JUMO mTRON T
Measuring, Control, and Automation System

Com1
RS422/485 or RS232,
Modbus master/slave

Com2
RS422/485 or RS232,
Modbus master/slave
or
PROFIBUS-DP slave

LAN

System bus

max. 100 m

- Web browser
- Setup program
- PC Evaluation Software PCA3000
- PCA Communication Software PCC
- Plant Visualization Software SVS3000
- Programming system CODESYS

max. 100 m

Com1
RS422/485 or RS232,
Modbus master/slave,
connection for bar code scanner

Com2
RS422/485 or RS232,
Modbus master/slave,
connection for bar code scanner

USB
Host and device

System Description

70500000T98Z001K000

V4.00/EN/00575652

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1.1 Structure of this system description

This system description, which is also a component of the system manual (accessories), describes features that relate to the overall measuring, control, and automation system or are equally applicable for all modules.

The complete scope of information for each module is contained in the downloadable operating manuals.

> **NOTE!**
> The user should follow the individual sections of this system description step for step to gain an overview of the measuring, control, and automation system and the available technical documentation.

Content of the individual sections

Section	Explanation
1 Introduction	• Initial information on the measuring, control, and automation system • Find out how the technical documentation is structured
2 Safety information	• Symbols and types of figures used and their meanings
3 Receipt of goods, storage, and transport	• Checking the delivery for damage and completeness • Notes on storage and transport • Handling the packaging material • Notes on disposal
4 Identifying the device version	• Detecting which device version is indicated by the specifications on the nameplate
5 Installation	• Correctly fitting or installing the devices, taking into consideration the prevailing climatic conditions at the installation location
6 Electrical connection	• Safely connecting the devices, taking into consideration the "installation notes"
7 Startup and configuration	• Starting up and configuring the system using the setup program (overview). • Configuring and operating the system using the multifunction panel (overview).
8 Appendix	• General technical data • System expansion by new system versions (expansion stages)

> **NOTE!**
> All additional information is module-specific and is contained in the respective index divider of the system manual and in the downloadable operating manuals.

1 Introduction

1.2 The JUMO mTRON T measuring, control, and automation system

1.2.1 Overview

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1.2.2 Brief description

The modular measuring, control, and automation system is suitable for the precise detection, regulation, control, and recording. Special features of the system are the easy operation and the corresponding software components, the high measuring accuracy and regulation quality as well as the sturdy and service-friendly mechanical system.

An application consists of a base unit (central processing unit), a maximum of 30 input/output modules (multichannel controller module, analog input module 4-channel, analog input module 8-channel, analog output module 4-channel, digital input/output module 12-channel, thyristor power controller type 70906x), and if necessary the multifunction panel, up to four operating panels, and router modules for distributed module arrangement. For user-friendly all-in-one solutions, various PC programs are available.

Automation solutions for small and medium size machine lines are possible due to the integration of an optional PLC including programming system according to IEC 61131-3.

The base unit is equipped with a sturdy metal case; the router module and the input and output modules are equipped with a plastic case. All these devices can be fitted on a 35 mm DIN rail. The multifunction panel with TFT touch screen has a metal case with decor foil and is intended for mounting into a panel cut-out.

The system operates at a voltage of DC 24 V. The supply of operating voltage is only required at the base unit (central processing unit), at the router module, and at the multifunction panel.

1.2.3 Base units

- The base unit, up to 30 input/output modules, and up to 30 router modules can be used to build a compact and economic central or decentral measuring, control, and automation system (visualization and operation either with the multifunction panel or the plant visualization software JUMO SVS3000).
- The base units contain the process image of the application. Furthermore, all configuration and parameter data of the system are stored in these modules (except for the multifunction panel). As a result, individual input/output modules can be replaced with Plug and Play.
- All base units operate at a voltage supply of DC 24 V.
- The setup program or the multifunction panel can be used to comfortably configure and parameterize the base units.
- LEDs are used to indicate the voltage supply as well as the operating status of a module and of the interfaces.

Central processing unit

CPU

- The central processing unit is the basis for the maximum extension of the system
- Nine program generators (option)
- 64 limit values are monitored
- An integrated PLC acc. to IEC 61 131-3 (option)
- Math and logic function (option) for all connected multichannel controller modules
- Two interfaces for field bus applications; optional:
  - RS232, Modbus RTU as master or slave
  - RS422/485 Modbus RTU as master or slave
  - PROFIBUS-DP as slave (as of system version 02)
- One USB device interface (setup)
- System bus connection at the front (Bus Out)
- A LAN interface (Ethernet) for HTTP and Modbus/TCP as master and slave
- Integrated web server
- E-mail transmission
- The central processing unit operates at a voltage supply of DC 24 V and supplies the connected input/output modules
- Dimensions (W x H x D): 135 mm x 101 mm x 67.1 mm (without connection elements)
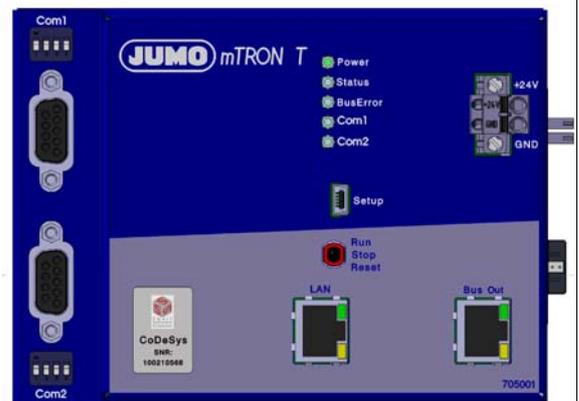
For further information: Refer to data sheet 705001

Additional base units in preparation.

1 Introduction

1.2.4   Input/output modules

- The modules are equipped with removable terminal strips with Push-In technology for the electrical connection.
- All input/output modules operate at a voltage supply of DC 24 V.
- The setup program, the multifunction panel or the optional PLC can be used to comfortably configure and parameterize the modules.
- LEDs are used to indicate the voltage supply as well as the operating status of a module and the input/output statuses.
- For service work (replacement) or adding optional boards, the module insert can be easily pulled out of the case at the front.

Multichannel controller module

- 2-channel PID controller with relay output or logic output to control solid-state relays
- Up to 4 PID controller channels can be activated (cascadable)
- Two universal analog inputs, two digital inputs (DC 0/24 V) and two digital outputs (relay or logic DC 0/15 V)
- Supported measuring probes: Thermocouples, RTD temperature probes, resistance transmitters, resistance/potentiometers, or standard signals (current or voltage)
- The analog inputs are electrically isolated from each other
- Three option slots for the extension of up to four universal analog inputs, eight digital inputs, three analog outputs, or eight digital outputs
- Supported controller types: Two-state controller, three-state controller, modulating controller, continuous controller, or continuous controller with integrated actuator controller
- Customer-specific linearization possible by using a formula
- Limit value monitoring
- Four formulae for math and logic functions (option)
- One counting input up to 10 kHz
- The module operates independently (configurable) which means the control task is carried out even if the base unit or the higher-ranking system malfunctions
- If the controller is replaced during service work the new controller (identical type) is automatically configured
- Dimensions (W x H x D): 45 mm x 103.6 mm x 101.5 mm (without connection elements)
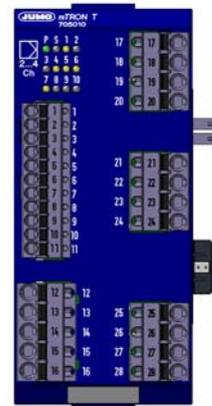
For further information: Refer to data sheet 705010

Relay module 4-channel

- Four relay outputs controlled via the system bus by digital signals
- Each relay is equipped with a changeover contact AC 230 V / 3 A
- Separate terminal strip per relay output
- Automatic configuration after the module insert has been exchanged during service work
- Dimensions (W x H x D): 22.5 mm x 103.6 mm x 101.5 mm (without connection elements)

For further information: Refer to data sheet 705015

Analog input module 4-channel

- Four universal analog inputs
- Supported measuring probes: Thermocouples, RTD temperature probes, resistance transmitters, resistance/potentiometers or standard signals (current or voltage)
- The analog inputs are electrically isolated from each other
- Customer-specific linearization possible by using a formula or up to 45 pairs of values
- Limit value monitoring
- Automatic configuration after the module insert has been exchanged during service work
- A digital input (DC 0/24 V) is also provided
- Dimensions (W x H x D): 22.5 mm x 103.6 mm x 101.5 mm (without connection elements)

For further information: Refer to data sheet 705020

Analog input module 8-channel

- Eight analog inputs for RTD temperature probes Pt100, Pt500 or Pt1000 in 2-wire circuit
- The analog inputs are not electrically isolated from each other
- Limit value monitoring
- Automatic configuration after the module insert has been exchanged during service work
- A digital input (DC 0/24 V) is also provided
- Dimensions (W x H x D): 22.5 mm x 103.6 mm x 101.5 mm (without connection elements)

For further information: Refer to data sheet 705021

1 Introduction

Analog output module 4-channel

- Four analog outputs 0(2) to 10 V or 0(4) to 20 mA (configurable per channel)
- The analog outputs are electrically isolated from each other
- Configurable behavior in case of an error, e.g. acc. to NAMUR recommendation NE 43
- Automatic configuration after the module insert has been exchanged during service work
- Dimensions (W x H x D): 22.5 mm x 103.6 mm x 101.5 mm (without connection elements)

For further information: Refer to data sheet 705025

Digital input/output module 12-channel

- 12 channels which can be respectively configured as digital inputs (DC 0/24 V) or as digital outputs (DC 0/24 V, 500 mA)
- Supply of external voltage through terminal at the front
- Automatic configuration after the module insert has been exchanged during service work
- Dimensions (W x H x D): 22.5 mm x 103.6 mm x 101.5 mm (without connection elements)
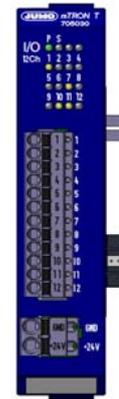
For further information: Refer to data sheet 705030

Thyristor power controller type 70906x

- Various device versions for single-phase operation, for operation in three-phase economy circuit and full three-phase operation
- Integration in the measuring, control, and automation system via system bus, using a network cable
- Each power controller counts as one input/output module (a maximum of 30 modules per system)
- Access to various process values of the power controller

For further information: Refer to data sheets 709061, 709062, 709063

1.2.5 Special modules

Router module

- The router module distributes the input/output modules to several DIN rails/control cabinets (decentralized arrangement)
- It uses the system bus to link modules to the base unit or the multifunction panel
- Up to 100 m distance between two router modules or between a router module and the base unit or the multifunction panel
- Up to 30 router modules are possible
- The router module operates at a voltage supply of DC 24 V and supplies the connected input/output modules
- No configuration of the router module required
- For applications such as Hot Connect, for example, the address of the router module can be set by rotary coding switches
- Three RJ45 system bus connections at the front (1 × Bus In, 2 × Bus Out), electrically isolated
- Dimensions (W x H x D): 22.5 mm x 103.6 mm x 101.5 mm (without connection elements)

For further information: Refer to data sheet 705040
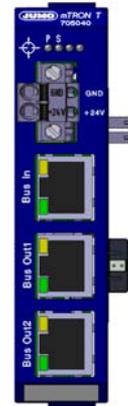
1.2.6 Operating, visualization, recording

Multifunction panel 840

- Touchscreen with front made of aluminum incl. design foil (IP67)
- TFT color monitor 21.3 cm (8.4"), resolution 640 x 480 pixels, 256 colors, with LED backlight
- As an interface between man and machine it allows an optimal and clearly-arranged view of the process statuses and parameters of the system
- Display (in real time) and operation of controller screen, process screen, program editor, and recording function (option)
- Configuration of all connected modules
- Setpoint values and batch texts are directly entered on the screen
- Data archiving and evaluation with PC
- The multifunction panel operates at a voltage supply of DC 24 V
- A setup program can be used to comfortably configure the multifunction panel
- Two interfaces for field bus applications; optional:
  - RS232, Modbus RTU as master or slave
  - RS422/485, Modbus RTU as master or slave
- One USB device interface (setup)
- Two USB host interfaces (memory stick)
- Two system bus connections (Bus In and Bus Out)
- A LAN interface (Ethernet) for HTTP and Modbus/TCP as master and slave
- Integrated web server
- E-mail transmission
- Connection possibility for barcode scanner
- Dimensions (W x H x D): 235 mm x 195 mm x 58 mm

For further information: Refer to data sheet 705060

1 Introduction

Operating panels 350, 570, 1040

HMI

- TFT color display (64k colors) with resistiv-touch technology
- Display sizes 8.9 cm (3.5''), 14.5 cm (5.7''), and 26.4 cm (10.4'')
- Display resolutions 320 × 240 pixels and 640 × 480 pixels
- Different case materials (plastics, metal)
- Protection type IP65 (at the front)
- Voltage supply DC 24 V
- Ethernet interface (RJ45) for connection to the system
- Up to four operating panels per central processing unit (PLC option required)
- Specific process screens for operating the system
- Direct access to PLC variables
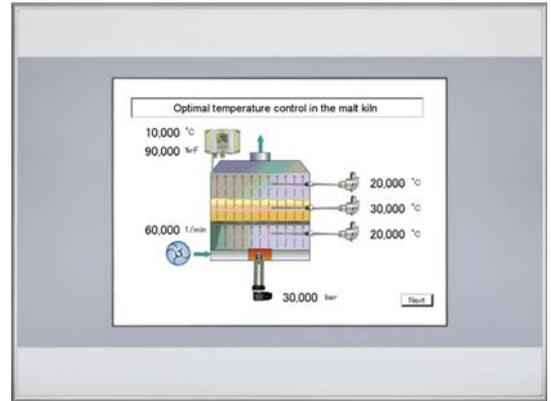
System structure:
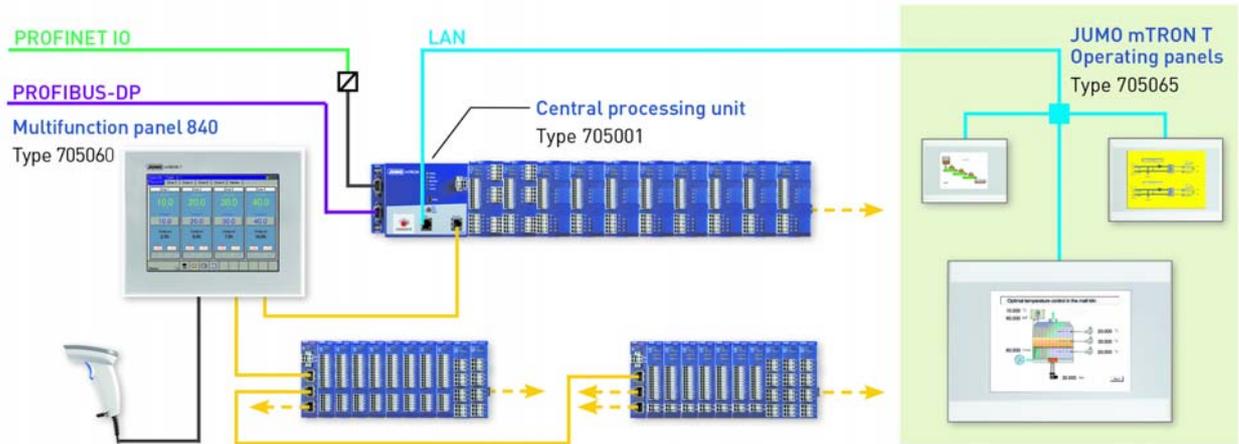
For further information: Refer to data sheet 705065

1.2.7 Power supply units

Power supply units 705090/...

