (Fig. 3). This prevents the feather keys of the voltage jumper and the keyway/feather key connection from being damaged. Moreover, the terminal can be accessed more easily.
- Operate the releasing mechanism (1 in Fig. 4) and remove the electronic socket perpendicular to the mounting rail (2 in Fig. 4). If you have failed to loosen the connector of the neighboring terminal to the left, this connector now loosens to protect the feather keys of the voltage jumper and the keyway/ feather key connection.

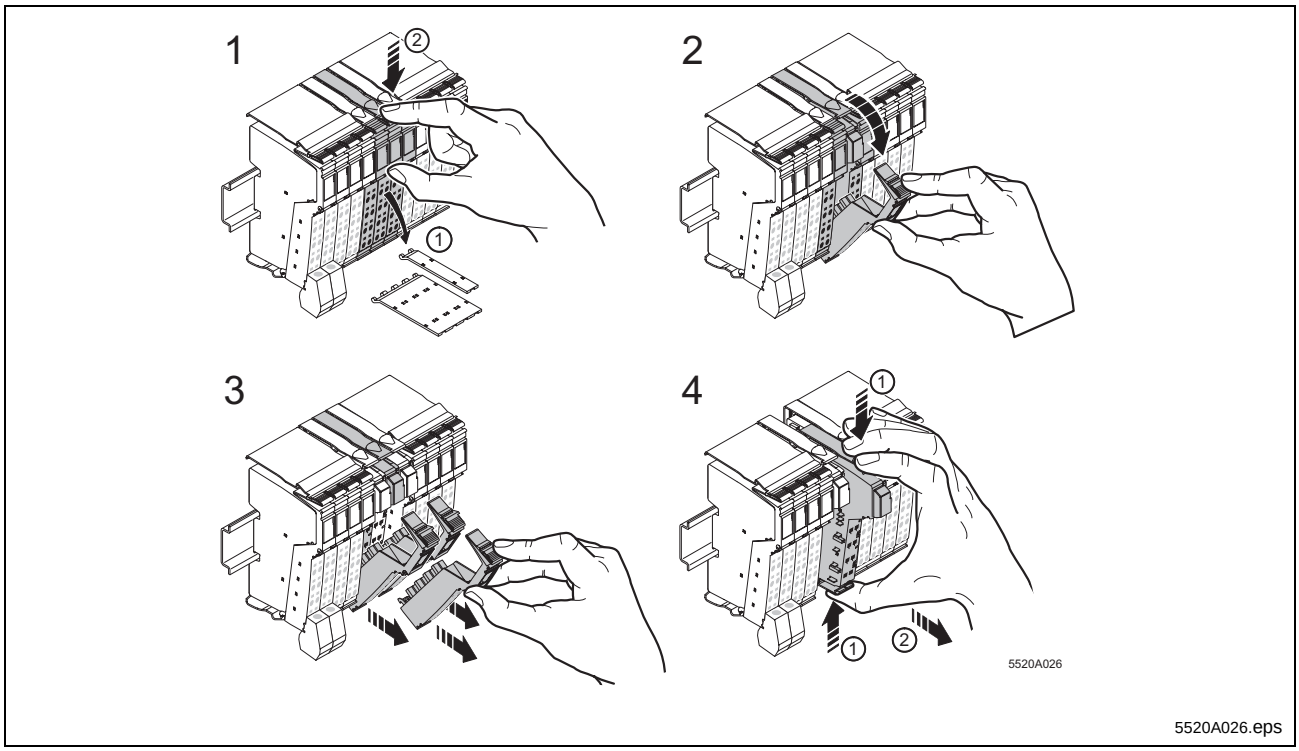


Fig. 6-2: Removal of a terminal

Replacing a terminal

If you intend to replace a terminal within the RECO Inline station, proceed as described above to remove it. Do not yet latch on the adjacent connector of the neighboring terminal to the left.

Insert the socket of the new terminal. Refit all connectors.

6.3 Grounding Concept

Note: Grounding protects people and machines from dangerous voltages. To exclude these dangers as far as possible, grounding according to the instructions and adapted to the respective situation is imperative.

General INTERBUS grounding concept

All INTERBUS devices must be grounded to keep possible interferences away from the data telegram and to leak them off to the ground.

With screw terminals, grounding must be provided via a 2.5 mm^2 conductor as a minimum, and with tension spring terminals, via a 1.5 mm^2 conductor. For certain device types, lines with larger cross sections may be required.

The grounding of RECO Inline terminals is described in this manual.

Grounding concept with RECO Inline

Bus terminals supply terminals

At the bottom of their electronic socket, the bus terminals, power terminals and segment terminals have an FE spring (metal clip) procuring an electric connection to the mounting rail Using ground terminals, connect the mounting rail to the protective ground. This also grounds the modules mentioned.

Mandatory additional grounding

To ensure reliable grounding even in case of a dirty mounting rail or a damaged metal clip, the bus terminal must additionally be grounded via the FE terminal point, as prescribed by Rexroth INDRAMAT(see module-specific data sheet.).

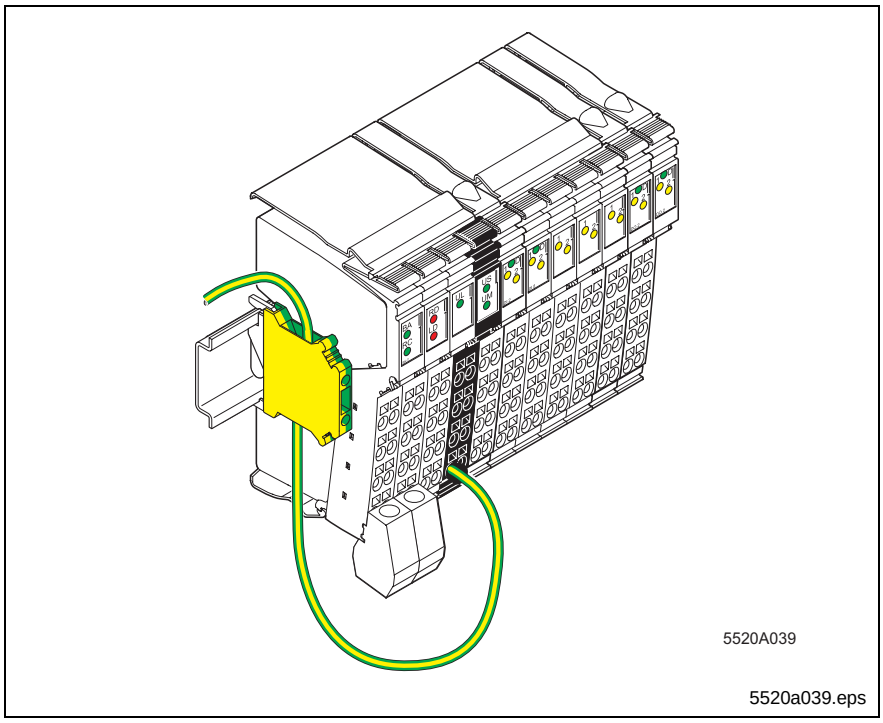


Fig. 6-3: Additional grounding of the bus terminal

FE voltage jumper

Starting at the bus terminal, the FE (functional earth ground voltage jumper is routed through the entire RECO Inline station. Ground the mounting rail. When latched on, the FE voltage jumper is connected to the grounded mounting rail. If the station is equipped with supply terminals, the FE voltage jumper is connected to the grounded mounting rail in these terminals as well.

Note: The FE functional earth ground is only intended to discharge disturbances. It is not provided as a protection against electric shock for persons.

Low signal level

The further RECO Inline terminals of the low signal level are grounded automatically via the FE voltage jumper when the modules are latched to each other.

6.4 Shielding concept

The shielding is intended to reduce any effects of interferences on the system.

Shielding concept with RECO Inline

In the RECO Inline system, the remote bus lines and the connection lines of terminals for analog signals are shielded.

Note: Observe the following when shielding:

- Fit the shield over as large an area as possible under the clip in the shield connection.
- Ensure proper contact between the connector and the terminal.
- Avoid damaging or squeezing of cores. Avoid stripping the lines too much.
- Properly terminate the cores.

Shielding with analog sensors and actuators

- Always connect analog sensors and actuators with shielded and twisted cable pairs.
- Connect the shield system via the shield connector. Connection of the shield to the shield connector is described on page 6-10, “Connecting shielded lines via the shield connector”.

Depending on the analog input and output terminals, there are several ways of grounding the shield. The length of the lines must also be taken into consideration.

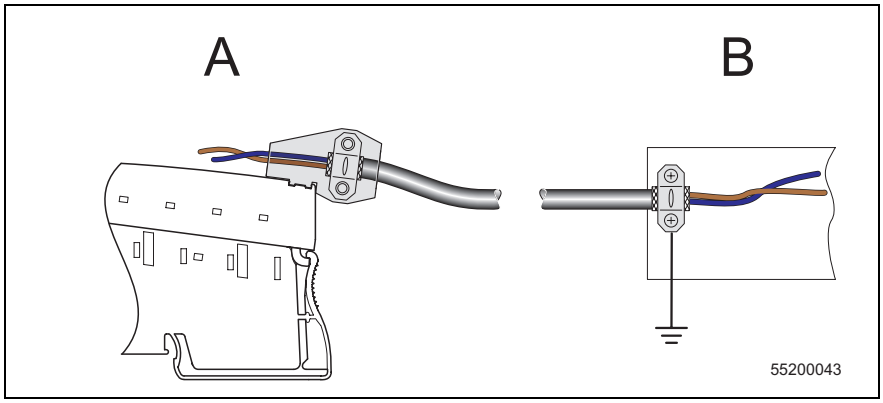
Module type	Connection to the module	Line length	Connection to the sensor/actuator
Analog input terminal R-IB IL AI ...	Ground connections are connected to FE via an RC element inside the module.	< 10 m	–
		> 10 m	Place the sensor directly on the PE.
Analog input terminal for temperature measuring R-IB IL TEMP 2 UTH	Directly on FE using a shield clip.		–
Analog output terminal R-IB IL AO...	Directly on FE using a shield clip.	< 10 m	–
		> 10 m	Decouple the actuator with RC element and place it on the PE.

Fig. 6-4: Overview: Shield connection of analog sensors and actuators

Connecting the analog input module R-IB IL 24 AI...

- Connect the shield system via the shield connector (see page 6-12, “Connecting shielded lines via the shield connector”).
- Connect the shield system at the sensor to the FE potential over as large an area as possible.

The ground connection in the module is connected to FE via an RC element inside the module.



L: A Terminal side
B Sensor side

Fig. 6-5: Connection of analog sensors in case of signal lines > 10 m

Note: If you intend to use both channels of the terminal R-IB IL AI 2/SF, you may connect the shield system in several ways, depending on the line cross-section.

1 To connect the two sensors, you should use a multi-core line; connect the shield via the shield connector, as described above.

2 To connect the two sensors, you should use a thin line; connect the shield system for both lines via the shield connector.

3 Use the standard connector (R-IB IL SCN-8; without shield connection). For each line, twist the braided shield and put it on one of the terminal points intended for the FE connection.

This method is only advisable if the line cross-section is not too large, and if the first two alternatives cannot be realized!

Connecting the analog output module R-IB IL AO ...

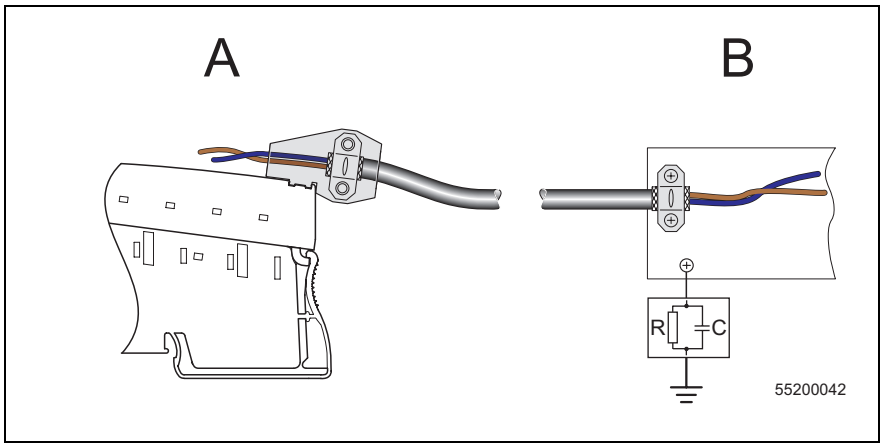
Note:

- Connect the shield system via the shield connector (see page 6-10, “Connecting shielded lines via the shield connector”).
- Connect the shield system to the FE potential over as large an area as possible.

Note: Risk of development of ground loops!

⇒ The shielding system may be connected directly to the ground potential at one point only.

If lines are more than 10 meters in length, they should always be decoupled by means of an RC element (on the actuator side). The typical value of the capacitor C should be 1 nF to 15 nF. The value of the resistor R should be at least 10 MΩ.



L: A Terminal side

B Actuator side

Fig. 6-6: Connection of actuators, in case of signal lines > 10 m

6.5 Connecting Lines

When a station is used, both shielded and unshielded lines are used.

Connect the lines for peripheral equipment and supply voltages via tension spring connection points. This permits connection of signals up to 250 V AC/DC and 5 A with a connection cross-section of 0.2 mm^2 to 1.5 mm^2 (AWG 24 -16).

Connecting unshielded lines

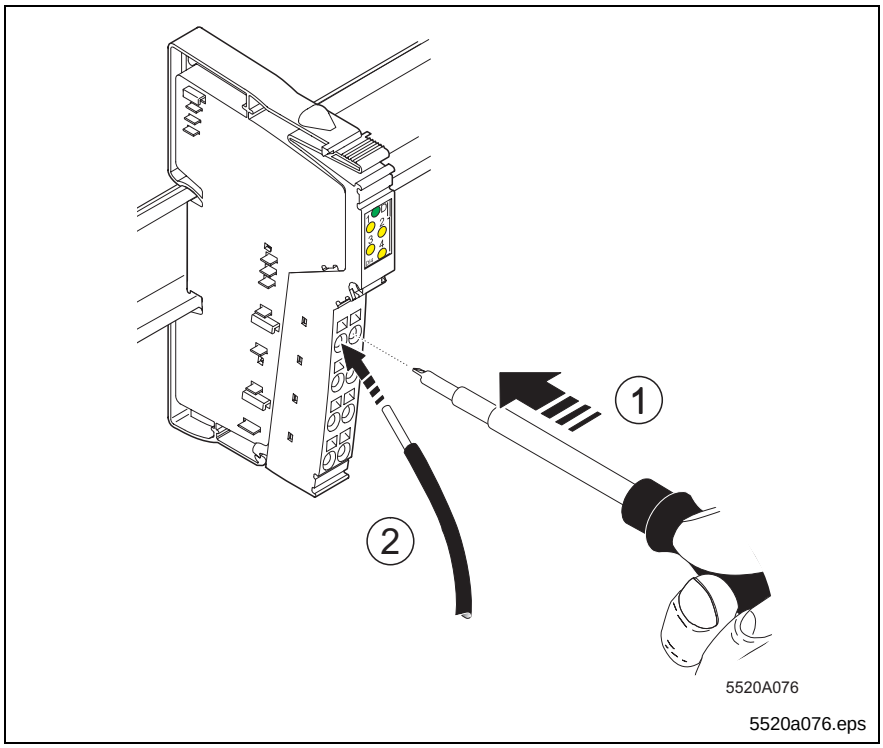


Fig. 6-7: Connecting unshielded lines

Wire the connectors as required by your application.

The connector pin assignment can be found in the pertinent module-specific data sheet.

Proceed as follows to wire the connectors:

- Strip the line to a length of 8 mm.

Note: The RECO Inline wiring is provided without connector sleeves. However, connector sleeves may be used, if desired. In this case, the connector sleeves must be properly crimped.

- Push a screw driver so far into the operating vertical raceway of the corresponding terminal point (Fig. 6-7, 1) that you are able to put the core into the opening of the spring. Insert the core (Fig. 6-7, 2). Pull the screwdriver out of the opening. This fixes the core.

We recommend to label both the cores and the terminal points after completed installation (also see the chapter “Marking and Labeling of Functions” on page 4-31).

Connecting shielded lines via the shield connector

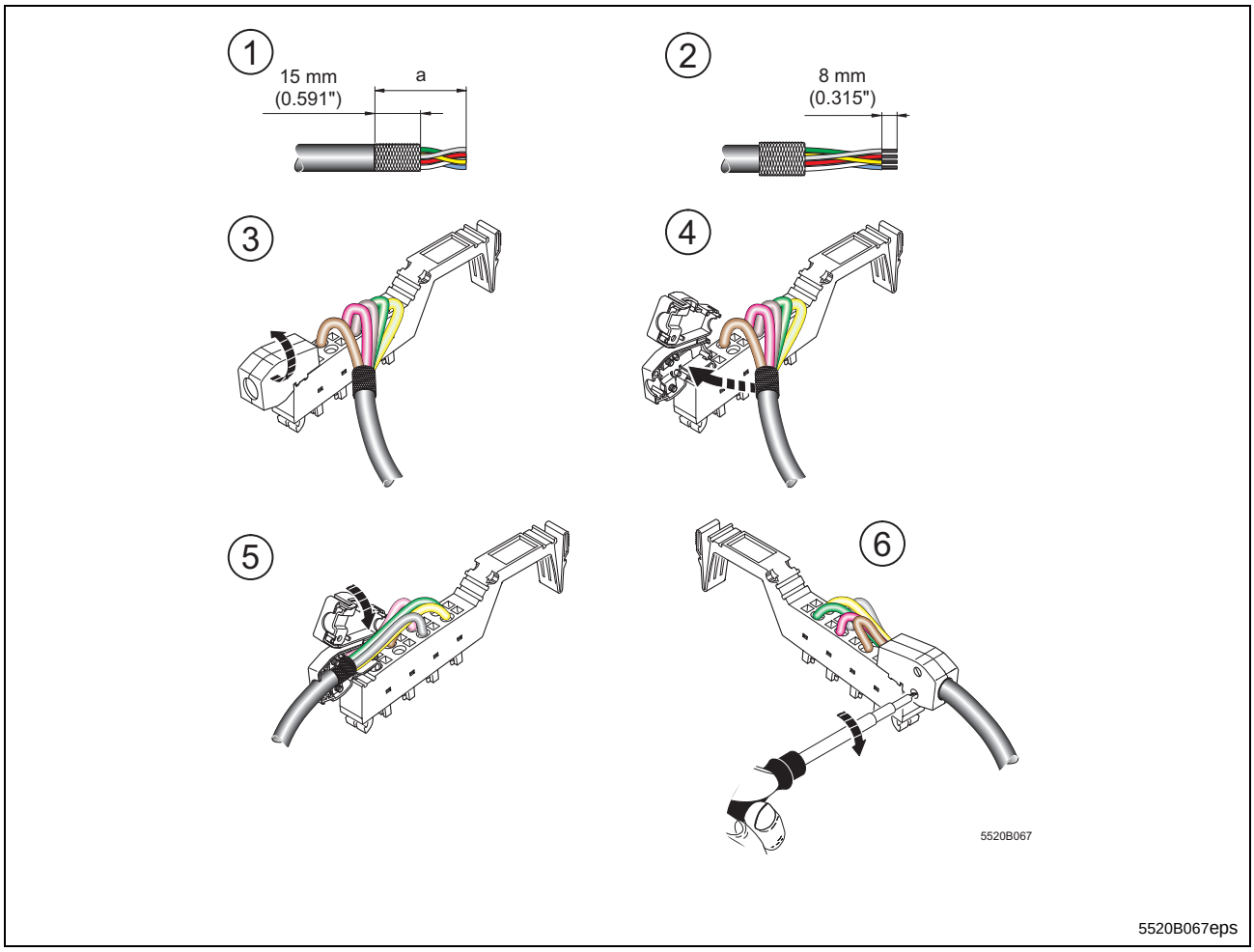


Fig. 6-8: Connecting the shield to the shield connector

Below, connection of a shielded line is described by example of an “analog line”.

Proceed as follows:

Stripping of lines

- Strip the outer sheath of the line to the desired length (a). (1)

  The desired length (a) depends on the position where you connect the cores and on whether you intend to lay the cores between the connection point and shield connection in a generous or a tight arrangement.
- Shorten the braided screen to 15 mm. (1)
- Place the braided screen around the outer sheath. (2)
- Remove the protective foil.
- Strip the lines for 8 mm. (2)

Note: The RECO Inline wiring is provided without connector sleeves. However, connector sleeves may be used, if desired. In this case, the connector sleeves must be properly crimped.

Wiring the connectors

- Push a screw driver so far into the operating vertical raceway of the corresponding terminal point (Fig. 6-7, 1) that you are able to put the core into the opening of the spring.
- Insert the core (Fig. 6-7, 2). Pull the screwdriver out of the opening. This fixes the core.

The connector pin assignment can be found in the pertinent module-specific data sheet.

Connecting the shield

- Open the shield connection. (3)
- Check the alignment of the shield clip in the shield connection (see Fig. 6-9).
- Place the line including surrounding braided screen in the screen connection. (4)
- Close the shield connection. (5)
- Tighten the screws on the shield connection using a screwdriver. (6)

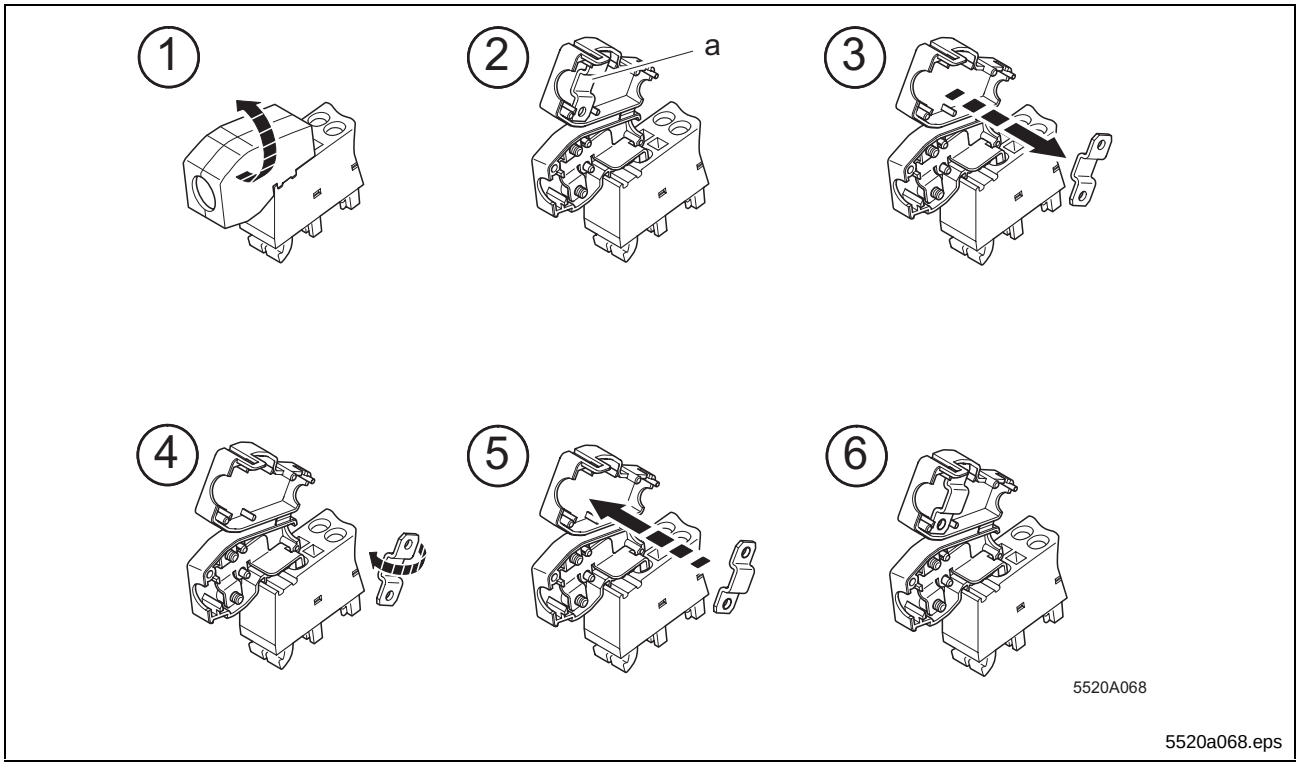


Fig. 6-9: Orientation of the shield clip

Shield clip

The shield clip (a in Fig. 6-9, 2) can be used according to the line cross-section. With thicker lines, the bulging of the clip must be directed away from the line (Fig. 6-9, 2) With thin lines, the bulging of the clip must be directed facing the line (Fig. 6-9, 6)

If you need to change the direction of the shield clip, proceed as follows according to Fig. 6-9:

- Open the housing of the shield connector (1).
- When delivered, the shield connector is intended for the connection of thicker lines (2).
- Remove the clip (3), turn the clip according to the cross-section of the line used (4), and fit the clip (5). (5)
- Figure 6 illustrates the clip if a thin line is used.

6.6 Connecting Supply Voltages

When using a station, the supply voltages for the bus terminal, for the logic of the terminals, for the sensors, and for the actuators must be made available.

The supply voltages are connected through unshielded lines in according with chapter “Connecting Unshielded Lines” on page 6-11.

For the connector assignments for the connection of the supply voltages, please refer to the terminal-specific data sheets for bus terminals, power terminals, and segment terminals.

CAUTION

Do not replace terminals with the station being live!

⇒ De-energize the entire station before you remove a terminal from the station or before you install a terminal in the station!

Reconnect the voltage only after you have set up the entire station.

Feeding in at the bus terminal

In the simplest case, all necessary 24-V supply voltages are fed in at the bus terminal. Then, voltage is supplied to the entire station from the bus terminal.

In this case, the supply voltages listed below must be fed in or made available.

U_{BK} 24 V bus terminal feed-in

From the bus terminal feed-in, the following voltages are generated:

- The internal logic supply for the bus terminal;
- The logic supply for the terminals of the RECO Inline station made available via the voltage jumper U_L
- The supply for the analog terminals made available via voltage jumper U_{ANA}

U_M 24-V feed-in into the main circuit

The main voltage U_M (Main circuit) is provided for the supply of all devices connected to the main circuit.

All digital initiators (sensors) with their own short-circuit protection as well as those initiators which need not be protected are supplied from the main circuit.

U_S **24-V feed-in into the segment circuit**

The segment voltage U_S can be separately fed in at the bus terminal or it can be picked off from the main circuit. To pick off the voltage U_s from the main circuit U_M, a jumper can be fitted or an activated segment circuit be established by means of a switch.

The voltage U_S is provided for the supply of all devices connected to the segment circuit.

The segment circuit supplies sensors without their own short-circuit protection and all digital actuators.

Electrical isolation: To set up electrical isolation between the logic and the peripheral systems, the feed-in of the bus terminal supply U_{BK} and the peripheral supply U_S/ U_M must be made available from different power supply units.

In this context, please also note the hints in the chapter “RECO Inline Product Groups” on page 5-3 and in the chapter “Voltage Concept” on page 4-37.

Supply at the power terminals

In addition to feeding the supply voltages for the peripheral equipment in at the bus terminal, it is also possible to feed in or provide the voltage via a power terminal.

Note: Please also observe the instructions in the chapter “Supply Terminals” on page 5-5.

U_M **24-V feed-in into the main circuit**

The power terminal is the initial feed-in point of the main voltage.

U_S **24-V feed-in into the segment circuit**

The segment voltage can be fed in at the power terminal or generated from the main voltage. To pick off the voltage U_S from the main circuit U_M, a jumper can be fitted or an activated segment circuit be established by means of a switch.