- Voltage supply AC 100 V ... 240 V
- 150 % peak load capability (for typical 4 s)
- Minimum current inrush
- Floating DC-OK relay contact
- Efficiency up to 93.5 %
- Active power factor correction (PFC)
- Active filter against mains transients
- Quick connection due to spring-cage terminals
- Dimensions (W x H x D):
  705090/05-33: 40 mm x 130.5 mm x 121.5 mm
  705090/10-33: 60 mm x 130.5 mm x 121.5 mm

For further information: Refer to data sheet 705090

1.2.8   PC programs

Setup program

SET	Setup program for project planning and configuration of the entire measuring, control, and automation system A complete PLC can be activated as an option. The setup program is distinguished by: • User-friendly configuration, parameterization, and startup of the base units, the input/output modules, and the multifunction panel • Automatic import of the hardware configuration into the PLC programming software CODESYS • Program editor • Process screen editor The project file contains all data that is relevant for the configuration, parameterization, and visualization. The file also contains the controller programs and, if applicable, the customer-specific PLC code.
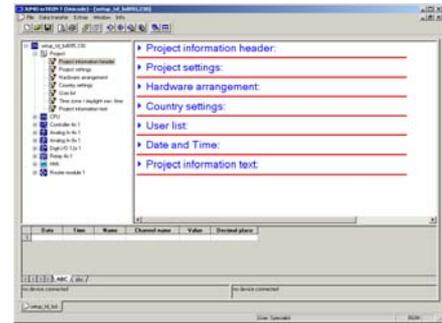
For further information: Refer to operating manual 705000.6

PC Evaluation Software PCA3000

PCA	Professional evaluation software to manage, archive, visualize and evaluate process data (measuring data, batch data, messages, ...) The process data can be imported via USB memory stick or provided by the software PCC. • Data memory: Clearly arranged and easy backup and archiving of all process data in a data file • Data backup: Archive data can directly be imported from CD/DVD and then displayed • Data export: Data export to HTML level or ASCII text file (for evaluation in Excel) or customer-specific forms • Communication: The communication software PCC optimally adapted to PCA3000 can be used to comfortably import data via an interface or a modem
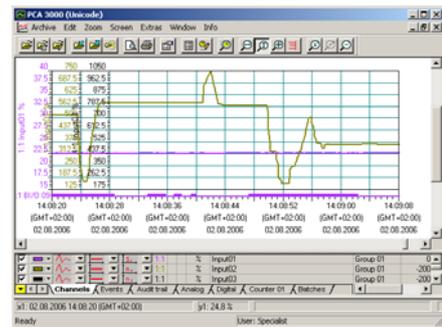
For further information: Refer to operating manual 709701.0

PCA Communication Software PCC

PCC	The communication software PCC optimally adapted to PCA3000 can be used to comfortably import data via an interface or modem. • Data memory: Clearly-arranged, easy backup and archiving of all process data in a data file • Teleservice function (display of the process data)
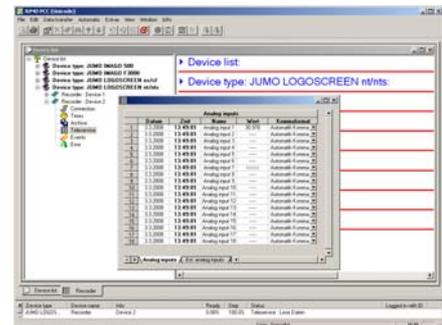
For further information: Refer to operating manual 709702.0

1 Introduction

Plant Visualization Software JUMO SVS3000

SVS

Plant Visualization Software for online visualization, batch reporting and operation of the measuring, control and automation system with a networked PC

This software ensures quick familiarity and easy creation of applications. The user is able to quickly configure an individual application according to his/her requirements due to the prepared masks (process, group, trend screens).

- Easy and quick application creation
- Extensive library with predefined graphical elements
- System operation via group masks
- Extensive documentation function with continuous and batch related evaluation
- Search function for date/time, plant, and batch criteria to be defined
- Automatic print and data export
- Recipe function
- Quick and easy commissioning/startup due to installation menu
- Alarm and event list
- Password protected
- History and real time trend
- Network compatible
- Connection of bar code scanner
- Remote alerting (optional)
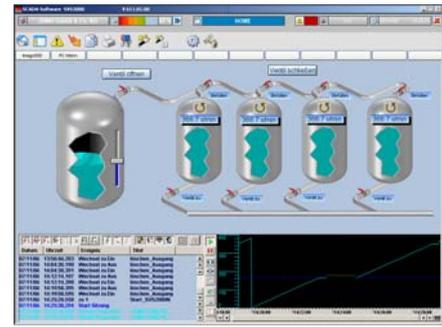
For further information: Refer to data sheet 700755

1.3   Content of the technical documentation

The documentation for the measuring, control, and automation system is intended for plant manufacturers and users with specialist training. It has a modular structure and comprises different sections.

In the following subsections, the various types of documents are listed (previous document number in parentheses).

1.3.1   Device documentation in printed form

7050XX00T94... (B 7050XX.4)

Installation instructions

A hard copy of the installation instructions is included in the scope of delivery of every module.

The installation instructions describe the installation of the device and the connection of the supply and signal cables. They also contain the order details and a list of technical data.

The scope of delivery for a power supply unit includes a hard copy of the operating instructions. These include information on installation and electrical connection.

70500000T90... (B 705000.0)

System manual

A hard copy of the system manual can be provided as an accessory subject to charge.

The system manual describes the scope of services of the measuring, control, and automation system and provides all information for project design and startup.

Index divider 1 "System description" summarizes the information applicable to all modules. Module-specific descriptions in the following sections complement the specifications stated here.

Index divider 2 "Setup program" describes the project design of the overall system.

1.3.2   Device documentation in the form of PDF files

The device documentation files specified below are saved as PDF files on the DVD contained in the scope of delivery of a base unit.

70500000T10... (T 705000)

Data sheet

The data sheet provides general information on the measuring, control, and automation system and forms the basis for plant planning and purchase decisions.

7050XX00T10... (T 7050XX)

Data sheet

The data sheets of the individual modules provide specific information, order details, and technical data.

70500000T98... (B 705000.8)

System description

The system description provides an overview of the measuring, control, and automation system. It describes properties that affect the entire system or are equally applicable for all modules.

1 Introduction

7050XX00T90... (B 7050XX.0)

Operating manual

The operating manuals of the individual modules contain all information on installation, electrical connection, startup, operation, and – if required – parameterization and configuration.

7050XX0XT92... (B 7050XX.2.X)

Interface description

The interface description provides information about the use of that interface and on communication with other devices, superordinate systems or certain sensors.

7050XX00T94... (B 7050XX.4)

Installation instructions

The installation instructions describe the installation of the device and the connection of the supply and signal cables. The instructions also contain a list of the technical data.

7050XX5XT90... (B 7050XX.5.X)

Operating manual (application)

The operating manual describes the use of a certain application (e. g. PLC application).

1.3.3　　Documentation for optional software

The manuals specified below are available on the Internet as PDF files. They also form part of the scope of delivery of the respective software.

70500000T96... (B 705000.6)

Setup program

The manual describes the function of the setup program.

70970100T90... (B 709701.0)

PC evaluation software PCA3000

The operating manual describes the operation and the features of the PC evaluation software. The PC evaluation software helps to visualize and evaluate the recorded process data (measurement data, batch data, messages, etc.).

70970200T90... (B 709702.0)

PCA communication software PCC

The operating manual describes the operation and the features of the PCA communication software. The PCA communication software is responsible for the data transfer from a device or system to a PC or to a network.

70075500T90... (B 700755.0)

Plant visualization software SVS3000

The operating manual describes the operation and features of the plant visualization software. The plant visualization software is responsible for networking interface-ready process devices with a PC.

1.3.4   Device documentation on the Internet

All documents are available for download on the Internet at www.jumo.net.
Download procedure:

Step	Action
1	On the JUMO website, enter the number of the relevant product group in the search field at the top right (e.g. 705001 for the central processing unit) and start the search. *The search results are listed.*
2	Select product (click the link).
3	In the "Documentation" dropdown list, select the desired documentation in the required national language (click the link).
4	+++++Open the PDF document or save it as a file.

1.3.5   Training documents on the Internet

Training documents (eLearning courses) on various topics are available at www.jumo.net.
Procedure:

Step	Action
1	On the JUMO website, navigate to the "Support/Services" area.
2	In the "Information & Training" menu on the left-hand side, select "eLearning courses".
3	Click the link "Review of our eLearning courses".
4	Select the desired eLearning course from the overview (click the link). *The presentation starts.*

1 Introduction

1.4 Available technical documentation

The documents specified below are available for the measuring, control, and automation system (previous document number in parentheses).

1.4.1 General information

Product	Type of documentation	No.	Printed	PDF file
Measuring, control, and automation system	Data sheet	70500000T10...	-	X
	System manual[1]	70500000T90... (B 705000.0)	X	-
	Setup program manual	70500000T96... (B 705000.6)	-	X
	System description[2]	70500000T98... (B 705000.8)	-	X

[1] Accessory subject to charge

[2] Includes an overview of the purpose and content of all documents

1.4.2 Base units

Product	Type of documentation	No.	Printed	PDF file
Central processing unit	Data sheet	70500100T10...	-	X
	Operating manual	70500100T90... (B 705001.0)	-	X
	Modbus interface description	70500100T92... (B 705001.2.0)	-	X
	PROFIBUS-DP interface description	70500103T92... (B 705001.2.3)	-	X
	digiLine interface description	70500106T92...	-	X
	Installation instructions	70500100T94... (B 705001.4)	X	X
	CODESYS OPC server operating manual	70500151T90... (B 705001.5.1)	-	X
	Process engineering application operating manual	70500152T90...	-	X
	Operating manual Thyristor power controller (type 70906x; integration in the measuring, control, and automation system)	70500153T90...	-	X

1.4.3 Input/output modules

Product	Type of documentation	No.	Printed	PDF file
Multichannel controller module	Data sheet	70501000T10...	-	X
	Operating manual	70501000T90... (B 705010.0)	-	X
	Installation instructions	70501000T94... (B 705010.4)	X	X
Relay module 4-channel	Data sheet	70501500T10...	-	X
	Operating manual	70501500T90... (B 705015.0)	-	X
	Installation instructions	70501500T94... (B 705015.4)	X	X
Analog input module 4-channel	Data sheet	70502000T10...	-	X
	Operating manual	70502000T90... (B 705020.0)	-	X
	Installation instructions	70502000T94... (B 705020.4)	X	X
Analog input module 8-channel	Data sheet	70502100T10...	-	X
	Operating manual	70502100T90... (B 705021.0)	-	X
	Installation instructions	70502100T94... (B 705021.4)	X	X
Analog output module 4-channel	Data sheet	70502500T10...	-	X
	Operating manual	70502500T90...	-	X
	Installation instructions	70502500T94...	X	X
Digital input/ output module 12-channel	Data sheet	70503000T10...	-	X
	Operating manual	70503000T90... (B 705030.0)	-	X
	Installation instructions	70503000T94... (B 705030.4)	X	X

1.4.4 Special modules

Product	Type of documentation	No.	Printed	PDF file
Router module	Data sheet	70504000T10...	-	X
	Installation instructions	70504000T94... (B 705040.4)	X	X

1 Introduction

1.4.5 Operating, visualization, recording

Product	Type of documentation	No.	Printed	PDF file
Multifunction panel 840	Data sheet	70506000T10...	-	X
	Operating manual	70506000T90... (B 705060.0)	-	X
	Modbus interface description	70506000T92... (B 705060.2.0)	-	X
	Installation instructions	70506000T94... (B 705060.4)	X	X
Operating panels	Data sheet	70506500T10...	-	X
	Operating manual	70506500T90...	-	X

1.4.6 Power supply units

Product	Type of documentation	No.	Printed	PDF file
24 V power supply units	Data sheet	70509000T10...	-	X
	Operating instructions QS5.241		X	-
	Operating instructions QS10.241		X	-

2.1   Warning symbols

	DANGER! This symbol indicates that **personal injury caused by electrical shock** may occur if the respective precautionary measures are not carried out.

	WARNING! This symbol in connection with the signal word indicates that personal injury may occur if the respective precautionary measures are not carried out.

	CAUTION! This symbol in connection with the signal word indicates that **damage to assets or data loss** will occur if the respective precautionary measures are not taken.

	CAUTION! This symbol indicates that **components could be destroyed** by electrostatic discharge (ESD = Electro Static Discharge) if the respective cautionary measures are not taken. Only use the ESD packages intended for this purpose to return device inserts, assembly groups, or assembly components.

	READ DOCUMENTATION! This symbol – placed on the device – indicates that the associated **device documentation has to be observed**. This is necessary to recognize the kind of the potential hazards as well as the measures to avoid them.

2.2   Note signs

	NOTE! This symbol refers to **important information** about the product, its handling, or additional use.

	REFERENCE! This symbol refers to **further information** in other sections, chapters, or manuals.

	FURTHER INFORMATION! This symbol is used in the tables and refers to **further information** in connection with the table.

	DISPOSAL! This device and the batteries (if installed) must not be disposed in the garbage can after use! Please ensure that they are disposed properly and in an **environmentally friendly manner**.

2 Safety information

2.3   Intended use

The modules described are intended for measuring, control, and automation tasks in an industrial environment, as described in the technical data. Other uses or uses beyond those defined are not viewed as intended uses.

The modules are built according to the relevant standards and directives as well as the applicable safety regulations. Nevertheless, incorrect use may lead to bodily injury or property damage.

To avoid danger, the modules may only be used:

- For the intended use
- When in good order and condition
- When taking into account the technical documentation provided

Even if a module is used correctly and according to the intended use, it may still cause application-related dangers (e.g. due to missing safety devices or incorrect settings).

2.4   Qualification of personnel

This document contains the necessary information for the intended use of the modules to which it relates.

It is intended for technically qualified personnel who have received special training and have the appropriate knowledge in the field of automation technology (measuring, process, and control technology).

The appropriate level of knowledge and the technically fault-free implementation of the safety information and warnings contained in the technical documentation provided are prerequisites for risk-free mounting, installation, and startup as well as for ensuring safety when operating the described modules. Only qualified personnel have the required specialist knowledge to correctly interpret and implement the safety information and warnings contained in this document in specific situations.

3 Acceptance of goods, storage, and transport

3.1   Checking the delivery

- Ensure that the packaging and contents are not damaged
- Check that the delivery is complete using the delivery papers and the order details
- Inform the supplier immediately if there is any damage
- Store damaged parts until clarification is received from the supplier

3.2   Notes on storage and transport

- Store the module in a dry and clean environment. Observe the admissible ambient conditions (see "Technical data")
- The transport of the module is to be shockproof
- The original packaging provides optimum protection for storage and transport

3.3   Returning goods

In the event of repair, please return the module in a clean and complete state.
Use the original packaging to return goods.

3.3.1   Accompanying letter for repair

Please include the completed accompanying letter for repair when returning goods.
Do not forget to state the following:
- Description of the application and
- Description of the error that has occurred

The accompanying letter for repair can be downloaded online from the manufacturer's website (use the search function if necessary).