Electrical isolation: A new potential range can be established via the power terminal.

Voltage ranges Power terminals can be used to establish segment stations with different voltage ranges/sections. Depending on the power terminal, the operating voltage is 24 V DC, 120 V AC, or 230 V AC.

CAUTION

Set up different voltage ranges by means of new power terminals!

⇒ If you intend to use different voltage ranges within one station, you must use a new power terminal for each range.

DANGER

Dangerous contact voltage!

⇒ If you remove the power terminal, the metal contacts are freely accessible.

With a 230-V power terminal, dangerous contact voltage is to be expected. It is absolutely necessary to de-energize the station before you remove a terminal!

Providing the segment voltage at power terminals

It is not possible to feed in voltage at the segment terminal.

Within the main circuit, the segment terminal permits setting up a new partial circuit (segment circuit), which allows power outputs, digital actuators and digital sensors to be supplied separately.

The segment voltage can be picked off from the main circuit via a jumper. If you use a switch, it is possible to control the segment circuit externally and to connect or disconnect it e.g. by means of emergency stop circuits.

Using a segment terminal with fuse, you can establish a fused segment circuit without any additional wiring.

Information on the supply voltages

U_{BK} / U_L The bus terminal supplies logic voltage to the module electronics of the linked modules. If this supply voltage is disconnected, the bus will come to a standstill.

U_{BK} / U_M / U_S The voltage supply of the sensors and actuators (U_M /U_S) should be installed and protected independent of the supply of the INTERBUS module electronics (U_{BK}). In this way, the INTERBUS can remain operative even when parts of the peripheral equipment are disconnected.

U_S Emergency stop With an integrated emergency tripping system, only the voltage supply of the actuators should be connected to the emergency tripping system.

In this way, the sensors can be used for trouble shooting when the system is in emergency stop status.

Requirements for the supply voltages

CAUTION

Use power supply units ensuring safe isolation

⇒ Only use power supply units which ensure safe isolation between the primary and the secondary circuits according to EN 50178.

Note: For the other requirements on the supply voltages, please refer to the data sheets for bus terminal and power terminal.

6.7 Connecting the bus

The INTERBUS remote bus is connected to a bus terminal. The bus lines are shielded lines. They are connected via the shield connector. For details on their connection, see chapter “Connection of Shielded Lines via the Shield Connector” on page 6-10.

6.8 Connecting Sensors and Actuators

Sensors and actuators must be connected using the connectors. The type of connector which can be used for the respective module is specified in the particular module-specific data sheet.

Connect unshielded lines as described on page 6-9 and shielded lines as described on page 6-10.

Connection methods for sensors and actuators

The digital I/O terminals of the RECO Inline product family usually permit 2-wire, 3-wire or 4-wire connection of sensors and actuators.

Owing to the connector versions, the following connections can be implemented on a connector:

- Two (2) sensors or actuators with 2-wire, 3-wire or 4-wire connection
- Four (4) sensors or actuators with 2-wire or 3-wire connection
- Two (2) sensors or actuators with 2-wire or 3-wire connection with shield (for analog sensors or actuators)

When connecting analog devices, please observe the module-specific data sheets, because the method of connecting analog devices is different from that of connecting digital devices.

Pin assignments with digital input/output terminals

Below, the terminals of the 24-V range serve as an example of the possible connection methods. The specifications must be adapted accordingly for the 120-V and 230-V ranges. A connection example is specified in each module-specific data sheet.

Connection	Legend used in the figure	2 cond.	3 cond.	4 cond.
Sensor signal IN	IN	X	X	X
Sensor supply U_S / U_M	U_S (+24 V)	X	X	X
Ground	GND	_	X	X
Grounding/shielding FE	FE	_	_	X

Fig. 6-10: Overview of the pin assignments with digital input terminals

X assigned

\- not assigned

Connection	Legend used in the figure	2 cond.	3 cond.	4 cond.
Actuator signal OUT	OUT	X	X	X
Actuator supply U_s	U_S (+24 V)	_	_	X
Ground	GND	X	X	X
Grounding/shielding FE	FE	_	X	X

Fig. 6-11: Overview of the pin assignments with digital output terminals

X assigned

- not assigned

Note: In the following illustrations, the supply voltage is described as U_s. Depending on which voltage jumper is accessed, either main voltage U_M or segment voltage U_S is the supply voltage.

Connecting sensors and actuators using the various connection methods

2-wire connection

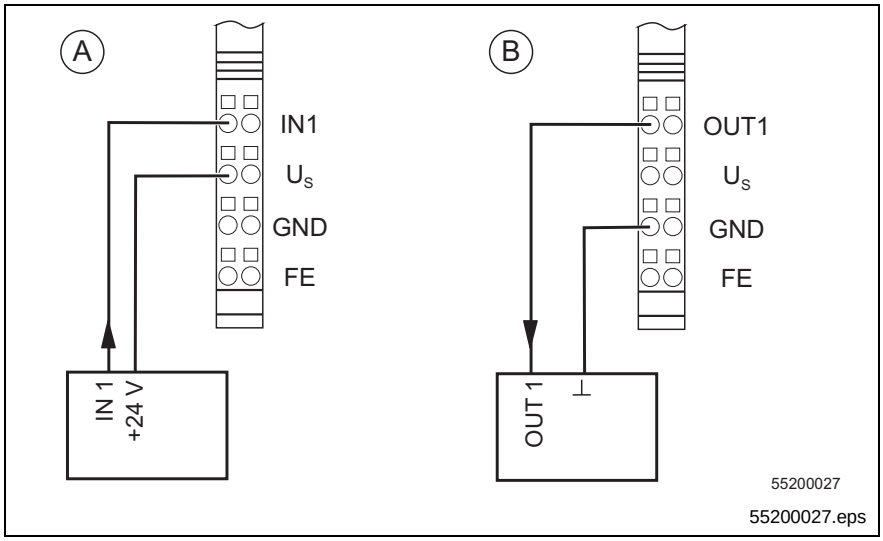


Fig. 6-12: 2-wire connection in case of digital units

Sensor Fig. 6-12, Section A illustrates the connection of a 2-wire sensor. The sensor signal is supplied to the terminal point IN1. The sensor is supplied by the voltage U_S.

Actuator Fig. 6-12, Section B illustrates the connection of an actuator. The actuator is supplied with voltage by the output OUT1. The load is switched directly via the output.

3-wire method

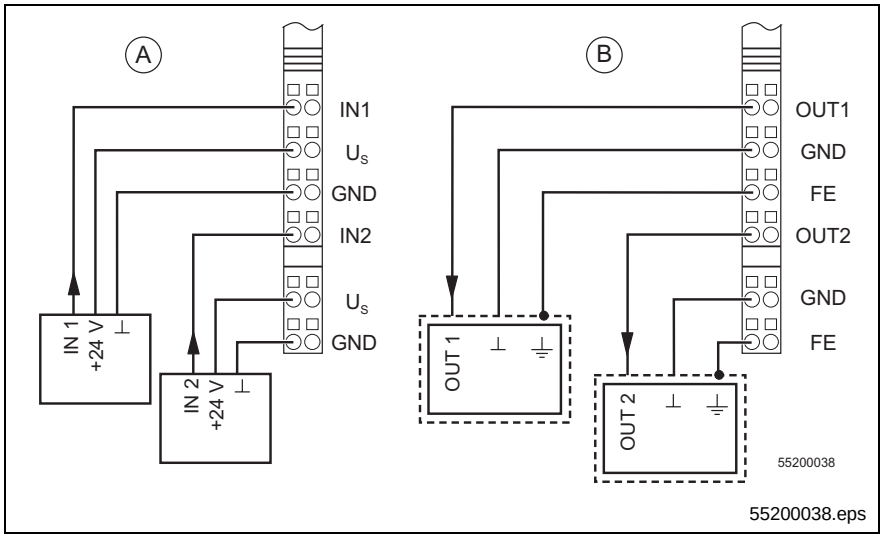


Fig. 6-13: 3-wire connection in case of digital units

Sensor Fig. 6-13, Section A illustrates the connection of a 3-wire sensor. The sensor signal is supplied to the terminal point IN1 (IN2). The sensor is supplied via the U_S and GND terminal points.

Actuator Fig. 6-13, Section B illustrates the connection of an actuator. The actuator is supplied by the output OUT1 (OUT2). The load is switched directly via the output.

4-wire connection

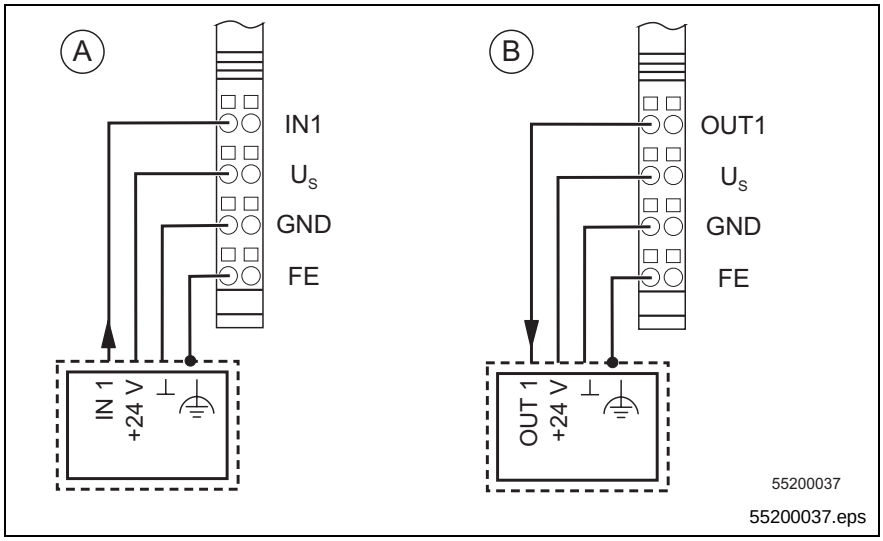


Fig. 6-14: 4-wire connection in case of digital units

Sensor Fig. 6-14, Section A illustrates the connection of a 3-wire sensor. The sensor signal is supplied to the terminal point IN1. The sensor is supplied via the U_S and GND terminal points. The sensor is grounded via the FE terminal point.

Actuator Fig. 6-14, Section B illustrates the connection of an actuator. By providing the supply voltage U_S, actuators requiring their own 24 V supply voltage can also be connected directly to the terminal.

7 Software Projecting

7.1 Software with INTERBUS

With the Rexroth INDRAMAT System 200, an SPS I/O editor is at your disposal for projecting and parameterizing your INTERBUS system. This editor includes all the necessary tools.

Note: For more detailed information, please refer to the documentation **DOK-CONTRL-SPS*PRO* Mat. No. 280754**

8 Technical Data

The following figures are standard values. For any deviating figures, please refer to the data sheets for the specific modules. The information refers to the favored mounting position (vertical). The completeness of these technical data is not guaranteed.

Technical changes reserved.

8.1 System Data INTERBUS

INTERBUS System	
Number of I/O points	Maximum 4096
Number of data words	Maximum 256
Transmission speed	500 kBit/s
Transmission reliability	CR check (hamming distance: 4)
Protocol	EN 50254

Fig. 8-1: INTERBUS System data

Number of devices	
Total number of bus devices	Maximum 512
Number of remote bus devices	Maximum 254
Number of PCP devices	Maximum 62
Number of remote bus levels	Maximum 16

Fig. 8-2: INTERBUS System number of devices

Distances	
From the controller board to the last bus terminal	Maximum 12.8 km (copper)
From the controller board module to the first device	Maximum 400 m (copper)
Between two remote bus devices	Maximum 400 m (copper)
Between two installation remote bus devices	Maximum 50 m (copper)
Between bus terminal and installation remote bus devices	Maximum 50 m (copper)

Fig. 8-3: INTERBUS System distances

8.2 RECO Inline: Technical Data

System data	
Firmware of the controller board	Surface: minimum 19VRS
Software CMD (for standard interface modules)	Minimum: version 4.40 and/or surface of a minimum of 19VRS
Number of devices of a RECO Inline station	Maximum 63
Maximum current of the bus terminal in the logic area	2 A
Maximum current input of the peripheral modules	See table A-1 on page A-4
Maximum load capacity of the voltage jumpers U_{ANA}	0.5 A
Maximum load capacity of the voltage jumpers $U_{M,}$ U_S (total current)	8 A

Fig. 8-4: System data RECO Inline

Note In planning and designing a RECO Inline station, please consider the logic current input and the current input from the voltage jumpers of each device! Please find the respective information in Fig. 9-1: IL list of devices (part 1), Fig. 9-2: IL list of devices (part 2) and in the specific data sheets for each module. It can be different for the various modules.

Accordingly, the potential number of devices that can be connected depends on the specific setup of the station in question.