3.3.2   Protection against electrostatic discharge (ESD)

(ESD = electrostatic discharge)
To prevent damage from ESD, electronic modules or components must be handled, packaged, and stored in an ESD-protected environment. Measures against electrostatic discharge and electrical fields are described in DIN EN 61340-5-1 and DIN EN 61340-5-2 "Protection of electronic devices from electrostatic phenomena".

When returning electronic modules or components, please note the following:
- Sensitive components must only be packaged in an ESD-protected environment. Workspaces such as this divert electrostatic charges to ground in a controlled manner and prevent static charges due to friction capacities.
- Only use packaging for ESD-sensitive modules/components. These must consist of conductive plastics.

No liability can be assumed for damage caused by ESD.

3 Acceptance of goods, storage, and transport

> **CAUTION!**
> Electrostatic charges occur in non-ESD protected environments.
> Electrostatic discharges can damage modules or components.
> For transport purposes, use only the ESD packaging provided.

3.4   Disposal

Disposing of the device

> **DISPOSAL!**
>
> Devices and/or replaced parts should not be placed in the refuse bin at the end of their service life as they consist of materials that can be recycled by specialist recycling plants.
>
> Dispose of the device and the packaging material in a proper and environmentally friendly manner.
>
> For this purpose, observe the country-specific laws and regulations for waste treatment and disposal.

Disposing of the packaging material

The entire packaging material (cardboard packaging, inserts, plastic film, and plastic bags) is fully recyclable.

4.1 Nameplates

The position and content of the nameplates is explained below using the example of the multi-channel controller module 705010.

Position

The nameplate (B) is affixed to the module case.

Additional nameplates with reduced information are located on the module insert (A) and inside the module case (C; not shown). This duplicate identification marking via nameplates (A) and (C) is important when replacing a module insert or retrofitting optional modules.
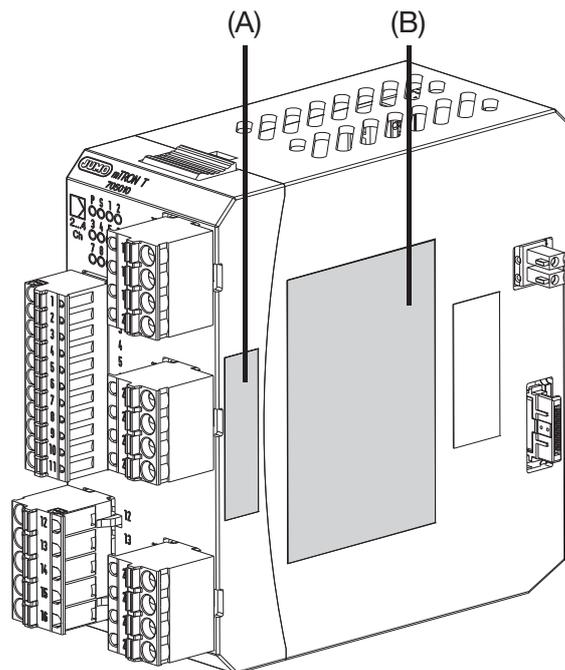
Content

The nameplates contain important information. This includes:

Description	Designation on the name-plate	Example
Device type (A + B + C)	Typ	705010/18-113-36
Part no. (A + B + C)	TN	00XXXXXX
Fabrication number (A + B + C)	F-Nr	0070033801211010006
Voltage supply (B)	-	DC 24 V +25/-20 %

Device type

Compare the specifications on the nameplate with the order.

Identify the supplied device version using the order details of the respective module.

Part no. (TN)

The part no. clearly identifies an article in the catalog. It is important for communication between the customer and the sales department.

4 Identifying the device version

Fabrication no. (F-Nr)

Among other things, the fabrication number contains the date of production (year/week).

Example: F-Nr = 00700338012**11101**0006

The figures concerned are in positions 12, 13, 14, and 15 (from the left).

The device was therefore produced in the 1st calendar week of 2011.

4.2 Scope of delivery

1x module in the ordered version
1x cover for system bus (for central processing unit and router module)
2x end brackets for DIN rail (for central processing unit and router module)
1x installation instructions B 7050xx.4
1x mini-DVD with setup program (demo version), programming software CODESYS V3, and detailed documentation on the central processing unit

If you have any questions, please contact the supplier!

4.3 Accessories

The following articles are subject to charge and must be ordered separately:

4.3.1 General accessories

Description	Part no.
JUMO mTRON T system manual, English	00575577
Setup program with program editor JUMO mTRON T (on MiniDVD), incl. USB cable (A-plug to mini-B-plug, 3 m)	00569494
Program editor JUMO mTRON T (on MiniDVD), incl. USB cable (A-plug to mini-B-plug, 3 m)	00622333
PCA3000/PCC JUMO software package	00431884
PC Evaluation Software PCA3000	00431882
Release automatic print for PC Evaluation Software PCA3000	00505548
PCA Communication Software PCC	00431879
Plant Visualization Software JUMO SVS3000: See data sheet 700755	-
USB cable A-plug mini-B-plug 3 m	00506252

Content of the Mini-DVD:
- Setup program with program editor JUMO mTRON T in case of part no. 00569494
- Program editor JUMO mTRON T in case of part no. 00622333
- CODESYS programming software (free version)
- CODESYS Repository Package - Operating panels (free version)
- GSD file JUMO mTRON T - CPU (free version)
- PC Evaluation Software PCA3000 (30-day trial version)
- PCA Communication Software PCC (30-day trial version)
- Documentation in PDF format

4 Identifying the device version

4.3.2   Central processing unit

Accessories

Description	Part no.
Interface modules (expansion boards):	
RS232 Modbus RTU	00569505
RS422/485 Modbus RTU	00569506
PROFIBUS-DP (slave; as of system version 02 and as of the central processing unit's production date 27/2013 (calendar week))	00569507
Extra codes (activations):	
Math/logic module (activation for all connected controller modules)	00569509
PLC according to IEC 61131-3 (CODESYS V3.5)	00569510
Program generator 1 to 9	00569511
Program generator 1 to 9 with process steps (as of system version 02)	00606498

4.3.3   Controller module

Accessories

Description	Part no.
Modules for option slots (expansion boards):	
Analog input	00569497
Relay (changeover contact)	00569498
2 relays (N/O contacts with common pole)	00569499
Analog output	00569500
2 digital inputs	00569501
Solid-state relay 1 A	00569502
2 open-collector outputs	00569503

5.1   General information on installation/dismounting

	DANGER!
⚡	With multichannel controller module 705010 and relay module 705015, the load circuits from relay or solid state relay outputs can be operated with a dangerous electrical voltage (e.g. 230 V). There is a risk of electric shock. Prior to the installation/dismounting of these modules or the removal of the module insert, the load circuits are to be disconnected from the voltage and the terminal strips are to be removed from the module. This work must only be performed by qualified personnel.

	WARNING!
⚠	The modules must never be installed in areas with an explosion hazard. There is the risk of an explosion. The entire system must only be used outside of areas with an explosion hazard.

Mounting site

All modules have protection type IP20 and are only intended for use in fireproof control cabinets or switch boxes. The mounting site should be virtually vibration-free. Electromagnetic fields caused by equipment such as motors or transformers should be avoided.

Multifunction panel 840 has protection type IP67 at the front and is intended for installation in a panel cut-out. The rear has protection type IP20.

Climatic conditions

The ambient temperature and the relative humidity at the mounting site must correspond to the technical data. Aggressive gases and vapors have a negative effect on the operating life of the modules. The mounting site must be free from dust, powder, and other suspended matter so that the cooling slots do not become blocked.

DIN rail

All modules are mounted on a DIN rail according to DIN EN 60715 (35 mm × 7.5 mm × 1 mm). For reasons of stability, the spacing of the fastening screws for the DIN rail should not exceed 200 mm. The minimum distances for the modules that are specified in the module-specific installation or operating instructions must be observed.

Installation position

The DIN rail should be mounted horizontally so that all modules are arranged vertically. Otherwise the admissible ambient temperature range will be restricted.

Space requirement

The modules require the minimum distances shown in the following figure for the purpose of installation/dismounting and for future maintenance or replacement. In the event of shorter distances the minimum bending radius of the cables, the performance of the electrical installation, and the clear arrangement of the plant are no longer guaranteed.
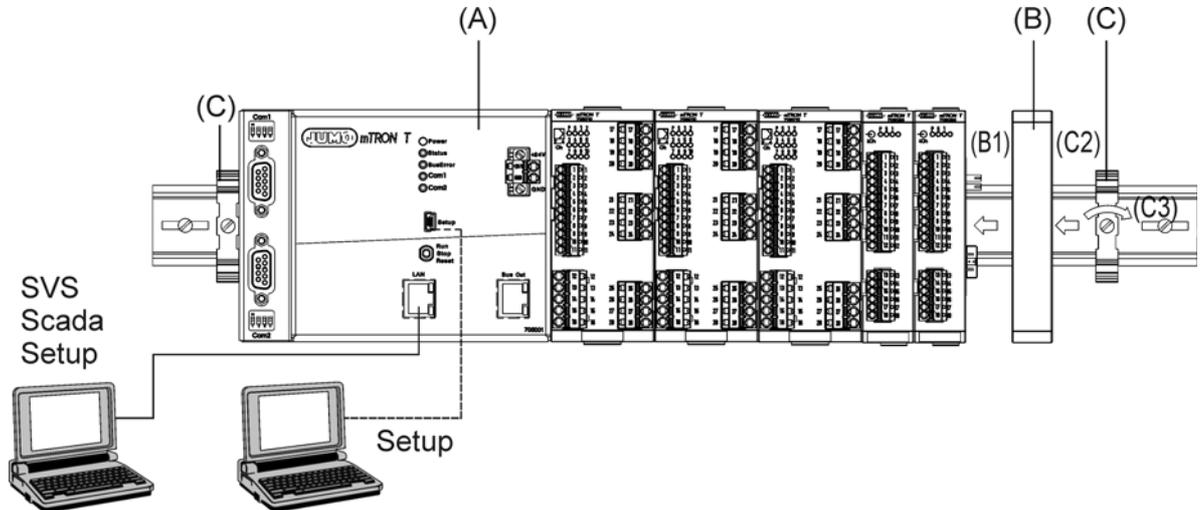
⇨ Installation instructions of the individual modules

5 Installation

5.2 Module sequence

5.2.1 System with centralized module assignment

Example: Central processing unit with input/output modules

The central processing unit (A) is required for this purpose. It contains all configuration, parameter, and process data of the entire system and the customer-specific PLC application (if applicable). All modules are mounted to the right; the sequence is at the user's discretion. They are snapped on to the DIN rail and moved to the left against the central processing unit or the previous module until the plug connections for the voltage supply and the system bus are connected. Any distance between two modules is not allowed.

A maximum of 30 input/output modules can be managed by one central processing unit.

Cover

Once all modules are installed the cover (B) must be positioned on the DIN rail from the right and moved to the left against the final module (B1). It protects the contacts of the final module against touching and contamination.

The cover is included in the scope of delivery of the central processing unit and therefore does not need to be ordered separately.

End brackets

The final mechanical element of the DIN rail is formed by an end bracket (C) on each side. The right end bracket is positioned on the DIN rail from the outside, moved to the left against the cover (C2), and fastened with a screwdriver (C3). The left end bracket is mounted according to the same principle following the installation of the central processing unit.

The end brackets are included in the scope of delivery of the central processing unit and therefore do not need to be ordered separately.

5.2.2   System with decentralized module assignment

Example: Modules on multiple DIN rails
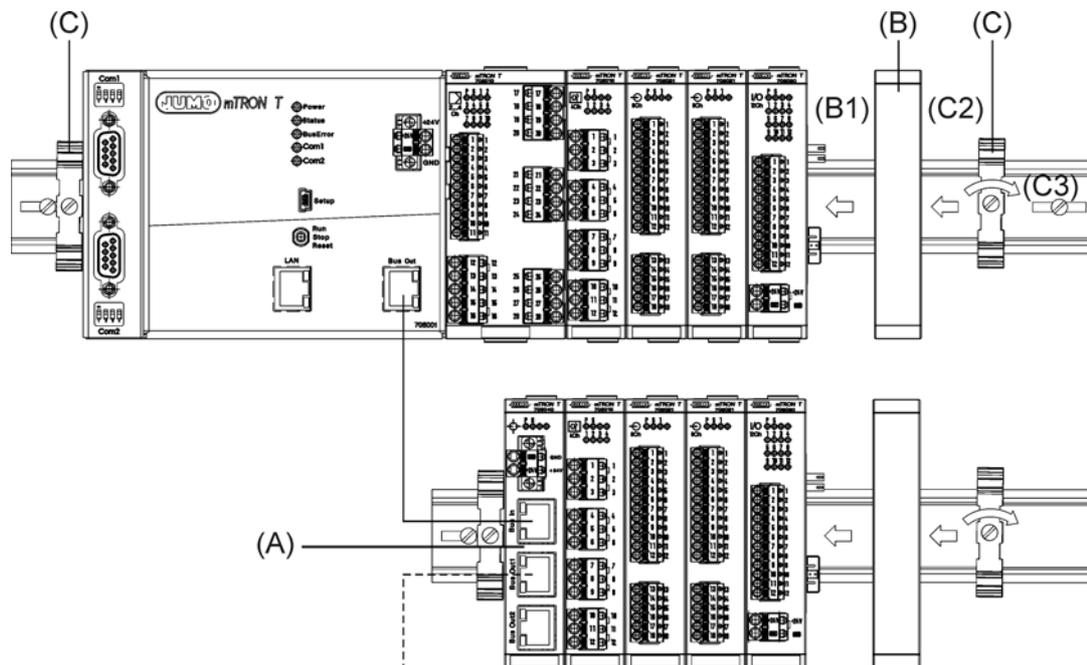
A router module (A) is required for the construction of a decentralized measuring, control, and automation system. This is the case, for example, if not all modules fit on a DIN rail, or if modules must be mounted at a distance of more than 100 m from the central processing unit or an upstream router module.

Cover

Once all modules are installed, the cover (B) must be positioned on the DIN rail from the right and moved to the left against the final module (B1). It protects the contacts of the final module against touching and contamination.

The strand with the router module is provided with a cover in the same manner.

The cover is included in the scope of delivery of the central processing unit and the router module. It therefore does not need to be ordered separately.

End brackets

The final mechanical element of the DIN rail is formed by an end bracket (C) on each side. The right end bracket is positioned on the DIN rail from the outside, moved to the left against the cover (C2), and fastened with a screwdriver (C3). The left end bracket is mounted according to the same principle following the installation of the central processing unit.

The strand with the router module is provided with end brackets in the same manner.

The end brackets are included in the scope of delivery of the central processing unit and the router module and therefore do not need to be ordered separately.

> **NOTE!**
> Therefore, the arrangement of modules on various DIN rails may also be required in order to differentiate between optional and mandatory modules (see setup program manual B 705000.6, Section "System bus": Alias device address).

5 Installation

5.3 Installation/dismounting on DIN rail

All modules in the system are intended for installation on a DIN rail according to DIN EN 60715 (35 mm × 7.5 mm × 1 mm).

The following must always be installed on the left, at the start of the DIN rail:
- A central processing unit *or*
- A router module

These modules connect the input/output modules to the voltage supply and the system bus.

> **NOTE!**
> To determine the required minimum width of the DIN rail, the widths of the individual modules are to be added (see technical data of the modules in the respective data sheet or the module-specific installation instructions).
> The widths of the cover (17.5 mm) and both end brackets (each 9.5 mm) should also be taken into consideration: 17.5 mm + 2 × 9.5 mm = 36.5 mm.

5.3.1 Base units

Installation of a base unit, using the example of a central processing unit 705001
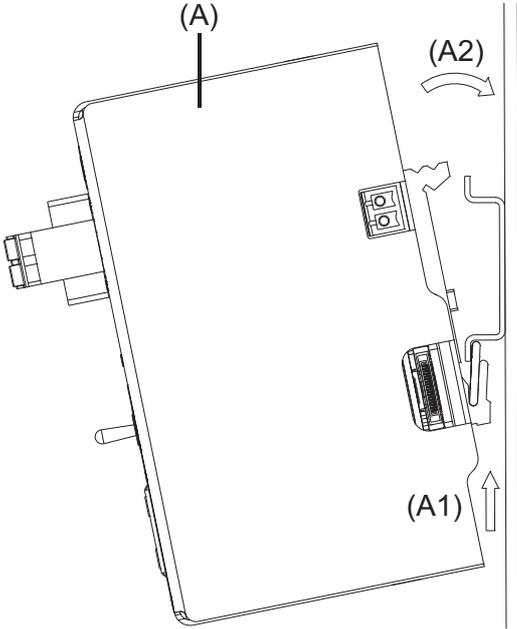
Installing the end brackets
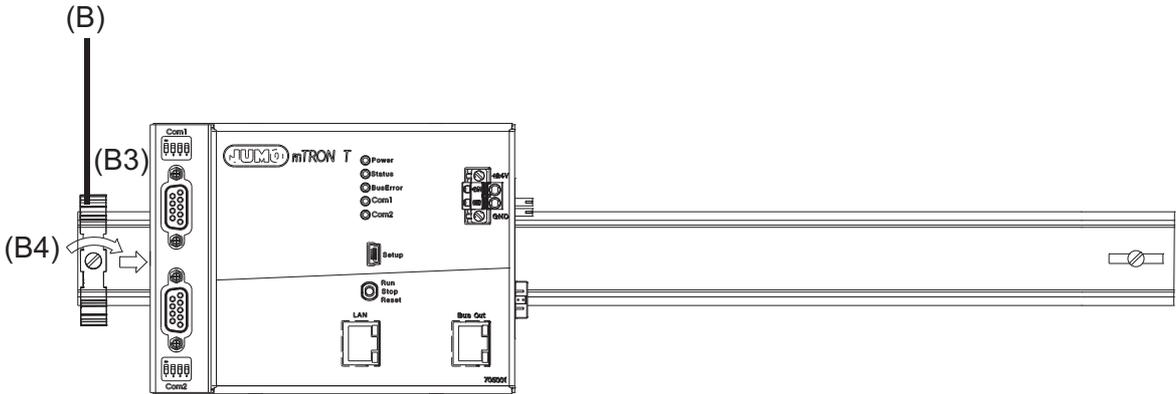
Procedure:

Step	Activity
1	Mount the central processing unit (A) on the DIN rail from below and press upward (A1).
2	Pivot the central processing unit (A) toward the rear until it snaps into place (A2).
3	Position the end bracket (B) on the DIN rail and move to the right against the central processing unit (B3). Fasten the end bracket using a screwdriver (B4).

5 Installation

Dismounting a base unit, using the example of a central processing unit 705001
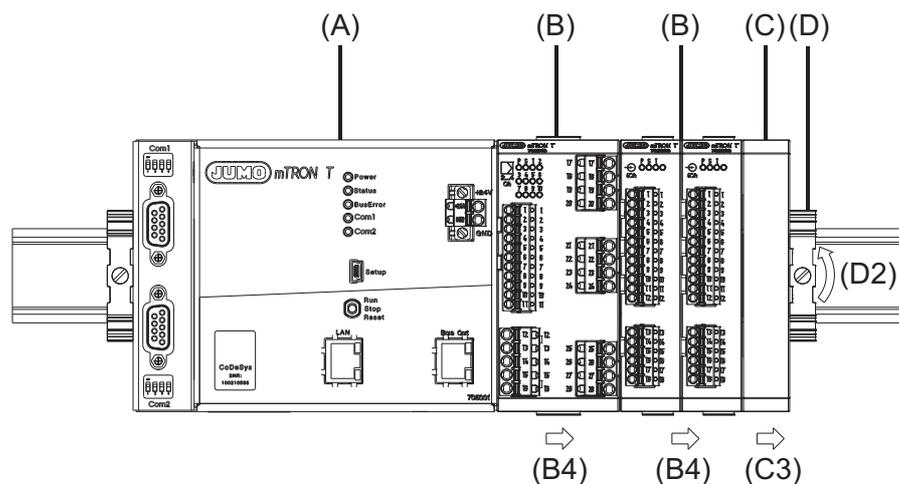
Removing the central processing unit from the DIN rail
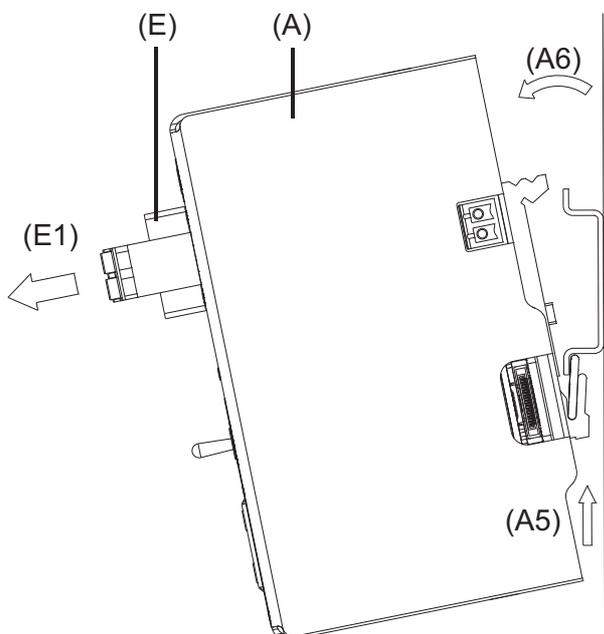
Procedure:

Step	Activity
1	Remove the connection cables if required (Setup, LAN, Bus Out).
2	If required, use a screwdriver to release the wired terminal (E) of the central processing unit (A) and pull off toward the front (E1).
3	Fully release the end bracket (D) using a screwdriver (D2), press upward from below, pivot toward the front, and remove from the DIN rail. Note: The end bracket does not need to be removed from the DIN rail if there is sufficient space to the side to move it at least 10 mm to the right.

Step	Activity
4	Move the cover (C) to the right (C3) until the side contacts of the neighboring module are exposed. Then release the cover at the bottom using a screwdriver, press upward, and remove from the DIN rail.
	Note: The cover does not need to be removed from the DIN rail if there is sufficient space to the side to move it at least 10 mm to the right.
5	Move the modules (B) on the right next to the central processing unit (A) to the right (B4) until the side contacts of the central processing unit are exposed.
	➥ These modules are isolated from the voltage supply and the system bus.
6	Press the central processing unit (A) upward from underneath (A5), pivot off the DIN rail toward the front (A6), and remove.

5 Installation

5.3.2　Input/output modules

In a sequence at the user's discretion, input/output modules can be arranged to the right next to a base unit or a router module.

Installation, using the example of a multichannel controller module 705010
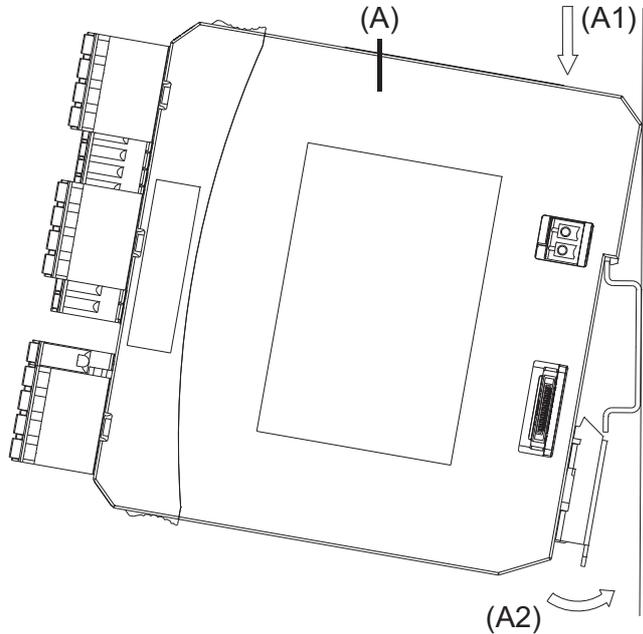
Example installation
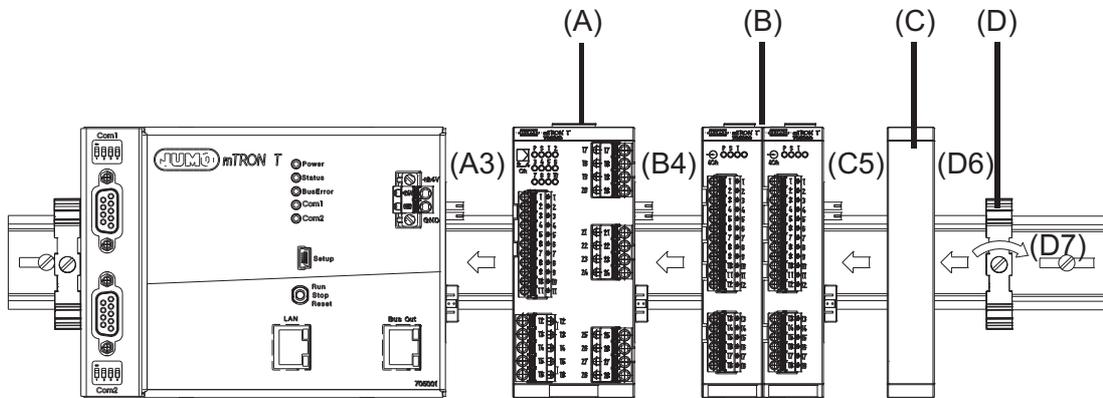
Procedure:

Step	Activity
1	Mount the multichannel controller module (A) in the DIN rail from above (A1).
2	Pivot the multichannel controller module (A) downward until it snaps into place (A2).
3	Move the multichannel controller module (A) to the left against the previous module (A3) until the plug connections for the voltage supply and the system bus are connected.
4	Position additional modules (B) and move to the left against the previous module (B4).
5	After the final module, position the cover (C) on the DIN rail and move to the left against the module (C5).

Step	Activity
6	After attaching the cover, position the end bracket (D) on the DIN rail and move to the left against the cover (D6).
7	Fasten the end bracket (D) using a screwdriver (D7). For this purpose, ensure that the end bracket and the cover are positioned flush against the final module.

5 Installation

Dismounting, using the example of a multichannel controller module 705010
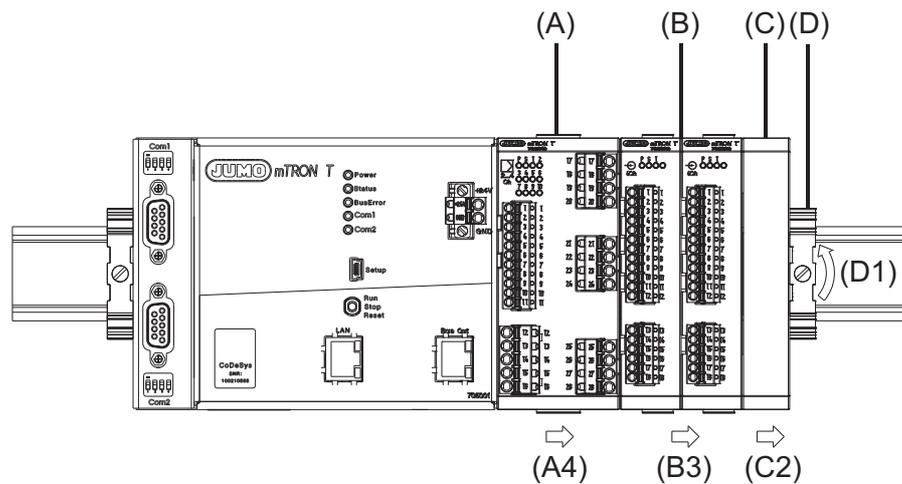
Removing the multichannel controller module from the DIN rail

Procedure:

Step	Activity
1	Fully release the end bracket (D) using a screwdriver (D1), press upward from below, pivot toward the front, and remove from the DIN rail.
	Note: The end bracket does not need to be removed from the DIN rail if there is sufficient space to the side to move it at least 20 mm to the right.
2	Move the cover (C) to the right (C2) until the side contacts of the neighboring module are exposed. Then release the cover at the bottom using a screwdriver, press upward, and remove from the DIN rail.
	Note: The cover does not need to be removed from the DIN rail if there is sufficient space to the side to move it at least 20 mm to the right.

Step	Activity
3	Move the modules (B) on the right next to the multichannel controller module that is to be replaced (A) a minimum of 20 mm to the right (B3). ➥ These modules are isolated from the voltage supply and the system bus.
4	Move the multichannel controller module (A) to the right (A4) until the side contacts of the neighboring module (here: central processing unit) – on the left, next to the multichannel controller module that is to be replaced – are exposed. ➥ The multichannel controller module is isolated from the voltage supply and the system bus. This is a prerequisite for the dismounting of the multichannel controller module.
5	If required, pull off the wired terminals (E) of the multichannel controller module (A) toward the front (E5).
6	Insert a suitable screwdriver (F) into the unlocking slot of the multichannel controller module (A6) and press upward (F7).
7	Pivot the multichannel controller module (A) upward off the DIN rail (A8) and remove it.

5 Installation

5.3.3   Special modules

Installation, using the example of a router module 705040

Procedure:

Step	Activity
1	Mount the router module (A) in the DIN rail from above (A1).
2	Pivot the router module (A) downward until it snaps into place (A2).
3	Position the end bracket (B) on the DIN rail and move to the right against the router module (B3).
4	Fasten the end bracket (B) using a screwdriver (B4). For this purpose, ensure that the end bracket is positioned flush against the router module.