Ambient conditions		
Regulations	developed according to VDE 0160, UL 508	
Ambient temperature	Operation storage/transport	0 ° C to + 55 ° C - 25 ° C to + 85 ° C
Temperature cycles (velocity of the change from positive to negative temperatures, and vice versa)	0,5 K/min (no dew deposit)	
Atmospheric humidity	Operation storage/transport	75 % on average, 85 % occasionally, dew deposits not admissible 75 % on average, 85 % occasionally, dew deposits not admissible
Atmospheric pressure	Operation storage/transport	80 kPa to 106 kPa (up to 2000 m above MSL) 70 kPa to 106 kPa (bis zu 3000 m above MSL)
Protection class according to DIN 40050, IEC 60529	IP 20	
Protection class according to DIN 57106-1	Class 3	
Clearance in air and leakage paths	According to IEC 60644/ IEC 60664A/ DIN VDE 0110: 1989-01 and DIN VDE 0110: 1988-05	
Housing material	Basic material: plastic CRASTIN AS6.6, self-extinguishing (V0)	
Contamination level according to EN 50178 2	2; dew deposit not admissible during operation!	
Overvoltage class	II. (low signal level) III. (power level)	
Ambient tolerance	Not resistant to chloroform	
Function-endangering gases according to DIN 40046-36, DIN 40046-37		
Sulfur dioxide (SO_2)	Concentration 10 ± 0,3 ppm Ambient conditions - Temperature: 25 °C (± 2 °C) Atmospheric humidity: 75 % (± 5 %) - Test period: 10 days	
Hydrogen sulphide (H_2S)	concentration 1 ± 0,3 ppm ambient conditions - temperature: 25 °C (± 2 °C) atmospheric humidity: 75 % (± 5 %) - test period: 4 days	
Resistance of the housing material to termite attacks	resistant	
Resistance of the housing material to fungal attacks	resistant	

Fig. 8-5: Ambient conditions RECO Inline

Mechanical requirements	
Vibration test sinusoidal oscillation according to IEC 60068-2-6; EN 60068-2-6	Load 2g, 2 h per room direction (low signal level) Load 2g, 2 h per room direction (power level)
Shock test according to IEC 60068-2-27; EN 60068-2-27	Load 25g over 11 ms, half sinusoidal wave, three shocks per room direction and orientation

Fig. 8-6: Mechanical requirements RECO Inline

Correspondence with EMC regulation 89/336/EEC		
Immunity test according to EN 50082-2		
Discharge of static electricity	EN 61000-4-2 / IEC 61000-4-2	Criterion B 6 kV contact discharge 8 kV air discharge
Electromagnetic field	EN 61000-4-3 / IEC 61000-4-3	Criterion B Field strength: 10 V/m
Fast transients (burst)	EN 61000-4-4 / IEC 61000-4-4	Criterion B Remote bus: 2 kV voltage supply: 4 kV I/O lines: 2 kV Criterion A All interfaces: 1 kV
Transient overvoltage (surge)	EN 61000-4-5 / IEC 61000-4-5	Criterion B Supply lines AC: 2,0 kV/4,0 kV (symmetrical/unsymmetrical) Supply lines DC: 0.5 kV/0.5 kV (symmetrical/unsymmetrical) Signal lines: 1.0 kV/2.0 kV (symmetrical/unsymmetrical)
Conducted interferences	EN 61000-4-6 / IEC 61000-4-6	Criterion A Test voltage 10 V
Noise radiation test according to EN 50081-2		
Interference emitted by the housing	EN 55011	Class A

Fig. 8-7: Compliance with EMC Guideline 89/336/EEC-RECO Inline

Data transfer	
Protocol	EN 50254; INTERBUS 2-wireconductor 500 kBit/s
Chip (not with supply terminals)	Optical Protocol Chip
Transfer	Data jumpers
Level	Logic level

Fig. 8-8: Data transfer RECO Inline

24 V Supply of the bus terminal	
Nominal voltage	24 V DC *
Ripple factor	± 5 %
Admissible voltage range	From 19.2 V DC to 30.0 V DC, ripple factor included
Connection	Tension spring terminals

Fig. 8-9: 24 V Supply of the bus terminal RECO Inline

7.5 V Supply of the bus logic voltage (U_L)	
Nominal voltage	7.5 V
Ripple factor	± 5 %
Load current	maximum 2 A
Connection	Lateral voltage jumpers
Note	The voltage is created in the bus terminal via a DC/DC transformer from the 24 V supply voltage. U_L is not isolated from the 24 V bus terminal voltage. U_L is isolated from the peripheral voltages U_M and U_S. The supply of the logic system U_L is electronically short-circuit proof.

Fig. 8-10: 7.5-V Supply of the bus logic voltage (U_L) – RECO Inline

Supply of terminals for digital signals (U_M , U_S) in the 24 V range	
Nominal voltage	24 V DC *
Tolerance	- 15 % / + 20 %
Ripple factor	± 5 %
Admissible voltage range	From 19.2 V DC to 30.0 V DC, ripple factor included
Load current	maximum 8 A
Connection	Lateral voltage jumpers
Note	
To the segment circuit U_S, the following is connected:	All digital outputs and initiator supplies without a short-circuit protection of their own
To the main circuit U_M, the following is connected:	Initiator supplies with a short-circuit protection of their own

Fig. 8-11: Supply of terminals for digital signals (U_M , U_S) in the 24 V range RECO Inline

Voltage supply of terminals for analog signals (U_{ANA})	
Nominal voltage	24 V DC *
Tolerance	- 15 % / + 20 %
Ripple factor	± 5 %
Admissible voltage range	From 19.2 V DC to 30.0 V DC, ripple factor included
Load current	maximum 500 mA
Connection	Lateral voltage jumpers
Note	Decoupling of 24 V input voltage by diode. Smoothing by π-filter with corner frequency 9.8 kHz and attenuation of 40 dB/decade. U_{ANA} is not isolated from the 24 V bus terminal supply and the 7.5 V logic voltage.

Fig. 8-12: Voltage supply of terminals for analog signals (U_{ANA}) –RECO Inline

Voltage dips and interruptions of the peripheral voltage supply	
Severity PS1	Interruption time < 1 ms
Time interval between voltage dips	< 1 s
Behavior	Judgment criterion 1 The bus does not register any supply voltage dip < 1 ms.
Severity PS2	Interruption time < 10 ms
Time interval between voltage dips	< 1 s
Behavior	Judgment criterion 3 Bus is disconnected, all outputs of the system are set back.

Fig. 8-13: Voltage dips and interruptions of the peripheral voltage supply RECO Inline

Current and voltage distribution in the voltage and data jumpers	
See chapter “Power and Voltage Distribution” (page 5-15)	

Fig. 8-14: Current and voltage distribution in the voltage and data jumpers

Connection type/line cross section	
Connection type of all lines	Tension spring terminals
Line cross section low signal level (typical)	0,2 mm² to1,5 mm²
Line cross section low signal level (connection of equalizer lines for thermal elements to the terminal IB IL TEMP 2 UTH)	0.13 mm² to1,5 mm²
Line cross section power level (power terminal, motor connection, brake connection)	0.2 mm² to 2.5 mm² (flexible and rigid lines)
Line cross section power level (emergency operation)	0,14 mm² to 1,5 mm² (flexible and rigid lines)

Fig. 8-15: Connection type/line cross section of RECO Inline

Parameter of the I/O modules of low signal level (does not apply to function modules)		
Parameter	**Minimum value**	**Maximum value**
Digital I/O modules		
Input/output voltage	18.2 V DC *	253 V AC
Input/output current	0.1 mA	5 A
Analog I/O modules		
Input/output voltage	0 V	30 V
Input/output current	0 A	20 mA

Fig. 8-16: Parameter of the I/O modules of low signal level (does not apply to function modules)RECO Inline

Isolated areas	
See specific data sheets for the respective module	

Fig. 8-17: Isolated areas RECO Inline

Clearance in air and leakage paths (according to EN 50178, VDE 0109, VDE 0110)			
Isolating distance	**Clearance in air**	**Leakage path**	**Impulse voltage withstand level**
Technology for the 24 V range			
Incoming bus / bus logic	0.3 mm	0.3 mm	0.5 kV
Next bus / bus logic	0.3 mm	0.3 mm	0.5 kV
Incoming bus / next bus	0.3 mm	0.3 mm	0.5 kV
Bus logic / peripheral equipment	0.3 mm	0.3 mm	0.5 kV
Technology for the range up to 250 V DC			
Bus logic / peripheral equipment	3.1 mm	1.1 mm	4 kV
Technology for the 230 V AC one-phase range (up to 253 V AC)			
Bus logic / peripheral equipment	3.1 mm	1.1 mm	4 kV
Relay outputs			
Main contact / make contact element		See specific data sheet for the respective module	
Relay contact / bus logic		See specific data sheet for the respective module	

Fig. 8-18: Clearance in air and leakage paths (according to EN 50178, VDE 0109, VDE 0110) RECO Inline

Test voltages	
Isolating distance	**Test voltage**
Technology for the 24 V range (up to 60 V DC)	
5 V supply of incoming remote bus / 5 V supply of next remote bus	500 V AC, 50 Hz, 1 min.
5 V supply of incoming remote bus / 7.5 V logic supply, 24 V bus coupler supply	500 V AC, 50 Hz, 1 min.
5 V supply of incoming remote bus / 7.5 V main supply, 24 V segment supply	500 V AC, 50 Hz, 1 min.
% V supply of incoming remote bus / function earth ground	500 V AC, 50 Hz, 1 min.
5 V supply of next remote bus / 7.5 V logic supply, 24 V bus coupler supply	500 V AC, 50 Hz, 1 min.
5 V supply of next remote bus / 7.5 V main supply, 24 V segment supply	500 V AC, 50 Hz, 1 min.
% V supply of next remote bus / function earth ground	500 V AC, 50 Hz, 1 min.
7.5 V logic supply, 24 V bus coupler supply / function earth ground	500 V AC, 50 Hz, 1 min.
7.5 V logic supply, 24 V bus coupler supply / 24 V main supply, 24 V segment supply	500 V AC, 50 Hz, 1 min.
24 V main supply, 24 V segment supply / function earth ground	500 V AC, 50 Hz, 1 min.
Technology for the range up to 250 V DC	
Bus logic / peripheral equipment	2500 V AC, 50 Hz, 1 min.
Technology for the 230 V AC one-phase range (up to 253 V AC)	
Bus logic / peripheral equipment	2500 V AC, 50 Hz, 1 min.
Relay outputs	
Main contact / make contact element	1000 V AC, 50 Hz, 1 min.
Relay contact / bus logic	2500 V AC, 50 Hz, 1 min.

Fig. 8-19: Test voltages RECO Inline

8.3 Ordering Information

Ordering information of the modules

For the ordering information on the RECO Inline terminals, please refer the current Rexroth INDRAMAT catalogue.

Ordering Information of the accessories

Description	Article identification	Article no.
END CLAMP	END CLAMP CLIPFIX35	289952

Fig. 8-20: Ordering information for accessories

Ordering Information of the connectors

Description	Article identification	Article no.
Connectors for RECO Inline terminals, 2 signals in 4-wire connection technology, printed	R-IB IL SCN-8-CP	289323
Connector for RECO Inline terminals, for signals with shielded lines, e.g. analog signals, with shield terminal clamp	R-IB IL SCN-6 SHIELD	289331
Connectors for RECO Inline input terminals, 4 signals in 3-wire connection technology, printed	R-IB IL SCN-12-CP	289326
Connectors for RECO Inline output terminals, 4 signals in 3-wire connection technology	R-IB IL SCN-12-CP	289327
Power connector for RECO Inline terminals, neighboring terminal points internally jumpered	R-IB IL SCN-PWR IN-CP	289328
Connector for RECO Inline bus coupler, set of 4	R-IB IL BK-PLSET	289338
Connector for RECO Inline terminals CNT and AO, set of 2	R-IB IL AO/CNT-PLSET	289339
Connectors for RECO Inline relay terminals, 4 signals in 3-wire connection technology	R-IB IL SCN-8-AC-REL	289337
Labeling field, snappable, 2-slot, set of 10	R-IB IL FIELD 2	289341
Labeling field, snappable, 8-slot, set of 10	R-IB IL FIELD 8	289342

Fig. 8-21: Ordering information of the connectors

Ordering Information of the Documentation

Description	Article identification	Article no.
System-specific data sheets bus couplers and supply modules	DOK-CONTRL-R-IL*IBS*BK	289584
System-specific data sheets digital I/O modules	DOK-CONTRL-R-IL*DIO	289586
System-specific data sheets analog I/O modules	DOK-CONTRL-R-IL*AIO	289590
System-specific data sheets counter-timer-modules	DOK-CONTRL-R-IL*CNT	289592

Fig. 8-22: Ordering information of the documentation

9 List of Devices of a RECO Inline Station

The following tables contain a list of all current RECO Inline devices with their most important properties, as well as the order numbers.

Short description

In the short description, please find a short overview of the respective terminal. It includes the following information as applicable:

- supply voltage,
- other voltages (e.g. sensor supply (sensor)),
- the number of inputs/outputs,
- the connection technology for the peripheral equipment,
- the maximum value for the input/output current per input/output and per module,
- special features.

ID code/ length code

Each INTERBUS device has its own ID code (identification code) to enable it to be identified by the controller board.

The ID code signals the device type. In the tables, it is given in decimal and hexadecimal representation.

The length code signals the number and representation type of the process data (bit, nibble, byte, word). In the tables, it is given in decimal and hexadecimal representation.

From the ID and length codes, the controller board generates a bus image that is referred to during operation for address assignment the I/O data and for fault identification.

IN address

Number of bytes in the input address range required by the module.

The input address range is a range where the INTERBUS devices file data or the control.

OUT address

Number of bytes in the output address range required by the module.

The output address range is a range where the control files the data to be transmitted to the INTERBUS devices

PCP

Size of the parameter channel.

The parameter channel is a channel for transmission of device parameters, data ranges, and services to these data ranges (functions).

Reg length

Number of bytes in the INTERBUS ring (register length) for calculating the cycle time.

The register length gives the number of bytes occupied by a device in the INTERBUS ring. This information is required to calculate the cycle time.

Fault message

This column contains the fault and diagnosis messages generated by the terminal.

Weight

The weight of the terminal without connector is given.

Current input at U_L , U_M , U_S , U_{ANA}

Here, the current input from the voltage jumpers of the RECO Inline station is listed.

Legend on the following tables:

Short description

IN:	Number of inputs
CNT IN:	Number of counter inputs
TC IN:	Number of input ports for thermal elements
OUT:	Number of outputs
x-Lt:	x-wire technology

Fault message

D	Signals wire breakage
D	Signals wire breakage at the input channel, only at 4 mA to 20 mA
D	Signals wire breakage in TC operation
S:	Signals fuse defect
K:	Signals short-circuit of one output
Ü:	Signals overload of one output
P:	Signals failure of the peripheral supply voltage
L:	Signals failure of range underflow of the logic voltage supply U_L
P:	Signals failure of the internal supply voltage
T:	Signals overheating of the module
M:	Signals module failure

R-IL List of Devices

Art. description	Article no.	Short description	ID code dec/hex	Length code dec/hex	IN addr.	OUT addr.	PCP	Reg . length
Bus terminal								
R-IBS IL 24 BK-T	289280	24 V	08/04 12/0C	00/00	0	0	0	0
Supply voltage (no device!)								
R-IB IL 24 PWR IN	289312	24 V	–	–	–	–	–	–
R-IB IL 24 SEG/F	289313	24 V; fuse	–	–	–	–	–	–
Ditigal inputs								
R-IB IL 24 DI 2	289286	24 V; 2 IN, 4-Lt	190/BE	194/C2	2 bit	0 bit	0 bit	2 bit
R-IB IL 24 DI 4	289287	24 V; 4 IN, 3-Lt	190/BE	65/41	4 bit	0 bit	0 bit	4 bit
R-IB IL 24 DI 8	289288	24 V; 8 IN, 4-Lt	190/BE	129/81	1 byte	0 byte	0 byte	1 byte
R-IB IL 24 DI 16	289290	24 V; 16 IN, 3-Lt	190/BE	01/01	2 byte	0 byte	0 byte	2 byte
Digital outputs								
R-IB IL 24 DO 2-2A	289294	24 V; 2 OUT, 4-Lt	189/BD	194/C2	0 bit	2 bit	0 bit	2 bit
R-IB IL 24 DO 4	289295	24 V; 4 OUT, 3-Lt	189/BD	65/41	0 bit	4 bit	0 bit	4 bit
R-IB IL 24 DO 8	289297	24 V; 8 OUT, 4-Lt	189/BD	129/81	0 byte	1 byte	0 byte	1 byte
R-IB IL 24 DO 16	289299	24 V; 16 OUT, 3-Lt	189/BD	01/01	0 byte	2 byte	0 byte	2 byte
Analog inputs								
R-IB IL AI 2/SF	289306	24 V; 2 IN, 2-Lt, 3-Lt 0 mA to 20mA, ±20mA, 4 mA to 20mA 0 V to 10 V, ±10 V	127/7F	02/02	4 byte	4 byte	0 byte	4 byte
R-IB IL TEMP 2 RTD	289305	24 V; 2 TC IN, 2-Lt, 3-Lt, 4-Lt	127/7F	02/02	4 byte	4 byte	0 byte	4 byte
Analog outputs								
R-IB IL AO 1/SF	289303	24 V; 1 OUT, 2-Lt 0 mA to 20mA, 4 mA to 20mA, 0 V to 10 V	125/7D	01/01	0 byte	2 byte	0 byte	2 byte
R-IB IL AO 1/U/BP	289381	24 V; 2 OUT, 2-Lt, 0 V to 10 V, ±10 V	91/5B	02/02	4 byte	4 byte	0 byte	4 byte

Fig. 9-1: IL list of devices (part 1)

Art. description	Article no.	Fault message	Weight	Current intake at			
				U_L	U_{ANA}	U_S channel/module	U_M
Bus terminal							
R-IBS IL 24 BK-T	289280	P (U S)	142 g	–	–	–	–
Supply voltage (no device!)							
R-IB IL 24 PWR IN	289312	–	44 g	–	–	–	–
R-IB IL 24 SEG/F	289313	–	44 g	–	–	–	–
Digital inputs							
R-IB IL 24 DI 2	289286	–	38 g	35 mA	–	250 mA/500 mA	–
R-IB IL 24 DI 4	289287	–	44 g	40 mA	–	250 mA/ 1 A	–
R-IB IL 24 DI 8	289288	–	118 g	50 mA	–	250 mA/ 2 A	–
R-IB IL 24 DI 16	289290	–	122 g	60 mA	–	250 mA/ 4 A	–
Digital outputs							
R-IB IL 24 DO 2-2A	289294	K / Ü	46 g	35 mA	–	2 A/4 A	–
R-IB IL 24 DO 4	289295	K / Ü	40 g	40 mA	–	500 mA/ 2 A	–
R-IB IL 24 DO 8	289297	K / Ü	130 g	60 mA	–	500 mA/ 4 A	–
R-IB IL 24 DO 16	289299	K / Ü	126 g	90 mA	–	500 mA/ 8 A	–
Analog inputs							
R-IB IL AI 2/SF	289306	P*	46 g	38 mA	15 mA	–	–
R-IB IL TEMP 2 RTD	289305	D**	46 g	33 mA	11 mA	–	–
Analog outputs							
R-IB IL AO 1/SF	289303	L	90 g	35 mA	25 mA	–	–
R-IB IL AO 1/U/BP	289381	L/M	48 g	33 mA	25 mA	–	–

Fig. 9-2: IL list of devices (part 2)

10 Examples and Tips

10.1 Examples for Project Planning

In Fig. 10-1 the realization of a part of a diagram by means of RECO Inline terminals is illustrated.

In Fig. 10-1 the realization of a circuit arrangement with four fused outputs is illustrated.

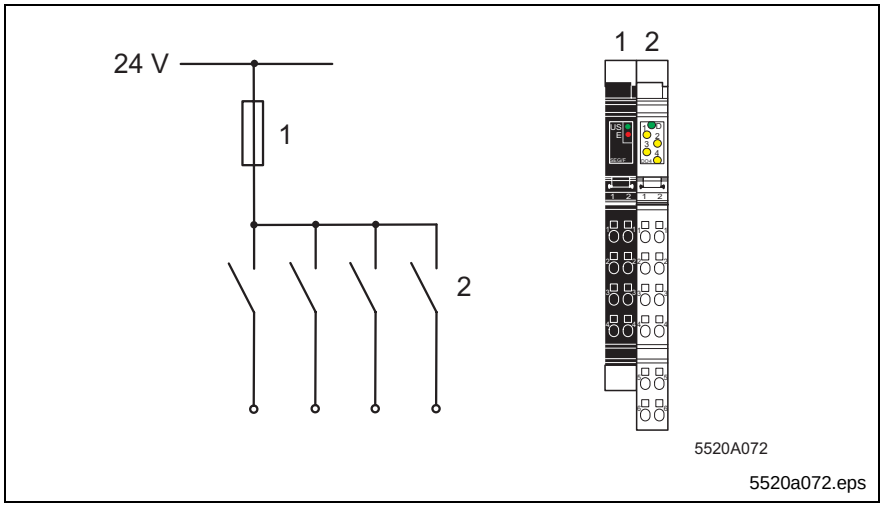


Fig. 10-1: Circuit arrangement with four fused outputs

The fuse in the diagram (1) is realized by means of a fused segment terminal (1; e.g. R-IB IL 24 SEG/F).

The four digital outputs (2) are realized by means of an output terminal with four connections (2; e.g. R-IB IL 24 DO 4).

10.2 Examples for Calculation of Power Losses and Operating Points

Constant power loss of the housing over the total operation temperature range

The calculation is explained by way of the example of the module IB IL 24 DO 8.

Formula for the calculation of electronics power loss

This formula is specific for each module and is to be found in each respective data sheet.

$$P_{EL} = 0{,}2W + \sum_{n=0}^{8} 0{,}15W + I_{LN}^{2}\, x 0{,}4\Omega$$

Fig. 10-2: Power loss P_{EL} (formula 1)

It signifies

P_{EL} Total power loss in the subassembly

n Index on the number of outputs set n = 0 to 8

I_{Ln} Load current of output n

Example: The load currents of the outputs amount to:

I_{L1} = 0,5 A; I_{L2} = 0,4 A; I_{L3} = 0,2 A; I_{L4}= 0,5 A; I_{L5} = 0,3 A; I_{L6} = 0,4 A

The outputs 7 and 8 are not assigned (I_{L7} = I_{L8} = 0 A).

Electronics power loss According to the formula, the following electronics loss results from this specific configuration:

P_{EL} = 0,20 W + [0,15 W + (0,5 A)^2 x 0,4 Ω]
+ [0,15 W + (0,4 A)^2 x 0,4 Ω]
+ [0,15 W + (0,2 A)^2 x 0,4 Ω]
+ [0,15 W + (0.5 A)^2 x 0,4 Ω]
+ [0, 15 W + (0,3 A)^2 x 0,4 Ω]
+ [0, 15 W + (0,4 A)^2 x 0,4 Ω]
+ [0, 15 W + (0,0 A)^2 x 0,4 Ω]
+ [0, 15 W + (0,0 A)^2 x 0,4 Ω]

P_{EL} = 0,20 W + 0,250 W + 0,214 W + 0,166 W + 0,250 W
+ 0,186 W + 0,214 W + 0,150 W + 0,150 W

P_{EL} = 1,78 W

Housing power loss For the figure for the housing power loss, please refer to the specific data sheet for the respective module.

The housing power loss for the above named module is 2.2 W within the operating temperature range of -25 °C to +55 °C.

Thus, the calculated electronics power loss remains below the admissible maximum.

Maximum load. Even with the maximum admissible load current (0.5 A per channel), the maximum of 2.2 W within the admissible temperature range of -25 °C to +55 °C is not exceeded.

P_{EL} = 0,20 W + 8 x [0,15 W + (0,5 A)^2 x 0,4 Ω]

P_{EL} = 2.2 W

Housing power loss within the operating temperature range depending on the ambient temperature

The calculation is explained by way of the example of the module IB IL 24 DO 8.

Formula for the calculation of electronics power loss

This formula is specific for each module and is to be found in each respective data sheet.

$$P_{EL} = 0{,}18W + \sum_{n=0}^{2} 200mW + I_{LN}^{2} x 0{,}1\Omega$$

Fig. 10-3: Power loss P_{EL} (formula 2)

It signifies

P_{EL} Total power loss in the subassembly

n Index on the number of outputs set n = 0 to 2

I_{Ln} Load current of output n

Example: Both outputs are activated and under full load. The load currents of the outputs are $I_{L1} = I_{L2} = 2$ A.

Electronics power loss According to the formula, the following electronics loss results from this specific configuration:

$P_{EL} = 0{,}18$ W + 2 x [0,20 W + $(2\text{ A})^2$ x 0,1Ω)]

$P_{EL} = 0{,}18$ W + 2 x 0,6 W

$P_{EL} = 0{,}18$ W + 1,2 W$P_{EL} = 1{,}38$ W

Housing power loss For the figure for the housing power loss, please refer to the specific data sheet for the respective module.

The admissible housing power loss for the terminal IB IL 24 DO 2-2A is temperature-dependent.

$P_{GEH} = 2{,}4$ W -25 °C < $T_U \leq$ -5 °C

$P_{GEH} = 2{,}4$ W - [(T_U - (-5 °C)) / 37,5 K/W] -5 °C < $T_U \leq$ 55 °C

It signifies

P_{GEH} Housing power loss

T_U Ambient temperature

With an ambient temperature of a maximum of -5 °C, both outputs can be loaded with 2 A, as $P_{EL} > P_{GEH}$

Admissibility of an operating point

With a higher ambient temperature, you must calculate the admissibility of the operating point for the calculated power loss.

For this purpose, take $P_{EL} = P_{GEH}$.

$P_{GEH} = 2,4\ W - [(T_U + 5\ °C) / 37,5\ K/W]$

After conversion of the equation, the maximum admissible ambient temperature at this load is as follows:

$T_U = (2,4\ W - P_{EL}) \times 37,5\ K/W - 5\ °C$

$P_{EL} = 1,38\ W$ (from the calculation of the electronics power loss)

$T_U = (2,4\ W - 1,38\ W) \times 37,5\ K/W - 5\ °C$

$T_U = 1,02\ W \times 37,5\ K/W - 5\ °C$

$T_U = 33,25\ °C$

With both outputs at full load, you can operate this terminal at an ambient temperature of a maximum of 33 °C.

If you never operate both outputs simultaneously, and if one output in set state uses a current of 2 A, you will be able to operate at the following maximum ambient temperature:

$P_{EL} = 0,18\ W + 1 \times [0,20\ W + (2\ A)^2 \times 0,1\Omega)]$

$P_{EL} = 0,18\ W + 0.60\ W$

$P_{EL} = 0.78\ W$

$T_U = (2,4\ W - P_{EL}) \times 37,5\ K/W - 5\ °C$

$P_{EL} = 0.78\ W$ (from the calculation of the electronics power loss)

$T_U = (2,4\ W - 0.78\ W) \times 37,5\ K/W - 5\ °C$

$T_U = 1.62\ W \times 37,5\ K/W - 5\ °C$

$T_U = 55.75\ °C$

$T_U = 55\ °C$ (maximum admissible ambient temperature)

As the maximum admissible ambient temperature is 55°C, you can operate in the whole admissible temperature range if the conditions are as mentioned above. This results in the concurrence of 50 % at 55 °C listed in the data sheet.

10.3 Tips for Working with RECO Inline

Planning and design of a station

To plan and design an RECO Inline station, you must observe the limiting parameter of a RECO Inline station in addition to the INTERBUS system parameters. These limiting parameters are as follows:

- A maximum of 63 devices
- A maximum current intake at U_L = 2 A
- A maximum current intake at U_{ANA} = 0.5 A
- Maximum current intake at U_S and U_M (total current) = 8 A

You can plan and design the station according to the list of devices (Chapter “List of devices of a RECO Inline station”, Fig. 9.1-9.2).

Diagnosis of a power failures

There are the following ways to diagnose a power failure in a segment within a RECO Inline station:

At present, only passive RECO Inline power and segment terminals are available. With these terminals, a power failure cannot be diagnosed via the bus. With terminals with integrated fuse, the fault is signaled by means of a red LED locally at the respective terminal. To consider the power failure under aspects of control engineering, it is recommended to monitor the segment voltage through a digital input (wiring in a DI module).

Sequence of the RECO Inline Terminals

It is advisable to design the sequence of terminals within a RECO Inline station depending on the current intake of the peripheral equipment from the voltage jumpers U_M and U_S.

As the voltage is fed anew into the voltage jumpers U_M and U_S at each power terminal, you must always consider the section (main circuit) between bus terminal and power terminal or between power terminal and power terminal for the current calculation. If you do not use any power terminal, the station as a whole is one main circuit.