Dismounting, using the example of a router module 705040
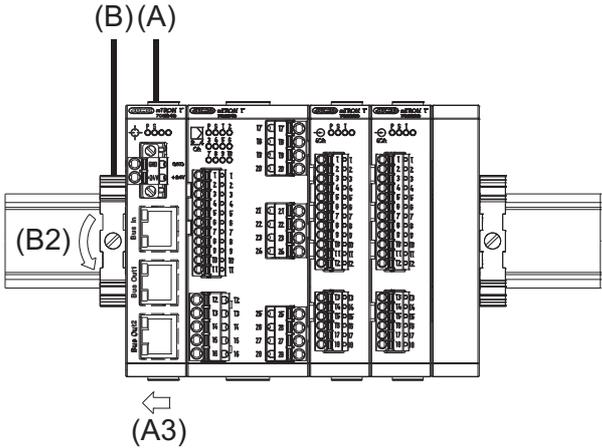
Removing the router module from the DIN rail

Procedure:

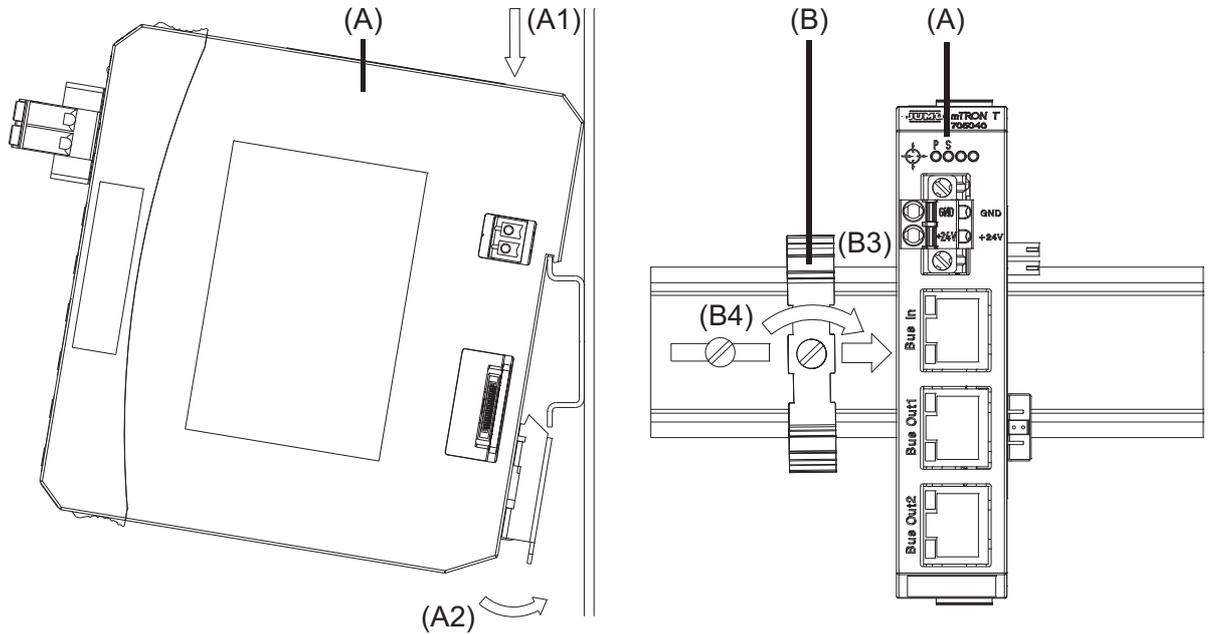| Step	Activity
1	Remove the connection cables if required (Bus In, Bus Out1, Bus Out2). ➥ The router module, all modules on the right next to the router module, and, where applicable, additional devices connected via Bus Out1 or Bus Out2 (router modules, multifunction panel) are isolated from the system bus.
2	If required, use a screwdriver to release the wired terminal (D) of the router module (A) and pull off toward the front (D1). ➥ The connection to the voltage supply is isolated.
3	Fully release the end bracket (B) using a screwdriver (B2), press upward from below, pivot toward the front, and remove from the DIN rail. Note: The end bracket does not need to be removed from the DIN rail if there is sufficient space to the side to move it at least 10 mm to the left.

5 Installation

Step	Activity
4	Move the router module (A) to the left (A3) until the side contacts on the right side of the router module are exposed.
5	Insert a suitable screwdriver (C) into the unlocking slot of the router module (A4) and press upward (C5).
6	Pivot the router module (A) upward off the DIN rail (A6) and remove it.

5.4   Mounting in a panel

5.4.1   Multifunction panel

Mounting a multifunction panel 840 (705060)
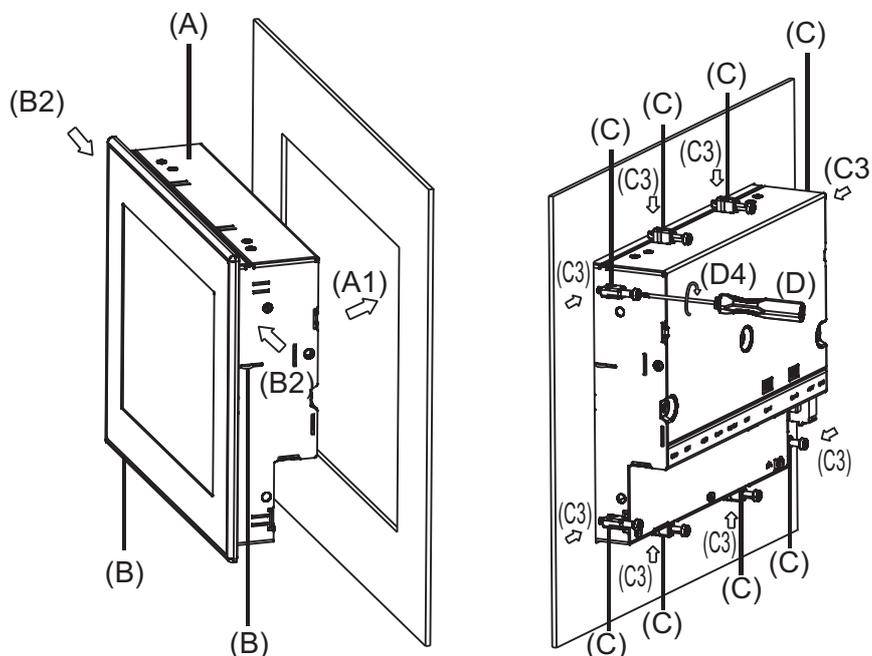
Procedure:

Step	Activity
1	Insert the device (A) into the panel cut-out (A1) from the front until the two side springs (B) click into place (B2). The springs facilitate the mounting, but do not replace the fastening elements (step 2).
2	Insert the fastening elements (C) into the recesses of the case (C3) and use a screwdriver (D) to evenly clamp them against the rear side of the panel with a torque of 0.5 Nm (D4).

NOTE!
The provided template is to be used to create the panel cut-out. This is the only way to guarantee optimum positioning of the multifunction panel.

5 Installation

5.5 Replacing module inserts

5.5.1 Input/output modules

> ⚠ **DANGER!**
> With multichannel controller module 705010 and relay module 705015, the load circuits from relay or solid state relay outputs can be operated with a dangerous electrical voltage (e.g. 230 V).
> There is a risk of electric shock.
> The load circuits are to be disconnected from the voltage supply prior to removing the wired terminal strips. This work must only be performed by qualified personnel.

Replacement of a module insert, using the example of a multichannel controller module 705010
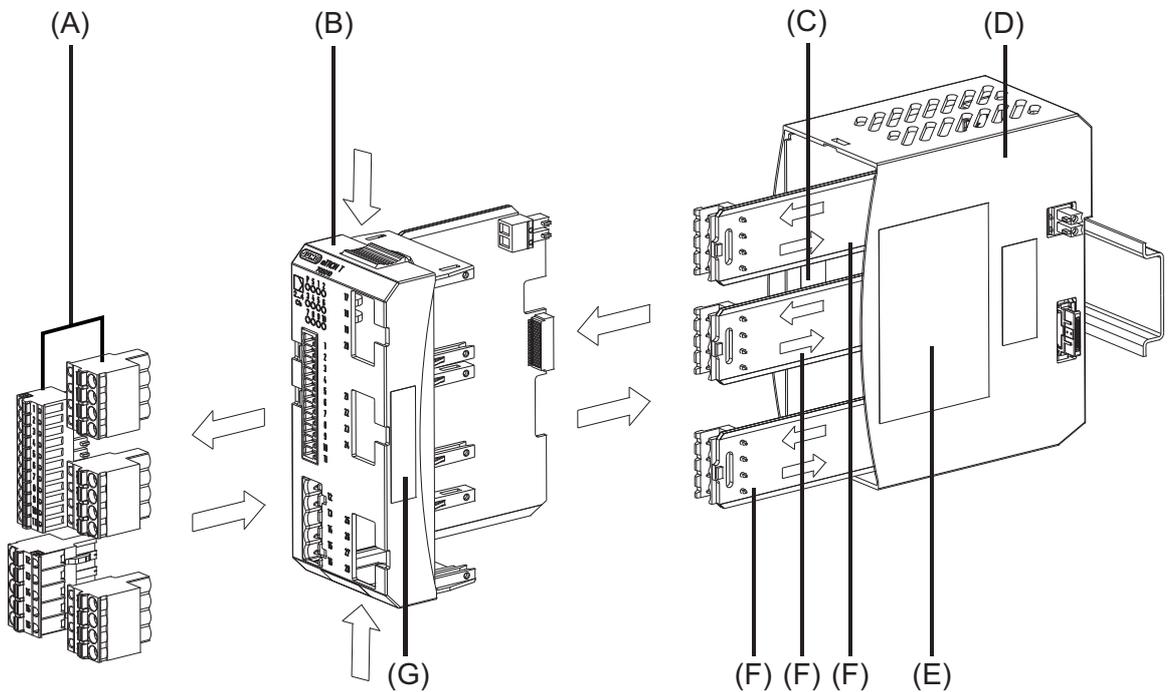
For service purposes (or when retrofitting options for the multichannel controller module), the case (D) can remain in the system; only the module insert (B) is replaced. For this purpose, the system does not need to be isolated from the voltage supply (hot swapping). If it is an optional module, the operation of the rest of the system (mandatory modules) is not interrupted. In the case of a mandatory module, the whole system goes into "Stop" system state (see setup program manual).

The system will detect a module insert of the same type that has been replaced and will automatically reconfigure it. Retrofitted functions for the multichannel controller module (expansion slots) must be configured using the setup program or the multifunction panel.

The new module insert also has a new nameplate (G), which will differ from the old one at least with regard to the fabrication number, and is no longer identical to nameplates (E) and (C) on the case (D).

Therefore, in the event of replacement, the module insert will be supplied along with a new nameplate that will be affixed to the case (D) in place of the old nameplate (C). This means that the specifications of nameplates (G) and (C) once again correspond to one another.

⚠	**CAUTION!** Only module inserts of the same type may be used for the replacement. Otherwise, the function of the system may be affected. The module inserts can be clearly identified using the nameplate.

⚠	**CAUTION!** With the multichannel controller module 705010, a new module insert may contain retrofitted inputs or outputs that have not yet been configured. This can lead to unintended behavior, particularly at the outputs and the actuators connected to them. Prior to using the retrofitted inputs or outputs, ensure that these have been configured correctly.

Removing the module insert

Step	Activity
1	Disconnect load circuits from the relay or solid state relay outputs.
2	Pull off the wired terminal strips (A) toward the front.
3	Press the old module insert (B) together on the grooved surfaces at the top and bottom and remove from the case (D).
4	For the multichannel controller module, also remove the modules (F) of the expansion slots from the case (D) toward the front, if required.

Mounting the module insert

Step	Activity
1	Affix the new nameplate in place of the old nameplate (C) in the case.
2	For the multichannel controller module, also insert the modules (F) of the expansion slots into the case (D), if required.
3	Hold the new module insert (B) at the grooved surfaces on the top and bottom and insert them into the case (D). For this purpose, ensure that the board of the module insert slides into the guide rails of the case. For the multichannel controller module, also ensure that the modules (F) of the expansion slots slide in the guide rails of the module insert.
4	Reattach the wired terminal strips (A).

ℹ	**NOTE!** When mounting the module insert, ensure that the snap holders (under the grooved surfaces) audibly snap into place.

ℹ	**NOTE!** The availability of the system can be increased through the storage of module inserts and modules for expansion slots.

5 Installation

5.5.2   Special modules

Replacing the module insert of a router module 705040
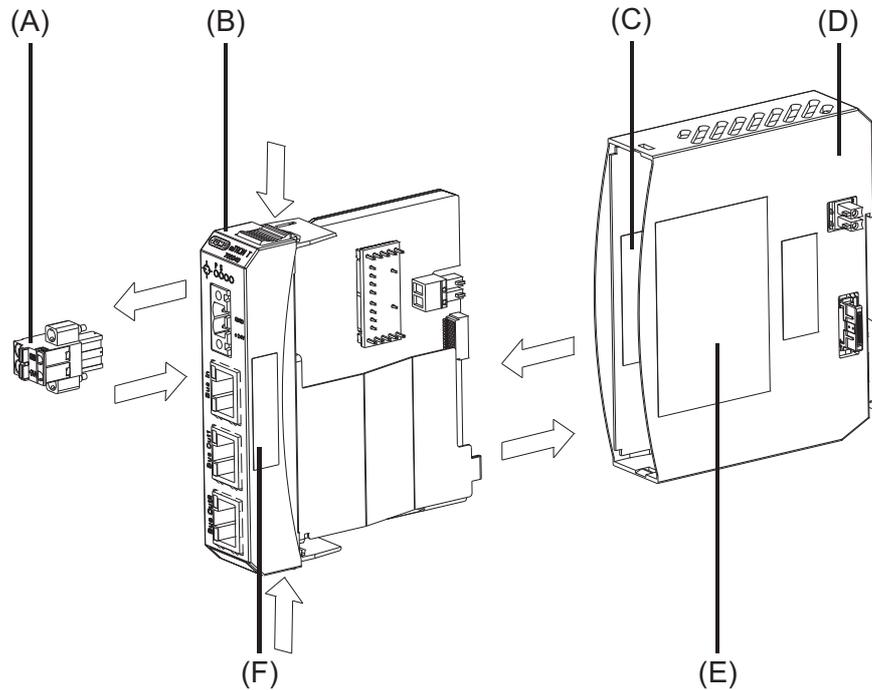
For service purposes, the case (D) can remain in the system; only the module insert (B) is re-placed. Thanks to the hot connect functionality of the router module, this can even be per-formed during operation with the corresponding configuration (alias device address).

The new module insert also has a new nameplate (F), which differs from the old one at least with regard to the fabrication number and is no longer identical to nameplates (E) and (C) on the case (D).

Therefore, in the event of replacement, the module insert will be supplied along with a new nameplate that will be affixed to the case (D) in place of the old nameplate (C). This means that the specifications of nameplates (F) and (C) once again correspond to one another.

Removing the module insert

Step	Activity
1	Pull off the connection cables if required (Bus In, Bus Out1, Bus Out2).
2	Pull off the wired terminal strip (A) toward the front.
3	Press the old module insert (B) together on the grooved surfaces at the top and bottom and remove from the case (D).

Mounting the module insert

Step	Activity
1	Affix the new nameplate in place of the old nameplate (C) in the case.
2	Hold the new module insert (B) at the grooved surfaces on the top and bottom and insert them into the case (D). For this purpose, ensure that the board of the module insert slides into the guide rails of the case.
3	Reattach the wired terminal strip (A).
4	Reconnect the connection cables if required (Bus In, Bus Out1, Bus Out2).

NOTE!
When mounting the module insert, ensure that the snap holders (under the grooved surfaces) audibly snap into place.

NOTE!
The availability of the system can be increased through the storage of module inserts.

5 Installation

6.1 Installation notes

> **NOTE!**
> These installation notes apply for the entire measuring, control, and automation system and, on some occasions, are only applicable for a specific module.
> The respective connection diagram shows the context.

Requirements for the personnel

- Work on the modules must only be carried out to the extent described and, like the electrical connection, only by qualified personnel.
- Before plugging and unplugging connection cables ensure that the person performing the work is electrostatically discharged (e.g. by touching grounded metallic parts).