Within a main circuit, first locate the terminals with the highest current intake. Thus, the high supply current advantageously does not flow through all the main circuit.

This results in the following sequence:

1. Digital output terminal with 8-slot housing
2. Digital output terminal with 2-slot housing
3. Digital input terminal with 8-slot housing
4. Digital input terminal with 2-slot housing
5. Function modules in any sequence:
6. Analog terminals in any sequence

Note: For the current intake of the terminals, please refer to Chapter 9, “List of Devices of a RECO Inline Station”.

A high current through the voltage jumpers U_M and U_S results in heating of the voltage jumpers, and thus in an increase of the temperature inside the terminals.

For the function of the terminal R-IB IL TEMP 2/RTH. the location at the end of the main circuit has the advantage that the temperature of the internal reference junction is not falsified by heating.

You achieve the lowest current through the voltage jumpers when you set up an independent main circuit for the analog terminals.

Remote bus branch in a RECO Inline station

For the integration of a remote bus branch into a RECO Inline station, please take note that the terminal with the remote bus branch must be located directly behind a bus terminal with remote bus branch. A maximum of 15 terminals with remote bus branch may be located directly behind one another.

Controller board G4

The INTERBUS installation system must be operated under an controller board with a firmware status of version 4.40 as a minimum requirement. That is to say that you will have to use a generation 4 controller board that can be operated with this firmware status.

Fig. 10-4: Controller boards G4

Safe grounding

Ground the bus terminal through the FE connection to make sure the RECO Inline station is reliably grounded.

For this purpose, connect the terminal points for the FE connection with an earthed PE terminal.

11 Glossary

1-wire connection Connection method for I/O modules with one connection per I/O port. This conductor transmits the signal. The I/O module and the sensor or actuator must have a common potential.

2-wire connection Connection method for I/O modules with two connections per I/O port. One conductor transmits the signal, the other one the common potential.

3-wire connection Connection method for I/O modules with three connections per I/O port. One conductor transmits the signal, the second the common potential, and the third another common potential (e.g. shield or ground).

4-wire connection Connection method for I/O modules with four connections per I/O port. One conductor transmits the signal, another one the common potential; the third and fourth conductor are provided for connecting shield and ground.

Actuator An actuator is a device which can change the behavior of a process, thus causing a change in the process variables. Actuators are, for example, lamps, relays, etc.

Address The address defines a certain memory location. When the memory location is accessed, data can be written on or read from this location.

Analog input An analog input is an input for receiving analog signals.

Analog output An analog output is an output that makes analog signals available.

Automatic addressing Automatic addressing is the assignment of process data (of devices) to the memory area of a control or computer system. With this addressing, the process data is automatically assigned to the memory according to the physical location of the devices in the bus.

When new devices are added later, the process data have to be assigned again.

Automation terminal Automation terminals are all modules of a RECO Inline system with its different functions.

BK → Bus terminal

Branch A branch is a sub-ring system branching off the remote bus. A branch is connected to the remote bus using a special bus terminal module. The bus terminal module allows to disconnect the branch.

Branch bus terminal for branching off a remote bus branch → Terminal with remote bus branch

Branching interface The INTERBUS interface of a device through which the data leave the device on the same device level (display: OUT1).

Bus diagnosis → Diagnosis

Bus segment A bus segment consists of a remote bus device including the I/O modules connected to it. The cable before it is part of the segment.

Bus terminal 1.

To set up a modular I/O station, a bus terminal is first connected to the remote bus. The decentralized local bus (or installation local bus) with the I/O modules branches off the remote bus. Via an additional interface, a remote bus branch can be connected as well. A bus terminal amplifies the signal (repeater function), divides the system into segments and permits individual branches to be disconnected during operation.

Additionally, it supplies logic voltage to the module electronics of the connected I/O modules.

2.

The bus terminal connects the RECO Inline station to the INTERBUS remote bus. It realizes the bus signal matching and the voltage supply of the connected RECO Inline terminals.

Components Devices, units, application programs which are part of an automated system.

Connector The connector is latched onto the electronic socket of the RECO Inline terminal. For instance, the connector can be used to connect the voltage supply equipment or the peripheral equipment.

Controller board The controller board connects programmable controllers (PLC) with the sensor/actuator bus INTERBUS. In the INTERBUS system, it holds the function of a master .

It controls data traffic in the INTERBUS, independent of the control or computer system in which it is installed.

Cycle error → Single error

Cycle time The cycle time is the time required by the INTERBUS system to read all data from the connected devices and to write data to all connected devices.

Data jumper Contact for → data routing.

Data routing Within a station, the INTERBUS signal is transmitted via a connection which is created automatically when the RECO Inline terminals are latched on.

Device General term for all the devices with different functions and application purposes which are involved in data exchange in the INTERBUS system (controller boards, interface boards, bus terminals, input/output modules in various housing types, process controllers, drive controllers, valve manifolds, shaft-angle encoders, identification systems, operating and display devices, etc). Each device has exactly one protocol chip. The devices are characterized by the device code. Some modules contain several devices (e.g. the module R-IBS ST 24 BK RB-T).

Device code The device code is a data word for labeling the characteristics of an INTERBUS device. It consists of the length code (more significant byte) and the ID code (least significant byte).

Device number With the INTERBUS, there are logic and physical device numbers (See device number, logic, and device number, physical).

Device number, logical Each INTERBUS device of a configuration frame is assigned a unique logic device number. This device number is given in the form of “Segment.Position” (Seg.Pos.). The logical device number 0.0 is reserved for the controller board. The numbers “1.0” to “254.254” can be assigned. Each remote bus device receives the position number 0. Each local bus device has the segment number of the assigned remote bus device.

Device number, physical The physical device number specifies the sequence of the devices determined by the physical setup of the bus system. It is assigned in ascending order without any gaps from 1 to 512.

Diagnosis The diagnosis provides information on the status of the bus, as e.g. the number of bus cycles or the number, location and type of errors potentially occurred.

Electrical isolation Electrical isolation means that the circuits of an electrical device are galvanically separated from each other.

End clamp In a RECO Inline station, the end clamps are placed on the mounting rail on the left-hand side of the bus terminal and behind the last module to prevent the modules from slipping out of place.

End plate The mechanical end plate terminates a RECO Inline station. It has no electrical function. It protects the station against ESD pulses and the user from dangerous contact voltages. The end plate is supplied together with the bus terminal and does not have to be ordered separately.

FE → Functional earth ground

Full duplex Simultaneous sending and receiving of data

Function terminal With RECO Inline, various function terminals are available, among other purposes for counting.

Function module A function module is a module with special functions (e.g. counter module).

Functional earth ground A low-impedance current path between electric circuits and ground, which is not intended as a safety measure but, for instance, to improve the noise immunity.

Host The control or computer system into which the controller board is integrated is described as ‘host’.

ID code Each INTERBUS device has its own ID code (identification code) so that it can be identified by the controller board. The ID code specifies the device type. It indicates whether it is an analog or digital module or a bus terminal, whether it is an input or output module, or a PCP device. It uses the low-order byte of the device code.

Ident-Code → ID code

Identification code → ID code

IN data → Input data

INTERBUS The INTERBUS is a fieldbus standardized according to EN 50254 (Volume 2) for the serial transmission of data from the sensor/actuator area.

INTERBUS device → Device

Input Connection contact of a circuit or a unit, to which a signal can be applied with the purpose to process, amplify, or store this signal or to link it to other signals.

“Lexikon der Elektronik” (Electronics Dictionary) by Vieweg

Input address area The input address area is an area where the INTERBUS devices file their data for the control system.

Input data Input data is data transported to the application program by an INTERBUS device.

Input/output module The I/O modules are the connection between the INTERBUS and the sensors and/or actuators.

Input/output terminal Analog and digital input and output terminals are available for a RECO Inline station. These modules constitute the connection between the INTERBUS and the sensors and/or actuators.

Input process data IN-PD data which is transported by a device to an application program represent input process data for this application program.

Installation manual The installation manual serves as a guideline for the technical/installation specialist to install an INTERBUS system. It contains basic information for the mounting and installation of the INTERBUS components. Furthermore, it includes notes on wiring.

Installation remote bus The installation remote bus is a variant of the remote bus. Besides the cores for the data transfer, the installation remote bus incorporates the supply voltage for the module electronic system of the connected I/O modules and the sensors. The voltage is bedded in via a bus terminal. Topologically, the installation remote bus is a remote bus branch suitable for setting up widely spread substations. Sensors and actuators can also be connected directly to these substations (See also extendend installation remote bus).

I/O terminal → Input/output terminal

Length code The length code represents the number and representation type of the process data (bit, nibble, byte, word). It uses the high order byte of the device code.

Local bus The local bus interconnects the local bus devices and connects them to a bus terminal. It branches off the remote bus via a bus terminal. A local bus is part of the segment of its bus terminal. Within one local bus, no branches are permitted. The RECO Inline local bus connects the RECO Inline terminals.

Local bus branch terminal → Branch terminal

Local bus devices Local bus devices are I/O devices for the setup of a decentralized sub-station in the switch cabinet. The devices are connected to the remote bus via a bus terminal.

Local bus error A local bus error is a bus error occurring within a local bus.

Logic circuit The logic circuit is used to supply all terminals connected with the logic voltage (U_L +, U_L –). This circuit starts at a RECO Inline bus terminal or at a control terminal and is routed through all the terminals of a RECO Inline station.

Logic addressing → User-defined addressing

Main circuit The main circuit supplies the terminals of the RECO Inline station with the main voltage (U_M , main circuit). The main circuit starts at the bus terminal or a power terminal and is led through the next power terminal. It supplies e.g. all terminals that do not have to be isolated from the peripheral voltage in case of emergency stop (e.g. digital input terminal with extended function).

Master A master is a central device that controls the access to the bus. All other devices operate as slaves.

Master-slave method Access method during the exchange of data: There is only one central station, the master, which controls the access to the bus. All other stations (slaves) only transmit a message upon request of the master.

Network A network is a communication link for the connection of devices. The link runs via a protocol that can be read by all devices.

Output address area The output address area is a area where the control system files the data to be transmitted to the INTERBUS devices.

Output data Output data is data which is transmitted to the INTERBUS devices by the INTERBUS controller board.

Output process data OUT-PD data which is sent by an application program to a device represent output process data for this application program.

PD → Process data

Peripheral bus error → Local bus error

Peripheral connector → Connector

Peripheral equipment connector → Connector

Peripheral fault PF

The message PF signals a fault of the peripheral equipment of an INTERBUS device.

Peripherals Communication Protocol → PCP

PF → Peripheral fault

Physical addressing → Automatic addressing

Position The position is a logical number that uniquely defines a device within a local bus.

Position number The position number is the low-order byte of the logical device number (See also Device number, logical).

Power terminal The power terminal is a supply terminal. A power terminal is used to supply the main voltage to the station-internal voltage jumper. In addition to the main voltage, the segment voltage can be supplied or tapped from the main voltage.

Several power terminals can be used within one station.

In this way, the electrical isolation between different electric circuits and the setup of areas with different voltages within the station (e.g. 24 V DC and 230 V AC) are realized.

Power level terminal → Power terminal

Process data Process data is input and output information send to and from INTERBUS devices. Process data changes continually an must be continuously updated. They must be transmitted quickly and in regular intervals via the process data channel (also see parameter data).

Process data channel Via the process data channel, data is transmitted in unacknowledged condition and in regular intervals (equidistant). The direction of the process data is regarded as from the host system to the bus, that is to say:

- output process data is data that the host system writes into the process data channel.
- Input process data is data which the host system reads out of the process data channel.

Process input data → Input process data

Process output data → Output process data

Projecting manual The projecting manual supports the user in the selection of components and the projecting of the INTERBUS system.

Protocol The protocol is a set of conventions. It defines data formats and control procedures for the communication between devices or processes.

RECO Inline The terminals of the RECO Inline product family constitute a modular automation system that is integrated into the INTERBUS system. With the RECO Inline automation terminals, functional units can be set up by tool-free butt-mounting corresponding to the respective automation tasks. RECO Inline can be utilized in the central switch cabinet as well as in the decentralized switchbox.

RECO Inline bus terminal → Bus terminal

Remote bus The remote bus interconnects remote bus devices and connects them to the controller board.

Remote bus branch A remote bus branch is started with a special bus terminal which, apart from the standard interfaces, has a remote bus interface. A remote bus branch can have additional branches. Up to 16 bus levels (branches) are permitted.

Remote bus cable A remote bus cable connects two remote bus devices. The cables consist of copper (twisted pair).

Remote bus devices Remote bus devices are INTERBUS devices with remote bus interface. This includes bus terminals, certain I/O modules, or a combination of both, as well as devices from third-party manufacturers, as e.g. frequency converters. Remote bus devices always have an external voltage supply.

Ring structure The ring structure is a network topology in which the cable forms a closed ring. All devices are coupled to the bus system within this ring. Forward and return lines can be routed within one cable so that the ring structure physically corresponds to a tree structure.

Segment → Bus segment

Segment circuit The segment circuit or auxiliary circuit supplies the terminals of the RECO Inline station with the segment voltage (U_S). The segment circuit starts at the bus terminal or at a supply terminal (power terminal or segment terminal) and is routed through all terminals to the next supply terminal. It is used to set up separate circuits within a RECO Inline station and to realize e.g. an emergency stop concept.

Segment number The segment number is the high-order byte of the logical device number (Also see Device number, logical)

Segment terminal The segment terminal is a supply terminal and enables the setup of a partial circuit (segment circuit).

Sensor A sensor is a device acquiring the physical quantities of a processor. The sensor determines the process variables.

Sensor/actuator box A product family with the protection class IP 67 that can be used without switch cabinet. The sensors and actuators are connected with M12 circular connectors to this modules.

Serial data transmission Serial data transmission is a transfer method where the bits are transmitted one after the other in one line.

Single error An error (e.g. a CRC error) occurring within a bus cycle.