Cables, shielding, and grounding

- When selecting the cable material, when installing, and when performing the electrical connection of the module, the regulations of DIN VDE 0100 "Erection of power installations with rated voltages up to 1000 V" and the respective national regulations (e.g. on the basis of IEC 60364) are to be observed.
- Certain cables must be heat resistant up to at least 80 °C at maximum load. The relevant instructions in the connection diagram of the affected modules must be observed.
- Route input, output, and supply cables separately and not parallel to one another.
- Only use shielded and twisted probe and interface cables. Do not route the lines close to current-carrying components or cables.
- For temperature probes, ground the shielding on one side in the control cabinet.
- Do not perform loopthroughs on the grounding cables, but route the cables individually to a shared grounding point in the control cabinet; in doing so, ensure that the cables are as short as possible.
  Ensure that the equipotential bonding is correct.

Electrical safety

- Isolate power supply units from the voltage supply on the primary side if there is a risk of touching parts with dangerous electrical voltage (e.g. 230 V) in the course of work.
- The fuse rating of the power supply units on the primary side should not exceed a value of 10 A (inert).
- With modules with relay or solid state relay outputs, the load circuits can be operated with a dangerous electrical voltage (e.g. 230 V). Disconnect load circuits from the voltage supply during installation/dismounting and electrical connection.
- In order to prevent the destruction of the relay or solid state relay outputs in the event of an external short circuit in the load circuit, the load circuit should be fused to the maximum admissible output current.
- The modules are not suitable for installation in areas with an explosion hazard.
- In addition to a faulty installation, incorrectly set values on the module could also impair the correct function of the following process. Therefore, ensure that safety devices independent of the module (e.g. overpressure valves or temperature limiters/monitors) are available and that it is only possible for qualified personnel to define settings. Please observe the corresponding safety regulations in this context.

6 Electrical connection

References to other information

- The electromagnetic compatibility meets the standards and regulations cited in the technical data.
- The USB device interface and voltage supply in the central processing unit 705001 are **not** electrically isolated. In general, please observe the specifications regarding electrical isolation.

6.2 Electrical isolation

Base units

		Central processing unit 705001	System bus
			24 V
USB device	↔	⌇ AC 1500 V	
System bus Out 1	↔	⌇ AC 1500 V	
Ethernet	↔	⌇ AC 1500 V	
Com 1	↔	⌇ AC 30, DC 50 V	
Com 2	↔	⌇ AC 30, DC 50 V	

Input/output modules

Multichannel controller module 705010

Analog input 1	→	⌇ AC 30 V, DC 50 V
Analog input 2	→	⌇ AC 30 V, DC 50 V
Relay output 3	←	⌇ AC 3800 V
Relay output 4	←	⌇ AC 3800 V
Digital input 1 to 2	→	⌇ AC 30 V, DC 50 V
Digital output 3	←	⌇ AC 30 V, DC 50 V
Digital output 4	←	⌇ AC 30 V, DC 50 V

⌇ ↔ Option 1
⌇ ↔ Option 2
⌇ ↔ Option 3

Options for the multichannel
controller module 705010

Analog input 3	→	⌇ AC 30 V, DC 50 V
Analog input 4	→	⌇ AC 30 V, DC 50 V
Digital input 5 to 6	→	⌇ AC 30 V, DC 50 V
Digital input 7 to 8	→	⌇ AC 30 V, DC 50 V
Digital input 9 to 10	→	⌇ AC 30 V, DC 50 V
Analog output 1	←	⌇ AC 30 V, DC 50 V
Analog output 2	←	⌇ AC 30 V, DC 50 V
Analog output 3	←	⌇ AC 30 V, DC 50 V
Relay output 5	←	⌇ AC 3800 V
⋮		
Relay output 10	←	⌇ AC 3800 V
Solid state relay output 5	←	⌇ AC 800 V (peak)
⋮		
Solid state relay output 10	←	⌇ AC 800 V (peak)
Open-collector output 5 to 6	←	⌇ AC 30 V, DC 50 V
Open-collector output 7 to 8	←	⌇ AC 30 V, DC 50 V
Open-collector output 9 to 10	←	⌇ AC 30 V, DC 50 V

Relay module 4-channel 705015

Relay output 1	←	⌇ AC 3800 V
⋮		
Relay output 4	←	⌇ AC 3800 V

6 Electrical connection

24 V

Analog input module 4-channel 705020

Analog input 1	→	≀≀ AC 30 V, DC 50 V
⋮		
Analog input 4	→	≀≀ AC 30 V, DC 50 V
Digital input	→	≀≀ AC 30 V, DC 50 V

Analog input module 8-channel 705021

| Analog input 1 to 8 | → | ≀≀ AC 30 V, DC 50 V |
| Digital input | → | ≀≀ AC 30 V, DC 50 V |

Analog output module 4-channel 705025

Analog output 1	←	≀≀ AC 500 V
⋮		
Analog output 4	←	≀≀ AC 500 V

Digital input/output module 12-channel 705030

| Digital input/output 1 to 12 | ↔ | ≀≀ AC 30 V, DC 50 V |

Special modules

Router module 705040

System bus In	↔	≀≀ AC 500 V
System bus Out 1	↔	≀≀ AC 500 V
System bus Out 2	↔	≀≀ AC 500 V

Operating, visualization, recording

Multifunction panel 840 705060

Com 1	↔	≀≀ AC 30, DC 50 V
Com 2	↔	≀≀ AC 30, DC 50 V
USB host	↔	≀≀ AC 30, DC 50 V
USB device	↔	≀≀ AC 30, DC 50 V
Ethernet	↔	≀≀ AC 1500 V
System bus In	↔	≀≀ AC 1500 V
System bus Out	↔	≀≀ AC 1500 V

Voltage supply

Power supply units 24 V 705090 DC 24 V

| AC 230 V → | ≀≀ | 3800 V |

SELV DIN EN 50178

> **NOTE!**
> The external voltage supply for the digital input/output module 12-channel and the voltage supply for controlling the digital inputs of this module must be switched on/off with a common disconnecting device (common electrical circuit).

> **NOTE!**
> Thyristor power controller (type 70906x; as of system version 04): Information concerning electrical isolation can be taken from the operating manual of the power controller.
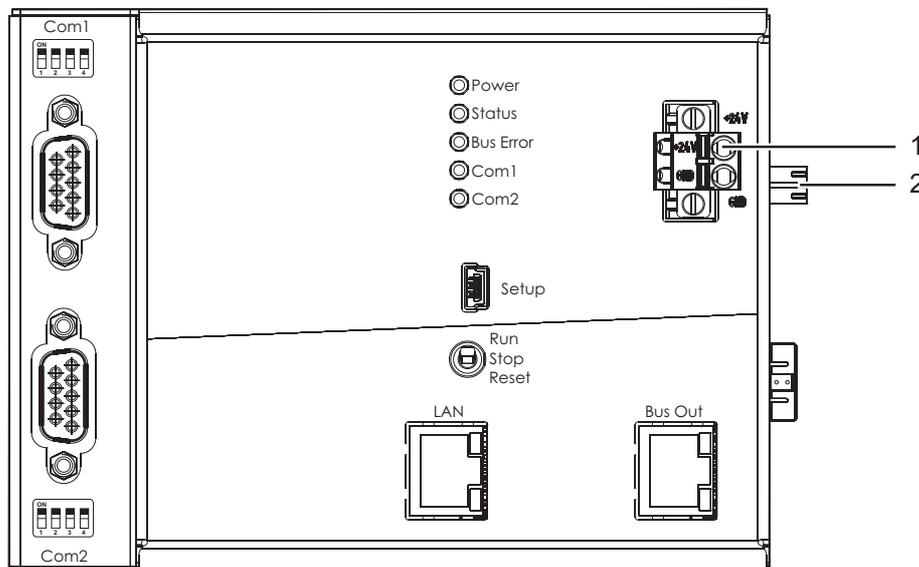
6.3   Voltage supply

The DC 24 V voltage supply is provided by an external power supply unit and fed in via the base unit (central processing unit) or a router module. For this purpose, these modules have a 2-pole terminal strip with Push-In technology that can be accessed from the front (1). The terminal strip can be removed after releasing a screw connection.

The input/output modules are supplied with voltage via the side contacts (2) of the base unit or router module.

The voltage supply for the multifunction panel – also DC 24 V – is to be fed in via a terminal strip (11) on the multifunction panel. This also involves a 2-pole terminal strip with Push-In technology that can be removed after releasing the screw connection.

Voltage supply of a base unit, using the example of a central processing unit

1   Voltage supply In, DC 24 V

2   Voltage supply Out, DC 24 V

The router module has identical connections to the voltage supply (note the reversed arrangement of the +24 V and GND terminals).

> **NOTE!**
> Only use the installation instructions or the operating manual of the affected module for the electrical connection. Follow the safety information stated there.
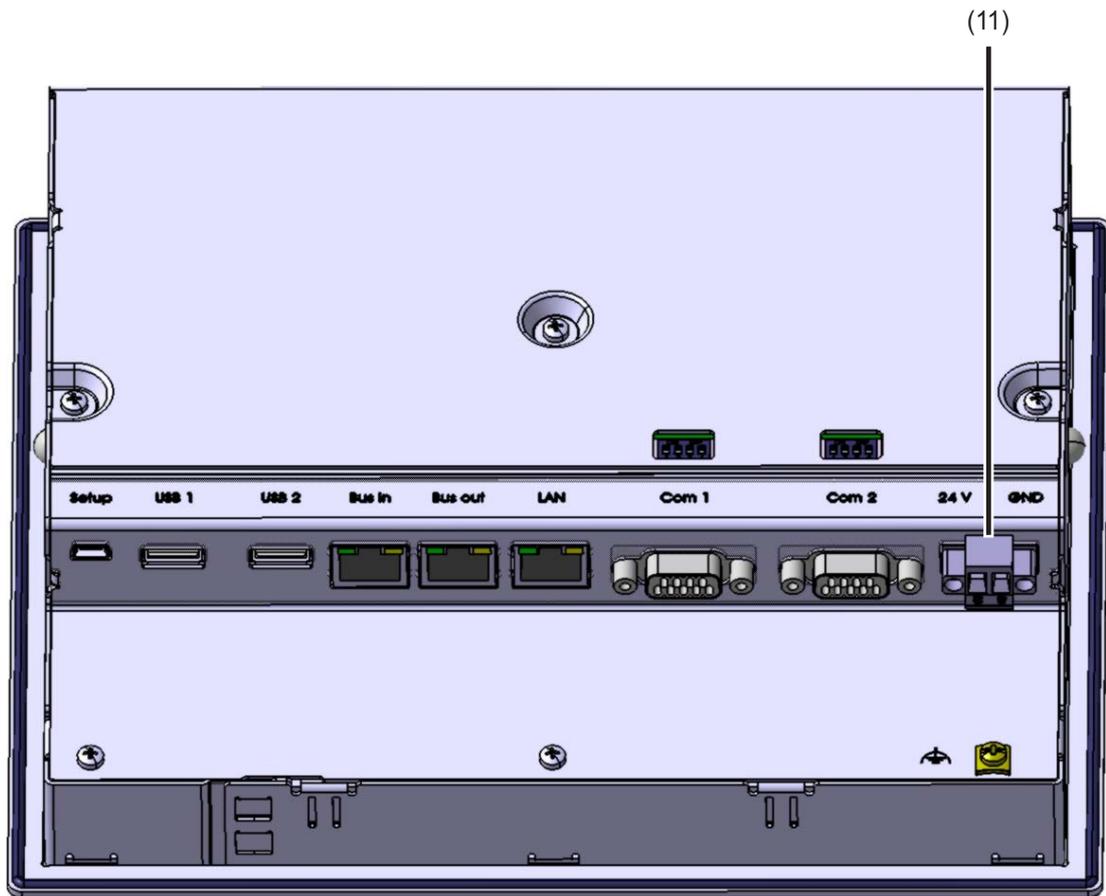
6 Electrical connection

> **CAUTION!**
> Long connecting cables can cause a significant voltage drop at high current load (max. 8 A).
> This may lead to an underflow of the minimum allowable input voltage of DC 19.2 V.
> To prevent this, the output voltage of the power supply has to be increased if possible. Hereby it is important to ensure that the maximum allowable input voltage of DC 30 V is not exceeded at any module.

Voltage supply of a multifunction panel 840

(11)

11   Voltage supply In, DC 24 V

> **NOTE!**
> Only use the installation instructions or the operating manual of the multifunction panel 840 for the electrical connection. Follow the safety information stated there.

6.4   Current load

⚠	**CAUTION!** The maximum current load of the plug-in connections is 8 A. The system may be damaged if this current limit is exceeded. Distribute modules between multiple DIN rails and also power supply units, if required.

Determining the maximum current without the setup program

The current consumption for each module is stated in the technical data. The currents can be added until the maximum value of 8 A is reached (base unit and input/output modules connected to it).

Additional input/output modules must then be mounted on the right, next to a router module on an additional DIN rail. In this case, the maximum admissible current consumption is also 8 A (router module input/output modules connected to it).

Where applicable, a second power supply unit is required for the voltage supply to the router module.

Base units

Designation	Current consumption
Central processing unit	Max. 350 mA

Input/output modules

Designation	Current consumption
Multichannel controller module	Max. 300 mA
Relay module 4-channel	120 mA
Analog input module 4-channel	130 mA
Analog input module 8-channel	80 mA
Analog output module 4-channel	220 mA
Digital input/output module	90 mA

Special modules

Designation	Current consumption
Router module	100 mA

Operating, visualization, recording

Designation	Current consumption
Multifunction panel 840	Max. 750 mA
Operating panel	Max. 750 mA

Determining the maximum current with the setup program

The setup program determines how many modules can be installed alongside one another. If the maximum current is exceeded, the user will be required to install additional modules on the right next to a router module on an additional DIN rail.

Where applicable, a second power supply unit is required for the voltage supply to the router module.

6 Electrical connection

	CAUTION!
⚠	The current consumption of the system can exceed the current load capacity of the used power supply units.
	The power supply units may be damaged.
	The dimensioning of the power supply units must be sufficiently large.

6.5   System bus

Side system bus

The side system bus connects the base unit or router module to the input/output modules arranged on the same DIN rail.

Either

• a base unit *or*
• a router module

must always be installed on the left, at the start of the DIN rail. The distinguishing feature is that their plug-in connections are only to the right; all other modules have plug-in connections on both sides.

The system bus on the side is physically implemented as a point-to-point connection. The connection is only ever made between two neighboring modules. If a module or a module insert does not function or is removed, the modules to the right can no longer be reached.

NOTE!

The further to the left a module is installed, the greater the probability that the module can still be reached in the event that a different module fails.