It causes a complete rejection of the data of the respective cycle. An individual error does not generate an error message and does not cause a bus downtime.

Summation frame The summation frame is a transmission protocol in which all physical INTERBUS devices are treated as one single logical device. All process data is taken over simultaneously from all devices in one cycle and transferred to all devices. Depending on the location of the information in the summation frame, each INTERBUS device can accept the data determined for it.

Supply terminal Supply terminals in a RECO Inline system are power terminals and segment terminals.

Supply voltage A specific value, to be specified in volts.

System coupler The system coupler hierarchically connects two INTERBUS systems. It acts as a device (slave) for the higher-level system and as an controller board (master) for the lower-level system.

Terminal with remote bus branch This terminal can only be latched directly after a RECO Inline bus terminal. Via this terminal, a remote bus branch can be branched off from the RECO Inline station. It can also be used to connect remote devices, e.g. displays and keypads, motor starters in protection class IP 65 or sensor/actuator boxes.

Transmission time The transmission time is the time interval between the start of data transmission by a functional unit and the end of this data transmission when another functional unit received the data.

User-defined addressing

User-defined addressing is an assignment of process data (of devices) to the memory areas of a control or computer system. With this addressing, the process data is (almost) freely assigned to the memory by the user. The assignment is independent of the physical location of the devices in the bus.

Thus, additional devices can be integrated into the bus at a later date without changing the assignment of the process data in the process picture of the control or computer system.

Voltage routing

Within the RECO Inline station, the potentials are transmitted via a connection which is automatically established when the terminals are latched.

Voltage supply

All components used to generate and transfer the supply voltage.

Word module

All devices with an even byte number are regarded as word modules.

12 Explanation of Abbreviations and Symbols

12.1 Explanation of abbreviations

Ground Ground, general symbol

FE Functional earth ground

Noiseless ground

This ground is noiseless and is used to ground cable shields and to suppress noise and noise voltages. The functional earth ground is a low-impedance current path between electric circuits and ground, which is not intended as a safety measure but, for instance, to improve the noise immunity (EN 61131).

This ground connection must be isolated from parts with a dangerous voltage by double and reinforced insulation (EN 60950).

PE Protective earth ground

This ground is used to ground devices. In addition, it is provided as a protection against electric shock for persons.

The protective earth ground is a low-impedance current path which, in case of an error, reduces the user's risk (EN 61131).

GND 0 V ground; chassis

In this manual, the term "ground" refers to common return lines of voltages. The ground is galvanically isolated from FE and PE. This isolation is removed if a jumper was applied across ground and FE or PE.

Different additions to GND (e.g. F-GND, BK-GND, ...) indicate separated potentials.

U_{BK} Bus terminal supply

The supply voltage U_{BK} supplies the power supply unit of the bus terminal. In the power supply unit, logic voltage U_L and analog voltage U_{ANA} are generated from the voltage U_{BK}.

U_M Main supply voltage (peripheral equipment supply in the main circuit)

The voltage U_M is provided for the supply of all devices connected to the main circuit.

All digital initiators (sensors) with their own short-circuit protection as well as those initiators which need not be protected are supplied from the main circuit.

The voltage U_M is fed in at the RECO Inline fieldbus coupler or at a power terminal, from where it is supplied to the next power terminal via the voltage jumpers.

U_S Segment supply voltage (peripheral equipment supply in the segment circuit)

The voltage U_S is provided for the supply of all devices connected to the segment circuit.

The segment circuit supplies sensors without their own short-circuit protection and all digital actuators.

The voltage U_S is fed in via a bus terminal or generated from the main supply U_M at the bus terminal, the power terminal or the segment terminal.

U_{ANA} Peripheral equipment supply voltage for analog terminals

The voltage U_{ANA} is provided to supply all modules for analog signals.

It is generated at the bus terminal and is supplied via the voltage jumper through the RECO Inline station.

U_L Logic supply voltage

The voltage U_L is provided to supply all devices with logic voltage (supply of the module electronics).

It is generated in the bus terminal and is supplied via the voltage jumper through the RECO Inline station.

P_{EL} Power loss of the electronics

P_{HOU} Power loss of the housing

12.2 Representations used in block diagrams

U_L This designation stands for the following voltage jumpers:

- Logic voltage U_{L+}
- Grounded logic voltage U_{L-}
- Supply voltage for analog terminals U_{ANA}

U_S Segment voltage + 24 V

U_M Main voltage + 24 V

12.3 Frequently used symbols

Ground, frame, equipotential

Ground, general symbol

Low-noise earth, functional earth ground (FE)

Protection earth (PE)

Ground, chassis (GND)

Ground
in block diagrams The different symbols refer to the electrical isolations.

Shield
in block diagrams The different symbols refer to the electrical isolations.

Inputs, outputs, and other connections

Analog input

Analog output

Digital input

Digital output

Voltage or data jumpers with lateral jumper contacts

Terminal connection

Line(s); x gives the number of lines

Ideal circuits

Ideal power source

Ideal voltage source

Resistors, capacitors, inductances

Resistor, general symbol

Capacitor, general symbol

Semiconductor

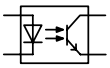
Semiconductor diode, general symbol

Light-emitting diode, general symbol (LED); in block diagrams LED; diagnostic and status display on the terminals

PNP transistor

Miscellaneous

Protocol chip (bus logic including voltage treatment



Optocoupler

Converter, general symbol

Analog-digital converter

Digital-analog converter

Coupler with electrical isolation
power supply unit with DC de-coupling (general symbol)

Coupling interface

Amplifier

Isolated area

Fuse

13 List of Figures

14 Index

C

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T

U

V

W

X

15 Service & Support

15.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

- telefonisch: **+49 (0) 9352 40 50 60**
  über Service Call Entry Center Mo-Fr 07:00-18:00
- per Fax: **+49 (0) 9352 40 49 41**
- per e-Mail: **service@indramat.de**

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

- by phone: **+49 (0) 9352 40 50 60**
  via Service Call Entry Center Mo-Fr 7:00 am - 6:00 pm
- by fax: **+49 (0) 9352 40 49 41**
- by e-mail: **service@indramat.de**

15.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

+49 (0) 171 333 88 26
oder **+49 (0) 172 660 04 06**

After helpdesk hours, contact our service department directly at

+49 (0) 171 333 88 26
or **+49 (0) 172 660 04 06**

15.3 Internet

Weitere Hinweise zu Service, Reparatur und Training finden Sie unter **www.indramat.de**, sowie die **aktuellen** Adressen unserer Service- und Vertriebsbüros – die Angaben in dieser gedruckten Dokumentation können inzwischen überholt sein.

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit Ihrem lokalen Ansprechpartner auf.

- Verkaufsniederlassungen
- Niederlassungen mit Kundendienst

Additional notes about service, repairs and training are available on the Internet at **www.indramat.de** and also the **actual** addresses of our sales- and service facilities – the information in this printed documentation may meanwhile be obsolete.

Please contact the sales & service offices in your area first.

- sales agencies
- offices providing service

15.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

1. detaillierte Beschreibung der Störung und der Umstände.
2. Angaben auf dem Typenschild der betreffenden Produkte, insbesondere Typenschlüssel und Seriennummern.
3. Tel.-/Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

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

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

15.5 Kundenbetreuungsstellen - Sales & Service Facilities

Deutschland – Germany

vom Ausland: (0) nach Landeskennziffer weglassen!
from abroad: don't dial (0) after country code!

Vertriebsgebiet Mitte Germany Centre	**SERVICE** **CALL ENTRY CENTER** **MO – FR** **von 07:00 - 18:00 Uhr** **from 7 am – 6 pm**	**SERVICE** **HOTLINE** **MO – FR** **von 17:00 - 07:00 Uhr** **from 5 pm - 7 am** + SA / SO	**SERVICE** **ERSATZTEILE / SPARES** verlängerte Ansprechzeit - extended office time - ♦ nur an Werktagen - only on working days - ♦ von 07:00 - 18:00 Uhr - from 7 am - 6 pm -
Rexroth Indramat GmbH Bgm.-Dr.-Nebel-Str. 2 97816 Lohr am Main **Kompetenz-Zentrum Europa** Tel.: +49 (0)9352 40-0 Fax: +49 (0)9352 40-4885	**Tel. +49 (0) 9352 40 50 60** service@indramat.de	**Tel.: +49 (0)172 660 04 06** **oder / or** **Tel.: +49 (0)171 333 88 26**	**Tel. +49 (0) 9352 40 42 22**
Vertriebsgebiet Süd Germany South	Gebiet Südwest Germany South-West	Vertriebsgebiet Ost Germany East	Vertriebsgebiet Nord Germany North
Rexroth Indramat GmbH Landshuter Allee 8-10 80637 München Tel.: +49 (0)89 127 14-0 Fax: +49 (0)89 127 14-490 indramat.mue@t-online.de	Mannesmann Rexroth AG Vertrieb Deutschland – VD-BI Geschäftsbereich Rexroth Indramat Regionalzentrum Südwest Ringstrasse 70 / Postfach 1144 70736 Fellbach / 70701 Fellbach Tel.: +49 (0)711 57 61–100 Fax: +49 (0)711 57 61–125	Rexroth Indramat GmbH Beckerstraße 31 09120 Chemnitz Tel.: +49 (0)371 35 55-0 Fax: +49 (0)371 35 55-333	Mannesmann Rexroth AG Regionalzentrum Hannover Gesch.ber. Rexroth Indramat Walsroder Str. 93 30853 Langenhagen Tel.: +49 (0) 511 72 66 57-0 Fax: +49 (0) 511 72 66 57-95
Vertriebsgebiet West Germany West	Vertriebsgebiet Mitte Germany Centre	Vertriebsgebiet Ost Germany East	Vertriebsgebiet Nord Germany North
Mannesmann Rexroth AG Vertrieb Deutschland Regionalzentrum West Borsigstrasse 15 40880 Ratingen Tel.: +49 (0)2102 409-0 Fax: +49 (0)2102 409-406	Mannesmann Rexroth AG Gesch.ber. Rexroth Indramat Lilistraße 14-18 63067 Offenbach Tel.: +49 (0) 69 82 00 90-0 Fax: +49 (0) 69 82 00 90-80	Mannesmann Rexroth AG GB Rexroth Indramat GmbH Holzhäuser Str. 122 04299 Leipzig Tel.: +49 (0)341 86 77-0 Fax: +49 (0)341 86 77-219	Rexroth Indramat GmbH Kieler Straße 212 22525 Hamburg Tel.: +49 (0) 40 81 955 966 Fax: +49 (0) 40 85 418 978

Europa (West) - Europe (West)

vom Ausland: (0) nach Landeskennziffer weglassen, Italien: 0 nach Landeskennziffer mitwählen
from abroad: don't dial (0) after country code, Italy: dial 0 after country code

Austria - Österreich	Austria – Österreich	Belgium - Belgien	Denmark - Dänemark
Mannesmann Rexroth GmbH Bereich Indramat Stachegasse 13 1120 Wien Tel.: +43 (0)1 985 25 40 Fax: +43 (0)1 985 25 40-93	Mannesmann Rexroth G.m.b.H. Gesch.ber. Rexroth Indramat Industriepark 18 4061 Pasching Tel.: +43 (0)7221 605-0 Fax: +43 (0)7221 605-21	Mannesmann Rexroth N.V.-S.A. Gesch.ber. Rexroth Indramat Industrielaan 8 1740 Ternat Tel.: +32 (0)2 5830719 Fax: +32 (0)2 5830731 indramat@rexroth.be	BEC AS Zinkvej 6 8900 Randers Tel.: +45 (0)87 11 90 60 Fax: +45 (0)87 11 90 61
England	**Finland - Finnland**	**France - Frankreich**	**France - Frankreich**
Mannesmann Rexroth Ltd. Rexroth Indramat Division Broadway Lane, South Cerney Cirencester, Glos GL7 5UH Tel.: +44 (0)1285 863000 Fax: +44 (0)1285 863030 sales@indramat.co.uk service@indramat.co.uk	Rexroth Mecman Oy Rexroth Indramat division Ansatie 6 017 40 Vantaa Tel.: +358 (0)9 84 91-11 Fax: +358 (0)9 84 91-13 60	Mannesmann Rexroth S.A. Division Rexroth Indramat Avenue de la Trentaine BP. 74 77503 CHELLES CEDEX Tel.: +33 (0)164 72-70 00 Fax: +33 (0)164 72-63 00 **Hotline:** +33 (0)608 33 43 28	Mannesmann Rexroth S.A. Division Rexroth Indramat 1270, Avenue de Lardenne 31100 Toulouse Tel.: +33 (0)5 61 49 95 19 Fax: +33 (0)5 61 31 00 41
France - Frankreich	**Italy - Italien**	**Italy - Italien**	**Italy - Italien**
Mannesmann Rexroth S.A. Division Rexroth Indramat 91, Bd. Irène Joliot-Curie 69634 Vénissieux – Cedex Tel.: +33 (0)4 78 78 53 65 Fax: +33 (0)4 78 78 53 62	Mannesmann Rexroth S.p.A. Divisione Rexroth Indramat Via G. Di Vittoria, 1 20063 Cernusco S/N.MI Tel.: +39 02 2 365 270 Fax: +39 02 700 408 252378	Mannesmann Rexroth S.p.A. Divisione Rexroth Indramat Via Borgomanero, 11 10145 Torino Tel.: +39 011 7 50 38 11 Fax: +39 011 7 71 01 90	Mannesmann Rexroth S.p.A. Divisione Rexroth Indramat Via del Progresso, 16 (Zona Ind.) 35020 Padova Tel.: +39 049 8 70 13 70 Fax: +39 049 8 70 13 77
Italy - Italien	**Italy - Italien**	**Netherlands - Niederlande/Holland**	**Netherlands - Niederlande/Holland**
Mannesmann Rexroth S.p.A. Divisione Rexroth Indramat Via Mascia, 1 80053 Castellamare di Stabia NA Tel.: +39 081 8 71 57 00 Fax: +39 081 8 71 68 85	Mannesmann Rexroth S.p.A. Divisione Rexroth Indramat Viale Oriani, 38/A 40137 Bologna Tel.: +39 051 34 14 14 Fax: +39 051 34 14 22	Rexroth B.V. Kruisbroeksestraat 1 (P.O. Box 32) 5281 RV Boxtel Tel.: +31 (0)411 65 19 51 Fax: +31 (0)411 65 14 83 indramat@hydraudyne.nl	Rexroth Hydrocare B.V. Kruisbroeksestraat 1 (P.O. Box 32) 5281 RV Boxtel Tel.: +31 (0)411 65 19 51 Fax: +31 (0)411 67 78 14
Norway - Norwegen	**Spain - Spanien**	**Spain - Spanien**	**Sweden - Schweden**
Rexroth Mecman AS Rexroth Indramat Division Berghagan 1 or: Box 3007 1405 Ski-Langhus 1402 Ski Tel.: +47 (0)64 86 41 00 Fax: +47 (0)64 86 90 62 jul.ruud@rexroth.no	Mannesmann Rexroth S.A. Divisiòn Rexroth Indramat Centro Industrial Santiga Obradors s/n 08130 Santa Perpetua de Mogoda Barcelona Tel.: +34 9 37 47 94 00 Fax: +34 9 37 47 94 01	Goimendi S.A. División Rexroth Indramat Parque Empresarial Zuatzu C/ Francisco Grandmontagne no.2 20018 San Sebastian Tel.: +34 9 43 31 84 21 - service: +34 9 43 31 84 56 Fax: +34 9 43 31 84 27 - service: +34 9 43 31 84 60 satindramat-goimendi@adegi.es	Rexroth Mecman Svenska AB Rexroth Indramat Division Varuvägen 7 125 81 Stockholm Tel.: +46 (0)8 727 92 00 Fax: +46 (0)8 647 32 77
Sweden - Schweden	**Switzerland West - Schweiz West**	**Switzerland East - Schweiz Ost**	
Rexroth Mecman Svenska AB Indramat Support Ekvändan 7 254 67 Helsingborg Tel.: +46 (0) 42 38 88 -50 Fax: +46 (0) 42 38 88 -74	Bosch Rexroth Suisse SA Département Rexroth Indramat Rue du village 1 1020 Renens Tel.: +41 (0)21 632 84 20 Fax: +41 (0)21 632 84 21	Bosch Rexroth Schweiz AG Geschäftsbereich Indramat Hemrietstrasse 2 8863 Buttikon Tel. +41 (0) 55 46 46 205 Fax +41 (0) 55 46 46 222	