System bus connections of a base unit, using the example of a central processing unit
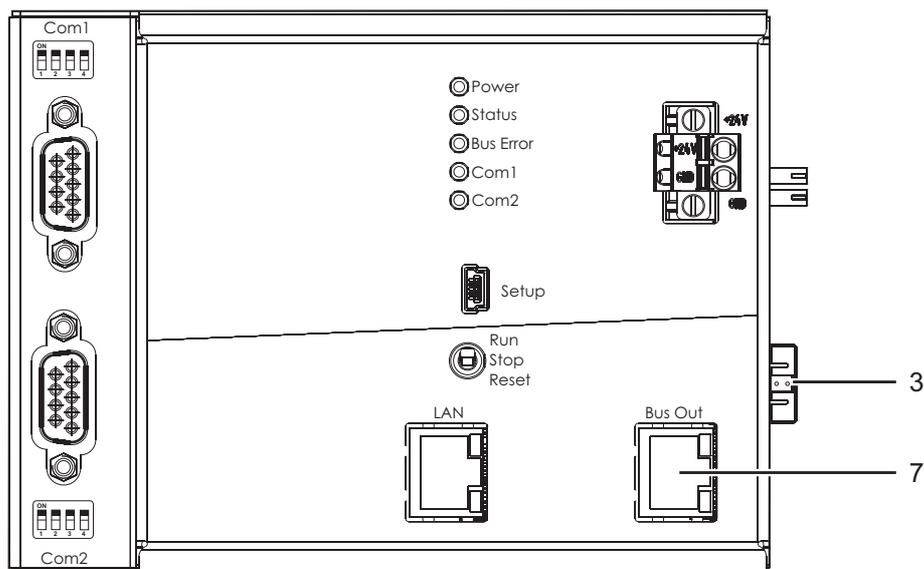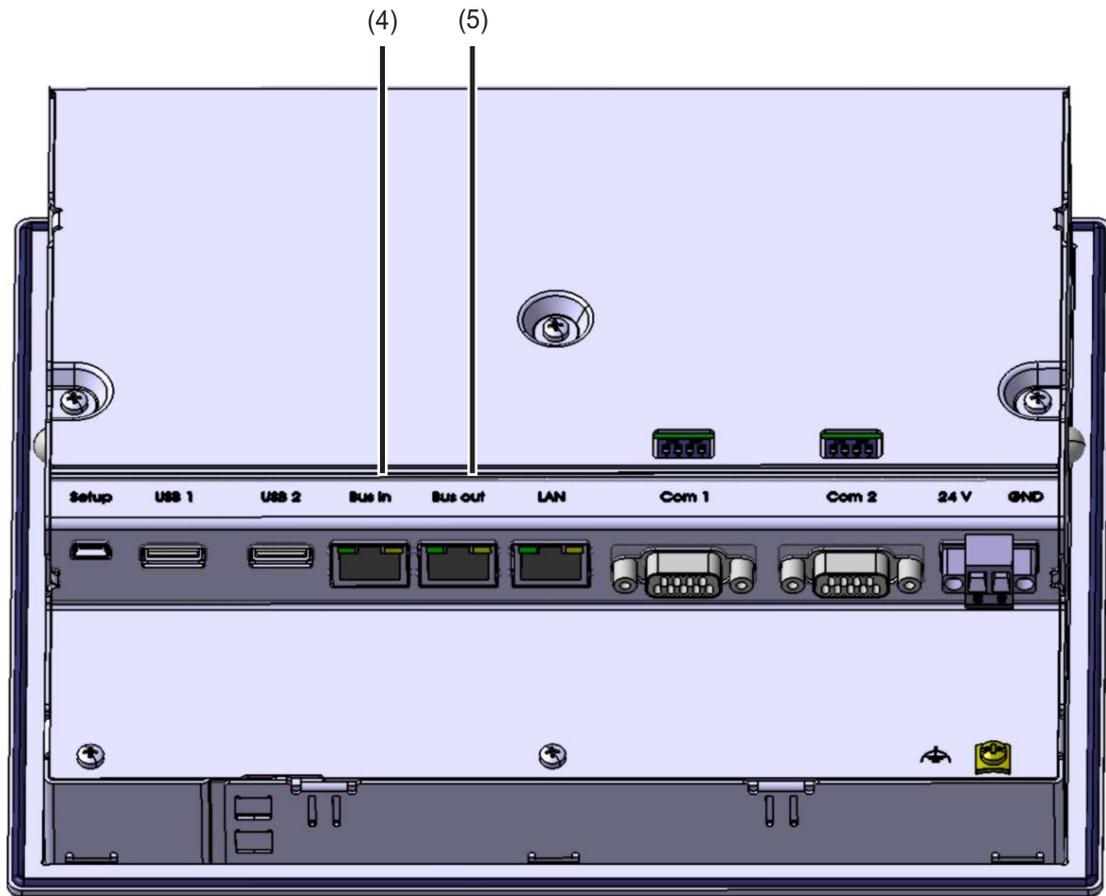

3   Side system bus Out

7   System bus Out

The router module has an identical connection for the side system bus, but a total of three RJ45 sockets for connecting to the base unit (Bus In), the multifunction panel, or additional router modules (Bus In, Bus Out1, Bus Out2).

6 Electrical connection

System bus connections of a multifunction panel 840

4   System bus In
5   System bus Out

System bus between base unit, router module, and multifunction panel

To connect the base unit to a multifunction panel or a router module, a connection is established via the RJ45 sockets (Bus Out – Bus In). For this purpose, use a commercially available network cable (patch or crossover cable) that corresponds to at least category 5 and has S/FTP shielding.

The connection can be established directly at a distance of up to 100 m. At greater distances, an additional router module will be required at a maximum of 100 m away. The distance can also be extended using a multifunction panel.
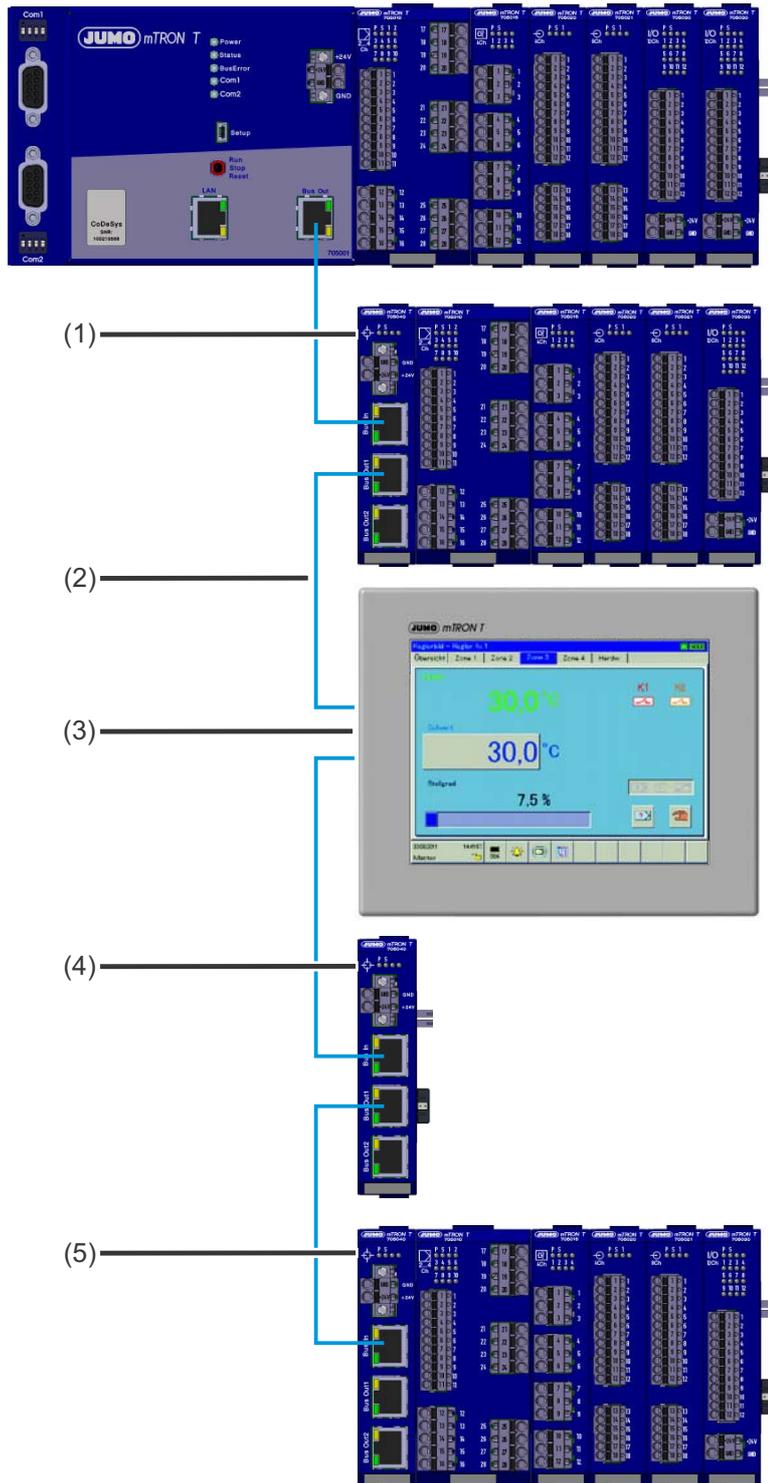
> **NOTE!**
> Commercially available Ethernet switches must not be used for the system bus. A connection between the system bus and a company network (LAN) is also not admissible.

The following figure shows an example for the connection between a central processing unit, multiple router modules, and a multifunction panel.

(1) Router module with downstream modules

(2) Network cable (patch or crossover cable), at least CAT5 (S/FTP); distance per connection up to 100 m

(3) Multifunction panel; instead of a router module

(4) Router module without downstream modules to increase the range

(5) Router module with downstream modules

6 Electrical connection

Connection of thyristor power controllers

As of system version 04, thyristor power controllers of type 70906x can be integrated in the measuring, control, and automation system via the system bus. Each power controller counts as one input/output module (max. 30 modules per system).

The power controller is connected to the central processing unit, to the multifunction panel, or to a router module, using a network cable. To the power controller, in turn, another power controller, a multifunction panel, or a router module can be connected.

Connection and configuration are described in a separate operating manual:

⇨ Operating manual 70500153T90...

A setup program is available for the measuring, control, and automation system. The setup program must be used for system startup; the first step is to perform project configuration. For example, this also includes:

- Creating a project and selecting the first module (e.g. central processing unit)
- Creating the hardware assignment. In other words, selecting the remaining modules including the optional extensions (inputs/outputs, interfaces)
- Selecting special software and hardware versions, if required
- Activating optional functions (e.g. math/logic, PLC)
- Settings and texts for collective alarms (system and modules)
- Project-specific settings (e.g. project description, language selection, collective alarm, PLC application, time zone)
- User administration

Following the project configuration, the individual modules and the multifunction panel must be configured. This task is also performed using the setup program. For example, this includes the configuration (and/or parameterization) of the following functions:

- Inputs and outputs, interfaces, internal signals
- Limit value monitoring
- Controller
- Math/logic (option)
- Program generator (option)
- PLC (option)
- Recording function (option)

With a few exceptions, the configuration of the modules can also be performed on the multifunction panel. A prerequisite for this is that the hardware assignment was created using the setup program and transferred to the system.

The following manual contains information on the configuration and startup of the overall measuring, control, and automation system:

⇨ Manual, setup program B 705000.6

In this manual, the user can find a simple example that describes the basic procedure during the initial startup of the measuring, control, and automation system.

In addition, a separate operating manual is available for each module; it describes the configuration of the module.

⇨ Chapter 1.4 "Available technical documentation", page 20

Both of the following sections are only intended to provide a brief insight into the setup program and the multifunction panel. For more information, see the respective manual.

7 Startup and configuration

7.1 Setup program
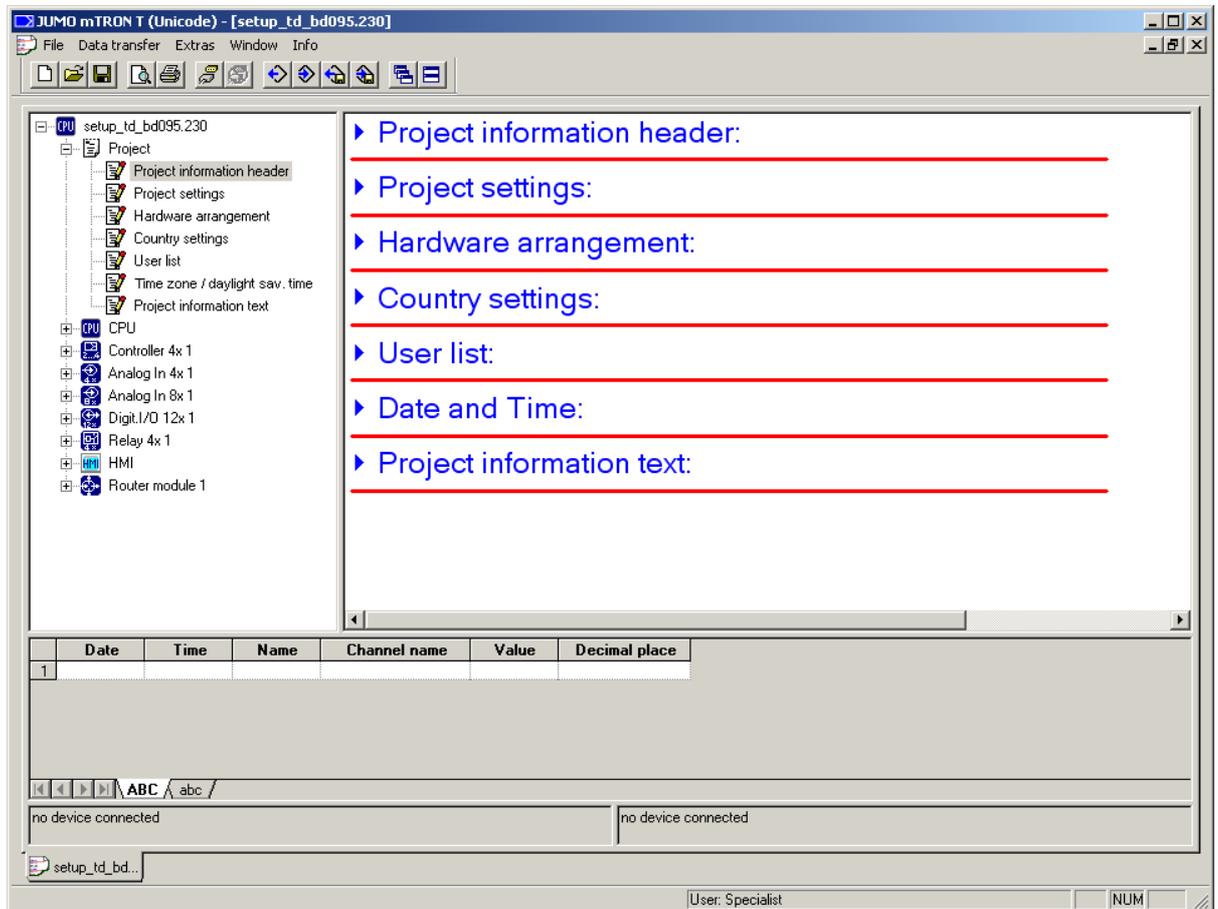
The setup program (accessories) is installed on a PC and connected to the base unit (e.g. central processing unit) via a USB or LAN interface. In this way, the entire system can be conveniently configured, parameterized, and operated. The setup data is transferred from the base unit via the system bus to the connected input/output modules, of which there may be a maximum of 30, even if these are connected via a router module. The base unit continuously compares the saved system configuration with the input/output modules that are present. For this reason, a module insert of an identical type can simply be replaced when service work is being performed. The new module insert is automatically detected by the base unit and configured (Plug and Play).

⇨ Manual, setup program B 705000.6

> **NOTE!**
> The setup program is an essential requirement for the initial startup and also for making changes to the hardware assignment. Certain parameters of the modules and the multifunction panel can also only be configured using the setup program.

7.2   Multifunction panel 840

The multifunction panel 840 with TFT-touchscreen allows easy and clearly-arranged measured data visualization, operation, configuration, and parameterization of the system.

The TFT color screen has a screen size of 21.3 cm (8.4"), a resolution of 640 × 480 pixels, 256 colors, and LED backlight.

As the interface between man and machine, the panel allows an optimum and clearly-arranged view of the process status and the system parameters. In addition, it is perfectly suitable for the display and operation of controller screens, process screens, the program editor, and the optional recording function. Setpoint values, batch text, parameters, and configuration data can be directly entered and changed by the user on the screen.

The process data that is transmitted by the system bus is shown in real time. Data archiving and evaluation is made possible by established PC-programs.

In addition to the standard interfaces (LAN, USB), two optional serial interfaces can be connected to a barcode scanner, modem, or other Modbus devices (master, slave).

The user can comfortably configure the multifunctional panel 840 with the setup program. And many functions are also configurable directly on the multifunction panel 840.

⇨ Operating manual, multifunction panel 840 B 705060.0

> **NOTE!**
> Some of the parameters of the multifunction panel and the modules can only be configured using the setup program. The setup program is an essential requirement for the initial startup of the system and for making changes to the hardware assignment.

7 Startup and configuration

8.1 General technical data

8.1.1 Directives

- 2014/35/EU – Low Voltage Directive
- 2014/30/EU – Electromagnetic Compatibility Directive

8.1.2 Electrical safety

- According to DIN EN 61010-1
- Overvoltage category III, pollution degree 2

8.1.3 Protection type according to DIN EN 60529

- Modules: IP20
- Multifunction panel 840: On front IP67, on rear IP20
- Operating panel: On front IP65, on rear IP20

8.1.4 Protection rating

- Overvoltage category III, pollution degree 2

Protection rating I

(with internal isolation to SELV current circuits)
- Multichannel controller module
- Relay module 4-channel

Protection rating III

- Multifunction panel 840
- Central processing unit
- Router module
- Analog input module 4-channel
- Analog input module 8-channel
- Analog output module 4-channel
- Digital input/output module 12-channel

8.1.5 EMC

- Interference emission: Class A – only for industrial use –
- Interference immunity: Industry requirement

8.1.6 Voltage supply

- DC 24 V (19.2 V to 30 V) SELV
- Residual ripple: 5 %
- Supply voltage range according to IEC 61131-1 standard: DC 20.4 to 28.8 V

8 Appendix

8.1.7 Ambient requirements

Multifunction panel 840

- Indoor use
- Ambient temperature: -20 to +55 °C
- Storage temperature: -30 to +70 °C
- Humidity ≤ 90 % rel. humidity without condensation
- Site altitude: Up to 2000 m above sea level

Modules

- Indoor use
- Ambient temperature: -20 to +55 °C
- Storage temperature: -40 to +70 °C
- Humidity: ≤ 90 % rel. humidity without condensation
- Site altitude: Up to 2000 m above sea level

8.1.8 Conformity

- CE (symbol of conformity according to DIN EN 61010-1 (LVD) + DIN EN 61326 (EMC))

8.1.9 Climatic tests

- Classification acc. to DIN EN 60721-3-3, class 3K3,
  but with extended temperature and humidity range
- Tests acc. to DIN EN 50178 requirements
  - Dry heat (table 11): DIN EN 60068-2-2, test Bd
  - Damp heat (table 12): DIN EN 60068-2-78, test Ca
- Tests acc. to DIN EN 61131-3 requirements
  - Dry heat: DIN EN 60068-2-2, test Bb
  - Cold: DIN EN 60068-2-1, test Ab

8.1.10   Mechanical tests

Modules for DIN rail mounting

Classification acc. to DIN EN 60721-3-3, table 6, class 3M2

Sinusoidal vibration, stationary	
Test method	Acc. to DIN EN 60068-2-6, test Fc
Deflection amplitude	1,5 mm
Accaleration amplitude	5 m/s^2 (~ 0,5 g)
Deflection frequency range	2 Hz $\leq$ f $\leq$ 9 Hz
Crossover frequency	9 Hz
Accaleration frequency range	9 Hz $\leq$ f $\leq$ 200 Hz
Vibration type	Continuously at a rate of 1 octave/minute
Vibration duration	20 cycles for each of three axes which are perpendicular to each other
Shocks, non-stationary	
Test method	Acc. to DIN EN 60068-2-27, test Ea and guidance: Shock
Total shock-response spectrum	Type L
Peak accaleration	40 m/s^2
Shock duration	22 ms
Number of shocks in each direction	100 $\pm$ 5 (a total of 600 shocks)

8 Appendix

Multifunction panel

- Vibration test acc. to DIN EN 50178, table 14

Sinusoidal vibration, stationary	
Test method	Acc. to DIN EN 60068-2-6, test Fc
Deflection amplitude	0,075 mm
Accelaration amplitude	10 m/s^2 (~ 1 g)
Deflection frequency range	10 Hz $\leq$ f $\leq$ 57 Hz
Crossover frequency	57 Hz
Accelaration frequency range	57 Hz $\leq$ f $\leq$ 150 Hz
Vibration type	Continuously at a rate of 1 octave/minute
Vibration duration	10 cycles for each of three axes which are perpendicular to each other

- Shock test

Shock	
Test method	Acc. to DIN EN 60068-2-27, test Ea and guidance: Shock
Basic form of shock	Half sine wave
Peak accelaration	250 m/s^2
Shock duration	10 ms
Number of shocks in each direction	Single shock: 3 $\pm$ 0; continuous shock: 5000 $\pm$ 10

- Drop test (with packaging) acc. to DIN EN 60068-2-32, method 1

8.2   Error codes for measured values in float format

For measured values in the float format, the error number appears directly in the value, i.e. it contains the error number instead of the measured value.

Error code with float values	Errors
1.0×10^{37}	Underrange
2.0×10^{37}	Overrange
3.0×10^{37}	No valid input value
4.0×10^{37}	Division by zero
5.0×10^{37}	Math error
6.0×10^{37}	Invalid terminal temperature of thermocouple
7.0×10^{37}	Invalid float value
8.0×10^{37}	Integrator or statistics destroyed

8.3　System expansions

The measuring, control, and automation system is continuously expanded by the enhancement of the setup program and by the integration of new hardware. These system expansions are implemented in the context of new system versions (expansion stages).

8.3.1　System version 02

The following expansions are available as of system version 02.

Favorite programs

Programs can be marked in the program editor as favorite programs so that they appear in the program selection at the beginning of the program list. If there is more than one favorite, the program number is the decisive criterion (in ascending order).

Program generator with process steps

- The nine program generators support the use of up to 100 process steps.
- In every process step, the admissible setpoints are selected, the time limits for a program section are defined, and up to 16 process contacts are activated. This specification is normally done by the plant manufacturer because specific knowledge of the plant is necessary for this job.
- While entering a program in the program editor, a specific process step is assigned to each program section. This means that the conditions which are defined in the process step are valid for the particular program section. As a result, only the permissible setpoint values and control contacts are used in the program section. Furthermore, the section time lies within the predefined limits.
- The process contacts are used to control PLC functions.

Expanded user administration

- Up to 16 user groups are supported by the system. Specific user rights that deal with the displaying and editing of certain system values or the controlling of certain system functions are assigned to each user group.
- Up to 50 users can be managed in the system. Each user gets the rights of the user group.
- The user group rights are exclusively defined with the setup program. The users themselves can be administrated with the setup program or the multifunction panel. The option to restrict the user administration to the multifunction panel is available.

Expanded process screen editor

- In each of a maximum of 18 process screens up to 16 levels can now be defined. The single objects of a process screen are assigned to a level.
- Visibility and editability of a level can be influenced by the user group or by the PLC.
- Additional object types allow the selection of programs and process steps, are used to display batch texts, or provide the user logon/logoff in the process screen.
- By hiding the JUMO toolbar, the whole screen area is available for the customer-specific process screen.

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8.3.2   System version 03

The following expansions are available as of system version 03.

Analog output module 4-channel

The new analog output module 4-channel is equipped with four outputs. The output signal, 0(2) to 10 V or 0(4) to 20 mA, can be configured individually for each channel.

Cyclic program repetition

A program can be repeated cyclically. The number of cycles is specified in the program editor. During program run, the current cycle is indicated in the generator screen.

New and extended functions of the program generators (process engineering)

- Ramp function with end value: A setpoint with ramp function is assisted by another setpoint which serves as an end value for the setpoint ramp in the relevant program section.
- Manufacturer programs: Up to 50 programs can be defined as manufacturer programs. These programs are editable with the setup program only, which is a task normally done by the system manufacturer. The user on the multifunction panel 840 is not able to edit these programs.
- Section changeover: The criteria for switching to the next program section are now configurable. The section changeover can be based on the section time, on a setpoint value, or on a combination of both. With system version 02, either the section time or setpoint value 2 is the decisive factor; this variant is also still supported.

Extended function of the process steps

The function of the process contacts is now configurable. Different time functions can be implemented for each of the 16 process contacts of a process step (direct switching, switch-on delayed, switch-off delayed, switch-on advanced).

Process screen input masks with title bar

Input objects in the process screen can be provided with a short text which, for example, describes the function of the object. This text appears in title bar of the input mask when the object is opened in the process screen.

Recognition of touchscreen operation

Each touchscreen operation on the multifunction panel 840 is recognized and can be evaluated by using a special PLC library function. This makes it possible, for example, to present another process screen after each operation.

Hierarchic user administration on the device

By appropriate configuration using the setup program (allocation of rights, user group assignment), it is possible to restrict the user administration on the multifunction panel 840 in consideration of hierarchy and function of the users. Therefore, a user who performs the user administration can only assign user groups of which he is a member to another user.

Horizontal recorder screen

Up to now, the recorder screen (analog and digital channels) has been displayed vertically in the multifunction panel 840 . Now, the horizontal display is also possible. The functions are identical in both display kinds, only the arrangement of single elements is different.

8.3.3   System version 04

The following expansions are available as of system version 04.

Connection of thyristor power controllers

Thyristor power controllers of type 70906x can be integrated in the measuring, control, and automation system via the system bus. Each power controller counts as one input/output module (max. 30 modules per system).

The power controller is connected to the central processing unit, to the multifunction panel, or to a router module, using a network cable. To the power controller, in turn, another power controller, a multifunction panel, or a router module can be connected.

The operation and configuration of the power controller is made directly at the power controller or with the power controller setup program. In the measuring, control, and automation system the power controller is integrated in the hardware arrangement by using the setup program. Various process values of the power controller are accessible via the system bus.

Connection of digiLine sensors

The digiLine sensors for liquid analysis are connected via a bus system to the serial interface of the central processing unit (RS485, Modbus RTU). Depending on the bus topology and the voltage supply, up to 31 sensors are possible at each interface. A total of 62 sensors can thus be connected to the measuring, control, and automation system.

The sensors are functionally integrated in the measuring, control, and automation system by means of a PLC application (as of CODESYS version 3.5 SP3 patch 9; extra code 224 required). For each sensor type a specific function block is available for the PLC software.

Additional external batch texts

The number of external batch texts and the text lenght have been increased. Instead of 27 texts (64 characters each) now 90 texts (187 characters each) can be transmitted via Modbus. For this purpose an additional Modbus address range has been provided (texts 1 to 27 can be transmitted in both the old and the new address range).

Additional PLC library functions

- Access (read/write) to configuration and process data of the multifunction panel
- Toggling the operator screen (visualisation) within the user operating level of the multifunction panel
- Temporary change of the function of the multifunction panel's home button

Automatic user logoff

This feature allows the device to be protected against unauthorized access. If the function is active and a user is logged on, there must be an operator action on the device (keypress on the touchpad) within a configurable time period (reauthentication time) so that the user remains logged on. The re-authentication time period begins with each keypress to run again. After the re-authentication time has expired, the user is automatically logged off with the next keypress. As a result, a new logon is required before the next operator action.

Setpoint standardization (cascade control)

Standardization of the setpoint input allows to realize a cascade control. With activated setpoint standardization the controller's setpoint input signal is limited to 0 to 100 and is standardized to the setpoint limits (setpoint limit min, setpoint limit max). The controller channel in question

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is then used as slave controller within the cascade control. Also controller channels of different controller modules can be used as a master controller and slave controller.

CODESYS remote maintenance via TCP connection

Maintenance of a customer's PLC application (CODESYS) is possible by the manufacturer via TCP connection. This eliminates the previously required gateway (TCP > UDP) at customer side.

Other new functions

- Improved ease of use for the process screen editor
- Calculation of the maximum recording time of measurement data (recording data) during group configuration

8.3.4 System version 05

The following expansions are available as of system version 05.

Program preview in the multifunction panel 840 (only for central processing unit with extra code 225)

The program preview displays the setpoint value course of one program channel over all program sections within one single screen. The operating contacts are also displayed. Program or section repetitions are not shown.

User logon via interface (e.g. with RFID chip card)

This function provides the prerequisites for a user logon to the system by means of the PLC (extra code 224 required). A PLC application enables the implementation of such applications as the user logon with RFID chip card. For this purpose a suitable card reader and a free serial interface on the central processing unit (RS232, RS422/485) are additionally required.

Additional configuration parameters and process values of the multichannel controller module, accessible via Modbus

Configuration parameters:

- Setpoint value functions: start value as well as the positive and the negative gradient of the setpoint ramps
- Limit value monitoring functions: switch-on and switch-off delay, pulse time

Process values:

- Digital outputs: process value, switching behavior (contact type NO or NC)
- Limit value monitoring functions: acknowledgement signal
- Controller channels: active parameter block, controller off, self-optimization stop
- Setpoint value functions: control bits (bit 0, bit 1) for the setpoint changeover

Copying of PLC generated measurement data to a USB flash drive

The data recording by means of a PLC application enables a file in a generally readable format to be created. The file is copied to a USB flash drive by the memory manager (multifunction panel 840).

Other new functions

- Update to CODESYS version 3.5 SP10 patch 0
- Expansion of the process contacts in the process steps from 16 to a maximum of 64; introduction of editable designations for the process contacts
- Introduction of editable designations for the limit value monitoring, binary linking, and math/logic functions
- Extension of the TAG numbers (designation for PLC) of inputs and outputs from 7 to 42 characters
- Increase in the number of the analog, integer, and the digital variables within the central processing unit from 64 to 128; introduction of TAG numbers (42 characters) for these variables
- Changeable SMTP port number for sending emails
- Expansion of the analog selector in the multichannel controller module for the independent operating mode (current setpoint value and actual value of the controller channel)
- Expanded import and copy functions in the setup program (import module configuration, import Modbus frames, copy frame entries to another frame)

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8.4   Training courses/seminars

Further training has become indispensable in the area of modern automation technology. As one of the leading manufacturers of systems for measurement and control technology, we want to pass on our specialist knowledge on products and general fundamental topics to customers and employees.

For this purpose, we have established a training center in Fulda, Germany, which is equipped with the latest technology. In addition to communicating theoretical contexts, the focus is on practical training in the individual courses, with tasks performed on models and simulators. Important knowledge for day-to-day work is communicated in the course of the practical aspects.

You can find an overview of the courses on offer in our training calendars. A detailed brief description is available for each course, including the target group, learning objectives, and a description of the content.

You can obtain more detailed information on training, the individual seminars, and the registration formalities from:

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