Europa (Ost) - Europe (East)

vom Ausland: (0) nach Landeskennziffer weglassen
from abroad: don't dial (0) after country code

Czech Republic - Tschechien	Czech Republic - Tschechien	Hungary - Ungarn	Poland – Polen
Mannesmann-Rexroth, spol.s.r.o. Hviezdoslavova 5 627 00 Brno Tel.: +420 (0)5 48 126 358 Fax: +420 (0)5 48 126 112	DEL a.s. Strojírenská 38 Zdar nad Sázavou 591 01 Czech republic Tel.: +420 616 64 3144 Fax: +420 616 216 57	Mannesmann Rexroth Kft. Angol utca 34 1149 Budapest Tel.: +36 (1) 364 00 02 Fax: +36 (1) 383 19 80	Mannesmann Rexroth Sp.zo.o. Biuro Poznan ul. Dabrowskiego 81/85 60-529 Poznan Tel.: +48 061 847 67 99 Fax: +48 061 847 64 02
Rumania - Rumänien	**Russia - Russland**	**Russia - Russland**	**Turkey - Türkei**
Mannesmann Rexroth Sp.zo.o. Str. Drobety nr. 4-10, app. 14 70258 Bucuresti, Sector 2 Tel.: +40 (0)1 210 48 25 +40 (0)1 210 29 50 Fax: +40 (0)1 210 29 52	Mannesmann Rexroth INDRAMAT Wolokolamskoje Chaussee 73 Zimmer 406, 408 RUS – 123424 Moskau Tel.: +7 095/ 232 08 34 +7 095/ 232 08 35 Fax: +7 095/ 232 08 36 info.rex@rexroth.ru	ELMIS 10, Internationalnaya Str. 246640 Gomel, Belarus Tel.: +375/ 232 53 42 70 Fax: +375/ 232 53 37 69 elmis_ltd@yahoo.com	Mannesmann Rexroth Hidropar A..S. Fevzi Cakmak Cad No. 3 34630 Sefaköy Istanbul Tel.: +90 212 541 60 70 Fax: +90 212 599 34 07
Slowenia - Slowenien			
DOMEL Otoki 21 64 228 Zelezniki Tel.: +386 5 5117 152 Fax: +386 5 5117 225 brane.ozebek@domel.si			

Africa, Asia, Australia – incl. Pacific Rim

vom Ausland: (0) nach Landeskennziffer weglassen!
from abroad: don't dial (0) after country code!

Australia - Australien AIMS - Australian Industrial Machinery Services Pty. Ltd. Unit 3/45 Horne ST Campbellfield , VIC 3061 Melbourne Tel.: +61 (0) 393 590 228 Fax: +61 (0) 393 590 286 Hotline: +61 (0) 419 369 195 terryobrien@aimservices.com.au	Australia - Australien Bosch Rexroth Pty. Ltd. No. 7, Endeavour Way Braeside Victoria, 31 95 Melbourne Tel.: +61 (0)3 95 80 39 33 Fax: +61 (0)3 95 80 17 33 mel@rexroth.com.au	China Shanghai Mannesmann Rexroth Hydraulics & Automation Ltd. Wai Gaoqiao Free Trade Zone No.122, Fu Te Dong Yi Road Shanghai 200131 - P.R.China Tel.: +86 21 58 66 30 30 Fax: +86 21 58 66 55 23 leonww@citiz.net	China Mannesmann Rexroth (China) Ltd. 15/F China World Trade Center 1, Jianguomenwai Avenue Beijing 100004, P.R.China Tel.: +86 10 65 05 03 80 Fax: +86 10 65 05 03 79
China Mannesmann Rexroth (China) Ltd. A-5F., 123 Lian Shan Street Sha He Kou District Dalian 116 023, P.R.China Tel.: +86 411 46 78 930 Fax: +86 411 46 78 932	China Mannesmann Rexroth (China) Ltd. Guangzhou Repres. Office Room 1014-1016, Metro Plaza, Tian He District, 183 Tian He Bei Rd Guangzhou 510075, P.R.China Tel.: +86 20 8755-0030 +86 20 8755-0011 Fax: +86 20 8755-2387	Hongkong Rexroth (China) Ltd. 1/F., 19 Cheung Shun Street Cheung Sha Wan, Kowloon, Hongkong Tel.: +852 22 62 51 00 Fax: +852 27 41 33 44	India - Indien Mannesmann Rexroth (India) Ltd. Rexroth Indramat Division Plot. A-58, TTC Industrial Area Thane Turbhe Midc Road Mahape Village Navi Mumbai - 400 701 Tel.: +91 (0)22 7 61 46 22 Fax: +91 (0)22 7 68 15 31
India - Indien Mannesmann Rexroth (India) Ltd. Rexroth Indramat Division Plot. 96, Phase III Peenya Industrial Area Bangalore - 560058 Tel.: +91 (0)80 8 39 73 74 Fax: +91 (0)80 8 39 43 45	Indonesia - Indonesien PT. Rexroth Wijayakusuma Building # 202, Cilandak Commercial Estate Jl. Cilandak KKO, Jakarta 12560 Tel.: +62 21 7891169 (5 lines) Fax: +62 21 7891170 - 71	Japan Rexroth Automation Co., Ltd. Service Center Japan Yutakagaoka 1810, Meito-ku, NAGOYA 465-0035, Japan Tel.: +81 (0)52 777 88 41 +81 (0)52 777 88 53 +81 (0)52 777 88 79 Fax: +81 (0)52 777 89 01	Japan Rexroth Automation Co., Ltd. Rexroth Indramat Division 1F, I.R. Building Nakamachidai 4-26-44, Tsuzuki-ku YOKOHAMA 224-0041, Japan Tel.: +81 (0)45 942 72 10 Fax: +81 (0)45 942 03 41
Korea Mannesmann Rexroth-Korea Ltd. 1515-14 Dadae-Dong, Saha-Ku Rexroth Indramat Division Pusan Metropolitan City, 604-050 Republic of South Korea Tel.: +82 (0)51 26 00 741 Fax: +82 (0)51 26 00 747 gyhan@rexrothkorea.co.kr	Malaysia Mannesmann Rexroth SDN.BHD. Head Office No. 3, Block B, Jalan SS 13/5 Subang Jaya Industrial Estate 47500 Petaling Jaya - Selangor Tel.: +60 (0) 3 73 44 870 Fax: +60 (0) 3 73 44 864 hockhwa@hotmail.com	South Africa - Südafrika TECTRA Automation (Pty) Ltd. 28 Banfield Road,Industria North RSA - Maraisburg 1700 Tel.: +27 (0)11 673 20 80 Fax: +27 (0)11 673 72 69 Hotline: +27 (0)82 903 29 23 georgv@tectra.co.za	Taiwan Rexroth Uchida Co., Ltd. No.17, Lane 136, Cheng Bei 1 Rd., Yungkang, Tainan Hsien Taiwan, R.O.C. Tel.: +886 (0)6 25 36 565 Fax: +886 (0)6 25 34 754 indramat@mail.net.tw
Thailand NC Advance Technology Co. Ltd. 59/76 Moo 9 Ramintra road 34 Tharang, Bangkhen, Bangkok 10230 Tel.: +66 2 943 70 62 +66 2 943 71 21 Fax: +66 2 509 23 62 sonkawin@hotmail.com			

Nordamerika – North America

USA Hauptniederlassung - Headquarters Mannesmann Rexroth Corporation Rexroth Indramat Division 5150 Prairie Stone Parkway Hoffman Estates, IL 60192-3707 Tel.: +1 847 6 45 36 00 Fax: +1 847 6 45 62 01 service@indramat.com	USA Central Region - Mitte Mannesmann Rexroth Corporation Rexroth Indramat Division Central Region Technical Center Auburn Hills, MI 48326 Tel.: +1 248 3 93 33 30 Fax: +1 248 3 93 29 06	USA Southeast Region - Südwest Mannesmann Rexroth Corporation Rexroth Indramat Division Southeastern Technical Center 3625 Swiftwater Park Drive Suwanee, Georgia 30174 Tel.: +1 770 9 32 32 00 Fax: +1 770 9 32 19 03	USA SERVICE-HOTLINE - 7 days x 24hrs - **+1-800-860-1055**
USA East Region –Ost Mannesmann Rexroth Corporation Rexroth Indramat Division Charlotte Regional Sales Office 14001 South Lakes Drive Charlotte, North Carolina 28273 Tel.: +1 704 5 83 97 62 +1 704 5 83 14 86	USA Northeast Region – Nordost Mannesmann Rexroth Corporation Rexroth Indramat Division Northeastern Technical Center 99 Rainbow Road East Granby, Connecticut 06026 Tel.: +1 860 8 44 83 77 Fax: +1 860 8 44 85 95	USA West Region – West Rexroth Indramat – Western Office 7901 Stoneridge Drive, Suite 220 Pleasant Hill, California 94588 Tel.: +1 925 227 10 84 Fax: +1 925 227 10 81	
Canada East - Kanada Ost Basic Technologies Corporation Burlington Division 3426 Mainway Drive Burlington, Ontario Canada L7M 1A8 Tel.: +1 905 335 55 11 Fax: +1 905 335-41 84 michael.moro@basic.ca	Canada West - Kanada West Basic Automation Burnaby 5345 Goring St. Burnaby, British Columbia Canada V7J 1R1 Tel. +1 604 205-5777 Fax +1 604 205-6944 david.gunby@basic.ca		

Südamerika – South America

Argentina - Argentinien Mannesmann Rexroth S.A.I.C. Division Rexroth Indramat Acassusso 48 41/7 RA - 1605 Munro (Buenos Aires) Tel.: +54 (0)11 4756 01 40 Fax: +54 (0)11 4762 6862	Argentina - Argentinien NAKASE Servicio Tecnico CNC Calle 49, No. 5764/66 RA - 1653 Villa Balester Prov. - Buenos Aires Tel.: +54 (0) 11 4768 36 43 Fax: +54 (0) 11 4768 24 13 nakase@usa.net nakase@nakase.com	Brazil - Brasilien Mannesmann Rexroth Automação Ltda. Divisão Rexroth Indramat Av. Tégula, 888 Ponte Alta, Atibaia SP CEP 12940-000 Tel.: +55 (0)11 4414 56 92 +55 (0)11 4414 56 84 Fax sales: +55 (0)11 4414 57 07 Fax serv.: +55 (0)11 4414 56 86 alexandre.wittwer@rexroth.com.br	Brazil - Brasilien Mannesmann Rexroth Automação Ltda. Divisão Rexroth Indramat R. Dr.Humberto Pinheiro Vieira, 100 Distrito Industrial [Caixa Postal 1273] BR - 89220-390 Joinville - SC Tel./Fax: +55 (0)47 473 58 33 Mobil: +55 (0)47 9974 6645 prochnow@zaz.com.br
Mexico Mannesmann Rexroth Mexico S.A. de C.V. Calle Neptuno 72 Unidad Ind. Vallejo MEX - 07700 Mexico, D.F. Tel.: +52 5 754 17 11 +52 5 754 36 84 +52 5 754 12 60 Fax: +52 5 754 50 73 +52 5 752 59 43	Columbia - Kolumbien Reflutec de Colombia Ltda. Calle 37 No. 22-31 Santafé de Bogotá, D.C. Colombia Tel.: +57 1 368 82 67 +57 1 368 02 59 Fax: +57 1 268 97 37 reflutec@inter.net. co		

Printed in Germany

Rexroth Indramat